Benefits and Success Factors of Buyer-Owned Electronic Trading Exchanges: Procurement at Komatsu America Corporation

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ABSTRACT
Application of e-business concepts and models can be successful, but anecdotal evidence has indicated numerous failures. In this paper we present an improvement framework, named the I-Frame, to analyze a best-practice implementation of a buyer-owned electronic trading exchange at Komatsu America Corp. – Peoria Manufacturing Operations (KAC-PMO). The I-Frame is derived from five e-business models taken from the literature and describes the benefits and factors for successful implementation of Internet-based purchasing of direct materials. The I-Frame views benefits and success factors in four dimensions: business process, purchasing costs, product quality, and organization. Almost all benefits and success factors in the KAC-PMO case can be identified using the I-Frame. Moreover, the I-Frame gives rise to ideas for the further enhancement of purchasing at KAC-PMO. In general, practitioners can use the I-Frame when (1) investigating possibilities for improvements in the procurement business function, (2) determining the scope and prioritization of requirements of a procurement improvement project, (3) monitoring the success factors of a running procurement project.

Keywords*: Procurement, Purchasing, Trading Exchange, E-business*

INTRODUCTION

Until five years ago, organizations mainly focused on optimizing business processes *within* organizations. Vendors of Enterprise Resource Planning (ERP) software realized high turnovers. Towards the end of the century however, organizations increasingly included supply chain management, customer relationship management, and supplier relationship management in their strategies. Business-to-business (B2B) transactions, and collaboration *between* organizations have received increasing attention.

E-procurement (e-purchasing) is a specific area of e-business that covers both internal processes as well as B2B processes. Procurement experts, analysts and procurement product vendors have described the procurement business function from several perspectives (De Paoli, 1999; Van Weele, 2001; "mySAP," 2003). We can identify procurement-related functions at the strategic, tactical and operational levels. The product life cycle management function and the strategic sourcing function are considered strategic: on this level purchasing decisions have consequences for market share in the long term. The order planning function is considered tactical: purchasing decisions influence the operations of the organization in the medium term. The order management, fulfillment and settlement functions are considered operational: purchasing decisions influence the operations of the company in the short term. In general, purchasing is recognized as a value-adding business function. Better integration with other departments (product development, manufacturing), strategic yet flexible relationships with

suppliers, and efficient and automated operational purchasing are essential elements for procurement today (Markham et al., 1999; Callioni and Billington, 2001; Van Weele, 2001; Sawhney, 2002). This is especially important for the purchasing of direct materials, i.e., those materials being part of the bills of materials of the products manufactured. Direct materials are complementary to indirect materials (e.g. office supplies, machines), which are supporting the business process. In this paper, we focus on the purchasing of direct materials.

Research Question and Methodology

In this paper, we examine the key factors for successful implementation of Internet-based purchasing of direct materials. We present a framework of benefits and success factors, and subsequently we analyze a case using the framework. In creating the framework, we have taken five widely referenced e-business models from existing literature that provide background material for the benefits and success factors. The framework was derived by analyzing these models in the perspective of procurement and electronic trading exchanges (Versendaal and Brinkkemper 2003). Benefits are defined as those objectives that, when reached, provide strategic advantage in a competitive market. Success factors are the conditions that, when met, contribute to achieving benefits. We identify the framework as the *I-Frame: I*mprovement *Frame*work.

The I-Frame (discussed in the next section) was developed using the following five models:

1. The model of trust between organizations (Sheppard and Sherman, 1998);
2. Timmers' categorization of e-business models (Timmers, 1999);
3. The channel transformation framework (Clark and Lee 2000);
4. Weill and Vitale's description of atomic e-business models (Weill and Vitale 2001);
5. The analysis framework for trading exchanges (Dai and Kauffman, 2002).

These models have been chosen based on their acceptance and reference by several other research works in the e-business area, and because together they cover a comprehensive spectrum of viewpoints: trust, business models and processes, procurement features and functions, and technology. Whereas each individual model has a limited scope, using the combination of models provides a wide set of benefits and success factors in the direct materials purchasing area.

In the purchasing domain, electronic trading exchanges can be categorized as intermediary-owned, supplier-owned, buyer-owned, private, public, etc. (Zwass, 2003; Versendaal and Brinkkemper, 2003). We focus specifically on buyer-owned electronic trading exchanges. Many Internet-based direct materials ordering systems have characteristics of buyer-owned electronic trading exchanges, e.g., supplier relationship management systems, e-procurement systems, sourcing systems and supplier portals. Consequently, the research question addressed in this paper is: what are the benefits and success factors of buyer-owned electronic trading exchanges for direct materials?

