

# ANALYSING B2B ELECTRONIC PROCUREMENT BENEFITS – INFORMATION SYSTEMS PERSPECTIVE

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## Abstract

*This paper presents electronic procurement benefits identified in four case companies. The benefits achieved in the case companies were classified according to taxonomies from the Information Systems discipline. Existing taxonomies were combined into a new taxonomy which allows evaluation of the complex e-procurement impact. Traditional financial-based methods failed to capture the nature of e-procurement benefits. In the new taxonomy, e-procurement benefits are classified using scorecard dimensions (strategic, tactical and operational), which allows the identification of areas of e-procurement impact, in addition the benefits characteristic is captured (tangible, intangible, financial and non-financial).*

*Keywords: electronic procurement, IT/IS evaluation, e-procurement, benefits, analysis*

## 1 INTRODUCTION

This paper presents electronic procurement benefits identified in four case companies from the IT/hi-tech sector. Interviews were completed with staff from various organisational levels to identify benefits achieved. As the next step, data was analysed and benefits were assigned according to various taxonomies identified in Information Systems literature. These allowed consideration of different dimensions, levels and types of benefits, whereas previous e-procurement studies concentrate mainly on productivity and financial aspects, not on overall impact on performance (Sriram and Stump 2004). Such an analysis of e-procurement benefits is important, as in many situations companies are not able to recognise real e-procurement value. Companies have problems identifying e-procurement strategic impact, intangible and non-financial implementation results (Gunasekaran and Ngai 2008). Evaluation could be complex, as benefits such as process cost reduction, cycle time shortening or process improvement are not achieved directly, but via improvement of communication and relationships with vendors (Sriram and Stump 2004), impact of the IT system, or process changes (Bendoly and Schroenherr 2005). There are problems with quantifying e-procurement benefits (Rajkumar 2001), especially at the strategic level, as traditional measurement methods such as ROI are not able to capture them (Hawking, *et al.* 2004). In this situation, lack of commonly used benchmarks to compare results of e-procurement implementations is listed as one of the major problems (Angeles and Nath 2007, Perona and Saccani 2004). At the same time Information Systems literature is rich in various frameworks and benefits taxonomies which could be applied in the e-procurement context, allowing capture of e-procurement benefits. In the paper, e-procurement benefits, and the categories identified in the literature, are briefly overviewed, followed by findings from four case companies. The identified benefits in companies are analysed using benefits taxonomies from IS literature, finally new taxonomy developed from the literature is presented.

## 2 DEFINING ELECTRONIC PROCUREMENT

E-procurement includes sourcing, negotiations with suppliers, and R&D co-ordination taking place on the Internet and electronic market (Yen and Ng 2003). Croom and Johnston (2003) defined e-procurement as the mirroring of procurement activities in the Internet, while Presutti (2003) defined it as all technologies which facilitate buying using the Internet. Knudsen (2003) included into e-procurement: e-sourcing, e-tendering, e-informing, e-reverse auctions, e-MRO, and web-based enterprise resource planning (ERP). E-procurement is a part of Supply Chain Management and includes: e-procurement software, Business to Business (B2B) market exchanges, B2B auctions, and purchasing consortia (Davila, et al. 2003). Rai, et al. (2006) presented four groups of electronic procurement innovations based on the major procurement processes: electronic reverse auctions, electronic catalogue management, electronic order fulfilment and electronic payment and settlement innovations. There is a variety of e-procurement classifications, but common to all is the fact that e-procurement is composed of different applications (Knudsen 2003).

