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E-Business in Third-Party Logistics: Driving the truck for information sharing.

Bachelor Thesis: Industrial Engineering and Management

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PREFACE

This report is written as a part of completing the bachelor study Industrial engineering and management as facilitated by the University of Twente. Information and knowledge is acquired during an internship in 2008 from mid April to mid July at Alexander Logistics Ltd., Sofia, Bulgaria. I would like to express special thanks to the employees of Alexanders Logistics Ltd., for assisting me during my internship and special thanks to Mr. T.Todorov for his support and supervisory role during the internship.
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MANAGEMENT SUMMARY

Doing business using the internet is still a fast growing platform. Current technological progress has extended the possibilities and tools for creating more and more functionality in internet enabled e-business solutions. In the Third-Party Logistics (3PL) market, organizations are trying to leverage their IT to create superior services and applications and successfully integrate their supply chain. Especially in 3PL, integrating of information flows with the customers is of significant importance.
For SME's and especially for SME's located in south-east Europe the cost of buying traditional IT, like EDI and proprietary networks for information sharing, is too high and the quality of the applications are poor compared to current technological advancements. Therefore 3PL needs to provide good e-business solutions to meet the customers demand.

This research shows that future demands and best practices in 3PL and e-business should leverage the available IT technology to provide the best service for 3PL customers. Nowadays, LIS have to be able to provide a high level of service for the customer. For the 3PL industry this means an increased use of open standards (extensibility) and an e-business architecture that enables the possibilities for scaling up of more customers as well as more IT applications and devices that are communicating with the information system Furthermore, offered web-services have sufficient functionality to meet customers demand and e-business solutions need to provide near real-time visibility of operations and truck location for 3PL customers. This research also emphasizes the fact that integrating e-business is a multidisciplinary activity that influences IT, business processes and communication.

To asses a business process that can be improved with the use of e-business to gain cost- and time reductions and increase the service quality, a model is constructed. This model uses 10 characteristics divided in business processes, communication and IT to assess to what extent e-business support can provide economic potential and cost savings for a 3PL firm. This model also takes into account trends and best practices for e-business application in 3PL and relevant general logistics.

This model has been applied to the forwarding department of Alexander Logistic Ltd.. After assessing the current and desired situation, Alexander Logistics needs to develop the characteristics of scalability, extensibility and improve near real time visibility. It also needs to exploit object generating, complexity, attribute variance and information importance for end-user. This means that Alexander logistics Ltd. should further develop its web application and other e-business solutions to facilitate full functionality. Alexander Logistics Ltd. should also actively stop with communicating the same information through multiple channels and quit using manual channels. Moreover, to increase real-time visibility, Alexander Logistics Ltd. should start with increasing the use of mobile devices with GPS functionality. This also reduces manual operations for the employees in the forwarding department. Effective training using online support for its customers should further increase the usage of the e-business solutions by customers.

After these enhancements Alexander Logistics Ltd. should have less trouble connecting additional customers and services devices and leveraging its e-business to become a 3PL leader in Bulgaria.

TABLE OF CONTENTS

INTRODUCTION

ALEXANDER LOGISTICS

Alexander logistics Ltd. (further referenced to as A-log) is a Bulgarian logistics company located in Sofia. It concentrates mainly on its international forwarding function for local Bulgarian organizations and creating forwarding and groupage possibilities for its international business partners. The company consists of several departments that are listed below and employs a workforce of about 150 strong.
According business functions in A-log are:

- ✓ Groupages
- ✓ Warehousing
- ✓ Freight forwarding
- ✓ IT
- ✓ Customs formalities

A-log offers these services operating using the following logistic channels:

- ✓ Road
- ✓ Airfreight
- ✓ Seafreight
- ✓ Railway

A-log's processes are especially designed for international freight forwarding and warehouse management. A-log shows several strengths when looking to the global market. A-logs first strength is low costs. Operating in Bulgaria reduces the cost of labor compared to other European countries. Even among the Slavic countries, operating cost are considered low. Because A-log, as well as other most 3PL organizations, concentrates on management and organizing of logistic transport and warehouse management, the cost of operations is lower than regular transport companies where the organization of international transport has to be done parallel to already existing functions of owning and maintaining trucks.

Combining this with a favorable South-East location on the European continent imposes considerable advantages in establishing national and international distribution lines for A-log. Moreover A-logs establishments throughout Bulgaria are located at strategic point near to railways or harbors. Main offices are located in Varna(harbor), Burgas(harbor), Plovdiv(E80 highway) and Sofia. A-log also has an establishment at Sofia Airport.
Before admittance to the EU in 2007 A-logs main strength was customs services. A-log nowadays, have a direct connection with Bulgarian customs. A-log is capable of taking care of every kind of customs procedure or protocol pertaining to Bulgarian trade and customs legislation as well as preparing documents for other countries. However, customs procedures have recently become simplified because of Bulgaria's entry to the EU and therefore focus has shifted to serving the customers.
Finally, a depending strength is A-logs in-house IT-department. The IT-department is responsible for creating various systems and applications which are used by A-log, A-logs business-partners, customers and even other logistic organizations that are not directly working with A-log. Again, because labor costs are low, having its own IT-department is still feasible whereas West-European organizations would outsource. A-logs IT-department creates ERP logistic software (more on ERP in Chapter 3: Theoretical framework) with the main system named the Integrated Management System or in short, IMS. Some of the modules in the ERP handle the information flows and business processes pertaining to the forwarding department. The forwarder employee has the possibility to share information with external parties through the system but this happens on an irregular basis. They are still unable to leverage the e-business solution for this purpose. Therefore it is important to analyze the business process and its accompanying information flows to find out where A-log can redefine or create extra possibilities for sharing information with outside parties and systems.

1 PROBLEM DEFINITION

This chapter of the report relies on the methodological checklist and Managerial Problem-Solving Method (MPSM) created by Mr. Heerkens (1998). The structure can be seen back in the Headers and problem identification chapter. Furthermore, Verschuren and Doorewaard[1] are used to set up the research question and sub-questions.
Other influences for structure, like data analysis chapters are derived from experience during courses attended at the University of Twente. Main contributor courses are Project: integral proces-design based on the Innobus ltd. case and Master-course: introduction to Industrial Engineering & Management. The MPSM methodology is chosen because of experience with this structure in previous reports and its applicability on the problem at hand.

1.1 PROBLEM IDENTIFICATION

1.1.1 CURRENT PRACTICES

A-log has transferred its operations from a paper- to an IT oriented-based shape like many other organizations who have to deal with automation. A-log already has a home-made information system developed by the general management in cooperation with the IT department. The IMS-system (Integrated Management System) is an ERP-system (see theoretical framework) which contains several modules for supporting logistic operations like Warehouse management system (WMS), Customer Relationship Management (CRM), Transport management system (TMS), financial management (FMS) and produces reports for management information (MIS), statistics and marketing. The ERP uses databases to store and access information. All information like invoices done, invoices paid, credit information, custom procedures, customer information, order location, truck information etc. are stored centrally for easy and full or restricted access.
In the logistic market many firms use similar systems to connect the supply chain.

Due to high cost of other ERP systems (like SAP or Microsoft dynamics), ranging from $200.000 for small enterprises to $600.000-$800.000[2] in medium sized enterprises, A-log has decided to create its own ERP-like system especially for logistic freight forwarders and by this, creating opportunities to offer the system on the market. The ERP's different functionalities individually support the pre-described task sufficiently. The structure of the ERP-system should be parallel with the activities of the employees working in the forwarding department.

The most important documents for external use in inter-organizational communication (invoices, financial debet/credit, shipping documents, customs documents) are now shipped with the cargo or send manually by email or fax but are at different extend all available through the web-applications as well. The ERP-system is able to create and send these documents. Some of these are generated or sent manually, semi-manual or automatic depending on the exchange party and document. Electronic Data Interchange (EDI) with large business partners and large regular customers is operational in specific cases but not in a unified format throughout the supply chain and is also dependent on the specific business partner. Every EDI format therefore has to be translated to a format that fits with A-log's ERP or the standard from the business partner. Because A-log is rather small in comparison with large customers, it comes down to compliance from A-logs side when bargaining over IT integration. Special customers, as described above, can manage its own inventory in A-logs warehouse and order shipments on its own accord. Special Customers have a Vendor Managed Inventory function like described in the theoretical framework later on. Focus furthermore is on the communication with A-logs smaller consignees. A-log offers a website-based application for smaller consignee's to manage logistic operations (channel website: 2% of total incoming orders).

[1] P. Verschuren, H. Doorewaard (2005), *Het ontwerpen van een onderzoekI*, page 66-77
[2] Wu et al.(2007), *Active ERP implementation management: A real options perspective*, p. 1044

Business partners use applications designed by A-log which they use to communicate with A-log's ERP through a Virtual Private Network (VPN). Special customers have the same application with restricted access on which they can manage different functions varying from online ordering of goods as well as inventory management. These are more or less embodied in the form of websites. Especially communication with smaller consignees is important when considering existing bottlenecks in processing of different orders and information sharing. Now, consignees can log in on A-log's website and perform different functions like posting order requests and checking status of the goods (track&trace). Although this seems a good solution to integrate the use of IS for SME's, the management sees only an estimated 5% or less of incoming orders through the website.

As previously mentioned, communication with consignee's is not optimal yet. Adoption of electronic information sharing and e-business solutions by these consignee's is hard to realize due to factors like lack of technical knowledge, high implementation costs and ambiguity toward internet-based information systems but also that the solutions still not offer full functionality. This results in frequent information sharing on a manual basis. This means that lead times and processing time are longer and employees can process smaller quantities of shipments while the ERP system retains the functionality to process higher quantities.

1.1.2 DESIRED SITUATION

The management of A-log wishes to have more insight in two topics pertaining to the business processes in combination with sharing of business information and documents using information systems and IT.

The first topic is based on intra-organizational communication. During the envisioning of the IMS-system and implementation a translation gap might have incurred. When designing the IMS most information and business processes have been streamlined for easy transfer of documents and faster processing times with littler effort. After having implemented the IMS and its following updates, it is still unclear if the ERP functions meet the perceived results as envisioned before. Management's vision of this hasn't been completely clear until now so mapping of business processes with information flows is needed to supply a clear overview. For example, documentation flows and activities are now centered on the arrival of trucks which increases work pressure and processing times in this time-frame. One question arising could be if documentation and activities can be spread more along the total business process to avoid bottlenecks. Although management is satisfied with its ERP's functionality, perceived benefits are not fully reaped upon.
The desired state therefore, in intra-organizational communication would be, to streamline remaining and inefficient sharing of documentation and information into automatic generated documents and automatic activation of subsequent actions performed by the forwarders or an external party (through e-business).

Secondly and lastly, there is inter-organizational communication (B2B: Business-to-Business). Having defined internal and external information and documentation flows, communication toward outside parties have to be adequate. This is either done manually by phone, mail or fax or through a direct electronic connection like e-business solutions as described before. The goal is to convert the gross of communication and information flows to an automated sequence. Questions like, how to increase the best functionality for the customer, how to link business processes to e-business support, and how to simulate the adoption of e-business solutions, can be answered given the current information flows, business processes and IT solutions available. To be able to offer services like checking of financial status, ordering online, track&trace etc. it is important that internal business processes correspond with information flows to external parties and vice versa. Hereafter, external entities that use or want to communicate with A-log, can be offered a clear package and overview of solutions.
In the end most of the external parties should be exchanging documents and information through e-business solutions offered either by A-log, the external party, or a direct link to establish an inter-

organizational information system. For A-log this means that when external parties use e-business functions more this will results into reduction of process times of the forwarder, increase in information quality, diminished communication costs and lead times etc..

The latter topic will be the focus of this report. In essence this means that the focus is on internal organization and how informational and documentation outcomes can be transferred to e-business so that external parties can use these outcomes in its own organization. From a theoretical perspective this would require both mapping and analyzing business processes as well as finding or creating a framework or model to assess whether current practices are perceived as "good or best practice" by valid researches and institution in the logistics or 3PL industry.

1.2 RESEARCH GOAL

This research has two goals as briefly mentioned in the above.
The first goal of this research is to give A-log more insight in its own business processes pertaining to the forwarding department with respect to e-business and information sharing. This is acquired by mapping the current business processes and also looking at the communication, e-business and IT. In the end this should result in a proposition to improve B2B information practices using e-business for the A-log case.

The second goal is to provide a framework or model that 3PL firms can use as a tool or guideline to assess the current e-business with respect to their internal organization. Again, this model is applied to A-log in order to supply A-log with a founded proposition.

Combining these should provide recommendations for the IT/IS business functions in the forwarding department and should give A-log operational and/or strategic guidance on how to improve usage of installed or planned e-business solutions. A-log could also use the content of this research to compare and hereafter align the structure of the IMS and communication with the business processes to gain better information sharing with e-business. It might also be used in persuading and offering a framework to customers in implementing and reconstructing the business processes for adopting e-business applications and using it to support their own primary process.

To obtain/reach the goals stated above the following central problem is defined.

1.3 PROBLEM IDENTIFICATION

Central problem:

"Business-2-Business, information and document sharing practices in A-log through e-business is not fully exploiting its potential."

From this central problem underlining core problems are brought forward. This is done by making a problem bundle of the existing problems in the framework of the central problem. The problem bundle is shown in appendix 2. The problem bundle shows the casual relationship between concrete problems in order to find core problems in a certain case. These problems came to the forefront after several interviews with the management and the IT-department. As can been seen in the problem bundle there are roughly 3 trees which represent 3 problematic areas.

1. IT-technologies for connecting ERP, IS or other end-users to A-logs IMS.
2. The introduction of more documentation standards for B2B communication.
3. Managing and supporting information and documentation sharing through e-business end-users.

Field 1 is not going to be the main focus for this research. This is because of the following reasoning. One reason is that customers and business partners of Alexander logistics have these connections already in place for sophisticated operations. For example, Office 1 superstore established a VPN connection to an application build by A-log which connects office 1 stores IS to that of A-log. Due to this connection Office 1 store can use manage inventory in A-logs warehouse. This solution is custom-made by A-log and to retain its customers, A-log has no choice

but to comply with these specific needs of these large customers. In these cases this solution is optimal. Another reason is the development of web-based solutions for less sophisticated operations like ordering, track&trace managing invoices etc. which are substituting non-internet based solutions. Knowledge about technology is already present in the A-log and effective usage depends on other issues than just owning technology. Theory and underlying technology and practices are relevant but will be discussed more in the theoretical framework and data gathering and analysis chapter of this report.

Field 2 is about the management of EDI (more in theoretical framework) communication standards within the supply chain. Several things can be said about this. Firstly, the EDI standards of A-logs external party are hardly used. A-logs management estimates only a maximum of 5% of all documentation flows are EDI based. Moreover, literature concerning this topic says that standardization for industry-specific EDI or any other standard is hard to obtain. For example, Dai and Kauffman(2003)[3] researched comparisons between internet based communication and EDI based extranets. They claim that extranets have a disadvantage in cost due to the limited market-making functions and restricted set of trading partners. Also high costs are involved when allowing more participants in the network. Giving the environment of a freight forwarder, who has an abundance of participants and needs a lot of market-making for establishing communication links, this is an unfavorable and expensive operation in efforts for change. This is not feasible for SME's (small and medium enterprises) who cannot afford implementing EDI. As Soliman & Janz[4] summarize, VAN's (see theoretical framework) used for EDI have service costs in the range of US$ 5000-6000 per month which is not affordable by SME's. Also EDI needs hardware on both ends to allow for seamless processing and pre-agreed-to standards have to be established which complicates e.g. switching to other suppliers or vendors outside the current supply chain. Switching to internet-based communication is proposed as a solution and refers to the e-business framework.

Both field 1 and 2 are linked to field 3 which is about e-business. A-log has some of its web-applications in place and according to A-logs management: *"users are interested and willing to use these applications."* However usage is low and business processes of outside parties do not include the web-services of A-log. There is also no clear planning how to train and familiarize SME's with web application functionality because they haven't got a clear view on information flows towards e-business tools. A-log also has no clear plan and structure to develop e-business solutions but have knowledge about the market and IT. In A-logs case e-business solutions are still incomplete and not used properly which results in that employees have to enter a lot of information into the information system by hand. This results in that they don't use the e-business solutions as the main channel for communication of business information which, again results in more manual work. After this research there will be a proposition on how to improve this. The core problems, which are interrelated and can be seen with a red mark-up in the problem bundle, are:

- Forwarder is entering information manually into the IMS.
- Automatic information integrating from consignee using e-business is low.

The ironic part of these core problems is that A-log itself already has the technology to overcome these problems but still misses out on the benefits. A-log misses the tools for successfully integrating IT, communication and business processes for e-business support. The green core problems represented the end-users share in solving this problem. Because of time restrictions and applicability on the problem at hand focus is not on the end-user side. However, relations between the internal and external is not ignored and some references will be made to this inter-relation.

[3] Dai Q. Kauffman, R.J. to be or not to B2B: *Evaluating managerial choices for E-procurement channel adoption*,p. 6, table 1

[4] Soliman K.S., Janz B.D. (2003), *an exploratory study to identify the critical factors affecting the decision to establish Internet-based interorganizational information systems*, p. 698.

Moreover, e-business and 3PL solutions are, in the end, created for the end-user and general practices in e-business or 3PL will always have to take the end-user into account.

Converging this into one core problem:
"Usage of integrated information flows, from and to, end-users through e-business is low or non-existing."

With integrated is meant that both parties have come to agreements about automating and integrating information and documentation flows. This can be looked at in general business practice, logistic supply chain, 3PL practice and more specific, services offered by A-log. This research will explore services of A-log in the logistic sector as being part of the 3PL industry. The discussion will contain statements about generalizations to meta-levels of industry. From this above core problem the main research question is derived.

1.4 SETUP OF REPORT

This report starts with a problem definition chapter were the exact problem is clarified. The current and desired situations are stated and the research goal and central problem will be presented. Hereafter the research definition will take place with its sub-questions and work plan.
In the next chapter the theoretical framework is presented. In this framework the main definitions theories and methodologies are presented which help in understanding this report. Moreover, some underlying knowledge that is important for the creating of this report is presented like trend to open standards and internet-based information systems.

