Dyadic integration of the performance management process: A delivery service case study

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DYADIC INTEGRATION OF THE PERFORMANCE MANAGEMENT PROCESS: A DELIVERY SERVICE CASE STUDY

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&

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Abstract

Purpose: The purpose is to explore how to integrate the performance management (PM) process of delivery service in customer/supplier dyads.

Methodology/approach: The paper is based on a multiple case study of six customer/supplier dyads of manufacturing companies.

Findings: The analysis focuses on describing and comparing the activities of the performance management process. Most activities show low levels of integration in the dyads studied. Defining metrics and target setting are considered most important to integrate. Lack of common metrics definitions and ERP deficiencies were important obstacles for integration. Research issues related to four areas of supply chain performance management are discussed.

Research limitations/implications: The study ends with a number of suggestions for further research on the PM process in supply chains. Proceeding into these studies is necessary for increasing knowledge about PM.

Practical implications: The paper reveals practical problems and outlines practical issues in integrating and handling the PM process in dyads, especially when measuring delivery service using the on-time delivery metric. It also presents a model for describing and integrating the performance management process and its activities.

Originality/value of the paper: Practical implications and generation of multiple issues for further research applying a dyadic approach in supply chain performance management, a research approach that is quite uncommon.

Keywords: supply chain performance, performance management process, delivery service, on-time delivery, customer service, dyads, supply chain integration

Introduction

Supply chain performance is typically related to cost, tied-up capital and customer service (Brewer and Speh, 2000). Customer service performance is expected to be especially critical in today's lean supply chains, where deficient service performance can have consequences that, for example, due to low buffer stocks and make-to-order strategies, can propagate to the end-customer. This article has a focus on delivery service – the transaction elements of customer service (Stock and Lambert, 2001). The importance of using supply chain oriented performance measures is emphasized by several scholars (e.g. Beamon, 1999; Lee, 2000; Brewer and Speh, 2000). It is, for example, the basis for the SCOR model (Lockamy and McCormack, 2004) and the balanced scorecard applied to supply chains (Brewer and Speh, 2000). A major international survey of supply chain performance management between manufacturing companies reported that 90% of the respondents believed that supply chain performance was important or very important for achieving competitive advantage in the future (Harrison and New, 2002). A scarcity of inter-organizational research in this area was pointed out by Schmitz and Platts (2004) and Seuring (2006). Only a few studies (e.g. Lohman *et al.*, 2004) described the management of supply chain performance in any depth. There is, consequently, a need for further developing knowledge about how to conduct performance management, supporting supply chain management ambitions.

Harrison and New (2002) found that a majority of the manufacturing companies had at best limited or no formal means of measuring supply chain performance. Practical problems are the lack of supply chain strategies and common goals, and familiarity with organizations involved in the same supply chain (Lohman *et al.*, 2004). Research has discussed implementation problems or hurdles of supply chain performance management (e.g. Brewer and Speh, 2001; Busi and Bitici, 2006). These problems can imply that managers bow out from managing supply chain performance.

From a focal company perspective, supply chain management is much about up- and down-stream process integration. Integration is in this paper defined as two companies who jointly conduct and agree upon activities in the supply chain. Several of these integration efforts concern pairs of processes, for example, integration of the purchasing process and the order-to-delivery process through vendor-managed inventory or customer purchasing through a supplier web portal. An alternative to managing supply chain performance across multiple organisations would therefore be to manage the performance of various paired, or dyadic, supply chain processes. Mattsson (2002) and Schmitz and Platts (2004) have advocated dyadic measurement systems, i.e. to manage performance involving pairs of customers and suppliers. Related research is scarce, however. In a study of methodologies used in performance management, only two papers out of 149 had dyadic approaches (Seuring, 2006). This article adopts such an approach, and studies performance management of delivery service in the business processes (the inter-linked purchasing, order-to-delivery and distribution processes) of manufacturing customer/supplier dyads.

Performance management (hereafter called PM) provides an integrating framework, both academically and practically, to focus on improving performance (Mwita, 2000). PM can be seen as a process, which is here defined as consisting of five activities: selecting performance variables, defining metrics, target setting, measurement and analysis. This article proposes that the PM process should be an integrated process between a supplier and a customer. Cooper *et al.* (1997) demonstrated the importance of identifying what processes to integrate with supply chain partners and what extent of integration and management should be applied for each process link. Holmberg (2000a) emphasized that as firms are integrating along supply chains, part of those processes that needs to be integrated is the management of performance measurement. This is supported by Bowersox *et al.* (1999), who pointed out measurement integration as one of the six critical areas for achieving supply chain integration. Daugherty *et al.* (1996) also included performance management in supply chain management. Studies have described different levels of business process integration in a supply chain where higher levels of integration result in higher general performance potentials (e.g. Spekman *et al.,* 1998). Few identified studies have focused on the distribution of responsibility between organizations when managing supply chain performance. Forslund (2005) conducted a broad survey of the responsibility for performance measurement activities in customer/supplier dyads, but interrogated customers and suppliers separately. No identified study has specified how to integrate the PM process. It is therefore necessary to develop a framework for the distribution of responsibility for PM activities. Knowledge on what issues to integrate in the activities need to be generated, to which levels, and how this could be done.

The purpose of this article is to explore how to integrate the performance management (PM) process of delivery service in customer/supplier dyads. The paper is organised as follows. The frame of reference describes the PM process and its integration in a dyadic perspective. The methodology describes how case-based empirical data were collected and categorized, and includes tables that give an overview of company and process characteristics. The empirical study focuses on measuring on-time delivery and integrating the PM process between a supplier and a customer. A cross-case analysis focuses on issues of integration in the respective PM activities and levels of integration of the PM process. Finally, conclusions and suggestions for further research are provided.

