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# Buyer–Supplier Information Sharing in ETO

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**Abstract.** This paper presents a case study of the information sharing practices in a buyer–supplier relationship of companies that deliver products to the global maritime industry. The main research question is whether improving the quality of shared information between buyer and supplier will enhance information utilization by the supplier and improve the operational efficiency of both companies. The case study describes the process of analyzing the information flows between the buyer and the supplier and the utilization of the shared information by the supplier. Our main focus was on analyzing information quality and information utilization, and finding solutions to improve the information sharing practices between the two companies.

**Keywords:** SCM · Information sharing · Buyer–supplier relationship

## 1 Introduction

The many different manufacturing environments are commonly distinguished using the following categories: make-to-stock (MTS), assemble-to-order (ATO), make-to-order (MTO), and engineer-to-order (ETO). All of these manufacturing strategies relate to the point at which a particular product is linked to a specific customer [1]. The ETO-supply chain is generally regarded as a supply chain where the ‘decoupling point’ is located at the design stage, while in MTO the ‘decoupling point’ is at the fabrication and procurement stage. ETO companies can be categorized by supplying high value, customized products with a deep and complex structure [2].

The case companies are a Norwegian ETO company (hereinafter, Company A), and one of its suppliers which can be characterized as MTO (hereinafter, Company B). Company A delivers capital-intensive, advanced products in low volumes to customers in the global maritime industry, and the production can be regarded as ETO. Company B supplies company A with components and can be considered as an MTO company. The relationship between the two companies is affected by uncertainties with regard to demand, which increases the need for collaborative planning and information sharing throughout the supply chain.

The case companies’ goals were to reduce the time between Company A ordering the components from Company B and the delivery to Company A, and

to reduce inventory levels at both companies. The project's participants decided to approach these problems by analyzing information-sharing practices between the two companies.

The research question in the present paper is whether improvement of the quality of shared information will increase its utilization and hence affect operational efficiency in buyer-supplier relationships.

The purpose of this paper is to illustrate a method of analyzing and improving information flows in a buyer-supplier relationship in an MTO-ETO environment.

## 2 Theoretical Background

The literature presents several areas related to supply chain management, with an emphasis on information sharing, particularly topics such as information quality (IQ) and information utilization (IU). Literature focusing on information sharing in the automotive industry has also been reviewed.

Information sharing is often mentioned as an important factor in the successful creation of supply chains. According to [3], both information and material flow integration are important for supply chain integration, and have significant effects on performance. According to [4], large investments in IT could fail to produce expected benefits if they are not supported by a willingness to share required information. The two main reasons why information is not utilized are the ability and the willingness to utilize the information. The utilization of information is influenced by IQ and inter- and intra-organizational factors [5].

Information shared between customers and suppliers is used to facilitate manufacturing, planning, and control activities at the companies; according to [6], companies cannot expect high returns from their collaborative initiatives in terms of improved operational performance unless the exchanged information is of high quality.

There are four facets to information sharing: content, frequency, direction, and modality. The facets describe the actual information, while information utilization refers to what the shared information is used for (production scheduling, resource planning, etc.) [5,7].

[8] defined IQ as the "ability to satisfy stated and implied needs of the information consumer", and considered that the stated IQ requirements are according to planning restrictions, policies and procedures, and the implied needs of the staff. In this relation, an IQ deficiency is defined as "deviation between stated and implied needs and perceived information quality" [8]. IQ dimensions are well defined in the literature, although different notions are used to refer to them. [9] used "in time," "accurate," "convenient to access," and "reliable," while [8] used "complete," "concise," "reliable," "timely," "valid," "accessible," "appropriate amount," "credible," "relevant," and "understandable." According to [5] reliability and credibility are related to the accuracy of information; relevance and validity are related to the value of information; conciseness, understandability,

and appropriate amount are related to the format of information; and completeness, accessibility, and timeliness are related to the availability of information.

[5] also identified different levels of information utilization: (1) utilization as potential usage (potential to use the information in the receivers processes); (2) utilization as intended usage (intention and ability to use the received information); (3) utilization as actual usage (the information is actually being used in the process); and (4) utilization as efficient and effective usage (the information has a positive impact on the receiver’s planning process performances).

Jonsson and Myrelid’s [5] analysis of information sharing, quality and utilization in the automotive industry showed that the producer had five different information entities shared with the supplier. The supplier mainly utilized one of these entities – the delivery schedule –which contained three periods of orders: forecasts, planned orders and frozen orders. The supplier, in turn, developed a production plan consisting of one preliminary planning period and frozen planning period. Similar examples of planning and supply chain management in the automotive industry have been reviewed; see [10,11].

