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# Measuring the Business Value of Electronic Supply Chain Collaboration: The Case of Electronic Invoicing

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## Measuring the Business Value of Electronic Supply Chain Collaboration: The Case of Electronic Invoicing

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### Abstract

*In the last decade, supply chain management has changed its focus, centring now on value creation, by taking into consideration the recent trends of partners integration and implementation of internet technologies. Within this context, this paper presents measurable results regarding the business value of supply chain collaboration practices enabled by e-commerce technologies. The presented research addresses electronic supply chain collaboration by examining the case of electronic invoicing (the electronic exchange of invoice data between supply chain partners) as a type of collaborative message-based system. The paper presents the quantitative and qualitative results of a series of case studies from the grocery retail sector. The results indicate considerable cost savings, especially as the extent of collaboration increases. Additionally, qualitative results from the interviews are provided, supporting suggestions for future research.*

**Keywords:** supply chain collaboration, electronic invoicing, business value

## 1 Introduction

Since its origins, supply chain management has changed its focus from purchasing and logistics between the mid-1960s and 1990s to an updated focus on value creation since the mid-1990s and the new millennium (Kampsta et al., 2006). At about that time, an ongoing discussion emerged that supply chain management should be built around the integration of trading partners (Barratt and Oliveira, 2001), the sharing of information and benefits (McLaren, 2002) and particularly, in the last decade, the development of innovative products and services utilizing both information technologies (such as the internet) and collaboration of organizations (Patrakosol and Olson, 2006). Today, supply chain management “seeks to strategically reconfigure business in a systematic way to optimize the long-term performance of all entities involved in delivering value to end-

customers through collaboration and partnerships between firms” (Davis-Sramek et al., 2007).

Within this context, this paper aims to contribute to the literature by presenting the practical business value of already applied supply chain collaboration practices enabled by e-commerce technologies and a research approach towards measuring similar services. Specifically, the practice of electronic invoicing between retailers and suppliers in the grocery retail sector is examined, through data collection and analysis of different case studies. Based on the data collected, practical value was estimated and alternative scenarios have been developed in order to examine how the extent of electronic collaboration may influence the benefits achieved. The results indicate that electronic invoicing triggers significant cost reductions for the retailer, especially for increased extent of collaboration.

The next section discusses the relevant literature. Then, section three describes the specific research design and context. Section four presents and discusses the results of the analysis. The paper concludes in section four, by referring also to directions for future research.

