Customer Integration and Operational Performance: The Influence of Learning Mechanisms in Third Party Logistics

by

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ABSTRACT

Third party logistics companies, also known as 3PLs, must adapt their operations to the supply chains of each of their customers. 3PLs either replace existing assets and resources operated by their customers or manage assets and resources on behalf of their customers. There are likely to be significant levels of complexity associated with these organizational adaptations, requiring ongoing adjustments to maintain relevance. To place these levels of complexity into context, consider that the larger 3PLs will have billion dollar US revenue streams and are likely to manage hundreds of individual operations on behalf of their customers. Despite 3PLs being placed in these integral management roles within their customers' supply chains, surprisingly little is known about 3PL customer integration and operational performance.

The present study is designed to partly close this gap in our knowledge by fulfilling two objectives: to identify direct effects of 3PL customer integration on 3PL operational performance; and, to identify how learning mechanisms influence 3PL customer integration and 3PL operational performance.

Learning mechanisms are processes that are capable of effecting change in operating capabilities, such as those that 3PLs require to integrate effectively with their customers. Organizational components that may be associated with learning mechanisms include learning processes, learning (absorptive) capacities, and customer oriented learning cultures. The present study examines how these elements influence 3PL customer integration and 3PL operational performance, both directly and indirectly, by addressing the high-level research question of how 3PL companies serving multiple customers are able to maintain effective levels of integration with their customers to positively influence operational performance.

More than 450 employees of a very large 3PL firm and its customers in Australia were surveyed using an email and web-based survey technique. A total of 230 surveys were answered and 214 were usable in the final analyses, which employed a recently developed structural equation modeling technique to test both direct and indirect relationships between five latent variables representing the constructs of interest.

The results demonstrate that 3PL customer integration has a significant, positive, direct effect on 3PL operational performance. The results also demonstrate that learning processes, absorptive capacities of individual employees, and a customer oriented learning culture, significantly and positively, influence both 3PL customer integration and 3PL operational performance.

The results contribute to organizational learning theories by demonstrating how components of organizational learning interact, and by demonstrating how learning mechanisms affect customer integration and operational performance. The results clarify theoretical arguments relating to the roles of organizational learning processes and customer oriented learning cultures. The absorptive capacity of employees is shown to be important to operational performance of 3PLs, closing an empirical gap in theories of absorptive capacity. Both customer orientation and absorptive capacity of employees are shown to act as dynamic capabilities with direct effects on 3PL customer integration and indirect effects on 3PL operational performance. The latter result suggests extant theories of absorptive capacity should be adjusted to reference its indirect, rather than direct, effects on performance.

The results contribute significantly to our understanding of how 3PLs are able to adapt to the supply chain environment of each of their customers by identifying learning mechanisms that influence customer integration and operational performance. The results also add to our understanding of the relationship between customer integration and operational performance by demonstrating that its positive nature holds in 3PL environments, extending existing knowledge of the impact of logistics integration. This is an important finding for managers of 3PLs. The results further contribute to managerial practice by demonstrating that specific investments in learning mechanisms have positive effects on operational performance.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

STATEMENT OF CANDIDATE

This work represents the original contribution of the author, except where specifically referenced or noted in footnotes. The work is submitted in fulfillment of the degree of Doctor of Philosophy in Management. The work was conducted whilst the author was a student at Macquarie Graduate School of Management, Macquarie University, Sydney, Australia.

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I hereby certify that the work has not been submitted for a higher degree at any other university or educational institution.

Stig Christer Hemstrom

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CHAPTER 1: INTRODUCTION

1.1 Overview of Chapter 1

This chapter introduces key ideas, arguments and perspectives that are used within the thesis to examine the relationship between customer integration and operational performance in third party logistics operations, and to explain how learning mechanisms influence the relationship between these factors. The three sections that follow the present one contain the key theoretical arguments that will be examined within the thesis. The research questions are then presented. The two subsequent sections present reasons the research questions are of academic and managerial interest. Summaries of the methodology and the high level answers to the research questions are then presented. The chapter closes with an outline of the structure of the thesis.