Integrating the performance management process

Due to the lack of research on dyadic integration of the PM process, studies on integration of supply chain business processes were consulted. The extent of business process integration in a supply chain can be described in different stages of development and in different dimensions. Spekman *et al.* (1998) described the transition towards supply chain management in different levels of inter-organizational integration. Low level of integration was characterized by open market negotiation, based on price discussions and adversarial relationships. Medium level of integration was characterized by co-operation with fewer suppliers, by exchanging bits of essential information and entering into long-term agreements, and by co-ordination, where specified workflow and information are linked in a way that permits EDI or JIT systems. High level of integration in the model of Spekman *et al.* (1998) was collaboration with supply chain integration, joint planning and processes, all based on trust and commitment and with a common future vision. APICS (2005) also discuss different levels of supply chain integration. Here, the least integrated enterprise lacks clear intra-organizational definitions and priorities and has no inter-organizational links other than transactional. According to the APICS (2005) framework, supply chain integration should be developed in stages. The first stage of supply chain integration is to focus on efficiency and effectiveness within the organization. The next level is to establish an intra-organizational focus on companywide processes rather than on individual functions. In the fully integrated supply chain, the firm integrates its intra-organizational network with the intra-organizational networks of selected supply chain partners to improve efficiency and effectiveness.

One common approach to describing supply chain integration is to distinguish between informational integration and organizational integration (e.g. Lee, 2000; Bagchi and Skjoett-Larsen, 2002). Information integration deals with the extent of information and knowledge exchange in the design, process management and planning and control; technology exchange and adaptation; and resource and risk sharing. Organizational integration is about sharing ideas, institutional culture, decision-making, skills, trust building and creation of bonds. Bagchi and Skjoett-Larsen (2002) include joint performance measurement and problem- solving among the organizational integration characteristics. This is different from the present article, where PM is viewed as a process. In accordance with other processes, it should thus be possible to analyze the level of dyadic integration of PM. Integration of the PM process means integration, i.e. jointly conducting and agreeing, on each of the respective activities and the PM process as such between customer and supplier.

Cooper *et al.* (1997) emphasized the importance of identifying what processes to integrate with supply chain partners and what extent of integration and management should be applied for each process link. The issue of when and how far to integrate is relevant for all supply chain processes, also supply chain PM. To integrate the PM process is however not only an issue of when and how far. There also exist a number of integration hurdles, which may obstruct the integration. Brewer and Speh (2001) emphasized, for example, the importance of overcoming *mistrust* developed from new ways of working with PM, that goals of the partners can differ significantly because of *different competitive situations*, financial circumstances and environments, and difficulties in linking measures to customer values. Difficulties of developing a *collaborative culture* and appropriate *performance metrics* are also identified as major barriers for collaborative performance management (Holmberg, 2000a; Brewer and Speh; 2001, Busi and Bitici, 2006). Another PM integration hurdle emphasized in the literature is an *information system* incapable of gathering non-traditional data or generating appropriate PM reports (Bourne *et al.*, 2000; Lohman *et al*., 2004; Busi and Bitici, 2006).

The PM process can be described as consisting of five activities; see Figure 1. The first activity, selecting performance variables, is based on the strategic priorities. From a dyadic perspective, these activities could be more or less integrated, i.e. conducted separately or jointly by the customer and supplier. The informational and organizational integration can, however, be expected to differ between activities. The level of integration of the activities “selecting performance variables”, “defining metrics” and “target setting” should, for example, be affected by the culture and organizational structure and functioning that allow for inter-organizational integration. The “measurement” and “analysis” activities rely more on the information and communication technology allowing for efficient collection, communication and processing of performance related data. However, the communication and acceptance of a metric is also related to organizational integration. The following sections describe the dyadic integration issues for the respective PM activity.

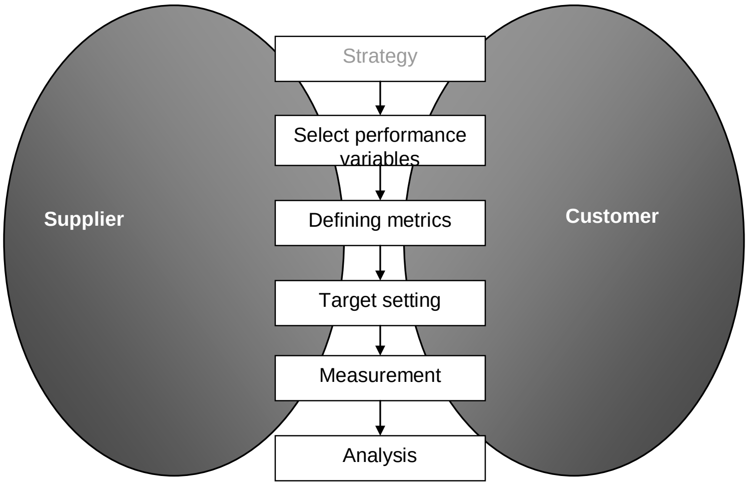

Figure 1. The PM process in a dyad

Selecting performance variables

One common measurement problem is that strategy and measurements are not connected, something that is emphasised by several scholars (e.g. Eccles, 1991; Holmberg, 2000a). The misalignment of functional, corporate and supply chain strategies is an often-mentioned obstacle to process integration and supply chain management (APICS, 2005). The selection of performance variables can be seen as concrete formulations of the company's strategic choices (Lohman *et al.*, 2004). Folan and Browne (2005) proposed more research around the subjective process of performance variables selection, and provided an overview of existing performance measurement frameworks. Problems associated with performance variables selection, such as the existence of an abundance of metrics and the indistinctness of what metrics to use in specific situations, were addressed by Beamon (1999), Hofman (2004) and Basu (2001).

On-time delivery (OTD), delivery accuracy, lead time length and inventory service level are common delivery service variables (Stock and Lambert, 2001). The appropriateness of different delivery service variables depends on the level of value-added necessary at the supplier upon order entry (if the ordered item is available for delivery directly from a finished goods stock or made/assembled to order), the order type (e.g. one-off, batch or sequential delivery order), the need of the ordered item at the customer company (e.g. item delivered to stock or directly for use in production), the characteristics of the ordered item (e.g. value, fragility) etc. The appropriateness of various delivery service level variables in a dyad is, thus, dependent on both supplier and customer characteristics. The integration of the activity "selecting performance variables" depends on the degree (weak or strong) of strategy alignment between the variables and the dyadic or supply chain strategy, i.e. the degree of common agreement to the variables between customer and supplier.