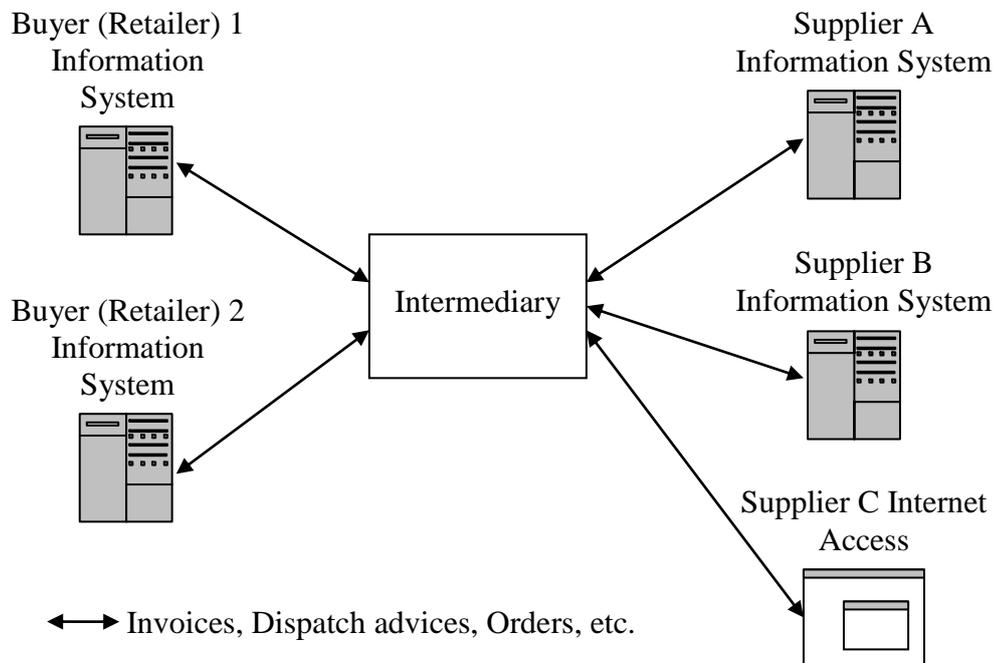
## **2 Related literature**

According to Barratt “collaboration is a very broad and encompassing term and when it is put in the context of the supply chain it needs yet further investigation. It is an amorphous meta-concept that has been interpreted in many different ways” (Barratt, 2004). Several definitions have been given to collaboration within the context of supply chain collaboration (Anthony, 2000; Akintoye et al., 2000; Simatupang and Sridharan, 2005; Manthou et al. 2004; McLaren et al. 2002) and electronic collaboration (Johnson and Whang, 2002). Specifically, Johnson and Whang defines electronic collaboration as “business-to-business interactions facilitated by the Internet” (Johnson and Whang, 2002). McLaren et al. classify supply chain collaboration information systems into three major types (McLaren et al. 2002):

- message-based systems that transmit information to partner applications using technologies such as fax, e-mail, EDI, or XML messages
- electronic procurement hubs, portals, or marketplaces that facilitate purchasing of goods or services from electronic catalogues, tenders, or auctions
- shared collaborative systems that include collaborative planning, forecasting and replenishment (CPFR) capabilities in addition to electronic procurement functionality

Using this typology, electronic invoicing, is categorized as a messaged based system. The specific e-invoicing service examined could be defined as “the electronic exchange of invoice data through the internet using an intermediary”. The use of internet and intermediate strongly differentiate the service examined from previous research undertaken for invoices for EDI. Figure 1 provides a schematic representation of the electronic invoicing service and the role of the intermediary. Given the use of an intermediary, electronic invoicing could also be

considered as a service of electronic marketplaces. A recent survey has indicated that electronic transactions (i.e. the electronic exchange of orders, invoices and dispatch advice messages), has been the main service used by the participants of five different e-marketplaces in the Greek market (Kioses et al., 2006).



**Figure 1:** Schematic representation of the electronic invoicing service

There are several researchers that have identified the need for research in the area of supply chain management and collaboration practices. Some of them have identified the need just in the area of supply chain collaboration, while others have also included the e-commerce perspective by referring to electronic collaboration. According to McLaren et al. (2002) “given the strategic importance of supply chain collaboration for many organizations, there is a clear need to further investigate and validate the models put forward in this study”. The same point is supported by other researchers as well, arguing that both practitioners and academics are increasingly interested in supply chain collaboration (Simatupang and Sridharan, 2005; Min et al. 2005). Vereecke and Muylle (2006) refer also to the important extension of the supply chain collaboration study with the research “of the impact of internet technology and electronic business practices on the relationship between supply chain collaboration and performance improvement”. Subramaniam and Shaw (2002) state that it is necessary to achieve a better understanding of the value creation process of business-to-business supply chain processes. Specifically, “even as organizations are moving to web-enabled B2B processes in the hope of improving their B2B supply chains and reaping economic benefits, there is a need to fully understand how this value is created and realized”. Likewise, Min et al. (2005) present the same opinion that “supply chain collaboration seems to have great potential, but further investigation is needed to understand its practical value”.

Nevertheless, there are several approaches in the literature towards understanding performance and the value of collaboration. In regard to the more practical impact of collaboration, such as cost reductions, although the trend in supply chain management since the mid-1990s is the inclusion of less tangible and non-financial measures in performance measurements (Saad and Patel, 2006), there are several publications that have referred to cost performance (McLaren et al. 2002; Cassivi et al. 2004; Lefebvre et al. 2003). Specifically, according to McLaren et al. (2002) “the benefits of collaboration include reduced process costs, inventory levels, and product costs”. Philips and Meeker discuss e-business connections (another terminology relevant to collaboration) arguing that “connecting with outsiders means lower transaction costs” (Phillips and Meeker, 2000) and as such they consider search costs, information costs, bargaining costs, decision costs, policing costs and enforcement costs. Subramaniam and Shaw (2002) refer to transaction costs, inventory holding costs and procurement costs.

Regarding electronic invoicing in particular, the European Associations of Corporate Treasurers (EACT), based on reports of BEWECO consulting firm, indicates 243 million euros saving from B2B e-invoicing in Europe and a 60 to 90 percent cost reduction. According to this report, the cost of processing a paper invoice for issuers is estimated to 5 to 15 euros savings from automatic reconciliation of payments; for receivers, the cost (and potential savings) is much higher because it includes data entry, matching with orders and consignments, disputes and electronic payments. It is estimated to a total cost of processing of 25 to 60 euros. A report of National Council for the Economy and Employment CNEL of Italy indicates invoice handling on the part of the issuing and receiving party to be circa 24 euros, and electronic invoicing reducing this cost in half.

