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Vertical Electronic Coordination versus Vertical
Electronic Integration - A 3PL Client Perspective

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Preface

This master thesis is accomplished as a part of the Master of Science in Logistics at Molde University College. The thesis is written in the period from January to May 2009. The main supervisor for this study is Berit Irene Helgheim

Fundamentally, the thesis attempts to shed light on issues concerning electronic coordination and electronic integration in 3PL arrangements by using a multiple theoretic approach.

Acknowledgements

In particular, we would like to express the following gratitude:

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To Molde University College for professional facilitation of their MsC Program in Logistics.

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Abstract

It has been observed a growing trend in outsourcing of logistics services during the last years. As these complex networks introduce coordination and integration challenges, researchers and academics have demonstrated increased interest to research phenomenon such as third party logistics (3PL) and supply chain management.

However, an understanding of how the nature of the relationship as well as outsourcing services related to strategic products, influence the third party logistics clients' diversity in use of information sharing solutions, has gained limited attention. To capture this variety a deliberate distinction between vertical electronic coordination and vertical electronic is made.

Factors exhibiting cooperative behavior and the strategic nature of the product are coupled with the supply chain management goal of effective information processing and hypothesized to influence vertical electronic integration among 3PL clients and their logistics service providers.

Data was collected by conducting a survey based on cross sectional data from a heterogeneous population of organizations. Results indicate that organizations outsourcing logistics services tend to deploy vertical electronic integration by using integrated information sharing solutions when trust and commitment, power and dependence are present in the 3PL arrangement. Interestingly, the bundling of logistics services and the strategic nature of the product turned out to be negatively associated with vertical electronic integration. This observation might indicate that vertical electronic coordination is preferred when outsourcing services related to strategic products, as well as when the 3PL clients outsource logistics operations in bundles.

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1. Introduction

1.1 Background and motivations

By taking a system approach, the Supply Chain Management philosophy has launched a holistic view on the notion of management. Every member of the supply chain affects overall performance and organizations work together as part of a joint network. Such networks, marked by tendencies of high integration among entities, differ in complexity where the most complex system has been described as the “ultimate supply chain”. The third party logistics (3PL) provider is typically a member of this system, which brings increased complexity into issues concerning governance and management, and thus requiring closer coordination and integration of activities (Mentzer et al., 2001). Despite arguments favoring coordination through integration, lack of integration and the need for relational improvements among logistics service providers and their clients are problems commonly reported in literature (see e.g. Stank et al. 1999). Additional concern has been expressed among researchers concerning the means of cooperation and coordination in 3PL arrangements (see e.g. Lemoine and Skjøtt-Larsen, 2004)

This study aims to focus particularly on the employment of effective information sharing which is considered as a vital factor when coordinating economic exchange between logistics service providers and their clients. The use of network technologies or integrated information systems, combined with the attempts to employ Supply Chain Management philosophies, are believed to change the way organizations behave externally with others supply chain members. Consequently, researchers are calling for increased attention to the nature of the relationship and the development of “electronic partnerships” (Hart and Saunders, 1988). Previous research has typically focused on “electronic dyads” between buyers and suppliers when examining coordination and integration challenges among entities in the supply chain (see. e.g Grover and Saeed, 2007; Hart and Saunders, 1998; Choudhury, 1997). Grover and Saeed (2007) argued that transaction characteristics, open information sharing environment and market characteristics are important antecedents when integrating information systems in manufacturer-supplier dyads. Hart and Saunders (1998) test a theoretical framework where they take a supplier perspective in a buyer – supplier dyad, and test a theoretical framework particularly based on two relational factors, power and trust, to the use of electronic data interchange systems. Among other findings,

they claim that trust increase diversity in use of such systems. In spite of increased focus on relational and transactional qualities when investigating integration and coordination among supply chain members, limited attention has been directed toward understanding how the nature of 3PL relationships as well as product characteristics, influence the 3PL clients' diversity in use of information sharing solutions.

1.2 Research problem

In essence this study investigates how factors exhibiting cooperative behavior affect the diversity in use of information sharing solutions among 3PL clients and their logistics service providers. Special attention is given to power, dependence, trust and commitment, and the duration of the 3PL arrangement. Additionally, we examine circumstances in which the 3PL client outsources services related to both non-strategic and strategic products, and how the strategic nature of these products can influence the 3PL clients' preferences concerning information sharing solutions. In order to capture the 3PL clients preferred electronic governance form, a deliberate distinction is made between vertical electronic coordination and vertical electronic integration.

1.3 Contribution on scope

The main contribution of this thesis is the theoretical modeling of how vertical electronic integration between a 3PL client and its 3PL providers is conditionally dependent upon relational factors (product). Dyadic perspectives are commonly preferred when performing empirical research in a 3PL setting. However, the triadic relation between customer, 3PL provider, and supplier has been suggested as the minimum unit of analysis when exploring 3PL relationships (Bask, 2001). For delimitation purposes, this study considers the 3PL arrangement as a two-way relation between a 3PL client and its logistics service providers, where we examine the relationship from the 3PL clients' point of view.

1.4 Organization

Henceforth, the thesis has two sections. In the first part is, a literature review on previous research concerning supply chain management, third party logistics, coordination and relational attributes are presented. Chapter 2 is followed by four chapters where we

explicitly present the multiple theories used as theoretical framework for our model, and corresponding hypotheses. In the second part, an overview and discussion of the research method is given, followed by the operationalization and validation of constructs. Finally, we present the results from our statistical analysis with subsequent discussions of our findings. We close by concluding and presenting suggestions for further research.

2. Literature Review

2.1 Conceptualizing Supply Chain Management (SCM)

2.1.1 The Supply Chain (SC)

Mentzer et al. (2001) points out that *“a supply chain consists of multiple firms, both upstream (i.e. supply) and downstream (i.e. distribution), and the ultimate consumer”*. They base this argument on earlier suggested propositions of the supply chain concept. It seems to be a joint consensus that a supply chain involves multiple independent companies which move products or even services from the manufacturer upstream in the chain to the consumer in the other end (LaLonde and Masters, 1994; Lambert et al., 1998). This set of companies referred to as producers, wholesalers, retailers, and transportation companies, are all moving materials forward towards the ultimate consumer, and can be referred to as a supply chain (LaLonde and Masters, 1994). Lambert et al., (1998) illustrate the supply chain by presenting it as an arrangement of companies passing products and services towards the market. On the basis of these definitional issues Mentzer et al. (2001) define a SC as *“a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer.”*

As explained all companies are participants in the supply chain, from the raw materials to the ultimate consumer. The length of the channel and thus the number of suppliers and customers at each level are dimensions which need special consideration. The structure of the supply chain looks like an “uprooted tree” with branches and roots constituting the network of customers and suppliers. Conversely, elements such as product complexity, available suppliers and raw materials, are determinative when deciding how much of the

chains' branches and roots that needs to be managed (Cooper et al., 1997a), as illustrated in figure 1.

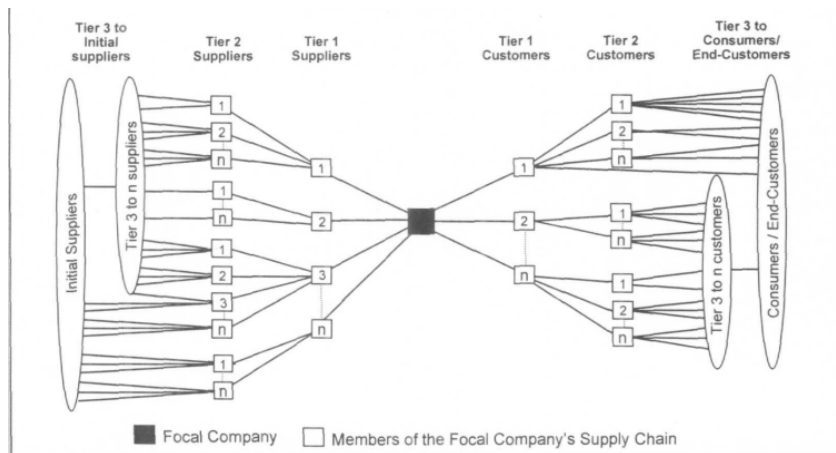


Figure 1 Supply Chain Network Structure. Adopted from Lambert et al. (1998)

Mentzer et al. (2001) put emphasis on the notion of supply chains as a phenomenon by proposing that it needs to be distinct from the actual *management* of these distribution channels. Channels of distribution exist whether they are managed or not. Managing these flows of products and services necessitate explicit efforts or more specific management strategies by the actors within the supply chain.

2.1.2 The SCM Philosophy

An effort to conceptualize SCM was made as early as in the 1960's. Already then it was identified a connection between organizations success and performance and the “interactions between flows of information, materials, manpower and capital equipment” (Giunipero et al., 2008). But Lambert et al. (1998) claim that regardless of this attempt of conceptualization, the term SCM was initially introduced by consultants and did not materialize until the early 1980's. Essentially, SCM as concept reached the stage of diffusion in the late 1990's and the theoretical and empirical investigation initiated in 1997 (Lambert et al., 1998). Reaching this stage, academics were trying to define the idea of SCM. The basic idea was to manage the movement of materials throughout the organization in a systematic manner in order to improve the overall effectiveness and efficiency of the operational system (LaLonde and Masters, 1994). These early developed definitions are clearly marked by the “flow of goods mindset”, similarly with the definition

of the supply chain. Additionally, they focus on the management of relationships and SCM were explained as “*a concept that extended from the supplier to the ultimate buyer*” (Giunipero et al., 2008).

In a SCM perspective the supply chain is seen as a single unit, not an arrangement of disjointed, individual pieces. The fundamental management philosophy is to take a system approach (Houlihan, 1988). This way of thinking widens the perceptions concerning SCM by defining the movement of goods from supplier to consumer as a “multi-firm effort” (Jones and Riley, 1985), and additionally it allows the company to make suitable tradeoffs between costs concerning logistics operations, like purchasing and transportation (LaLonde and Masters, 1994). Such a network approach philosophy attaches importance to the belief that every member of the supply chain affects the overall performance of the total supply chain, both directly and indirectly (Cooper et al. 1997a). Cooper et al. (1997a) acknowledge this approach by defining SCM as “*an integrative philosophy to manage the total flow of a distribution channel from supplier to the ultimate use.*” Based on previous literature, outsourcing can be a vital link in this network of entities as logistics service providers commonly offer value adding services and thereby enhance the overall performance (Bask, 2001).

Management of supply chain activities

In order to adopt SCM as a philosophy certain management practices or activities need to be launched which allow supply chain members to behave dependably by the means of the philosophy. To be an effective, competitive actor in the market environment, organizations should perform SCM activities such as extensive integration behavior, which incorporate their customer and supplier base. Furthermore, activities concerning mutual sharing of information as well as risks and rewards between supply chain participants are both seen as SCM philosophy implementation requirements. Because SCM has been referred to as external integration, all of these chain management activities ought to include integrated behavior (Mentzer, 2001).

Management of supply chain processes

However, academics and researchers have also focused on *management processes* as well as the *management activities* constituting SCM, when constructing an adequate definition (Mentzer, 2001). A definition of supply chain management was made by the Global

Supply Chain Forum in 1994 and modified in 1998 by members of the forum: “*Supply chain management is the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders*”.

This description depicts a rather wide understanding of the SCM concept, which is illustrated in figure 2. The model describes a simplified supply chain network structure, the flow of information and products, and the eight key supply chain business processes.

Marketing, Finance, R&D, Production, Purchasing and Logistics are included in the functional silos. Activities in these processes reside inside a functional silo, but an entire process will not be contained within one function. The importance of each process and the specific activities included may vary between companies (Croxtton, et al. 2001).

The business processes need to be implemented within the focal organization itself as well as across firms in the supply chain. They run the length of the supply chain and cut across firms and functional silos within each firm (Croxtton, et al. 2001). Consequently, because the processes are linked across intra- and intercompany boundaries, the business processes become supply chain business processes (Lambert and Cooper, 2000).

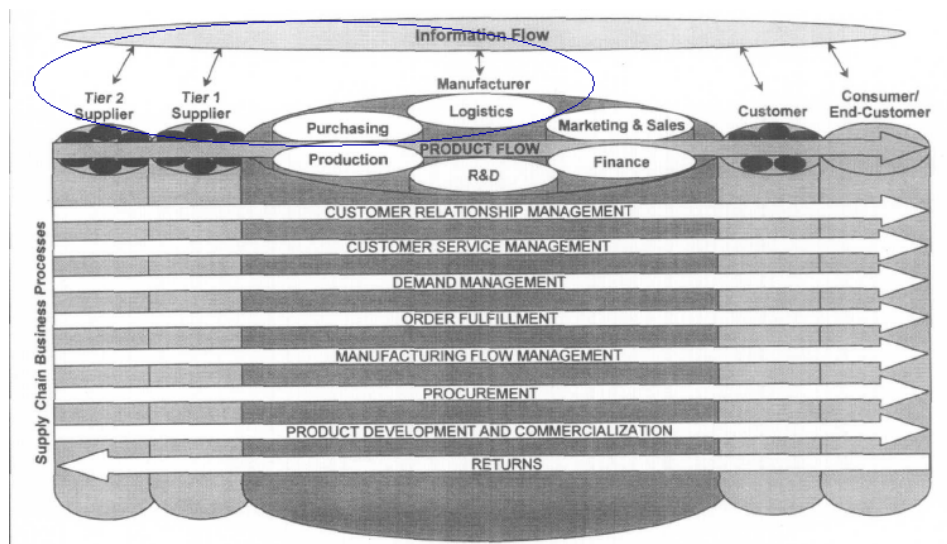


Figure 2 The silo model. Adopted from Lambert et al. (1998).

Discussing the management of supply chain processes, it is necessary to point out that a third party logistics provider can typically be located inside the circle illustrated in the figure above. This reasoning is based on the statement that a third party logistics provider is commonly known as an external party which performs various logistics services to others in the supply chain (Coyle et al., 2003). These services are a part of the eight processes in the Silo model and might include transportation, procurement, and

information processing. It appears to be a joint consensus among researchers that, the integration of outsourced logistics functions across multiple functional areas, can contract *processes* as opposed to distinct activities. (Rabinovich et al., 1999)

Cooper et al (1997b) believe, based on definitional statements on SCM, that SCM is actually “*logistics taken across inter-organizational boundaries*”, and amplifies that there is a “*need for the integration of business operations in the supply chain that goes beyond logistics*. A management process can be viewed as “*a structure of activities designed for action with a focus on end-customers and on the dynamic management of flows involving products, information, cash, knowledge and/or ideas*” (Lambert et al., 1998).

Having in mind that SCM goes beyond logistics and across inter – organizational boundaries, it seems reasonable to view a supply chain business process as a course of action which can cross intra- and inter-organizational boundaries, independently of formal structure (Cooper et al., 1997b). Considering SCM as management of processes, Lambert et al. (1998) encapsulate the implementation issue concerning SCM as a management philosophy by arguing that “*SCM involves identifying the supply chain members, with whom it is critical to link, what processes need to be linked with each of these key members, and what type /level of integration applies to each process link.*”

Long term orientation and strategic perspective

The notion of the long term perspective in SCM has been put forward by researchers when trying to conceptualize the concept, and as a SCM philosophy implementation issue (see e.g. Cooper et al. 1997a; LaLonde and Masters, 1994; Mentzer, 2001). Updated information, particularly concerning the planning and monitoring of processes, makes the supply chain more effective and the sharing of benefits and burdens give way for competitive advantage and supports a long –term, cooperative behavior among supply chain actors. Besides, cooperation is initiated by joint planning and is known to end with joint evaluation of performance, which involves evaluating processes over several years (Cooper et al. 1997a, 1997b). Anderson and Narus (1990) support this long – term aspect concerning cooperation by explaining that cooperative behavior represent complementary, coordinated activities carried out by organizations in business to business relationships. The goal of this management practice is to produce superior mutual outcomes which are mutually expected over time (Anderson and Narus, 1990).

Several researchers put emphasize on the strategic perspective concerning SCM (see e.g. Houlihan, 1988; LaLonde and Masters, 1994). SCM is said to represent close co-

ordination of logistics operations, also referred to as integrated logistics management. Similarly, as this study points out in subsequent chapters, the motivations for outsourcing of logistics services to third parties of the SC, is changing from being of operational concern, to be included in the strategic agenda (Kremic et al., 2006).

It is obvious and maybe not surprising that there is confusion and much debate about developing a specific definition. But based on the previous discussion about SCM as a management philosophy, implementation of SCM, and the perception that SCM is a set of management processes, this study intend to use the definition presented by Mentzer et al. (2001), who describe SCM as the “*systematic strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within a supply chain, for the purpose of improving the long – term performance of the individual companies and the supply chain as a whole.*” As table 1 indicates, a number of researchers and academics have made an effort in defining SCM, but no one appears to have managed to develop a more specific definition generated by Mentzer et al. (2001).

Since this study employ the definition of the SC as stated earlier, it indicates that the SCM definition given by Mentzer et al. (2001) account for both up- and down – stream flows, which in turn gives the SCM concept a network perspective.

Various definitions of SCM presented by academics and researchers from 1985 to 2001

Authors	Proposed definition of SCM
Jones and Riley (1985)	“Supply chain management deals with the total flow of materials from suppliers through end users...”
Houlihan (1988)	Differences between supply chain management and classical materials and manufacturing control: “1) The supply chain is viewed as a single process. Responsibility for the various segments in the chain is not fragmented and relegated to functional areas such as manufacturing, purchasing, distribution, and sales. 2) Supply chain management calls for, and in the end depends on, strategic decision making. “Supply” is a shared objective of practically every function in the chain and is of particular strategic significance because of its impact on overall costs and market share. 3) Supply chain management calls for a different perspective on inventories which are used as a balancing mechanism of last, not first, resort. 4) A new approach to systems is required – integration rather than interfacing.”
Novak and Simco (1991)	“The supply chain management covers the flow of goods from the supplier through manufacturer and distributor to the end user.”
Cavinato (1992)	“The supply chain concept consists of actively managed channels of procurement and distribution. It is the group of forms that add value along product flow from original materials to final customer. It concentrates on relational factors rather than transactional ones.”
Cooper and Ellram (1993)	“Supply chain management is an approach whereby the entire network – from suppliers through to the ultimate customers, is analyzed and managed in order to achieve the “best” outcome for the whole system”.
LaLonde and Masters (1994)	Supply chain strategy includes: “...two or more firms in a supply chain entering into a long-term agreement; ...the development of trust and commitment to the relationship; ...the integration of logistics activities involving the sharing of demand and sales data; ...the potential for a shift in the focus of control of the logistics process.”
Cooper et al. (1997a)	Supply chain management is; ...” an integrative philosophy to manage the total flow of a distribution channel from supplier to the ultimate user.”
Monczka et al. (1998)	“SCM is a concept, whose primary objective is to integrate and manage sourcing, flow, and control of materials using a total system perspective across multiple functions and multiple tiers of suppliers.”
Mentzer et al. (2001)	Supply chain management is the “systematic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within a supply chain, for the purpose of improving the long – term performance as a whole.”

Table 1 Definitions of SCM. Adopted from Mentzer et al. (2001) and Giunipero et al. (2008)

2.1.3 The “Ultimate Supply Chain”

Included in the SC definition presented by Mentzer et al., (2001) they manage to give a classification of three different “degrees” of complexity: The first degree of complexity is referred to as a “direct supply chain” (figure 3) and is comprised of a supplier, and a customer, which are concerned with operations both upstream and downstream. Secondly, the “extended supply chain” (figure 4) is identified where suppliers and customers are introduced to the immediate suppliers and immediate customers. Third and last they present the “ultimate supply chain” (figure 5). All the organizations involved in the movement of products, finances, services and information both up- and down – stream are represented in the “ultimate supply chain”. It is in this latter degree of supply chain complexity that third party logistics providers, which offer logistics services to other dyads in the chain, can be represented (Mentzer et al., 2001). Because firms are members of others’ supply chain, it is important for management of each firm to understand their inter-related roles and perspectives. As this study discuss further in following chapters, this problem is often observed particularly in arrangements where a third party logistics providers is engaged. This tendency of increased integration and collaboration is assumed to bring along increased complexity to governance - and management issues since it requires a higher degree of coordination of resources and activities in the chain (Lambert et al, 1998).The figure below is adopted from Menzter et al. (2001) and is rather limited with respect to how complex a supply chain can become, but gives a brief overview of different degrees of SC complexity.

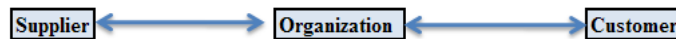


Figure 3 Direct Supply Chain

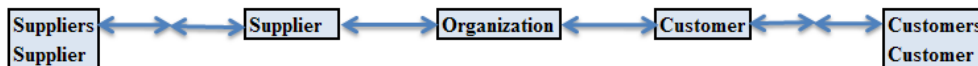


Figure 4 Extended Supply Chain

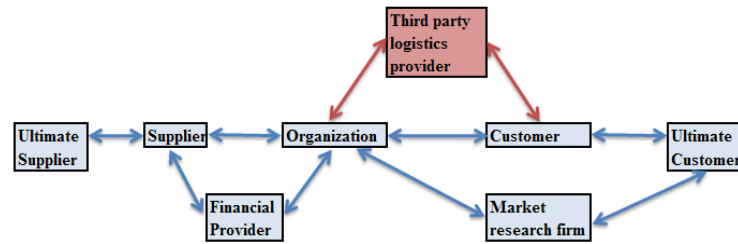


Figure 5 Ultimate Supply Chain

2.2 Third party logistics (3PL)

2.2.1 Definition of 3PL and 3PL provider.

A variety of terms such as “logistics alliances”, “logistics outsourcing”, “contract logistics” and “3PL” have been applied when describing the process of externalizing tasks and services earlier performed in-house to outside vendors (Bagchi and Virum, 1998; Sheen and Tai, 2006; Sink, 1996; Jenster and Pedersen, 2000). It seems to be a tendency towards underlining diverse features of the outsourcing arrangements such as the service offered, nature and duration of the relationship, extent of the third party responsibility over the logistics process, and position in the supply chain (Selviaridis and Spring, 2007). This thesis aims to use the term 3PL and logistics outsourcing alternately when explaining the externalizing of logistics processes. In the next section definitional issues concerning 3PL will be discussed.

Defining 3PL

3PL has not got a unique definition attached and researchers often employ different definitions to the concept. Coyle et al. (2003) suggested that “*third-party logistics involves an external organization that performs all or part of a company’s logistics functions.*” In similar vein, Lieb (1992) states that 3PL involve “*the use of external companies to perform logistics functions that have traditionally been performed within an organization. The functions performed by the third party encompass the entire logistics process or selected activities within that process.*” These definitions are distinguished by being rather open and propose that 3PL covers any type of outsourcing of logistics processes which earlier were performed “in-house” (Marasco, 2008). Haldórsson and Skjøtt – Larsen (2004) have a Scandinavian approach when defining 3PL. Based on the belief that Scandinavian managers have a tradition for close and long – term cooperation with external partners, they argue that the nature of Scandinavian definitional suggestions also tend to be rather broad. Berglund et al (1999) define 3PL as: “*activities carried out by a*

logistics service provider on behalf of a shipper and consisting of at least management and execution of transportation and warehousing (if warehousing is part of the process.)” But additionally, the definition also include operational management support of other logistics outsourcing activities such as inventory management, information related services (e. g. track and trace), value added activities (e.g. secondary assembly), or even supply chain management. They also stress the need to distinguish 3PL from traditional arms – length sourcing of transportation by suggesting contractual requirements on the duration of the 3PL provider - client relationship (Berglund et al., 1999). By adding distinguishing functional and interorganizational features to the concept of 3PL the definition moves from being rather broad to becoming a more “narrow” approach. Other researchers seeking a more narrow perspective of 3PL as a concept are Bagchi and Virum (1996). By distinguishing between simple outsourcing and logistics alliances, they consider a logistics alliance as *“a long – term formal or informal relationship between a shipper and a logistics provider to render all or a considerable number of logistics activities for the shipper. The shipper and the logistics provider see themselves as long-term partners in these arrangements. Although these alliances may start with a narrow range of activities, there is a potential for a much broader set of value – added services, including simple fabrication, assemblies, repackaging, and supply chin integration”* (Bagchi and Virum, 1996) While this latter definition stresses the relationship duration when conceptualizing 3PL, Murphy and Poist’s (1998) add the win – win nature of a the relation and define 3PL as *“a relationship between a shipper and a third party, which, compared with basic services, has more customized offerings, encompasses a broader number of service functions and is characterized by a longer term, more mutually beneficial relationship.”* As well as emphasizing on duration, these narrow definitions differentiate 3PL arrangements from traditional outsourcing of logistics functions assume that a number of features are fulfilled before the arrangement between 3PLprovider and its client can be seen as a 3PL relationship. The features referred to includes among others the prerequisite of a broad range of services, long-term duration, the development of cooperative relations, customization of solutions, and sharing of benefits and risks. By adding these attributes the idea of 3PL moves from pure tactical decision making into more strategic dimensions in the supply chain (Skjøtt-Larsen, 2000).