After the theory, the data collection process is presented concerning the results of the knowledge and information which was needed to setup the model presented in this report. First a start is made by describing the original model and using the other collected data in this chapter to argument why and what is changed to create a new model for the third party logistics sector. This data is derived from different literature and shows main trends in the combination of third party logistics and IT/IS field. Furthermore, data concerning the creation of the business model is presented like practical boundary conditions and assumption made during the creation.

In the data analysis, findings for the current and desired situation are described and explained. Also the key findings are highlighted.

This is summarized and fed back to the model to present a general conclusion of its applicability on Alexander Logistics Ltd. The concluding chapter also summarizes the main areas of improvement for Alexander logistics. Hereafter these areas are supplemented with practical solutions in the proposition chapter

Lastly, a small discussion chapter will state were the model is applicable and what assumptions are done to generalize and validate this model. It also proposes some recommendations for extending the research.

2 RESEARCH DEFINITION

2.1 MAIN RESEARCH QUESTION:

"What is third party logistics (3PL) and how does it relates to e-business and what characteristics will be most suitable to improve e-business support in third party logistics?"

This research is based on trying to devise a general model for the third party logistics industry but described below is the approach which is used in Alexander logistics Ltd. freight forwarding division where the research is conducted and applied.

To answer the research question and apply it there is a knowledge question pertaining to what 3PL is and what e-business in 3PL represents. Furthermore this research should give a framework to identify characteristics in an organization that can be improved to use the advantages of e-business successfully. This means this research has to explore the combined practices of e-business and 3PL and aggregate this into a framework where a 3PL firm can be assessed upon. This framework can then be applied to A-log in order to give a case example and first check whether the theory behind the framework is sound.

2.2 SUB-QUESTIONS:

The main research question roughly crosses 3 areas where there is a lack of knowledge in the forwarding department. These are knowledge about internet-based inter-organizational information sharing practices and 3PL, mapping business processes, and proposing improvements for the current processes.
Therefore, to obtain knowledge is these 3 areas they are divided in 4 sub-questions:

1) What are 3PL and e-business and what is known about successful application of e-business in 3PL now and in emerging trends?
2) How can a third party logistics firm asses the added value of e-business support on their business processes.
3) On what characteristics can Alexander logistics Ltd. increase the performance by further developing e-business?

The assessment for question 3 will be only dealt with briefly due to time restrictions and scope.

Resulting from these sub-questions will at first give an explanation of the concepts 3PL and e-business. Secondly the influence and dynamics of e-business on the 3PL organization will be presented. Thirdly, identification of a suitable model or framework for assessing effective e-business practices in 3PL. Fourth, checking and updating this framework on operational effectiveness, new technologies in e-business or current and future application of e-business solutions and trends. Lastly, give an overview of the business processes in the forwarding department of A-log and results of the applied updated model on A-log.

2.3 WORK PLAN

To solve the research questions and gathering information to do so, a work plan is devised:

1. Analyze 3PL and e-business.
    a. Find literature that describes the concept of e-business application in 3PL and 3PL itself.
    b. Find researches, best-practice cases and technologies in literature that have successfully applied e-business in 3PL.
2. Identify a framework to assess the effectiveness of a 3PL organization that uses e-business.
    a. Search for a framework that has explored the interaction between 3PL and e-business.
    b. Update the framework from 2a with the results from what is found in 1b.
3. Make a proposal for the A-log IT department.

a. Map out the forwarding department using an applicable business process modeling technique.
b. Apply the framework coming from 2 to give an overview of the current status and desired situation.
c. Make recommendation for the forwarding department of A-log to reach the desired state according to the framework.

Appendix 1 shows a rough planning in the time-span of 13.
Steps 1 and 3a will be done in parallel because they require the most time and they can be performed independent from each other. Step 2 requires knowledge acquired from step so can only be done after each other.

3 THEORETICAL FRAMEWORK

In the theoretical framework, terms and theories are introduced which are relevant when reading this report. Part I will provide the practical terms which are needed to understand the basic theories that have been used and applied in this research. Part II will consist out of supporting theory and finding in literature that supports the revision of the model for assessing the success of e-business support in 3PL. This model will eventually be applied on the Alexander logistics Ltd. case.

Because of rapid technological improvement and the relative age of the 3PL sector, this report uses sources from mostly 2002 and later for Part II. Moreover this research uses most articles from quality information systems journals (Schwartz & Russo, 2004[5]). Authors and articles are chosen based on number of citations and publications to ensure the research validity. Moreover this implies that this research will be adequate in recognizing current trends and advances in 3PL and e-business to incur in the model.

Again, this report is neither about business process re-design theories or technology implementation theories. Although it is recognized that these areas of expertise are important these are outside the scope of this research.

PART I: BASIC DEFINITION, THEORY AND EXPLANATIONS

3.1 GENERAL AND TASK ENVIRONMENT

According to Daft(2002) the general and task environment can be described using the dimensions in Table 1. These two environmental forms together describe the external environment. To get an overall feeling for the organizations operating environment and local implications this brief analysis is done. This will help clarifying the immediate influences on A-log and why these are important for A-logs position in the Bulgarian market. It will also help in interpreting restrictions on A-logs capabilities and performance due to nation specific factors. Thus support in answering sub-question 3.
The general task environment is defined as the layer in the environment that indirectly influences the organization[6]. The task environment is defined as the layer in the environment that influences the organization directly. The general- and task-environment have the following structure.

General environment	Task environment
Global environment	Suppliers
Legal/Political	Customer
Technological	Competitors
Social-cultural	Labor market
Economical	

TABLE 1: GENERAL AND TASK ENVIRONMENT

[5] Schwartz R.B., Russo M.C. (2004), *How to Quickly Find Articles in the Top IS Journals*
[6] R.L. Daft(2003), *Management 6th edition,* p. 75

3.1.1 GENERAL ENVIRONMENT

The **global environment** represents events originating in other countries as well as opportunities for the host country in other countries. The global dimension is represents a context that influences all other aspects of the general environment. Technological advancements can influence the external environment significantly.

The **Legal/political** dimension includes government regulations at the local, state, and federal levels as well as political activities designed to influence company behavior.

The **technological** dimension includes scientific and technological advancements in a specific industry as well as in society at large.

The **social-cultural** dimension describes the demographic characteristics as well as the norms, customs and values of the general population. These kinds of characteristics can include education level, geographical distribution population density etc.

The **economical** dimension represents the general economic health of the country or region in which the organization operates.

3.1.2 TASK ENVIRONMENT

Suppliers are the distributors or producers of raw materials that an organization uses to produce its output. The relationship between manufacturers and suppliers has traditionally been an adversarial one, but many companies are finding that cooperation is the key to saving money, maintaining quality and speedy products to market.

Customers are those who people and organization that acquire goods and services. The recipients of the organization that determine an organizations success. Customers have changing demands and purchase through changing channels as well.

Competitors are other organization in the same industry or type of business that provides goods or services to the same set of customers. Each issue is characterized by specific competitive issues

The **labor market** represents the pool of people in the environment who can be hired to work for the organization. Every organization needs a supply of trained, qualified personnel.

3.2 3PL, 4PL AND FREIGHT FORWARDING

In its purest organization form A-log can be seen as a **3PL or Third Party Logistics firms (TPL)** also occasionally referred to as a Logistic Service Provider (LSP). In this report the term 3PL will be pre-dominantly used. Coyle et al. states that *"a 3PL firm is an external supplier that performs all or part of a company's logistic function"*. 3PL can be categorized into different types according to Coyle et all[7] These are:

- **Transportation based**: mainly transportation activity but with a more comprehensive set of logistic offerings
- **Warehouse/distribution based**: inventory management, warehousing, distribution etc.
- **Forwarder based**: freight forwarding
- **Financial based**: Freight payment and auditing, cost accounting and control, logistics management tools for monitoring, booking, tracking, tracing and managing inventory.
- **Information based**: internet-based, B2B, electronic marketplace.

[7] Coyle et al (2003), *The management of business logistics: a supply chain perspective*, p.424.

Every type has its own specifications but interrelations can occur when organizations do multidisciplinary activities. In essence any of these logistic functions can be outsources to a 3PL firm. Customers of 3PL organizations use these services because in-house organization will be more expensive and efficiency and quality of logistic operations will be lower. 3PL firms are specialized in the logistics function and have expertise knowledge and facilities.
For the application of this research, focus lies on the forwarding department.

Below are some more definitions and terms that will be used throughout this report.
Freight forwarding essentially collects small shipments and consolidates these into large loads for transport further down the supply chain[8]. This usually means facilitating both for international partners as well as for local customers (consignee's or domestic).

As stated by Van Hoek[9] **4PL or fourth-party-logistic** firms elevate 3PL to a coordinator of the flow of goods, not just as an operator in the physical movement of goods. With this the 4PL firm can also offer higher value added activities in the supply chain in addition to regular warehousing and transport services. In some cases this even means having an independent employee of a 4PL firm in your company, managing all logistics operations.

It is possible for a 3PL or 4PL to also be an **Application service provider (ASP)**. The ASP provides application software on its own computer systems[10]. Outsourcing of information systems or information management is done to ASP's. Facilitating information sharing in an ASP kind of way is usually a part of the 3PL service.

The environment in which the 3PL organization has to operate is more dynamic when compared to normal supply chain management. The following is to show a brief example how 3PL is different from normal logistics. Vaidyanathan[11] provides characteristics in his literature study about the 3PL environment. Factors that 3PL firms are subjected to are: end-user satisfaction, just-in-case instead of just-in-time, flow to multiple directions, highly distributed stocking strategy, next day of immediate transportation and a penalty when breeching the service agreement level. To implement 3PL, real-time information flow is essential especially when considering the factors described above.

3.3 E-BUSINESS AND E-COMMERCE

For this research the terms electronic business (e-business) and electronic commerce (e-commerce) describe the platform where information sharing for business purposes will take place. Therefore these concepts need a clear definition. Electronic commerce (EC or e-commerce) is described by Soliman and Janz[12] and being defined as "*the use of electronic means to exchange information and conduct business transactions within and across organizational boundaries*.".
Also Rushton et al.[13] define e-commerce as being "*a generic term which embodies all logistic terms which are related to the transfer of digitalized information between computer systems.*". Laudon & Laudon (2006)[14] define E-commerce when "*companies utilize Information and Communication Technologies (ICT's) in sales with their customers or in purchases with their suppliers".*
Laudon & Laudon also specify B2B e-commerce to be a part of electronic business (e-business) in which companies use ICTs in all kinds of collaborations with its business partners. The same

[8] Coyle et all (2003), *The management of business logistics: a supply chain perspective,* p. 366.
[9] Prof. Dr. van Hoek R.I., *UPS Logistics and to move towards 4PL –or not?* p. 2,3
[10] Obal. P. (2007), *selecting warehouse software from WMS & ERP providers* ,p. 187
[11] Vaidyanathan G.(2005), *A framework for evaluating third-party logistics,* p. 91,92
[12] Soliman K.S., Janz B.D., an exploratory study to identify the critical factors affecting the decision to establish Internet-based interorganizational information systems, p. 697.
[13] Rushton et all, *The handbook of: Logistics and distribution management,* p. *491*
[14] Laudon, J.P., Laudon, K.C (2006)., *Essentials of Business Information Systems*

definition is also used by Nurmulaakso (2008)[15]. As can be seen, a lot of different definitions are used. When e-commerce or e-business is used in this research it has to be interpreted in the more general form.

For this research however the original definition (1999) of IBM[16] is adopted. They define E-business as "*the transformation of key business processes through the use of Internet technologies*". From now on this when there is a referral to e-business it is about doing business using the internet for connecting and organizing of business processes.

When referring to e-commerce and its specific function on the exchange of documents solely required for payment or sales, referral is made to the format e.g. EDI or specify it for the situation it is used in. The generalization is done because e-business and e-commerce have become so interrelated that one cannot function without the other. Especially when considering supply chain management and 3PL both are on such a high diffusion level meaning, doing e-business and practicing electronic payments, is so interrelated that it is hard to make such a clear distinction between the terms e-business and e-commerce. After the data collection and analysis chapters it will be clearer why this is done.

3.4 E-BUSINESS: FORMATS AND INFORMATION SYSTEMS

As this report mentioned already, A-log has developed its own unique **Enterprise Resource Planning (ERP) system**. Laudon & Laudon (2002) [17] define ERP's as being Information Systems (IS) for the entire enterprise which integrates important business processes resulting in free information flows between different parts of the enterprise. An ERP adapted and used for logistic functions is called a **Logistics Information System[18] (LIS)**. For the understanding of different modules that are widely used in an ERP for logistics other definitions are:

OMS: order management system→ order management, assigning and placing orders etc.
TMS: transportation management system→planning delivery of ordered materials, invoice management, freight tracking, dispatch management.
WMS: warehouse management systems→ managing inventory, storing materials, tracking movements in warehouse, accurate inventory information towards clients.
CRM: customer relationship management→ manage customer info, appointments, lead-management, marketing campaigns.

Furthermore, Laudon & Laudon (2002)[19] define various applications and data information practices that are important in the current e-commerce framework. The first technological instrument they mention is **Electronic Data Interchange (EDI)**. EDI is defined by Laudon & Laudon (2002)[9] as the direct exchange of standard transaction documentation between two enterprises through a computer. This is used for various applications and various IS. EDI is technology that facilitates standard transactions like ordering forms, bills, cargo letters etc. EDI lowers transaction costs and increases transaction speed. EDI is one way to facilitate inter-organizational communication whereas ERP-systems are organizing intra-organizational communication.

[15] Nurmilaakso J-M. (2007), *EDI, XML and e-business frameworks: A survey*,
[16] www.ibm.com/e-business
[17] Laudon & Laudon (2002) *B2B e-commerce*, p. 58.
[18] Kim et al., *A strategy for third-party logistics systems: A case analysis using the blue ocean strategy, p. 523.*
[19] Laudon & Laudon (2002) *B2B e-commerce,* p. 126-140.

To connect an ERP-system to the outside world inter-organizational connections are facilitating e-commerce and e-business:

Value added network (VAN) is described by Laudon & Laudon (2002)[9] as being a private network, with different tracks and specifically designed for information, that can be used by different organization on a subscription basis. Used for EDI document transfer.

Virtual private networks are used to make a secure connection through the internet between two locations. The advantage of this is that it reduces costs because it doesn't require facilitating a separate line e.g. like renting private phone lines and frame-relay connections.

Intranet and extranet (Laudon & Laudon (2002))**:** Intranet are private networks secured from the outside using firewalls and security -software and –systems. Intranets work with the same technology as normal internet and can be accessed using web-browsers etc. Extranets occur when outside organization or persons get (restricted) access to one other organizations intranet. Used for EDI document transfer.

XML (extensible mark-up language): according to Nurmilaakso[20] is developed by WWW Consortium (W3C) and is not only a meta-language for electronic document management and web publishing but also a data format. Tens of e-business frameworks, such as Electronic Business XML (ebXML) and RosettaNet, have been standardized to use the XML format and are called XML-based e-business frameworks. The mark-up dynamics make its outlook flexible and easily translatable by processors.

IBIS and EDI: Soliman and Janz[21] state that there is a distinction that has to be made. The distinction between EDI-based communication and internet based inter-organizational information systems (IBIS or also referred to as internet-based or web-based EDI). Where IBIS is used this refers to e-business using the internet and not traditional EDI communication by a virtual VAN or extranet.

3.5 EVENT DRIVEN INFORMATION FLOWS

To create an overview which shows business processes with information flows the decision is made to use Event-driven process chains diagrams (EPC). Other modeling techniques have also been evaluated like Data flow Diagrams (DFD), Resource Agent Activity diagram (REA) and use-case diagrams (UCD) etc. Even after mapping the business processes with DFD it did not show the details the EPC can offer. EPC illustrates business process work flows, and is an important component of the SAP R/3 modeling concepts for business engineering. According to Keller et al. (1998), EPC's are an intuitive graphical business process description language. The language is targeted to describe processes on the level of business logic and can easily be understood and used by business people. The EPC shows functions that spawn from certain events. Different paths or decisions can also be illustrated using OR, XOR and AND instances. It also shows how external parties or system communicate with the functions performed in the modeled business process. Furthermore, EPC provides a good structure to show the presence of documentation flows and information flows effectively and is therefore used instead of other modeling techniques.

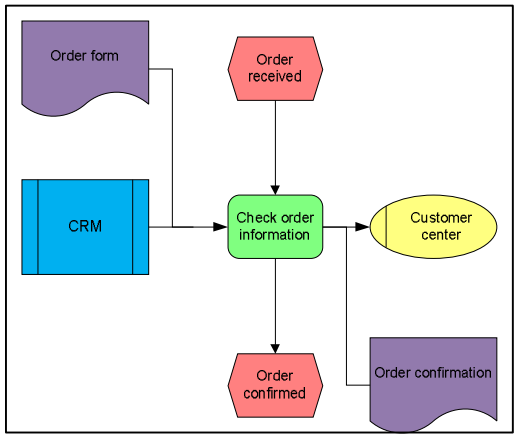

FIGURE 1: EPC EXAMPLE DIAGRAM

An example is given in Figure 1: This example shows most instances of the EPC. To get a better understanding about information flows and notifications used extra instances are added to the

[20] Nurmilaakso J-M. (2008), *EDI, XML and e-business frameworks: A survey*, p. 371

[21] Soliman K.S., Janz B.D., an exploratory study to identify the critical factors affecting the decision to establish Internet-based interorganizational information systems, p. 698.

original set. These will consist of electronic notification of mail or/and a physical document. An overall view of objects is shown in Appendix 11: EPC legend. EPC with additional communication flows will show which functions trigger documentation flows or information sharing. When a complete schedule is available it shows an overview of the complete business process to determine where communication and information sharing with external parties through the web-application or through other channels takes place.

3.6 A FRAMEWORK FOR ESTIMATING POTENTIAL IN INFORMATION SHARING WITH E-BUSINESS SUPPORT.

Like described in the theory above e-business, ERP and the way IT supports the business processes in an organization are important for the operational effectiveness of one's organization. Especially when connecting supply chains and logistic operations there is a tradition of using IT support because information flows can be easily standardized. It is therefore important to have a clear view of how e-business can support the business process.