The importance of invoice verification in the procurement process is noted by Rosemann (2003), who describes it as the interface between procurement and accounts payable. Wong and Li (1998), in their case study for EDI, refer to cost reduction of invoice in terms of man-hours saved and paper flow reduction. Staff reduction from EDI-based e-invoicing is also noted by Williamson et al. (1997). Golden and Powel (1999) measured that before EDI there was an extra cost of 1.5 person days a week to process invoices of one supplier. They also observed greater information accuracy. Attaran (2001) argues that when invoice data are transmitted electronically, company cash flow is improved. McIvor et al. (2000) state that electronic invoicing has the potential to change the role of the purchasing professional from merely being involved in clerical type activities. Humphreys et al. (2006) also refer to business-to-business e-commerce and indicate errors reduction in invoice data, which was also expected by EDI (Fenton, 1984). McIvor et al. (2003) refer also to the positive effect of electronic invoicing, within the context of supply chain collaboration, in terms of improving transaction accuracy and invoice payments.

The aforementioned literature demonstrates that although there is research in the area of electronic invoicing, this research mostly refers to EDI which does not take into consideration the emergence of e-invoicing conducted through the internet using an intermediate. Thus, the impact of e-invoicing conducted through the internet is usually based on findings from the EDI literature, while specific

estimations of the practical value of e-invoicing are usually based on the work of practitioners.

The purpose of this research is to specifically examine electronic invoicing conducted through the internet using an intermediate, as the basic service of electronic supply chain collaboration and measure its practical value. Within the context described in the previous section, this paper addresses the question of “does higher extent of electronic supply chain collaboration, and specifically e-invoicing, lead to increased business value for the company?”. The following section presents the research approach towards this question.

### **3 Research approach**

Because of the exploratory nature of the research, a case study approach was selected. The case study approach conforms to the identified increase of direct observation methods of a more interpretive nature in the supply chain management research (Sachan and Datta, 2005).

In order to answer the aforementioned research question the case of electronic invoicing has been selected. The reasons for the selection of this case are that it represents the simpler type of electronic supply chain collaboration in McLaren et al. (2002) typology, and because the invoice is the basic document in commerce.

The supply chain chosen for examination is the one of the grocery retail industry, based on the criteria proposed by Cassivi for the selection of a single supply chain for research (Cassivi et al. 2004). These criteria were that the supply chain itself has to be electronically integrated and electronic supply chain collaboration has to be under way among its members; that the supply chain structure has to consist of several layers; publicly available information has to be obtained in order to appropriately qualify the supply chain members for the multiple case study; the number of supply chain members has to be high so that it can be possible to obtain a critical mass of respondents for the survey. The grocery retail industry conforms to most of these criteria. In addition, in the 1990s a number of supply chain innovations have emerged in this sector (Holmstrom et al. 2002). Additionally, the specific supply chain has a large number of invoices exchanged yearly in a many to many environment.

For the case study research, the well-established approach of Eisenhardt for building theories was adopted (Eisenhardt, 1989).

The approach included firstly, the definition of the research question (“Does higher extent of electronic supply chain collaboration, leads to increased business value for the company”).

The next step was the selection of the case which, as already mentioned, was the electronic exchange of invoices using an intermediary in the Greek grocery retail sector. Firstly, the research would address the receivers of invoices and secondly the issuers (currently, only the receivers data analysis is complete and presented in this paper).

The next step was the crafting of instruments and protocols for the collection of both quantitative and qualitative data using semi-structured interviews. The qualitative data of the developed questionnaire aimed to process mapping and the quantitative data to acquiring figures for the process, in order to measure cost savings. Based on the pertinent literature, the research was designed to measure the process man-hour costs, errors, paper flow costs, storage costs and other related operational costs.

When this step was completed, in-depth interviews were conducted with both retailers and suppliers (receivers and issuers) followed when possible by on-sight observations. Interviews were conducted between December 2006 and January 2007. Firstly, a series of interviews aiming to the mapping of the invoice management process. The first interview involved the personnel of the intermediate (two persons considered as experts in the invoice area). The duration of this main interview was 1.5 to 2 hours. Then one interview per participating company (total of 5 interviews, three retailers and two suppliers) was conducted for the same purpose of mapping the process. These interviews' duration was 15 to 30 minutes and they mostly validated the results of the first interview.