1.2 Why study customer integration and performance in third-party logistics?

Logistics outsourcing companies, often known as third party logistics companies or 3PLs, represent a growth sector of the international economy. Many 3PLs have US billion dollar revenues, international footprints, and good growth profiles (Lieb and Lieb, 2010, 2012). 3PLs generate their revenues by providing warehousing services (e.g., Cui and Hertz, 2011), specialized transport services (e.g., Liu, 2011; Solakivi et al., 2013), and in some cases broader supply chain services (e.g., Banomyong and Supatn, 2011; Huemer, 2012) to their customers. The 3PL segment of the service industry has been on a growth path since the 1980s (Maloni and Carter, 2006) and is now growing within emerging economies (Banomyong and Supatn, 2011; Mothilal et al., 2012) as well as within developed economies (Lieb and Leib, 2012; Solakivi et al., 2013).

The nature of the services delivered by 3PLs demands that 3PLs adapt their operations to their customers' operating environments (Hertz and Alfredsson, 2003; Bourlakis and Melewar, 2011; Cui and Hertz, 2011). Organizational adaptation presents managers in most industries with significant levels of complexity (Lee, 2004). 3PLs often replace existing assets and resources operated by their customers (Large, 2007). These assets may include fleets of trucks and warehouses (Maloni and Carter, 2006; Zhou and Lee, 2009), complex information technology systems (Marasco, 2008), or product assembly, installation and returns capabilities (Wilding and Juriado, 2004). In other cases, they these manage existing assets and resources on behalf of their customers (Huemer, 2012). Whether 3PLs replace or manage the assets and resources is emerging as less of an issue (Zacharia et al., 2011b) than the fact that these assets play critical roles for companies that rely on physical distribution of goods to generate sales. In all cases, they must, to a degree, be operationally integrated with their customers in order to provide their services (Lambert et al., 1999; Hertz and Alfredsson, 2003).

Operational integration sits at the heart of the supply chain concept (Schoenherr and Swink, 2012) and is known to have significant positive effects on both operational performance (e.g., Flynn et al., 2010; Iyer, 2011; Huo, 2012) and financial performance (e.g., Singh and Power, 2009; Wong et al., 2011) of companies. Integration is generally thought of in terms of supplier integration, internal integration, and customer integration (e.g., Flynn et al., 2010). Each type of integration has its own characteristics (e.g., Pagell, 2004; Flynn et al., 2010) and provides its own levels of contribution to organizational performance (e.g., Swink et al., 2007), which may vary as environments or market change (e.g., Wong et al., 2011). So, though there is a substantial amount of research yet to be done to fully understand the relationship between integration and performance (Fabbe-Costes and Jahre, 2008), much is already known about this relationship within business environments in general.

Substantially less is known about the formation and development of operational integration, and how antecedents or causal factors of integration affect performance. For example, the three types of integration display some levels of interaction (e.g., Germain and Iyer, 2006) and many researchers believe that all companies must start their integration efforts by integrating their own internal operations (e.g., Flynn et al., 2010; Germain and Iyer, 2006; Stank et al., 2001b). Others disagree with this perspective and believe the different types of integration should be developed in concert (e.g., Droge et al., 2004). To date, there has been a lack of research relating operational integration of 3PLs with their customers and 3PL performance (Fabbe-Costes et al., 2009). This lack of research extends to the development and evolution of these operational capabilities in 3PLs. The literature that is emerging explores aspects of this area of operations management through the use of selective case studies linked to theoretical frameworks (e.g., Cui and Hertz, 2011; Zacharia et al., 2011b; Huemer, 2006, 2012).