Defining metrics

Metrics definitions need to reflect the detailed characteristics of the companies' operations (Lohman *et al.*, 2004). Defining delivery service performance metrics can be done in a number of ways, and is often done differently by customer and supplier (Keebler *et al*., 1999; Forslund, 2004). The supplier may refer to an order being on time when it is ready for delivery, while the customer wants the products to be accessible at the customer's site on time. A study by Bourne *et al.* (2002) found that companies categorized as successful in performance measurement understood the importance of using validated, measurable and sufficiently detailed definitions of metrics. In order to achieve common definitions of performance metrics, the activity of defining metrics should be coordinated between the customer and the supplier. A set of shared and clearly defined performance metrics could, for example, be ensured by a joint "metrics dictionary" containing information on name, objective, scope, target, definition, unit of measure, frequency, data source, owner, drivers and comments, as suggested by Lohman *et al.* (2004). This is supported by Bowersox *et al.* (1999) who included definitions of metrics that extend across supply chain relationships into measurement integration.

Defining delivery service metrics is complex. The definition of the OTD metric contains four different issues, necessary to handle in order to integrate this activity. The first integration issue concerns the measurement object (MO) and could be the number of orders, order lines or individual items. The second concerns the time unit (TU) for measuring being on time. It could vary between the correct day, the correct week or within a specific time window (e.g. +1/-2 days). The third integration issue concerns the measurement point (MP), i.e. where along the supply chain the order is considered to be delivered (e.g. after packaging, available for delivery, accessible at customer or after the customer's goods reception or quality control). The fourth concerns the comparison date (CD) for an actual delivery date in order to decide if it is on time or not. The comparison date could, for example, be the desired or acknowledged date.

Target setting

Each performance metric should have a formulated target, as claimed by e.g. Basu (2001). Clear, specific performance targets, rather than ambiguous targets or none at all, will improve the overall accuracy and effectiveness of performance measurement (Soltani *et al*., 2004). The process of setting specific and precise targets is, however, not simple. A survey among UK-based quality-focused organisations reported problems in defining performance targets, lack of targets, the subjectivity and vagueness of targets, and the lack of consistency between targets (Soltani *et al.*, 2004). Targets are actionable only when they are quantitative and connected to time frames (Simons, 2000). Target performance often reflects the supplier's subjective interpretation of customers' needs. Ideally, targets would accurately reflect customer needs, which they do if they are set in a shared manner (Holmberg, 2000b). Consequently, involving the customer in target setting should be imperative. Simons (2000) claims that those who should participate in target setting are the ones that have the relevant information, but still make this an intra-organizational issue. Forslund (2005) found in a survey that as many as 88% of the customers in dyads were involved in target setting of suppliers' delivery service.

Performance target figures can be formulated as averages, i.e. the same target level for all customers or suppliers, or as specific targets, i.e. unique targets for specific customers or suppliers. An average target figure is consequently not determined jointly by the customer and the supplier, and is a sign of a low level of integration in the "target setting" activity.

Measurement

It is not obvious who should conduct the actual measurement in the dyad, the supplier or the customer. Forslund (2005) found 88% of customers studied in dyads to be involved in measurement of suppliers' delivery service. Benefits of joint measurement between customer and supplier is, for example, stressed in the literature on Collaborative Planning, Forecasting and Replenishment – CPFR (Stank *et al.*, 1999) and in Holmberg (2000b). Problems caused by lack of dyadic measurement have been identified by e.g. Keebler *et al.* (1999) and Byrne and Markham (1991).

Four issues of integration can be found in the "measurement" activity. Measurement reports generation (RG) could be done directly from the transaction system (e.g. the ERP system) or indirectly (by taking data from the ERP system into Excel and creating reports there). Measurement could also be done with different measurement frequencies (MF), for example, daily, weekly or monthly. The measurement frequency restricts the frequency of conducting analysis. The performance outcome (PO) could, in a similar way as for target figures, be either average for all customers or suppliers, or specific for certain customers or suppliers. Performance feedback (PF) could be done by the other partner and be commented on, adjusted and accepted, in order to assure common agreement of actual performance outcome before starting the next activity, "analysis".

Analysis

The analysis should be input to corporate or dyadic related continuous improvement projects and proactive decision making, as well as to monitoring and following up past performance for making reactive decisions. Analysing logistics performance measurement results was discussed by Mentzer and Konrad (1991). They emphasise the importance of analysing the deviation from targets and of critically reviewing the metrics actually used. The analysis should review the performance output in relation to the corporate and supply chain strategies. Analysis could also have a broader scope and monitor the PM system and its position in the company, the dyad and the supply chain. The analysis then supports selecting performance variables for the future measurement. Important aspects of the "analysis" activity include who is responsible for the activity (Simons, 2000). Caplice and Sheffi (1995) found systematic analysis and review of performance measurement systems to be a weak point in industry. The measurement activity of communicating performance feedback between managers and employees is a prerequisite for corporate action. In analogy with this, communicating performance feedback between customers and suppliers should be a necessary prerequisite for correct actions in dyads or supply chains. A properly conducted measurement activity is consequently a prerequisite for conducting analysis.

This activity and its integration have issues of form and result. Forms of analysis (FA) can be meetings and discussions. Continuous improvement (CI) can be the result of the analysis activity, and can be conducted with different approaches. Table I summarizes the issues to integrate in the PM process.