### 3 Research Methodology

This paper presents a case study of two companies: a Norwegian producer of advanced capital-intensive products to customers in the global maritime industry, and a major supplier. The literature on information sharing was reviewed, with primary focus on information quality and information utilization. We have especially emphasized an article by Jonsson and Myrelid [5], which used cases from the automotive industry, to develop the steps for improving information sharing practices. Based on an initial literature study, the authors conducted several workshops with participants from the companies and these workshops have been the main source of data collection. The workshops were the arena for discussions, which facilitated the introduction of changes in practices in the two companies.

### 4 Analysis

Keeping in mind the identified goals in the improvement of the relationship between the two companies, we started by mapping all of the information flows between them. We then categorized all information flows with regard to the facets of information sharing. The next step was to identify what the information that Company B receives is used for, and what processes the company performs based on the received information. The fourth step was to identify information quality deficiencies that hinder Company B in performing its processes. The last step was to suggest improvements in information flows and information quality adapted to Company B’s processes.

#### 4.1 Steps 1 and 2: Mapping and Categorization of Information Flows

We identified five different information flows related to production and delivery of components from Company B to Company A (Table 1).

**Table 1.** Information flows (AS-IS)

	<b>Facets of information sharing</b>			
	Content	Frequency	Direction	Format
<b>Shared information</b>				
Main production plan	# of components each week in the year	Approx. 1 per month	To supplier	E-mail – MS Excel
Purchase orders	PO, including delivery date	2 months before delivery date	To supplier	E-mail – PDF
List of changed orders	List of components with new date	Every two weeks	To supplier	E-mail – MS Excel
Meeting	Wrecks, deviations, general situation	Once a month	Two-way	Meeting
Spontaneous	Miscellaneous	Spontaneous	Two-way	Telephone, E-mail, meetings

#### 4.2 Step 3: Information Utilization

Having identified all of the information flows between Company A and Company B, the next step was to identify what processes Company B performed based on the shared information. [5] distinguished among four levels of information utilization. Given that the main point of this step was to identify the actual usage of information, we focused on Levels 3 (information as actual usage) and 4 (information as efficient an effective usage).

In the workshops we identified that Company B conducted two planning processes: one was long-term capacity and resource planning and the other was production planning. To execute the long-term capacity and resource planning, Company B used the main production plan it received from Company A. To execute production planning, Company B used the purchase orders and a list of components with changed delivery dates. The planning activities were done in separate computer systems.

#### 4.3 Step 4: Identify Information Quality Deficiencies

We used Gustavsson and Wänström’s [8] definition of information quality deficiency (“deviation between stated and implied needs and perceived information quality”) to analyze the quality of the shared information.

From the previous steps, all information flows were mapped and the actual usage of these flows was identified. In Step 4, the information flows should be evaluated from an IQ perspective. We have chosen all 10 of the dimensions presented by [8]. By using these, the analysis covers the accuracy, value, format

and availability of information [5]. The IQ dimension was evaluated based on the definitions of each of the dimensions by [8], which are presented in Table 2.

**Table 2.** Definitions of IQ dimensions [8]

<b>IQ dimension</b>	<b>Definition</b>
Complete	The extent to which the information is comprehensive for the planning tasks.
Concise	The information can be used directly, without needing to be re-worked before use, in terms of format, content and/or structure.
Reliable	The extent to which the information provided to the planning staff is accurate.
Timely	The extent to which the information is delivered on time and at correct intervals; that is, not too often or too seldom for the planning process.
Valid	The extent to which the information measures what it should measure.
Accessible	The extent to which the information is easy to access when required.
Appropriate amount	The extent to which filtration of the information is necessary.
Credible	The extent to which information is accepted or regarded as true, real, and believable.
Relevant	The extent to which the information is appropriate for the tasks and applications.
Understandable	The extent to which information is easy to use, but also easy to learn and easy to manipulate, aggregate, and combine with other information.

In our case the IQ was analyzed on three of the information entities. The two entities – “meetings” and “spontaneous” – were excluded as these would vary and are not directly connected to the planning tasks. The IQ dimensions ‘valid’, ‘accessible’, ‘credible’, ‘relevant’ and ‘understandable’ were all regarded as having good enough quality on all three information entities for the supplier to perform its processes.