Manecke & Schoensleben[22] performed research on the adoption of internet-based applications to support a business process. Their research focuses on creating a framework that can estimate the expected benefits of replacing a certain business process in an organization with an e-business solution that supports the process. During research done in Switzerland on the level of SME's they argue that "*SME's have to carefully choose the most suitable IT and information strategy for their processes because of typically having limited resources for investments: there is limited room for resource fixation in strategic investments, of which the operative payback is uncertain and in the far future, if it can be expected at all (Löser 1999)*". Like mentioned before, this will reduce the chances significantly of SME's adopting any kind of EDI.

Moreover, in this article they address the need for SME's to align both business processes, communication and IT levels with each other and propose a model to identify economic potential focusing on the information flows of the business process and its contributors, both external and internal. A visual representation of this framework is given in Appendix 4: Method for identification of potential when using internet-based . The characteristics describe influence on the different parts of the organization that are influenced by internet-based support. With this method, business processes that promise high economic potential for internet-based support can be identified and hereafter propositions can be done for how SME's can align their business processes with these requirements.

The model uses 10 criteria divided over 3 dimensions:

Characteristics of the process

1. geographic separation of process contributors
2. Repetition frequency of similar communication within one process
3. Repetition frequency of the process
4. Relevance of communication time

Characteristics of the communication

5. Attribute variance
6. Object generating
7. Homogeneity of information formats
8. Complexity

Characteristics of the IT

9. Frequency of changes of relevant information
10. Synchronization of internal IT and internet

This model is one of the few that also proposes characteristics which can be used to analyze the organizations business process. In this report this model will be partly reshaped by adding and deleting characteristics of the model to let it represent potential in information sharing to gain better integration with e-business solutions in the specific 3PL industry. Eventually, the model could be able to determine potential for better B2B information sharing based on criteria of good

[22] Manecke N., Schoensleben P.(2004), *Cost and benefit of internet-based support*. P. 213,214,215

3PL practices and e-business. The model will therefore be more industry specific and applicable for the logistics context instead of being developed for industries in general like Manecke & Schoensleben originally used it for.

3.6.1 THE 2-STEPS APPROACH:

To measure economic potential in the framework Manecke & Schoensleben[23] distinguish 2 steps:

1. The first step is to determine the desired and actual performance and estimate if economic potential is attainable. This is usually done in a subjective matter and is assessed per organization and per business process.
2. Step 2 is to measure or estimate the potential using in this case, the process-oriented analysis by Eversheim (1995). The choice for method for estimating a potential is free and can be chosen by the researcher. The researchers see the process-oriented analysis methodology the best adequate for the job in the case of SME's in Switzerland. This measures the value of process cost and time on the basis of costs, time, quality and flexibility. Furthermore this measurement model measures resource consumption of different resources in the resource model.

Given these resources, savings per characteristic can be estimated for each process. The benefits can be assigned to either internal or external factors. For example, a process will disappear because of the new internet support which represents internal benefits in cost and time reduction. On the external side the customer will e.g. increase its sales because of the enhanced service or, on the internal side, suppliers will lower prices because of cost reductions caused due to the internet-based service in its operations.
In the end this model shows a clear picture what characteristics can be influenced for the better to obtain optimal use of internet-based/e-business support. In Part II of the theoretical framework this report will make argumentation on changing the model to be applicable to 3PL.

PART II: THEORY ON DEVELOPING E-BUSINESS AND 3PL

From here on this report will begin in addressing important best practices and trends in 3PL and e-business. These findings will hereafter be translated to characteristics which can be introduced or changed in the already existing model of Manecke & Schoensleben.

3.7 3PL AND 4PL BEST PRACTICES AND FUTURE DIRECTION

Information technology is becoming more and more important to customers of 3PL and a research done by Langley et al.[24] in 2000 already showed this. For the question if customers relied on 3PL for leadership in information technology, 66% responded with "yes" or "somewhat". It also shows that a large part of 3PL customers expected more leadership in IT in the following years. This trend should be taken into account and is even more applicable anno 2008. A more actual research performed by Cap Gemini[25] in 2007 shows that current and desired use of 3PL technologies are for more than 88% of total users focused on web enabled communication and visibility tools (track&trace, event management). More traditional functions like transport management (execution) and warehouse/distribution center management, have respectively 86% and 85% of total users supporting or having technology usage in these fields.

Furthermore Cap Gemini's research also shows interesting guidelines for growth in a maturity model for 3PL. Data in this research is obtained by interviewing 1,500 senior executives of 3PL firms across the world. Together with the fact that Cap Gemini is one of the global leaders in consulting, technology, outsourcing and local professional services this research is very usefull in identifying best practices and trends in 3PL. Their report contains implications for 3PL on what

[23] Manecke N., Schoensleben P.(2004), *Cost and benefit of internet-based support*. P. 221,222

[24] Langley et all (2001). *Third party-logistics services: views from the customers*

[25] Capgemini et all, T*he state of logistic outsourcing:2007 Third-Party Logistics results and findings of the 12th annual study*,

aspects to develop for effective cooperation with 3PL-customers. All these aspects are considered to be very relevant for A-log as claimed by A-logs management and could all be aimed for in A-logs case.
Main aspects considered relevant for collaboration and adopting offered e-business practices in the progressive and leading stages are shown in Table 2: Progressive and leading implications for 3PlL and a full overview is given in Appendix 3: Maturity model for effective 3PL-customer collaboration.

Progressive	Leading
Good working relationships between 3PL and customer on an individual basis	Organizational and strategic alignment from executive level down to operational level
Customer and 3PL cooperatively manage business processes across company boundaries	On-site representatives from other company
Value added services beyond traditional transportation and warehousing	Shared KPIs / metrics and a joint focus on continuous process improvement
Increasing focus on proactive process improvement to deliver joint benefits	Information shared widely with significant benefits
Near real-time visibility and alerts for shipments for some flows	3PL Services extend to customer facing and strategic planning processes
Periodic communication of planning information	Holistic solutions supporting optimization across the extended supply chain
Upgraded IT, leveraging 3PL best practices	3PL Toolbox of applications (services) allowing fast customer implementations and requirements updates

TABLE 2: PROGRESSIVE AND LEADING IMPLICATIONS FOR 3PL

As can be seen from the research of Cap Gemini there is a heavy focus on integrating information flows to the a high level. Moreover, they suggest organizational and strategic alignment in different levels of the organization and on-site representatives in the leadership stage (4PL). To obtain these kinds of collaborations business processes, IT and communication should be clear and transparent so that both parties can benefit. The maturity model also shows traditional practices that are non-favorable in the development towards a leadership role. Non-favorable and important to mention for e-business are:

- Information shared by email and some EDI
- Shipments status only available by request (not in real time)
- Proprietary information formats in logistic sector (RosettaNet , EDIFACT)
- Ad-hoc information exchange
- Reactive improvements to resolve process issues between customer and 3PL.
- Process design and execution confined to intra-company boundaries

Traditional practices are better to be avoided. In short this means a 3PL firms should limit EDI with its trademark formats and email communication of structured information. Don't use a pull strategy for shipment status and real time notifications. Provide continuous and structured information provision for end-users. So do not have rigid, single format, ad hoc information flows.
The following theory will further support especially the motivation to go "online" instead of using traditional communication standards.

3.7.1 THE CJ-GLS CASE

A connecting case study that illustrates the issues mentioned by CapGemini's research is Kim's et al.[26] research of the CJ-GLS case. Their research concerns a best-practice case of a 3PL firm (CJ-GLS) in South Korea. This case shows that effective E-business support is the basis for successful implementation of subsequent M-business (mobile) and Ubiquitous oriented LIS (RFID, "everywhere" oriented LIS). CJ-GLS's, LIS evolved from providing good e-business support to communicate with more and more different users and (mobile) technologies to mutating to a system that is compatible with RFID. Studying CJ-GLS shows the development of e-business support features that increase business efficiency, reduce business process times and improves ease of use. For CJ-GLS it was important to map the information flows and analyzes which system communicates with which users/systems. In this case information flows, IT and communication should take into account the need for up scaling and ability to communicate with different devices and systems. This research showed the goal of remodeling business processes toward an ASP and eventually a 4PL firm. For a new model this implies having to deal with different users and devices and the ability to adapt the LIS easily for new technology and different kind of business processes.

3.8 TREND TO OPEN STANDARDS

There are a lot of researches available that acknowledge the downsides of EDI and see future benefits of using more open standards for information sharing. For example Yen et al.[27] researched the influence of XML on B2B commerce. They acknowledge the fact that EDI is expensive because of using an indispensible protocol or using a VAN. They acknowledge the advantages of internet-based EDI and the use of XML of being more flexible and inexpensive. They also show that most XML is supported in most web browsers and standard-setting corporations like Microsoft who has business frameworks based on XML.

Stefansson (2002)[28] supports the transition to internet-based communication. In his research towards B2B data sharing in supply chains he explains why SME, large and huge companies cannot reap the benefits from EDI. SME simply are without systems, resources or communication modules because they are technically too difficult to design. Large and huge companies have possibilities to develop EDI but cannot or will not because most customers are not using it and most of them will never realize the benefits to full extend. Instead of EDI they recognize the use of internet as superior for supply chain integration.

Moreover, Nurmilaakso (2008)[29] did a survey towards the use of EDI or XML e-business frameworks. His research shows that nowadays, there are more XML than EDI based framework for doing e-business. Also, for cross-industry-process e-business, there only exist XML-based frameworks. The research is done in several kinds of industries and uses 7593 observations. The results show that EDI still has a strong position but the XML-framework is superior. The research also shows that XML-based framework are increasing more in number than EDI-based ones in 2004. More important is the fact that in new market economies more XML-based frameworks are being used than EDI-based ones.

In the end multiple researches (Soliman & Janz(2003), Nurmilaakso(2006,2008), Hong and Zhu (2005), Stefansson (2002)) have acknowledged the use of internet-based information systems over current practices like EDI or other traditional practices in inter-organizational information systems.

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[26] Kim et al., *A strategy for third-party logistics systems: A case analysis using the blue ocean strategy, p. 525-526,529-530.*

[27] Yen D.C., Shi-Ming Huang, Cheng-Yuan Ku(2002), *The impact and implementation of XML on business-to-business commerce, p. 349,351*

[28] Stefansson G.(2002), *Business-to-business data sharing: A source for integration of supply chains, p. 141-144*

[29] Nurmilaakso J-M. (2008), *EDI,XML and e-business frameworks:A survey,* p. 374

These researches indicate the definite trend of different kinds of industries getting rid of traditional EDI and moving towards XML or more open-format frameworks for information sharing.

3.9 IMPLEMENTING INTERNET-BASED (E-)BUSINESS SOLUTIONS

Soliman & Janz propose to use IBIS in favor of non-internet based communication for reasons explained already like cost and technical expertise. For developing e-business Nurmilaakso[30] (2006) describes the e-business framework as a framework for specifying business documents, business processes and messaging for exchange of standardized data. His research shows that enhancing inter- and intra-organizational communication is a multidisciplinary activity. It has implications for the organization as a whole and is not only concentrated on IT and technology.

This multidisciplinary assumption is more or less supported by statements by Power & Singh[31] who conclude out of research toward "E-integration" that *"difficulties of implementation is going to be a function of the capabilities of organizations to cope with process re-design, organizational re-structuring, basic data and systems management. Technology becomes more openly accessible for use by its end-users."*

Also Manecke & Schoensleben(2004) previously mentioned framework acknowledge the influence of internet-based support in multiple aspect of the organization. These are business process, communication and IT. As can be seen researches towards e-business show that developing and increasing usage of e-business has implications on the organization as a whole and it is not only creating the technological link or a web-site.

In short these 3 researches show that implementing e-business has its affinity with implementation and adoption theories like e.g. the TAM (technology acceptance model) or technochange like described by Markus(2004). In any case the technological change influences the organization as a whole and should be managed accordingly.

3.10 IDENTIFYING A MODEL: E-BUSINESS, 3PL AND INTEGRATION

In the literature about 3PL, 4PL and general logistic supply chains there are limited researches towards how to structure information sharing and the use of e-business or structuring information flows for gaining new demands like real-time visibility, scalability and other characteristics influencing information sharing. Marasco[32](2007) supports this in his literature review of 152 articles devoted to 3PL. Most topics discussed in 3PL are about the influences of the general environment on 3PL practices, about describing different factors that are changing supply chains and about the 3PL actor framework etc. Although integration of IT and more specific, E-commerce, is recognized and described by e.g. Koh & Tan(2005) and Ying & Dayong(2005). The literature review performed for this research together with the research of Marasco[33] shows that no extensive models or frameworks are presented to adapt business processes and information sharing for leveraging e-business solution to optimal performance. Especially not in the face of 3PL or e-business solutions which are being used by SME's. In literature, about internet-based information systems, whether it is inter- or intra-organizational communication, alignment between business processes and communication flows and IT is predominantly mentioned (described more in next chapter) but not for the specific 3PL framework. Other researches like those from Lai et al. and Rutner et al. only described general influences of e-commerce or LIS on logistics.

For this research a model is needed that has its focus on 3PL, combining e-business and the influence on organizational processes. Hereby this research attempts to give more insight towards

[30] Nurmilaakso, J.-M (2006), *Adoption of e-business functions and migration from EDI-based to XML-based e-business frameworks in supply chain integration*,p. 4
[31] Power D., Singh P. (2007), *The E-integration dilemma: The linkages between internet technology application, trading partner relationships and structural change.*, p. 1306.
[32] Marasco A(2007). *Third party logistics: A literature review*, p. 133-138
[33] Marasco A(2007). *Third party logistics: A literature review*, p. 141

how to determine whether information sharing practices with corresponding business processes and IT are to be optimized for exploiting e-business solutions. Earlier the research of Manecke & Schoensleben has been identified as viable but not suited for 3PL yet. Another research mentioned hereafter provides another framework that corresponds to that of Manecke & Schoensleben.

A research performed by Gosain et al.(2004)[34] towards flexibility in inter-organizational information systems (IOIS) in the supply chain, shows more or less the same framework as the one of Manecke & Schoensleben as presented earlier. They describe 2 ways of flexibility in IOIS. One is, offering flexibility and the other is, partnering flexibility. In the research they used their experience in RosettaNet (well known organization that develops universal standards for the global supply chain) and a survey among 16 enterprises to find the influence of several practices on increasing flexibility of IOIS. These practices are:

- Structured data connectivity
- Modular interconnected processes
- Standardization of process and content interfaces
- Quality of information sharing
- Breath of information sharing
- Deep-related-knowledge

These practices look similar to the characteristic descriptions of Manecke & Schoensleben although these from Gosain et al. (2004) are not focusing on internet-based information systems alone but are also for the more general inter-organizational connectivity framework. However, Gosain et al's. (2004) findings support the validity of the model this research uses. Still Manecke & Schoensleben have not regarded traditional EDI as an option in their model so propose a more specific framework which is needed for this research. This is because the focus will be on e-business with SME's which as stated before cannot afford EDI and EDI uses proprietary formats which are closed standards and provide lesser interoperability compared to open standards. Therefore Manecke & Schoensleben's framework looks better equipped for future implication of 3PL.

Like mentioned before, apart from framework like that of Gosain et al. (2004) and Manecke et al.(2004) there are very few researches that provide a solid framework that assesses the successfulness of e-business integration in 3PL.

3.11 ADOPTING IBIS/WEB-APPLICATIONS

A trend towards internet-based inter-organizational information systems of internet based communication (e-business) is visible in almost every industry. For the logistic industry and specifically the 3PL sector this trend hold extra value in enhancing competitive advantage. This chapter will further discuss several trend and key issues that lead to succesfull e-business integration in a 3PL firm. Therefore these issues and trend should be added or mutated to make Manecke & Schoensleben framework more up to date and applicable for 3PL.

Marasco[35], for example, states in his literature research in 3PL literature the following: *"rapid progress in information processing and communication technology supports the outsourcing of logistics activities to 3PL firms as IT allows buyers and sellers of logistic services to communicate directly over data-rich, easy-to-use information channels, thereby reducing coordination costs and fostering strategic partnership based on mutually agreed goals*.". Information sharing when outsourcing logistics needs data-rich and easy-to-use practices.

Manecke & Schoensleben[36] characterizes the advantages of internet over common communication channels as advantages in:

[34] Gosain S., Malhotra A., El Sawy O.A., *Coordinating for flexibility in e-business supply chains*
[35] Marasco A(2007). *Third party logistics: A literature review*, p. 134
[36] Manecke N., Schoensleben P.(2004), *Cost and benefit of internet-based support*. P. 216

- Speed
- Consistency
- Immediate access
- Lowering transaction costs
- Flexibility
- Extensibility

In the case of SME's however, there is a complete lack of any electronic communication other than mail.

This is supported by Ketikidis et al.[37] for the SEE (South Eastern Europe) region. In the data set they encountered for all logistic companies only 27% that are users of CRM-users, 11% of e-commerce users, 20% of e-business users and 28% of EDI users. Most of these will probably pertain to big logistic organizations. Moreover the research shows that CRM followed by e-commerce and e-business are the most desired applications which indicates the need for information systems development.
Implementation of EDI, VAN's or extranet is just too expensive for SME's. Moreover, many have no or simple IS for operations and let alone for the logistic function only. Internet-based service will therefore be a warm welcome for SME's to manage their logistics and to structure their information management.

More about the use of the internet to provide e-business solution is provided by Hong & Zhu[38].
They surveyed 1036 companies about their willingness to adopt and migrate to internet-based e-commerce. A migration model demonstrates that "*web functionality, web spending and integration of externally oriented inter-organizational systems tend to be the most influential drivers in a firms migration toward e-commerce.*".