Author(s)	Proposed 3PL definition	Observations
Coyle et al. (2003)	3PL involves an external organization “that performs all or part of a company’s logistics functions.”	Broad definition. Assume 3PL includes any form of earlier in-house activities.
Lieb (1992)	...“the use of external companies to perform logistics functions that have traditionally been performed within an organization. The functions performed by the third party can encompass the entire logistics process or selected or selected activities within that process”.	Relatively broad definition. Activities transferred from within the organization to external parties. Distinguish between processes and activities
Berglund et al., (1999)	...”activities carried out by a logistics service provider on behalf of a shipper and consisting of at least management and execution of transportation and warehousing.”	Relative narrow definition. Emphasize on the management of support, operational activities and the duration of the 3PL relationship
Bagchi and Virum (1996)	...“a long – term formal or informal relationship between a shipper and a logistics provider to render all or a considerable number of logistics activities for the shipper. The shipper and the logistics provider see themselves as long-term partners in these arrangements. Although these alliances may start with a narrow range of activities, there is a potential for a much broader set of value – added services, including simple fabrication, assemblies, repackaging, and supply chain integration”.	Narrow definition View 3PL as a logistics alliance focusing on relationship duration. Includes the potentially wide range of logistics services offered in the arrangement.
Murphy and Poist, (1998)	...“a relationship between a shipper and third party, which, compared with basic services, has customized offerings, encompasses a broader number of service functions and is characterized by a longer term, more mutually beneficial relationship.”	Narrow definition focusing on the notion of duration and the win – win nature of the relationship. Emphasize on customized and broader range of services.
Bask (2001)	...”relationships between interfaces in the supply chains and third – party logistics providers, where logistics services are offered, from basic to customized ones, in a shorter or longer-term relationship, with the aim of effectiveness and efficiency,	Reconciliation of narrow and broad definition. Involving B2B relationships. Recognize the wide range concerning, duration, scope, and content. Indicates a triadic relation between supplier, buyer and 3PL provider.

Table 2 Various narrow and broad definitions of 3PL. Adopted from Marasco (2008)

For the purpose of this study, a reconciliation of the broad and narrow explanations of 3PL arrangements was needed. The definition applied in this thesis amplifies the essential bond between the concept of 3PL and business to business relationships, where third party logistics providers cover the needs of their clients. The recognition of the potential range of the relations in terms of duration, scope and content is also captured in this definition proposed by Bask (2001): *“3PL is relationships between interfaces in the supply chains and third-party logistics providers, where logistics services are offered, from basic to customized ones, in a shorter- or longer-term relationship, with the aim of effectiveness and efficiency.”* Besides this, Bask (2001) calls attention to the triadic link between supplier, buyer and 3PL provider, suggesting that 3PL is a *set* of dyadic relationships. However, this study considers the two-way relationship between the 3PL provider and its client when conceptualizing 3PL arrangements. For the purpose of this study we have therefore modified Bask (2001) definition and define 3PL as *“a two way relationship between a 3PL client and an external 3PL provider representing everything from short-term arms – length to more collaborative long-term arrangements. Logistics services are offered, from traditional and single to customized and bundled offerings, and the partners share a mutual goal to achieve supply chain effectiveness and efficiency.”*

3PL provider

Included in the conceptualization of 3PL, a definition of the 3PL provider is needed. As discussed in the previous section, 3PL is usually associated with offering of multiple, bundled services, not just isolated services like transport or warehousing (Leahy et al., 1995). The parties taking over these logistics services are 3PL providers. Bask (2001) exemplify 3PL providers as supportive supply chain members, which entail that the service providers should support supply chain strategies. Lambert et al. (1998) recognize 3PL providers as supportive actors in the supply chain as well, and propose a definition where they distinguish *supportive* members from *primary* members of the supply chain: *“companies that simply provide recourses, knowledge, utilities, or assets for the primary members of the supply chain”* (Lambert et al. 1998). Another definition of such a supportive logistics actor has been given by Langley et al. (1999), which say that *“the 3PL provider is a company that provides multiple services for its customers, whereby it is external to the customer company and is compensated for its services.”* Since the latter definition covers both the offering of bundled services and the

notion of the provider's externality to the customer, it is applicable for the purpose of this study.

2.2.2 Outsourcing trends

Broadly speaking outsourcing of logistics services adds value by enhancing the performance of a supply chain member or customer. 3PL providers offer a variety of services and can add value through transportation, terminal activities, forwarding, distribution, information processing, and so on (Bask, 2001). Logistics as a functional system is vital to improve efficiency, both in the flow of information as well as in the flow of goods. Additionally, it is crucial to meet the low-cost expectations, and the fast, reliable delivery objectives both within the organization itself, and throughout the supply chain network (Rabinovich et al., 1999). Thus, logistics can add considerable contributions to organization's competitive advantage in both effectiveness (i.e. customer service) and efficiency (i.e. cost leadership) (Panayides and So, 2005).

Recent studies (Lieb and Bentz, 2004, 2005a) indicate an increase in the number of organizations in a wide variety of industrial sectors, using 3PL service providers to manage all or part of their logistics activities. This growing trend has also resulted in the emergence of large companies offering sophisticated logistics solutions on a global scale. Looking back on the past 20 years the business environment has gone through dramatic and deep changes. Jenster and Pedersen (2000) suggest a summary of these transformations consisting of three inter-related points:

- a) Globalization
- b) Information technology
- c) Rapidly changing customer needs and preferences

These trends are also visible in the market of 3PL service providers and play an important role because of their influence on the outsourcing evolution:

First of all companies nowadays are members of and compete in global markets. Having a supply chain perspective, the trend of globalization is characterized by long supply lines and worldwide distribution channels. Further it intensifies the call for higher service levels, and for timely and effective transportation system modifications (Sheffi, 1990). Increased global competition is seen as one of the main forces causing 3PL services to experience explosive growth (Marasco, 2008).

Secondly, information technology allows buyers and sellers of logistics services to communicate over data-rich, easy-to-use information channels and thereby it might act as a supporting factor of outsourcing logistics services. With a foundation in jointly agreed goals, information technology can be seen as a buffer fostering strategic partnerships and outsourcing (Lewis and Talalayevsky, 2000).

Thirdly, in view of the fact that more offerings are available, customers have a wide range of goods and services to choose from. (Jenster and Pedersen, 2000) Companies strive to meet the growing customer expectations and see the opportunity to achieve competitive advantages by outsourcing logistics services, consequently trying to provide clients with superior services (Wang et al., 2008).

2.2.3 Incentives for outsourcing

Cost driven outsourcing

Kremic et al. (2006), report that a relatively large share of the literature recognizes the desire to save costs as a justification for why outsourcing occurs. Outsourcing driven by cost savings can take place if the providers' costs are low enough that even after adding overhead, profit and transaction costs logistics service providers can still offer a service for a lower price. Even though significant savings can be achieved, savings are not a given outsourcing benefit. It seems to be confusion concerning the effects of cost driven outsourcing. Recent trends show that motivations for outsourcing are changing from costs to more strategic issues, such as core competence (Kremic et al., 2008).

Strategy driven outsourcing

As indicated above, organizations seems to be treating the logistical issues as a component of the strategic agenda instead of considering it as a part of an operational concern (Qureshi et al., 2008). Consequently, 3PL companies become increasingly sophisticated by expanding their scale and scope of operations in order to meet its own assumptions of a more strategic role within the supply chain (Selviaridis and Spring, 2007).

It is has been proven in research literature that the logistics function can be considered as a tool to maneuver the highly competitive, global market and to surpass rivals in

approaching the high expectation of stakeholders and customers (see e.g. Wang et al., 2008; Selviaridis and Spring, 2007; Menon et al., 1998).

In this intense competitive environment organizations are forced to perform reassessments and redirection of scarce resources. The resources are typically reassessed to the organizations core functions, where they can make the utmost positive impact. Core competence is one of the widely debated aspects linked to the motivations behind outsourcing, and is known as an organizational competitive advantage. Further, core competencies are utilized by core functions. Even though the concept of core competence is fundamental to the outsourcing decision, a precise definition to the term is subject to an ongoing discussion in academic literature (Kremic et al., 2006).

Gallon et al. (1995) states that “*the things that some companies know how to do uniquely well and that have the scope to provide them with a better-than average degree of success over the long term*”, can be recognized as the core functions of the company. This focus on “uniqueness” is also emphasized by Quinn and Hilmer (1994). Quinn and Hilmer (1994) combine two strategic approaches in order to leverage an organizations skills and resources. They suggest that managers are to recognize which processes that can create unique value for customers and which processes the organization can more effectively buy externally.

Supplementary, they propose a number of additional characteristics of the core competence issue. Effective core competencies are: Skill of knowledge sets, flexible long-term platforms, limited in number, unique sources of leverage in the value chain, areas where the company dominate, elements important for customers in the long run and embedded in the organization’s systems (Quinn and Hilmer, 1994). This refocusing of resources is proposed to be a central element supporting strategic outsourcing (Kremic et al., 2006; Quinn and Hilmer, 1994).

SCM highlights the strategic perspective as well, by noticing a need for tighter coordination of logistics activities and joint planning and monitoring across organizational boundaries. This should imply that making outsourcing a part of the strategic agenda by focusing on core skills, increases the need for closer coordination between the exchanging partners in the 3PL arrangement.

2.3 Supply Chain Coordination (SCC)

By revisiting the definition of SCM applied for this study, it indicates that the coordination of business functions both within the organization and across organizational boundaries is considered as a vital element. According to the SCM philosophy, systematic coordination on a strategic level can improve long term performance, not only for the individual companies, but for the entire chain (Mentzer et al., 2001). Arshinder et al. (2008), view this network of organizations as “*a continuous evolving dynamic structure*”. Companies work together as a part of a joint network or system, not as individual actors, which can create various coordination challenges, which in turn necessitate effective coordination systems and mechanisms (Arshinder et al., 2008).

The concept of coordination has been proposed to involve some sort of dependence between the actors, e.g. Xu and Beamon (2006) who claim that SC coordination (SCC) “*is a strategic response to the challenges that arise from the dependencies SC members.*” Typically, coordination is defined as “*the act of managing dependencies between entities working together towards mutually defined goals*” (Malone and Crowston, 1994).

Effective coordination among SC entities, such as manufacturers, third-party logistics providers, and retailers, can be the solution to achieve improvements in logistics processes in a rapidly changing business environment (Simatupang et al., 2002). Interdependencies among actors can be dependent activities such as, procurement, inventory management, and distribution (Arshinder et al., 2008).

When examining relational behavior between members of the SC, Arshinder et al. (2008) call attention to usage of coordination theory. They argue further that “*in any system, the smooth functioning of entities is the result of well-coordinated entities*” (Arshinder et al., 2008).

2.3.1 Managing the “Ultimate SC”

According to Mentzer et al. (2001), a 3PL provider is a part of the “ultimate SC”, and adds complexity to the system. Consequently, this increased complexity necessitates higher coordination efforts by the SC members. A variety of different coordination problems among logistics service providers and their clients have been discussed by academics and researchers. Mismatch between shipper and transportation provider (Stank et al., 1999; Stank and Goldsby, 2000), and the need for relational improvements among logistics service provider and its clients, (Huiskonen and Pirttilä, 2002) are just some of the issues reported in literature. The lack of ability to coordinate complex systems of business

relationships, like the “ultimate SC” (Mentzer et al., 2001), has been indicated as a problematic issue by researchers (e.g. Lambert and Cooper, 2000), and various consequences from poor SCC have been proposed: imprecise estimates, excessive inventory, hence, increased inventory costs, inefficient utilization of the existing capacity, enhancement in time to market, inadequate customer service, (Ramdas and Spekman, 2000), and a rise in the costs of stock out, expediting and transshipment (Fisher et al., 1994).

Several findings of literature focusing on how 3PL’s can improve the effectiveness of the supply chain are presented in an article by Mortensen and Lemoine (2008). They claim that organizational coordination, integration of business processes and well managed information processing, is the main source to achieve value creation.

2.3.2 Coordination Mechanisms

Different coordination mechanisms are connected to the management of SC activities. Coordination mechanisms, such as knowledge and information sharing, joint decision making and implementation of information sharing systems, have the purpose of dealing with the management of the interdependencies among SC members. By implementing methods or tools to solve the complexities regarding SCC, an improvement in performance can be achieved, such as, reduction in lead times, elimination of excess inventory, increased sales and flexibility to cope with demand volatility, improved customer service and revenue enhancements (Arshinder et al., 2008).

Respectively, information sharing and IT is suggested as key coordination mechanisms generating better information processing and consequently enhancing the organizations’ coordination abilities (Stank et al., 1999; Stank and Goldsby, 2000; Stock et al., 2000; Huiskonen and Pirttilä, 2002). For the intention of this study, special attention is given to information sharing and the use of information technology as coordination mechanisms among 3PL clients and logistics service providers.

Larsen (2000) believes that SCC is “*collaborative working for...mutual exchange information and integrated information systems...*” According to information processing

theory, the fundamental source causing coordination needs is uncertainty, which requires to be toned with information processing capabilities through establishing suitable coordination mechanisms (Grover and Saeed, 2007). Respectively, Gnyawali and Madhavan (2001) present a study where they focus on day-to-day communication between a company and its 3PL provider. The results demonstrate that logistics service providers and their clients make relationship-specific investments that are proportionate to the value added service of information sharing.

By reviewing case studies of SCC Arshinder et al. (2008) recognize that information systems are the most widely used mechanisms to coordinate business functions in the SC, which contribute to strengthen the importance of effective information sharing as a coordination mechanism.

The traditional intermediary relationship between companies and their logistics service providers has developed through the last years (Klein et al., 2007). After the introduction of information technology, it has become possible to expand the electronic intermediary function that allows the parties to share information related to inventory movement, or financial flow, based on the character of the supply chain or the product provided by the company (Klein et al., 2007). Lee (2000) believes that information sharing act as a fundamental element supporting broader supply chain integration.

2.3.3 Vertical Electronic Coordination versus Vertical Electronic Integration

In order to capture the different levels of sharing information among 3PL clients and their providers of logistics services, a deliberate distinction between vertical electronic coordination and vertical electronic integration is made. In essence this study argue that vertical electronic coordination involves information sharing through “traditional” means such as meetings, face to face, e-mail, fax and telephone, while vertical electronic integration involves the use of an integrated information sharing system (collaborative system) among two or more entities in the SC.

Vertical coordination concerns the flow of information, and cooperation on strategic issues and operational performance, (Buvik and John, 2000) and the coordination of communication activities have been commonly performed by “traditional” means of information sharing (e.g. telephone, fax and mail) (Hannås, 2007) Further Hannås (2007)

claims that “*vertical electronic coordination involves information exchange, and coordination of activities, tasks, and processes between firms by the means of digital information systems.*”

A similar distinction was made by Hannås (2007). By characterizing vertical electronic coordination based on the purpose of the exchange (collaborative or transactional purpose), she argued that it would “*capture the differences of activities and processes that are exchanged in an electronic form...*” The use of the term vertical electronic coordination was applied and defined “*as a mechanism for electronic governance forms (EGF) between firms*”, which is based on the type of vertical electronic coordination and the features of the integrated information system used (Hannås, 2007). Grover and Saeed (2007) claim that governance structures explain how entities control and coordinate and hence, represent different methods for information sharing. In other words, Hannås (2007) argues for a taxonomy consisting of two main governance forms of vertical electronic coordination, vertical electronic coordination for transactional purposes and vertical electronic integration for collaborative purposes, wherein interorganizational information systems are used as coordination mechanism. This argument is built on the belief that collaborative systems as a coordination mechanism can be configured to support different structures, and therefore the use of such systems can be a result of trade - offs between electronic brokerage and electronic integration (Grover and Saeed, 2007).

When focusing on the intensity of electronic data interchange (a type of collaborative information system) use, Bensaou and Venkatraman (1995) manage to capture another distinction regarding the variety of coordination mechanisms. They suggest two types of governance, electronic coordination and electronic interdependence, wherein information technology is the dominant mechanism. Among other factors Bensaou and Venkatraman (1995) claim that type of relationship between trading partners and the environment surrounding them are main sources of uncertainty and as a result determine the coordination needs.

Relationship and environmental characteristics	
Electronic control	<ul style="list-style-type: none"> - Highly standardized components - High market fragmentation - Mutual trust is absent - No significant investments between the actors - Structured routines creating little interdependence between actors - Low exchange frequency - Information exchange limited to operational necessity (contract based) - Use of information technology functionality almost non-existing (mail, fax or other standardized systems) - Low information processing capabilities
Electronic Interdependence	<ul style="list-style-type: none"> - Highly customized components, close to core competence - Investments have been made into the relationship - High interdependence - Rich and intense information exchange - Information technology enhancing information processing are used (EDI) - Information are used across multiple functions - Conflicts solved in a collaborative fashion - High commitment and willingness to engage joint actions

Table 3 Types of electronic governance. Based on arguments made by Bensaou and Venkatraman (1995)

The table above indicates a distinction between electronic control and electronic interdependence. Electronic control is marked by highly standardized products, low information coordination capabilities and needs limited to operational necessity. Electronic coordination is performed through traditional “paper based” solutions, such as fax and mail, as well as telephone. Electronic interdependence show signs of high interdependence between partners, the products are customized and the use of collaborative information systems across firm boundaries to enhance information coordination is clearly present (Bensaou and Venkatraman, 1995).

When discussing differences in the diversity in use of information technology, it is a necessity to elaborate on the distinction between the concepts of information systems (IS) and information technology (IT). According to Hannås’ (2007) reflections on this particular issue, information systems are applied to support decision making, coordination and control within as well as between organizations, while information technology on the other hand, facilitates the activities of gathering and processing the data and disseminating information to users. (Hannås, 2007)

Further, the integration of collaborative information systems is known to share similarities with the notion of assimilation. Assimilation is defined as “*the extent to which IT becomes*

an integral part of the organizational processes” (Cooper and Zmud, 1990). Electronic integration has also been suggested to capture the IT-enabled integration of business processes across organizational boundaries (Kim and Umanath, 2005). Kambil and Short (1994) propose the following statement regarding electronic integration:”Electronic integration the use of information technology to reengineer key business processes and business relations – enables new forms of organization that transcend traditional industry and firm boundaries. Indeed, electronic integration strategies alter fundamental structure of both firms as well as their environments, requiring a shift in the study of organizations from the level of focal firm to that of the business network.”

A main reason for using collaborative information systems is to advance the coordination between exchange partners through electronic integration. Such integrated systems may give tighter linkages between SC members, (Grover and Saeed, 2007) which create the opportunity to argue that traditional information sharing coordination solutions do not generate this tightening effect.

Transactional characteristics and relationship structures are believed to be a vital source of coordination needs. These requirements have to be corresponded with the proper coordination mechanism for efficient and effective governance (Grover and Saeed, 2007).

By making a deliberate distinction between vertical electronic integration (integrated information system) and vertical electronic coordination (mail, fax and telephone), and thereby view them as two separate electronic governance structures in which information technology is used as coordination mechanism, we may be able to capture diversity in use of information sharing solutions among 3PL clients.

Building on these arguments, vertical electronic integration is in this case, viewed as the use of an integrated information system between two or more companies in order to enhance the coordination of information. Vertical electronic integration is further elaborated in subsequent chapter.

2.4 Vertical Electronic Integration – The use of Interorganizational Information Systems (IOS)

2.4.1 Conceptualization and historical perspectives of IOS

Barrett and Konsynski first introduced the term “Inter-Organizational Information Systems” (IOS) in 1982 (Bakos, 1991, Robey, 2008). Later, IOS research developed into several different subject areas, such as specific technologies and further, supply chain management and electronic commerce (Robey et al., 2008). Today, there are many different types of IOS in the market including solutions like electronic data interchange (EDI), electronic data systems, web-based procurement systems, supplier relationship management systems (Saeed et al., 2005). Some of these systems have been an object of research and defined within the IOS field, as for example electronic marketplaces (see e.g. Kauffman and Mohtadi, 2003). Bakos (1991) suggested electronic marketplaces to be defined as *“an inter-organizational information system that allows the participating buyers and seller to exchange information about prices and product offerings*. However, because these systems or artifacts are considered as perishables, Robey et al. (2008) find it important that theoretical explanations are applicable to new technologies. Barret et al. defined one of the most recognizable and used definitions of IOS in 1982: *“A system that involves the sharing, between two or more organizations, of information resources such as hardware, software, transmission facilities, rules and procedures, data/databases and expertise”*.

IOS became a popular research field, developing during the 80’s, 90’s and into the second millennium. In its childhood, the majority of researchers had a quite transactional approach where the goal was to determine wherever the organization should use the market, or implement hierarchy in order to secure supply. While a market based approach has been defined by Malone et al. (1987) to *“coordinate the flow through supply and demand forces and external transactions between different individuals and firms”*, they view the hierarchal approach to *“coordinate the flow of materials thorough adjacent steps by controlling and directing at a higher level in the managerial hierarchy*.

In 1993, Clemons et al. observed a change in the companies’ behavior. Instead of using what Clemons et al. (1993) described as historical trade off guideline of procurement versus production, companies embodied new organizational forms such as ”strategic

networks” and value-added- partnerships”. These authors suggested information technology (IT) to be an important factor resulting in these changes. By coordinating through IT an increase in economic value can be achieved through increased operational efficiency and may create strategic advantages. Thus, IT enables better coordination of operations (Hannås, 2007).

The introduction of IOS systems made companies rethink their strategies when it came to other companies in the value chain. Historically, the norm was to either under invest in coordination tools, because they often were considered as investments of high specificity and therefore involved high risk, or vertical integration, that would eliminate the element of risking the other company to make an advantage of the situation (Clemons et al. 1993a).

In the early research of IOS, these systems were often considered as strategic weapons in order to gain competitive advantage (Vitale, 1986). Premkumar and Ramamurthy (1995) argue that IOS offers trading organizations considerable benefits, as for example reduced inventory costs, elimination of redundant handling of data entries, improved scheduling, processing, and distribution of goods and improved information accuracy. Discussions about first mover advantage when it comes to IOS adoption and its competitive advantage were present in IOS literature in late 80’ and early 90’s (see e.g. Clemons and Kimbrough, 1986; Vitale, 1986), but the competitive advantage when implementing IT solutions had not been of the scale expected by researchers at that time (Clemons and Row, 1991). Furthermore, the prediction of IOS as a competitive necessity in order to keep up, or in front of competing companies (Vitale, 1986), has also been questioned by later studies (see e.g. Clemons and Row, 1991).

The “move to the middle” hypothesis presented by Clemons et al. (1993a), predicted that companies would move away from ownership and vertical coordination because IOS would improve the conditions for outsourcing. This proposal fits the argument of Malone et al. (1987) who suggested that IOS would lead to a higher outsourcing degree and hence, less vertical integration. Further, Clemons et al. (1993a) implied companies would decrease the number of suppliers as a result of the introduction of IOS. However, as open standards have increased in numbers and range of applications, and the economic barriers have decreased, new IOS researchers have now started to predict an increase in the number of suppliers (Robey et al., 2008).

2.4.2 Types of IOS

Kauffman and Mohtadi (2003) identify three types of Business-to-Business (B2B) e-procurement systems platforms.

- **Proprietary platform procurement systems**

Kauffman and Mohtadi (2003) define proprietary platform procurement as *“those information systems with capabilities developed by individual firms (especially buyers or sellers), who have an incentive to specify the software and hardware infrastructure requirements so that they best match their own procurement infrastructure or supply services infrastructure capabilities.”* These systems were traditionally offered through private networks, or secure dedicated lines. One of the perhaps most recognizable systems is Electronic Data Interchange (EDI) which is still operative in many organizations in combination with a Web-based proprietary EDI (Kauffman and Mohtadi, 2003).

- **Open platform procurement systems**

Another procurement system is the open platform procurement systems. *“They tend to be developed in a more neutral manner with respect to the infrastructure capabilities of buyers and suppliers, both by industry consortia and by third-party electronic intermediaries (Kauffman and Mohtadi, 2003,).* However, these systems are more likely to be operated by an intermediary, or a B2B e-market firm, than a supplier or buyer (Kauffman and Mohtadi, 2003).

- **Hybrid platforms systems**

Hybrid platform systems are defined as a system with fragments of both proprietary platform procurement systems and open platform procurement systems (Kauffman and Mohtadi, 2003).