As the request for direct observation was declined for the majority of the process steps, the data gathering was based on acquiring data from already conducted internal surveys from the companies and in-depth interviews with the personnel. There were two to three interviews for acquiring data with one up to three employees per company. A total of 8 people (retailers' low level employees and supervisors) were interviewed. These employees were selected by the companies as experts in the area of invoice management. The personnel questioned came from the information systems departments, the accounting departments and the financial departments. The duration of these interviews was from 45 minutes to 1.5 hours. The data provided were based on actual data (e.g. document numbers, personnel numbers), internal surveys (e.g. processing times) and experience. These interviews provided data measurements for labour costs (related to processing times, associated with the processing of invoices at different points within the company), storage costs, packing costs, shipment costs from the stores to the headquarters, costs of the e-invoicing service, errors in the process, number of documents among others.

During these interviews there was also further discussion referring to the overall experience from the e-invoicing adoption.

The approach towards the measurement of cost was based on the description of organizational processes (Pentland et al., 1999) and activity-based costing (Gunasekaran et al., 1999) by considering the invoice as the product examined. Previous work using activity based costing for similar purposes exists for both EDI (Hoogeweegen et al., 1998) and electronic commerce (Tatsiopoulou et al., 2002). Due to the fact that some of the data acquired validity could be questioned, the figures acquired were validated internally per case (for different figures related) and then cross validated among cases. The aforementioned data collection and data analysis approach can be summarized in the following 9 steps:

- 1st step: Map the process
- 2nd step: Identify sources of cost in the process
- 3rd step: Measure the sources of cost
- 4th step: Validate measurements for the case
- 5th step: Repeat steps 1-4 for different cases
- 6th step: Cross validate for all cases
- 7th step: Cost model development
- 8th step: Experiment with different scenarios
- 9th step: Request additional data

Data analysis followed, including detailed write-ups, transformation of this information to a more structure registry, cost model development, scenarios development, cross-case pattern and recollection of data. The different scenarios and their rational are presented in the following section. The data acquired were cross validated with the three retailers that have accepted to participate in the study.

The final steps of the case study research include the shaping of hypotheses, generalization, enfolding of literature and reaching a closure. The following section presents the results of the research.

## **4 Results**

Before presenting the results of the research, the document flow of invoices in the grocery retail sector is presented, as it was recorded during the in-depth interviews. Then, the different scenarios developed are presented, followed by a separate discussion of quantitative and qualitative results.

### **1.1 The process**

This section presents the flow of invoices in the grocery retail sector, focusing namely on the receiver of the invoice (i.e. the retailer).

Currently, even if the invoice is sent electronically from the supplier to the retailer, the supplier is obliged to issue a hardcopy invoice and sent it to the retailer (which is not necessarily the case for the future). It is also important to clarify that the process described below is the outcome of cross validation among different retailers. The process mapping focuses namely on steps of the process that can be quantified.

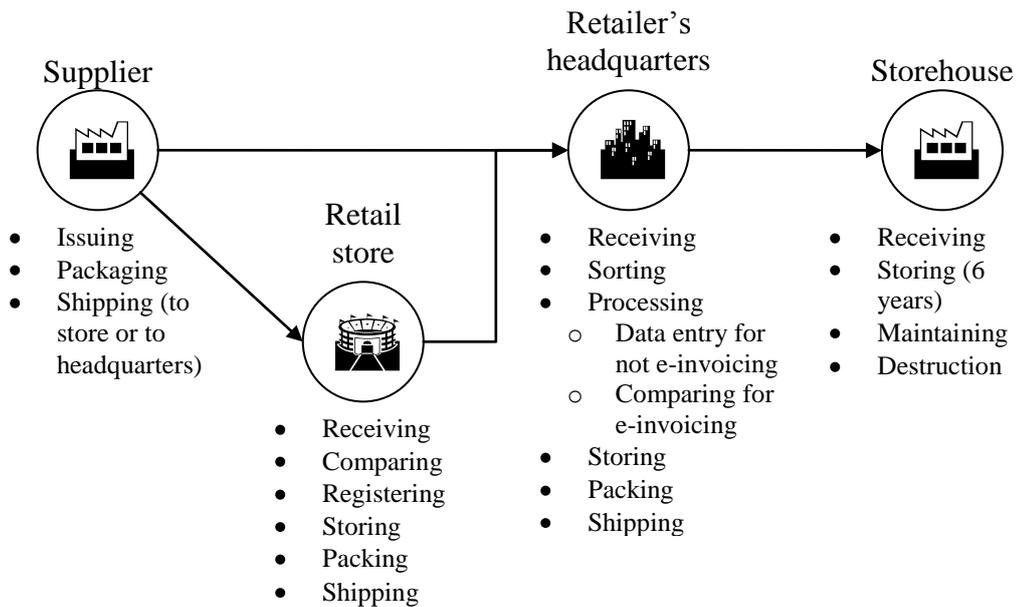
The process (figures 2 and 3) starts with the issuing of the invoice by the supplier. When the supplier issues the invoice, he has two options: to send the invoice along with the products to the store (with the exception of delivering to headquarters) or to send it separately to the headquarters through regular mail.