Surprisingly, EDI, Firms size and perceived obstacles were found to negatively affect e-commerce integration. This says that when dealing with e-business, adoption works better when dealing with flexible, small and open firms who are willing to leverage internet and open standards for better integration in the supply chain. In A-logs case, the drivers are perceived to be very valid and concentration of A-log to use these drivers in their developed services is important. The non-drivers are to be avoided. For firm size this is already done. Large firms are slowed down by their structural inertia (Hong & Zhu[39]) but for SME this is less applicable. EDI and perceived obstacles will be the main de-motivators for adoption, especially when SME's request more process integration and functionality in the web-applications. Web spending will be one of the main motivators because A-log will offer basic web-application as free additional service to SME's.
For building a model to assess the potential for e-business information sharing it is important to include characteristics that show the focus on high functionality and easier integration with IBIS.

Research performed by Gosain et al.[40] results in that for IOIS flexibility in the supply chain, structured data connectivity, modular interconnected processes, quality of information sharing and deep-related-knowledge are positively related to supply chain flexibility. This essentially means that bigger processes should be cut into modular pieces for modular design of interconnected processes which should contain expertise knowledge and high quality information. It also means that although standardization of processes and data is necessary this should not mean deep-related-knowledge is lost. Moreover, information should be very structured and clear.

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[37] Ketikidis et al. (2007), The use of information systems for logistics and supply chain management in South East Europe: Current status and future direction, p. 596 .
[38] Hong W., Zhu K.(2005), *Migrating to internet-based e-commerce: factors affecting e-commerce adoption and migration at firm level*, p. 215, 216.
[39] Hong W., Zhu K.(2005), *Migrating to internet-based e-commerce: factors affecting e-commerce adoption and migration at firm level*, p. 217.
[40] Gosain S., Malhotra A., El Sawy O.A., *Coordinating for flexibility in e-business supply chains,* p. 28-34

Further researching the implications of this for the IS designer by Gosain et al. brought forth some interesting conclusions:

- *"Quality of information is extremely important in terms of accuracy, timeliness, coverage, and relevancy."*
- *"An enterprise's processes and information flows must be designed in a manner that encapsulates complex processing within processes and minimizes the need to coordinate with other processes, especially those in different enterprises."*
- *"Newer technologies such as Web services and XML-based data interchange may enable overcoming the inflexibility of conventional EDI, and thus not pose an excessive investment cost to rule out diverse partners."*
- *"Standardization of process, content, and information exchanges is important to deal with changes in the business environment."*
- *"Web services would provide the technical platform for flexible applications that would easily evolve and deal with inevitable change."*

This shows ones more the trend towards web-enabled e-business. The research also provides some important implications for information sharing practices to take into account when considering revision of the model.

Soliman & Janz[41] support Kim et al. research where they analyzed the advantages of IBIS over EDI. After asking 420 practitioners and professionals they address that scalability and complexity (complexity: the easy of adoption of the internet standards→extensibility) as being 2 factors of concern for future application. They also express concern in data security, top management support and trust.

Author(s)	Conclusion(s) and areas of recommended development
Kim et al.	LIS has to communicate with more and more different users, solutions and devices.
Soliman & Janz	Scalability and extensibility, data security, top management support and trust.
Gosain at all.	Quality of information is extremely important, align business process with IT, Web services, XML-based data interchange, supply chain flexibility is becoming more important.
Hong & Zhu	Web functionality, web spending integration of externally oriented inter-organizational systems to migrate to e-commerce.
Ketikidis et al.	Large untapped market in SEE region, no EDI
Soliman & Janz, Nurmilaakso, Hong & Zhu, Stefansson, Yen at all.	Use internet-based information systems over current traditional practices like EDI.
Marasco	Channels should provide data-richness and easy-to-use information channels
Langley et al.	Customers rely on 3PL firms for leadership in IT

TABLE 3: OVERVIEW OF LITERATURE FINDINGS

Table 3 summarizes what has been said in this chapter about the influence of IT on 3PL. This table and Cap Gemini's findings in Table 2 is the basis on the adaptations in the model as presented currently by Manecke & Schoensleben.

Main focus point in, in internet-based information sharing, evolves around scalability and extensibility. As addressed earlier by the rapport of Capgemini, for 3PL issues like real time visibility and alerts for shipment, communication of planning information and information shared widely are important to gain leadership when sharing information with external parties. In most of

[41] Soliman K.S., Janz B.D., *an exploratory study to identify the critical factors affecting the decision to establish Internet-based interorganizational information systems*, p. 702,703.

the reviewed literature on the foreground is displayed that IT in 3PL should be able to share high quality information. Furthermore it says that information should use an open format for easy of transfer and high compatibility. Moreover, the IT system should be able to process high quantities of information to a high number of devices or end-users thus signaling scalability issues.

Concluding remarks:

All factors which are mentioned above and in the theoretical framework are relevant for e-business and 3PL best practices. For a model that estimates potential for e-business solutions in 3PL is it important to take factors like these into account. The trend clearly shows stepping of traditional EDI and going towards internet-based information sharing for e-business. For IBIS it is important that the diversity of offered functionality can be used. Therefore information and communication will have to become more flexible, structured and fast.

3.12 MODEL FOR ESTIMATING POTENTIAL IN INFORMATION SHARING WITH E-BUSINESS SUPPORT

Gathering information for the revised model of Manecke & Schoensleben is motivated by acknowledging findings and statement as presented in the above theoretical framework.
Considering this input, the new model characteristics will be organized like the following:

characteristics of the process			
1.repetition frequency of similar communication within one process (per tree)	1.non-recurring	2.rare repetition	3.frequent repetition
2.repetition frequency of the process (per day)	1.nonrecurring	2.rare repetition	3.frequent repetition
3.speed of information transfer to end-user (reaction time triggering after event)	1. real time/immediate (direct on entry)	2. indirect (not on entry)	3. pulled end-user communication (when asked for)
characteristics of the communication			
4.attribute variance	1.unlimited convention (manual check or insert)	2.limited convention (human checkup still needed after entering)	3.definition (no check-pup after entering)
5.complexity	1.unstable (functionalities are ill-defined)		2.stable (functionalities are well-defined)
6.extensibility of the information	1.no extend (no electronic connection)	2.EDI traditional standards	3. XML, open structure format/direct entry
7.Importance information for end-user	2.notification suffices		3.critical
8.object generating	1.situative		2.programmed
characteristics of the IT			
9.frequency of changes of relevant information (mutation object)	1: non-recurring	2.rare repetition	3. frequent repetition
10.scalability of information process	1.easy	2.medium	3.complex

FIGURE 2: NEW MODEL FOR ESTIMATING POTENTIAL FOR INFORMATION SHARING TOWARDS E-BUSINESS SOLUTIONS

In the case of A-log the model will be used to assess on what characteristics they can make improvements in their information sharing policy. Normally the whole framework is done and economic potential is analyzed using some kind of heuristic like ABC-costing or, in the case of Manecke & Schoensleben's research, process-oriented analysis. For A-logs case the cost and benefits are not assessed directly. The reason to do this is because the costs are not so important and relative low. As said before they have a very capable IT department who has already developed al the functional tools and know the technicalities. Maintaining the IMS system and its applications is part of the day job so no real new investments are necessary because this investment has already been made. The case with A-log is that they need guidance on processes who still need evolving. Also, due to time-scope and research scope restrcitions these heuristics cannot be assessed thoroughly enough and application is also outside the time-span.

It is therefore enough in the A-log case to analyze actual information sharing practices and asses it's discrepancy with the desired situation to find areas of improvement. The determination of the desired state will be based on information provided above and in the theoretical framework. Summarize what has been said already in this research, the desired state will have to provide:

- ✓ Maximum flexibility for end-users to mutate, insert and filter information
- ✓ Structured points of information sharing with consistent information quality
- ✓ The possibility to scale up the system, applications and business processes (more users, more services, more communication devices)
- ✓ The possibility to make new e-business applications in a fast way. (customizable)
- ✓ Automate frequent communication processes as much as possible.
- ✓ Making information offered in e-business communication structured, standard and central while remaining an extensible and widely used format.

Because information or knowledge is known to be hard to express in a monetary value the estimation of potential is more or less based on knowledge from the general manager and is obtained during researching the literature in the time and academic scope of this report. Again, the estimation for potential is more seen from an information sharing viewpoint. This means that the potential is tacitly estimated having in mind the increase it will have on information quality the measure of automation and process time reduction which are realizable through this. Establishing a monetary value should still be an aim to show estimated results and profitability but as said before is outside the scope of this research.

In general the "desired" box will contain a lot of potential and boxes beside the "desired" on will contain moderate potential. The boxes in Figure 2 who have red text represent the desired situation.

3.12.1 HOW TO GET FROM OLD TO A NEW MODEL

The measurements originally are done in the SME in a variety of industries in Switzerland to assess which processes are eligible for web-based solution support. Here after, the estimation of the consequences on the processes, the possible benefit and the necessary investments is done as in the 2 steps previously described. In the A-log case the context of the model is somewhat different on various aspects of the business.

Firstly, the research of Manecke & Schoensleben is done in Switzerland where the use of the internet is in a more advanced state. Bulgarian SME's are open for new technologies but still underestimate the real potential of E-business. According to A-log management and order data SME's are not using the web-application extensively. They are only using it for monitoring but not as an integral tool in managing their business. Although a lot is possible for checking of goods, check open invoices, request orders/shipments, track incoming shipments etc. customers are still persistent to use traditional ways (mainly phone) to communicate and do check-ups. Also, the research is originally based on normal and service industry data the data is still partly focused on customer supplier relations. The new model should be able to address more to 3PL and its dynamics.

Secondly, the original model is derived from a research amongst SME's. It cannot be said in definite that all size organization in 3PL completely are conform this model. With the new characteristics this problem could be overcome. The combination of the new characteristics together with the literature it is derived from could also be applicable for larger firms. Like mentioned before, e-business mostly focusing on end-users that are in the SME segment because smaller organizations cannot afford the high cost of EDI or more traditional IT systems. Larger organizations require customized solutions or are already communicating in an automated way. Because e-business solutions are going to be used by SME's in 3PL and the former model was designed for SME's who are considering internet-based support, the new model is applicable for its designed purpose. Moreover, when larger 3PL firms are designing e-business it should serve the end-user. As mentioned before in the theoretical framework successful integration of e-business is a multidisciplinary activity so designing e-business for SME's means that business processes and

practices should be adopted to facilitate information sharing. This concerns both the providing party as well as the utilizing party.

Lastly, important with designing the e-business solutions is the end-users. This organization has to learn and use the applications wisely, know how the logistic process looks like and integrate the information and business output supplied by A-log into its own business processes. A new model that can be applied in the case of 3PL should therefore be able to:

- ✓ Look at information sharing in business processes to determine the information flows that have the best quality and quantity for external usage.
- ✓ Measuring potential with indicators as for example information quantity, information quality, accuracy, real-time visibility, extensibility and scalability and thereafter translate this to economic benefit for the specific case (self-chosen measuring method).

Implementing these assumptions in the old model results to the model as presented in Figure 2.

3.12.2 CHANGING THE CHARACTERISTICS

4 new (based on 3PL/e-business) characteristics are introduced and 4 are deleted from the model. Some of the added characteristics are almost similar to the deleted ones but are perceived to be more suitable when using it in the 3PL context so they are exchanges.
Figure x shows a small overview of changed characteristics

Characteristic	Mutation	Result
Relevance of communication time	Replaced	Speed of information transfer
Homogeneity	Replaced	Scalability
Relevance of communication time	Replaced and deleted	Importance of information for end-user
-	Add	Extensibility
Synchronization of internal IT	Rendered obsolete	None
Geographic contributors of process contributors	Rendered obsolete	None

TABLE 1: OVERVIEW OF CHARACTERISTIC MUTATIONS

These are similar but the new characteristics embody the 3PL framework more in terminology and scale. *Speed of information transfer and scalability* are replacing respectively *relevance of communication time* and *homogeneity*. The *relevance of communication time* is exchanged for characteristics which better embody real-time visibility. These new characteristics are *importance of information for end user* and *speed of information transfer after documentation phase*. Both combined show the need for accurate (high quality) information being shared on near real-time visibility.

Furthermore, *synchronization of internal IT and internet* and *geographic separation of process contributors* are deleted. Synchronization is deleted because this characteristic has become obsolete. Continuous synchronization is possible in 2008 between the ERP and the internet application. Nowadays organizations use filters which have enough security to provide continuous synchronization. A-log has one to. The *geographic separation of process contributors* characteristic is deleted because for logistics and especially the 3PL and international freight forwarder always works on different domestic, international or continental levels. E-business has to be able to communicate with both international and domestic. The situation therefore is always the same in dynamics and the information flows have to be valid for an international context anyway. The last remaining characteristic that has to be added is *extensibility.* This should account for the trend to open format standards use like XML based formats.
One more note: for frequency of changes continuously and frequently are assumed to be the same. This is because the synchronization issue is not viable any longer.

4 METHODOLOGY

To apply the updated model for assessing value in 3PL with e-business support on A-log several measurements have to be performed. With this chapter a description is made of how the model will be applied on A-log and the measurement model that is used to assess A-logs situation according to the updated e-business/3PL assessment model.

4.1 MEASUREMENT MODEL

The revised e-business support model has predefined "boxes" where a business process can be placed in. As can be seen from Figure 2 the number of boxes varies from either 2 or 3 possibilities. To determine in what "box" the desired and actual situation can be placed a pragmatic approach is used based on both theory as well as objective criteria. Like mentioned in the theoretical framework, there is no real predefined measurement model to determine in what "box" the desired or actual situation should be. This varies from the business process at hand in combination with the goals that the organization sets for itself. However, it is clear that scoring in the boxes with red text provides the best configuration for e-business support.

4.1.1 ASSUMPTIONS BEHIND INDICATORS

Now that there is a clear model it can be applied on the A-log case. To do this some sort of estimation for the actual and desired situation is required. Heerkens (1998) states that indicators need to be determined to put a situation into measurable terms. Like explained before, this research does not use the complete process-oriented analysis methodology like Manecke & Schoensleben use in their approach due to time restriction. The indicators from the process-oriented methodology are not used. However, this research wants to make a proposition on how A-log can configure information sharing practices and how to connect better to its customers using e-business. As a shortcut therefore the actual situation at A-log is based on the basis of business processes, communication and documentation specifications and does not need a full process-oriented analysis. The fact is that measuring the characteristics in this pragmatic way makes the measurement model very subjective and applicable for the A-log case. In this way it is possible to assess A-logs situation to the point that a deficiency can be reported but this also means that the results does not hold a hard indication of priority explained in either monetary value, time savings or resource reductions.

To place a kind of weight on the measurement the term "cycle" is used in the analysis. A cycle is defined as 1 week. This is the average time the regular groupages services are offered. Depending on the country, business partner and number of regular groupages that are made this differs from 1, 2 or more times per week. In any case they are offered on a weekly basis so are most suitable to represent a cycle of the business process.

4.1.2 THEORY BEHIND INDICATORS

The indicators that are used to measure the actual situation at A-log are not part from one theory or scientific measurement model. Although the set of indicators is subjective for this case the indicators itself are derived from the same theory that is used prior to determine the outline of the revised model.

The revised model already has a set of predefined indicators. For example characteristic 3. *speed of information transfer to end-user*, can be qualified as being near-real time, indirect of end-user pull driven. Every communication flow can therefore be categorized in one of these terms. However, not every characteristic in the model has such a clear way being categorized.
To measure characteristics that are not clear-cut measurable by the definition itself other indicators are required as well.

To measure indirect characteristics a distinction is made according to Nurmilaakso[42] between manual supply, semi-automatic and full-automatic connections in supply chain integration. According to him "*the exchange of business documents does not work well if the business partners do not integrate the related business processes.*". In their research this integration will be used to determine information sharing through IBIS and future appliance in full-automatic communication.

- Manual (*m*) consists of human-to-human information sharing with human intervention at both sides (e.g. fax, email, phone).
- Semi-automatic (*s*) consists of human-to-system communication with human intervention needed at one end (e.g. web portal, information system).
- Full-automation (*f*) will consist of system-to-system, with no or minimal human intervention needed at one end.

Creating two sided full automation should produce the fastest information sharing and also the one with most information quality because less human intervention results in less mistakes when sharing information (Lai et al.[43]).
Combining this with statements by Manecke & Schoensleben[44] on different communication elements and logical reasoning indirect quantitative measurement of information flows are assessed on the following set of indicators:

- Event/function/document name
- Information drain (Maneck&Schoensleben)
- Information source (Maneck&Schoensleben)
- Sender (Maneck&Schoensleben)
- Receiver (Maneck&Schoensleben)
- Manual/semi-auto/full-auto (m/s/f) (Nurmilaakso)
- External/internal

These characteristics can provide further insight, when necessary, to analyze specific observations or particular results after applying the model to A-log.

4.1.3 MEASUREMENT MODEL AND FINAL SCORES

Altogether, the characteristics in the revised model are measured in three ways. A overview of the complete measurement model is also presented in Table 4: Operational definitionsTable 4:

1. **Direct quantitative**, numbering the characteristic based on every documentation flow. (characteristics: 1,2,3,4,6,7)
2. **Indirect quantitative**, analysis on characteristic of communication and relating this back to the designated characteristic for the model.(characteristics: 9,10)
3. **Qualitative**, deriving and estimating a performance through facts. (characteristics: 5,8)

1. (direct quantitative) It means that all documentation flows have been numbered to determine an overall average score in the end for that characteristic like mentioned in the example of characteristic 3. For characteristic 1 and 2 range values in frequencies for the different boxes have been determined on a pragmatic basis in accordance with the general manager.

2. (indirect quantitative) It means that the final value is determined using an indirect measurement. For example, scalability final score is based on the number of total documents and notification that the forwarder has to send manually for this (whether being a automated or manual flow) is the main restriction on scalability. Thus this is based on the extra set of indicators

3. (qualitative scores) Logical qualitative indicators are used. For the actual situation the aim is to place them in one of the 2 or 3 boxes for every characteristic. For example, complexity is defined as can be seen in Table 4 as: *"complexity of the functionality, the transactions and the information*

[42] Nurmilaakso, J.-M (2006), *Adoption of e-business functions and migration from EDI-based to XML-based e-business frameworks in supply chain integration,*p. 3
[43] Kee-Hung Lai , Christina W.Y. Wong , T.C.E. Cheng (2007), *A coordination-theoretic investigation of the impact of electronic integration on logistics performance,* p. 12
[44] Manecke N., Schoensleben P.(2004), *Cost and benefit of internet-based support*. P. 219

objects influencing the initial cost when programming the internet application.". This characteristic can have a performance in the unstable box or stable box. When the communication is perceived to be stable this means that the functionality, transactions and information object are not perceived to be very complex. The business processes are well-defined and information sharing is kept understandable. Complexity is in this case can be measured through a qualitative indicator (e.g. ISO certification) because measuring complexity on a quantitative basis is to complex in this case. This results in that complexity will measured by evaluating quality of the ERP-system and business processes.