The case study discussed is an implementation of a system that enhanced the purchasing of direct materials at Komatsu America Corp. – Peoria Manufacturing Operations[1] (KAC-PMO). The implementation and 'roll-out' of this particular case was very successful; the Aberdeen Group has labeled the implementation as "best practice in e-procurement" ("KMS," 2001).

[1] In 2002, Komatsu Mining Systems Inc. changed its name into Komatsu America Corp. – Peoria Manufacturing Operations (KAC-PMO)

Related Work

In a comprehensive paper, Zwass (2003) provides a categorization of e-business. He presents a broad overview of the many aspects of e-business. With the categorization, potential benefits and innovational opportunities are listed. Other authors have focused on the potential effects and benefits of e-business in general and Internet-based purchasing in particular (Standing and Vasudavan, 2001; Icasati-Johanson and Fleck, 2003; Santema and Reunis, 2003). In their investigation of lessons learned from EDI implementations, Ratnasingam and Tan (2003) identify facilitating conditions based on institutional trust that should also be met in electronic trading exchanges. Factors for successful implementation of e-business were identified. Koh, et al. (2000) elaborate on fail factors for ERP implementations, through an analysis of a specific case using a process theory approach. Boyson, et al., (1999) and Bovet and Martha (2000) have taken both success factors and potential benefits into account. They describe a number of successful implementations of e-business with their achieved benefits and perceived factors that were necessary in achieving the benefits.

We position our research within the described context of related work; however, we explicitly take the perspective of direct materials purchasing. Purchase managers and IT managers can take our results and use them in their organizations in order to improve their direct materials purchasing process.

Organization of the Paper

In the next section we describe the I-Frame, the framework describing benefits and success factors of buyer-owned electronic trading exchanges for direct materials purchasing. Next, the details of a single, buyer-owned electronic trading exchange – the KAC-PMO case – are presented. We describe this case's characteristics, benefits and success factors in the light of the derived I-Frame. In the last two sections the results are analyzed, conclusions are drawn, and future research is suggested.

THE I-FRAME

The I-Frame was conceived by a careful review of five different models as explained above (Sheppard and Sherman, 1998; Timmers, 1999; Clark and Lee, 2000; Weill and Vitale, 2001; Dai and Kauffman, 2002). The parts of the models related to procurement of direct materials or applicable to buyer-owned trading exchanges formed the starting material. Summaries of these selections can be found in Versendaal and Brinkkemper (2003).

The analysis of the models started with the identification of e-business aspects within the aforementioned scope. E-business aspects include business partners trust (Sheppard and Sherman, 1998), collaboration platform, e-auction (Timmers, 1999), channel performance (Clark and Lee, 2000), facilitation, matching, outsourcing (Dai and Kauffman, 2002), and value net integration (Weill and Vitale, 2001). The business aspects revealed various benefits and critical factors for success. The benefits and success factors were ordered and scrutinized for overlap to result in unique, elementary business concepts. Finally, the benefits were associated to the success factors only if there exists a reported successful contribution of a factor to a benefit by one of the authors. This resulted in a list of 20 potential benefits associated with 33 success factors, listed in the I-frame as given in Table 1.

The achievable or potential benefits are grouped in four dimensions: Process, Cost, Product quality, and Organization. Factors that contribute to the success as reported by the authors are listed in the right column. Each success factor is first listed by its full name and abbreviation

(SFxx). These abbreviations are listed as subsequent contributions of the same success factors to other benefits. Note, that the order of the benefits in table 1 is arbitrary.