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Table I. Issues to integrate in the PM process for on-time delivery (OTD) measurement

PM activities	**On-time delivery integration issues**
Selecting performance variables	Supply chain strategy alignment - weak or strong
Defining metrics	Measurement object (MO) - orders, order line or items Time unit (TU) - day, week or window Measurement point (MP) - after packaging, available for delivery, accessible at customer or after goods reception and control Comparison date (CD) - desired or acknowledged date
Target setting	Target figures - average or specific
Measurement	Measurement frequency (MF) - day, week or month Report generation (RG) - directly or indirectly Performance outcome (PO) - average or specific Performance feedback (PF) - none, commented, adjusted, accepted
Analysis	Forms of analysis (FA) - meetings, discussions Continuous improvement (CI) – approaches

Methodology

A case study method was used in order to allow for a deeper qualitative analysis, suiting the explorative purpose. Initially the purpose was formulated in order to collect specific data systematically (Eisenhardt, 1989). To ensure construct validity (Yin, 2003), a theoretical frame of reference concerning the PM process was developed out of multiple sources. It specified integration issues for PM process integration. Literature on process integration was however scarce. Primary case companies were selected based on access to the companies and their interest in delivery service PM. Practically, they were found in two different networks for logistics or process managers, which we are in ongoing contact with. All companies were manufacturing companies located in Sweden. Sampling was not random but rather theoretical (Eisenhardt, 1989); by looking for a variety of company characteristics, a number of typical situations or conceptual categories were covered. Company sizes varied from two to 580 MEuro. Some were individual companies, while others were part of business groups. Most companies were Swedish, while one dyad belonged to an international company group. That dyad was the only company group-internal dyad, although consisting of two separate companies. In some dyads, the supplier could easily be exchanged; in others, the supplier was chosen based on unique technologies and is hard to replace. Each case selected one customer or supplier to focus the study on, generally an important business partner. The researchers did consequently not execute this part of the sampling. Company characteristics are further described in the following section and concluded in Table II.

Data collection was crafted by designing an interview questionnaire. It was semi-structured and open-ended in order to describe and explore issues and patterns. Each interview was conducted by at least two (of the three) researchers, where all made notes during the interviews. This increases the reliability of the study (Eisenhardt, 1989; Yin, 2003). Twenty-seven in-depth interviews were conduced during Winter 2005/2006. The manager in respective company selected the interviewees; those that worked with measuring delivery precision. In the smaller companies, one person was interviewed, in the larger companies up to five persons supplied information. The interviews lasted between one and three hours. Some performance data and archives were used as a secondary source of information; hence both qualitative and quantitative data were collected. After the interviews, follow-up questions were sent to the interviewees. The detailed specification of variables can be found in the case description section.

Analysis was firstly conducted as a within-case analysis. The interviewees validated these case descriptions (however not shown in this article) to ensure construct validity, as recommended by Yin (2003). After this a cross-case analysis phase followed, which can be found in the analysis section. Pattern matching was conducted, searching for patterns in integration of the PM process and the relation between business process integration and PM process integration. Comparisons with literature (explanation building) were made, in order to increase internal validity. Pattern matching and explanation building are two ways to reach internal validity (Yin, 2003). Altogether, the study was judged to possess validity and reliability.

Case descriptions

The empirical section contains descriptions of company characteristics, in order to understand typical situations (Table II), the dyadic business processes, in order to understand the context of PM (also Table II) and delivery service PM processes (Table III) of the six dyads, and was based on the interviews with the case companies.

The company characteristics descriptions contain the following information: *Respondents* refers to who (which position) supplied information during the interviews (C for customer interviewees, S for supplier interviewees). *Products* refer to the customer's end product. *Delivered items* are what the supplier delivers in the dyad. *Turnover* in MEuros for each studied company is shown. *Dependency in the dyad* is described based on type and length of cooperation and the proportion of the other partner's turnover in the dyad. It is categorized as high or low, based on the interviewees' perception.

The dyadic business processes descriptions contain the following information: The purchasing process describes order and forecast information exchange. The order-to-delivery process is described as make-to-order (MTO) or make-to-stock (MTS), and notes whether there are any specific demands. The distribution process describes delivery and transportation.

The PM process descriptions contain information about the five activities and are structured using the issues of integration of Table I. Data from both customer (C) and supplier (S) is presented. The focus of all studies was on measuring delivery service, especially on-time delivery. Therefore, the first PM activity "selecting performance variables" is not emphasized to the same extent as the other activities. *Performance* is the customer companies' perception of the supplier's delivery service. Performance is coded as high if it is perceived to be equal or higher than targets, and low if it is perceived to be lower than targets.

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Table II. Overview of the studied dyads - company characteristics and dyadic business processes

		Customer A Supplier A	Customer B Supplier B	Customer C Supplier C	Customer D Supplier D	Customer E Supplier E	Customer F Supplier F
Company characteristics	**Respondents**	C: Logistics mgr S: Managing director	C: Production mgr, purchasing mgr, 2 purchasers S: Production mgr	C: Material&quality mgr, supply mgr, purchasing mgr, material planner S: Managing director	C: Logistics mgr, production mgr S. Purchaser	C: Logistics mgr, sourcing mgr, logistician S: Logistics mgr, seller	C: Purchasing mgr, SCM mgr, quality mgr, strategic purchasing mgr, goods receiver S: Production mgr, logistics mgr
	Products	Industrial dish washers	Air treatment products	Military airplanes	Automotive roof racks	Brake systems	Turbine maintenance
	Delivered items	Pumps	Metal components	Electronic and hydraulic components	Aluminium profiles	Brake components	Turbine spare parts
	Turnover	C: 52 MEuro S: 2.2 MEuro	C: 18 MEuro S: 2.5 MEuro	C: 580 MEuro S: 40 MEuro	C: 90 MEuro S: 100 MEuro	C: 104 MEuro S. 45 MEuro	C: 100 MEuro S: 13 MEuro
	Dependency in the dyad	Long-term engineering cooperation. Customer A is one of 6 large customers. High dependency	Supplier B can be exchanged, supplier B has 15-20% of its turnover to customer B. Low dependency	Supplier C is a strategic supplier that does development work, 40% of customer C's turnover to supplier C. High dependency	Supplier D is one of the largest suppliers. Customer D is one of the largest customers but the plant studied is a small customer. High dependency	Supplier E is single source supplier, with a unique manufacturing process, customer E is one of the largest customers. High dependency	Supplier F single source supplier of the actual items, customer F the only customer. High dependency
The dyadic business processes	**Purchasing process**	12 months rolling delivery schedule (10 days frozen demand), by web-EDI	Five orders per week. Daily informal communication	Long-term contracts with agreed annual demand (3 months frozen demand).	No forecasts Purchasing orders every second week	Annual forecasts. 12 weeks rolling delivery schedules (2 days frozen demand).	3 years forecast (1 month frozen demand)
	Order-to-delivery process	MTO	MTO. Very high product quality requirements.	MTS	MTO	MTO + safety stock. Very high product quality requirements.	MTO
	Distribution process	Weekly deliveries to inbound stock 15 min delivery time Outsourced transportation	Weekly deliveries to inbound stock 1 hour delivery time Outsourced transportation	Daily deliveries 3 hour delivery time Outsourced transportation	Delivery when order finished (weekly) 2 hour delivery time Outsourced transportation	Weekly deliveries 1 day delivery time Outsourced transportation	Delivery when order finished Same location Outsourced transportation