Bakos (1991) suggest that IOS should be categorized based on the functional structure of the interconnections between the participants in the system. This view is supported by many, though within certain variations (see e.g. Choudhury, 1997). The four functional structures are:

1. Market exchange with multiple suppliers and buyers
2. Many buyers doing transactions with one seller
3. Many sellers doing transactions with one buyer
4. One supplier transaction with one buyer

It is highlighted by Bask (2001) that *“the selling and ordering between TPL provider and interfaces in supply chains should be centered so that different processes can be implemented with the help of information technology.”* Just as observed in Bakos’ (1991) functional structures, Bask (2001) state that in a 3PL context internet and marketplaces introduce the opportunity for several actors to purchase and sell 3PL services. Further, a selected group of service providers might offer a joint marketplace or one 3PL company may organize a routinized marketplace for its logistics services. Electronic commerce and other IT investments is claimed to create new business opportunities for transportation logistics providers (Bask, 2001).

2.4.3 Integration challenges

Basically, the information technology is said to reduce costly activities like monitoring, controlling and coordination (Clemons and Row, 1992). However, there are discussions about how much integration that is needed to truly get advantages of IOS (Saeed et al., 2005). It has been indicated that research concerning the adoption of IOS has been very focused on the advantages of implementing IOS and that negative outcomes of the adoption perhaps have been overlooked (Robey et al., 2008).

Researchers have implied many reasons for why companies tend to not integrate with other players in their supply chains. Barret (2004) believes the companies might not understand the behavior of collaboration practices. The resistance of integration might also be urged by skepticism to other companies.

A study proposes this resistance is embodied in some companies because they are not *“willing to bet their future on such close integration with key supply chain partners”* (Bagchi and Skøtt-Larsen, 2002). Furthermore, there might also be boundaries and

limitations tied to the IOS itself, making it unattractive as an investment (Mortensen and Lemoine, 2008). One example pointed out by Ackerman et al. (2003) is ERP-systems which conceivably support external communication and coordination, but might also worsen the company's situation when it comes to internal cooperation. However, authors agree that standardization and open systems will enhance the adoption level of IOS (Robey et al. 2008, Mortensen and Lemoine, 2008).

Even though research findings indicate that overall SC effectiveness can be achieved through organizational coordination and integration, coordination through integration among 3PL clients and their 3PL providers appears to be less pronounced compared to other players in the supply chain, like for example customers or suppliers (Lemoine and Skjøtt-Larsen, 2004). In their study, the authors question the way cooperation and coordination between 3PL and manufacturers are organized. The researchers find the integration level between 3PL's and other companies unexpectedly low, especially integration with manufacturers (Skjøtt-Larsen and Lemoine, 2007). One argument presented in the study that might explain this asymmetry, is the view of transport services as a commodity and a cost that ought to be minimized, instead of consider such services as strategic important for the supply chain (Mortensen and Lemoine, 2008).

Gnyawali and Madhavan (2001) suggest the possible differences in hardware platforms, telecommunication protocols, data formats, enterprise systems, process standards and employee skill sets might explain the lack of integration between the logistics service providers and their clients. Further, at least one of the involved parties must make an effort in the integration process (Gnyawali and Madhavan, 2001).

Further, a need to examine the decision pertaining to electronic integration in the context of its possible impact on loss of brokerage effect is proposed by Grover and Saeed (2007). Their reasoning is based on the notion to assess the trade – offs between brokerage and integration when deciding whether the use of an integrated system is the appropriate approach.

2.4.4 The adoption issue

The adaption issue is a widely researched area of IOS. One of the probably most intriguing questions when discussing adoption is the forces behind it. Sanders and Premus (2002) bring up the environment as an important factor when it comes to what type of IOS that is

optimal. Other factors have been discovered and analyzed by different researchers for the past years; including power and competitive pressure (Premkumar and Ramamurthy, 1995) firm size, technological readiness and management support (Grover, 1993; Iacovou, Benbasat, and Dexter, 1995; Min and Galle 2003). Other motivations for IOS adoption that is mentioned in literature is reduced operation cost, competitive advantage and improved customer service (Premkumar et al. 1999). Subramani (2004) uses the “exploitation and exploration” approach, suggested by March(1991) to explain actions taken by organizations to analyze why organizations choose to adopt IOS.

2.4.4.1 IOS adoption and the nature of the 3PL relationship

Based on the intention for this study it is important to put emphasize on research focusing on the significance of the nature of the relationships among organizations, such as 3PL providers and their clients, and its possibility to impact governance and coordination decisions, hence influencing the adoption and use of IOS. The use of network technologies or collaborative information systems, combined with attempts to employ SCM philosophies, are continuously changing the way organizations behave both internally and externally with other SC members. SCM has launched a holistic view of the SC and covers the coordination of activities. As a consequence processes are integrated beyond narrow functional areas. New organizational forms can emerge from evolving computer networks, thus researchers are calling for increased attention to the nature of the relationships and the development of “electronic partnerships” (Hart and Saunders, 1998).

Choudhury (1997) suggests IOS adoption relies upon the cooperation of the parties, indicating that adoption may not be understood without taking the nature of the relationship into account. Some researchers have also detected unfavorable relationships as a hinder for IOS adoption with trading partners (Kurnia and Johnston, 2003).

Further, Son et al. (2005) measured the effect of two relational factors, power and reciprocal investments, within the context of developing an electronic data network. Their research model combined insights attained from social exchange theory and TCE. Even though they found that exercised power might not be efficient regarding successful

development of IOS, other factors generated results indicating that the management of relationships is a key source for developing IOS successfully (Son et al., 2005).

The definition of IOS state that the use of such collaborative systems “... *involves the sharing, between two or more organizations, of information resources...*” (Barrot, 1982) In other words, it cannot be used unilaterally. Organizations inhabiting positivity towards using IOS, needs to search for partners equally motivated, or persuade their existing partners to adopt and use IOS. Once the IOS has been adopted, it is an essentiality to continue investing in the technology in order to achieve coordination benefits. The employment of IOS induces improved information processing between organizations, thus making the information more visible among the trading partners (Hart and Saunders, 1998).

Supporters of social contracting theory claim that exchange activity is rooted in a social context, and argue further that frequent interaction between organizations can create relational capital which shapes the choice of exchange design. Hence, the nature of the relationship has a potential to shape the deployment of coordination mechanisms in the management of relations (Grover and Saeed, 2007).

2.4.5 The applicability of a multiple theoretic approach

IOS as electronic governance form has been an object of research for some years, which has resulted in many theories, but there is still no dominant theory in this field (Robey et al., 2008; Chatterjee and Ravichandran, 2004; Elgarah, 2005). Robey et al. (2008) argue in their guide of the theoretical development and future research that theoretical diversity is of great value dealing with the variety of facets attached to the IOS phenomenon. They also encourage further research to include multiple theories in order to “...*compensate for blind spots in specific theories.*” (Robey et al. 2008)

According to Robey et al. (2008), many of the researchers have used TCE as a part of their theoretical framework. Nevertheless, TCE is said to become less relevant in IS research as the asset-specificity and switching cost lose their dominant role for more open standards and systems. The early research on IOS systems considered the system rightfully as a

transaction specific capital investment. Further, the systems were large investments that had limited or no value outside the relationship it was implemented in (Wareham, 2003). Further, he states that the change in focus from proprietary highly transactional investments to open systems and standards, does not make the early research irrelevant. Instead, it makes a shift in the empirical focus towards other variables that influence relationships (Wareham, 2003).

Robey et. al. (2008) has suggested the use of multiple theories produce more balanced research which also account for cases where IOS is not adopted. A multiple theory was used by Clemons and Row (1993) in order to explain why the retailers in an industry did not want to implement IOS. Moreover, a theoretical approach in IOS research using multiple theories was the study by Wareham where he combined agency theory and networking theory. In his article, Warham (2003) presents different examples of relations between companies, arguing that electronic communication is expected, but the level of asset specificity is minimal measured up to key procedural and social variables.

It seems like there is an agreement in the later research of the possibilities and limitations of TCE, often demonstrated by introducing other theories in the theoretical approach such as relationship, power and product (Robey et al.,2008).

Additionally, Grover and Saeed (2007) approached the issues concerning IOS integration in manufacturing dyads by using multiple theories (information processing theory and social contracting theory), and thereby initiated further insights to relational attributes and transaction characteristics and its' importance in integration context.

As this study particularly seeks to focus on various theories regarding certain relationship and product attributes and their potential influence on the 3PL clients' choice of electronic governance, we purposely choose to employ a multiple theoretical approach to the subject of IOS integration suggested by Wareham (2003) and Robey et al., (2008). In the following chapter we present the trend towards focusing on relational factors in SCM, where we emphasize on the development from arms-length to more collaborative relational behavior among SC members. Moreover, a brief discussion where we highlight factors exhibiting cooperative behavior in a 3PL arrangement is given.

2.5 From arm's length to relational thinking in SCM

3PL arrangements involve transactions of logistics services among 3PL clients and their providers, and as discussed previously, the desire to save costs is believed to be one of the incentives for outsourcing of non-core processes to logistics service providers (Kremic et al., 2006). Transaction cost analysis has been a widely used theory when evaluating the choice of governance structures. Williamson's (1975) theoretical approach maintains the idea that buyers are subject to opportunistic actions from sellers. This will in turn result in stringent governance mechanisms in order to adjust and control relationships marked by high investments for each of the parties involved. On the contrary, relational environment (e. g, environment with low risk) where these mechanisms are present does exist (Dyer and Singh, 1998). Such relations are also known as arms – length relationships and have been applied as the basic platform when explaining governance mechanisms and practices (Hoyt and Huq, 2000). Just as business management has entered a state where firms compete in networks instead of firm versus firm (Lambert and Cooper, 2000), the way organizations manage their relational environment has been changing as well (Hoyt and Huq, 2000). Hoyt and Huq (2000) amplify that transactions between buyers and suppliers relied on arms-length arrangements based on market prices in the mid-1980s, while in the 1990s the relational issues were characterized by elements such as trust originated from collaboration and information sharing (Giunipero et al., 2008).

One perspective derived from the first decade is research results proposed by Walker and Weber (1984), where they present a model to explain the effects of transaction costs on the make-or-buy decision. Their results designated that make-or-buy decisions had a tendency to rely on economic factors. Relational contracting was irrelevant when explaining whether to outsource or not (Walker and Weber, 1984). Walker and Poppo (1991) made a comparison between suppliers within the organization, and single source suppliers external to the organization and identified four variables: asset uniqueness, competition in the supplier's market, newness of technology, and required investments. Even though the study results supported the arm's – length transactions, the authors distinguished relationship complexity by concluding that relational contracting could reduce the effects of asset specificity on transaction costs (Walker and Poppo, 1991).

These two examples underline that regardless of the growing consciousness of the role of collaboration in business relations (e. g. Heide and John, 1990), early supply chain research tended to highlight traditional way of doing business, or in other words the arms – length relationship. This mindset, based on the principles of transaction cost theory, offered a policy in order to explain buyer – supplier governance mechanisms into the 1990s (Hoyt and Huq, 2000).

On the other hand, some researchers began to question the explanatory power of transaction cost theory. Ghoshal and Moran (1996), initiated a shift in relational thinking, by focusing on trust and mutual collaboration as the foundational pillars of effective business interaction. Since transaction cost theory is based on opportunism, buyers and suppliers would ultimately experience some sort of “self – fulfilling prophecy”. They believed that organizations were noticing these insinuations and therefore shifting from such techniques to more collaborative and trusting relationships. Recent research publications present signals indicating that parties involved in supply chain activities seem to move away from transaction-based relational forms toward long – term collaborative relations (Giunipero et al., 2008). This new perspective, known to move away from adversarial approaches and give greater interest in establishing long – term relationships, introduce issues such as effective communication, sharing of information, assets, and knowledge, and trust as popular elements in the context of research (Dyer and Singh, 1998; Moore and Cunningham, 1999; Dyer and Chu, 2000; Johnston et al., 2004).

The table below is meant to illustrate the development of relational thinking from arms – length to more collaborative relational behavior amongst organizations.

From arm's – length to collaborative relationships

Authors	Objective	Explanatory factors/measurements
Walker and Weber (1984)	Explain the effects of transaction costs on the make-or-buy decision.	Economic factors (market price)
Walker and Poppo (1991)	Studied two types of buyer – supplier relationship. They compared <ol style="list-style-type: none"> 1) suppliers within the organization 2) suppliers external to the organization 	Transaction costs assets uniqueness Competition in the suppliers market Newness of the technology Required investments
Heide and John (1990)	Testing the following proposal: “Establishment of closer relationships between organization leads to a shift away from market based exchange toward a more bilateral governance”.	Level of joint activity Expectation of continuing relationship Level of surveillance that the buyer exercises over the supplier's process
Dyer and Singh (1998)	...”increasingly important unit of analysis for understanding competitive advantage is the relationship between firms...”	Relation-specific assets Knowledge-sharing routines Complementary resources/capabilities Effective governance
Johnston et al. (2004)	The study tested “a path analytical model of buyer-supplier relationships, linking the supplier's level of trust to the three categories of inter-firm cooperative behaviors and these behaviors to the buyer's perception of the relationship's performance.”	Suppliers trust <ul style="list-style-type: none"> - Suppliers perception of buyer's benevolence - Supplier's perception of buyer's dependability

Table 4 From arms – length to collaborative relationships. Adopted from Hoyt and Huq (2000)

2.5.1 Factors exhibiting cooperative behavior in a 3PL arrangement

As previously discussed, organizations tend to focus on their core operations and outsource non-core activities to providers of logistics services, hence adopting a strategic approach to outsourcing. As insinuated above, an additional trend is that organizations become more and more aware of the collaborative aspect of economic exchange. These strategies, which move away from both cost driven outsourcing and transaction cost analysis, enhance the need for closer cooperation among SC members. Consequently, a rising interest is generated in understanding how companies form and manage their relationships, as well as how such interorganizational operations are coordinated (Huiskonen and Pirttilä, 2001).

In order to gain deeper perceptiveness in how buyers of 3PL services and 3PL providers conduct and structure their relationships, researcher has paid particular attention to the elements exhibiting cooperative behaviors between the supply chain parties. The empirical research provides insight into the structural nature of the relations where the attributes of attention have been in terms of number and typology of activities outsourced and duration (Marasco, 2008).

Moreover, recent studies cover behavioral features such as trust, commitment, dependence, power, conflict and equity, (see e. g. Frazier, 1983; Etgar, 1976; Morgan and Hunt, 1994; Moore and Cunningham, 1999; Heide and John, 1988; Gardner et al. 1994; Knemeyer et al., 2003; Knemeyer and Murphy, 2005, Moore, 1998; Dyer and Chu, 2000) and hence been established as vital variables in relational and economic exchange. A marketing perspective appears to be engraved in most of these studies, which indicates that these factors are not unique to the SCM literature. The factors mentioned typically examine the distinctions in key relational factors across distinct types of relationships.

Three different types of relationships has been suggested in the context of supply chain management; arms – length/transactional exchanges, cooperative relations, and integration. As it takes account for the entire value chain, the latter category is said to describe the essence of SCM. Integration also calls for recognition of the delicate balance between power and risk sharing, thus for higher requirements for trust and commitment within the supply chain (Giunipero et al., 2008).

In similar fashion, 3PL arrangements cover straightforward arms – length relationships involving everything from a small number of relative simple logistics activities, to sophisticated logistics solutions including value – added activities (Stefansson, 2006). In a 3PL setting, where the 3PL clients purchase *services* rather than physical products it is reasonable to believe that trust, commitment and dependence among the trading partners can be of greater significance as it often involves high degree of organizational interdependence.

Rindfleisch and Heide (1997) state that organizations ought to apply coordination mechanisms that can effectively solve problems related to governance. Since these problems are believed to emerge from contingencies such as the transactional environment and relational direction amongst exchanging organizations (Rindfleisch and Heide, 1997), we seek to shed light on factors exhibiting cooperative behavior when investigating diversity in use of information technology. Essentially, when examining the nature of the relationship, this study wish to review 3PL provider - 3PL client arrangements from three main relational perspectives; duration, 3PL provider power and 3PL client dependence, and mutual trust and commitment. Additionally we wish to draw attention to the outsourcing of services related to strategic products. These antecedents of cooperative behavior are discussed in subsequent chapters and linked to the issues concerning coordination and integration in 3PL arrangements. Corresponding hypotheses are presented for each antecedent.

3. Trust and Commitment

3.1 Conceptualizing/defining trust

In the context of business relationships and organizational analysis environment the meaning of trust has been the center of attention for many sociologists, economists and management researchers. Even though it seems difficult to find a universally accepted approach concerning trust, certain key elements about trust has been recognized and gained support (Rousseau et al., 1998).

First of all risk and interdependence among actors is closely associated with trust. There would be no need for trust to exist if every move one make has a known result or outcome. Trust has been argued to be the acceptance of *“the risks associated with the type and depth of the interdependence inherent in a given relationship”*. No dependency between actors means that the element of trust is not present (Sheppard and Sherman, 1998). Further, risk and interdependence can be the creators of vulnerability. Dyer and Chu (2000) approaches trust by saying that trust involves, *“one party’s confidence that the other party in the exchange relationship will not exploit its vulnerabilities”*. Conversely, the acceptance of vulnerability will become easier if the parties involved have positive expectations of future behavior. Positive future expectations is said to be highly correlated with the existence of trust (Sheppard and Sherman, 1998).

Gambetta (1988) states that *“when we say that we trust someone or that someone is trustworthy, we implicitly mean that the probability that he will perform an action that is beneficial or at least not detrimental to us is high enough for us to consider engaging in some form of cooperation with him.”* This definition is supported by Gulati (1995) which visualizes trust as *“a type of expectation that alleviates the fear that one’s exchange partner will act opportunistically.”* These approaches suggest that the motivation to act in favor of another is embedded in the process of conceptualizing trust. This motivation is explained by Moorman et al. (1992) which introduce the behavioral intention of *“willingness”* by claiming that trust consists of compliance to rely on and have confidence in an exchange partner.

Mayer et al. (1995) also points out *“willingness”* as a distinctiveness regarding trust by defining trust as the *“willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespectively of the ability to monitor and control that other party.”*

Even though Morgan and Hunt (1994) believe that this *“willingness”* should be viewed as an outcome of trust and not as a part of the definition, this research support the arguments given by Mayer et al. (1995) and Moorman et al. (1992) They allege that a trading partner must be willing to take actions that entail risk and express reliance towards the partner in order to be considered trustworthy, otherwise trust is limited. It seems reasonable to view trust as a behavioral intention which engages vulnerability, uncertainty and the willingness of the exchange parties to take risks.

Since trust seems to amplify the scope to which partners take on risky exchanges, trust may increase the possibility of actors to be committed to a relationship (Moorman et al., 1992). Based on the belief that actors are unlikely to be committed to something they do not value and that commitment normally does not change often, the following definition has been proposed: “*commitment to a relationship is an enduring desire to maintain a valued relationship*” (Moorman et al., 1992). Morgan and Hunt (1994) refer to commitment as vital to all relational exchanges between firms, and argue further that “*when both commitment and trust – not just one or the other – are present, they produce outcomes that promote efficiency, productivity and effectiveness.*” And because of both partners’ efforts and sacrifices in trading agreements, committed relationships have the confidence which is essential to ensure that the relation endures (Boyle et al., 1992).

3.2 Trust and commitment in social- and economic exchange

A starting point for social exchange is the need to reciprocate for benefits obtained from the trading in order to continue receiving them. The sharing of relational benefits makes the relationship more interdependent and acts as a foundation when establishing mutual trust (Moore and Cunningham, 1999). As trust can be able to reduce risk of opportunistic behavior, lower transaction costs and develop long – term oriented arrangements (Williamson, 1975, Anderson and Weitz, 1989), social exchange necessitates trusting others to discharge their obligations (Moore and Cunningham, 1999). Trust as a value of social exchange has also been described as an “externality” which provides economic value and increase efficiency, thus giving trust an economic perspective. Organizations are believed to try to maximize economic value in a relationship by selecting collaborators who demonstrate social exchange values, such as cooperation and trust (Williamson, 1975).

Interorganizational exchange theory implies that winning relationships depend greatly on social exchange behavior, such as trust and commitment (Williamson, 1975; Ring and Van de Ven, 1994). Consequently a rising interest in interorganizational trust has evolved over the past years (Moorman et al., 1992; Morgan and Hunt, 1994; Zaheer et al., 1998; Dyer and Chu, 2000).

While some researchers speak of trust as a feature or quality of the relationship, (Dwyer et al., 1987; Morgan and Hunt, 1994) others address the element of trust as an actual determinant of relationship qualities, such as the amount of cooperation and the functionality of conflict between the parties. (Moorman et al., 1992) Closer examination reveals that the features of trust and its role as determinant in exchange activity might be “*dependent upon the form of the relationship in which this exchange takes place*” (Rindfleisch, 2000).

If trading partners operate in an environment where trust is lacking it can create a state where every transaction has to be verified and the partners see the necessity to spend time on analyzing each others’ reliability and trustworthiness. In addition to an increase in transaction costs, this situation will compromise cornerstones of supply chain goals, such as efficiency, effectiveness and productivity (Kwon and Suh, 2004).

3.3 Trust and commitment when sharing information in a 3PL arrangement

An emergent number of organizations form outsourcing relationships, alliances, joint ventures and other types of inter - firm exchange. Since the use of 3PL service providers has increased, a profound understanding of the structures of these arrangements and the cooperative behavioral elements behind them has been given augmented attention in research literature. It is commonly known that it can be difficult achieving and sustaining cooperation among organizations. 3PL arrangements have especially been highlighted as difficult because of their property of adding complexity to the SC (Mentzer et al., 2001). Hence, it is reasonable to believe that higher levels of trust and commitment are a necessity in order to manage these trading relationships efficiently. It has been suggested that unlike other governance mechanisms, such as contracts and financial hostages, trust and commitment are unique because it has the ability to generate value beyond transaction cost reductions. Thus trust can be a basis of substantial competitive advantage for logistics outsourcing partnerships (Dyer and Chu, 2000). High trust levels are also found to increase the cooperative behavior among client and 3PL service provider (Johnston et al., 2004).

In a 3PL perspective, the dependence between trust and type of relationship is discovered by Moore and Cunningham (1999). They propose results which indicate that shippers in logistics alliances trust their 3PL service provider more and are more willing to rely on

their provider than that exhibited by shippers in purely transactional exchange arrangements (Moore and Cunningham, 1999). Knemeyer et al. (2003) also uncovered significant differences for intangible behavioral attributes like trust, commitment, dependence, communication, and shared benefits, across distinct types of partnerships.

Hart and Saunders (1998) believe that the use of EDI (IOS) may introduce “procedural changes” to the transactions involved, which initiate certain vulnerabilities for the trading partners. Moreover they state that trust “*is an important antecedent of EDI use...*” and elaborates further that “*...trust mitigates the uncertainty related to these vulnerabilities*” (Hart and Saunders, 1998). Just as suppliers have the opportunity to express their reliability by consistently meeting the customers’ needs (Hart and Saunders, 1998), 3PL providers can demonstrate reliability or trustworthiness by fulfilling the 3PL clients’ requirements in terms of lead times, on – time delivery, no damaged goods, cost reductions, and the ability to handle rush orders. From the suppliers’ point of view, customers can express their trustworthiness by presenting precise forecasts and thereby creating the flexibility suppliers need to manage their inventories effectively. By fulfilling each others’ needs, the trading partners contribute to build relational trust (Hart and Saunders, 1998). Because this study argues that it is reasonable to believe that the 3PL client is more dependent upon the 3PL provider rather than vice versa, the 3PL client commonly is the one who has to develop greater trust.

Information sharing between entities in the SC often requires a discharge of guarded financial and strategic information to other partners who have been or will become competitors in the future, since “*effective information sharing is heavily dependent on trust beginning within the firm and ultimately extending to supply chain partners*” (Bowersox et al., 2000). Since a 3PL provider typically has a portfolio of several clients competing in the same market, the concern of sharing information with competitors might be particularly high in 3PL arrangements. Such high degree of interdependence among providers and their clients consequently requires high levels of trust and commitment. Furthermore, it is commonly known that the value of shared information degrades if the information available cannot be shared by the partners (Kwon and Suh, 2004). Based on this reasoning, trust and commitment is considered as a vital factor when sharing information and managing electronic partnerships, especially between partners in a 3PL arrangement.

It is reasonable to assume that the demonstration of trust among 3PL client and its provider encourage commitment and thus increasing the probability of vertical electronic integration. This assumption is based on Moorman et al. (1992) arguments that trust amplifies risk among trading partners and thereby increases the possibility of commitment in the arrangement.