Table 1. The I-Frame of Benefits and Success Factors of Buyer-Owned Electronic Trading Exchanges

Potential Benefits	Success Factors
Process	
Reduced time to market for newly developed products	High supply chain power of the buying company (SF1); Business-IT alignment applied (SF2); High level of awareness of Internet technology and application (SF3)
Improved product life cycle management	SF1; SF2; SF3
Easier to pre-select suppliers	Private negotiating mechanisms available (SF4); In case of shallow B2B interdependence: predictability and consistency continuously supported (SF5)
Improved sourcing decisions	Availability of mechanisms to analyze transactional data (SF6); Availability of mechanisms to analyze external, industry specific data (SF7)
Streamlined settlement of purchasing	Partnering with third party for financial and delivery services (SF8); Availability of financing and delivery services (SF9)
Increased coordination between partners	SF1; Operating in markets where information can add significant value (SF10); Reduced ownership of physical assets while retained ownership of data (SF11); Accuracy and timeliness of information (SF12); Business partners aided in capitalizing on information (SF13); Standardization of data format and process level (SF14)
Improved process efficiency	SF4; SF5; SF12; Quality control, with standardized quality measurements (SF15); Quickly reached economies of scale (SF16); Sophisticated data processing and network technology (SF17); Synchronized planning and scheduling activities of buyers and suppliers (SF18); Common data model shared by business partners (SF19); Automated ordering process through workflow management (SF20); Organizational need for improving efficiency (SF21); High degree of systems integration (SF22)
Increased compatibility and easy connectivity	SF14; Technology outsourcing vendor involved (SF23)
Cost	
Reduced design costs	SF1; SF2; SF3
Lower costs of products purchased	SF15; SF16
Reduced costs of coordinating interdependent tasks among multiple business partners	SF17; SF12; SF18; SF19; SF20; SF21

Potential Benefits	Success Factors
Reduced product search costs	SF1; SF6; SF7; Ability to build up an infrastructure just quickly enough to meet demand as it increases (SF24); Critical mass of business partners attracted and retained (SF25)
Reduced purchasing costs	SF1; SF2; SF3; SF15; SF16; SF24; SF25; Expanded coordination between business partners (SF26); BPR applied in association with IT-introduction (SF27); Private e-cataloging (SF28); Established contracts with suppliers (SF29); Transactional purchasing occurring frequently and in large quantities (SF30)
Product quality	
Correct products chosen	SF6; SF7
Better quality and improved product innovation	SF1; SF2; SF3
Organization	
Effective roll-out of the trading exchange	SF22
Smoother adoption of purchasing systems	SF23
Wider choice of suppliers	SF4; SF5; SF15; SF16; SF22
Increased trustworthiness	SF5; In case of shallow B2B dependence: continuously supported discretion, reliability and competence (SF31); In case of deep B2B dependence: continuously supported integrity, concern and benevolence (SF32); In case of deep B2B interdependence: continuously supported foresight, intuition and empathy (SF33)
Retention of preferred supplier relationships	SF4; SF5; SF28; SF29; SF30

Our application of the I-frame is to perform an in-depth analysis of an e-procurement implementation project. This is illustrated in the case study in the next two sections.

CASE STUDY: PROCUREMENT AT KAC-PMO

With the I-Frame and its categorization in hand we will now analyze the case at KAC-PMO. The data of the case have been taken from the Aberdeen Group ("KMS," 2001), Baan ("iBaan," 2001), and Ryburn (2002), and have been verified by the Director of IT Development at KAC-PMO and the Director of Product Management for Supply Chain Management at Baan.

Former Purchasing and the Development of the Buyer-Owned Electronic Trading Exchange

Komatsu is a global supplier of heavy equipment, especially construction and mining equipment. Worldwide, Komatsu employs 28,000 employees. Komatsu America Corp. - Peoria Manufacturing Operations (KAC-PMO), located in the US, is a world-leading producer

of special, heavy mining equipment. KAC-PMO employs 450 employees. Annual sales are $300 million. Being a heavy equipment manufacturer, KAC-PMO's business is characterized by delivering high-value products with long production cycles, many parts, unique product configurations, and many customer order changes. KAC-PMO has a range of about 350 direct materials suppliers. Referring to the Kraljic-matrix (Kraljic, 1983), the majority of the products purchased are strategic items and leverage items. Strategic items are those items for which the supply market is complex (few suppliers, complex logistics) and for which the financial impact of the items is high. The supply market for leverage items is less complex, but the financial impact is high. KAC-PMO strives for accurate demand forecasting, development of long-term supply relationships, and logistics control for strategic items. Careful vendor selection, pricing negotiations, and order volume optimizations are part of the strategy to optimize the purchase of leverage items.