Third party logistics companies need to adapt to multiple supply chains on multiple occasions once they grow beyond serving a single customer. For larger 3PLs, with revenues of hundreds of millions of dollars or more (Lieb and Lieb, 2010, 2012), this need to adapt occurs routinely, on each occasion they acquire a new customer, and on each occasion one of the existing customers adapts to external environmental changes or internal strategic changes. While recent research has shown that companies that adapt effectively to their external environments deliver higher levels of supply chain performance (Whitten et al., 2012), previous research has also highlighted that the complexity of single organizational adaptations often drives sub-optimal performance (Lee, 2004). A key question, which has not been addressed in the literature to date, is how is it possible for 3PLs to survive and thrive in an environment of multiple, routine, demands to adapt to changing business conditions? This question is a major motivating factor for the present study, which examines *mechanisms* that make it possible for 3PLs to successfully integrate their operations with their customers to maintain operational performance.

Introducing a focus on mechanisms that support operational performance associated with customer integration benefits both organizational theory and operational practice. Firstly, this focus builds our understanding of the theoretical base for 3PL success. It brings new theoretical lenses to the study of customer integration and introduces new theories that explain how customer integration can be maintained to positively affect operational performance in environments subject to constant, routine, change. Secondly, the focus on these mechanisms helps 3PL managers better understand the areas of activity they must address to ensure they maintain operational performance in the face of ongoing demands for change from existing and new customers. Focusing on mechanisms that help 3PLs build and effectively maintain customer integration therefore extends the theoretical base of operations management.

The present study is based on a different approach to the case study approach. An initial objective of the present research is to close one of the gaps in the literature identified by Fabbe-Costes et al. (2009), viz., the nature of the relationship between customer integration and operational performance in 3PLs. This relationship will be studied using a quantitative methodology to provide measures of the strength and significance of the relationship. Previous studies have shown this relationship to be positive (Huo, 2012;

Peng et al., 2013; Wong, 2013); however, there is a lack of studies within the 3PL environment (Fabbe-Costes et al., 2009) to confirm that this relationship holds firm under third party logistics outsourcing conditions. A second objective, which is more interesting from a theoretical perspective, is to extend this work by exploring operational performance effects of learning mechanisms (Bunge, 1997) that influence customer integration. Theories and research published in the strategic management (Zollo and Winter, 2002; Winter, 2003; Kale and Singh, 2007; Helfat and Winter, 2011) and organizational learning literatures (Crossan et al., 1999; Argyris, 2003; Easterby-Smith and Prieto, 2008; Crossan et al., 2011; Vera et al., 2011) that contribute to our understanding of a broad learning framework, or learning system (Bunge, 1997, 2004), will be operationalized within a 3PL environment to meet this second objective. Theoretical justification for introducing a learning framework to explain the adaptation of 3PLs within their environments, and the enabling of customer integration to affect operational performance, is based on early work by Zollo and Winter (2002), Winter (2003), and Argyris (2003), which reference multiple theoretical perspectives. The study draws on organizational learning theory (Argyris, 2003; Vera et al., 2011), theory addressing dynamic capabilities (Teece et al., 2007), theory focusing on absorptive capacity (Cohen and Levinthal, 1991), and theory based on evolutionary economics (Zollo and Winter, 2002). Closing the gap in the literature relating customer integration to operational performance in 3PLs therefore serves as a point of departure. Exploration of the relevance and utility of the learning system within 3PL environments presents a new perspective on this area of operations management. The perspective introduces a theoretical framework that places customer integration and its relationship with operational performance within a broader context of adaptation and learning, which is critical in 3PL environments that are subject to constant change (Terreberry, 1968), and is likely to be of interest to operations management researchers (Selviaridis and Spring, 2007). Testing mechanisms within the learning system should also be of interest to theoreticians because research exploring these mechanisms is limited (Vera et al., 2011), especially within 3PL environments.

