



Strategic and Operational Benefits of B2B Data Exchange Technologies in Supply Chain Management

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RESEARCH MOTIVATION

The diffusion of electronic media for b2b data exchange in supply chain management, especially electronic data interchange (EDI), has reached an advanced level among most large firms. But penetration of these technologies is still far away from a 100% usage level. In Europe, 39% of firms exchange data electronically by means of standardized formats, a total of 23% applies EDI standards (Berlecon Research 2004). On a global scale, 95% of the Fortune 1000 companies used EDI a few years ago, but only 5% of smaller companies were EDI users (Kottok and Webber 2001). Consequently, it is highly probable that a firm that uses EDI cannot apply EDI for all its transactions and therefore uses several technologies for b2b data exchange. As a consequence, the efficiency advantages and benefits that are related to EDI and Web-based data exchange are not exploited for a firm's total transactions. It is possible, however, that a firm's optimal EDI penetration is less than 100% due to related costs and strategic reasons.

The research in progress at hand addresses the problem of multiple technologies in b2b data exchange. By today, there is little knowledge both in IS research as well as in supply chain management and logistics research concerning the question of costs and benefits of different data exchange technologies used within a single firm. In order to gain insights into the nature of performance of data exchange technologies, a research framework is developed that will be empirically tested by means of real-life data of a cooperating retailer. The firm belongs to the top three Austrian food retailers and pioneers in application of retail technology and electronic business tools. It is also a very active member of the national Efficient Consumer Response (ECR) initiative. This active role in ECR does favor the retailer's interest in b2b collaboration and related EDI support but it can also contribute to specific benefits for the retailer.

THEORETICAL BACKGROUND

In IS research, much effort has been done in order to evaluate EDI costs and benefits in different theoretical contexts. EDI benefits have been analyzed on the basis of Transaction Costs Economics (TCE) (Mukhopadhyay and Kekre 2002), the Resource-Based View of the Firm (RBV) (Melville et al. 2004, Dyer and Singh 1998), the Embeddedness Theory (Chatfield and Yetton 2000), and Power Theory (Hart and Saunders 1998). Mukhopadhyay and Kekre (2002) stress the institutional perspective of EDI benefits and argue that a decisive influencing factor of EDI payoffs is a firm's role as EDI initiator or EDI adopter. Additionally, a firm's position within the supply chain, i.e. whether a firm is a supplier or a customer, has been identified as an antecedent of EDI payoffs. Based on these categorizations, we identify studies about firms that are (1) supplier and EDI initiator (Mukhopadhyay et al. 1995; Droege and Germain 2000), (2) supplier and EDI adopter (Benjamin et al. 1990; Wang and Seidmann 1995), and (3) customer and EDI adopter (Lee et al. 1999). Therefore, there is little research on EDI payoffs from a customer's point of view and no focus on customers that are EDI initiators. But especially retailers are often reluctant to apply EDI as they fear that the increased degree of information transparency could weaken their bargaining power towards trading partners (Riggins and Mukhopadhyay 1994).

DEVELOPMENT OF THE RESEARCH MODEL

The basic assumption that inter-organizational information systems (IOS) contribute to an increase in benefits complies with all theoretical approaches mentioned above. One major issue is the decrease in transaction and communication costs that can be achieved by IOS application.

The theory of TCE (Williamson 1975) argues that a decrease in transaction costs favors the adoption of governance mechanisms that are closer to hierarchies than traditional relationships without IOS. Hierarchies are characterized by tight connection and a high level of interdependence between the engaged organizations whereas market-based governance is dominated by loose and short-term interaction that is transaction-oriented (Dyer and Singh 1998). Hence, according to TCE, short-term as well as long-term benefits can be achieved, the former by efficiency gains (Sutton 1997), the latter by establishment of close interfirm relationships (Lee, Clark and Tam 1999).

The theory of embeddedness goes into a similar direction as it argues that close interfirm relationships are characterized by a high degree of trust, joint problem-solving, and exchange of information (Uzzi 1997). The basis of embedded relationships are IOS, especially EDI systems (Chatfield and Yetton 2000). Empirical research revealed that embedded relationships achieve higher strategic benefits than others, related to the performance measurement by MIT90s (Scott-Morton 1991).

In a first instance, it is hard to apply IOS and their benefits to the findings of RBV (Barney 1991) as it is in contradiction to the implications of interfirm relationships that deploy resources jointly. In its original form, the RBV focuses on one single firm's resources and stresses factors that make these resources not accessible to other firms. If, however, RBV is adapted to issues of interfirm relationships, as suggested by Dyer and Singh (1998) and Dovev (2002), strategic and operative benefits of commonly shared resources, such as IOS, can be explained by RBV.