Depending on the way of measuring and characteristic final scores are either calculated by taking the average of the individual scores per information flow or by argumentation on qualitative principles.

4.2 EPC DATA GATHERING

Data that is used making the EPC's is gathered mostly through conversations and observations. Conversations during observations have been with several members of the forwarding division. Also, several conversations have been with the IS administrator and general manager. The conversations focused mainly on the ERP system and its relation to current business processes and information flows.

Also, a concise analysis of the external environment is done to create a general overview for A-log.

TABLE 4: OPERATIONAL DEFINITIONS	**Explanation and definition:**	**qualitative or quantitative**	**indicators for measurement:**	**explanation indicator:**
characteristics of the process				
1. repetition frequency of similar communication within one process (per tree)	influences communication cost and duration, e.g. same information is simultaneous given to several receivers, information repetively exchanged, relevant information changes often -> change initiates another communication	quantitative	nonrecurring=0,1, rare repetition=2,3 frequent comp= <3	# same documentation flows in 1 stage of a tree (0 = only 1 entry)
2. repetition frequency of the process (per day)	shows how much an information source is being accessed, savings per processes	quantitative	nonrecurring=0,1, rare repetition=2,3 frequent comp= <3	# process repetitions per cycle (1 week) (0 means only 1 entry)
3. speed of information transfer to end-user (reaction time triggering after event)	what is the reaction time of the business process/ERP-system in communicating information to the end-user for which the information is relevant.	quantitative	1,2,3,	see terms characteristics: near-real time, indirect or pulled end-user communication
characteristics of the communication				
4. attribute variance	An information object consists of a number of attributes which describe a specific issue. The variations of these attributes indicate whether the information object can be processed by a machine or has to be processed by a human being: defined attributes allow an automated processing because the computer can identify and interpret each attribute clearly.	qualitative	1,2,3	asses the number of attributes the information objects consist off. For value assignment see terms characteristics
5. complexity	complexity of the functionality, the transactions and the information objects influence the initial costs when programming the internet application	qualitative	1,2	asses the overall environment of the complexity e.g. with ISO certification, employees understanding of system etc.
6. extensibility of the information	can the information format be extended to other applications internally or externally. Can there be different formats be added fast when dealing with new partners or customers. Can the same information flows be translated easy for usage in different applications or to support new business processes.	quantitative	1,2,3	assign in according to forms that are in particular format which are described in the characteristic terms.
7. Importance information for end-user	is the information send or received critical for the completion of the business process and successful exploiting the web applications functionality. How important is the information for the end-user? Together with speed of communication this determines accurate real-time visibility .	quantitative	2,3	How necessary is it for the end-user to receive the information in the hands of the 3PL organization for completing its tasks.
8. object generating	Generating information objects can be based on a specific situation and differ significantly in each case, or can be programmed and follow a certain procedure. Making object generation programmed works to minimize the amount of data object who essentially refer to the same information.	qualitative	1,2	Overall assessment of the processes in place for reducing situative object generation.
characteristics of the IT				
9. frequency of changes of relevant information (mutation object)	Which frequency the relevant information changes. if relevant information changes infrequent fax, phone or postal services might be sufficient if there are only a few receivers or few occasions.	quantitative	non-recurring= >4 rare repetition=4-10 frequent comp= <10	Measures the times data is added or changed during the total process on informational objects. Measure the mutation on different files which are information source.
10. scalability of information process	how does the complexity of the current information source influence the possibilities for scalability. Scalability when serving more end-users or devices. Scalability when processing more orders, truck or shipments.	qualitative	1,2,3	Asses the general practices which could become or are bottlenecks. E.g. manual handling of information by human actors.

green= measures per documentation flow

blue= based on overall view measurements

brown= based on other criteria (qualitative)

5 DATA COLLECTION AND RESULTS

This chapter holds most underlying data and information that are used to support changes in the model as presented by Manecke & Schoensleben. In the beginning these theories and facts will be explained briefly to make a conclusion of overall trends and implications in the end. These matters will then be used to adapt the before mentioned model of Manecke & Schoensleben. Off course, general and specific logistic matters were also discussed to get a view of the organization as a whole and its environment. Because of the diversity of the people questioned and observed an objective data set can be acquired which has input from several perspectives.

5.1 GENERAL ENVIRONMENT:

Global Environment:
The situation for logistic companies in South-East Europe are partly researched by Ketikid et al.[45]. They have researched this sector in this region and conclude that "*their use of information systems explains their heavy focus on supply chain partnership and weakness in demand chain partnership.*" and that "*government and companies not yet seem to be ready for playing a significant and demanding role in global supply chains.*". Problems vary in areas of infrastructure, organization, forwarding relations and weak strategic planning. This is also the case for A-log and Bulgaria but there are some exceptions. Western oriented companies have organizational and strategic planning and seem to be in order but this is not representing the overall market. With A-log, adequate plans for organizational growth are available and plans for implementation of new technologies, entrant to new markets and human resource management are in place. For example, A-log acquired property to have the possibility to build 2 large warehouses and 3 cross docks. While most ideas are present they are not elaborated upon into concrete goals and plans. Establishing good forwarding contacts is still a problem. Because of the little export from Bulgarian economy in comparison with import, logistic firms have a weak bargaining position towards West-European nations. In international lines this means ratios of export-import of around 40%-60% and 30%-70% and even 20%-80% in some occasions at A-log. For Bulgaria in 2007 this meant a ratio of about 40%-60%[46]. This implies this weakness in demand chain partnerships also for them.

Legal/Political:
Bulgaria has joined the EU on the 1st of January 2007. This entry brought along some interesting implications for A-log. A large number of customs formalities have been greatly reduced due to general EU trade legislation. It is known[47] that there is an unfavorable investment climate because of irregular and erratical regulations. This is a real burden to senior managers that spend about 17% of the time on dealing with requirement imposed by regulation. Bulgaria nowadays is a democratic republic state but reigning leaders and parliament almost never end their prescribed ruling period of 4 years. This is mostly related to false promises, losing electoral trust or corruption. Nevertheless established parties have in the found subsequent ways to retain their position but as the pressure and support of the EU increases this will hopefully change over time. This results in that governments support for development on economic, infrastructure, agriculture and industry is not on the level of West-Europe. According to key figures in NSI[48] the export is staying far behind the import partly due to this. A good example is offered when traveling through Bulgaria when you can see that some fertile areas are not cultivated but when for example travelling through same climate countries like Spain, France (south), Italy and Greece you will find more ground cultivated for agriculture.

[45] Ketikidis et al. (2007), The use of information systems for logistics and supply chain management in South East Europe: Current status and future direction, p. 592-599.
[46] http://www.nsi.bg/Transport_e/Transport_e.htm *(consulted:26-01-2009)*
[47] Bulgaria investment climate assesement:
http://www.worldbank.bg/WBSITE/EXTERNAL/COUNTRIES/ECAEXT/BULGARIA
[48] National Statistical Institute (NSI), http://www.nsi.bg/ZActual_e/GDP1q08.htm *(consulted:6/01/2008),*

Technological:
Because A-log has limited human resources (e.g. IT-division consists out of 6 employees) they are heavily dependent of technology. As said earlier logistic companies in SEE (South Eastern Europe) rely heavily on IT but lack in technologic implementation. Ketikidis et all[49] also show in their research that at most 44% or lower lack in implementing logistic-specific technology. This research also emphasizes the high dependence of logistic firms in the SEE-region on IT. Current technology used is for example bar-code devices to identify goods and supplies. Incoming goods are checked and bar-coded. The use of RFID (radio frequency identification device) hasn't been adopted by A-log due to a combination of high cost and limited application practice. However, using RFID can increase processing times of the unloading and loading of trucks. For most countries in the SEE region this technology is very expensive in comparison to the profit. The price of a tag is now still around €0.50 which is too expensive for wide use, but prices are estimated to lower to be feasible at around 2010 (Moscatiello R. (2003)),.
Furthermore, a World Bank research states that investment in R&D is low, declining, and is mostly financed and performed in the public sector. This is discouraging given the strong link between firm productivity and technology and its adoption. As well as directly leading to low levels of innovation, low investment in R&D can also make it more difficult for firms to absorb and adopt technologies from abroad.

Social:
The social environment can be compared to most post-communistic countries[50]. Seniors and elders are equipped with old-dated thinking. The majority can only speak Russian and Bulgarian and have only basic education. Higher educated seniors and technicians have been working abroad in the past but are more and more returning to Bulgaria to develop business here. This is also the case with A-log. The founders returned to Bulgaria after the fall of communism to study and set up this business. Youth, students and graduates are now developed more extensively in a more western oriented society and working while studying is common in Bulgaria for education in the universities in sometimes outdated and of poor quality. However, general education is not very strong. Illustrating this is for example a research performed by the NSI[51] on educational levels. This research state that only 20% of the working population between age 25-64 uses English. Moreover, it[52] shows that after the age of 18 only about 36% enroll in further formal education.

Economical:
Economically Bulgaria is not doing great but getting better. When communism left a lot of companies and organization where abandoned and assets sold off. The economy was struggling but shows a constant growth of 6% with still shaky inflation. Compared to the Netherlands for example they have a gross domestic product that is almost 20 times smaller and a gross net income per capita that is 10 times smaller[53]. Also, comparing to its neighbor Romania gross net per capita is still about 33% higher in Romania which is a high considering Bulgaria is a neighbor. The same is for Turkey which had a 74% higher gross net per capita. This indicates that Bulgaria is not yet competing with West-European countries but is also behind compared to other countries in the South East Europe region. This accompanied by, bad import/export ratio holds back Bulgarian potential for a thriving economy.[54].

[49] Ketikidis et al. (2007), The use of information systems for logistics and supply chain management in South East Europe: Current status and future direction, p. 596
[50] Watkins R., Masters T(2005)., *Lonely planet: Bulgaria 2nd edition. P. 30-38* .
[51] http://www.nsi.bg/SocialActivities_e/AdultEducationSurvey2007en.pdf
[52] http://www.nsi.bg/SocialActivities_e/Education_e.htm
[53] The World Bank, http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS
[54] The world bank http://web.worldbank.org

5.2 TASK ENVIRONMENT:

Suppliers: In the case of 3PL or 4PL, suppliers can be seen as the transport organization which A-log relies on for its trucks. Access to these transport organizations can be through various channels like speditor.net or regular contacts. According to A-log, suppliers mainly consist out of dedicated self-owned SME's. These are for the biggest part family owned and consist only out of 1 or 2 trucks.

Customers: Research done by Ketikidis et al.[55] also suggests that the market for logistic outsourcing is fairly large. There research showed that, of the 79 replies that where questioned, 67.87% consider 3PL as not appropriate, 4% being satisfied with 3PL and 8% having started implementing such collaborations. Moreover the research says that 70% do not have a logistic department. These statistics give a hint of the large market potential in this region although interest needs to be drawn upon. In the case of A-log, competitors are also customers because they also sell software that they use to other 3PL organizations.

A-log customer base consists of several different types of organizations:

- SME (Consignee's): These are small organizations that have structural or sporadic shipments from/towards foreign or local trade partners.
- Special customers: these are larger organizations that outsourced some or all of warehousing and logistic activities to A-log.
- Business partners: These are other forwarding companies who supply shipments to Bulgaria and vice-versa.

Competitors:
As said before competitors can be found in other 3PL organizations and other transport/logistic companies. There is little known about the precise layout of organization that are active in third party logistics or logistics in general. Large players like DHL are present and the basic package service market looks saturated already. However, the market for logistic outsourcing, inventory outsourcing and groupages is still very open according to A-log. Not a lot of large competitors are active that represent a large market share. However, there are no official researches yet that have assessed the 3PL market and possible competitors in Bulgaria.

Labor market:
According to a research of the World Bank[56] most of the higher educated people are unemployed. Unemployment rates in 2007 go not higher than 2.4% for 2007. However, firms in Bulgaria are fairly concerned with the worker skill and education of its workers. In particular in the IT, non-skilled and non-educated workers are a large problem. Training that is provided by the organizations themselves it less than in other new EU entrants and this is seen as a obstacle by firms.
According to the manager of A-log the labor market looks promising. Average age of the workforce on important positions is surprisingly low. This can be contributed to better educational programs after the downfall of communism. Bulgarian universities produce highly motivated and sufficiently skilled graduates. About 80% of the forwarding division who work at the head office of A-log has an academic background and almost all are not older than 30. Surveying amongst current students and by listening to experiences of them has taught that overall quality of education is not yet up to West-European standards. Like other government related agencies/institutes organization sometimes lacks in structure, completeness and maintaining quality. Still, Bulgarian students show a lot of motivation and willingness to learn and develop working skills. This is

[55] Ketikidis et al. (2007), The use of information systems for logistics and supply chain management in South East Europe: Current status and future direction, p. 595,596.
[56] The World Bank, Bulgaria, Investment climate assessment- overview, *http://www-wds.worldbank.org*

partly due to fact that the labor market is large and working while studying is very common. Statistics[57] say that the average unemployment in Bulgaria is 8% and total employment rate is 47.2% of the total population in 2007. Comparing this with Dutch statistics[58] which has an unemployment rate of 4% and 51% in 2007 it shows possibilities for improvement for overall economy. However, in Bulgaria almost 1/3 of the population has to support the rest because only about 1/3 is working of the entire population[59].

All in all, the Bulgarian environment does not have the best circumstances for a thriving economy. Government lacks in giving proper support and educational level and quality is not yet up to western standards. Society has not yet fully transitioned to a western and democratic market that can support on its own. Admission in the EU however shows future perspective to create a more stable and democratic society where government support is better and development of basic demographics like educational level, infrastructure and agriculture is up to par with its surrounding countries.

5.3 ALEXANDER LOGISTICS AS A 3PL FIRM

Figure 3 shows the logistic flow (marked blue) from end-customer to end-customer for main road groupage operations. An identical structure is also applicable for sea an air. A 3PL firm manages these flows which they are responsible for. Note that during creation of the EPC diagram these are the flows which are described. Other flows (green) will only be monitored.

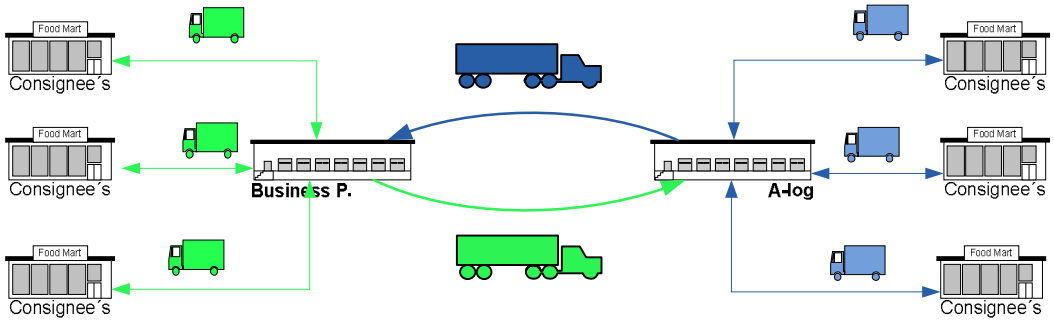

FIGURE 3: TRANSPORTATION FLOWS

A-log as a 3PL mainly embodies itself by being warehouse/distribution, forwarder, financial and information based. Transportation based is less applicable due to that A-log doesn't have a truck fleet. For this report focus will be mainly on how to develop its internet based qualities. Because of interrelation this could also have implication for other logistic functions

5.4 EPC LAYOUT AND ASSUMPTION

To gain information from A-log about the information sharing practices an EPC diagram is created. With this, and the revised model (from Part II of theoretical framework) it is possible to analyze the current situation at A-log.

Using the instances from the EPC and showing documentation flows, EPC diagrams are created for both import and export for the business processes that occur in the forwarding department. This EPC encompasses 3 main functions or "tree's" of the IMS which are used in the forwarding department of A-log. These 3 functions are:

- Consolidation (grouping of shipments into consolidated shipments revered to as groupages)

[57] Bulgarian National Statistical Institute (NSI), *(consulted: 5/14/2008),*
[58] Centraal Bureau voor de Statistiek (CBS), *(consulted: 5/14/2008).*

[59] http://www.nsi.bg/Labour_e/Labour_e.htm

- Shipment (managing of separate shipments and orders)
- Transportation vehicle (managing trucks)

These tree's contain so-called "stages". In every stage other activities will take place and the stage name (e.g. loading) describes the main activity. Appendix 12 shows the complete diagrams for Import and Export and as can be seen the diagrams are somewhat elaborate but so are the business processes involved. The diagrams are designed to follow the tree's and stages which are used in the system. Because the system is designed around the business process this shows the exact processes that take place in each stage. The diagrams in Appendix 12 show all the documentation flows towards external parties or internal/external information systems or databases.

Before a more elaborate analysis of the business processes of A-log will be given, there are a few preconditions that have to be kept in mind when going through business processes at A-log's international forwarding department. These conditions show what different kinds of variation influence the data. Note that during this analysis the goal is to show a general overview of the business processes. Doing this for every single shipping line will become elaborate and the end goal of A-log is reduce variability by trying to get similar agreements and contracts irrelevant of foreign partner choice.
During the creation of the diagrams there are several assumptions which have been taken into account to consider the variety that these process maps hold:

1. When information has entered the IMS everything is possible with dynamic use of information. Most semi-automatic documentation flows (BORDERO, AVISO, invoices etc.) are generated by the IMS. The forwarder in most cases has only to give the order for the creation or sending of the document. The IMS makes/sends different kind of documents and different structures of information, automatic. Something which is not always showed with all *s* and *f* information flows is that most information has been entered manually. More about this will become clear in the data analysis part.