1.3 What are organizational learning mechanisms and why study them in third party logistics?

Bunge's (1997, 2004) ideas on systems and mechanisms will be called on for guidance when reflecting on the notions of organizational learning that are deployed in this study. These ideas have previously been used by Vera et al. (2011) to build an organizational learning framework, and to focus, in a general sense, on the process elements associated with the learning system. The present research is directly concerned with the learning mechanisms that affect customer integration and operational performance within 3PL environments. Three of Bunge's ideas have particular relevance in this context:

1. The idea of a system "… behaving as a unit in some respects and … embedded in some environment…" (Bunge, 1997, p415).
2. The idea that a system "…may be analyzed into its composition … environment, and structure …" (Bunge, 1997, p416).
3. The idea of a mechanism as a process in the system "… that it is capable of bringing about or preventing some change in the system as a whole or in some of its subsystems…" (Bunge, 1997, p414).

Bunge's ideas provide a framework for reflection within the present study and the third idea is particularly relevant to organizational learning within the context of 3PL environments. Researchers and theoreticians believe that organizational learning processes and learning capacities influence the evolution of operational capabilities and their effects on organizational performance (see Easterby-Smith and Prieto, 2008; Vera et al., 2011). Thinking of the former factors as components or processes of a system may help provide perspective when reflecting on the indirect and total effects of those factors on operational performance within 3PL environments.

Learning mechanisms must involve at least two components of an organizational learning system (Bunge, 1997, p447). These components include learning processes (Zollo and Winter, 2002) and learning capacities (Cohen and Levinthal, 1989, 1990; Vera et al., 2011). Learning processes are often characterized to include both reflective activities such as articulation and codification (Zollo and Winter, 2002; Kale and Singh, 2007) as well as communication related activities such as knowledge sharing (e.g., Kale and Singh, 2007; Crossan et al., 2011). Learning capacities, or absorptive capacities as they are more commonly called (see Cohen and Levinthal, 1989, for a discussion on the terminology), have historically been characterized as being embedded within individuals working in organizations, within groups that operate in organizational environments, and within processes that have been developed by organizations (Cohen and Levinthal, 1989, 1990; Zahra and George, 2002; Lane et al., 2006). They are often characterized as being specific to learning about environments external to the focal organizations (Vera et al., 2011). Absorptive capacities of individuals, which will be termed employee absorptive capacities in this study, have had less focus from researchers than their related organizational processes, so their roles within learning systems are less well understood (Lane et al., 2006; Volberda et al., 2010). Learning mechanisms lay bare the processes (Bunge, 1997, p447) that link these components of learning systems to the organizational levers, generally the operational capabilities, that influence organizational performance (Zollo and Winter, 2002; Easterby-Smith and Prieto, 2008; Vera et al., 2011).

Theoretical frameworks that contribute to our understanding of how organizational learning mechanisms, learning processes, learning capacities, and operational capabilities affect performance within organizational learning systems emphasize hierarchical effects (see Vera et al., 2011). Winter (2003), for example, used the framework and terminology of differential calculus to define levels of capabilities; higher-order capabilities cause change in lower-order capabilities. And Argyris (2003) ranked double-loop learning and deutero-learning above single loop learning. These frameworks position operational capabilities at the lowest level of the hierarchy with limited learning capacities (Zollo and Winter, 2002; Argyris, 2003; Winter, 2003; Vera et al., 2011). Operational capabilities are thought to deal well with transactional perturbations (Argyris, 2003; Winter, 2003), but are held to be largely incapable of addressing structural changes within markets or operating environments (Argyris, 2003; Winter, 2003). Tempering these arguments are Helfat and Winter (2011), who have cautioned that there are both time-based issues and framing issues that may place limits on these hierarchical perspectives. Operational capabilities are characterized as zero-order capabilities (Winter, 2003; Vera et al., 2011) that directly influence organizational performance and enable organizations to earn tangible profits (Winter, 2003). These same frameworks embed the idea that higher level learning processes, learning capacities, and learning mechanisms enable organizational adaptations that are based on strategic initiatives or new perspectives of implications of environmental changes (Zollo and Winter, 2002; Argyris, 2003; Winter, 2003; Vera et al., 2011). Though empirical research is limited to date (Vera et al., 2011), evidence within a number of fields supports these ideas (see Easterby-Smith and Prieto, 2008; Verona and Zollo, 2011). However, to the present author's knowledge, the general hierarchical framework has never been tested within supply chain environments that focus on customer integration, let alone within 3PL environments. Studying an integrated learning system based on well-grounded theoretical frameworks within a 3PL environment to identify the learning mechanisms that influence operational performance associated with customer integration therefore presents the opportunity to contribute meaningful new knowledge to the operations management literature.