In summary, five IQ dimensions did not fulfil the stated and implied needs and perceived information quality on all or some of the information entities: complete, concise, reliable, timely, and appropriate amount. An overview of the analysis of IQ deficiencies is presented in Table 3.

#### **4.4 Step 5: Improving Information Flows and Information Utilization**

In order to maximize utilization of the shared information, we addressed the current processes at Company B. The long-term capacity and resource planning

**Table 3.** Information quality deficiencies

<b>Shared Information</b>	<b>Main production plan</b>	<b>Purchase order</b>	<b>List of changes</b>
<b>IQ dimension</b>			
Complete	No, not rolling horizon	Yes	Yes
Concise	No, rework needed	No, must be typed into system	No, must be typed into system
Reliable	No, frequent changes	No, frequent changes of dates	No, frequent changes of dates
Timely	No, too few updates, and different times	No, non-specific times	No, not at reliable intervals
Valid	Yes	Yes	Yes
Accessible	Yes	Yes	Yes
Appropriate amount	No, much rework	Yes	Yes
Credible	Yes	Yes	Yes
Relevant	Yes	Yes	Yes
Understandable	Yes	Yes	Yes

that Company B performed was based on the main production plan received from Company A. The production planning was done using information from the purchase orders and the list of changed dates.

The five identified IQ deficiencies were all preventing Company B from performing its processes in the best possible way. In order to increase IU, the IQ in the dimensions concise, reliable, timely, and appropriate amount needed to be improved.

The companies were positive about changing their routines, including both information sharing practices and the connected planning activities. Even though the case companies produce in much smaller volumes than car manufacturers, similarities between them were found, and best practice from the automotive industry was a basis for changing the information sharing practices and connected planning tasks. In the example from the automotive industry, the shared delivery schedule contained three periods of order: forecasts, planned orders, and frozen orders. The supplier then developed a production plan consisting of a preliminary planning period and a frozen planning period. Through several workshops involving company representatives and researchers, improvements were made to the current information sharing processes. Consideration was given to improving

the IQ dimensions that were considered to be lacking quality and how this would affect the information utilization by Company B.

The main production plan that was previously shared was developed into containing three periods. One category comprised all forecasts and planned orders up to a certain point before delivery. Then there was an extended period of orders that could be considered slushy orders, which at a certain point before delivery date would be called off by a purchase order. The last period was frozen orders confirmed by a purchase order.

The list of forecasts and planned orders replaced the previous main production plan. Because of increased IQ, Company B was able to replace the previously used long-term capacity and resource plan by incorporating the information it contained in its current production planning tool. By doing this, the information sharing entities have been reduced from three to two, and the processes at Company B have been reduced from two to one (Table 4).

**Table 4.** Improved information quality dimensions

<b>Shared information</b>	<b>List of forecast and planned orders</b>	<b>Purchase Order</b>
<b>IQ Dimension</b>		
Complete	Yes, rolling horizon	Yes
Concise	No, still need to be typed in, but more tailored to planning process	No, still need to be typed into system
Reliable	No, dynamic environment causes changes	Yes, closer to delivery date, fewer changes
Timely	Yes, every 14th day	Yes, once a week
Valid	Yes	Yes
Accessible	Yes	Yes
Appropriate amount	Yes, only relevant information	Yes
Credible	Yes	Yes
Relevant	Yes	Yes
Understandable	Yes	Yes

An analysis of the information quality showed an increase in the quality in several of the dimensions. The IQ dimensions complete, timely, and appropriate amount were improved. Two IQ dimension were not able to satisfy the stated and implied needs and perceived information quality. Although it had been improved, the concise dimension was not regarded well enough because the supplier still needed to type in all the information into its planning system. Since these companies operate in a dynamic environment, and changes in product specifica-



tions and delivery dates are very likely to occur in the planning phase on longer terms, the reliable dimension also had deficiencies which are difficult to eliminate as flexibility is considered a competitive advantage.

## 5 Conclusions

This paper presents an analysis of the information sharing practices between a Norwegian ETO and MTO company. For this purpose, a step-by-step procedure to analyze and improve information sharing practices in buyer–supplier relationships was used. The procedure was as follows: (1) map information flows; (2) categorize the information; (3) identify information utilization; (4) identify information quality deficiencies; and (5) improve information flows and information quality adapted to the supplier’s processes. By using this procedure the companies were able to improve the information quality of the shared information, and by adjusting connected planning processes, they also increased the information utilization of the information at the supplier.

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