## 3 ELECTRONIC PROCUREMENT BENEFITS

A variety of e-procurement benefits have been reported as achieved, or expected, in the academic literature. Among different benefits listed in the literature (Annex 1A and 1B), the most common are: transaction cost and buying price reduction, process shortening, improvement of information exchange, and control. Such benefits were grouped into several taxonomies (see Annex 1A) that include; operational and strategic (Croom 2000), operational, strategic and opportunity (Attaran 2001), operational, tactical and strategic; direct and indirect (De Boer, *et al.* 2002), market efficiency, process efficiency and effectiveness (Bartezzaghi and Ronchi 2003). Subramaniam and Shaw (2002) distinguished between immediate and performance measures, while Bendoly and Schroenherr (2005) looked at variability, bottleneck and waste reduction from implemented systems and process changes. Gunasekaran and Ngai (2008) noted impact on short and long-term organisational performance, cost-performance, competitiveness, alliances and networking. At the operational level, benefits include categories related to operational efficiency and effectiveness (Gebauer and Shaw 2004). Mukhopadhyay and Kekre (2002) distinguished between direct operational impacts based on transaction process improvement, direct strategic impact through sales increase, and long term indirect strategic impact. Schoenherr and Tummala (2007) did not look at benefits and their categories in their e-procurement review, but listed some of them, such as: reduced transaction costs, more efficient negotiation with, and identification of suppliers, workflow automation, organisational spending control and leverage, improved process monitoring, co-ordination and control, information sharing and integration. There are also papers that do not classify, but report achieved benefits (Annex 1B). E-procurement benefits classifications are simple compared to benefits taxonomies used in Information Systems discipline, and do not reflect the complex character of e-procurement impact, nor capture characteristics of such benefits. IS benefits taxonomies, such as balanced scorecard (Kaplan 1996, Kaplan and Norton 1992, Milis and Mercker 2004, Stewart and Mohamed 2003, 2004), strategic, tactical and operational benefits (Irani 2002), tangible and intangible benefits (Gunasekaran, *et al.* 2001, Irani and Love 2002), financial and non-financial benefits (Irani and Love 2002) are able to reflect area and character of e-procurement benefits, allowing identification of results achieved.

## 4 METHODOLOGY AND RESEARCH DESIGN

Data was collected from the purposeful sample of four companies from IT/hi-tech, electronic components sector. All of them are business units of large international corporations and are located in Central Europe. E-procurement is commonly used in ICT electronic components industry regardless the country (Batenburg 2007). The interpretive research concentrates on

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evaluation of electronic procurement applications, defined as all systems used to support procurement processes (Presutti 2003). The aim of this research part was to look at e-procurement benefits and their characteristics, to find how they could be categorised. Multiple respondents within each organisation have been interviewed from various organisational levels: senior and middle management, purchasing and IT departments, and system users. It was followed by data triangulation with external and internal documents such as company reports, presentations, guidelines. 27 interviews with 20 people were completed. Interview length was up to two hours. Most of the interviews were recorded and transcribed. Findings are specific for the case companies, which operate in specific industrial, corporate and national context. This research looked at business-to-business (B2B) only; there could be differences in public sector procurement. In addition, identified benefits are within the case organisations, the impact of e-procurement on the whole supply chain was not covered in this study. Similarly, costs and risks associated with e-procurement implementation are not covered in this paper.

## 5 FINDINGS

Within case companies, different e-procurement solutions were implemented. The procurement processes were supported by e-procurement applications, e-procurement modules of ERP systems, sell-side electronic marketplaces, e-catalogues and EDI. All companies used private e-procurement systems. In the following sections, the benefits achieved in the case companies are briefly presented.

### 5.2 Case company 1

Using the system it is possible to measure and monitor orders and their details such as: processing time, time an order was sent, and current status. Additionally processes become fully transparent. As part of the implementation, processes were standardized and improved, and non-value-added activities were removed. After process automation, paper documents were eliminated resulting in faster order approval and document processing. All information related to the order, and its current stage, is stored in the system, therefore the time to access information was reduced – all required information is in a single database. The sales department have access to the same data as the purchasing department. Before the system was implemented purchasing staff had to answer questions from sales people, spending a considerable amount of time on it. Now the sales people are able to check all information needed on their computers and can answer questions immediately. Members of the purchasing department used to spend around half of their time (four to five hours a day) answering questions from sales; now they spend just seconds a day. The system has also increased customer service; the sales people have access to the procurement system, therefore they can answer customer questions on-line. Increased customer service gave a competitive advantage, and fast response to customer questions looks good from the customer's point of view. Now the company is able to answer the customer needs faster. Usage of the system has increased efficiency as the same number of people can process a higher number of orders. The system has increased reporting capabilities, as the implementation access to information is easier and faster, reports can be generated and customised. The system increased controls at the local level; employees have pre defined roles (profiles) and cannot do anything that is not defined in the system. It also acts as fraud prevention. At the same time it had an impact on control at the corporate level – processes within corporation tend to be standardised, so it is possible to compare processes and performance between various countries and offices within the region. Increased reporting gives possibilities to monitor operations at the regional and country level. Additionally there were benefits through an automatic invoicing system, as earlier payment improves financial results.