1.4 Why study customer orientation in third party logistics?

A critically important idea pertaining to the foregoing frameworks is the notion that organizations introduce changes to their operations for all sorts of reasons, not simply because they perceive that they need to respond to environmental or market turbulence (Zollo and Winter, 2002). This idea is especially relevant to 3PLs because they must adapt their operations to supply chains of multiple customers (Hertz and Alfredsson, 2003; Large, 2007). Organizational changes initiated by 3PL customers may introduce substantial levels of complexity to 3PLs since the supply chains of most 3PL customers are likely to differ in structure and performance characteristics (e.g., Childerhouse et al., 2002; Christopher et al., 2006), particularly in those cases where 3PLs provide services to customers from multiple industries (Fisher, 1997) or in multiple countries (e.g., Childerhouse et al., 2011).

It is important to recognize that adaptation to supply chains of multiple customers cannot be a series of single events for 3PLs, where these events reflect newly formed relationships between the 3PL service providers and their customers. 3PLs must also be sensitive to changes that are occurring over time within the supply chains of their customers, since these supply chains may be those that lead broader environmental or technological changes over time (see Lee, 2004). This type of sensitivity is generally provided through the development of a customer oriented learning culture (Narver and Slater, 1990; Slater and Narver, 1995).

One could envisage that the learning capabilities that facilitate adaptation to changes within supply chains of customers must to a significant degree be embedded as a cultural orientation of successful 3PL operations. To put the scale of the issues related to this proposition into perspective, consider the larger 3PLs that have gained and retained a substantial number of customers over time. These 3PLs will have billion dollar US revenue streams (Lieb and Lieb, 2012). 3PLs often manage multiple types of operations on behalf of each customer (Lieb and Miller, 2002), so the larger 3PLs are likely to manage hundreds of operations in total on behalf of their customers. They need to adapt to each of the operations they manage on behalf of their customers (Hertz and Alfredson, 2003; Large, 2007). They must also be able to adapt to each customer's supply chain as it leads change, or adapts to the external environment (Whitten et al., 2012) to maintain or extend operational performance standards. To do otherwise is likely to lead to sub-par performance outcomes (Handley, 2012). A culture developed to adapt to customer environments is therefore likely to facilitate the processes of adjustment associated with changes in supply chain operations.

The foregoing proposition does not trivialize the need for dynamic capabilities that facilitate change at strategic and structural levels within companies (Eisenhardt and Martin, 2000; Helfat et al., 2007). Rather, it recognizes that some capabilities, or some elements of operating capabilities, perhaps the team members, switch modes at certain times and under certain circumstances. This is a theme that Helfat and Winter (2011) recently addressed. A question that will be explored in the current research is therefore whether there is a cultural aspect of learning that affects customer integration and operational performance in 3PLs. This is likely to be a customer oriented learning culture that sensitizes individuals, or groups of individuals, within 3PLs to adapt their work orientation from addressing the requirements of the next order to dealing with issues related to structural change (Zollo and Winter, 2002, p341) within the supply chains of their customers (Slater and Narver, 1995). If this proposition has merit, it suggests customer orientation acts in the manner of a dynamic capability, and presents as another learning system component positively influencing the relationship between customer integration and operational performance.