Originally KAC-PMO and its suppliers used traditional means in the purchasing process. Forecast reports and purchase orders were printed and faxed to suppliers. Suppliers keyed-in order data when receiving a purchase order fax. Suppliers provided fulfillment dates to KAC-PMO on paper or by phone. KAC-PMO entered promise dates of supplier fulfillment manually. Purchase order change proposals needed to be approved manually. Raised customer demands and increased competition were forcing KAC-PMO to produce faster and at lower cost. Consequently, the IT organization initiated a discussion for improving the purchasing process, which was supported by the head of procurement and plant manager. KAC-PMO realized that an improvement in direct materials supply base management was required. Purchasing cost savings, internal process improvements, reduced order lead-time, and successful connection of a number of suppliers on short notice were defined as the major objectives.

Weekly sessions with the IT manager, IT-people, head purchasing, the purchasing department (buyers), and a controller were initiated, during which the improvement of the purchasing process was vetted. Consequences for the procurement process, employees and suppliers were investigated. The basic technique used in these sessions was Root Cause Analysis (RCA) (Latino and Latino, 2002). Involving buyers in this early stage using RCA has been identified as a success factor in receiving commitment to accept and adopt the improvements. This is in contrast with top-down driven implementations of new systems, which as a result may be less successful. See for example the implementation of ERP in Revel Asia as described by Koh, et al. (2000), where user acceptance was wrongly taken for granted. In the RCA sessions, much time was dedicated to finding ways to convince suppliers to join the electronic trading exchange. In anticipation of this issue, optimal support for suppliers became one of the critical issues in the project. Ken Ryburn, the director of IT Development at KAC-PMO says: "We recognized early that if we were going to get our supplier partners to participate in this electronic trading exchange, we would need to provide them with some value in return. This realization has been key to why our trading exchange is so successful in gaining supplier adoption and trust."

The RCA sessions continued for about 5 weeks. In the second phase, Rapid Application Development techniques were used to develop the software (Martin, 1991). In this phase mock-ups of user interfaces and the new workflow process made the intended purchasing process visible for the participants: buyers, and suppliers. IT-people received rapid and useful feedback on the mock-ups and as a result quickly improved the designs. This phase took about 9 weeks, and was followed by about 14 weeks of testing and modifying. Once the trading

exchange started operating, suppliers connected quickly. Within twelve months, all of KAC-PMO's major suppliers used the trading exchange.

KAC-PMO's electronic trading exchange for direct materials was implemented using Baan's B2B Server standard software product, which has a pre-built integration with the Baan ERP system. As a result the new software could be easily integrated with the existing back-end system of KAC-PMO, Baan ERP. Baan's standard software allowed connection of the majority of KAC-PMO's suppliers to the trading exchange within one year.

We will now discuss the trading exchange's further characteristics and results (achieved objectives and perceived success factors) per I-Frame category.

Process-Related

Business scenarios supported by the electronic trading exchange include (1) Web-based purchase order issuance - All purchase orders are sent electronically through the buyer-owned electronic trading exchange. Electronic order acknowledgements are sent, received and processed through the electronic trading exchange. The purchase order contains the items and specification details. The electronic trading exchange also determines possible joining of purchase orders for leveraging price breaks. (2) Supplier shipping portal - The electronic trading exchange provides dedicated entry for suppliers to KAC-PMO. Suppliers are optimally supported because they can at any time inspect a list of all open purchase orders. Suppliers can also open or convert the list into an Excel-document and enter the order acknowledgement dates and return the list to KAC-PMO. Suppliers can create an electronic Advanced Shipment Notice (ASN) from an open purchase order, from which they can then print shipment and packing labels. (3) Automated re-scheduling of purchase orders - The buyer at KAC-PMO can create rules through which changes in purchase orders can automatically be sent to suppliers. 4) Web-based forecasting - Item forecasts are sent to suppliers.

KAC-PMO has reported successful achievement of the initial objectives: purchase order process improvement, shortened purchase order lead-time, and successful connection of a number of key-suppliers on short notice. Within a year's time, KAC-PMO linked 90% of their direct material suppliers to the buyer-owned electronic trading exchange. With the implementation of the trading exchange, KAC-PMO was able to simplify the purchasing process dramatically. For instance many efficiencies were achieved in the administrative process, leaving out manual handling in the following procedures: separately print and fax purchase orders, manually determine price break optimizations, manually associate documents with purchase items, and manually approve purchase orders. Quantitatively KAC-PMO has reported the following process-related benefits from their trading exchange implementation: reduction of core supplier lead times from 60 days to 20 days through regular posting of item forecast reports, and reduced purchase order placement from 5 days to a matter of hours.