### 5.3 Case company 2

At this case company it is estimated that around 50% of transactions are in an electronic format. When the procurement system is used, the orders are monitored, so when more departments order products and services from the same supplier it is possible to find such information and sign an agreement with a supplier, including re-negotiations of prices and conditions. Before the system was implemented, exactly the same, or very similar products were ordered from various sources. A central database of suppliers is held at a corporate level, therefore regional offices have access to suppliers with business partners or offices within the country. This offers the possibility to buy items at reduced prices agreed at the corporate level. It is possible to monitor processes and their key elements, such as order placing time and completion, so the control of orders was increased. It is possible to know who is buying what and why. As the process is in an electronic format, it is possible to block all transactions with selected suppliers in case of any problems. Time to make the decision was reduced through the automated and defined workflow, as well as orders being prioritised or the FIFO (First In First Out) rule applied. The electronic workflow eliminated mistakes and problems with paper documents (missing, sent to the wrong place etc.) and with fax transmission. Electronic documents are easy to find and their status can be confirmed; also, document transfer is much faster. At the time when documents were faxed problems often occurred. Now orders are delivered electronically in one to two hours. Processes were simplified. Before, an order in paper format required two days to be processed; in an electronic version this can be done in 15 minutes. Additionally, with the e-procurement implemented for orders, there is a single point of data entry. There are also benefits achieved as the result of the standardisation of ordered products for internal use (standard computer configuration); non standard products increase service time, costs and the ordering of spare parts. Savings on bank transfer costs were also reported with a lower number of payments (payments are aggregated). Another category of savings was on transportation, operations and warehousing costs; it is possible to send transport directly from supplier to customer. Systems and processes are the same within the region, so there are possibilities to transfer staff easily between countries. Changes in the system are now easier within the region as every country has exactly the same system, allowing understanding of how other branches operate and what the common issues are.

### 5.4 Case company 3

Benefits at this company were also reported. One of them was the single point of data entry into the system; data do not need to be entered into several systems, but are entered once only. As a result of the system implementation, data exchange with suppliers was improved. Document transfer was faster, and electronic documents eliminated the mistakes of data entry and transmission. Efficiency was increased; because the system was implemented there was no need to employ new people, even though the department had to process more orders. After two years of using an EDI system everybody got used to use it. Without the system, the company had to employ additional staff. Analysis of historical data in the system allowed the creation of approximations of delivery time from suppliers (based on historical statistical analysis of previous delivery times). Also important is system transparency and easy access to information. From a system user point of view, all available information to place the order is easily accessible. The system gives the possibility to send ordered products directly to a customer, while the company receives only an invoice. Non-material products, such as software licences, as well as large orders, are sent directly. In the case of large orders it reduced the company costs related to transport and warehousing.

## 5.5 Case company 4

At this company, the advantages of using the e-purchasing system were related to process improvement. The system saved time as the orders could be created in minutes and sent in seconds. Reduction of the process time was estimated to be from four days to four hours, but it was not measured. Because all data are in the system, it is easy to know when, where, and by whom orders were created; the whole process is fully transparent. It is easy to review all processes, decision points, sending dates and order history. Not only the processes but the whole supply chain is clear and visible. The system has increased control as it is known that money was spent from a correct budget and to which cost pool it was assigned. It is important that the system is fully integrated with other modules, such as financing, so data are automatically exchanged and procurement expenditures are automatically compared with the allocated budget. Additionally, the system eliminates potential problems with suppliers as both parties have exactly the same documents. This reduces misunderstandings related to the number and types of products ordered. All transactions are realised through the system only, so it is possible to negotiate better prices and rebates from suppliers for both products and services. Additionally, it is possible to reduce buying and service costs through product standardisation. For example, all computers ordered for staff are in pre-defined configurations only, and from one supplier only, so prices could be negotiated once a year. The volume and value of orders is predictable, so other costs, such as service and warranty costs, are listed and added into the buying price to determine the total cost. Required data related to the buying prices and conditions are in the system, so it is possible to compare suppliers from various countries to determine the cheaper supplier who can provide products for the whole region and for more than just one country. Supplier searching costs are reduced. In the system a set of supplier-related benchmarks is included, which reduces the risk of potential problems. Every supplier (or customer) who is listed on the US department or the European list of companies that might support terrorism is also included in the e-procurement system. The system will not allow transactions with them. Document creation, such as Request for Quotation (RFQ), is easy and automated. Documents can be automatically generated and e-mailed to the selected suppliers. Next, it is possible to complete automated analysis of answers from suppliers. Tables are generated from documents received; this provides the possibility to compare financial and non-financial conditions such as price, region covered or regional experience. In the buying process, the number of documents is reduced as there is one invoice from a supplier instead of many invoices from various suppliers, which again reduces transaction costs. An automation of the process and the system usage gives possibilities to reduce the number of employees who need to work for the purchasing department. Also, as all processes, procedures and software are exactly the same in all offices around the globe, it is easy to transfer people between branches. An automated purchase order processing function also allowed reduction of labour costs after transferring the processing department overseas. The system reduces, or even eliminates, the risk of fraud, as payment is made only for products and services ordered. Money is transferred only to a supplier account, as defined in the centralised supplier database.