The invoices received at the store are processed by the store employees. Invoices are compared to the respective orders for errors, their data are registered and then they are stored to be sent to the headquarters usually through an internal mail service.

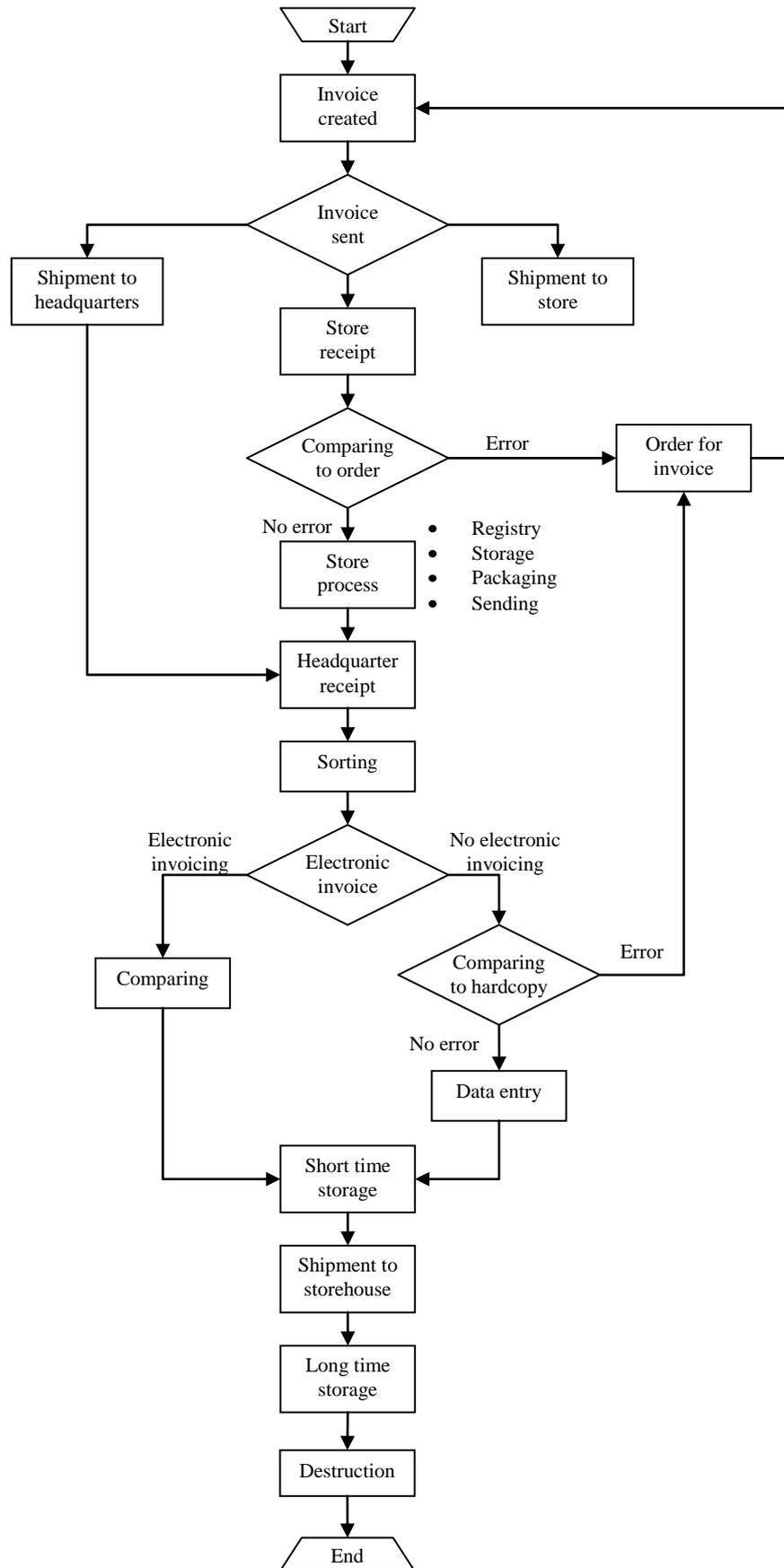
The invoices received at the headquarters are sorted out, separating those coming from the stores and those coming directly from the supplier. Then, if the invoices come from a supplier that uses the electronic invoice service they are rapidly compared to the electronically received data. If the supplier does not use the electronic invoice service then the invoices are checked for errors and then their data are entered into the system manually by an employee. When the check is complete, the invoices are stored for 6 months to one year in the headquarters.