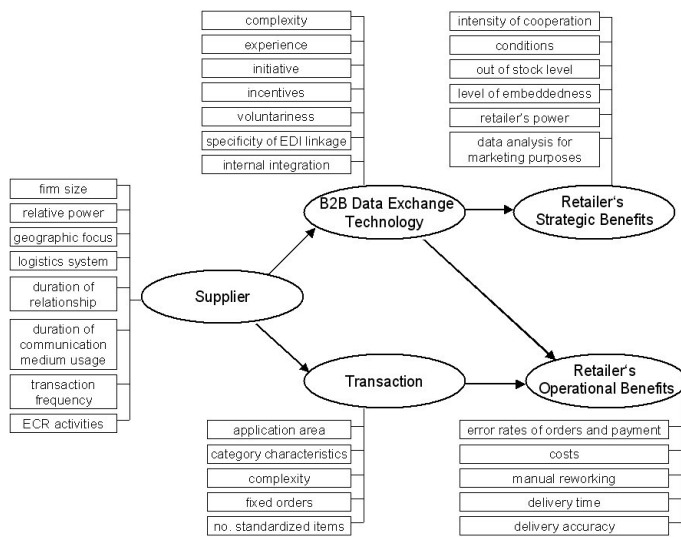
Based on the above-mentioned considerations, the study investigates strategic and operational payoffs of EDI compared to other electronic and non-electronic b2b communication media. The following research questions are defined:

- To what extent does operational benefit of b2b data exchange differ across various b2b data exchange technologies?
- To what extent do supplier's attributes, characteristics of b2b data exchange technologies, and the type of transaction influence a technology's strategic and operational benefit for a retailer?

Operational and strategic benefits are conceptually different constructs (Mukhopadhyay and Kekre 2002). For this reason, both focal variables are investigated. Influencing factors identified by literature research are transaction characteristics (derived from the considerations by Mukhopadhyay and Kekre 2002), the involved technology for b2b data exchange (derived from Chatfield and Yetton 2000 and Mukhopadhyay and Kekre 2002), and supplier characteristics. All drivers and their measurement items are depicted in Figure 1.

Strategic benefits are characterized by long-term and relation-specific properties that potentially alter processes and therefore improve

Figure 1. Research model on B2B data exchange technology performance



operational performance in the long run. Items that describe strategic benefits are a higher degree of cooperation between the retailer and its suppliers (Mukhopadhyay and Kekre 2002), a higher level of relationship embeddedness (Chatfield and Yetton 2000), and a lower stockout rate. As Mukhopadhyay and Kekre (2002) point out, strategic benefits can only be obtained in the post-implementation phase as they are long-term oriented. Hence, strategic benefits are only applicable for retailer-supplier relationships that have been supported by EDI for several years. *Operational benefits* denote the direct impact of a data exchange technology on efficiency. According to Mukhopadhyay and Kekre (2002), operational benefits are characterized by the degree of manual handling and timely and correct payment. In addition, error rates, costs, and duration of transactions as well as logistics performance figures are considered relevant. *Transaction characteristics* contain key attributes of the transactions between the retailer and its suppliers. Beside the type of transaction (order, shopping notice, invoice), the complexity and degree of standardization as well as the involved product groups are used to describe the nature of transaction. The *b2b data exchange technology* is analyzed in the context of the technological support of the retailer-supplier relationship. Applied technologies can be EDI, Web-based EDI, e-mail, telefax, and non-electronic media. Further relevant issues are experience with the technology (Sriram et al. 2000), the initiative of technology implementation (Mukhopadhyay and Kekre 2002), and the degree of integration with the retailer's ERP system (Chatfield and Yetton 2000). Finally, *supplier characteristics* are included in the analysis. Following the findings by Hart and Saunders (1998), the relative power of the supplier and its size (Mukhopadhyay and Kekre 2002), but also its logistical performance are measured. In order to ensure that strategic benefits are applicable, the duration of the relationship and its support by EDI systems is measured by assigning the supplier to the adoption, implementation or post-implementation phase (Mukhopadhyay and Kekre 2002).

DATA COLLECTION

The data necessary for model testing will be collected in close cooperation with an Austrian groceries retailer. Three ways of data collection will be applied:

1. Analysis of the retailer's real-time transactions, i.e. orders, shipping notices, and invoices in order to measure the transaction.
2. Interviews with the employees of the retailer and the involved suppliers in order to measure the suppliers' attributes and the data exchange technology's characteristics as well as strategic benefits.

3. Process observation in order to measure the operational benefits of the communication media.

A total of approximately 200 suppliers within several product categories in different stages of EDI adoption will be examined. Transaction analysis will cover 5.000 transactions from a period of several weeks.

IMPLICATIONS AND EXPECTED CONTRIBUTION

For firms, an estimation of costs caused by various b2b communication media is an important information as it can be used for decisions concerning an appropriate medium. Payoffs achieved by different data exchange technologies may differ across product categories or even individual suppliers. The study results should not only be complementary to the widely investigated field of EDI benefits and therefore help to get a better understanding of key drivers of EDI and other technologies' performance. An important goal of the study is developing recommendations for retailers concerning the choice of appropriate b2b data exchange technologies. Further research perspectives could focus on benefits achieved by lower inventory costs using economic order quantity modeling.

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