## 6 E-PROCUREMENT BENEFITS - ANALYSIS

In the following section, benefits identified in the case companies are classified using various benefits taxonomies such as balanced scorecard (Kaplan 1996, Milis and Mercker 2004, Stewart and Mohamed 2003, 2004), strategic, tactical and operational (Irani 2002), tangible and intangible (Gunasekaran, *et al.* 2001, Irani and Love 2002), financial and non-financial benefits (Irani and Love 2002).

## 6.2 Strategic, tactical, operational benefits

Benefits reported by the case companies have been classified by the author according to the IS benefits taxonomy proposed by Irani (2002) – annex 2. The same approach to classify benefits is also used in the e-procurement literature: operational, tactical, strategic (De Boer, Harink, et al. 2002), and operational and strategic (Attaran 2001, Croom 2000). As the benefits taxonomy is used both in IS and e-procurement literature, the author applied it for further analysis. Looking at benefits reported by the companies it is possible to see that the majority of them can be classified as operational and tactical. They mostly improve procurement processes and reduce the costs of goods and services procured. Electronic procurement and process automation had an impact on the procurement processes; simplifying flow, reducing decision points and eliminating exceptions, this resulted in increased efficiency and time as well as cost reductions. Similarly the e-procurement allows the reduction of buying costs through order-pulling, buying centralization, and negotiations of the buying prices. However, of the reported benefits, only some could be classified as strategic; mainly those benefits that give an opportunity to improve customer service (case companies 1 and 2) and increase control at the corporate level (case companies 1, 3 and 4). An important issue identified at case companies 3 and 4 and to a low extent at case 2, is the elimination of “unwanted” suppliers – companies that support terrorism or trade with these organisations is forbidden by the US and the EU authorities. As all the case companies trade in hi-tech, dual purpose products, increased control is a very important factor. At case companies 1, 3 and 4, fraud prevention was also mentioned; increased control eliminates or highly reduces the risk of possible fraud by employees or third parties. Increased control protects company reputation on the market. When comparing identified benefits of the e-procurement implementation with those from other types of IT projects (Lin and Pervan 2003), where most common benefits listed were: competitive advantage, process efficiency and satisfying information needs, it is possible to see that in the case companies competitive advantage was mentioned only once. This might suggest that the e-procurement has a limited impact on strategic benefits compared to other systems, while it improves on the operational and tactical level.

## 6.3 Tangible and intangible, financial and non-financial

Benefits were assigned into two categories – tangible and intangible (Gunasekaran, Love, et al. 2001, Irani and Love 2002) – annex 2. Annex 2 shows how the tangible benefits could be measured, and what their nature is: financial, or non-financial (Irani and Love 2002). Analysing the types of benefits it is possible to see that at the operational level, tangible benefits dominate, such as a cost reduction or a process improvement. On the tactical level, tangible and intangible benefits are equally distributed, while at the strategic level, intangible benefits dominate. This creates problems in quantifying intangible benefits at the strategic level. Annex 2 also shows that over half of the benefits (seven of thirteen) can be easily reflected using financial measures. Even though the remaining six benefits cannot be directly calculated, there are still such possibilities: calculating time improvement and resources that were involved previously and are available after system implementation. Employment reduction might also be calculated, through savings on salaries, or transferring people to other positions.

