

Supply Chain Visibility: Implementing the Supply Chain Monitoring

Concept in Europe

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Abstract: This paper presents findings from the implementation of a supply chain visibility concept called Supply Chain Monitoring (SCMo) in the automotive industry in Europe. The purpose of the paper is to outline managerial implications from the implementation. The empirical data presented is summarized into the four problems identified among the organizations that have implemented SCMo; trust, interoperability, compatibility and commitment. The benefits of SCMo and smooth supply are obvious and the potential savings are huge. Why is it then so difficult to manage the concept and why are there so many problems to face when implementing the concept?

Keywords: Supply Chain Visibility; Supply Chain Monitoring, Europe.

1. INTRODUCTION

The automotive industry has often been referred to as the ‘industry of industries’ [1] as it is an industry that is in the forefront of management practice and technological development. Due to its importance, a lot of scholarly attention has been given to the industry over the years [e.g., 2, 3]. In most countries where the automotive is present with production, the scale and scope of the industry is shown by the significance on the country’s general economic performance. In Sweden, for example, with more than 1200 individual companies and an annual turnover of more than € 11 billion, the automotive industry is one of the largest and most important industries. However, in Sweden and elsewhere, the automotive industry is struggling with problems of profitability. To cope with increasing pressure from competition and diminishing margins, one trend has been to try to enable increased efficiency in product development through production of new car models based on a single vehicle platform [e.g., 4]. Another trend has been to increase involvement in product development and subsequently push costs for research and development upstream [e.g., 5]. In addition, a third trend has been to in general work with close and integrated relationships to enable smooth and secure supply, for example enabled by integrated information technology for supply chain integration [e.g., 6]. The reason for increased integration to secure supply is of course that disturbance in production and

distribution is extremely costly. For example, one of the OEMs included in this study had an estimated cost of € 1500-3000 per minute for a stop in their production line.

All these current trends imply that information handling needs to be enabled both within and across continents and firm borders. In heavy industries like the automotive industry, it has recently been argued that the information handling costs, broadly defined, account for substantial proportion of total costs [7]. As business activities seems to become more and more information intensive and integrated, the sharing of information to enable smooth and secure supply becomes vital. This paper presents the findings from a research project with the objective to study the implementation of a supply chain visibility concept called Supply Chain Monitoring (SCMo) in the automotive industry. SCMo is an industry initiative that aims to increase visibility in supply chains and thereby enable coordination of inventory levels and propagation of demand. The purpose of the paper is to outline managerial implications from the implementation of SCMo in Sweden, France and Germany.

2. RESEARCH METHOD

This paper is built on empirical findings obtained through scheduled interviews at European automotive OEMs, their suppliers and other stakeholders. Since the research project had an exploratory nature, a case study approach was selected [8]. The case study approach seemed particularly appropriate due to the practice- and problem-oriented character of the SCMo concept, as exploratory research enables the researcher to come close to the respondents' experiences and context. The firms approached in the study are one Swedish OEM, one French OEM and one German OEM and parts of their respective and sometimes overlapping supply chains. The interviews with German and French OEMs and their suppliers were either telephone interviews or interviews made through internet meeting software. Additional interviews were made with SCMo software application providers and other stakeholders both in Sweden and elsewhere in accordance with table 1.

Table 1., Actors approached in the reported study

	OEMs	Suppliers	Other	Application providers
France	1	1		-
Germany	1	2		1
Sweden	1	1	2	2

The study has been conducted in two overlapping phases. The first phase, the information gathering phase, involved interviews with key informants in Sweden. Among the informants that we interacted with were representatives from various automotive industry stakeholders and OEMs in Sweden. From this initial phase, three implementation projects were selected for inclusion in the study. The case selection was made on two bases. First, not all OEMs have started implementation of SCMo and thus not all were relevant for inclusion. Second, we were forced to rely on access. Originally, a fourth OEM was contacted but declined involvement in our study. In the second step, we conducted interviews with key informants (e.g., project

managers, e-business directors, logistics managers) of SCMo implementations at the three selected OEMs in three different countries. All interviews have been transcribed and checked for accuracy prior to analysis. Since the project to a large extent is ongoing in all countries, we have left out the names of firms included in the study. For each interview, a detailed list of questions or areas for discussion was sent out in advance. Each SCMo implementation was separately analyzed and a preliminary description of salient points from each project was drawn [9]. At a later stage, all three implementation projects were analyzed through a cross-case display.