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Table III. The performance management process in the six dyads

		Customer A Supplier A	Customer B Supplier B	Customer C Supplier C	Customer D Supplier D	Customer E Supplier E	Customer F Supplier F
The performance management process	**Selecting perfor-mance variables**	Activity not relevant because the focus of the study is on the existing OTD metric and not on selecting metric.					
	Defining metrics MO – measurement object TU – time unit MP – measurement point CD – comparison date	**C**: MO - order lines TU - 4 days delivery window (-2/+1 day) MP - after quality control CD - acknowledged date **S**: MO – not known TU – not known MP – not known CD – not known	**C**: MO – not defined TU – not defined MP – not defined CD – not defined **S**: MO - orders TU - day MP - available for delivery CD - acknowledged date	**C**: MO - orders TU - 3 weeks delivery window (-1/+1 week) MP - after quality control CD – desired date **S**: MO - order lines TU - day MP - available for delivery CD – acknowledged date	**C**: MO - order line TU -day MP – accessible at customer CD - acknowledged date **S**: MO - order TU -day MP - available for delivery CD - acknowledged date	**C**: MO - order line TU – 3 days delivery window (-2/+1 days) MP – after goods reception CD - acknowledged date **S**: MO - order line TU - day MP - available for delivery CD - acknowledged date	**C**: MO - order line TU - day MP - available for delivery CD - acknowledged date **S**: MO - order TU - day MP - available for packaging CD - acknowledged date
	Target setting	**C**: average, 95% **S**: average, 96%	**C**: specific, 100% **S**: specific, 100%	**C**: specific, 95% **S**: specific, 100%	**C**: average, 100% **S**: average, 95%	**C**: average, 98% **S**: average, 100%	**C**: specific, 90% **S**: specific, 95%.
	Measurement MF – measurement frequency RG – report generation PO – performance outcome PF – performance feedback	**C**: MF - monthly RG - direct PO - average 90%. PF - none **S**: MF - monthly RG – direct PO – average 98% PF – none	**C**: MF – no measurement RG – no measurement PO – no measurement PF - none **S**: MF – monthly RG - direct PO – specific 100% PF - accepted	**C**: MF - monthly RG - indirect PO - specific 95% PF – not accepted **S**: MF - monthly RG – indirect PO – specific 100% PF – none	**C**: MF - monthly RG – indirect PO – specific <90% PF – not commented **S**: MF - monthly RG - indirect PO - <90% PF – none	**C**: MF – monthly RG – direct PO – specific >97% PF - none **S**: MF - weekly RG – indirect PO - average 96%. PF - none	**C**: MF - monthly RG – indirect PO - specific 81% PF – common server, accepted **S**: MF – weekly RG – indirect PO – specific 90% (8 weeks) and 96% (6 months) PF – common server, accepted
	Analysis FA – forms of analysis CI – continuous improvement	**C/S**: FA - Discussions when problems CI – none	**C/S**: FA - Meetings when problems CI - none	**C/S**: FA - Annual meetings CI – trend analyses initiate actions at the supplier	**C/S**: FA - meetings CI – supplier identifies causes for each late delivery.	**C/S**: FA - meetings CI - none	**C/S**: FA - monthly meetings CI – common analysis and actions, six sigma projects.
	Perceived performance	High	High	High	Low	High	Low

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Analysis and discussion

This section contains cross-case analysis conducted in two steps, and a discussion identifying future research needs related to performance management. The first analysis focuses on comparing issues of integration in each activity making up the PM process in the six dyads studied. The second analysis concerns the levels of integration of the PM process. Table IV summarizes the state of integration between customer and supplier of the respective PM activity. The activity "selecting performance variables" was not analyzed because the study focused on the OTD metric. "Defining metrics" integration is coded as low if there are differences in two or more issues, and high if not more than one issue differs. "Target setting" integration is coded as high if it is jointly discussed, and low if it is not. "Measurement" integration is coded as low if performance outcome is measured as an average for all suppliers or customers. To be coded as high, specific (for the supplier or customer) measurement of performance outcome is required. Furthermore, at least commented performance feedback between the partners is necessary for being coded as high integration. "Analysis" integration is coded as high if both analysis and continuous improvement are conducted in a joint manner.