When this period of 6 months to one year is over, the invoices are sent to a storehouse (usually around a 2,000 m<sup>2</sup> size). The invoices are stored and maintained for 5 to 6 years in the storehouse. Then the invoices are simply destroyed.

In regard to invoice errors, regardless of their nature (with the exception of extreme problems, such as the disagreement on prices that initiates negotiation), the solution is mainly requesting the supplier to issue a new invoice. This new invoice could be either a regular invoice or a credit invoice. The reduction of observed errors was suggested in the literature as well by Humphreys (Humphreys et al., 2006).



**Figure 2:** The document flow of invoices in the grocery retail sector



**Figure 3:** The generic data flow diagram of the invoice process in the grocery retail sector

## **1.2 Collaboration scenarios**

In order to understand the practical value and cost reduction of electronic invoicing, alternative scenarios were defined, depending on the percentage of invoices exchanged electronically and on whether the hard-copy invoice is also used in association. The scenarios examined are the following:

**Scenario 1:** This scenario describes the situation before the adoption of electronic invoicing. In other words, it is the case of 0 percent electronic invoicing.

**Scenario 2:** This scenario describes the initial phase of adoption of electronic invoicing by the major suppliers and it is represented by 25 percent of invoices exchanged electronically.

**Scenario 3:** This scenario describes the current situation. Based on the cases studied, today around 50 percent of invoices are exchanged electronically.

**Scenario 4:** This scenario describes what will happen to today's situation if one more major supplier (supplier that delivers daily to the stores) adopts the electronic invoices.

**Scenario 5:** This scenario describes a future situation, when 75 percent of invoices are exchanged electronically.

**Scenario 6:** This scenario describes a future extreme situation, when all the invoices (100 percent) are exchanged electronically.

**Scenario 7:** This scenario describes also a future situation, when the actual hardcopy invoice is not sent by the suppliers (currently there is the necessary legislation for this practice, but it is not yet applied by the companies). In this scenario it is assumed that today's percentage of invoices exchanged electronically (50 percent) is not represented by an actual hardcopy invoice.

**Scenario 8:** This scenario is the more futuristic and extreme scenario of all, when all the invoices (100 percent) are sent only electronically.

## **1.3 Quantitative results**

The cost for the aforementioned scenarios was calculated based on the quantified elements of the previously described process for each of the eight scenarios presented in the previous section.

As far as the cost of the process is concerned, there are several cost factors in this process. The main cost factors that influence the total cost of invoice identified are:

- The labour costs associated with the processing of invoices:
  - at the store
  - at the headquarters
  - and at the storehouse
- The storage costs for
  - the headquarters
  - and the storehouse
- The packing costs
  - At the stores
  - and at the headquarters
- The shipment costs from the stores to the headquarters

The calculation of the labour costs for the stores and the headquarters was based on the process time for each activity for each invoice. The participants provided the number of invoices, daily, yearly per store, and the average process time for the activities. These figures were cross validated with the total cost of man-months provided by the participants and then cross validated among the three retailers. Regarding the process time, different figures occurred only in one case, in which the average time was used for calculations. The labour cost for the storehouse was based only on man-months of full-time personnel employed in the storehouses. The storage cost (not including the respective labour cost) was directly calculated for the facilities used. The packing and shipment cost was calculated per store using an average cost (since the invoices were packed and shipped in butches). These figures were also cross validated among the three retailers.