1.5 Summary of research questions

The research and arguments discussed in the foregoing paragraphs lead to a general question of whether organizational learning processes, organizational learning capacities, such as employee absorptive capacities, and customer orientation positively influence 3PL customer integration and 3PL operational performance (see Table 1.1 for a glossary of terms). The overarching research question was specified as follows:

> *How do 3PL companies serving multiple customers maintain effective levels of integration with their customers to positively influence operational performance?*

The learning system perspective suggests the search for the presence of learning mechanisms that explain how the components of the system interact to influence operational performance may be of value.

Table 1.1 Glossary of terms for key variables

Variable name	Definition of variable	Reference
Organizational learning processes	"… a process that is directed toward helping a firm (and its managers) learn, accumulate, and leverage … [3PL] … know-how and best practices …"	Kale and Singh, 2007, p984; terms in square brackets provided by the author
Employee absorptive capacities	"… Understanding of job skills, technology, and practices possessed by workers and managers in the organization …"	Tu et al., 2006, Table 1; see Footnote (a) of this Table for distinction between workers and managers
Customer orientation	"… sufficient understanding of one's target buyers to be able to create superior value for them continuously … [requiring] … that a seller understand a buyer's entire value chain … not only as it is today but also as it will evolve over time subject to internal and market dynamics …"	Narver and Slater, 1990, p21; terms in square brackets provided by the author
3PL customer integration	"… the degree to which a [3PL] partners with its [customers] to structure inter-organizational strategies, practices and processes into collaborative, synchronized processes …"	Based on definition by Flynn et al., 2010, p59; terms in square brackets provided by the author
3PL operational performance	Performance of logistics operations 3PLs manage on behalf of their customers; specifically, the order fulfillment processes that ensure physical products are delivered to their intended destinations within the agreed time window. This performance measure can reasonably be restricted to cost or service performance according to analysis by Mason-Jones et al. (2000a).	See Mason-Jones et al., 2000a, Figure 2.

There are five research questions relevant to foregoing general question that are addressed in the thesis as part of the search for learning mechanisms; these are presented below. The literature that provides specific background to these questions is presented within the Literature Review where the questions are re-stated to assist the reader to place them in their proper context. The questions are included in this section to provide context for the thesis. Specific hypotheses are presented at the end of the

Literature Review and are linked directly to the research questions. The research questions are as follows:

1. How do the relationships linking learning processes, dynamic capabilities, customer integration, and operational performance function in 3PL companies?
2. How is the known positive relationship between customer integration and operational performance achieved in a 3PL environment?
3. How do learning processes positively influence (a) 3PL customer integration and (b) 3PL operational performance?
4. How does customer orientation influence (a) 3PL customer integration and (b) 3PL operational performance?
5. How does learning capacity, in the form of employee absorptive capacity, influence (a) 3PL customer integration and (b) 3PL operational performance?

1.6 Why are the research questions of academic interest?

There are at least five major points of academic interest that are relevant to the research questions:

- At the broadest theoretical level, the general hierarchical framework of learning processes, learning capacities, customer orientation, and their effects on operations and operational performance has not, to the author's knowledge, been tested in operational supply chain environments or, more specifically, in 3PL environments focusing on customer integration. The general hierarchical framework emerged from the theoretical strategic management literature (Zollo and Winter, 2002) and the organizational learning literature (Argyris, 2003; Vera et al., 2011). Tests of various components of organizational learning and their effects on organizational performance have been examined within operations management (e.g., Hult et al., 2004). These streams have included studies of 3PL environments (Panayides, 2007). However, no unified frameworks that link organizational learning processes, learning capacities, and customer orientation to operations related to customer integration and operational performance appear to have been the subject of empirical research, suggesting studies of such frameworks should be of academic interest.