H 1: The 3PL clients' commitment to the 3PL arrangement is positively associated with vertical electronic integration between a 3PL client and its 3PL provider(s).

4. Power and Dependence

Emerson (1962) pointed out that “*power is an attribute of the social relation; it is not an attribute of the actor*”. He explains this by saying that power is often treated as though it was a property of a person. Leadership and conformity are commonly referred to as personal qualities of “leaders” and “conformers” as if they were a group of distinguishable kind of people. Hence, in a sociological perspective, power should be treated as an attribute of a relation rather than a person (Emerson, 1962). According to Emerson (1962) social relations entail “*ties of mutual dependence*”. He calls attention to the relationship between power and dependence, by implying that the dependence of one actor provides the basis for the power of the other actor. Consequently actor A’s power in the relationship with B is inverse of B’s dependence upon A. In a SCM perspective, the power of a 3PL provider over a 3PL client is related to the dependence of the client on the 3PL provider. This relationship is a part of how Emerson (1962) defines the nature of power: “*...the power of A over B is equal to, and based upon, the dependence of B upon A...The dependence of actor A upon actor B is (1) directly proportional to A’s motivational investment in goals meditated by B, and (2) inversely proportional to the availability of those goals to A outside of the A-B relation*”. Emerson (1962) used the word “goals” to describe the gratifications deliberately sought as well as the rewards deliberately attained through the relationship. The “availability of those goals” refers to optional possibilities of goal accomplishment (El-Ansaray and Stern, 1972). The definition of power given by Emerson (1962) implies that in exchange relationship dependence is the recognition by both parties that the relationship provides greater benefits than either of the actors could

accomplish alone, or that outcomes obtained from the trading are bigger than potential benefits from other business alternatives (Mohr and Spekman, 1994; Dywer, et al., 1987).

4.1 Asymmetric and symmetric dependence in exchange relationships

Power and dependency have been extensively covered in marketing literature, and are in addition to conflict, possibly the most studied aspects of channel working relationships (Heide and John, 1988; Frazier, 1983; Etgar, 1976; El-Ansary and Stern, 1972; Anderson and Narus, 1990). Anderson and Narus (1990) contend that rather than considering an organization's *perceived* dependence on an exchange relationship, the organization's *perception* of its dependence *relative* to its partner's dependence on the trading relation is of greater interest in channel research. Relative dependence has been defined as "*a firm's perceived difference between its own and its partner firm's dependence on the working partnership*", and is known to "*determine the extent to which a firm will have influence over, and be influenced by, its partner*" (Anderson and Narus, 1990).

Power is seen as a primary consequence of relative dependence (Anderson and Narus, 1990). Additionally, relative dependence can be an indicator of whether a relationship is symmetric or asymmetric. Symmetry can be determined by recognizing to which extent the exchange partners assess one another's resources. Equally valued resources indicate that the relationship between the two parties is symmetric. If one party values the resources of the other actor more, the relationship is asymmetric. The level of dependence range from high to low in symmetric relationships, and in asymmetric relationships the less dependent partner holds the power position, and therefore dominates the exchange (Buchanan, 1992).

4.2 Resource Dependence (RDT)

Dependence is known to occur when external parties provide important recourses for which there are only few alternatives (Emerson, 1962). In trading relationships the center of attention is on the recourses provided by the partners involved. The external recourses offered ensure the organization's continued existence (Roemer, 2004). Organizations are not self-sufficient. In a supply chain setting companies rely on its trading partners for the supply of raw materials and logistics services. Such resources are crucial to the company's performance. Since these assets can have limited availability, the company has to develop

and maintain relationships with exchange partners controlling these resources (Buchanan, 1992).

Buchanan (1992) reports, that the boundaries of the negotiated exchange relationship can be identified from the symmetry of the dependence relation. Frazier (1983) also argues that partners in relational exchange are, to some degree, dependent on each other. He supports the notion that dependence among trading partners can be referred to as a firm's necessity to uphold an exchange relationship to achieve desired goals (Frazier, 1983). This phenomenon has been referred to as resource dependency theory (RDT). RDT embrace the fact that organizations are entrenched in a network of relationships. In order to manage the uncertainties in this network environment, the exchange organizations are dependent on each other for survival. Consequently, the organizational power depends upon the resource dependency relationships it has with other organizations (Medcof, 2001). RDT states that if a 3PL client is highly dependent on the resources offered by a 3PL provider, the logistics service provider will hold the relative balance of power.

Based on earlier proposed definition of power and recourse dependence, Heide and John (1988) argue for a measurement – scale consisting of four means by which dependence can be increased in transaction specific investments. The scale has been applied when measuring distributors' perception of their own dependence on their suppliers' dependence.

First, dependence encompasses the *importance* of the recourse. A resource is important when the outcomes gained from a relationship are greatly valued. Consequently the focal party becomes more dependent. Augmented dependence is also connected to the *magnitude* of the exchange (Heide and John, 1988). Dependence increases when for example a 3PL client purchases a large fraction of services from one particular 3PL provider.

Second, an augmentation in dependence is visible when the outcomes from a relationship are comparatively better than the outcomes available from other business alternatives (Heide and John, 1988). Hence, the buyers of 3PL services dealing with a “best-in-class” 3PL provider can experience to be more dependent as the results linked towards that particular logistics service provider are higher than those available with lower performing providers.

Third, the *concentration* of exchange partners increases the dependence. When fewer alternative sources of trading are accessible to the focal party the dependence of the incumbent exchange partner enhances (Heide and John, 1988). For instance, when a 3PL client has a relation to a service provider who holds a patent on a specific technical solution, he will be dependent on the provider because no other providers are able to provide this specialized competence.

The fourth and last means proposed by Heide and John (1988) is related to the potential alternative sources of exchange available in the market. Few potential sources available increases dependence. *“The presence of potential exchange possibilities is assessed by examining the difficulty involved in replacing the incumbent exchange partner.”* (Heide and John, 1988) A 3PL client experiencing difficulties when substituting a 3PL service provider signifies few potential alternatives, thus the clients’ dependence upon the provider increase. El-Ansaray and Stern (1972) also support the usage of the notion of *replaceability* when measuring dependence among organizations. For the purpose of this study, we suggest that 3PL providers might exercise power over the dependent 3PL client, and possibly influence them to implement IOS and thereby integrate electronically.

H2: The more dependent the 3PL client is on the resources offered by the 3PL provider, the greater is the 3PL provider’s power to influence its client to integrate electronically.

4.3 Dependence in relation to typologies of outsourced logistics activities

Logistics management activities can be separated into two; activities concerning physical flows such as handling, storage and transportation, and activities concerning information flows such as invoicing, goods clearance and order entry (Van Damme and Ploos van Amstel, 1996). But as mentioned introductorily, outsourced activities can be classified more thoroughly (Wilding and Juriado, 2004).

The first category presented is related to transport and shipment operations, such as shipment planning, fleet management, freight payment and auditing (Boyson et al. 1999), line haul and network based transport (van Laarhoven, 2000).

Second category refers to warehousing and inventory activities which include storage, order picking, inventory management and various warehousing operations (van Laarhoven, 2000; Boyson et al. 1999).

Thirdly, operations related to information systems are mentioned, and comprise activities such as track and trace, order entry and forecasting (van Laarhoven, 2000). Last, Wilding and Juriado (2004) introduce a category related to value added services. This group represents activities like packaging and final assembly (van Laarhoven, 2000), which indicate that these operations are commonly performed by a manufacturer at the end of the supply chain. Lieb and Randall (1996) name these offerings as “end – of – supply – chain services”, while in a 3PL setting they are generally referred to as value added services.

4.3.1 Bundling

3PL companies continue to expand their assortment of services offering bundled services including everything from simple transportation to consulting, contract management, information sharing solutions, and financial services (Lieb and Bentz, 2005b; Lieb and Kendrick, 2003). Delfmann et al. (2002) presents a model consisting of four different types or clusters of 3PL providers based on their standardization of the services offered. The first group provides standardized services like transportation and warehousing. Secondly, they propose a cluster of providers who offer bundled services, where the standardized services are put together on packages which fulfill the customer’s special requirements and demand. The third group comprises services which are highly customized (Delfmann et al. 2002). Reports indicate that by offering supplementary services, 3PL providers can enter segments of the supply chain with higher value adding services than the generally offered transport – and warehousing related services. Transportation and warehousing services are rapidly becoming commodities with low involvement from clients, low margins, and stability of relations. In other words, by expanding the scope of services, the logistics service provider can deepen the relationship with customers, and possibly give the provider a position as value added solution supplier (van Hoek, 2000). But customers seem to show little or no interest in these solutions. This is supported by evidence from industry surveys which show that buyers of 3PL services prefer to outsource transport- and warehouse – related functions. The bulk of logistics services bought are to be found in the areas of transportation and warehousing (Lieb and Bentz, 2005b; Lieb and Kendrick, 2003). Especially value – added solutions such as information systems are marked by low

priority, and perceived as too important to outsource. Organizations have expressed their reservation about the 3PL service providers' capabilities with information systems, and suggest that many of the existing systems are supply-driven. Even though 3PL providers wish to offer IT related services and have made relatively large technological investments, the systems seem to disregard the shippers' requirements and needs (Wilding and Juriado, 2004).

On the other hand, it has been stated that in essence, organizations outsource clusters of non-core operations which create "*strategic subsystems*" (Rabinovich et al., 1999). The activities in these clusters have a mutual influence on what customers recognize as important product attributes. Equally, they commonly share operational skills, processes, technologies and transactional information. Research support this by demonstrating that shippers outsource services in bundles by combining activities that share common elements like transactional similarities and information flows (Ellram and Maltz, 2000; Rabinovich et al., 1999). Additionally, Rabinovich et al. (1999) introduced survey results revealing that organizations outsource bundled functional activities in distinct patterns with the objective of achieving efficiency gains replicated in the attainment of economies of scale, scope, and conjunction. The result indicates that companies outsource bundled transactional and physical functions within inventory and customer – service areas. They also provided outcomes signifying that companies "*bundle the outsourcing of logistics information systems with the information flows across transactional functions such as inventory management and shipment planning*" (Rabinovich et al. 1999).

Since customers provide suppliers a large share of their sales revenue, suppliers tends to be dependent upon its customers. Typically, the larger the percentage of the revenue, or the bigger the supplier pool customers can choose a service, the greater the supplier's dependence on its client. Nevertheless, supplier dependence can be counterbalanced if the supplier, hence the 3PL provider, offers relatively unique logistics services or invests in assets required by the customer which is not possessed by potential suppliers in the market (Hart and Saunders, 1998).

This study has previously stated that 3PL providers are continuously in search for a deeper relationship with their customers, and they approach this by offering relatively customized value adding service in bundles, e.g. information sharing system and expediting (Rabinovich et al., 1999). The customers are answering by outsourcing clusters of

activities, which commonly share elements like transactional similarities and information flows (Ellram and Maltz, 2000; Rabinovich et al., 1999).

In situations where the supplier is dependent on the customer, Hart and Saunders (1998) state that, “*the customer may exert power over the dependent supplier to influence that firm to adopt EDI*”. Just as Hart and Saunders’ (1998) argue about the possibilities of counterbalancing this supplier dependence, 3PL provider’s dependence might be offset by offering customized, bundled logistics solutions to its 3PL clients.

Derived from this interpretation, we expect that the 3PL clients’ dependence upon the 3PL provider increase in situations where the client outsources services in bundles.

H3: The more dependent the 3PL clients become by bundling their outsourced logistics services, the greater is the 3PL providers’ power to influence its client to integrate electronically.

5. Outsourcing services related to strategic products

5.1 The strategic importance of the product

Not much has been written about how product characteristics, nor how its strategic nature influence the choice of coordination mechanisms between a 3PL client and its providers. Literature observing transactional characteristics generally focuses on electronic dyads between buyer and supplier (see e.g. Hart and Saunders, 1998; Choudhury, 1997). Nonetheless, Maltz and Ellram (2000) imply that the logistics service provider is as related to the product perception as the one buying the product is. The strategic importance of the product purchased by the 3PL client might have an effect on buyers purchasing conduct, and thus create fluctuations in buyers’ apprehension regarding how they choose to coordinate their logistics services (Maltz and Ellram, 2000). While researchers have studied electronic governance forms in electronic buyer – supplier dyads by focusing on complexity and uncertainty of the transaction, this study aims to highlight the strategic importance of the product by using Kraljic’s portfolio approach as theoretical lens when examining electronic governance forms in 3PL provider – client relationship.

IOS is typically used to manage purchasing operations between organizations (Grover and Saeed, 2007), which call for a need to examine transactional characteristics as well as the product and thereby obtain a greater understanding of how the product characteristics impact on the diversity in use of IOS.

Metcalf and Frear (1993) test the role of perceived product importance and how it affects the complexity of interaction processes in relationships, and thereby test the perceived product importance directly. They find that product importance is positively correlated with higher levels of information exchange, higher levels of trust and better interpersonal relationships, and higher perceived levels of cooperation (Metcalf and Frear, 1993).

Third parties seeking to market logistics services need to be aware and pay attention to what types of purchases they are servicing. A product can be of importance for an organization for a number of various reasons, and the buyer behavior literature gives an indication that the particular purchase makes a difference with respect to the process of buying and the continuing buyer – supplier relationship (Maltz and Ellram, 2000).

Kraljic's purchasing portfolio approach (1983) ties purchasing strategies to product type, and views strategic items as the products with high profit impact and high supply risk.

Strategic purchased items may represent major costs for a company and can be critical for its competitive advantage (Maltz and Ellram, 2000).

5.2 Kraljic's portfolio matrix

According to Kraljic (1983) purchased products can be categorized into four groups which require specific purchasing strategies.

Profit Impact	High	<p>Leverage items:</p> <p>Exploitation of purchasing power</p>	<p>Strategic items:</p> <p>Diversify, balance or exploit</p>
	Low	<p>Non - critical items:</p> <p>Efficient processing</p>	<p>Bottleneck items:</p> <p>Volume assurance Search for alternatives</p>
		Low	High

Supply Risk

Figure 6 Kraljic's portfolio matrix (1983)

Strategic products

Strategic products has a large impact on profit and has high risk attached to the purchasing. Typically, strategic products are offered by only one single supplier, which according to the Kraljic matrix suggests the company to develop and maintain a *strategic partnership* with the supplier in order to reduce risk due to mutual trust, and commitment. The intensified partnership will balance the power between the companies and result in a high mutual dependency. Moreover, the strengthened relationship will also result in a higher interdependence between the partners. (Kraljic, 1983)

Bottleneck products

The typical characteristics of bottleneck products have a moderate impact on the company's profit when purchased. Further, there is a high degree of risk associated with the supply of these products. Since this situation is dominated by the supplier, the commonly recommendation is to accept the situation and focus on *minimizing the negative effects of the relationship*. One strategy is for example to keep a safety stock, or consigned stock agreements with the supplier. Another way to handle bottleneck products is to *reduce the dependence of the supplier*. One possibility is to find another supplier, or

broaden the specifications of the product so other suppliers will be able to deliver the product as well (Kraljic, 1983).

Non-critical products

Products with low supply risk and low economical impact for the company are normally considered as non-critical products by Kraljic. Following the nature of the Pareto principle, handling these routine products is time absorbing for the purchasing department and they represent only a small sum compared to the overall turnover. There are two suggested strategies for non-critical products (Gelderman and Van Weele, 2003); *pool purchasing requirements* which seek to reduce the complexity by standardizing and bundling the purchasing operations, and *individual ordering, and efficient processing*.

Leverage products

Leverage products have a relatively high impact on profit and can be purchased from a variety of suppliers. The supplier dependence in this situation is described as low; hence the supply risk will also be reduced. Considering the high quantity, the buying party will have both possibilities and incentives to negotiate with the supplier since small reduction in a product's cost will result in a large sum at the bottom line (Olsen and Ellram, 1997). The recommendation for handling leverage products is to *exploit bargaining power*. Since there is little risk involved with interchangeable suppliers and products, the portfolio matrix proposes the buyer to exploit his dominating position. Coordinated purchasing is recommended by Kraljic (1983). This approach includes umbrella agreements of relatively short time horizon where the ordering itself is placed at an administrative level.

5.3 Linking the 3PL provider to the product

As mentioned several places in this study, the SCM philosophy introduces a holistic, strategic view of the SC. In a 3PL perspective, this holistic approach seeks to answer how 3PL service providers should offer their services toward different types of SC strategies (Bask, 2001). A 3PL provider is commonly positioned between the supplier and the buyer, and might have a central function in handling the end customer (Bask, 2001), as well as the product purchased by the customer (Maltz and Ellram, 2000). Different purchasing strategies are attached to the four groups of products in Kraljic's (1983) portfolio

approach, and typically consider buyer supplier relationships. However, based on the holistic view of the SC it is reasonable to believe that these logistics purchasing strategies influence how 3PL providers choose to segment their services, and thus affect how the 3PL client prefer to coordinate logistics processes with their logistics service providers with respect to the strategic importance of the product.

Bask (2001) introduce three segments of 3PL strategies based on services offered; 1: routine, 2: standard, and 3: customized. This 3PL service segmentation model is deliberately chosen based on its contents, for the purpose of linking 3PL services offered, purchasing strategies employed and thus the product processed by the 3PL provider. Additionally, each of the three categories has distinct requirements pertaining to information processing.

The reasoning behind the first category, routine services, is economies of scale. In other words, the services are volume based. Traditional operations like transportation are offered, with the focus on competitive pricing and reliability (Bask, 2001). Looking at Kraljic's matrix it is reasonable to assume that these offerings are connected to efficient processing of bottleneck and non-critical items. A marketplace where actors buy and sell 3PL services is a typical coordination mechanism for this category (Bask, 2001).

Second category, requires a closer relationship and coordination with the 3PL provider, and often includes special transportation solutions where products need to be cooled, heated, etc. in addition to standardized operations (Bask, 2001). Following Kraljic's reasoning on profit impact and supply risk, these items can be categorized as leverage. Electronic commerce has provided new opportunities for actors offering services with standardized elements, such as express transportation (Bask, 2001).

Last, Bask (2001) introduce customized 3PL services where the 3PL arrangement is in its closest form and the offerings can be highly customized. Customized 3PL services require an open information sharing environment, and causes high IT investments to ensure efficient information processing between the parties in the 3PL arrangement (Bask, 2001). High IT investments can signify vertical electronic integration. Since customized 3PL services generate closer partnerships between client and provider, it is reasonable to assume that the products processed in this setting are mainly of high strategic importance to the 3PL client (Kraljic, 1983).

Linking theories regarding the holistic view in SCM philosophy and logistics strategies among 3PL clients and 3PL providers reveal that outsourcing of logistics services related to strategic products can have a decisive effect on the 3PL clients' preferred electronic governance form.

H 4: The strategic importance of the product is positively associated with vertical electronic integration between the 3PL client and its 3PL provider(s).

6. Duration

Bowersox (1990) positions the relation between 3PL provider its clients on a continuous scale ranging from single transactions to integrated service agreements. At the lowest level the altitude of the cooperation encompasses single transactions and corresponds to the traditional relationship between provider and client in the market of transportation services, and generally involves a short time horizon. No commitments are made between the parties apart from the specific transaction. While moving to the right on the scale, the arrangements become more formalized. The mutual obligations increase and the relationship move from short term to long term agreements (Bowersox, 1990). Moreover, Cox (1996) suggests a relationship typology spanning from contracts and incentives to market exchanges. While this typology classifies various types of buyer-supplier relationships, Halldorsson and Skjøtt – Larsen (2004) adapt Cox's classification to propose different types of 3PL relationships. These various levels of 3PL relations range from pure market exchanges with low degree of integration and competence manifested by standard skills and low asset specificity, to in house logistics solutions with high degree of integration, core competence skills and high asset specificity. The model consists of four steps: market exchanges, customized logistics solutions, joint logistics solutions, and in-house logistics solutions.

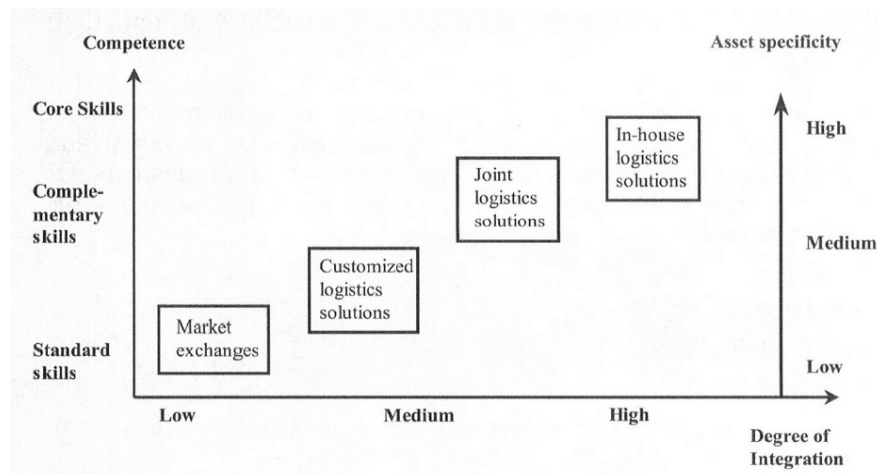


Figure 7 Stage model of different 3PL arrangements.

Adopted from Haldorsson and Skjøtt-Larsen (2004)

The spot market of transport and logistics services is found on the lowest level of the model. The collaboration between 3PL providers and clients are *short term and adversarial*, and the main focus is on prices. As illustrated above, asset specificity is low and services offered by the 3PL providers are based in relative standard skills (Haldorsson and Skjøtt – Larsen, 2004).

Next, customized solutions are offered and the 3PL provider offers a wide range of standard services. Since the services can be adjusted to fit the customers' requirements, the asset specificity is low to medium. The duration of the relation is characteristically limited to *one year or less* and the information sharing and joint problem solutions are rather limited (Haldorsson and Skjøtt – Larsen, 2004).

Joint logistics solutions are found on the third level in Haldorsson and Skjøtt – Larsen's (2004) stage model, and represent the stage where the providers and clients develop logistics solutions that are unique for the particular 3PL relationship. They look at the collaboration as a win – win relationship and consequently a *long term orientation* is expected by both parties. The willingness to share information with each other and solve problems jointly is elements that are clearly present on this stage of the model. The asset specificity is at a medium to high level. Human assets such as knowledge and experience transformation, and physical assets such as information technology and warehouse facilities, are often involved.

The last and fourth stage suggested by Haldorsson and Skjøtt – Larsen (2004) is in – house logistics solutions. Logistics is seen as a core skill of the organization and the asset specificity is usually high. The situation described at level four, is in accordance with both the transaction costs theory (Williamson, 1975), which recommends hierarchy as the most proper governance structure in situations with high specificity, and with the competence theory which advocate to keep core competencies in – house and outsource non – core activities (Haldorsson and Skjøtt – Larsen, 2004).

Concerning the actual outsourcing of logistics services, their stage model suggests three different levels of outsourced services. The “true” level of outsourced logistics services becomes two in the end. One is based on the customized solutions which are commonly developed around the customers’ demand and requirements (van Hoek, 2000) and the other is based on joint logistics solutions.

Electronic Relationship	Observations on duration and level of information sharing
Market exchanges	
<i>Electronic Control</i>	<ul style="list-style-type: none"> - Short – term duration, adversarial collaboration - Low degree of integration
Customized logistics solution	
<i>Electronic Control</i>	<ul style="list-style-type: none"> - Duration commonly limited to one year or less - Limited information sharing and joint decision making - Low to medium degree of integration
Joint logistics solutions	
<i>Electronic Interdependence</i>	<ul style="list-style-type: none"> - Joint decision making - Physical assets (information technology) are involved - Win-win relation with a long-term orientation - Willingness to share information is present - Medium to high degree of integration

Table 5 Observations regarding duration and type of 3PL provider- client relationship (Haldorsson and Skjøtt-Larsen, 2004)

Comparing Haldorsson and Skjøtt – Larsen’s (2004) stage model with Bensaou and Venkatraman’s (1995) categorization of two types of electronic relationships (electronic control and electronic interdependence), similarities can be observed. Market exchanges and customized solutions can be described by elements found in electronic control, while joint logistics solutions contain elements from electronic interdependence. By the means of this reasoning, we might be able to capture how the duration of the relationship affects the way partners in 3PL arrangements choose to manage their information processing.

H 5: The expected duration of the relationship is positively associated with vertical electronic integration between the 3PL client and its provider(s).