2. International and domestic process is the same. The structure of the IMS system is designed around the business processes of the forwarder. For domestic and international transportation this essentially means that they can use the same tree's and stages structure and business processes. Still there are two departments devoted to each one of these functions.

3. Financial agreement can be divided into two categories:

    a. Singular invoicing
    b. AMETA (pre-determined profit sharing)

    Depending on factors like trust, import/export ratio, market share and collaboration history A-logs managers will asses and negotiate which form of invoicing they will use. Therefore, the number of invoices differs per business partner. AMETA's reduce the number of invoices by making up periodic balances between business partners.

4. Websites, web-applications and other divisions are shown as external parties who communicate directly with the system. This is done to show full-automatic communication flows toward information sources for external and internal use and in some cases illustrate duplicate information flows.

5. Inter-tree communication is shown with blue arrows. This is done to for better visibility of triggering events and IMS dynamics.

After creating the diagrams for export and import, every documentation flow which is represented on the diagram is inserted into an excel sheet for data analysis according to certain characteristics of the information flow. Because performing step 2 of the model by Manecke & Schoensleben takes considerable time this research only analyzes the potential on basis of information sharing and communication automation.

The sheet has the same division as the EPC into tree's and stages. These tree's and stages correspond to the arrangement of the information systems layout structure where the employees of A-log work in. A consolidated overview is given in Appendix 5: Consolidated data, and a full view is given in Import_Export_Info_Flows.xlsx. This view also shows the new characteristics and values.

5.5 EPC RESULTS

During collecting information for the schematics some interesting implications have been discovered which have to be kept in mind during the analysis of the information flows.

Firstly, more than 90% of requested proposals for shipments are done by phone, mail or fax according to A-logs management and data of the IMS. The web-application keeps a record of every request for offering entered through the web-application. Last year this was about 200 applications on the almost average of 12,620 of inbound and outbound shipments in the warehouse. This is almost 1.5% of total 10% non manual requests for offering. The other 8.5% can be assigned to large customers who produce orders by using custom-made connections (e.g.VMI and EDI). When considering the duplicate information flows which are sometimes showed, it can be said that a large portion of internet request are communicated back through manual channels again. Communication to the website is shown in parallel with communication towards an external party for example with requests for proposal. Again, here only a small percentage uses the website as main input channel.

Secondly, processes are modeled how they should be not how they are sometimes done in practice. In practice employees sometimes cut corners because of an expected certainty of the order. For example, a regular consignee places a request for proposal to ship his goods. Because of tacit knowledge the relevant forwarder has with respect to this consignee, the forwarder in question has trust and places the order before the official acceptance by the consignee. This is also true for the booking of trucks. For an objective overview of the process most of these shortcuts are not mapped and relevant information flows are mapped where they should occur.

Lastly, in about 95% of the case the goods are alright and no problems occur during the processes where A-log is responsible for. This percentage is based on the fact that they have about a shipment/cargo missing report ratio of about 8. Considering that some cargo missing reports are also issued when damage is minor and no additional processing is needed it is fair to say that there aren't a lot of problems. When following a path of least resistance in the process maps of Appendix 12 it can be seen that the road towards the orders closed stage is not very far. This indicates that the process itself doesn't have to be very complicated. These facts are important due the fact that when the process of shipping and consolidating is managed properly and information sharing is automated, the forwarder can process a lot of shipments without having too much time-consuming manual interference.

In general the EPC diagrams turned out big, which is good because this means the level of detail is sufficient to represent the entire process for forwarding. Processes are shown in two maps. One for import and one for export who are the sub-categorized as mentioned in tree's and stages, so it is possible to see the distinction of processes occurring for every category. Whereas the main processes for domestic and international forwarding is the same this is not the case for import and export as can been seen in Appendix 12 (1): Export EPC. (and ECP_export.vsd+EPC_import.vsd).

5.5.1 CONCLUSION: IMPORT VS EXPORT DIAGRAM

The business process for import and export is not so different because almost all the same functions are performed. The difference shows itself in the location and point in time where the functions are performed. When looked upon more closely it can be seen that main processes are almost the same but only located in a different stage. This shows the main strengths of the IMS

system like mentioned before. A-log perceives that the IMS system is modeled with the forwarder function taken into account. Whereas traditional organizations would make a departmental difference into the systems and processes, A-log does not. According to them the system is modeled around the principle that the forwarder is able to perform import/export and its accompanying support like creating invoices and making offers. Therefore there is not a separate department for invoicing but only for accounting and money transactions. There are no separate departments for import and export but only for domestic and international. Given that since this structure has been introduced, the revenues have increased in subsequent years and the forwarding department is expanding rapidly, it is fair to say that this structure hasn't failed its design purpose. Furthermore, the EPC diagrams provide a good overview of the business process that takes place and the information flows to other actors or data repositories.

5.6 THE ACTUAL SITUATION ACCORDING TO THE REVISED MODEL

Below are the scores for the 10 different characteristics for the actual situation presented, explained and supported with remarkable figures that have influence on the choice of grade. When calculating different scores readers should have in mind that some calculations are made without considering relative number of occurrences. For the scores where occurrence in the business process is perceived to have too much influence on the final characteristic score this is accounted for by multipliers and is explicitly mentioned. With occurrences is meant that some functions will be performed more than others during a cycle. Main bottlenecks and important influences are explained per characteristic. Overviews for the totals that are direct measured are given in Appendix 10: Total overview of direct measuring of characteristic. For indirect measured characteristics there are Appendix 8: Frequency of changes of relevant information and Appendix 9:Scalability for further information.

1. *Repetition frequency of similar communication within one process (per tree)*
   (overall score 1.33)

Overall repetition frequency of similar communication is low within each tree. As can be seen in the overall view for import and export (Appendix 12 (1): Export EPC) communication flows are centered respectively in the ending and beginning of the process. Communication flows for import are centered mostly in the on the road stages for the consolidation and transport vehicle tree. Also the unloading stages contain a lot of flows.
For export this is centered in the loading stages of consolidation and transport vehicle stage. Altogether repetition frequencies within these stages depend on the occurrence of problems. When there are few problems with the shipment or truck, repetition frequency within the process is even lower. In general the negotiation stage of the shipments tree holds a large proportion of similar communication within this process when receiving and making proposals and accepting orders with according invoicing later in the process.

2. *Repetition frequency of the process (per order cycle)*
   (overall score 1.96)

The repetition of the various stages in the tree's are based on data shown in Appendix 10: Total overview of direct measuring of characteristic. In short, anything that has to do with managing single shipments will be very repetitive. Moreover, dealing with invoicing and contacting different consignees the same applies. Concerning trucks and consolidations repetition frequencies, these are lower and fall in box 2. Have in mind that not every function is performed with every order/truck/consolidation cycle because some information flows are only triggered when an error occurs. The results of characteristic 1 combined with 2 gives multiplicity for information sharing that can become very high. Therefore when considering the total repetitive nature of the process it shows high frequency for the overall forwarding process. More will be said about this during analysis of characteristic 9 and 10. The IMS has a lot of functionality in place to deal with order management but a lot of orders are still entered manually by the forwarder.

3. *Speed of information transfer to end-user (reaction time triggering after event)*
   (overall score 1.74)

The overall score for speed of information transfer to end-users consists out of a lot of notifications and information flows which are not triggered when an action is performed, hence the relative vicinity to value 2. Usually, when the triggering event for a new flow of information takes place, the system cannot make a direct notification or trigger another corresponding information flow towards the end-user immediate. Moreover, for the track&trace system, information flows are not directly communicated with the IMS by the sending actor. In all cases the track&trace system depends on the forwarders input. Concerning the sender role of the forwarder, Nearly in 75% of the cases the information drain is the IMS. This means that in these cases the IMS is used for communication or the information is extracted from the IMS and used in manual communication. This is important because the IMS has pre-structured the information into the required format which is more efficient and speeds up the processing aspect of the speed of transfer. However, the same factor that influences scalability is valid and applicable for this characteristic as well. Little messages towards externals are triggered full-automatic but only around an estimated 21%. Included is also track&trace which uses manual communication to trigger so hence it is not a pure automated information flow as well. This reduces the speed of information to customer.

4. *Attribute variance*
   (overall score 2.70)

This value is reasonable high which means it leans on the definition box. A lot of information is pre-defined and variance of the attributes of an information object is low. The logistic business has a lot of industry standards for communicating and doing business. For example, the variables which are necessary for an order are: sender and receiver address and name, # of collets, weight, # loading meters and volume. This is the only data which is required to make a proposal when there aren't any extra requirements to the transportation. Therefore, information objects can be kept basic with low variance of attributes. Information sharing in logistics is usually nothing less than "filling up the blanks" when properly organized. This is why logistics is so sensitive for cost reductions and cutting process times and lead times when EDI or other information sharing standards are used and B2B connections can be established. Nevertheless an estimated 57% of external communication is manual which illustrates that although attribute variance is good for standardization, this is not exploited fully.

5. *Complexity*
   (score →2.00)

Considering the complexity of the system a swift conclusion can be made caused by current events. Although ERP-systems usually are known for being large and complex, the current system that A-log offers is perceived to be stable. Functionalities are well defined and proof for this is the IMS recent involvement in the ISO-certification of Militzer & Münch (M&M) Bulgaria. ISO (international organization for standardization) is the leading authority for quality standards globally. During a recent audit at M&M Bulgaria who are operating with IMS, the speed of the audit was significantly increased because of the use of the IMS system. They stated that the system described all processes, documents, functions etc. so detailed that this gave the ISO auditors a clear overview of practices in M&M Bulgaria. Furthermore, M&M is one of the largest logistic firms in Europe and is rapidly expanding in Eastern Europe[60].
Functionality is therefore perceived as well-defined.

[60] http://www.mumnet.com/englisch/wir_uber_uns/global/index.php

6. *Extensibility of the information*
   (overall score 1.84)

Extensibility of the information is almost good. Most documents are fit in XML-format for transfer towards A-logs applications or any other system for that matter which has greatly reduced paper archives. But, the advantages of using these kinds of open formats are not exploited fully as can be seen from Appendix 6: Remarkable statistics and legend for direct measurement. In an estimated 54% of the occasions sending and receiving from or to external parties is happening with a format with no extend. Of the 22% of full-automatic communication most is towards the website or track&trace which is send by the IMS. Keep into mind that still of this portion is entered manually into the system (e.g. monitoring truck) and is not triggered automatic full-automatic communication is perceived to be low. A good example of adequate practice is the billing of consignee's. Invoices are made by the system after entering the order specifications which has to be done nevertheless. When the service has been completed and the invoices are definite, the IMS posts the invoices automatically on the website with its current invoice status (paid, unpaid etc). Off course the status is updated automatically when paid.

Again, the fact that every invoice is send in paper form to the consignees shows the sub-optimality and duality. A lot of internal documentation flows are forwarders entering data into the system which is translated into an extensible format when it is entered. Another problem that was already mentioned in the problem definition chapter is relevant to this characteristic. This is the problem that other external organizations haven't developed information systems that support formats like XML automatically. Again, that is why e-business comes in to play again. If external parties haven't got the means or ends to process information in a automated way, the offering party can facilitate this. Offering a well-developed e-business framework will result in that the external party can choose its own way of further integrating the offered information into its own business processes. As long as external parties communicate in an automated way using standard formats (either through e-business or a direct connection), the receiving party can process the information in an automated way.

7. *Importance information for end-user*
   (overall score 2.62)

Importance for the end-user is again, reasonably high. This is a both logical and confronting fact. It is essential to subject important information as least as possible to human interference (Lai et al.[61]). Human entry of information imposes the chance for entering incorrect information. Currently an estimated 36% of information flows rendered "critical", is communicated manually (Appendix 6: Remarkable statistics and legend). When information is more important better information quality is attained when information is entered from the core drain. With this is meant that actors who have the best view/access/expertise regarding this information should enter it directly without other manual interferences. This information can hereafter be communicated towards other end-users while keeping its low error margin.

8. *Object generating*
   (overall score 2)

In the case of object generating the following can be said. Currently, end-users have a lot of influence on the data that is entered into documents or in the system. Problems result according to this mainly in the area of customer relationship management. For example the process of inserting a new customer works like the following:

1. Forwarder receives order through fax, phone, mail or website.
2. Forwarder extracts necessary information about customer name, address, consignee name, transport org. name.

[61] Kee-Hung Lai , Christina W.Y. Wong , T.C.E. Cheng (2007), *A coordination-theoretic investigation of the impact of electronic integration on logistics performance*, p. 12

3. Forwarder searches and matches the data of the order/request with data in the system.
4. Forwarder inserts order/request and contact info into the system.
5. Order request complete.

Taking away step 2, 3 and 4 would reduce the time necessary for making an order request. Minimizing object generating in this case is making sure that every company is only entered into the database once. The above procedure describes the current process but is labor intensive. Moreover, end-users enter its own data into the system directly through the website which currently causes problems with database synchronization. End-users produce new objects for instances like company names and addresses when entering this into the system. A good combination of filters, servers and fast databases are not yet in place to solve this problem.

Again, A-log has solved the problem software-wise but hasn't combined it with hardware in place. This results in a set of objects which essentially refer to the same instance but are denoted in different ways. This is called "garbage" in database jargon. Because of this the system becomes slower and information becomes blurry. Having only 1 definite name for e.g. Alexander logistics instead of also having A-logistics and Alexander logistics Ltd. in the dataset is much clearer when inserting and validating information. It also reduces the size of the database and therefore is able to execute queries faster.
Therefore the object generating characteristic is still situation dependent in especially the negotiation stages of the system. In the other stages the system the object generating is almost optimal from the IMS point of view. Object generation is programmed when the forwarder works directly into the system whereas external users using the website don't have access to these tools yet. Although the web-application doesn't support this fully yet, most orders are entered manually once by the forwarder and are corrected accordingly to stay definite. This is why the actual situation is placed in box 2. However, benefits in e-business are only gained by giving the web-application the same functionality.

9. *Frequency of changes of relevant information (mutation of object)*
   (overall score 3)

In general every information flow triggers a mutation in the information. The information objects that have the most mutations throughout the process are the consolidation file and shipment file. From the processes described in appendix 12 import/export diagram, it can be seen that the shipment file, truck file and consolidation file are used a lot to store and extract information. Depending in what tree of the system the forwarder is working in, information is displayed in different arrangements but still referring to the same table in the database. So mutations made which are shown in the EPC-diagrams have the same destination source. Nevertheless, for a more objective analysis the information source is taken into account. Appendix 8: Frequency of changes of relevant information shows mutation in files that are acting as a source or receiver. Considering the estimated average mutations of 1 cycle this indicates high frequency of changes of relevant information. Even when low occurrence processes are left out (reduction for example 50%-70%), average mutations are still high in 1 cycle. Overall score is therefore placed in box 3.

10. *Scalability of information process*
    (score 1.5-2.5)

Essentially the forwarder is busy with entering data into the system. All the documents that are semi-automatic are perceived to use the system which allows quick creation of these documents in most cases. The bottleneck with some of the semi-automatic operations is that after being performed, output is send to the end-user in a manual way. As mentioned before, some data is entered manually (like orders, cargo lists etc.). These procedures reflect a sub-optimal way of transferring information and documentation to the end-user given the fact that it has a semi-automatic characteristic. Moreover, after creating some documents manually or semi-automatic the forwarder has to both send some documents out through the system and send out manually by fax or mail. These are dual information flows. As can be seen in Appendix 6: Remarkable statistics and legend for direct measurement, on the sending side a lot of external communication is done

manually by the forwarder. About 56% is still being send by mail fax or phone (Appendix 9: Scalability). About 36% of information withholding important information (Appendix 6: Remarkable statistics and legend for direct measurement) is send manually which seems high. On the receiving side the same counts with respect to manual and semi-automatic communication flows. On average about 60% of communication (Appendix 9: Scalability) where the forwarder is either a sender or receiver, the flow in manual.

This implies that manual communication received should be also manually inserted into the IMS. Again, external is predominant represented in these flows. For this the scalability in the actual situation is perceived to be sub-optimal due to the high percentage of manual inserting or copying of information for external usage. About semi-automatic flows performed by the forwarder: s-flows are now been perceived as being good. Most s-flows take a lot less time than sending mails, doing phone calls or sending faxes. As mentioned various times before, the bottleneck is again the receiving and entering of information into the IMS manually. If the number of transactions increases or communication devices increases, the manual labor will increase as well. Given the current standards and interoperatibility functions that the IMS offers, scalability could be increase easily but is now restricted by manual labor.

6 CONCLUSION

With this report an answer is sought to the question: *"What is third party logistics (3PL) and how does it relates to e-business and what characteristics will be most suitable to improve e-business support in third party logistics?"*

Having read this report, it will be clear that 3PL are organizations that facilitate logistics outsourcing. While performing the 3PL function these companies rely heavily on IT to connect to customers and business partners. Especially e-business support helps in successfully automating communication towards customers. However, just installing IT is not enough. 3PL organization needs to indentify key characteristics in business processes, IT and communication so that e-business support can reap the benefits of automation. It will also be clear what best practices and future trends are for e-business in 3PL.
The model presented in this report provides this set of characteristics is where a 3PL organization can assess how e-business can further support a business process in the organization. These characteristics are again displayed in Table 2. Applying this model on Alexander logistics ltd. provides a first empirical test of this model.

6.1 OVERVIEW OF RESULTS FOR ALEXANDER LOGISTICS LTD.

table 2:discrepancies, showing estimated benefits in information sharing for e-business, gives an overview of the assessment of A-log with its actual and desired state together with the possibilities per characteristic to improve information sharing. Again, boxes which contain red text are for the optimal information sharing situation when using e-business solutions. Hatched boxes show high estimated benefits when improving information sharing for the relevant characteristic. Gray boxes show moderate estimated benefits when improving information sharing for the relevant characteristic. As can be seen most characteristics actual scores are already close to the desired situation. 5 of the characteristics fall into hatched boxes where benefits can be reaped upon when the characteristics can be exploited in an optimal way.