3. PREVIOUS RESEARCH ON SUPPLY CHAIN MANAGEMENT AND SUPPLY VISIBILITY

The notion of supply chain management has most certainly its origins in management consulting and is considered a rather novel concept among scholars [10]. The empirical phenomenon of supply chain management, however, has its antecedents in a changed approach to marketing and purchasing during the last thirty years [11]. Also, supply chain management and supply visibility is highly connected to parallel research streams on visibility and smooth flows within the research field of logistics management [e.g., 12]. From a sourcing perspective, supply chain management is seen as the natural development of the purchasing function from being mainly clerical to having a strategic role in the firm as a whole [e.g., 13]. In contrast to the view that the concept is relatively new, is the seminal article in marketing [14] where scholars mapped the flows of material in a house-building project already in the 50's. Their ideas on how to manage the flows and the supply, corresponds quite well with the ideas that are considered as core concepts in the contemporary view on supply chain management. If we instead look at business markets in contemporary studies, it is evident that competition is taking place between supply chains and in chain constellations or network constellations rather than between single firms [e.g., 15]. Thus, firms need a holistic view when attempting to manage business processes not only internally but also across firm borders. The increased need to manage flows of materials along an entire supply chain, and the associated information of such material flows, brings firms to put focus on increased supply chain management as an embedded business processes [16].

To manage flows of material and information, coordination and integration is a necessity. In supply chain management, integration and coordination are central concepts. Here, coordination refers to the way activities (production, planning, decision processes and functions etc.) in the supply chain are executed in synchronization with other activities. Integration refers to the way organizational entities (actors, departments, firms and systems etc.) are joined together through activities and shared resources and thus integrated with other entities. Simatupang and Sridharan [17] emphasize the need for collaboration in order to achieve supply chains to be effective. In this paper, collaboration refers to the way organizational entities make decisions in association with other organizational entities. Without the holistic approach and collaboration, but rather an atomistic perspective and opportunistic

behavior, flows of material and information are unlikely to function, resulting in mismatch of supply and demand, conflicts and general disturbances in the supply chain. One aspect of the proposed collaborative behavior of Stank et al., [18] and Simatupang and Sridharan [17] is the structuring and sharing of information. The general idea is that information sharing allows firms to make more informed decisions and reduces risk.

In enabling shared information, the utilization of information technology is an important aspect. Few would probably disagree with the view that the exploitation of ICT's has a central role in creating integrated and collaborative supply chains. In fact, how to exploit information technology has shown to be one of the most important current concerns among managers and purchasing and supply executives [19]. As it seems, more and more companies exploit information technology to achieve efficiency and effectiveness in their supply chains. This could be compared with the situation before the diffusion of business applications for inter-organizational communication as for example EDI-systems (Electronic Data Interchange) and ERP-systems (Enterprise Resource Systems). Prior to the 1980's the major part of information flows both within and between organizations were paper-based [20]. The idea of sharing information is not new. The concept of supply chain visibility, in specific, has been subject to a few studies within the literature of supply chain integration. There is, for example, a distinct stream of research on data-sharing concepts such as VMI (Vendor Managed Inventory) [e.g., 21], ECR (Efficient Consumer Response) [e.g., 22] and CPFR (Collaborative Planning Forecasting and Replenishment) [e.g., 23] that all deal with visibility issues. In addition, the problem and potentials of monitoring has been brought up within the development of the concept of transparency the supply chain management and industrial marketing literature [e.g., 24, 25]. To characterize the concept of transparency, Lamming et al. [25] have applied the metaphor of how much light (information) that can shine through mineral (the space between two organizations – the relationship). Drawing on the work of Lamming et al., one can elaborate on transparency along four dimensions. First, if transparency is an element of a relationship and not a property of a system, then one can elaborate on types of transparency (e.g., cost or supply). Second, if transparency is not necessarily reciprocal, then one can elaborate on direction of transparency (e.g., upstream or downstream). Third, if transparency is neither static nor permanent, then one can elaborate on degrees of transparency. Fourth, if we elevate the analysis from the dyad to the chain or system with several relationships, then one can elaborate on distribution of transparency along these relationships (e.g., direct or indirect).

4. IMPLEMENTING THE SUPPLY CHAIN MONITORING CONCEPT

In our exploratory efforts, we have defined SCMo as; the efforts of the actors in a supply chain to manage and control visibility of information regarding flows of products and services in different levels and directions in a supply chain. In a buyer-supplier relationship information naturally flows in both directions, e.g., through invoices, delivery notes and alerts, in contrast to flow of production input or finalized products. The integration and specific information

sharing that SCMo refers to is the data handled in ERP-systems. The concept is based upon recommendations for supply chain monitoring developed by a task force with participants from nine OEMs, four automotive suppliers and interest organizations for the automotive industry. The task force and idea of the SCMo development was led by an industry-owned organization with the purpose to set up standards for e-business communications, engineering data exchange. This championing organization gave the following argument to why a standard for transparency in flow of information was needed:

“The Automotive Industry is facing the challenge that a comprehensive flow of information must be made transparent between supply chain partners [...]. This transparency cannot be fulfilled just by exchanging EDI messages, but there has to be real-time exchange, synchronisation, aggregation etc. to be shown in a separate VMI level.”