Table IV. Summary of PM activity differences and integration

PM activities	A	B	C	D	E	F
Selecting performance variables	Activity not relevant because the focus of the study is on the existing OTD metric and not on selecting metric.					
Defining metrics	Customer defines, supplier does not know. Difference not known. Low integration	Supplier defines, customer accepts. No difference. High integration	Both partners define, diff in four issues (MO, TU, MP, CD). Low integration	Both partners define, diff in two issues (MO and MP). Low integration	Both partners define, difference in two issues (TU and MP). Low integration	Both partners define, diff in two issues (MO and MP). Low integration
Target setting	Average targets, 1% difference. Low integration	Specific targets, 0% difference. Low integration	Specific targets, 5% difference. Low integration	Average targets, 5% difference. Low integration	Average targets, 2% difference. Low integration	Specific targets, 5% difference. Low integration
Measurement	Same MF and RG. Difference in PO not known, no PF. Low integration	0% difference in PO, accepted PF. High integration	Same MF and RG. 5% difference in PO. PF not accepted. Low integration	Same MF and RG, 0% difference in PO. Not commented PF. Low integration	Differences in MF and RG, difference in PO not known. No PF. Low integration	Different MF, same RG. 9% difference in PO. Accepted PF. High integration
Analysis	Common FA, no common CI. Low integration	Common FA, no common CI. Low integration	Common FA, no common CI. Low integration	Common FA, no common CI. Low integration	Common FA, no common CI. Low integration	Common FA and CI. High integration

Issues of integration in the PM process

Integration in defining metrics: All dyads, except for dyad B, show differences in how the supplying and buying companies define metrics, i.e. this activity has a low level of integration. In dyad B, the supplier defines and the customer accepts. The complexity of the OTD metric requires that four issues in the definition must be agreed between the partners. Most companies define metrics in their own way, based on their own (Lohman *et al.*, 2004) and their ERP systems' logic. This conforms to the results of Keebler *et al.* (1999) and Forslund (2004). This is the case even if the dyadic business processes between the partners is considered to perform well. For some dyads, the definitions show small differences between suppliers and customers, even though they define the metric individually. This is, however, just a coincidence. Most dyads show differences in two or more issues of definition. Even if one dyad uses a logistics contract, the contract does not regulate details around metrics definitions. Metrics dictionaries, as suggested by Lohman *et al.* (2004), would be a valuable part of a PM process, which could lead to increased integration of "defining metrics" and decreased differences of the actual metrics. Defining metrics similarly in the dyad is a prerequisite for validity, and has consequences for all remaining PM activities.

Integration in target setting: Target setting integration is low in all dyads. Targets are used in all dyads, which was recommended by e.g. Basu (2001). In two of the dyads, targets are the same or very similar. Dyad A with low target setting integration shows only small differences between the average targets used, but this is just a coincidence. None of the companies, however, refer to a joint discussion or a formal procedure on "target setting", as recommended by Holmberg (2000b). In the other dyads, targets show differences. Still, one of these dyads actually uses a logistics contract, which obviously does not regulate "target setting". The lack of consistency between performance targets is an obstacle to achieving an integrated PM process, which was also emphasized by Soltani *et al.* (2004). This reflects the lack of focus on performance measurement in general, because "target setting" should be an important activity for achieving accurate and effective performance measurement (Soltani *et al.*, 2004).

Integration in measurement: Two dyads have high integration in "measurement". Not all companies measure OTD for the specific business partner. Customer B does not measure OTD as supplier B does. This is a form of integration, as no duplication of activities is taking place, and can be a step towards a joint measurement system as suggested by Stank *et al.*, (1999) and Holmberg (2000b). In dyad A, all suppliers and customers are measured together and the performance of individual companies is not traced. This is related to priorities, as that relation is characterized by high performance and good information exchange in the shape of accurate delivery plans. As long as the performance is considered to be as high as expected, the need for measurement is considered lower, especially when perceived deviations from the normal and expected performance are communicated. "Measurement" is often a complicated issue, as most companies (dyad C, dyad D, supplier E and dyad F) generate their measurement reports indirectly. In this manoeuvre, it is possible to affect performance outcome. The use of Excel also results in non-standardised, individually designed reports that may be difficult to read in other companies. This procedure is hence only done monthly in the dyads studied, which might be too seldom to trace deviations from targets. Dyads E and F have different measurement frequencies.

In some of the dyads, performance results are fed back from customers to suppliers. Supplier C does not agree on the delivery service performance received from customer C. Customer D expects their suppliers to comment on their own feed-back results, which supplier D does not do, however. In dyad F the partners have access to each other's performance outcome on a common server, but as definitions differ, so too do the performance outcome. A similar situation exists for dyad C. Differing measurement frequencies, indirect report generation and no performance feedback result in suppliers and customers working with different performance outcome. This is the case in five of the six dyads. Without a common performance outcome, it is not possible to conduct common analysis.

Integration in analysis: Just one dyad has high integration in “analysis”. The PM “analysis” activity is weakly conducted in most cases. All dyads have some kinds of meetings where PM can be discussed, either annually or when problems occur. One consequence of differing definitions can be that this is the focus on meetings, rather than to constructively discuss how performance can be improved. This was the situation for dyad C. However, the fact that the partners actually meet is a first step of integration in this activity. The focus is mainly on studying deviation from targets, as suggested by Mentzer and Konrad (1991). No company reviews the PM system as a whole or its position in the company, which accords to the results of Caplice and Sheffi (1995). Supplier C, customer F and supplier F clearly use analysis results in order to improve the performance of their own processes, while customer C, customer D and supplier E do not. Only dyad F uses the PM as input to common continuous improvement, yet all companies consider PM to be important.

Integration of the PM process: The importance of integration, in order to achieve an integrated and well functioning PM process, differs among the PM activities. The level of integration of the activities also differed in the dyads studied. The “selecting performance variables” is related to the actual strategy and priorities. If there is a dyadic or supply chain strategy, then this activity could involve both partners. But if such a strategy is not clear, the strategy and priorities from which to derive the performance variables are corporate ones. The same is true for the analysis activity. If the objective of the measurement is to conduct common continuous improvement in the dyad, then the activity should be integrated; otherwise it is not. The activities “selecting performance variables” and “analysis” could, consequently, be considered to have a low level of integration even in a well functioning and integrated PM process.