Model for estimation potential for information sharing towards e-business solutions				Current	falls in box?
characteristics of the process					
1.repetition frequency of similar communication within one process (per tree)	1.non-recurring	2.rare repetition	3.frequent repetition	1.47	2
2.repetition frequency of the process (per day)	1.nonrecurring	2.rare repetition	3.frequent repetition	1.96	2
3.speed of information transfer to end-user (reaction time triggering after event)	1. real time/immediate (direct on entry)	2. indirect (not on entry)	3. pulled end-user communication (when asked for)	1.74	2
characteristics of the communication					
4.attribute variance	1.unlimited convention	2.limited convention	3.definition	2.70	3
5.complexity	1.unstable (functionalities are ill-defined)	2.stable (functionalities are well-defined)		2.00	2
6.extensibility of the information	1.no extend (no electronic connection)	2.EDI traditional standards	3. XML, open structure format/direct entry	1.84	2
7.Importance information for end-user	2.notification suffices		3.critical	2.62	3
8.object generating	1.situative		2.programmed	2.00	2
characteristics of the IT					
9.frequency of changes of relevant information (mutation object)	1: non-recurring	2.rare repetition	3. frequent repetition	3.00	3
10.scalability of information process	1.easy	2.medium	3.complex	1.5-2.5	between 2-3

TABLE 2:DISCREPANCIES, SHOWING ESTIMATED BENEFITS IN INFORMATION SHARING FOR E-BUSINESS

For the characteristics which fall into the gray or white boxes both exploitation and transition to hatched boxes are possible and desired. Take into account that the model shows potential for benefits with the precondition that it is exploited successfully. Whether the potential can be exploited is a second and also depends on the end-user side as well. During this analysis end-user compatibility with different standards and behavior in information sharing have been highlighted as in-adequate in various occasions.

Supporting this statement, a research done amongst 1000 firms in manufacturing, retail and wholesale sectors focusing on business value created through e-business value chain activities (Barua et al.2004[62]) also observed the importance of end-user compatibility and willingness. They investigated customer/supplier-relations in e-business with different constructs like: system integration, digitalization level, process alignment, process readiness, online informational capabilities and financial performance. In all relations any increase in 1 of the constructs on supplier side positively influences another construct on customer side and vice versa (except for "*the higher the level of supplier-side digitization, the higher the financial performance attributable to electronic business*."). This research suggests that, when the actual situation in the model shifts to the optimal side for the supplying side the chances that the end-user will cooperate will increase. Having this in mind, the results in table 2:discrepancies, showing estimated benefits in information sharing for e-business show how A-log as a supplier of services can do its part. E-business is a tool to offer value activities like described above. Therefore it is imperative to first develop the e-business framework on a supplier basis to a level of performance where these value activities can be supported. This is a major part of influence for customers to adopt e-business solutions.

6.2 CHARACTERISTICS FOR IMPROVEMENT AND EXPLOITATION

Acknowledging potential and creating/aligning communication, processes and IT-solutions which situate itself in all hatched boxes would theoretically be the most optimal formula for exploiting e-business solutions from the logistic service provider-side. Hereafter it is important that the physical execution to achieve these states is sufficient to fully reap the benefits of the estimated potential. In this way the model can provide a solid instrument in tactical and strategic planning for 3PL firms. E-business through internet holds the key to successful information sharing with its end-users and especially for SME who aren't able to make the capital investments that traditional inter-organizational information system solutions need. This model can be the first step in determining how to adapt your logistics firm to e-business requirements.

For A-log, some characteristics of the model can only be influenced in a limited manner because they are controlled by the amount of transactions and business the organization currently has. For example, characteristics 1 and 2 can only be dominantly influenced by the number of shipment placed by the customers. Nevertheless, after applying the model, the following conclusions can be drawn which flow forth from the results and analysis of the actual situation.

[62] Barua A., Konan P., Whinston A.B., Yin F.(2004), *An empirical investigation of net-enabled business value*, p. 610.

3 situations are recognized.

A. Characteristics that are perceived to have to most opportunity for improvement.
B. Characteristics that have high potential but are not yet exploited fully but can be realized within short/long term notice.
C. Characteristics which are already operational for exploiting.

A: need improvement	B: need exploiting	C: ready
3 Speed of information transfer to end-user	8 Object generating	1 Repetition frequency of similar communication within one process
6 Extensibility of the information	5 Complexity	2 Repetition frequency of the process
10 Scalability of the information process.	4 Attribute variance	9 Frequency of changes of relevant information
	7 importance information for end user	

TABLE 5: 3 SITUATIONS FOR EXPLOITING CHARACTERISTICS OF MODEL

This means:

- A-log should concentrate on making 3, 6 and 10 up to the desired level and exploitable.
- A-log should concentrate on making 4, 5, 7 and 8 exploitable to the highest level.
- When these mentioned above are developed, 1, 2 and 9 will be ready to the necessary level to support the rest of the model.

In the next chapter some propositions are done to attain the desired levels of performance.

The future of A-log is promising. In the SEE region there are few 3PL firms that show so much technical and organizational knowledge in combining 3PL and information technology. A-log should evolve itself fast and perfect its practices while it is still small and relatively flexible. If they are able to leverage IT for e-business as good as they leverage IT for internal operations they can create an own niche in SEE region. Moreover, A-log could sell the developed IT solutions across Europe and maybe even across the whole world-wide logistics industry.

7 PROPOSITION

As can be seen from the results as displayed in the data analysis and conclusion chapters, there are still several discrepancies between the desired state and current state. Even with all the current technological installments in place there are issues to be solved. During this research the main problems addressed are in order management, speed of information transfer to end-users for increasing real-time visibility, extensibility, scalability and object generating. Solutions for these problems can roughly be divided into 3 solution areas:

1. Stop dual information and communication flows
2. Install full functionality from IMS to web-application.
3. Increase use of GPS-technologies and mobile devices.

7.1 STOP DUAL INFORMATION AND COMMUNICATION FLOWS:

This is really relatively straightforward. If A-log wants to reduce manual insertion and manual external communication it should firstly stop offering dual manual flows to their end-users. Now A-log uses it as extra service asides electronic information sharing but this encourages the end-users to forget the web-application. A prerequisite for this is that full functionality should be guaranteed. Information and documents which are now distributed manually like order requests, order status, invoicing, track&trace, shipment lists where they can also be offered through e-business as electronic documents. They can and should offer full functionality in online order management, electronic invoicing, and communication of shipping lists. Parallel to this they should communicate this to the end-user immediately. The web-application has to become the central place for communication, information and order management of electronic documents that are now physically send by mail.

7.2 INSTALL FULL FUNCTIONALITY FROM IMS TO WEB-APPLICATION:

Currently the web-application only offers restricted functionality on mainly order management and lacks in CRM. Moreover, the issue discussed during object generating relates to this problem as well. With current internet technologies a lot of functionality is possible which is similar to desktop application technology. Using the same functionality can further integrate the information flows from the web-application to the IMS whilst not encouraging object generation and keeping possibilities for scalability high. This could require the installment of better servers or other database tools. This installment will also solve the object oriented problem.
For the exchange of documents options restricted to displaying is not enough. Functionality should be installed to react on documents or mutate them e.g. accept or decline transportation offers online.

7.3 INCREASE USE OF GPS AND MOBILE TECHNOLOGY:

Track&trace operations should be done by the forwarder. Track&trace should be full-automatic and triggered by location of a truck using the global positioning system. This needs the installment of GPS on trucks. Combining GPS with mobile devices immediately gives the possibility to reduce more manual communication related to the transport process. Truck drivers can insert damage reports, order delivery notifications and other information directly into the system independent from the forwarder. These documents are now still physical but can be electronic. Different devices should thus be able to communicate with the IMS using internet.

7.4 IMPROVE THE COMMUNICATION TOWARDS THE END-USER:

As mentioned in the research definition the adoption of the external parties should be taken into account. End-user relations are already described briefly in the conclusion but for A-log this needs more elaboration. An e-business solution which is going to be used extensively by SME's should be made transparent and clear. Moreover, A-logs strategy is to supply them with more custom-made solutions and gradually (while the SME outsources more and more of its operations to A-log) implement and train the end-user with optimal use of the e-business solutions. For this case a

proposal is done to qualify the e-business functions/modules which the end-users will be able to use according to the level of process integration and amount of business every separate end-user does with A-log. When the customer needs more information, training or functionality because of the increases of business, number of transactions and logistics, customer demand should be satisfied. This means that the ASP should provide more training and more applications when the customer will use e-business more extensively. An example of a basic model is supplied in Table 6. This one could for example be used for the use of web-applications for consignees provided by A-log.

Example: module/expertise level		**beginner**	**experienced**	**Expert**
order management	1	X	X	X
	2		X	X
	3			X
track&tracé		X	X	X
WMS	1		X	X
	2			X
	3			X
invoice management	1	X	X	X
	2		X	X
	3			X

TABLE 6: OFFERING INCREASED FUNCTIONALITY TO CUSTOMERS

This example shows the integration of more service and functionality according to the trade and experience level of the end-user. The numbers represent different functional options. An increasing level of expertise of the customer can be coupled with access to more services or functions of the e-business solutions. Depending on factors like business requirements, turnover, trade volumes, level of expertise etc. the expertise level increases.

E.g. for invoice management 1, 2 and 3 could be defined as

1. invoice overview
2. electronic invoicing
3. full ability for FMS functions

Having a clear structure what services customers can use what level of integration will give the customer a good overview of potential e-business solutions. This transparency should be accompanied with an online support center where customers can find instruction movies and explanations on how to work with the system. When they move up an expertise level they will get more access to training and new or more elaborate applications and thus should results in more customer support. Having good online support is important when offering elaborate e-business solutions because the excess time which is acquired by the fact that more customers are using the web-application shouldn't be replaced by phone calls on how the website works.

Setting up and implementing this set of solutions should provide a good basis for Alexander Logistics Ltd. Hereafter A-log can begin extending current online services to accommodate further business requirements.

8 DISCUSSION

8.1 ASSUMPTIONS MADE FOR THE STRUCTURE OF THE MODEL

The model proposed in this report is based on theory and best practices in the 3PL sector. Furthermore, the characteristics are combined from different areas of expertise. General information sharing practices, internet-based inter-organizational information sharing and the use of IT in logistic supply chain integration and general 3PL practices are all used in determining the relevant characteristics. Although the model spawns from different researches and theories questions arise whether the model is valid. Theoretically it is perceived sound and theoretically supported but the model has not been empirically tested on a large scale. Some characteristics flow from empirically tested researches but the new model as a whole is not. It is therefore hard to say if all characteristics and the composition of the whole are scientifically sound. This can be an argument to question the academic integrity of the model which is a fair assumption. Nevertheless, by applying this on a real-life organization, the first basis for empiric testing has been given.

The approach for measuring economic potential is not pre-determined by the model but is dynamic in choosing evaluating methods. This is also why one of the reasons the model is chosen in the first place but also places some questions on which measuring method is most effective for this model. The dynamic foundation gives freedom to apply the model in environments where the specification of the process, IT and communication differs. Examples of methods that can be used to measure economic value are activity based costing or the process-oriented approach. Hereby the evaluation method for determining economic potential can also be varied to fit different kind of processes (e.g. information sharing or financial performance). This report did not take into account which measuring method to use although it makes a statement about the possible economic potential for A-log. This statement is discussed with the general manager and derived tacitly from knowledge acquired through the literature review.
The same is true for the assessment of the actual situation. This assessment is done using a more pragmatic approach that can also satisfy the demand from A-log. Determination of indicators and scales for the characteristics are made by reviewing the business processes and discussion with the general manager of A-log but also by looking at other researches (chapter 4: methodology). There is not yet one definite approach on how to effectively measure the actual and desired situation.

8.2 FURTHER ACADEMIC ASSUMPTIONS

The choice for updating the model as presented by Manecke & Schoensleben in 2004 and not applying the original is because of 2 reasons:

One, the model was not up to date according to internet technology. Internet technology is generally known to evolve fast. High connection speeds for the masses become available and e.g. the .NET framework or other business-oriented modeling tools bring new opportunities for the creation of business driven IT-solutions. Deleting the synchronization characteristic is an example of such an improvement.

Two, the combination of 3PL and internet technology is a fast developing market. As discussed in this report trends towards the need for information sharing using web-applications are strong and fast-moving. So is the 3PL industry and so is the theory pertaining to this industry.
Finally the model operates in a theoretical area where there are a lot of unanswered questions. Not a lot of research is done for assessing supply chains integration using e-business issues in this industry which makes this contribution more valuable.

A-log finds the revised model applicable to an organization in the 3PL industry and also sees the usefulness on applying this model in more general logistics. Especially the fact that the model uses characteristics that can be practically applied helps 3PL organizations in understanding the link between e-business and the business processes. However, to determine the generalization validity the model first needs more empirical testing. Hereafter, statistical testing can determine whether all

the characteristics are significantly contributing to e-business performance and whether economic potential has unexplained variance that is not explained by the current characteristics.

Future research or application of step 2 (estimating economic potential) of the model could happen in a more elaborate way. For future research other heuristics to measure gains in monetary value could be applied to determine focus on characteristics and to determine the optimal distribution of resources to exploit the most economic benefit. Also, it could be useful to analyze the relations between the different characteristics and the important of every characteristic using a statistical analysis.

9 REFLECTION

Performing this bachelor assignment in Sofia, Bulgaria was very satisfying and interesting. To be in a company like Alexander Logistics Ltd. that can on a technological and organizational level, measure up to Western firms in 3PL is very insightful and I think, rare in Bulgaria. Especially considering limited well-educated human resources, malfunctioning road infrastructure and further lack of government support.

Researching a fast paced developing sector like third party logistics is pleasing and emphasizes the multidisciplinary character of industrial engineering and management. Researching such a fast paced market is also the downside when performing scientific research because it is always a little behind the newest developments.

Country-specific problems were fairly easy to overcome during this research. Getting information from Bulgarians acquired me to be persistent and resourceful. Complications that arose during the research were mostly contributable to the fact that all documentation from A-log was in Cyrillic. Although being able to read Cyrillic the Bulgarian language is less easy to master. However, with the help of some English speaking employees it was still possible to get a good overview of the forwarding department and successfully translating the main concepts.

TABLE OF FIGURES

OVERVIEW OF TABLES.

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APPENDIX 1: PLANNING

task\week	1	2	3	4	5	6	7	8	9	10	11	12	13
Literature study													
Mapping Forwarding business function													
Analysing IS-function within forwarding department													
finding B2B information sharing practices													
mapping critical succes factors													
preparing final proposal													
presenting results													

actual done

planned

APPENDIX 2: PROBLEM BUNDLE

APPENDIX 3: MATURITY MODEL FOR EFFECTIVE 3PL-CUSTOMER COLLABORATION

	Traditional	Progressive	Leading
People	▪ Limited meaningful 3PL-customer interaction ▪ Individuals focused on area of responsibility within their own company ▪ 3PL perceived as "just another vendor", with a focus on cost management ▪ Detailed attention to the terms and conditions of the contract	▪ Good working relationships between 3PL and customer on an individual basis ▪ Management open to discrete opportunities to work together ▪ Planning and review meetings on an "as needed" basis ▪ Attention to the "spirit" of the contract – to ensure good service to the end customer	▪ Organizational and strategic alignment from executive level down to operational level ▪ On-site representatives from other company ▪ Regular cadence of joint review and planning meetings also on strategic topics ▪ Contract structured to foster collaboration. Gain sharing
Process	▪ Process design and execution confined to intra-company boundaries ▪ General awareness of importance information sharing ▪ Ad hoc Information exchange ▪ KPIs limited to internal metrics and vendor (3PL) scorecards ▪ Reactive improvements to resolve process issues between customer and 3PL	▪ Customer and 3PL cooperatively manage business processes across company boundaries ▪ Value added services beyond traditional transportation and warehousing ▪ Sharing of information put to some good use ▪ Increasing focus on proactive process improvement to deliver joint benefits	▪ Customer, 3PL, and trading partners work together to optimize processes across extended supply chain ▪ Shared KPIs / metrics and a joint focus on continuous process improvement ▪ Information shared widely with significant benefits ▪ 3PL Services extend to customer facing and strategic planning processes
Technology	▪ Non-integrated point solutions ▪ Information sharing by e-mail and some EDI ▪ Shipment status only available by request (not real time) ▪ Proprietary data formats ▪ Legacy IT solutions inherited from 3PL customer	▪ Selective integration of point solutions. Customer ERP input used ▪ Near real-time visibility and alerts for shipments for some flows ▪ Periodic communication of planning information ▪ Upgraded IT, leveraging 3PL best practices	▪ Holistic solutions supporting optimization across the extended supply chain ▪ 3PL Toolbox of applications (services) allowing fast customer implementations and requirements updates ▪ Open integration based on Service Oriented Architecture ▪ Event Management: real time visibility, forecasting and pro-active alerts. ▪ Global standards applied

FIGURE 4: MATURITY MODEL FOR EFFECTIVE 3PL-CUSTOMER COLLABORATION[63]

[63] http://3plstudy.com/

APPENDIX 4: METHOD FOR IDENTIFICATION OF POTENTIAL WHEN USING INTERNET-BASED SUPPORT

The model below shows the different levels where internet communication can impose economic potential. Through an analysis of the characteristics like shown in figure 6 every characteristic has its own indicators. The model will be rewritten to incorporate some indicators which are relevant for the forwarding department and from the information sharing angle..