7. The VEI model

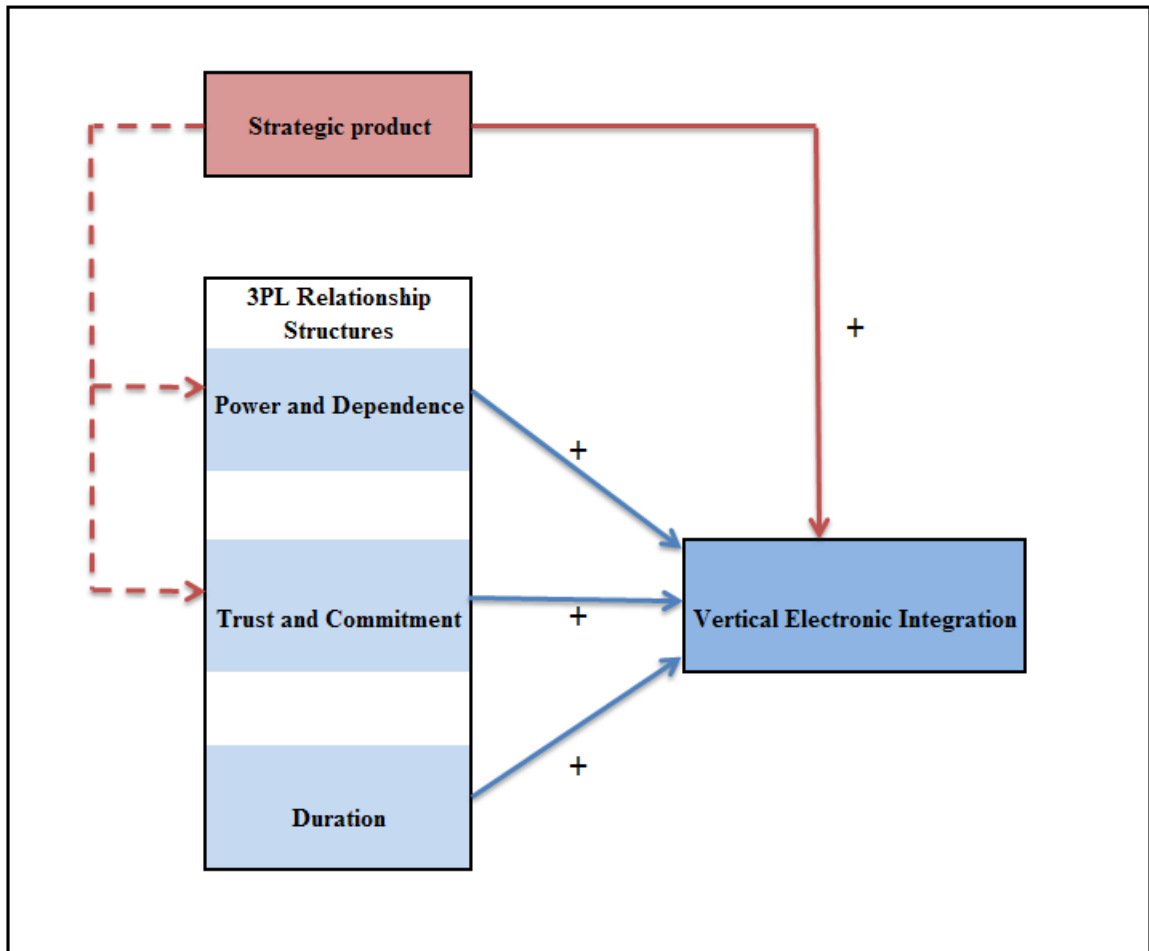
Vertical electronic integration (VEI) is the dependent variable in our model, with the independent variables being 3PL providers’ power and 3PL clients’ dependence of the provider, mutual trust and commitment, duration and strategic products. We explicitly hypothesize a positive association between 3PL providers’ power, 3PL clients’ dependence, mutual commitment and duration of the 3PL arrangement and the dependent variable, VEI.

However, previous empirical research indicates that strategic products insinuate higher degree of trust, commitment, in addition to higher perceived levels of cooperation (Metcalf and Frear, 1993). Further, it is reasonable to expect situations with high degree of dependence when a 3PL client outsources logistics services that are attached to a strategic product. Hence, we predict that in situations, where high degree of trust commitment and dependence is observed, due to the strategic nature of the product, investments are made to ensure an open information sharing environment. Derived from this reasoning, we propose that there is a positive interaction between strategic products and the degree of VEI.

This open environment, engraved by mutual sharing of information, is seen as a central element in the SCM philosophy. Such an open information sharing environment can be achieved by vertical electronic integration among 3PL clients and their logistics service providers. Furthermore, integration is proposed to take account for the entire chain and

describe the essence of SCM. Derived from this line of reasoning, SCM constitutes the surroundings of the VEI model.

Our implications of the VEI model is that we can differentiate preferred electronic governance form among 3PL clients by observing relational attributes in a 3PL arrangement and the strategic importance of the product purchased by the 3PL client. The main effect of the independent variables is represented by solid lines. The indirect effect trust, commitment, power and dependence have on the strategic product and thereby VEI, is represented by the dotted lines.



Supply Chain Management Philosophy Driven Environment

Figure 8 The Vertical Electronic Integration Model

The model illustrates that the 3PL clients' preferred electronic governance form is moderated by the strategic importance of the products processed by the 3PL provider, as well as the 3PL relationship structures

8. Research Methodology

In order to conduct empirical testing of the hypotheses and research model presented in the previous chapter, a proper research methodology is fundamental. Research design, sampling frame, respondent profile will be presented in the following chapter.

The research questions presented in this study are of an explorative character (“how and “why”). In addition, the focal concepts, vertical electronic coordination and vertical electronic integration in a 3PL provider – client relationship, have gained rather limited attention in prior research. In these situations, Yin (2003) proposes a qualitative research design through case studies as most appropriate. The underlying arguments are based on the possibilities to explore and gain depth and insight into a little known phenomenon. However, quantitative methods can be preferred in situations where we as researchers believe that some activity is taking place and seek better understanding of the occurrence (Ellram, 1996). The objective of this study is theory testing, appropriate to how theory regarding relational attributes (e.g. dependency and commitment) apply to the dimensions of “electronic governance” decisions in a dyadic relationship between a 3PL client and its logistics service provider. Moreover, researchers have called for further research relating to the importance of relational attributes and how they affect governance decisions in the context of “electronic relationships” (see e.g. Hart and Saunders, 1998; Choudhury, 1997; Grover and Saeed, 2007; Wareham, 2003). Hence, this study deliberately chooses a quantitative approach in order to encapsulate the explorative character of the focal variables.

8.1 Research Context

The main objective of this study is to empirically investigate how relational antecedents as well as the importance of the product, shape 3PL clients’ electronic governance decisions. The methodological approach to the problem is to test the research model, based in the literature review, in an empirical framework within an applicable sample frame. This examination was performed by a survey based on cross sectional data (Gujarati, 2003) from a heterogeneous population of organizations.

8.2 Sampling frame and respondent profile

The main focus by conducting the survey was to capture differences in relational structures and the utilization of information technology for the purpose of governing information among 3PL clients and their 3PL providers. Thus, the unit of analysis is explicit 3PL client – 3PL provider relationships, where the 3PL trading partners use various types of information technology to manage economic exchange.

With the aim of generating an applicable sample frame, we followed some of the directions presented by Hannås (2007):

- Sufficient disparity of industries to avoid bias toward one specific industry group
- Use key persons, preferably from managers from the purchasing department.
- And as electronic integration is our dependent variable, the population must vary with respect to the usage of information technology for governance purposes.

Founded in these directions, we define the population as consisting of organizations using 3PL providers for transportation or other logistics services, and which vary in the choice of information technology when managing economic exchange with 3PL providers.

Additionally, the organizations in the population must employ the services of purchasing professionals.

Selecting sample frame consists of finding the site and sample in order to gain accessibility to the occurrence of interest. (Ellram, 1996) To obtain high-quality responses, it was our intention to perceive a population sample of experienced employees working in purchasing divisions. Such a key informant approach is repeatedly used both within organizational economics and inter-firm phenomena (e.g. Buvik and John, 2000). Their firsthand knowledge and understanding of their company's products and relationships with supply chain partners, in addition to experience in using information sharing solutions such as IOS, would hopefully result in a highly rational data collection. The Norwegian Association of Purchasing and Logistics (NIMA) were contacted for the purpose of using their members as sampling frame.

The survey was first sent electronically to the associations' members 12. March 2009 . At that point in time NIMA had 1998 members, including both individual and corporate memberships. Our interest was to gain a sample frame consisting of organizations, not

individuals. Consequently duplicates and defunct companies and organizations were not considered as a part of the sample frame for this study. Further, companies and organizations that core activities were not affected by transportation were considered irrelevant as respondents, and hence excluded in the final sample frame. These companies were consultant companies and interest groups. By these measures, the final sample frame for this survey consisted of 516 companies from various industries, creating a cross – industrial sample frame.

Respondent profile	Percentage
Director	5.1
Purchasing manager, senior buyer, buyer	41
Top management (connected to logistics department, but not directly related to the purchasing function)	41
Other management	12.9

Table 6 Profile of the respondents

Due to low response rate (13 respondents) on the electronic based survey, a second solicitation was performed. By visiting the annual NIMA conference, additional 26 respondents were collected. Finally, 39 responses were received, giving a response rate of about 8%. Theoretically speaking, with a population of 516, the sample size ought to be between 72 to 96 respondents depending on the preferable significance level (Bartlett et al., 2001).

The respondent profile is given in table 6, which show that the majority (82%) of the respondents was stationed within the company’s logistics function. 41% of these were directly involved in purchasing at the managerial level. In order to avoid bias toward one specific industry group, data were collected across industrial borders creating sufficient disparity of industries (Hannås, 2007). We managed to identify the respondents industry by asking for their core industry, and a categorization is given in table 7. Companies within manufacturing and commodity trade represent the majority in type of industry (41%), followed by oil and energy and maritime equipment vendor (30.8%).

Industry profile	Percentage
------------------	------------

Manufacturing	20.5
Commodity trade	20.5
Private service	2.6
Public administration	12.8
Maritime – equipment vendor	15.4
Maritime – shipbuilding yard	7.7
Oil/energy	15.4
Others	5.1

Table 7 Profile of the industry

With respect to company size, table 8 indicate that a relatively large share (51%) of the responding companies represent a size from 1 to 250 man – years. Information gathered on how the 3PL clients communicate with their 3PL provider indicate that the clients use a combination of telephone and e-mail. 58.9% report that they sometimes use telephone, while 41.1% sometimes use e-mail as communication method. 74.4% of the respondents almost never use fax, making fax a rather limited communication form. With respect to vertical electronic integration and the use of IOS, 43.6% reports that communication through the 3PL providers IOS is never performed, and 59% never use their own IOS when communicating with their 3PL provider. It is important to highlight that even though the distribution of respondents was skewed towards smaller companies, the preponderance (56.5%) of the respondents state that they have an IOS with other actors in the SC, like customers and suppliers. The remaining 43.6% reports a total absence of such an integrated information sharing solution.

Company profile (in man-years)	Percentage
1-250	51.6
251 – 500	12.9
501 – 1,000	17.1
1,001 – 2200	7.7
> 2201	7.7
Missing	2.6

Table 8 Profile of the companies based on man - years

When asking the respondents for their preferences related to type of information sharing solution preferred when communicating with their 3PL provider, 51.2% believed that e-mail is the most appropriate solution. While only 5.2% of the respondents agreed on the applicability of fax, the majority (56.5%) were neutral with respect to telephone

communication. Regarding IOS, 66.8% was positive to employ such systems with their 3PL provider.

8.3 Data collection strategy

Data collection methods can be categorized into 2 groups; primary data, secondary data. Secondary data is already existing data and is often gathered to serve other research objectives. Yet, secondary data has once been primary data. Even though primary data has to be created before it can be used, hence generating a rather time consuming and cumbersome data collection, it can produce a more detailed representation of the objectives for the research. Within these two categories, two subgroups are found, internal and external data. By conducting a survey this study makes use of internal primary data. With respect to external data, the framework was mainly based on research articles from medium- to high- rated journals.¹In addition, Ph. D dissertations and specialized books were used. A combination of primary- and secondary data is considered adequate to gain a better understanding of the research objectives.

8.4 Electronic survey for data collection

There are several advantages when performing an electronic survey for data collection. Speed and cost efficiency are often mentioned. E-mail is easy obtainable and does not require to be printed on paper and sent by mail, hence the cost for reaching supplementary respondents is marginal. Also, e-mail might facilitate fast response. The risk of process errors decreases because the surveys are registered electronically instead of being punched manually afterwards.

To facilitate good measures of the items to capture the research problem, as well as identify an appropriate vocabulary for the survey, we looked at secondary data and previous surveys conducted by other researchers (see e.g. Grover and Saeed, 2007, Kwon and Suh, 2004; Kenmeyer and Murphy, 2004)

¹ Rating Scheme:, Journal Quality List (2008) Edited by Dr. Anne-Wil Harzing, (<http://www.harzing.com>) University of Melbourne, Department of Management,

In addition to our supervisor, other professionals² helped us in the process of drafting the survey. The proposed five page survey was then run as a pilot test through an interest group where fellow students and others made comments and suggestions for further improvements of the questionnaire.

9. Operationalization of the dependent and independent variables

9.1 Dependent variable

Preferred communication methods or electronic governance forms between 3PL clients and their 3PL providers are important facets of this study. Academic literature reveals few attempts to operationalize the concept of electronic collaboration with the intent to measure diversity in employment of technological solutions for information sharing purposes among 3PL clients and their providers. Consequently, previous research on coordination of the SC and associated coordination mechanisms and thereby issues concerning IOS, was investigated with the intention to get an overview of how other researchers have approached the operationalization of similar concepts. Hannås (2007) made a distinction between two main forms of vertical electronic coordination; collaborative and transactional. In order to capture these differences she used several indicators measuring the *scope* of coordination activities performed through various forms of IOS in a buyer supplier dyad, because the scope mirrors the degree of electronic coordination. Bensaou and Venkatraman (1995) managed to capture variety in coordination needs, and thus coordination mechanisms, based on type of relationship and surrounding environment. They found two types of electronic governance; electronic control and electronic interdependence (see table 3).

As discussed in chapter 2.4, this study makes a deliberate distinction between vertical electronic integration and vertical electronic coordination. The former indicates collaboration and integration of electronic activities between the 3PL client and its logistics service provider, while the latter reflects that the partners in the 3PL arrangement coordinate their electronic activities on arms-length basis, or performing economic exchange on a rather transactional, non-strategic level.

² Associate professor Svein Bråthen gave valuable comments regarding the construction of the survey and measurements at the last part of the developing process.

In measuring how the 3PL client choose to coordinate the information flow when performing economic exchange with a 3PL provider we are interested in looking at the differences in applied technological solution, because the chosen information sharing solution reflects whether the 3PL client pertain to vertical electronic coordination or vertical electronic integration as electronic governance structure.

In order to capture a realistic picture of the extensiveness of employed electronic governance form, the question has a Licker Scale where the respondents were to categorize the company’s exercise of the communication methods from “never” to “always”.

Q6 Communication form VEI	<i>“In general, how does your company communicate with your 3PL/transportation provider?”</i>
Q6_1	Phone
Q6_2	E-mail
Q6_3	Fax
Q6_4	Through the information system owned by the 3PL/transportation provider
Q6_5	Through the information system owned by your company

Table 9 Q6 Communication form

The responses are based on a Licker Scale from 1 to 7 where 1 is “never” and 7 is “always”

9.2 Independent Variables

3PL clients’ commitment to the 3PL arrangement

With the intent of testing how the 3PL clients’ commitment to the relationship affects the dependent variable, we needed to develop indicators measuring efforts made by the 3PL client, in order to ensure that the relation to the 3PL arrangement endures. Through making changes in internal processes, a 3PL client can express its commitment by fulfilling the

3PL providers' requirements. For the purpose of this study we deliberately chose to measure internal changes directly involved with electronic cooperation exclusively.

Table 10 present the indicators for the 3PL_CLI_COM constructs, respectively.

Q11 3PL clients' commitment 3PLCliCom	<i>“Your company has conducted the following adjustments in order to cooperate electronically with the 3PL/transportation provider”</i>
Q11_1	Performed modifications of internal processes and routines
Q11_2	Performed adjustments in the IT systems of your company
Q11_3	Performed investments in order to integrate your company's IT system with the system of the 3PL/transportation provider
Q11_4	Spent man-hours on internal training on the IS used for sharing information with the 3PL/transportation provider

Table 10 Q11 3PL Clients' Commitment

The responses are based on a Licker Scale from 1 to 7 where 1 is “strongly disagree” and 7 is “strongly agree”

3PL clients' dependence

To capture how 3PL client's dependence of the resources offered by 3PL provider affect the dependent variable, we had to develop indicators measuring the *importance* of the resource offered, the presence of other 3PL providers, the *replaceability* of the 3PL provider, and the *concentration* of 3PL providers (customization of services). Moreover, prior research propose that 3PL providers search for a deeper relationship with their clients and tend to offer bundled services (Rabinovich et al., 1999), which we argue might contribute to the creation of higher dependence among its 3PL clients. For that reason, we had to develop indicators capturing the extent of bundling of services among the

respondents. Table 11 and table 12 present the CLI_DEP_PROV construct and the BUND_SERV construct, respectively.

Q13 Clients dependence of the 3PL provider CliDepProv		<i>“Please consider the following statements.”</i>
Q13_1	Your company holds good IT competence	
Q13_2	Your company is dependent on buying IT competence from external actors	
Q13_3	The 3PL/transportation provider has customized their services in order to meet your company’s requirements.	
Q13_4	It would be difficult for your company to find a 3PL/transportation provider that could replace the current 3PL/transportation provider.	
Q13_5	Your company expects the 3PL/transportation provider to deliver orders as scheduled	

Table 11 Q13 3PL Clients Dependence

The responses are based on a Licker Scale from 1 to 7 where 1 is “strongly disagree” and 7 is “strongly agree”

Q5 Bundling of services BundServ		<i>“ Which logistics services does your company buy from the 3PL/transportation provider?”</i>
Q5_1	Transportation	
Q5_2	Procurement	
Q5_3	Inventory services	
Q5_4	Other	

Table 12 Q5 Bundling

The strategic importance of the product

This study chose to develop indicators representing different product groups. This was done deliberately based on the belief that a product can be of importance for an organization for a number of various reasons depending on factors such as core competence and type of industry. Further, we wish to separate the products into two main groups; strategic and non-strategic products. For the purpose of this study, strategic products are, viewed as critical for the organizations competitive advantage, has high supply risk and profit impact and are directly involved in production. Items in this category are products such as raw materials and minerals. Non – strategic products are typically considered as items with low supply risk and profit impact, and not directly involved in the organizations production, but have a more “supportive” role. Operation and repairing materials and components are typical non – strategic items in this setting. The indicators are modified to the context of this study and used as independent variable in the VEI model. Table 13 present the indicators for the PROD_TYP E construct.

Q 15 Product type ProdType	<i>“The product distributed by the 3PL/transportation provider belongs to what product groups? (You may mark more than one group)”</i>
Q15_1	Natural raw materials
Q15_2	Minerals
Q15_3	Semi-finished products
Q15_4	Components
Q15_4	Operation and repairing materials
Q15_5	Investment objects

Table 13 Q15 Product type

The responses are based on “multiple choice” where the respondent can choose several alternatives

The duration of the 3PL relationship

For the purpose of testing how the duration of the 3PL relationship affects vertical electronic integration, we generated measurements based on previous empirical research (Haldorsson and Skjøtt-Larsen, 2004; Bensaou and Venkatraman, 1995; Bowersox, 1990). The scale describes different levels of possible 3PL relationships, ranging from pure market exchanges with low degree of integration to more customized and joint logistics solutions. The element of duration is embedded in each of these relational categories.

Subsequently, by measuring the different types of relationships among the partners, we can encapsulate the length or duration of the relation as well.

An additional construct was developed, measuring the duration of the current 3PL relationship directly.

Table 14 and table 15 present the indicators of the DUR_RELTA construct.

Q18 Duration of the relationship DurRela	<i>“How does your company consider the future cooperation with the 3PL/transportation provider”</i>
Q18_1	A onetime transaction
Q18_2	Several transactions, but not interested in a deeper relationship
Q18_3	A cooperation with a given time horizon (e.g. general agreement)
Q18_4	A long term relationship without any end-date
Q18_5	Cooperation related to a given project (Joint Venture)

Table 14 Q18 Duration

The responses are based on a Licker Scale from 1 to 7 where 1 is “strongly disagree” and 7 is “strongly agree”

Q4 Duration of the current relationship CurDur	<i>“Please state the duration of your current 3PL relationship” (If you buy logistics services from multiple providers, please state the relationship with the longest duration)</i>
Q4_1	< 1 year
Q4_2	1-3 years
Q4_3	3-5 years
Q4_4	5-10years
Q4_5	< 10 years

Table 15 Q4 Duration years

10. Data examination and validation

10.1 Descriptive statistics

A preliminary data examination was performed to evaluate the data quality. The dataset was tested for potential outliers, normality assumptions, multicollinearity and heteroskedaticity.

When pre-analyzing the dataset, one of the first steps was to determine the global picture of the data. If the normality assumptions and other requirements are not met, constructs derived from data reduction methods, such as factor analysis and principal components,

may be influenced (Gujarati, 2003). Stewart (1981) mentions particularly the shape of the distribution of data, and state that the size of the correlation is restricted if the distribution of data on individual item level is shaped differently. In situations where the normality assumptions are not met, it might be necessary to perform modifications of the variables. The indicators, or descriptive statistics, studied in this thesis is shortly presented in this section.

Distribution and normality on individual item level

Investigating the distribution of data on individual item level indicated that the measures of skewness and kurtosis, respectively lack of symmetry and tallness or flatness, had violations against the assumption of normality in some of the variables. Further we compared the mean (arithmetic mean) to the median in order to determine the level of normality. Comparing to the median, which is considered rather insensitive to outliers and other extreme cases, the mean might give a misleading impression if these cases occurs (Marques de Sa, 2007). Especially, when the sample size is small as in this study, such extremes will cause a higher impact on the mean. Thus, for a variable possessing perfect symmetrical distributions, the mean and median will be the same (Marques de Sá, 2007) and the difference between these indices are preferred to be as small as possible.

Modifying the items

Examination of the data on item level also revealed that the dataset contained missing data. The extent of missing data can distort the outcome of the analysis, (Hannås, 2007) consequently we needed to assess the degree of missing data in our set. Moreover, we transformed the items in the scale constructs (Licker scale) by using logit transformation³ and normal score, resulting in three new versions for each individual item. These items were then examined in the same way as the raw data in order to find the most applicable transformation for the dataset.

Missing data

Examination of the data on item level also revealed that the dataset contained missing data. The extent of missing data can distort the outcome of the analysis, (Hannås, 2007) consequently we needed to assess the degree of missing data in our set. The assessment of missing revealed rather low missing values for nearly all the variables (5% - 10%) In order

to replace missing values and thereby provide complete data for future calculations, we chose mean substitution as replacement method. Such a replacement method can constrain the variance, but since the dataset report rather low levels of missing values, it is applicable (see table in appendix 2).

Correlation matrix of untransformed variables is presented on the following page.

	Com Form_1	Com Form_2	Com Form_3	Com Form_4	Com Form_5	Clients Commi_1	Clients Commi_2	Clients Commi_3	Clients Commi_4	Clients Depend_1	Clients Depend_2	Clients Depend_3	Clients Depend_4	Providers Commi_1	Providers Commi_2	Providers Commi_3	Providers Commi_4	Providers Commi_5	Providers Commi_7	
Com Form_1	1																			
Com Form_2	0.32*	1																		
Com Form_3	0.06	-0.07	1																	
Com Form_4	0.15	0.00	-0.20	1																
Com Form_5	-0.10	-0.30	-0.17	0.34*	1															
Clients Commi_2	0.05	-0.13	-0.20	0.08	0.56**	1														
Clients Commi_3	0.00	-0.29	-0.29	0.33*	0.78**	0.59**	1													
Clients Commi_4	-0.05	-0.21	-0.18	0.23	0.57**	0.62**	0.78**	1												
Clients Depend_2	0.19	0.09	0.16	0.30	0.13	0.23	0.14	0.17	1											
Clients Depend_3	-0.02	-0.01	-0.16	0.17	0.25	0.29	0.49**	0.46*	-0.23	1										
Clients Depend_4	-0.02	0.01	-0.05	0.02	0.18	0.27	0.40*	0.24	0.01	0.64**	1									
Providers Commi_4	0.23	0.02	-0.06	-0.08	0.19	0.35*	0.42*	0.23	-0.18	-0.05	0.15	1								
Providers Commi_5	0.22	0.23	0.04	-0.01	0.20	0.34	0.16	0.36*	-0.07	0.11	0.02	0.24	1							
Providers Commi_7	0.25	0.01	0.35	0.18	0.05	0.12	0.16	0.12	0.16	0.16	0.15	-0.07	0.27	0.07	1					

* Correlation significant at the 0.01 level

** Correlation significant at the 0.05 level

10.2 Factor analysis

Correlation analysis is fundamentally different from a regression analysis as its main objective is to measure the strength of a linear association between two variables, while regression analysis assumes that causal relationships flow in one direction from the explanatory variable to the dependent variable (Gujarati, 2003)

Factor analysis is a multivariate statistical technique and is often applied to “solve” the problems of multicollinearity. (Gujarati, 2003) Factor analysis is concerned with identifying structures (i.e. latent variables) within a set of observed variables, and is applicable in the study of interrelationships among variables when finding a new set of variables. (Stewart, 1981)

Validation of measures

Identifying good measures of a latent variable requires that the observable indicators of a construct must be confirmed associated with a common factor. Further, the included items should load on only one construct, the covariance between the measures is arbitrated by the common factor, and there is a high correlation between the measures. In order to ensure that the operationalization of a construct actually measures what it is meant to measure, we can perform tests which measures internal consistency and reliability. The former test, internal consistency, refers to both reliability and unidimensionality.