Also, KAC-PMO's suppliers gained benefits from the electronic trading exchange, as Ryburn explains: "In the past suppliers received our plans by fax and had to re-key these into their own systems. Now they can download plans and order directly from the Web in for example an Excel format, for their own analysis of the data." The supported business scenarios expanded the coordination between KAC-PMO and its suppliers through inter-organizational workflow management and a high degree of automation. The right information is available at the right time, and scheduling activities are being synchronized by sending item forecasts to suppliers. Data format and databases are now shared through the supplier shipping portal and B2B-messages. The shipping portal and B2B-messages provide suppliers with information, on

which they can capitalize: forecasts can be fed into the supplier's ERP-system, shipping and packing labels no longer have to be created, etc.

Cost-Related

With the software support of the mentioned business scenarios, KAC-PMO wanted to achieve reductions in purchasing costs. The cost objectives at KAC-PMO were reducing inventory costs, and minimization of other transaction-related purchasing costs. Once the electronic trading exchange was implemented, KAC-PMO reported a number of quantitative benefits. Approximately 100 to 150 man-hours were saved per week; some procurement personnel have been re-assigned. Printing and faxing paper savings of about 3000 pages a month were achieved. Significant reduction of inventory of purchased goods was also accomplished due to improved B2B coordination.

In addition, the supported business scenarios reduced the coordinating costs between KAC-PMO and its suppliers. Although not quantified, fewer errors are occurring, due to less manual involvement, better support of exception handling, and increased automation of standard processes. For example, the label printing process reduced the number of errors in packing slips.

Product Quality

As for product quality, KAC-PMO did not report any new achievements due to the implementation of the electronic trading exchange. Quality standards were already in place and defined in contracts, which are managed and maintained in KAC-PMO's back-end ERP system. However, quality in messaging has improved: the successful implementation of KAC-PMO's trading exchange reduced communication errors. The reduction was possible because of the high level of automation of the business scenarios, and the minimizing of manual handling.

Organization-Related

In the new architecture, information flows from KAC-PMO to suppliers, and from suppliers to KAC-PMO. From KAC-PMO to each supplier the following information is provided: purchase orders (including specification details of the required items), purchase order changes, lists of all open purchase orders, shipment and packing slip files, and item forecasts. The suppliers provide KAC-PMO with information on purchase order acknowledgements, acknowledgements for purchase order changes, and advanced shipping notices. Messages are sent in XML-format and follow a standard order flow, resembling RosettaNet descriptions (www.rosettanet.org).

For supplier convenience, the electronic trading exchange allows for two ways of connecting, (1) fully automated, in which XML messages can be sent from and to the supplier's back-end system; (2) through a supplier portal in a browser environment, from where e.g., purchase orders can be downloaded in XML- or Excel-format. This makes the electronic trading suitable and easy connectable for highly Internet-experienced suppliers as well as less experienced suppliers.

Because most purchased items are strategic items and leverage items, and change orders occur frequently, there exist mainly shallow and deep interdependence relationships between KAC-PMO and its suppliers. The implemented business scenarios, namely, Web-based purchase ordering, supplier shipping portal, automated re-scheduling of purchase orders, and the usage of technology standards (XML, standard B2B workflow) caused improved predictability and

consistency between KAC-PMO and its suppliers, improving the shallow relationships. The business scenario Web-based forecasting increased foresight and improved deep interdependent relationships.

MAPPING AND ANALYSIS OF THE KAC-PMO CASE

The mapping of the KAC-PMO case onto the I-Frame is shown in Table 2.

Table 2. Detailed Mapping of the KAC-PMO Case onto the I-Frame

Benefits	Achieved?[2]	Related Success Factors Met
Process		
Reduced time to market for newly developed products	O	SF1, SF2, SF3: N/A (= Not Applicable)
Improved product life cycle management	O	SF1, SF2, SF3: N/A
Easier to pre-select suppliers	O	SF4, SF5: N/A
Improved sourcing decisions	O	SF6, SF7: N/A
Streamlined settlement of purchasing	A	SF8, SF9: met
Increased coordination between partners	A	SF10, SF12, SF13, SF14: met *SF1, SF11 - not met*
Improved process efficiency	A	SF4, SF5, SF12, SF15, SF16, SF17, SF18, SF19, SF20, SF21, SF22: met
Increased compatibility and easy connectivity	A	SF14, SF23: met
Cost		
Reduced design costs	O	SF1, SF2, SF3: N/A
Lower costs of products purchased	O	SF15, SF16: N/A
Reduced costs of coordinating interdependent tasks among multiple business partners	A	SF17, SF12, SF18, SF19, SF20, SF21: met
Reduced product search costs	O	SF1, SF6, SF7, SF24, SF25: N/A
Reduced purchasing costs	A	SF2, SF15, SF16, SF24, SF25, SF26, SF27, SF28, SF29: met *SF1, SF3, SF30: not met*
Product quality		
Correct products chosen	O	SF6, SF7: N/A
Better quality and improved product innovation	O	SF1, SF2, SF3: N/A
Organization		