Normally, the “measurement” activity needs not be carried out by both partners in a dyadic relationship. It should suffice that one partner is measuring and communicating the measurement outcome to the other partner, who comments, adjusts and accepts the figures. The order fulfilment process is actually not fulfilled until the delivery is accessible at the customer, so it could be considered that the most relevant measurement point would be to let the customer measure this. However, it is the supplier who directly affects the order fulfilment performance, which suggests that the supplier should measure. An approach where one partner measures and the other comments, adjusts and accepts results in a PM process where both parties work with the same data. This is a first step towards integration. The same is true for the “defining metrics” and “target setting” activities. They could be conducted by one party and commented, adjusted and accepted by the other party. However, these activities often require much larger amounts of discussion and negotiation. Therefore, they are the activities with the largest integration requirements of all activities.

Figure 2 illustrates the integration requirements of the separate PM activities, and is a development of Figure 1. In order to align the PM process with the corporate strategy and to conduct corporate performance analysis, a company needs a process that includes all activities. Another party could conduct some of the activities, as long as the necessary input is achieved from the previous activity (as illustrated by the dashed arrows between the “select performance variables”, “measurement” and “analysis” activities in Figure 2).

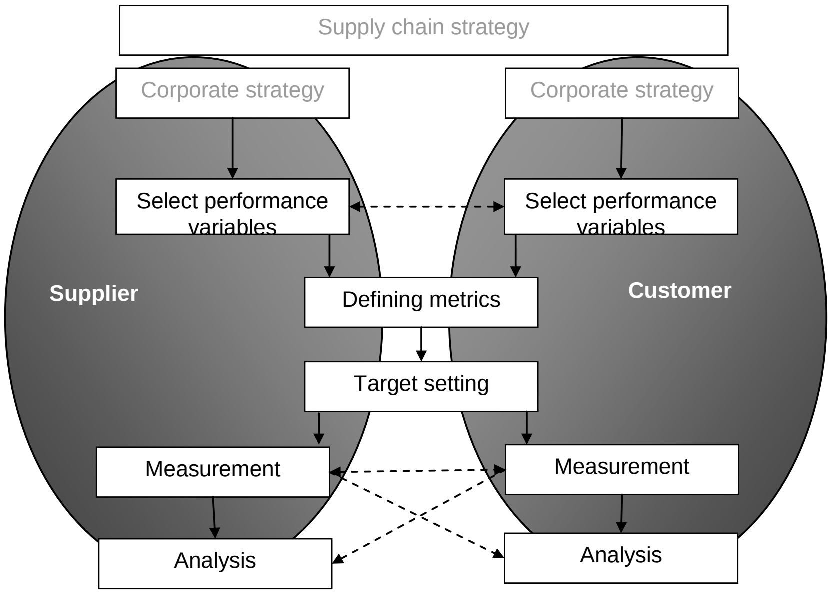

Figure 2. Suggested integration of the PM process in a dyad

Levels of integration in the PM process

The levels of integration in the dyadic business processes differ but are in general low. With regard to Spekman's *et al.* (1998) and APICS's (2005) supply chain integration frameworks, all dyads have passed the non-integration stages with open price negotiation and adversary relationships. In the first stages of supply chain integration, functional and corporate priorities are defined. Bits of essential information are exchanged with some partners. The companies in dyad B are characterized by low dependency because the supplier can be exchanged. Information is exchanged, but not in specified information linkages. The long delivery times from when customer D orders to delivery from supplier D permit supplier D to apply a make-to-order strategy, and could thus be seen as a way of integrating the business processes. However, they do not communicate forecasts, and the long delivery times result in higher stock levels at customer D. Also this dyad has, thus, only marginally integrated its business processes. The parties in dyad F are heavily dependent on each other, but they do not exchange information in a standardized and well-developed way. Supplier A has a long-term engineering co-operation with customer A and coordination with specified information linkages (exchange of delivery plans via web EDI), and could therefore be considered to have advanced somewhat further in supply chain integration. Dyad E has a long-term relationship between the parties and a mutually high dependency. The information exchange is standardized and well developed. Dyad C is the one with most integrated business processes, for example, specified information linkages, specified workflow and formal contracts.

The levels of integration of the PM processes differ between the companies and dyads studied. For all dyads, the integration of the PM process is perceived to be lower than the dyadic business process integration, in terms of both informational and organizational integration. This is especially true for the dyads with higher general business process integration (dyads A, C and E). Previous studies (e.g. Holmberg, 2000a, Brewer and Speh, 2001, Busi and Bitici, 2006) have also reported low levels of PM integration in supply chains. In all but dyad B, the supplier was a strategically important supplier. Dyad B showed lowest dependency between suppliers and customers but was one of the two dyads with highest PM integration. The empirical study could, thus, not propose a direct relationship between the dyadic business process integration and PM integration. All dyadic relationships had existed for some time and were considered to be characterized of trust and collaboration. This may be the reason why mistrust, lack of collaborative culture and different competitive situations, as opposed to Brewer and Speh (2001), were not considered to be major hurdles for PM integration in any of the dyads. Instead, a general hurdle for PM integration in all dyads was the lack of standardized metrics or common metric definitions (Holmberg, 2000b; Brewer and Speh, 2001). The low level of PM integration can also be related to poor intra-organizational informational integration, as most companies (dyads C, D and F plus supplier E) regard their ERP systems as being dysfunctional and have to move data to Excel in order to produce usable performance reports. This supports the findings of Bourne *et al.* (2000), Lohman *et al.* (2004) and Busi and Bitici (2006) who identified computer system issues as causes for lack of PM integration. Based on the empirical study, the following propositions regarding PM integration hurdles could consequently be generated:

P1. Lack of standardized metrics is a major hurdle that obstructs PM integration.

P2. Non-appropriate ERP functionality is a major hurdle that obstructs PM integration.