## 6.4 Benefits measurement

The findings from the four case companies show how the benefits were evaluated. Different benefits were measured using various methods. Some benefits were estimated and the interviewees were able to give quantitative examples, the impact was not based on a precise measurement, the interviewees just gave their opinions about benefits achieved. The other groups of benefits were just observed, or even assumed. The interviewees noticed impact and

improvement but were not able to assess it. Part of a positive impact was prevention, such as fraud prevention, or reducing possible damage to company reputation due to involvement in trade with an illegal or suspicious organisation, as well as any allegation of corruption involvement. All these benefits are hard or even impossible to quantify. The e-procurement resulted in benefits, but in many cases there was no confirmation of objective benefits, or benefits could not be quantified as they are highly intangible. There were more attempts to measure tangible benefits at the operational level. At the tactical level the interviewees were able to estimate the e-procurement impact, while at the strategic level they believed that benefits were achieved based on their observations and assumptions. In the case companies the benefits not measured are those in theory easiest to quantify – financial benefits. In most cases they were estimated. Benefit quantification was mostly process related to assess how a system improves process parameters, such as process time or the number of decision points.

## 6.5 Balanced Scorecard perspectives

Table 1 classifies benefits according to the Balanced Scorecard perspectives (Kaplan 1996, Kaplan and Norton 1992, 1996, Milis and Mercker 2004). Some benefits are listed in more than one perspective, as they influence both.

Customer	Balance Scorecard perspectives		
	Business process	Learn and growth	Financial
Increased customer service	Elimination of non-value-added activities Improved orders approval Improved procurement process Improved orders creation Improved supplier searching process Improved monitoring and control Eliminate exceptions Eliminate, reduce problems with suppliers Eliminate problems with paper documents	Improved access to information Increased reporting capabilities Increased control (corporate level) Increased competitive advantage Improved cooperation and communication with other business units	Reduced bank transfer costs Reduced transaction costs Reduced buying costs Reduced service costs Increased efficiency Eliminate, reduce problems with suppliers Improved financial results (faster payment) Reduced warehousing and transport costs Fraud prevention

Table 1 Benefits achieved – the Balanced Scorecard perspectives

Based on Table 1 it is possible to conclude that the main areas of improvement are two interlinked perspectives: business process and financial. Savings are realised through cost reduction (warehousing, transportation, transaction, service and buying costs) as well as faster payment. Additionally, financial improvement is linked with the improvement of internal business processes. To some extent growth and learning is supported, mainly due to increased control and reporting capabilities. The impact on customers is not high, as the only element mentioned by interviewees was increased customer service. However, due to the e-procurement the “internal customer” service is improved, mainly through cooperation with a sales department.

## 7 SYNTHESIS

Benefits analysis indicates that to evaluate the achieved benefits, more than a single taxonomy of IS benefit is required. The usage of various taxonomies gives the opportunity to observe how benefits are distributed according to the level and area of their impact. The author found that to be able to present and reflect multi-dimensional e-procurement impact, multiple taxonomies combined together (Table 2) could provide the best overview of planned and realised benefits. More specifically the author recommends combination of classifications such as; tactical, operational and strategic (De Boer, Harink, et al. 2002, Irani 2002); tangible and intangible (Gunasekaran, Love, et al. 2001, Irani and Love 2002); balanced scorecard perspectives: financial, customer, internal process, growth and learning (Kaplan 1996, Kaplan

and Norton 1992, Milis and Mercker 2004, Stewart and Mohamed 2003, 2004). Such combination allows identification of areas where benefits are identified or planned (using balanced scorecard perspectives), benefits importance (strategic, tactical, operational) and characteristics (tangible, intangible, financial, non-financial). It is important to note that a traditional performance measurement is unable to capture and precisely calculate benefits, as they are moving up in the benefits classification from the operational, through the tactical, to the strategic level. It is possible to measure and quantify operational benefits and to some extent tactical benefits. The strategic benefits are very hard, or even impossible, to quantify, but nevertheless they could be realised and influence overall e-procurement impact.

Level	Balance Scorecard perspectives			
	Customer	Business process	Learn and growth	Financial
<b>Strategic</b>	Increased customer service (INT)	Eliminate, reduce problems with suppliers (INT) Eliminate "unwanted" suppliers (INT)	Increased control (corporate level) (INT) Increased competitive advantage (INT) Improved cooperation and communication with other business units (INT)	Fraud prevention (INT)
<b>Tactical</b>		Increased efficiency (INT) Process transparency (INT) Improved supplier searching process (INT)	Improved monitoring and control (INT) Increased reporting capabilities (INT) Provide better information about suppliers (INT) Increased staff transferability (T)	Improved financial results (faster payment) (INT) Reduced buying costs (T-F) Reduced service costs (T-F) Reduced cost of procured goods and services (T-F) Reduced transaction costs (T-F) Reduced employment (or keep the same despite higher workload) (T-NF)
<b>Operational</b>		Improved orders processing (T-NF) Improved orders creation (T-NF) Improved procurement process (T-NF) Improved orders approval (T-NF) Elimination of non-value-added activities (T-NF) Eliminate exceptions in the processes (INT) Eliminate problems with paper documents (INT)	Improved access to information (T-NF)	Reduced bank transfer costs (T-F) Reduced warehousing and transport costs (T-F)