The idea of the concept is simple; the information flow in supply chains should be handled as ordinary telecommunication between any users over a common telecommunication net, i.e. the user phones and the receiving part answers. Data (e.g., voice) is standardized and to access the information flow, you need a system (e.g., a telephone that is connected to a widely diffused telecommunication net) to handle incoming data and outgoing data as described in figure 1. For a system like SCMo, there is a strong dependency on the fact that the chain of demand propagation (upstream) is consistent. The work of the task force was concluded in May 2003 but the implementation of SCMo started immediately as the task force consisted of industry representatives.

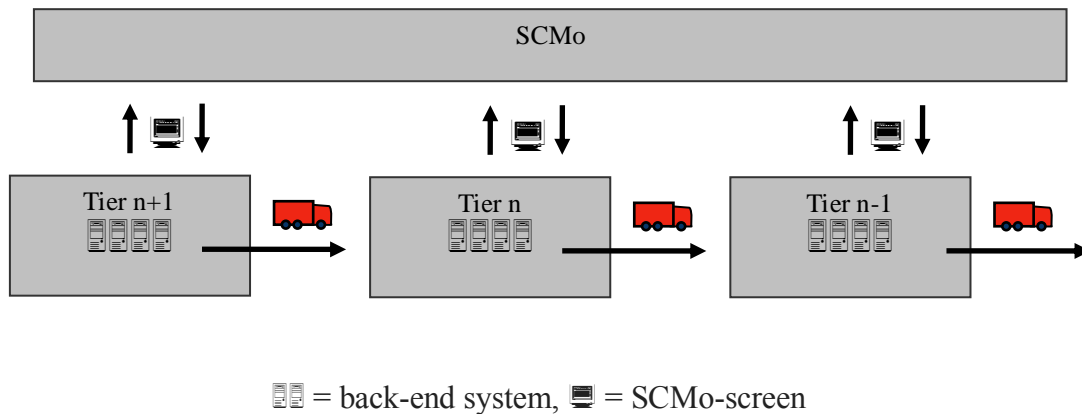


Figure 1., A schematic description of the SCMo concept

The publication of the SCMo recommendations in May 2003 of has been the impetus to implementation projects in France, Germany and Sweden. Germany seems to be the country that is in the forefront of implementation where several firms has either implemented SCMo either more permanently or tested as pilot applications. At the German OEM that this research project targeted, the implementation started in February 2003 and the first live pilot of SCMo was launched in November 2003. The French OEM started the implementation in June 2003. In the implementation of SCMo in France, one had experienced some severe problems with getting key suppliers to participate. The work to implement SCMo is strategically important and the insight is that to enable a smooth supply chain, the whole chain and not just the direct

relationships of OEMs needs to be developed. The Vice President Material Planning and Logistics at the Swedish OEM included in the research project expressed it as:

“It is not always among the 1st tiers where the problems are found. This is why it is so important for us to monitor the whole or parts of the chain through SMCo.”

When running the SCMo, four specific but to some extent interrelated problems were identified. First and foremost, it is from the SCMo projects that this research has followed evident that, in contrast with former studies, there are not only positive effects of transparency. The first problem, here labeled *the trust problem*, refers to the extended line of visibility and transparency that a concept like SCMo entails and the inertia to extend line of visibility across firm borders due to lack of trust. As expressed by the respondents in the study, the information shared in the SCMo system can be sensitive if it comes in the wrong hands. For example, some suppliers do not want the purchasing department of their customers to see certain information regarding capacity and production planning. We have noted some strong reluctance among suppliers, especially 1st tier, to share information about supply or information regarding their suppliers to their customers. However, the intention of SCMo, according to the participating OEMs, is not to use the data in purchasing situations. The project manager at the German OEM expressed the following to confirm that the idea of setting up SCMo was to ensure smooth supply and that they had not intention to act on the data for other purposes:

“Our material suppliers are not responsible for the 3rd or 4th tiers performance. We are just interested in the fact that the 1st tier supplies us with components as we have agreed. We don’t want to control the whole supply chain, our material planner would not call tier 3 suppliers, no, they have enough with their own problems and they don’t want to have any part in that.”