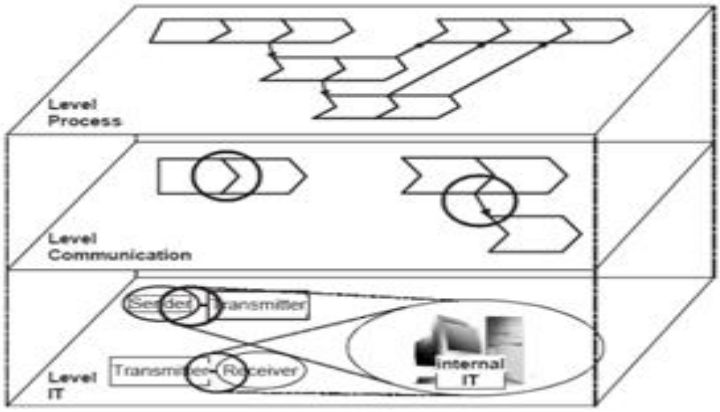


FIGURE 5: ANALYSIS LEVELS FOR THE IDENTIFICATION OF POTENTIAL

characteristics of the process				
geographic separation of process contributors	local	national	international	continental
repetition frequency of similar communication within one process	Nonrecurring	rare competition	frequent repetition	
repetition frequency of the process	Nonrecurring	rare competition	frequent repetition	
relevance of communication time	uncritical		critical	
characteristics of the communication				
attribute variance	unlimited convention	limited convention	definition	
object generating	situative		programmed	
homogeneity of information formats	None	low	high	
complexity	unstable		stable	
characteristics of the IT				
frequency of changes of relevant information	nonrecurrent	rare	frequently	continuously
synchronization of internal IT and internet	Manually	partly automated	automatically	

FIGURE 6: CHARACTERISTICS OF PROCESS, COMMUNICATION AND IT

APPENDIX 5: CONSOLIDATED DATA

receiver		
forwarder external	25	83.33%
forwarder internal	5	16.67%
total	30	100.00%
sender		
forwarder external	59	65.56%
forwarder internal	31	34.44%
total	90	100.00%

m/s/f

#m	55
# s	57
#f	21
# m/s	2
#sf	1
total	136
total sheets	136

EXTERNAL	95
INTERNAL	41
total	136
total sheets	136

Sender	
s-website	5
f-website	10
website-internal	15
forwarder-m	34
forwarder-s	41
forwarder- m/s	2
forwarder-f	13
Receiver	
forwarder-m	18
forwarder-s	11
forwarder- m/s	0
forwarder-f	0
forwarder s/f	1
Total	150
total sheets	150

drains: (extra export in *italic)*	
BP	2
CMR	2
consignee	3
consolidation file	1
customs	2
ERP	0
external IS	4
fax, phone, mail	11
forwarder	13
offering for transport	2
order request file	6
physical shipment	16
rejected order file	3
shipment file	54
transportation org.	5
truck file	3
virtual truck file	6
website	1
WMS	2
total	136
total sheets	136

source: (extra export in *italic)*	
@log.net	2
BP	6
CMR	2
consignee	2
consolidation file	9
customs	2
damaged good list	3
ERP	0
fax, mail, phone	29
forwarder	14
order request file	3
physical shipment	2
rejected order file	1
shipment file	24
shipping documents	0
track&trace	8
truck database	2
truck file	6
virtual truck file	2
website	19
total	136
total sheets	136

(export is *italic)*	**sender**	**receiver**	**diff. Sender-receiver**	**sender**	**receiver**
Alog.net	0	2	2	0.00%	1.47%
BP	8	9	1	5.88%	6.62%
consignee	7	13	6	5.15%	9.56%
consolidation file	0	3	3	0.00%	2.21%
customs	2	3	1	1.47%	2.21%
ERP	0	0	0	0.00%	0.00%
external IS	2	0	2	1.47%	0.00%
forwarder	90	30	60	66.18%	22.06%
insurance company	0	8	8	0.00%	5.88%
order request file	1	3	2	0.74%	2.21%
rejected order file	4	0	4	2.94%	0.00%
shipment file	5	19	14	3.68%	13.97%
speditor.net	0	2	2	0.00%	1.47%
track&trace	0	10	10	0.00%	7.35%
transportation org.	6	11	5	4.41%	8.09%
truck database	0	2	2	0.00%	1.47%
truck file	3	3	0	2.21%	2.21%
virtual truck file	0	2	2	0.00%	1.47%
warehouse	3	1	2	2.21%	0.74%
website	5	15	10	3.68%	11.03%
total	136	136		percentages of total	
total sheets	136	136		100.00%	100.00%

APPENDIX 6: REMARKABLE STATISTICS AND LEGEND FOR DIRECT MEASUREMENT

REMARKABLE STATISTICS		*IM=import EX=export*							
IM	EX		IM	EX		IM	EX		
7	7	m AND column_M=3	14	16	m AND column P=3	23	26	m AND column R=3	
5	4	s AND column_M=3	10	10	s AND column P=3	10	14	s AND column R=3	
5	0	f AND column_M=3	11	8	f AND column P=3	6	2	f AND column R=3	
17	20	m AND column_M=1	12	10	m AND column P=2	4	2	m AND column R=2	
20	24	s AND column_M=1	2	3	s AND column P=2	17	16	s AND column R=2	
8	8	f AND column_M=1	1	0	f AND column P=2	7	6	f AND column R=2	
62	63		50	47		67	66	**Totals**	
	11.20%	percentage m of total M=3		30.93%	percentage m of total P=3	36.84%		percentage m of total R=3	
	29.60%	percentage m of total M=2		22.68%	percentage m of total P=2	4.51%		percentage m of total R=2	

extensibility			
IM	EX		percentages
0	1	m AND column Q=3	1.10%
11	9	s AND column Q=3	21.98%
10	8	f AND column Q=3	19.78%
26	22	m AND column Q=1	52.75%
1	1	s AND column Q=1	2.20%
2	0	f AND column Q=1	2.20%
50	41	**Totals**	100.00%

extra forwarder statsistics

sender		*IM=import EX=export*		***receiver***			
IM	EX		**percentage**	IM	EX		**Percentage**
10	6	forwarder and M=3	17.98%	3	3	forwarder and M=3	20.00%
2	1	forwarder and M=2	3.37%	3	0	forwarder and M=2	10.00%
28	42	forwarder and M=1	78.65%	12	9	forwarder and M=1	70.00%
40	49	total	100.00%	18	12	total	100.00%

sender			***receiver***		
IM	EX		IM	EX	
2	1	website and Q=3	7	8	website and Q=3
			5	3	track&trace and Q=3

M	N	O	P	Q	R
repetition frequency of similar communication within one process (per tree).	**repetition frequency of the process (per order cycle)**	**speed of information transfer to end-user (reaction time triggering after event)**	**attribute variance**	**extensibility of the information**	**Importance information for end-user**
1: non-recurring(0,1)	1: non-recurring(0,1)	1. real time/immediate (direct on entry)	1.unlimited convention (manual check or insert)	1.no extend (no electronic connection)	
rare repetition(2,3)	rare repetition(2-4)	2. indirect (not on entry)	2.limited convention (human checkup still needed after entering)	2.EDI traditional standards	2.notification suffices
3 frequent repetition (3>)	3 frequent repetition (4>)	3. pulled end-user communication (when asked for)	3.definition (no check-pup after entering)	3. XML, open structure format/direct entry	3.critical

APPENDIX 7: GENERAL STATISTICS A-LOG

repitition frequency of process.

from 01-juni-2007 till 24-june-2008

.	inbound shipments	outbound shipments
per year	12591.00	12642.00
per week	242.13	243.12
per forwarder per week (7 forwarders)	34.59	34.73
	cargo missing report	**shipment/cargo miss. Rep. Ratio**
extra	1591.00	7.95
	total consolidations	**total trucks**
import	878.00	737.00
export	274.00	416.00
per year	1152.00	1153.00
per week	22.15	22.17
per forwarder per week (7 forwarders)	3.16	3.17

	external	
m	49	52.69%
s	24	25.81%
f	20	21.51%
Total	93	100.00%

APPENDIX 8: FREQUENCY OF CHANGES OF RELEVANT INFORMATION

frequency of changes of relevant information (mutation of object)

 # times a file gets accessed

	source	reciever
CMR	2	
consolidation file	9	3
order request file	3	3
rejected order file	1	3
shipment file	24	19
track&trace		10
truck database	2	2
truck file	6	3
virtual truck file	2	2
total	47	45

<10	red	2	12.50%
between 4-10	yellow	3	18.75%
>4	green	11	68.75%
		16	100.00%

source table		**reciever table**		**per cycle**	
1	11.11%	1	12.50%	***multipliers***	
2	22.22%	1	12.50%	***shipment***	***34***
6	66.67%	6	75.00%	***consol***	***3***
9	100.00%	8	100.00%	***truck***	***3***

after multipliers

	multipliers	source	reciever	**source table**		**reciever table**	
CMR	3	6		4	50.00%	3	37.50%
consolidation file	3	27	9	3	37.50%	4	50.00%
order request file	34	102	102	1	12.50%	1	12.50%
rejected order file	1	1	1	8	100.00%	8	100.00%
shipment file	34	816	646				
track&trace	3		30				
truck database	3	6	6				
truck file	3	18	9				
virtual truck file	3	6	6				
total		982	809				

<10	-	red	5	31.25%	
between 4-10	-	yellow	7	43.75%	
>4	-	green	4	25.00%	
			16	100.00%	
average	-	**109**	**90**		**final score** **3**

APPENDIX 9: SCALABILITY

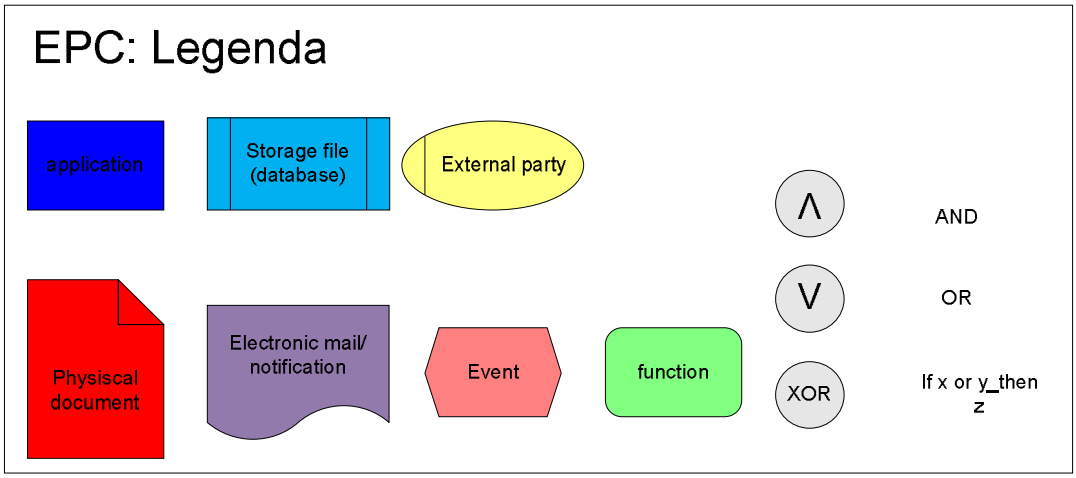
scalabilty--> Forwarder communication specifications

	import			**export**			**SUM**					
	sender			**sender**			**sender**		**forwarder**		*percentage of total sum* **sender**	
14	forwarder external	m	18	forwarder external	M	32	forwarder external	m	57	total external	**56.14%**	m+external
0	forwarder internal	m	2	forwarder internal	M	2	forwarder internal	m	31	total internal	6.45%	m+internal
5	forwarder external	s	7	forwarder external	S	12	forwarder external	s				
13	forwarder internal	s	16	forwarder internal	S	29	forwarder internal	s				
6	forwarder external	f	7	forwarder external	F	13	forwarder external	f				
0	forwarder internal	f	0	forwarder internal	F	0	forwarder internal	f				
						2	*forwarder external m/s*					
	reciever			**reciever**			**reciever**		**forwarder**		**receiver**	
11	forwarder external	m	5	forwarder external	M	16	forwarder external	m	25	total external	**64.00%**	m-internal
0	forwarder internal	m	2	forwarder internal	M	2	forwarder internal	m	4	total internal	**50.00%**	but only 2 so no problem
5	forwarder external	s	4	forwarder external	S	9	forwarder external	s				
1	forwarder internal	s	1	forwarder internal	S	2	forwarder internal	s			**60.07%**	**average manual+external**
0	forwarder external	f	0	forwarder external	F	0	forwarder external	f				
0	forwarder internal	f	0	forwarder internal	F	0	forwarder internal	f		**final score**	**in between box 2 and 3**	

APPENDIX 10: TOTAL OVERVIEW OF DIRECT MEASURING OF CHARACTERISTIC

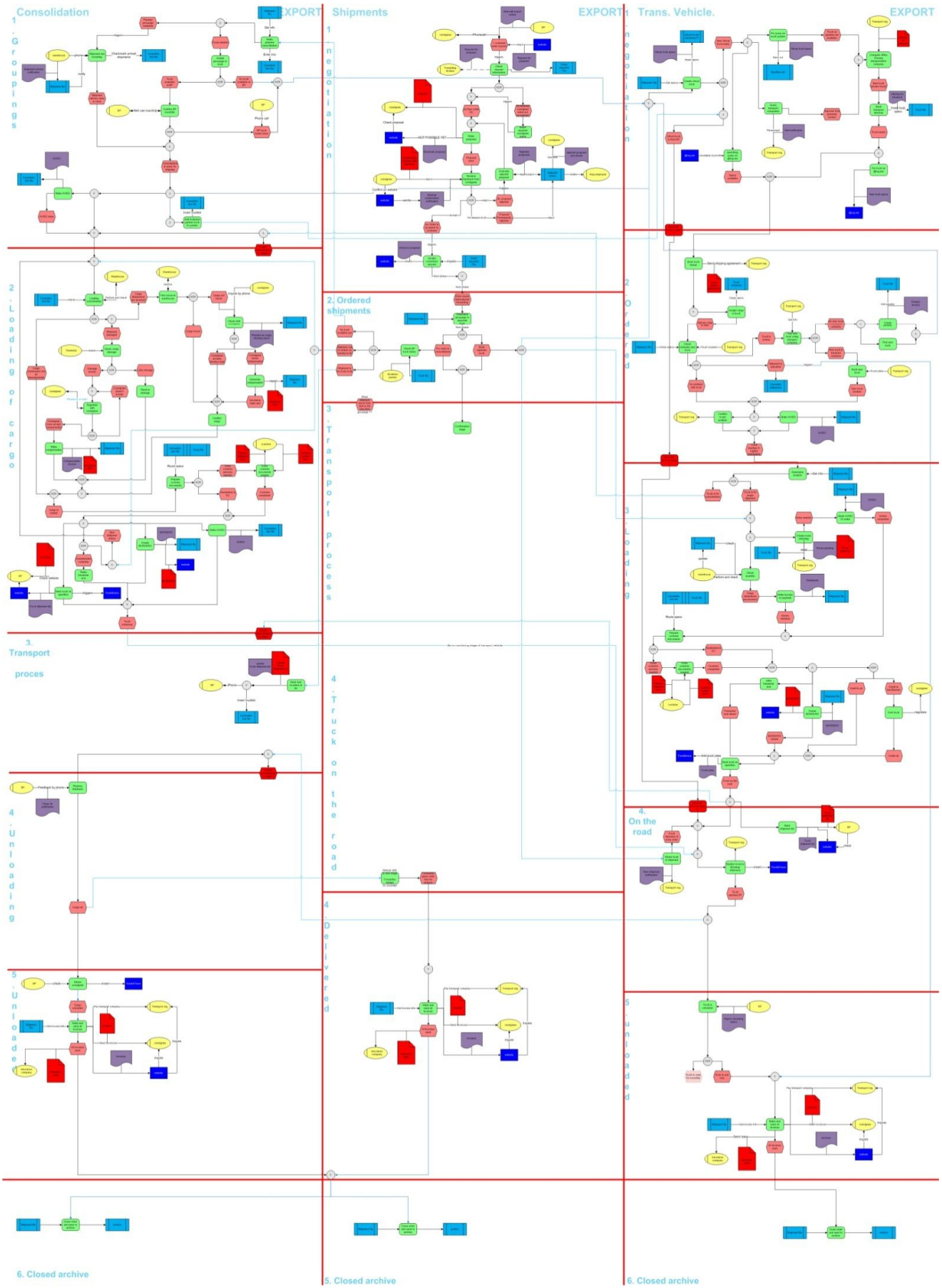
Occurence table		*repetition frequency of similar communication within one process (per tree)*	*repetition frequency of the process (per order cycle)*	*speed of information transfer to end-user (reaction time triggering after event)*	*attribute variance*	*extensibility of the information*	*Importance information for end-user*
		1: non-recurring(0,1) *rare repetition(2,3)* *3 frequent repetition (3>)*	*1: non-recurring(0,1)* *rare repetition(2-4)* *3 frequent repetition (4>)*	*1. real time/immediate (direct on entry)* *2. indirect (not on entry)* *3. pulled end-user communication (when asked for)*	*1.unlimited convention (manual check or insert)* *2.limited convention (human checkup still needed after entering)* *3.definition (no check-pup after entering)*	*1.no extend (no electronic connection)* *2.EDI traditional standards* *3. XML, open structure format/direct entry*	*2.notification suffices* *3.critical*
import	**1**	*47*	*4*	*13*	*0*	*31*	*0*
	2	*6*	*6*	*38*	*17*	*0*	*28*
	3	*17*	*2*	*3*	*35*	*21*	*42*
	average	***1.57***	***1.83***	***1.81***	***2.67***	***1.81***	***2.60***
export	**1**	*52*	*2*	*15*	*0*	*23*	*0*
	2	*2*	*8*	*23*	*13*	*0*	*24*
	3	*11*	*3*	*2*	*34*	*18*	*42*
	average	***1.37***	***2.08***	***1.68***	***2.72***	***1.88***	***2.64***
consolidation	**1**	*99*	*6*	*28*	*0*	*54*	*0*
	2	*8*	*14*	*61*	*30*	*0*	*52*
	3	*28*	*5*	*5*	*69*	*39*	*84*
	average	**1.47**	**1.96**	**1.74**	**2.70**	**1.84**	**2.62**

APPENDIX 11: EPC LEGEND



Reading the EPC is fairly easy. Processes are denoted in the constructs and the cardinalities are created using the AND, OR and XOR crossings.
Blue connection lines in the IMPORT/EXPORT diagrams will represent inter-tree relations for extra clarity.

APPENDIX 12 (1): EXPORT EPC



APPENDIX 12 (2): IMPORT EPC