INT – Intangible benefits, T-F – Tangible, financial, T-NF- Tangible, non-financial

Table 2 *E-procurement benefits reported in case companies*

## 8 CONCLUSION

The findings confirmed IT/IS evaluation problems indicated in the literature. Some of the benefits identified in case companies at the strategic level, such as fraud prevention and company reputation, are highly intangible but have significant impact on an organisation and its future. While electronic procurement has an influence on the organisational performance, in many cases benefits are intangible and non-financial, therefore traditional accounting based evaluation methods, such as ROI, are not able to capture them. This requires changes in the approaches to evaluate IT/IS investments, including electronic procurement. There is a need to clearly state expected intangible and strategic benefits expected from the system. The proposed benefits taxonomy allows structuring and defining character as well as area of e-procurement benefits, creating an opportunity to determine impact of the system implemented. The framework could be used as a practical tool to assess e-procurement benefits, at the planning stage as well as for already implemented systems. Ability to capture a variety of e-procurement benefits is especially important in situations when analysis of



financial impact alone shows that e-procurement does not deliver expected benefits; e-procurement is perceived as an unsuccessful initiative. The research also indicated low levels of knowledge exchange between the Information Systems discipline and the field of e-procurement. This creates an opportunity for IS researchers to test theories in an e-procurement context, as well as for procurement researchers to apply approaches already developed and established in the Information Systems discipline. There are also opportunities to apply the benefits taxonomy into different IT/IS systems, as well as to analyse e-procurement impact in different industry sectors and countries/regions. Especially cross-sector study could determine differences in the e-procurement impact in various contexts. Further work could look beyond e-procurement benefits, incorporating costs and risks associated with the system implementation.

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*Annex 1A Benefits and their categories*