Reliability is central when investigating the validity of operationalized constructs, and indicates the extent to which measurements are repeatable and stable. (Hannås, 2007) We approached the reliability and consistency dimensions by an exploratory factor analysis.

Exploratory Factor Analysis

An exploratory factor analysis is appropriate where the underlying dimensions of the dataset are unknown. (Stewart, 1981) Thus we performed an exploratory factor analysis, to test if there are sufficient numbers of significant correlations between the items. This is done to confirm if it is possible to conduct a factor analysis. We tested our data by the Bartlett’s test of sphericity and the Keyser-Meyer-Olkin.

In order to extract an optimal structure of underlying factors from the measured items we performed testing by an explorative factor analysis. We tested the variables by using principal component analysis (PCA) as estimation method. The factor analysis was run through orthogonal rotation (Varimax with Kaiser normalization).

As a rule of thumb the factor loadings should be 0.5 or higher (Hannås, 2007), consequently variables with low loadings (< 0.50) was disregarded unless theoretically justified. Significant and substantial measures of the factors loadings indicate validity evidence in favor of the indicators representing that construct (Hannås, 2007). Due to small sample size (39) we cannot employ advanced methodology such as “structural equation modeling” which typically requires a minimum of 100 respondents. (Marques de Sá, 2007). For that reason we generated measurements of the coefficient alpha, Cronbach’s alpha (CB), with the aim of testing the reliability and unidimensionality of the extracted factors (latent constructs). CB is a coefficient of consistency or reliability, and measures how well the set of variables measure a single unidimensional latent construct. In situations where the data have unidimensional structure, CB will typically be high. Or in other words, high inter – item correlations signify that the items are measuring the same underlying factor. CB can be constructed as a function of number of items and their average inter-correlation.⁴ The standardized CB formula is presented below. CB values less than 0.5 were disregarded.

5

N = number of items

c = average inter-item covariance among the items

v = average variance

$$\alpha = \frac{N \cdot \bar{c}}{\bar{v} + (N - 1) \cdot \bar{c}}$$

Results from the factor analysis

The Communication Form Structure – Dependent Variable

The results of the factor analysis for the communication form construct indicate two convergent factors, respectively vertical electronic coordination and vertical electronic integration. These factors subscribe to our theoretical framework concerning electronic governance form among 3PL clients and their providers. Based in results from the factor analysis as well as the theoretical reasoning behind the factors, we aim to use Vertical Electronic Integration through the 3PL client’s IOS as our dependent variable.

⁴ <http://www.ats.ucla.edu/stat/Spss/faq/alpha.html>

⁵ <http://www.ats.ucla.edu/stat/Spss/faq/alpha.html>

Results from the factor analysis measurements for the communication form construct

Construct	Item Description
Q6 Communication Form 4 items converging in 2 factors	<i>“In general, how does your company communicate with your 3PL/transportation provider?”</i>
Vertical Electronic Coordination	- Q6_1 Telephone (0.757) - Q6_2 E-mail (0.821)
Vertical Electronic Integration	- Q6_4 Through the information system owned by your 3PL provider (0.804) - Q6_5 Through the information system owned by your company (0.700)

The Independent Variables

The results of the factor analysis congregated in one factor for the 3PL clients' dependence, 3PL clients' and providers' commitment constructs, as well as for the communication form construct. With respect to the product type construct as well as the bundling construct, we had to perform re-specifications to generate a construct which side well with our conceptual framework. The duration construct did not meet the requirements concerning high loadings.

Construct	Item Description
3PL Clients Commitment 3 items converging in 1 factor CB = 0.839	<i>“Your company has conducted the following adjustments in order to communicate electronically with your 3PL/transportation provider”</i> - Q11_2 Performed adjustments in the IT systems of your company (0.774) - Q11_3 Performed investments in order to integrate your company's IT system with the system of the 3PL/transportation provider (0.879) - Q11_4 Used time on internal training on the IT system used for sharing information with the 3PL/transportation provider (0.833)
3PL Providers Commitment 3 items converging in 1 factor CB = 0.529	<i>“Please consider the following statements:”</i> - Q17_4 The cooperation with the 3PL/transportation provider has reduced the transportation costs (0.467)

- Q17_5 The cooperation with the 3PL/transportation provider has reduced inventory costs (0.801)

- Q17_7 The cooperation with the 3PL/transportation provider has reduced other costs (0.767)

3PL clients' Dependence
3 items converging in 1 factor-

CB = 0.526

“Please consider the following statements:”

Q13_2 Your company is dependent on buying IT competence from external actors (0.643)

- Q13_3 The 3PL/transportation provider has customized their services in order to meet your company's requirements. (0.858)

- Q13_4 It would be difficult for your company to find a 3PL/transportation provider that could replace the current 3PL/transportation provider. (0.841)

The fit statistics for the research model is presented in the table below, and contain three latent variables with 9 items. The product, duration and bundling constructs are not included in the table due to the re-specifications mentioned earlier. These constructs were constructed as indexes and subsequently embedded in the model.

Item	CLI_DEP_PROV 3PL_CLI_COM	3PL_PROV_COM	
Q13_2	0.634		
Q13_3	0.858		
Q13_4	0.841		
Q17_4		0.643	
Q17_5		0.858	
Q17_7		0.841	
Q11_2			0.774
Q11_3			0.879
Q11_4			0.833
Standardized estimated factor loadings			

11. Regression analysis

The Ordinary Least Squares (OLS) requires certain assumptions to be met in order to produce solutions of good quality. Including linearity in the parameters and the normality assumptions, we have given special attention to the elements of multicollinearity and homoscedasticity as these assumptions are important in our context.

The general model for OLS is given by the following equation where, Y_t is the dependent variable, X_{nt} is the number of explanatory variables in the model, and ε_t is the variance of the residuals.

$$Y_t = \beta_1 + \beta_2 X_{1t} + \beta_3 X_{2t} + \dots + \beta_n X_{nt} + \varepsilon_t \quad \beta_1 X_{1t} = 1 \text{ for all } t$$

Homoscedasticity

If the variance of the residuals is non-constant, there exist heteroscedasticity in the dataset. According to Gujarati (2003), existence of heteroscedasticity in cross-sectional data is probably rather a rule of thumb than an exception. As a matter of fact, heteroscedasticity should be expected when sampling small-, medium-, and large-sized companies. Checking the data for presence of heteroscedasticity can be done graphically by applying regression of predicted value and standardized residual of regression in a scatter plot.

Homoscedasticity will merge as a random pattern around zero, while patterns might indicate heteroscedasticity (Gujarati, 2003). Other tests are the White test and the Breusch-Pagan test.

Multicollinearity

Another important issue when analyzing the regression is multicollinearity.

Multicollinearity includes both cases with perfect multicollinearity and cases where variables are not perfect correlated, but still has some correlations between them (Gujarati, 2003). “*Multicollinearity leads to imprecise determination coefficient, imprecise fitted values and imprecise tests on the regression coefficients*” (Marques de Sa, 2007, p300).

Another possible result of multicollinearity in a dataset is the applicability in terms of accepting false hypothesis, or type II error (Gujarati 2003). Uncorrelated independent variables will remain constant whether or not another independent variable is added to the

model (Marques de Sá, 2007) Moreover, a perfect correlation between independent variables would make it possible to determine an infinite number of regression solutions (Marques de Sá, 2007). Gujarati (2003) mentions some sources for multicollinearity, including the employed data collection method and model specifications.

11.1 Test of hypotheses for the VEI model

This chapter describes the testing of the model and hypothesis and the empirical results. Hypotheses 1 and 2 of vertical electronic integration were tested by regressing VEI on 3PL clients' commitment and 3PL clients' dependence, 3PLCliCom and CliDepProv respectively. Next, we test hypotheses 3 and 4 by regressing VEI on the bundling and product type indexes, BundServ and ProdType respectively. According to the optimal ratio of ten to one in the number of regressors in a multiple regression model (Bartlett et al., 2001), our models should consist of maximum 3-4 independent variables. The models were tested for normality assumptions by testing for normal variance of data, potential outliers, heteroscedasticity and multicollinearity.

11.1. Commitment and dependence

The examination of heteroscedasticity turned out to be significant when running the White test and Breusch-Weisberg test, with values of $p=0.0098$ and $P=0.0475$ respectively. Examining the Kernel density estimates also demonstrated contravention of the assumptions of normality (see appendix 2). In situations where the normality assumptions are violated, it might be applicable to weigh the cases differently by running Weighted Least Square (WLS) (Gujarati, 2003). However, running a WLS weighted on commitment, a rather limited effect on the variance in the standard error of the constant, as well as the significance of the p-values, was observed. Consequently, an OLS regression was used as estimation method. Table 17 presents the results from the OLS regression analysis.

Source	SS	df	MS	N	34	
Model	93.197	2	46.598	F(2,31)	18.837	
Residual	76.686	31	2.474	Prob >F	0.000	
Total	169.883	33		R-sq	0.5486	
				Adj R-sq	0.5195	
				Root	1.5728	
	VEI	Coef.	Std. Err.	t	P	[95% Conf. Interval]
	Commitment	0.839	0.157	5.327	0.000	
	Dependence	0.165	0.76	2.166	0.038	
	Constant	0.051	0.537	0.95	0.925	

Table 17 Regression Model Commitment Dependence

The following equation using ordinary least square regression was estimated.

$$VEI = \beta_1 + \beta_2 3PLCliCom + \beta_3 CliDepProv + \epsilon$$

The variables in the model are:

VEI = Vertical Electronic Integration (dependent variable)

3PLCliCom = the 3PL clients' commitment to the 3PL arrangement (independent variable)

CliDepProv = 3PL clients' dependence on the 3PL provider (independent variable)

11.1.2 Bundling and product

The model generated acceptable results when testing it for normality in variance, outliers and multicollinearity. However, a minor variance was found by analyzing the model for heteroscedasticity. The heteroscedasticity tests showed values of $p=0.0288$ and $p=0.0511$, indicating that heteroscedasticity might exist in the model. Just as in previous regression, the kernel density estimates differed from the normal density. However, the violations are somewhat more severe in these variables; ProdType and BundServ (see Appendix 2). As elucidated when describing the factor analysis, both ProdType and BundServ had to be re-specified as indexes to fit the conceptual framework. Consequently, the normality violations can be explained by the current nature of the two variables, respectively the ProdType- and BundServ index.

Table 18 presents the result from the OLS regression analysis

Source	SS	df	MS		N	34
Model	39.067	2	19.534		F(2,31)	4.63
Residual	130.823	31	4.220		Prob >F	0.0174
Total	170.00	33	5.148		R-sq	0.2300
					Adj R-sq	0.1803
					Root	2.0543
VEI	Coef.	Std. Err.	t	P	[95% Conf. Interval]	
Bundling	-0.9284	0.4580	-2.03	0.051	-1.8625	0.0058
Product	-1.2241	0.5395	-2.27	0.030	-2.3244	-0.1239
Constant	7.3016	1.6113	4.53	0.000	4.0152	10.5879

Table 18 Regression Model Bundling Product

The following equation using ordinary least square regression was estimated.

$$VEI = \beta_1 + \beta_2 ProdType + \beta_3 BundServ + \epsilon$$

The variables in the model are:

VEI = Vertical Electronic Integration (dependent variable)

ProdType = index indicating the strategic nature of the product (independent variable)

BundServ = index indicating the number of outsourced logistics services (independent variable)

Buyers' type of industry is considered as a selection variable in both models. In its original form it is a categorical variable of seven categories. However, it is coded into a dummy variable where 0 = public services and 1= all other types of industry. This is done deliberately to control the model for buyers type of industry, due to the cross sectional nature of our study. This significant effect indicates that vertical electronic integration is not independent of the type of industry in which the buyer operates.

Supplementary testing: Coordination as a dependent variable.

Due to the nature of this thesis by assuming organizations to either integrate or coordinate, we generated a dependent variable to improve the empiric foundations for the VEI model. This latent variable consists of three items: Q6_1, Q6_3 and Q14_3 with a Cronbachs alpha value of 0.496. Descriptive of this latent variable is presented in Appendix 4. By produce regressions at the same conditions as with the VEI variable, we would be able to

gain support, or question our findings with the VEI variable. Conversely, these regressions did not create any significant answers.

13. Discussion

By employing a multiple theoretical approach, this study has tested the relationship between relational attributes in a 3PL arrangement as well as the strategic importance of the product processed by the 3PL provider, and the 3PL clients' diversity in use of information technology. Our implications behind the research model was that we could differentiate preferred electronic governance form by observing interactions between vertical electronic integration and the theoretical framework concerning relationship and product.

First of all, we claim that if the partners fulfill each others' needs and thereby express trust it will lead to increased commitment between the partners. However, because we assume that it is the 3PL client who has to develop greater trust in a 3PL arrangement due to resource dependence, we deliberately focus on trust and commitment expressed by the client. This study argues further, that the demonstration of trust by the 3PL client encourages commitment, thus increasing the probability of vertical electronic integration. When both commitment and trust are present in a 3PL relationship, they can produce results promoting efficiency, effectiveness and productivity, hence act as a promoter for vertical electronic integration among exchanging 3PL partners. Due to elevated degree of interdependence in 3PL arrangements, we expected high levels of both trust and commitment among buyers of logistics services. Empirical results demonstrated support for H1. By measuring the 3PL clients' commitment to the relationship, results indicated that the 3PL clients' trust and thereby commitment have a statistically significant and positive effect on vertical electronic integration. These results support our expectations that the 3PL clients' trust and commitment are vital elements when sharing information and managing electronic 3PL relations. This should imply that the more the 3PL client express their trustworthiness and commitment by making internal changes in order to ensure effective information processing, the higher level of vertical electronic integration will be observed between the client and its providers. Moreover, is reasonable to believe that the lack of integration, which is commonly observed when examining 3PL

arrangements, can and has been explained by limited contributions of trust and commitment. Consequently, in these situations 3PL clients might choose to coordinate their information flow by using “traditional” IT solutions such as phone and e-mail. The relative dependence between a 3PL client and its logistics provider is determined by the amount to which the parties are able to exercise power and influence each other. RDT states that if a 3PL client is highly dependent on the resources offered by a 3PL provider, the logistics service provider will hold the relative balance of power. 3PL clients’ dependence is measured by investigating the level of customization, replaceability and internal IT skills. This should imply that the more dependent the 3PL client is on the logistics resources offered, the more the 3PL provider exercise power and try to influence its clients to integrate electronically. Analysis results provided support for H2, which demonstrate that there is a significant level and positive interaction between the 3PL clients’ resource dependence and vertical electronic integration.

This study claims that when outsourcing logistics services in bundles, an enhancement in the 3PL clients’ dependence of the 3PL provider will be observed. Research indicates that 3PL providers continuously are in search of a deeper relationship to their clients, and the 3PL clients tend to outsource activities in clusters. Bundled services are often customized to meet the clients’ requirements, thus creating higher dependence among 3PL clients. An augmentation in the 3PL clients’ relative dependence will increase the 3PL providers’ power to influence the 3PL client to electronically integrate. Despite this theoretical reasoning, our findings suggest bundling to be negative associated with electronic vertical integration. An explanation for this negative association can be found in our scale of measuring, which is somewhat diminutive compared to the actual range of 3PL bundling services. As it most likely did not capture the true variance of bundling services, it will give a wrong and inconsistent impression of the association.

The forth hypothesis suggest the strategic importance of the product to be positively associated with vertical electronic integration between the 3PL client and its 3PL providers. We expected this variable to be positive and significant. However, based on the results, we had to reject this hypothesis as it clearly shows a negative association. As stated by Metcalf and Frear (1993), the importance of the product is positive associated with higher levels of information sharing. One underlying force might be that companies don’t consider the 3PL provider in the same way as they regard the supplier of the product, even though it is the same product. This suggestion carries support from Mortensen and Lemoine (2008) who propose companies regard transport services as a commodity where

cost ought to be minimized, instead of noticing the strategic perspective of outsourcing. According to our model, the strategic nature of the product influence power and dependence, trust and commitment. Theoretically speaking, if a 3PL client outsources logistics services related to a strategic product, we would expect higher levels of trust, commitment, power and dependence. These links might cause the negative association. If the 3PL client does not find the 3PL provider trustable, it may seem reasonable for the 3PL client to not integrate electronically, particularly if the product processed is of strategic importance. As indicated by Kwon and Suh (2004), trading partners operating in an environment where trust is lacking might generate a situation where all transactions have to be verified and the partners find it necessary to analyze the reliability and trustworthiness of each other. This signifies a trend towards vertical electronic coordination instead of vertical electronic integration. In addition to an increase in transaction cost, this situation will compromise cornerstones of supply chain goals such as efficiency, effectiveness and productivity.

We were not able to generate a significant result for the duration construct, hence not provide support for H5. As this question had the same construct as bundling, we might questioning whether the reason might be lack of variance among the respondents as a result of wrong measurement method.

14 Conclusion

A number of previous studies have investigate factors that impact the diversity in use of information sharing solutions. Most of the research in this domain has a dyadic approach to electronic partnerships. While prior work has contributed greatly to the knowledge base, few empirical studies have investigated how relational factors exhibiting cooperative behavior among 3PL clients and their logistics service providers, nor how the strategic nature of the product impact the 3PL clients preferred electronic governance form. We argue that by jointly examining these factors coupled by effective information sharing goals embedded in the SCM philosophy provides a perspective that can contribute to the existing knowledge base.

From a managerial perspective, vertical electronic integration is the appropriate electronic governance form under conditions where the 3PL clients trust their logistics services providers and express commitment so that the relation endures. This should imply that

vertical electronic integration is not the appropriate electronic governance form if trust and commitment is lacking between the 3PL client and its 3PL provider. Further we conclude that the presence of resource dependence can result in vertical electronic integration, due to 3PL providers' power to influence employment of integrated information systems. Findings might indicate that vertical electronic coordination is preferred when outsourcing services related to strategic products, as well as when the 3PL clients outsource logistics operations in bundles.

15 Future Research

Based on recommendations by Bask (2001), we suggest future studies considering 3PL relationships to be of a triadic nature in order to capture the complexity of the ultimate supply chain. Further, Robey et al. (2008), and Mortensen and Lemoine, (2008) have proposed that "hybrids", or multiple theories will enhance IOS research as open resources and standards get more common and thereby require other issues besides pure economic factors to be considered. We therefore suggest future research on IOS in supply chain relationships, including 3PL's, to consider these recommendations. Finally, based on this study's findings and limitations, we also encourage bringing more attention toward how the strategic importance of the product influences the purchasers preferences in 3PL integration issues compared to other factors, such as mutual trust, dependence, commitment and duration of relationship.

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Appendix 1

The survey in English

Effective information exchange plays an increasingly important role for the cooperation in the value chain to succeed. Norsk Logistikk Barometer (The Norwegian Logistics Barometer), which was last conducted in 2007, points out a trend towards an increased focus on a comprehensive logistics strategy and that more companies will invest in a closer and more strategic cooperation with their transporters. At the same time, the barometer may also indicate that there is a relatively large proportion of companies that would, but for various reasons nevertheless choose not to integrate themselves to their partners in the value chain. Several factors affect how the purchases are made and information exchanged. Among others, product type can be an important factor when the company should consider what kind of information that is optimal in the relationship between the goods and 3PL/transporter. Data being collected in this survey will be used as part of a master's degree and further research. All responses will be treated confidentially. Thank you in advance for your help. Sincerely, Berit Irene Helgheim, Associate Professor at University College in Molde.

Name of the company

Department

Year of establishment

Number of employees

Annual sales

Your title/function

Q1 Buyers type of industry

(Q1_alt1) Manufacturing

(Q1_alt2) Commodity trade

(Q1_alt3) Private services

(Q1_alt4) Public administration

(Q1_alt5) Maritime – equipment vendor

(Q1_alt6) Maritime – Shipbuilding yard

(Q1_alt7) Others

Q2 Does your company buy services from more than one 3PL/transporter?

(Q2_alt1) Yes

(Q2_alt2) No

(Q2_alt3) Don't know

Q3

“For how long have you bought 3PL/transportation services?”

- (Q3_alt1) Less than a year
(Q3_alt2) 1 – 3 years
(Q3_alt3) 3 – 5 years
(Q3_alt4) 5 – 10 years
(Q3_alt5) More than 10 years
-

Q4

“For how long have you bought services from the 3PL/transportation provider? (If you buy from several providers, please chose the longest relationship)”

- (Q4_alt1) Less than a year
(Q4_alt2) 1 – 3 years
(Q4_alt3) 3 – 5 years
(Q4_alt4) 5 – 10 years
(Q4_alt5) More than 10 years
-

Q5

“ What services does your company buy from the 3PL/transportation provider?”

- (Q5_alt1) Transportation
(Q5_alt2) Procurement
(Q5_alt3) Inventory services
(Q5_alt4) Other
-

Q06

“In general, how does your company communicate with your 3PL/transportation provider?”

- (Q6_1) Phone
(Q6_2) E-mail
(Q6_3) Fax
(Q6_4) Through the information system owned by the 3PL/transportation provider
(Q6_5) Through the information system owned by your company
-

The responses are based on a Likert Scale from 1 to 7 where 1 is “never” and 7 is “always”

Q07 General integration level of the company

“Does your company have an information system?”

- (Q7_alt1) Yes
(Q7_alt2) No
(Q7_alt3) Don’t know
-

Q08

“Given that your company has not implemented an integrated information sharing system, what are the reasons?”

(Q8_1) The order frequency for the products purchased is too low

(Q8_2) Your company does not possess the IT competence to adopt and operate the system yourself

(Q8_3) The investment cost is too high (e.g. the purchase of software)

(Q8_4) Your company is concerned the 3PL/transportation provider will share strategic information with the competitors of your company

(Q8_5) The training of the employees will be too time-consuming

The responses are based on a Likert Scale from 1 to 7 where 1 is “strongly disagree” and 7 is “strongly agree”

Q09

“Suppose your company had not implemented an integrated information system, but considers doing so. How much time would your company be willing to use on training employees to use the new system?”

(Q9_alt1) 1 day

(Q9_alt2) 3-5 days

(Q9_alt3) 2-3 weeks

(Q9_alt4) 3 months

(Q9_alt5) 6 months

(Q9_alt6) 1 year

(Q9_alt7) More than 1 year

(Q9_alt8) Don't know

Q10

“Suppose your company had not implemented a common information system, but considers doing so. How much resource would your company be willing to use on operating the common information system with the 3PL/transportation provider (in NOK 1000)?”

(Q10_alt1) 10'

(Q10_alt2) 50'

(Q10_alt3) 100'

(Q10_alt4) 200'

(Q10_alt5) 400'

(Q10_alt6) 500'

(Q10_alt7) 1,000'

(Q10_alt8) Don't know

Q11

“Your company has conducted the following adjustments in order to cooperate electronically with the 3PL/transportation provider”

(Q11_1) Performed modifications of internal processes and routines

(Q11_2) Performed adjustments in the IT systems of your company

(Q11_3) Performed investments in order to integrate your company's IT system with the system of

the 3PL/transportation provider

(Q11_4) Used time on internal training on the IT system used for sharing information with the

3PL/transportation provider

The responses are based on a Likert Scale from 1 to 7 where 1 is “strongly disagree” and 7 is “strongly agree”

Q12

“Does your company share an integrated information sharing system with other companies in the supply chain?”