The second problem, here labeled *the compatibility problem*, refers to the characteristics of production of components that are made in the supply chains selected for implementation of SCMo and the difficulty to implement new practices due to problems in compatibility with current processes. As it seems, an assumption made by the developers of the SCMo concept is that if the production along the supply chain has disturbances, it has to do with the business process. In the business process, production of security stock, uneven distribution of information, variation in demands due to differences in optimization parameters, and other business process related issues can lead to bullwhip effect [see 26] and uneven supply. The problem, however, can also be traced back to specific tiers production processes. At instances, the production of large quantities is necessary due to the characteristics of the raw material supply. Even though smooth supply is preferred, production characteristics circumscribe the options for the supplier. For a 2nd tier supplier in the study, the production from raw material to a component could only be made in bulks. The supplier expressed the problem as:

“There is no doubt we make-to-order. But, we don’t have a cycle that fits with any form of Kanban and we cannot produce one product at the time because that is not the way our process works. When we extrude something we extrude a number of tonnes and refine the output into a product. It is not feasible to produce in any other way. We have an internal optimization of our

material flow based on, say, that the customer wants 300 pieces per week. We extrude every second week in even intervals.”

When implementing a concept like SCMo, that has the purpose of propagating end-customer demand upstream to enable smooth supply, the fact that different actors in the supply chain have different perspectives and are still autonomous actors needs to be taken into consideration. The third problem identified in this research, here labeled *the interoperability problem*, refers to the confusion and problems in communication, trust and commitment that having two separate demands causes. Each relationship in a supply chain is built on agreements regarding supply and demand that on one hand is built on forecasts coming from the OEM but on the other hand is individually dealt with for each firm by its own. However, when demand is automatically propagated through add-on technology, this leads to a problem with two demands for each actor in the middle of the supply chain. The project manager at one of the OEMs in the study confirmed the problem with having two streams of information. He also confirmed that this was a problem for more OEMs than just them:

“[The] point is that there were two demands. One is coming from SCMo which is the computed, propagated, demand and, the other is the contractual demand from their direct customer. This is the very basic problem behind SCMo. [...] the first one to make the project with SCMo was XX [Author’s note: a German OEM] for the leather seats supply chain [...] they still had two flows of demands, one official and contractual that was sent to them via EDI or fax and one that came from the SMC software. They still dealt with the two flows. This is a basic problem with SCMo.”

The fourth problem, here labeled *the commitment problem*, refers to the fact that supply chain wide concept like SCMo is dependent on strong commitment among its users and to the problem in lack of commitment among users due the increased effort of data feed and administration that adoption can cause. In the case of SCMo, all actors involved need to commit and give input and use data, otherwise the demand propagation (upstream) will lead to a decrease in accuracy and preciseness and the data in the system will not be less useful and in some cases completely false. The Director Logistics and former project manager of SCMo at the French OEM included in our study expressed the following regarding the commitment problem:

“We had some problems with the input of data into the system. For each actor in the system, it takes a lot of time to manually feed the system with data on stock and demand and so on. On the flip-side, if you don’t input the data into the system the information that the system feeds you and everyone else with will not be accurate. As you can imagine, this is a two-sided problem.”

The quote reveals that there seem to be two dimensions to the commitment problem. First, there is a technological dimension to the problem with a need for all actors to commit or else the system breaks down. Second, there is an organizational dimension to the problem with a need for employees dealing with supply chain in the different organizations involved to change

routines and priorities. Regardless of the problems that organizations implementing SCMo seems to face, SCMo is still seems to be a growing concept in the European automotive industry. According to one of the organizations participating in the task force, the implementation has been successful and already in January 2003, around 100 companies were already using SCMo: *“Standardising SCMo across the automotive industry will save millions of euros in terms of greater efficiency and improved build-to order times, but the key to ultimate success is interoperability of the various applications.”*

In the coming section, we will outline managerial implications and concluding remarks regarding the findings from our empirical study. The four problems identified the study are summarized in table 2.

Table 2., Identified problems in SCMo implementation

Defined problem	Description
Trust	Inertia to extend line of visibility across firm borders due to lack of trust
Compatibility	Difficulty to implement new practices due to problems in compatibility with current processes
Interoperability	Problems in communication, trust and commitment due to having two separate demands
Commitment	Lack of commitment among users due the increased effort of data feed and administration