Paper	Benefit category 1 Strategic	Benefit category 2 Operational	Benefit category 3 Opportunity	Benefit category 4
Attaran 2001	<ul style="list-style-type: none"> <li>Purchasing consolidation, lower buying price and better service</li> <li>Freeing human resources</li> <li>Faster response to changes</li> <li>Improve chance to win new business</li> </ul>	<ul style="list-style-type: none"> <li>Better financial control</li> <li>Less paperwork</li> <li>Improved auditing and security</li> <li>Shorten delivery time</li> <li>Eliminate time-zone limitations</li> <li>Reduce inventory</li> <li>Maximise labour</li> <li>Data re-entry elimination</li> </ul>	<ul style="list-style-type: none"> <li>Better company image and relationships</li> <li>On-time and correct delivery to the customer, less delays and errors</li> </ul>	
Bartezzaghi and Ronchi 2003, 2004	<p><b>Increased market efficiency</b></p> <ul style="list-style-type: none"> <li>Reduced supplier searching and selection costs/</li> </ul>	<p><b>Increased supply process efficiency</b></p> <ul style="list-style-type: none"> <li>Leaning procurement process</li> <li>Aggregating demand</li> <li>Internal efficiency improvement</li> <li>Delivery performance improvement</li> <li>Operative and inventory cost reduction</li> </ul>	<p><b>Increased process effectiveness</b></p> <ul style="list-style-type: none"> <li>Quality</li> <li>Degree of innovation</li> <li>Time-to-market</li> <li>Service level</li> <li>Stock-outs reduction</li> </ul>	<p><b>Cost reduction</b></p> <ul style="list-style-type: none"> <li>Negotiation</li> <li>Supplier searching</li> <li>Material costs</li> </ul>
Bendoly and Schroenherr 2005	<p><b>Variability reduction</b></p> <p>From ERP product</p> <ul style="list-style-type: none"> <li>Common data base</li> <li>Standardised human-computer interface – shorter processing time</li> </ul> <p>ERP Process effect</p> <ul style="list-style-type: none"> <li>Business procedures rationalisation – less uncertainty regarding execution</li> <li>Simplified user training</li> </ul>	<p><b>Bottleneck reduction</b></p> <p>From ERP product</p> <ul style="list-style-type: none"> <li>Process time tracking and bottleneck reduction</li> <li>Standardised human-computer interface – short time required for transaction</li> </ul> <p>ERP Process effect</p> <ul style="list-style-type: none"> <li>Business procedures rationalisation – easier bottleneck identification, fewer processes</li> </ul>	<p><b>Waste reduction</b></p> <p>From ERP product</p> <ul style="list-style-type: none"> <li>Monitoring of different waste types</li> <li>Standardised interface – easier comparability with other departments</li> </ul> <p>ERP Process effect</p> <ul style="list-style-type: none"> <li>Business procedures rationalisation – elimination of not necessary and waste generating processes and sub processes</li> <li>Training/education of users- more workers have ability to recognise waste generating processes</li> </ul>	
Croom 2000	<p><b>Operational</b></p> <ul style="list-style-type: none"> <li>Administrative costs reduction</li> <li>Improved audit and increased procurement control, greater visibility</li> <li>Consolidation, supply base reduction</li> <li>Transparency</li> <li>Real-time data access</li> </ul> <p><b>Cost efficiency</b></p> <ul style="list-style-type: none"> <li>Transaction costs</li> <li>Shorter processing time</li> <li>Purchase price reduction</li> </ul>	<p><b>Strategic</b></p> <ul style="list-style-type: none"> <li>Strategic advantage</li> <li>Increase in internal service level</li> <li>Improved information transparency</li> </ul>	<p><b>Internal customer satisfaction</b></p> <ul style="list-style-type: none"> <li>Increased employee satisfaction</li> <li>Responsiveness</li> <li>Flexibility</li> </ul>	
Croom and Johnston 2003, 2006	<ul style="list-style-type: none"> <li>Transaction costs</li> <li>Shorter processing time</li> <li>Purchase price reduction</li> </ul>	<p><b>Process compliance</b></p> <ul style="list-style-type: none"> <li>Improved budgetary control</li> <li>Robust processes performance</li> <li>Transparency and data accessibility</li> </ul>		

	<ul style="list-style-type: none"> <li>• Internal process cost improvements: electronic transmission, single point of data entry, less errors</li> <li>• Lower handling and warehousing costs</li> </ul>	<ul style="list-style-type: none"> <li>• Systems reliability assured compliance to process</li> <li>• Improved management information</li> </ul>	<ul style="list-style-type: none"> <li>• Care</li> <li>• Reliability</li> <li>• Integrity</li> <li>• Competence</li> <li>• Security</li> </ul>
Gebauer and Shaw 2004	<ul style="list-style-type: none"> <li>• <b>Increased operational efficiency</b></li> <li>• Bottleneck elimination and faster processing</li> <li>• Improved employee productivity</li> <li>• Delays reduction</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Increased operational effectiveness</b>, including flexibility and emergency handling</li> <li>• Better communication</li> <li>• Increased control</li> <li>• Shorter response time</li> </ul>	
Hawking, <i>et al.</i> 2004	<ul style="list-style-type: none"> <li>• <b>Cost-related and tactical</b></li> <li>• Price reduction</li> <li>• Reduction of administrative costs</li> <li>• Reduced operational and inventory costs</li> <li>• Enhanced inventory management</li> <li>• Improved contract compliance</li> <li>• Shortened procurement cycle</li> <li>• Increased accuracy of production capacity</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Strategic</b></li> <li>• Improved visibility of customer demand</li> <li>• Better market intelligence</li> <li>• Enhanced decision making</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Non-classified</b></li> <li>• Improved visibility of supply chain</li> </ul>
Sriram and Stump 2004	<ul style="list-style-type: none"> <li>• <b>Purchasing cost</b></li> <li>• Value of buffer stocks</li> <li>• Frequency of stock outs</li> <li>• Inspection/quality costs</li> <li>• Ordering costs</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Order processing time</b></li> <li>• Order processing time</li> <li>• Purchase lead time</li> <li>• Length of the planning cycle</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Purchasing process improvements</b></li> <li>• Order processing accuracy</li> <li>• Order processing reliability</li> <li>• Timeliness of deliveries</li> <li>• Early detection of non-compliance by vendors</li> </ul>
Subramaniam and Shaw 2002	<ul style="list-style-type: none"> <li>• <b>Intermediate measures</b></li> <li>• Lower transaction costs</li> <li>• Lower inventory</li> <li>• Lower buying price</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Performance measures</b></li> <li>• Higher process quality</li> <li>• Lower total procurement costs</li> <li>• Increased user satisfaction</li> <li>• Increased system responsiveness</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Relationship quality</b></li> <li>• Mutual trust</li> <li>• Overall coordination</li> <li>• Frequency of disputes</li> <li>• Information sharing</li> </ul>