(Q12_alt1) Suppliers

(Q12_alt2) Customers

(Q12_alt3) No, your company does not share an integrated information sharing system with anyone

(Q12_alt4) Don't know (Please specify)

Q13

“Please consider the following statements:”

(Q13_1) Your company possesses superior IT competence

(Q13_2) Your company is depending on buying external IT competence

(Q13_3) The 3PL/transportation provider has customized their services in order to meet your

company's requirements.

(Q13_4) It would be difficult for your company to find a 3PL/transportation provider that could

replace the current 3PL/transportation provider.

(Q13_5) Your company expects the 3PL/transportation provider to deliver orders as scheduled.

The responses are based on a Likert Scale from 1 to 7 where 1 is “strongly disagree” and 7 is “strongly agree”

Q14

“Your company believes it is most efficient to communicate through:”

(Q14_alt1) E-mail

(Q14_alt2) Fax

(Q14_alt3) Phone

(Q14_alt4) An integrated information sharing system towards the 3PL/transportation provider

Q15

“The product distributed by the 3PL/transportation provider belongs to what product groups? (You may mark more than one group)”

(Q15_alt1) Natural raw materials

(Q15_alt2) Minerals

(Q15_alt3) Semi-finished products

(Q15_alt4) Components

(Q16_alt5) Operation and repairing materials

(Q17_alt6) Investment objects

Q16

"Please rank these values according to your company's preferences concerning entering co-operations with 3PL/transportation providers:"

(Q16_1) Delivery reliability (right product at the right time at the right price)

(Q16_2) Delivery time (from ordering to delivery)

(Q16_3) Security of supply (product delivered without breakage/damage)

(Q16_4) Flexibility (ability to handle rush orders)

(Q16_5) Competitive price level

(Q16_6) Possibility to get information electronically from 3PL/transportation providers into

your company's internal information sharing system (e.g. EDI)

(Q16_7) 3PL/transportation provider provides the most environment friendly transport solution

The responses are based on a Likert Scale from 1 to 7 where 1 is "strongly disagree" and 7 is "strongly agree"

Q17

"Please consider the following statements:"

(Q17_1) The co-operation with the 3PL/transportation provider has contributed making your

company more flexible and able to handle changes in demand

(Q17_1) The 3PL/transportation provider has contributed to lower the supply risk by minimizing BRUDD in the supply chain

(Q17_1) The cooperation with the 3PL/transportation provider has contributed in a reduction of lead

time

(Q17_1) The cooperation with the 3PL/transportation provider has reduced the transportation costs

(Q17_1) The cooperation with the 3PL/transportation provider has reduced inventory costs

(Q17_1) The cooperation with the 3PL/transportation provider has reduced procurement costs

(Q17_1) The cooperation with the 3PL/transportation provider has reduced other costs

The responses are based on a Likert Scale from 1 to 7 where 1 is "strongly disagree" and 7 is "strongly agree"

Q18

"How does your company consider the future cooperation with the 3PL/transportation provider?"

(Q18_1) A onetime transaction

(Q18_2) Several transactions, but are not interested in a TETTERE cooperation

(Q18_3) A cooperation with a given time horizon (e.g. frame AVTALER)

(Q18_4) A long-term relationship without any end-date

(Q18_5) A cooperation related to a given project (Joint Venture)

The responses are based on a Likert Scale from 1 to 7 where 1 is "strongly disagree" and 7 is "strongly agree"

Thanks for your help

The survey in Norwegian

NIMA: Elektronisk integrering mot 3PL/transportør

<http://www.freemoveonline.com/fso/AskSurvey.fso?Survey=16287..>



Effektiv informasjonsutveksling spiller stadig en viktigere rolle for at samarbeidet i verdikjeden skal lykkes. Norsk Logistikkbarometer, som sist ble gjennomført i 2007, påpeker en trend mot et økt fokus på en helhetlig logistikkstrategi og at flere bedrifter vil satse på et tettere og mer strategisk samarbeid med transportørene sine. Samtidig kan barometeret også indikere at det er en relativt stor andel av bedriftene som ønsker, men av ulike grunner likevel velger å ikke integrere seg mot sine samarbeidspartnere i verdikjeden. Flere forhold påvirker hvordan innkjøpene blir foretatt og informasjon utvekslet. Blant annet kan varetype være en viktig faktor når bedriften skal vurdere hva slags informasjonssystem som er optimalt i forholdet mellom varene og 3PL/transportøren. Data som blir samlet i denne undersøkelsen vil bli brukt som en del av en mastergrad og videre forskning. Alle besvarelser vil bli behandlet konfidensielt. På forhånd takk for hjelpen. Med hilsen Berit Irene Helgheim, førsteamanuensis ved Høgskolen i Molde.

Navn på bedriften

Navn på eventuell avdeling

Antall årsverk (ca.)

Bedriften ble grunnlagt i år

Ca. årlig omsetning (NOK)

Din tittel/funksjon

1. I hvilken kategori vil du plassere kjernevirksomheten i din bedrift?

- a. Industri
- b. Varehandel
- c. Privat tjenesteyting
- d. Offentlig forvaltning
- e. Maritime - utstyrsleverandør
- f. Maritime - verft
- g. Annet

Hvis annet, vennligst spesifiser:

2. Benytter bedriften din mer enn én ekstern 3PL/transportør?

- a. Ja
 b. Nei
 c. Vet ikke

Hvis ja, hvor mange (ca.):

3. Hvor lenge har dere kjøpt tjenester fra 3PLfirma(er)/transportør(er)?

Under ett år

4. Hvor lenge har dere kjøpt tjenester fra 3PL/transportøren dere har nå? (Hvis dere kjøper tjenester fra flere, oppgi det forholdet med lengst varighet)

Under ett år

5. Hvilke tjenester kjøper dere av 3PL/transportøren?

- a. Transport
 b. Leveranseoppfølging
 c. Lagertjenester
 d. Annet

Hvis annet, vennligst spesifiser:

6. Hvordan pleier din bedrift i hovedsak å kommunisere med 3PL/transportøren?

- | | Aldri | 2 | 3 | 4 | 5 | 6 | Alltid | Vet ikke |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| a. Telefon | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| b. E-mail | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| c. Fax | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| d. Gjennom 3PL/transportørens informasjonssystem (f.eks: EDI) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| e. Gjennom din bedrifts informasjonssystem (f.eks: EDI) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

7. Har din bedrift et informasjonssystem (F.eks EDI)

- a. Ja
 b. Nei
 c. Vet ikke

8. Dersom din bedrift ikke har innført et felles informasjonssystem. Hva er årsaken til dette:

Svært uenig 2 3 4 5 6 Svært enig Vet ikke

- a. Ordrefrekvensen på produktene behandlet av 3PL/transportøren er for lav
- b. Din bedrift har ikke høy nok IT kompetanse til å kunne innføre og drive systemet selv
- c. Investeringskostnaden er for høy (f.eks kjøp av software)
- d. Din bedrift er bekymret for at 3PL/transportøren skal dele strategisk informasjon med din bedrifts konkurrenter
- e. Det vil ta for lang tid å lære opp de ansatte i bruken av systemet

9. Sett at din bedrift ikke har innført et felles informasjonssystem, men vurderer å gjøre dette:

- | | 1 | 3-5 | 2-3 | 3 | 6 | 1 | mer | Vet |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| | dag | dager | uker | mnd | mnd | år | enn 1 | ikke |
| a. Hvor mye tid ville din bedrift vært villig til å sette av på å lære opp de ansatte i bruken av informasjonssystemet ved en eventuell innføring? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

10. Sett at din bedrift ikke har innført et felles informasjonssystem, men vurderer å gjøre dette:

- | | 10' | 50' | 100' | 200' | 400' | 500' | 1'000 | Vet |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| | | | | | | | | ikke |
| a. Hvor mye ressurser ville din bedrift være villig til å bruke på årlig service av et felles informasjonssystem med 3PL/transportøren ved en eventuell innføring? (oppgitt i 1000 kr) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

11. For å kunne samarbeide elektronisk med 3PL/transportøren har din bedrift gjort følgende tilpasninger:

- | | Liten | 2 | 3 | 4 | 5 | 6 | Stor | Vet |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| | grad | | | | | | grad | ikke |
| a. Foretatt endringer i interne prosesser og rutiner | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| b. Foretatt tilpasninger til din bedrifts IT systemer | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| c. Foretatt investeringer for å integrere din bedrifts IT systemer med systemet til 3PL/transportøren | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| d. Brukt tid på intern opplæring på IT systemet som brukes for å dele informasjonen med 3PL/transportøren | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

12. Har din bedrift et felles informasjonssystem opp mot andre bedrifter i verdikjeden?

- a. Leverandører
- b. Kunder
- c. Nei, din bedrift har ikke noe felles informasjonssystem med noen
- d. Andre

Hvis andre, vennligst spesifiser:

13. Vennligst vurder følgende påstander:

	Svært uenig	2	3	4	5	6	Svært enig	Vet ikke
a. Din bedrift har svært god IT kompetanse	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Din bedrift er avhengig av å kjøpe eksterne IT kompetanse	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. 3PL/transportøren har skreddersydd tjenestene sine for å møte behovene til din bedrift	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Det ville være vanskelig for din bedrift å erstatte denne 3PL/transportøren med en annen 3PL/transportør	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Din bedrift forventer at 3PL/transportøren leverer ordrene til rett tid uten forsinkelser	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

14. Din bedrift tror det mest effektive er å bruke:

	Svært uenig	2	3	4	5	6	Svært enig	Vet ikke
a. E-mail	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Fax	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Telefon	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Felles informasjonssystem	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

15. Produktet/produktene som blir behandlet av 3PL/transportøren hører til følgende produktgrupper (du kan merke flere hvis dette passer)

- a. Naturlige råmaterialer
- b. Mineraler
- c. Halvfabrikat
- d. Komponenter
- e. Drifts- og reparasjonsmaterieil
- f. Investeringsobjekter

16. Vennligst ranger din bedrifts viktigste verdier når det gjelder å inngå samarbeid med 3PL/transportører:

	Ikke viktig	2	3	4	5	6	Svært viktig	Vet ikke
a. Leveringspålitelighet (rett produkt på rett tid på rett sted)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Leveringstid (fra bestilling til levering)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Leveringssikkerhet (produkt levert uten brekkasje/skade)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Leveringsfleksibilitet (evne til å behandle hasteordre)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Konkurransedyktig prisnivå	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. Mulighet for å få informasjonen elektronisk fra 3PL/transportør og inn i bedriftens egne informasjonssystem (f.eks EDI)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. 3PL/transportøren velger den mest miljøvennlige transportløsningen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

17. Vennligst vurder disse påstandene:

	Svært uenig	2	3	4	5	6	Svært enig	Vet ikke
a. Samarbeidet med 3PL/transportøren har bidratt til at din bedrift har blitt mer fleksibel og dermed kan tilpasse seg behovsendringer (f.eks: hasteordre)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

- b. 3PL/transportøren har bidratt til at din bedrift har redusert leveringsrisikoen ved å minimere avbrudd i verdikjeden
- c. Samarbeidet med 3PL/transportøren har ført til at leveringstiden har blitt redusert
- d. Samarbeidet til 3PL/transportøren har redusert transportkostnadene
- e. Samarbeidet til 3PL/transportøren har redusert lagerkostnadene
- f. Samarbeidet til 3PL/transportøren har redusert leveranseoppfølgingskostnadene
- g. Samarbeidet til 3PL/transportøren har redusert andre kostnader

Hvis andre kostnader, vennligst spesifiser

18. Hvordan ser din bedrift på det fremtidige samarbeidet med 3PL/transportøren?

- | | Svært uenig | 2 | 3 | 4 | 5 | 6 | Svært enig | Vet ikke |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| a. Et engangstilfelle | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| b. Flere transaksjoner, men ikke interessert i et tettere samarbeid | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| c. Et samarbeid med en gitt tidshorisont (f.eks: rammeavtaler) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| d. Et samarbeid som er langsiktig og ikke har noen "sluttdato" | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| e. Et samarbeid i forbindelse med et spesielt prosjekt (Joint Venture) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Tusen takk for hjelpen

Submit

Appendix 2

Descriptive statistics untransformed variables

Descriptive statistics for the duration of the relationship DUR_RELA indicators

Items	N	Miss	Mean	Med	Std	Min	Max	Skew	Kurtosis
Q18_1 A onetime transaction	36	3	1.50	1	1.183	1	7	3.397	13.446
Q18_2 Multiple transactions, but not interested in a deeper relationship	36	3	2.06	2	1.264	1	5	1.060	-0.039
Q18_3 A cooperation with a given time horizon (e.g. general agreement)	36	3	5.22	6	2.257	1	7	-1.035	-0.470
Q18_4 A long-term relationship without any end-date	36	3	3.89	4	2.240	1	7	-0.015	-1.473
Q18_5 Cooperation related to a given project (Joint Venture)	36	3	2.83	2	2.077	1	7	0.742	-0.787

Descriptive statistics for the dependent variable COM_FORM indicators

Items	N	Miss	Mean	Med	Std	Min	Max	Skew	Kurtosis
Q6_1 Telephone	37	2	4.81	5	1.411	1	7	-0.398	0.349
Q6_2 E-mail	37	2	5.16	5.16	1.463	1	7	-0.860	0.728
Q6_3 Fax	37	2	2.16	2.16	1.344	1	6	1.140	0.541
Q6_4 Through the 3PL providers information system	37	2	2.59	2.59	1.922	1	7	0.965	-0.260
Q6_5 Through your company's information system	37	2	2.54	2.54	2.256	1	7	1.011	-0.728

Descriptive statistics for the 3PL client commitment COM_FORM indicators

Items	N	Miss	Mean	Med	Std	Min	Max	Skew	Kurtosis
Q11_1 Performed modifications of internal processes and routines	33	6	3.61	4	1.968	1	7	0.041	-1.090
Q11_2 Performed adjustments in the IT systems of your company	33	6	3.67	4	2.102	1	7	0.063	-1.236
Q11_3 Performed investments in order to integrate your company's IT system with the system of the	34	5	2.82	1.50	2.067	1	7	0.579	-1.094

3PL/transportation provider									
Q11_4 Used time on internal training on the IT system used for sharing information with the 3PL/transportation provider	34	5	2.59	1.50	1.877	1	7	0.730	-0.839

Descriptive statistics for the 3PL clients' dependence on the 3PL provider

CLI_DEP_PROV indicators

Items	N	Miss	Mean	Med	Std	Min	Max	Skew	Kurtosis
Q13_1 Your company holds good IT competence	39	0	4.97	5	1.460	1	7	-0.274	-0.120
Q13_2 Your company is dependent on buying IT competence from external actors	39	0	4.13	4	1.720	1	7	0.086	-1.018
Q13_3 The 3PL/transportation provider has customized their services in order to meet your company's requirements.	32	7	3.78	4	1.879	1	7	-0.035	-1.124
Q13_4 It would be difficult for your company to find a 3PL/transportation provider that could replace the current 3PL/transportation provider.	34	5	2.71	2	1.643	1	6	0.417	-1.291
Q13_5 Your company expects the 3PL/transportation provider to deliver orders as scheduled.	37	2	6.38	7	1.233	1	7	-2.855	9.694

Discriptive statistics for Q4, a part of duration

Items	N	Miss	Mean	Med	Std	Min	Max	Skew	Kurtosis
Q4 The length of the relationship	39	0	4.64	7.5	3.34	0.5	10	-0.221	-1.332

Descriptive statistics for the products in product_index

Items	N	Miss	Mean	Med	Std	Min	Max	Skew	Kurtosis
Q15_1 Natural raw materials	39	0	0.28	0	0.456	0	1	1.008	-1.040
Q15_2 Minerals	39	0	0.05	0	0.223	0	1	4.233	16.779
Q15_3 Semi-finished products	39	0	0.64	0	1.158	0	1	4.512	24.817

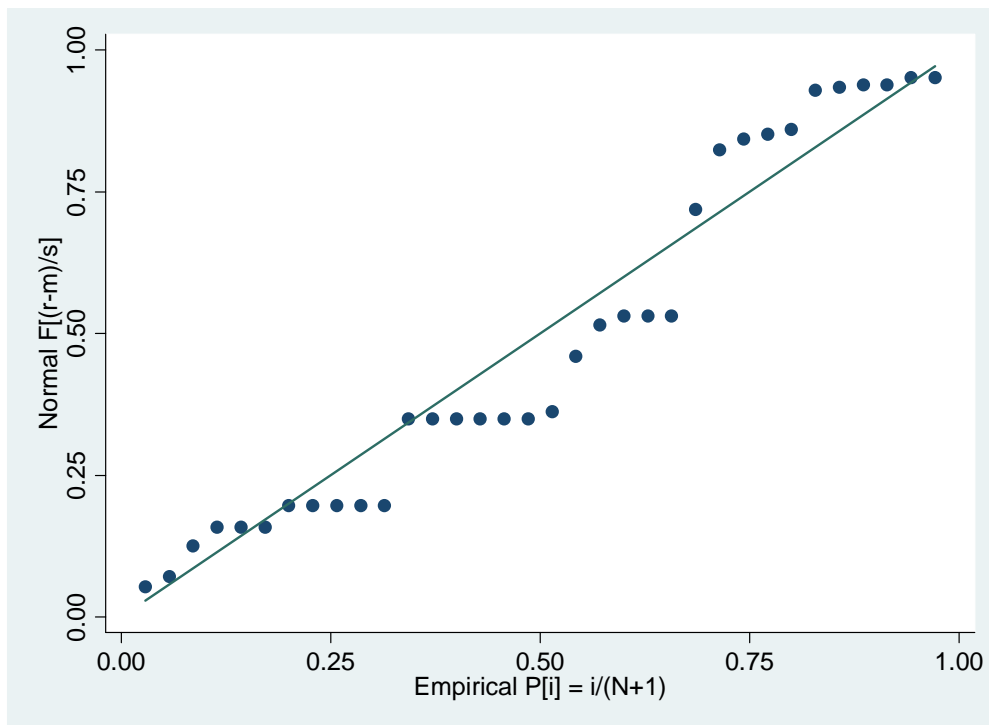
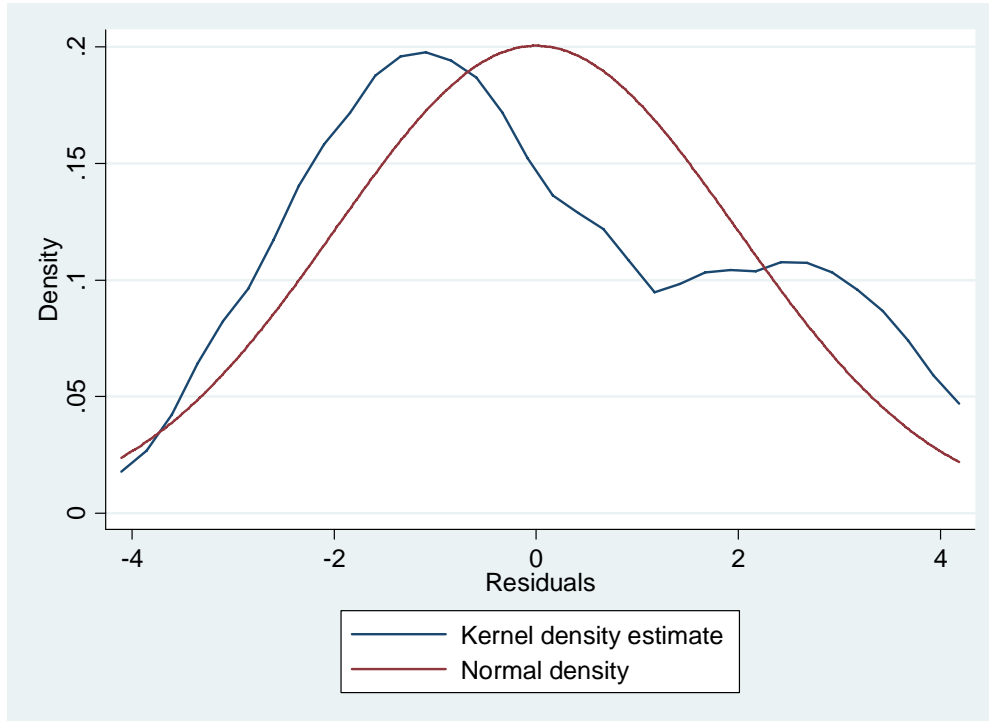
Q15_4 Components	39	0	0.74	1	0.442	0	1	-1.161	-0.691
Q15_5 Operation and repairing materials	39	0	0.51	1	0.506	0	1	-0.53	-2.108
Q15_6 Investment objects	39	0	0.28	0	0.456	0	1	1.008	-1.040

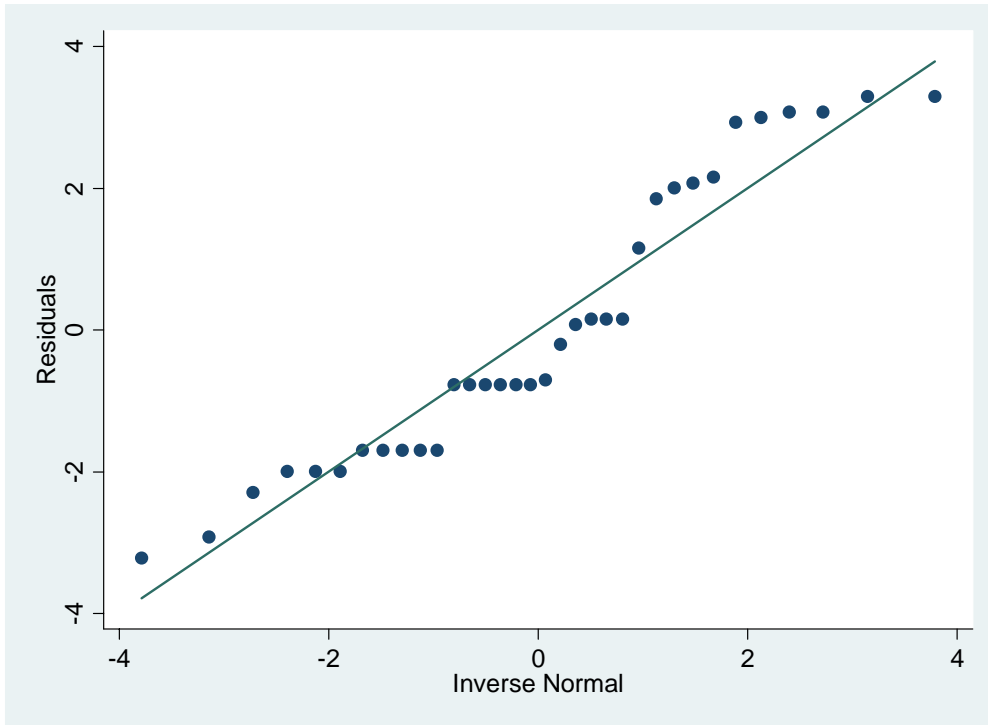
Descriptive statistics for the services in bundling

Items	N	Miss	Mean	Med	Std	Min	Max	Skew	Kurtosis
Transportation	39	0							
Procurement	15	0							
Inventory Services	8	0							
Others	0	0							

Appendix 3

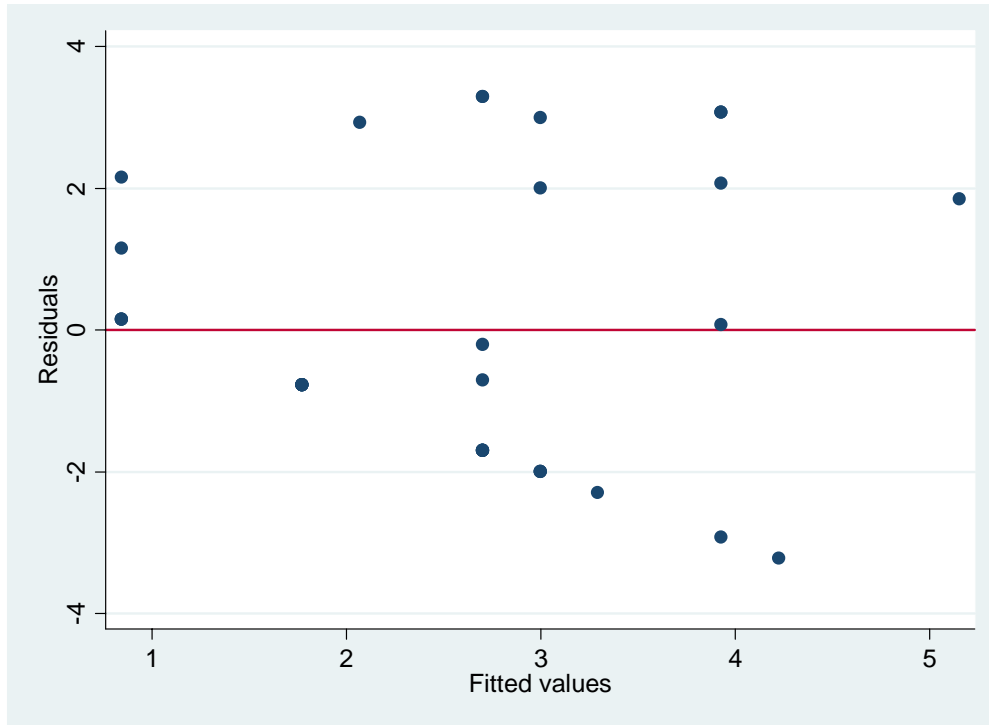
Regression analysis bundling, product





Mean		Std. Dev	1.991	n	34
Median	-0.7366	Pseudo std. Dev.	2.746	IQR	3.704
10 trim	-0.07				
			low		High
		Inner fences	-7.257		7.56
		Mild outliers	0		0
		Mild outliers %	0%		0%
		Outer fences	-12.81		13.12
		Severe outliers	0		0
		Severe outliers	0%		0%