Another explanation for the low level of integration could be that the PM process is not a process that is strategically important to integrate (Cooper *et al.*, 1997). The empirical data also show that the PM process is awarded differing priorities depending on the integration and perceived performance of the dyadic business processes. The dyads with highest levels of dyadic business process integration had the least integrated PM processes. When the customer's and supplier's business processes are coordinated, it consequently seems less important to monitor and control performances with an integrated PM process. Business process performances vary between studied dyads, which may impact the priority being directed to the PM process. If the performance of the business process is perceived to be high, less interest for and priority of PM is observed. Less interest and priority impact the interest for and extent of actual PM integration. Consequently, the following hypothetical relationships or propositions between PM integration and the business processes that the PM process intends to measure existed in the dyads studied:

P3. The higher the level of integration of the dyadic business processes, the lower the demand for an integrated PM process.

P4. The higher the performance of the dyadic business processes, the lower the demand for an integrated PM process.

Conclusions and further research

The purpose of this article was to explore how to integrate the performance management (PM) process of delivery service in customer/supplier dyads. The theoretical contribution of this article is a framework of integration issues for delivery service, together with a key to how to categorize the levels of integration in the PM activities and in the PM process. The analysis did not test any proposed relationship and did not intend to generate findings possible to generalize to a wider population. The study was based on the proposition that performance of dyadic business processes should be managed with a dyadic performance management process, consisting of the activities of "selecting performance variables", "defining metrics", "target setting", "measurement" and "analysis". The level of integration of the PM process depends on how well the five performance management activities are jointly conducted and agreed upon by the supplier and customer in the dyad. Often, the "defining metrics" and "target setting" are the activities that are most relevant and important to integrate. "Selecting performance variables" and "measurement" have to be agreed by both customer and supplier, and "analysis" is often an individual activity conducted separately by each party. The empirical study focuses on measuring on-time-delivery in different Swedish manufacturing industries. The findings are specific for this context but the conclusions are considered to be relevant also for other metrics and company contexts.

The empirical findings indicate a lack of focus and priority for PM in general and for performance management integration in particular. In all the dyads studied, the levels of integration of the PM process were lower than of the dyadic business processes. Causes for lack of PM process integration were considered related to the lack of standardized metrics, inappropriate ERP functionality and that the PM process was not considered being strategically important to integrate. Some propositions generated from the empirical findings were formulated to enable further empirical testing.

The following four areas and related questions were identified as challenging and important for further research related to PM integration in supply chains: 1) PM integration importance, 2) obstacles to PM integration, 3) means for integrating the PM process activities and 4) consequences of PM process integration.

Research needs related to performance management

One reflection emanating from the analysis is the lack of integration of the PM process between the business partners. Integration of the PM process means integration of each of the respective activities, especially the *defining metrics* and *target setting* activities, and for the PM process as such. The analysis in this article did not test any proposed relationship and did not intend to generate findings possible to generalize to a wider population. A natural next step for further research would therefore be to conduct a broader based survey study, testing proposed relationships and patterns identified here. From the analysis conducted, the following areas of research needs related to PM in supply chains could be generated:

1. PM integration importance: Cooper *et al.* (1997) emphasize the importance of identifying what processes to integrate with supply chain partners and what degree of integration and management should be applied for each process link. They do not emphasize PM as a generally important process to integrate, but others do (e.g. Holmberg, 2000b). The present study identified the lack of understanding of the benefits of integrating PM with supply chain partners. Therefore, the following questions should be important for further research: What makes the PM process a strategically important process? In what situations would it be beneficial to integrate it in the supply chain? How far should the PM process be integrated? In certain environments, enough effects might be reached on low levels of integration. In the analysis, two propositions focusing on situations with low PM process integration were generated. These propositions could be empirically tested on a larger sample of companies.

2. Obstacles to PM integration: It was revealed in this study that the lack of standardized metrics, inappropriate ERP functionality and lack of priorities could be obstacles for PM integration. These issues are also identified as integration hurdles in previous research, together with for example mistrust, lack of understanding, lack of control, different goals and objectives and problems of deciding where to begin (Brewer and Speh, 2001). Similar causes to lack of organizational and information-related supply chain integration are identified (Benton and Maloni, 2005). The degree of PM integration should not only depend on the existence of integration hurdles. Company internal conditions, for example, who is responsible for the measurement process, and the tradition and characteristics of measuring and collaborating in the industry and supply chain may also impact the degree of PM integration. Another reason for lack of PM integration may be that it has to mature over a longer period of time in an evolutionary manner, i.e similar to development on long-term relationships. An important question for future research is consequently: Which are the most important PM integration obstacles and how do they actually impact the degree of PM integration?

3. Means of integration: One challenging area is obviously how to operationally manage the integration of the five PM activities. How can supply chain partners decide on and agree on what variables to measure? Maybe a supply chain strategy is required for this step. Given that, how can the selected metrics be defined – a critical activity in the PM process? In what way can target setting be an integrated activity between the partners? How can the actual measurement be conducted in the most efficient way in the dyad? And finally, how can PM analysis be conducted in a way that drives improvement for the supply chain as one entity? The ways to practically reach integration might be shared goals and strategies, a common culture between the partners, the organizational design of the respective companies, and metrics dictionaries (Lohman *et al.*, 2004), and the construction and content of contracts regulating logistics performance when it comes to defining metrics and target setting. Compatible information and communication technology (ICT) for communication as well as for the generation of measurement reports seems to be relevant when it comes to measurement and analysis, as suggested by Busi and Bititci (2006).

4. Consequences of PM process integration: This study has shown a number of weaknesses in how the PM process is integrated and handled in dyads. It can be expected that a number of consequences emanate from this handling. What kind of consequences can occur? They can probably be expected to be of a financial or practical nature, affecting trust etc. What are the possible benefits and costs of integration? Benefits could be based on the reduction of duplicated activities and more efficient and effective dyadic business processes. Costs could be related to investments in compatible ICT or to the time spent on discussions. Another question is where do those consequences appear? We believe there must be consequences for the customer, such as lost income due to low performance; for the supplier, such as imperfect signals of what performance is important; and for the dyad, such as a relation characterized by discussions on who to blame rather than on constructive continuous improvements, or lower efficiency and effectiveness towards the next dyad in the supply chain.

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