[2] A = Achieved; O = Not in project scope

Benefits	Achieved?[2]	Related Success Factors Met
Effective roll-out of the trading exchange	A	SF22: met
Smoother adoption of purchasing systems	A	SF23: met
Wider choice of suppliers	O	SF4, SF5, SF15, SF16, SF22: N/A
Increased trustworthiness	A	SF5; SF33: met SF31, SF32: N/A
Retention of preferred supplier relationships	A	SF4, SF5, SF28, SF29: met *SF30: not met*

The impressive benefits in terms of process efficiencies and cost reductions for KAC-PMO, as well as the support for suppliers, have made KAC-PMO's electronic trading exchange successful. KAC-PMO was able to realize success in emphasizing the operational and tactical aspects of purchasing: actual purchase ordering, purchase settlement, and purchase order forecast are major attributes of the trading exchange. Sourcing and product life cycle management were not part of the development scope of KAC-PMO's electronic trading exchange. Referencing Table 2, the KAC-PMO implementation of the electronic trading exchange was successful in achieving benefits that correspond with tactical and operational procurement. As for the process-related, cost related and organizational benefits, all benefits were achieved, except for the sourcing and product life cycle benefits that were not in scope. Regarding the product quality type of benefits, no new benefits were achieved: these refer to sourcing and product life cycle management. Note, that although sourcing and product life cycle management were not in the scope of the first version of the electronic trading exchange, to some extent they were already part of KAC-PMO's business. Sourcing and product life cycle management are supported by existing systems and procedures, but may be improved by adding related features to the electronic trading exchange.

The degree to which the success factors have been met for achieved benefits at KAC-PMO is high for the benefits that were in the project scope. Some success factors were not assisted by the electronic trading exchange, but were already available through existing systems and procedures, for example private e-cataloging: product descriptions and specifications are already maintained in KAC-PMO's ERP-system. There are also success factors that have not been (completely) met. First, KAC-PMO has medium supply chain power (SF1). This is a characteristic for many Original Equipment Manufacturers (OEMs) in this type of industry, heavy equipment. OEMs, like KAC-PMO, have strategic *interdependent* relationships with their suppliers in order to cope with the numerous changes in ordered product configurations combined with low volume sales (Svensson and Barfod, 2002). KAC-PMO has well managed the risk here. As KAC-PMO could not comply with 'buyer's power' it has focused on 'buyer's attractiveness': there is a low threshold for suppliers to connect to the electronic trading exchange; suppliers even benefit from the electronic trading exchange in terms of costs and B2B process efficiency. In contrast, in industries like electronics and automotive, OEMs do have high supply chain power: once ordered there are few product specification changes, and high volume sales, which results in suppliers being dependent on the OEMs (Hicks et al., 2000).

Second, with so many suppliers, not all have high awareness of Internet technology and application (SF3). For these suppliers, KAC-PMO has created a user friendly, browser-based, connection to the electronic trading exchange. Suppliers can download the list of purchase orders via an Internet-browser in Excel-format. At the same time the trading exchange provides facilities for full automation of the B2B transaction processes for suppliers that do excel in 'Internet awareness'. Third, transactional purchasing occurs frequently (high volumes of purchase orders per month), but often in lower quantities (the number of items purchased per order is not very large, SF30). According to Ryburn "it is the dollars and the length of the forecast, 6 to 9 months, that determines the amount." High volume purchase order issuance is not the norm. As with the discussion on supply chain power above (SF1), the electronics and automotive industries do have high procurement volumes, implying compliance to SF30. (4) Finally, reduced ownership of physical assets while retained ownership of data is a success factor that is not met (SF11). We recognize contract manufacturing in the automotive and especially the electronics industry, but much less in the heavy equipment industry (Hicks, et al., 2000).