Shapiro Wilk W test for normal data					
Variable	Obs	W	V	z	Prob>z
r	34	0.93222	2.367	1.795	0.03631

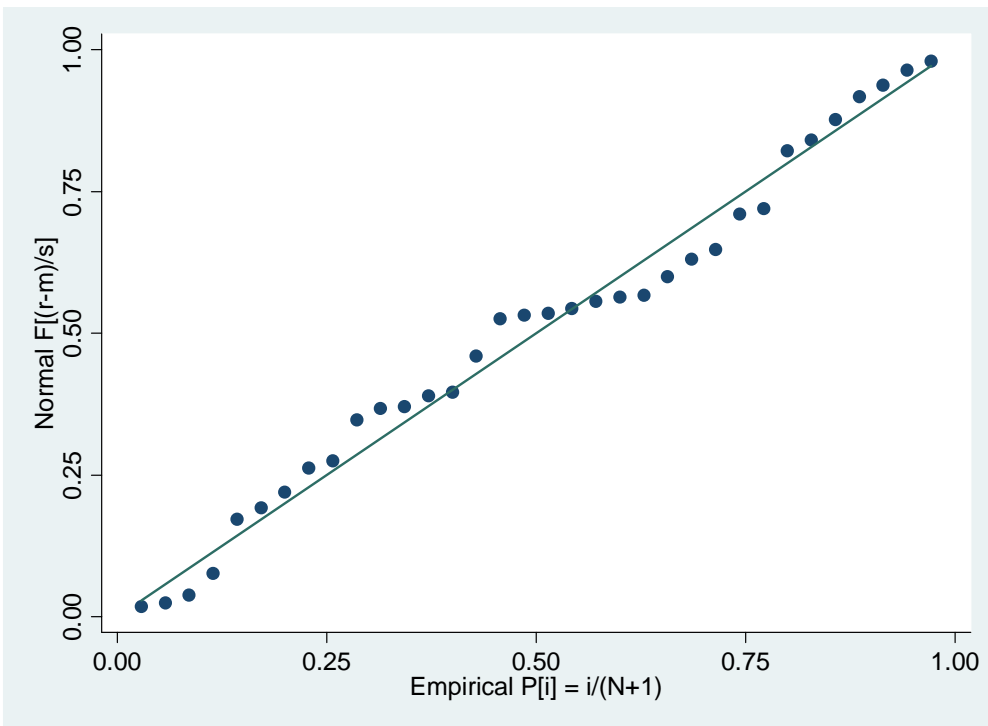
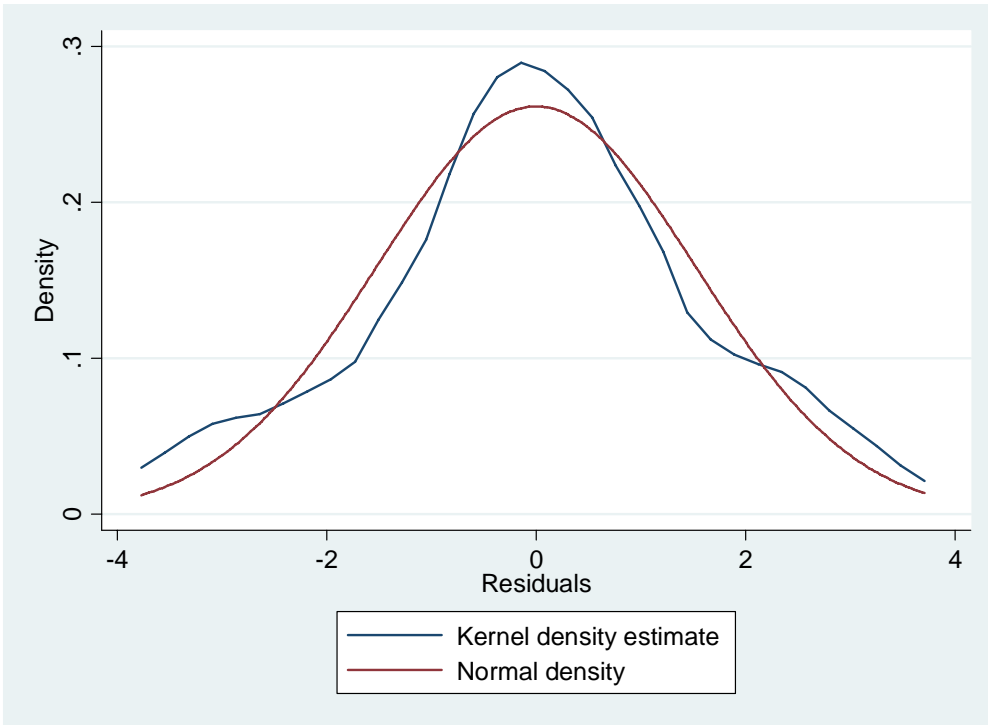


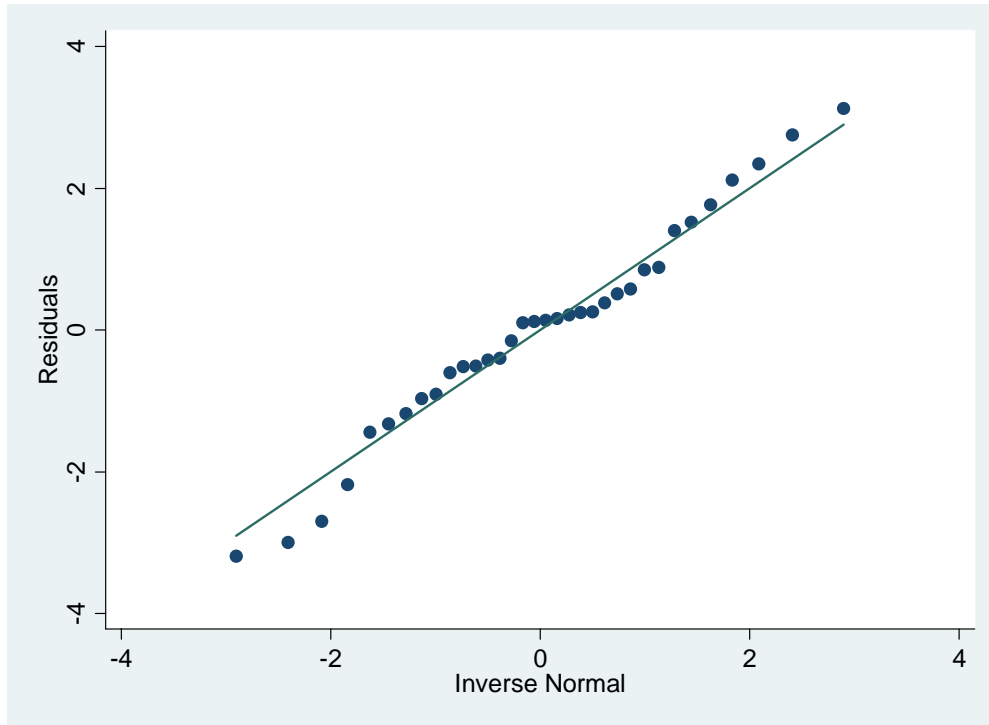
Cameron & Trivedi's decomposition of IM-test			
Source	Chi2	df	P
Heteroskedasticity	12.48	5	0.0288
Skewness	4.75	2	0.0930
Kurtosis	3.81	1	0.0509
Total	21.04	8	0.0070

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity	
Chi2(1)	3.81
Prob > chi2	0.0511

Variable	VIF	1/VIF
Product	1.00	1.00
Bundling	1.00	1.00
MEan VIF	1.00	

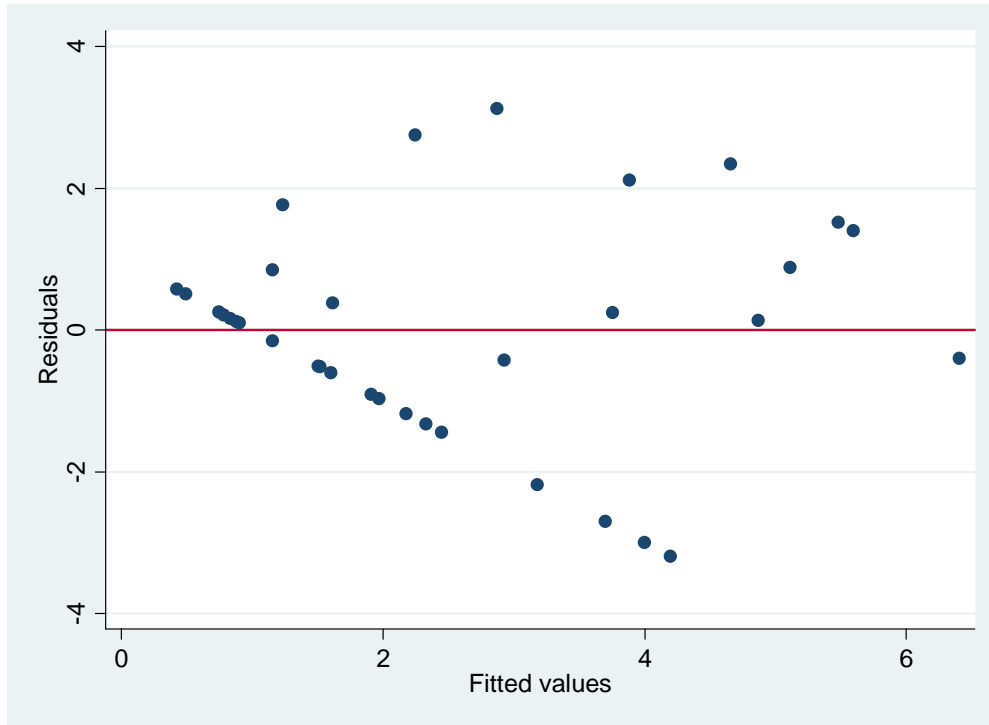
Regression analysis Commitment Dependence





Mean		Std. Dev	1.525	n	34
Median	-0.1288	Pseudo std. Dev.	1.302	IQR	1.756
10 trim	-0.0275				
Mean	0.0086		low		High
Median	0.0121	Inner fences	-3.544		3.482
10 trim	0.0105	Mild outliers	0		0
		Mild outliers %	0%		0%
		Outer fences	-6.179		6.117
		Severe outliers	0		0
		Severe outliers	0%		0%

Shapiro Wilk W test for normal data					
Variable	Obs	W	V	z	Prob>z
r	34	0.97737	0.790	-0.491	0.68829



Cameron & Trivedi's decomposition of IM-test			
Source	Chi2	df	P
Heteroskedasticity	15.14	5	0.0098
Skewness	4.69	2	0.0958
Kurtosis	0.06	1	0.0958
Total	19.89	8	0.8030

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity	
Chi2(1)	3.93
Prob > chi2	0.0475

Variable	VIF	1/VIF
Product	1.03	0.9748
Bundling	1.03	0.9748
Mean VIF	1.03	

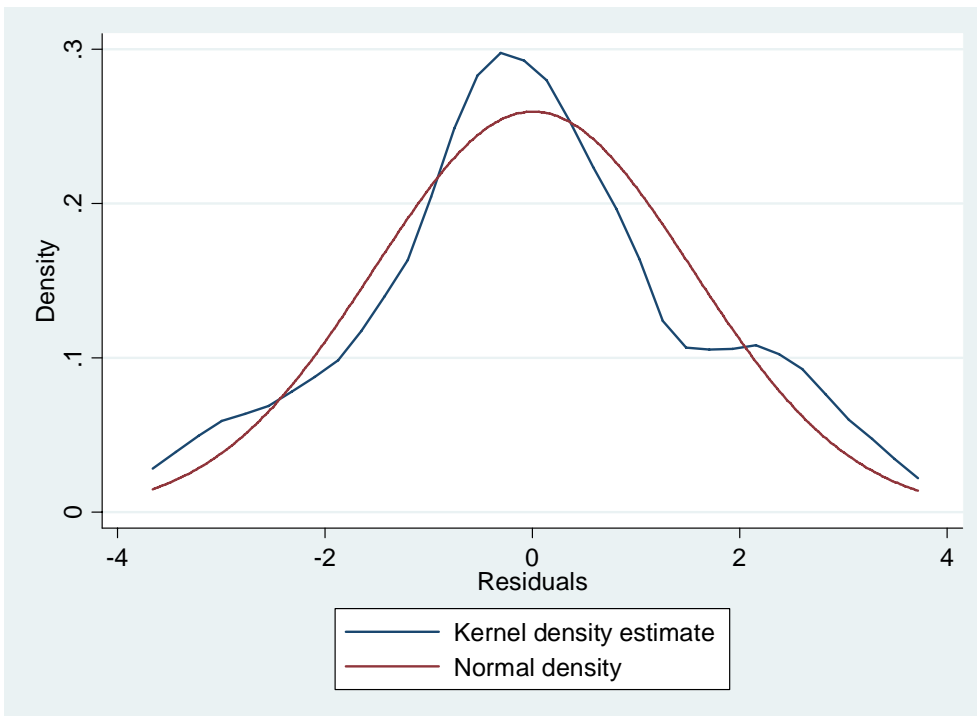
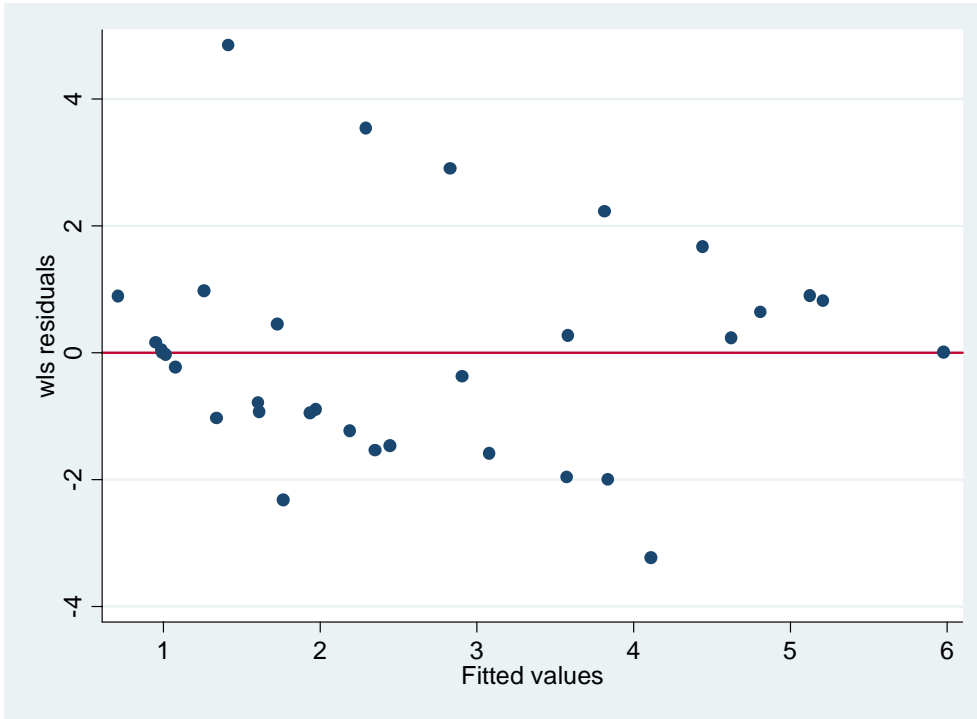
Appendix 4

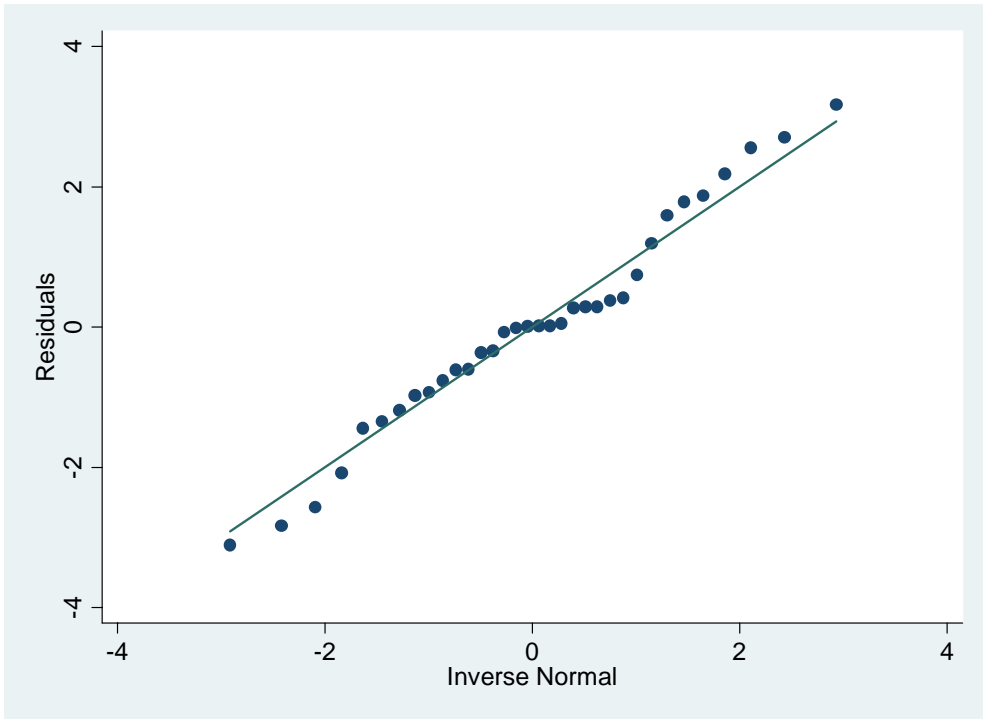
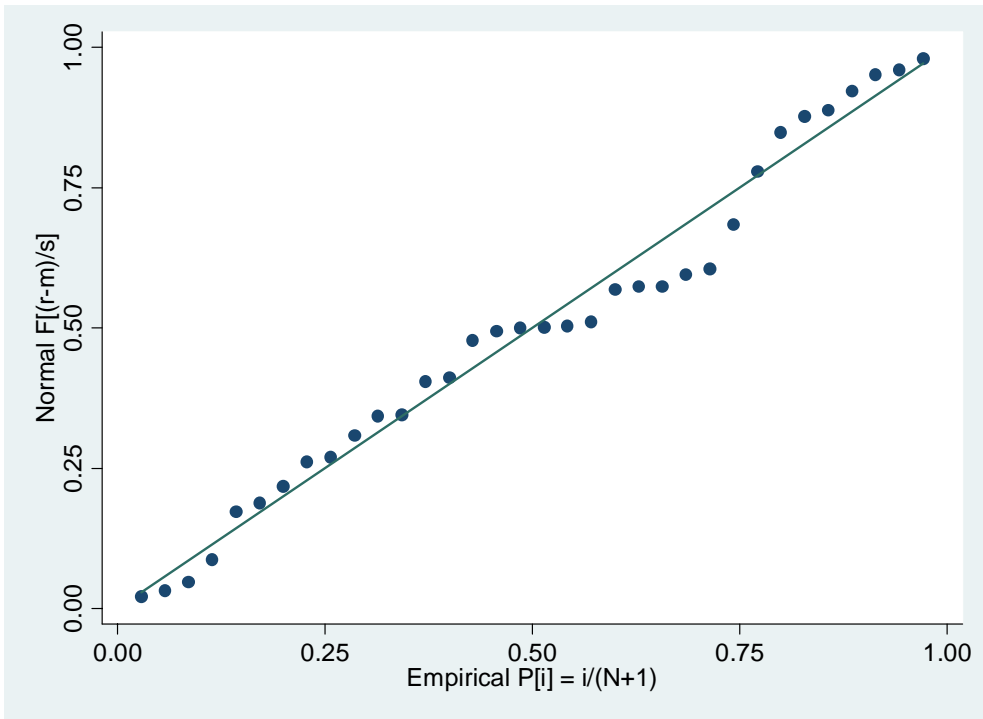
DEP - Coordination

Items	N	Miss	Mean	Med	Std	Min	Max	Skew	Kurtosis
Coordination	39	0	0.8668	0.8797	0.356	0	1.67	0.026	-0.082

Result of WLS regression

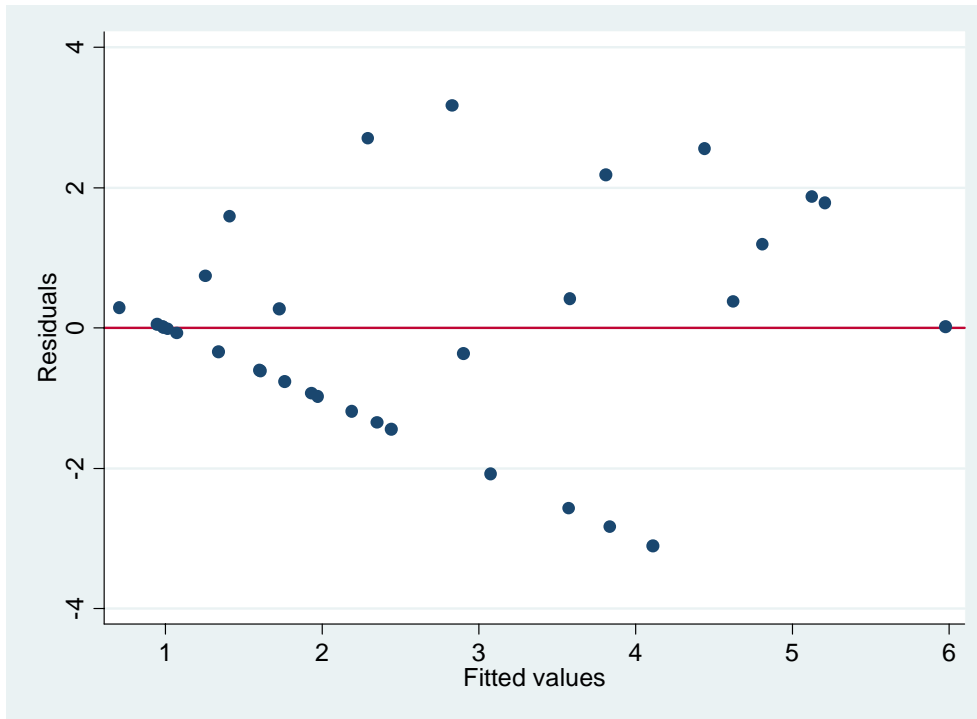
Source	SS	df	MS	N	34
Model	46.992	2	46.598	F(2,31)	13.30
Residual	52.999	30	2.474	Prob >F	0.001
Total	99.991	32		R-sq	0.4700
				Adj R-sq	0.4346
				Root	1.3292
VEI	Coef.	Std. Err.	t	P	[95% Conf. Interval]
Commitment	0.736	0.165	4.45	0.000	
Dependence	0.157	0.701	2.22	0.034	
Constant	0.350	0.422	0.83	0.412	





r | 34 0.97507 0.871 -0.289 0.61356

Shapiro Wilk W test for normal data					
Variable	Obs	W	V	z	Prob>z
r	34	0.97507	0.871	-0.289	0.61356



Cameron & Trivedi's decomposition of IM-test could not be tested due to WLS regression

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity	
Chi2(1)	14.66
Prob > chi2	0.0001

Variable	VIF	1/VIF
Client Commitment	1.01	0.992846
Dependence	1.01	0.992846
Mean VIF	1.01	

mean	0.0086		low		High
median	0.0121	Inner fences	-3.447		3.258
10 trim	0.0105	Mild outliers	0		0
		Mild outliers %	0%		0%
		Outer fences	-5.962		5.772
		Severe outliers	0		0
		Severe outliers %	0%		0%