Another source of cost is the errors that cause the repeat of the process through the issuing of new invoices. In today's scenario the errors that cause the repeat of the process are calculated from 5 to 6 percent. The figure before the implementation of electronic invoicing, according to conservative estimates of the participants exceeded 10 to 12 percent. The percentage of errors was also incorporated in the calculations.

Additionally, there is the cost of the charge of the intermediate for the provision of electronic invoice service, which was provided by the intermediate fixed per invoice.

It is important to note that the calculations were based on additional assumptions that lead towards a conservative calculation of figures, such as the cost of man-month or the cost of mail. Furthermore, some costs were considered unimportant and were not calculated (for example, the storage cost in stores, telephone communication charges, the cost of electricity for the personal computers used).

The electronic invoice influences the process cost in several steps.

- In headquarters, the increase of invoices sent electronically, reduce the invoices for data entry (total of 3.5 minutes per invoice process time required) and increase invoices for simple comparison (total of 1.4 minutes per invoice process time required). The ratio of process time influences scenarios 1 to 6.
- In the store, the existence of invoice data electronically reduces the process time for receiving the order. This also influences scenario 1 to 6.
- Reduced errors caused by electronic invoicing reduce the total flow of invoices in the system. This reduction influences all scenarios, including scenarios 7 and 8, which are expected to have dramatically reduced errors.

The future elimination of the hardcopy invoice (scenarios 7 and 8) influences the process cost in almost all steps of the process, since for the electronically exchanged invoices:

- There is no need for storage

- There is no need for packing and shipping
- The errors are dramatically reduced
- There is still the need for comparing the invoice data with the actual order, but processing time is similar to current process time for electronically received invoices (assumed the same for calculations)
- There is a need for electronic storage of the data

Table 1 summarizes the results for all the scenarios. This table includes the average cost per invoice as well as an indication of the cost of an average size retailer with 1,050,000 invoices per year. Furthermore, the table includes the percentage reduction between scenario 1 (no electronic invoice) and the other scenarios.

		<b>Total Cost for 1,050,000 invoices yearly</b>	<b>Average cost per invoice</b>	<b>Reduction</b>
<b>Existence of hardcopy invoice</b>	<b>Scenario 1:</b> 0 percent of invoices exchanged electronically	3,643,282 €	3.469 €	
	<b>Scenario 2:</b> 25 percent of invoices exchanged electronically	3,349,988 €	3.190 €	-8.04%
	<b>Scenario 3:</b> 50 percent of invoices exchanged electronically (today)	3,046,278 €	2.901 €	-16.37%
	<b>Scenario 4:</b> Scenario 3 plus one major supplier	3,040,937 €	2.896 €	-16.52%
	<b>Scenario 5:</b> 75 percent of invoices exchanged electronically	2,536,437 €	2.415 €	-30.38%
	<b>Scenario 6:</b> 100 percent of invoices exchanged electronically	2,035,277 €	1.938 €	-44.13%
<b>No hardcopy invoice allowed</b>	<b>Scenario 7:</b> 50 percent of invoices sent only electronically	1,035,495 €	0.986 €	-71.58%
	<b>Scenario 8:</b> 100 percent of invoices sent only electronically	806,615 €	0.768 €	-77.86%

**Table 1:** Summarized results for the scenarios

In regard to the actual figures for the average cost per invoice (3.469 euros), this is quite low compare to the aforementioned European surveys. However, this can be explained. The grocery retail sector is characterized by a large number of invoices; consequently all fixed costs are distributed to a large number, thus lowering the cost per invoice. Additionally, invoices are recognized by the

sector's practitioners as a source of cost and are managed efficiently (perhaps by taking advantage of economies of scales in their processing).

The results of table 1 provide the basis for further discussion. A first observation is that electronic invoicing causes important savings. Comparing the current situation to what happened before the introduction of electronic invoices, we observe savings of 16.32 percent which is quite important for a sector such as the grocery retailing, with high competition and low profit margins. Given that this is a proportional reduction, it is expected that larger organizations, will experience greater overall benefits than smaller companies, which conforms to previous research (Kioses et al., 2006). Additionally, further calculations indicate that the intermediary could increase the fee per invoice up to 200 percent and the retailers would still break even this cost.

However, as indicated by scenarios 5 and 6 (especially the more feasible scenario 5), there is still a margin for further cost reduction. This reduction is considerable for scenario 5 compare to the current situation (scenario 3) (an additional 16.6 percent reduction), thus proposing that there is a point for retailers to try to persuade more suppliers to adopt electronic invoicing. The contribution per new supplier is expressed in scenario 4. According to this scenario, a supplier that delivers per store daily and will adopt the system will cause a reduction of 0.27 percent per invoice. This proportional reduction may lead to savings of thousands of euros for the retailer (in this example, for a retailer with 1,050,000 invoices volume, savings of 6,000 euros).