5. MANAGERIAL IMPLICATIONS AND CONCLUDING REMARKS FROM THE STUDY

The basic idea of SCMo, as it seems from our research, is to deal with problems related to the *lack* of transparency. In our efforts, however, we have found that there also are significant problems to deal with related to the presence of transparency. Thus, our general conclusion is, in contrast with what former studies seem to imply [e.g., 24], that there are not only positive effects. Instead, we propose that the effects that transparency carries rather can be described through tradeoffs or managerial dilemmas. First, there seems to be a trade-off between reduce uncertainty in some aspects and increase uncertainty in other aspects. For example, on one hand, the demand uncertainty is decreased by increasing the degree of transparency. However, on the other hand, due to the fact that the transparency is one-directional and also present in the form of indirect transparency seen from the OEMs perspective, some of the suppliers expressed their concern about the uncertainty in terms of for example the risk of being bypassed in communications or negotiations. Second, there seems to be a similar trade-off regarding transaction costs. In this project, costs regarding material and information flow can be said to

decrease in some aspects and increase in other aspects. For example, the monitoring costs can be said to be reduced with the help of software enabling shared information. However, on the other hand the increased amount of information that firms have access to and the investments and maintenance that has to be made when in the SCMo system will increase costs in other aspects. Trade-offs, or managerial dilemmas, are certainly relevant for both practitioners and scholars and seems to be a good basis for further research.

This paper is delimited to report only SCMo application specific problems and thus we have not considered the project-related problems that any implementation project can suffer from. These problems are of course also many but hardly specific for a concept like SCMo. Although the idea of SCMo seems to be quite simple and the supply chain's benefits of a smooth supply are evident, the concept is extremely complex and the problems that supply chains that intend to implement SCMo needs to overcome are quite a few. In one of the studied implementations, the issue of lack of trust led to so severe problems for the project that it resulted with a several months long complete stop in implementation. In this case, a formal contract on how the information in the SCMo system was to be used and by whom it could be used was needed in order to solve the conflict. In one of the projects, the relationship atmosphere was characterized by cooperation and orientation towards mutual goals, in contrast with the project that experienced severe problems in implementation where the relationship was characterized by conflict and inertia to enable increased visibility. One explanation to the significant differences between projects might be found in the power balance that the relationship is based on. However, trust was not an issue for all actors that we approached in our study.

Among all the studied implementations reported in this paper, the interoperability problem was the major concern. Both for current and future implementation processes of visibility enabling applications like SCMo, and for other stakeholders in SCMo or visibility related projects, a key priority is to secure interoperability between firm specific back-end systems and SCMo applications. Our proposition is therefore to prioritize interoperability when considering implementation issues. There seems to be more than one aspect to deal with when handling the interoperability problem. First, from a technical point of view, it seems to be vital to secure automatic feeding of data between back-end system and SCMo application. Second, from a business relationship point of view, it is important to agree on what demand to consider as real demand in the supply chain. In the case where interoperability between systems is not possible, we propose that the SCMo data is treated merely as extended information. Regarding commitment, which in the case of the implementation project characterized by cooperation and orientation towards mutual goals was not a problem, it seems important when managing implementation of SCMo to communicate the mutual or chain benefit. In addition, an implication may be to only implement where the need for visibility is seen as critical. The problem of commitment is not specific for SCMo applications, but particularly important due to the nature of the application where the propagation of demand depends on multiple-actor input. Regarding compatibility, this is a problem that implementation teams need to deal with already during the selection of supply chains to implement SCMo in, and thus prior to

implementation per se. From our study, we propose that one takes compatibility into consideration when selecting supply chains for SMCo implementation. For chains that lack compatibility from a production process point of view, but still are critical, one need to put specific attention to the demand structures present in the supply chain and perhaps focus on alert generation and not smoothing.

To conclude, the contribution of the research project reported here lies in the empirical material collected on SCMo. The benefits of SCMo and smooth supply are obvious from almost every perspective of a supply chain. Why is it then so difficult to manage the concept and why are there so many problems to face when implementing the concept? Part of the answer to this question lies in the scope of the concept, to deal with information flow across a chain of firms and not just between two firms. For the future, new forms of agreements and new forms of business relationship structures seems to be necessary in order to deal with innovative applications like SCMo. From the respondents interviewed in this study it stands clear that systems like SCMo are part of the future for the automotive industry. The promises of SCMo are too tempting to overlook.

The purpose of the paper was to outline managerial implications from the implementation of SCMo in Sweden, France and Germany. The implications presented in this paper refer to the four problems identified in the empirical section. Based on the research made on implementation of SCMo in Sweden, France and Germany, we conclude that the organizations that has implemented SCMo has met are four major problems; trust, interoperability, compatibility and commitment. Among the four challenges, interoperability was found as the most central problem to deal with. Thus, for current and future implementation processes, and for other stakeholders in SCMo or visibility related projects, our proposition is that a key priority should be to secure interoperability between firm specific back-end systems and SCMo applications.

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