*Annex 1A Benefits – not classified or single category only*

Ageshin 2001	Increased product customisation and build-to-order capabilities, increased collaboration, use of the single system
Davila, <i>et al.</i> 2003	Transaction costs reduction, shorter purchasing order fulfillment time, reduced number of suppliers, lower prices paid for goods, reduced head count to support purchasing transactions, increased flexibility, more up-to date information about order, increased control on spending
Falk 2005	Increase of labour productivity
Gunasekaran and Ngai 2008	Better staff utilisation, efficiencies increment, help to achieve supply chain management, improved existing markets, increased customer service level, increased customer satisfaction, increased market share, reduced inventory levels, reduction in maverick buying, reduction in operational tasks, reduction in processing time, reduction in transaction costs, support for environmental issues
Lin and Hsieh 2000	Process improvement, shorter delivery time, less administration, purchasing consolidation, time zone elimination, faster information flow, less inventory, better buyer/supplier relationships, maximising labour by empowering employees
Muffatto and Payaro 2004a, b)	Better information management, increased flexibility, reduced lead time, increased system reliability, increased process efficiency, elimination of manual procedures, better control, fewer mistakes, warehouses optimisation, procurement consolidation
Tanner, <i>et al.</i> 2008	Reduction of purchasing price, optimising total cost of procurement, internal process optimisation, securing supplies, maintaining quality guidelines, increase in cost transparency, B2B process optimisation, minimising warehousing costs, reduction of the number of suppliers, product development with suppliers
Tatsis, <i>et al.</i> 2006	Price decrease, reduction of administrative expenses, inventory reduction, shorter cycle times, improved communication and information flow, improved planning and control, improved collaboration with suppliers

*Annex 2 Benefits achieved – strategic, tactical and operational*

Benefits	Case 1	Case 4	Case 2	Case 3	Tangible	Intangible	Measured	Estimated	Observed/ Assumed
<b>Strategic</b>									
Increased control (corporate level)	V	V	V	V		Non-financial			V
Increased customer service	V		V			Non-financial			V
Increased competitive advantage	V					Non-financial			V
Eliminate, reduce problems with suppliers		V	V	V		Non-financial			V
Eliminate “unwanted” suppliers		V	V	V		Non-financial			V
Fraud prevention	V	V	V	V		Non-financial			V
Improve cooperation and communication with other business units			V			Non-financial			V
<b>Tactical</b>									
Improved financial results (faster payment)	V				Financial			V	
Increased efficiency	V	V		V	Non-financial			V	
Improved monitoring and control	V	V	V			Non-financial			V
Increased reporting capabilities	V					Non-financial			V
Process transparency	V	V	V	V		Non-financial			V
Reduce buying costs		V	V		Financial		V		
Reduce service costs		V	V		Financial		V		
Reduce cost of procured goods and services	V	V	V	V	Financial		V		
Provide better information about suppliers		V	V	V		Non-financial			V
Improve supplier searching process		V	V	V	Financial			V	
Reduce transaction costs		V	V	V		Non-financial			V
Increased staff transferability		V	V	V	Financial			V	
Reduce employment (or keep the same despite higher workload)	V	V	V	V	Non-financial			V	
<b>Operational</b>									
Improved orders processing	V		V	V	Non-financial		V		
Improve orders creation		V			Non-financial		V		
Improved procurement process	V	V	V	V	Non-financial		V		V
Improved orders approval	V	V	V	V	Non-financial		V		V
Improved access to information	V	V	V	V		Non-financial			V
Elimination of non-value-added activities						Non-financial		V	V
Reduce bank transfer costs			V		Financial			V	
Reduce warehousing and transport costs	V	V	V	V	Financial				V
Eliminate exceptions in the processes	V	V	V	V		Non-financial			V
Eliminate problems with paper documents	V	V	V	V		Non-financial			V