The case at KAC-PMO shows that involvement of key-users in the beginning and during the development of the electronic trading exchange was considered essential for user acceptance. The IT systems development factors have deliberately been excluded from the I-Frame, as this would expand it beyond the procurement scope. Therefore, also the development techniques used, RCA and RAD, are omitted, although they seemed to have a positive influence on the success of the implementation of the electronic trading exchange.

Having mapped the KAC-PMO case onto the I-Frame, and having identified that benefits are achieved and that success factors are largely met, the usage of the I-Frame may be extended. In addition to applying the I-Frame *after* a project implementation, it can be used as a checklist for possible benefits *before* embarking on a project to improve an organization's procurement business function for direct materials. Next to that, the success factors aid in identifying project activities to meet the success factors. Moreover, the I-Frame can be a monitoring tool for the status of success factors in a running project.

CONCLUSIONS AND IMPLICATIONS

We have presented the I-Frame of benefits and success factors of buyer-owned electronic trading exchanges for direct materials, which is based on five well-accepted e-business models. Due to its roots in existing models, the I-Frame encompasses a comprehensive spectrum of benefits and success factors for the implementation of buyer-owned trading exchanges. The description of the KAC-PMO case and the subsequent discussion has shown that the benefits are achieved, and the success factors are largely met for the operational and tactical levels of the procurement business function. Therefore, to a great extent, the success of the KAC-PMO case can be explained by the I-Frame. Hence, the I-Frame can be used as a tool to systematically study successful and unsuccessful implementations of direct materials purchasing. Through such studies, reasons for failure and success can be identified.

However, there are other ways to utilize the I-Frame. First, practitioners can use the I-Frame to identify strategic benefits in the procurement business function of an organization. Regarding process-related benefits, managers wanting to improve the procurement business function in their organizations may identify benefits to be gained in the domain of product life cycle management, strategic sourcing, coordination of item forecasts (order planning), and order management and settlement. Regarding cost-related benefits, managers can identify cost reductions in the area of product design, product search, B2B transactions and coordination,

and actual product prices. Further, improved product and process quality, increased trustworthiness between the organization and its suppliers, effective trading exchange roll out, smooth supplier adoption and supplier retention can be identified as important benefits. Second, management may prioritize a selected set of benefits as a target for an e-procurement implementation project. The associated success factors determine, on the one hand, the scope of the project, and on the other hand, show the distribution of focus and workload of the project. Next to identifying the scope, one can also initiate risk management for the success factors that will not be met. For example KAC-PMO, not having high supply chain power, provided supplier features in order to allure suppliers to connect to the trading exchange. While we congratulate KAC-PMO on the successful implementation, we also encourage them to further look at the benefits and success factors of the I-Frame, when rolling out features of the strategic level of the procurement business function. Third, the I-Frame can provide a measurement of success by comparing the complete or incomplete status of success factors in the context of the organization's goals for a running procurement project.

There are a number of areas for future research. For further validation of the I-Frame, more cases need to be analyzed. These cases should also take the strategic aspects of the procurement business function into account. Also, the I-Frame does not possess degrees and levels to which benefits are achieved and success factors are met. In analyzing the KAC-PMO case, benefits were either achieved, or not achieved, and success factors were either met, or not met. Defining such levels of compliance will further fine-tune the I-Frame. Another important area of further study is to investigate whether the I-Frame is industry specific. In our analysis of the KAC-PMO case, we suggested that two of the success factors were not met at KAC-PMO, but would possibly be met in an automotive or electronics industry, namely high supply chain power (SF1) and frequent and high volume purchasing (SF30). Further research is needed to support this. Moreover, although direct materials purchasing is an important area that is obviously in the core of a company's main business, it is only one part of purchasing. We encourage similar research in the area of indirect materials, like office supplies, and capital goods purchasing. In these situations the procurement business function needs to be redefined for indirect goods (e.g., incorporating requisitioning on the tactical level), or capital goods (e.g., including preventive asset maintenance on the tactical level). Finally, similar studies could identify benefits and success factors for implementations in, for example, seller-owned electronic trading exchanges, and customer relationship management.

Acknowledgements
The authors wish to thank Manuel Pumarada (Baan Company), Ken Ryburn (Komatsu America Corp. - Peoria Manufacturing Operations), colleagues at Utrecht University, the guest editor, and the anonymous reviewers for their contributions and feedback on earlier versions of this paper.

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