However, although, there is a point for the retailer to add more suppliers to the system, there are even more arguments to upgrade the electronic invoicing service to eliminating the hardcopy invoice (scenario 7). As indicated, the adoption of scenario 7 will lead to a further decrease of 59.17 percent compared to scenario 3 (today), which is considerably larger than the reduction caused by the inclusion of more suppliers (which is usually a challenging task).

As far as the research question is concerned, although there is the limitation of only examining one aspect of collaboration (message-based systems), the output of the case studies propose that the greater extent of collaboration leads to increased business value for the companies. Moreover, it is suggested that the impact on business value could be influenced by service (or system) characteristics (in this case the existence or not of hardcopy invoice).

#### **1.4 Qualitative results**

The qualitative results of the research were based on the in-depth interviews. They mostly validate previous findings of the EDI literature, but their value is that they present these findings for business-to-business interactions facilitated by the internet and an intermediary.

According to the participants, comparing their experience with EDI systems from the previous decade, the existence of the intermediary makes the electronic exchange of invoices feasible also for small companies. This is the main benefit of

this internet-enabled service compare to the classical EDI, since the larger retail companies are now able to cooperate electronically, with a greater number of suppliers compare to the EDI (thus achieving greater proportions of document exchange), and the smaller supplier companies to begin their engagement in electronic activities.

As expected, the information exchange between retailer and supplier is improved. It is faster, more accurate and safer, since the only possible “licking” point could be the intermediary. The accuracy of information was proposed in the literature by Golden and Powel (Golden and Powel, 1999). However, an innovative aspect recognized was that the existence of data fast in an electronic form makes possible their statistical analysis, which leads to the evaluation of partner’s performance and personnel performance. Especially the evaluation of the partner’s performance is a first sign towards the change of the cooperation of the two sides, which may have important consequences in the future. As far as the personnel is concerned it can now be used for more important activities instead of simple data entry, as proposed by McIvor et al. (2000).

Regarding the relationship between supplier and retailer, it is improved due to cost savings, to problem reduction and to faster supplier payment. Additionally, the existence of such a service provides the basis for future more advanced collaborative practices for the supply chain. However, the large number of electronic linkages created empowers this base, by creating the opportunity for the cooperation of more partners.

## **5 Conclusions**

The paper indicates that electronic supply chain collaboration in the form of electronic invoicing provides actual business value for the participating companies. In parallel, it proposes a research approach for the evaluation of electronic supply chain collaboration.

As far as the research question is concerned, the output of the case studies proposes that greater extent of collaboration leads to increased business value for the companies. The business value is greater for larger organizations, but significant to all organizations. Fully electronic invoices are expected to strongly decrease costs even for a smaller number of invoices. Achieving proportions near to 100%, although beneficial, is not practically possible due to the large number of suppliers that have to be convinced; but seeking further cost reductions towards upgrading existing services can provide even higher benefits. Eliminating hardcopy invoice is a possibility, but perhaps not the only one.

Additionally, the paper presents these conclusions using a measurement of the business value of electronic invoicing that could interest the management of organizations. Practitioners may use such findings in order to support their decision making process towards the management of invoices (or related activities). Furthermore, the aforementioned research approach towards measuring the business value can be used for the measurement of other similar electronic

applications as well, and in this way support the management of electronic linkages.

Nevertheless, the presented research has certain limitations that need to be addressed in the future. The main limitation is the examination of only one aspect of electronic supply chain collaboration, the case of message-based systems in the form of electronic invoicing. Another limitation is that this is a case study research and consequently it is subject to the respective limitation of this methodology. Finally, another limitation is that the research was conducted for the Greek grocery retail sector, disregarding different practices in other countries.

Indications for future research address these limitations and suggest other directions. The first clear future step is the completion of current research with the inclusion of a similar analysis for the issuer of invoices (the supplier). Other suggestions for future research are the implementation of this research approach to other types of supply chain collaboration such as electronic hubs or CPFR. A possible proposition would be a field survey addressing companies applying e-invoicing for validating and empowering these results. Finally, the trend in supply chain management research is moving from exploratory to model building and testing (Sachan and Datta, 2005), thus developing a theoretical model incorporating this research may be recommended.

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