- There are arguments in the academic literature about the sequence of effects (Zollo and Winter, 2002; Argyris, 2003; Winter, 2003; Ali et al., 2010; Vera et al., 2011) and their influence within the hierarchical frameworks. Studies to test these effects within environments of interest to operations management researchers focusing on customer integration should be of theoretical interest.

- Examination of causal mechanisms within the frameworks using appropriate statistical tests of significance are also lacking in the research literature. This means there is a lack of clarity in the research literature with respect to the balance between direct and indirect effects, as well as the total effects (Sobel, 1987), of learning processes, learning capacities, and customer orientation on operations associated with customer integration and operational performance.

- At more micro-levels within the frameworks, there is a clear lack of research linking 3PL customer integration to 3PL operational performance (Fabbe-Costes et al., 2009).

- There have been multiple calls to understand how individual learning capacities affect organizational-level variables and the organizational outcomes of these variables (Lane et al., 2006; Volberda et al., 2010). These calls point to the need to explore these relationships within the framework.

1.7 Why are the research questions of managerial interest?

There are also a number of key points of interest to managers:

- Managers of 3PL businesses should be interested in whether customer integration positively affects operational performance. Investments need a rate of return within commercial firms (Koller et al., 2010; Brealey et al., 2011), so managers should be interested in whether costs are affected in a positive manner by customer integration. Equally, achieved service levels will to a significant degree determine whether 3PLs retain their customers (Knemeyer and Murphy, 2005; Wallenburg et al., 2010), so managers should also be interested in whether these are affected in a positive manner by customer integration.

- Establishing formal organizational learning processes, nurturing learning capacities, and driving customer oriented learning cultures are necessarily high cost investments because they are reliant on employee participation that deflects attention from standard operating tasks (Winter, 2003; Helfat and Winter, 2011). Managers will therefore be interested in whether these investments affect operational performance.

- Managers are also likely to be interested in whether there are specific contributions to performance from specific organizational learning mechanisms, learning processes, learning capacities, or from the development of a customer orientation. This point is related to the previous point to the extent that such understanding can be used as a guide to future investments.

1.8 Summary of methodology

The organizational unit of interest in the current study was the unit at which customer integration occurs within a 3PL business. This may have been a transport operation or a distribution center for a given 3PL customer, depending upon what aspect of their logistics operation they had outsourced. The study was based on the use of a survey for which participants were asked to reflect on a specific profit center that was known to them. The participants were employees and customers of one of Asia-Pacific's largest 3PLs, a two billion dollar AUD company, and were all located in Australia.

A quantitative approach was used to study the relationships of interest. The survey instrument used statements that were adapted from extant literature. This approach was used because the interest of the present study was the relationships between established factors rather than the development of new constructs. Relationships were examined using nested structural equation models; reflecting perspectives of multiple theoretical models for which direct, indirect, and total effects were estimated.

1.9 Summary of findings – high level answers to research questions

The answer to the general question of whether organizational learning processes, learning capacities, and customer orientation positively influence 3PL customer integration and 3PL operational performance is, "Yes, they do". The high level answers to the research questions are shown in Table 1.2. This table is drawn from analyses and tables in the Results section and the Discussion section of the thesis where substantially more detail is provided.

Table 1.2 High level answers to research questions

Research Question	High level answer based on the present research
1	The relationships linking learning processes, dynamic capabilities, customer integration, and operational performance have positive direct and indirect relationships in 3PL companies. Learning processes form the foundation for positive influence on the factors examined in this study.
2	The research found a direct, positive relationship between customer integration and operational performance 3PL operations.
3	The research found positive indirect effects of learning processes on both 3PL customer integration and 3PL operational performance.
4	Customer orientation was found to directly affect both customer integration and operational performance. Customer orientation was also found to indirectly affect operational performance.
5	Employee absorptive capacity was found to positively directly affect customer integration and to positively, indirectly, affect operational performance.

1.10 The structure of this thesis

This thesis has six chapters and is organized in a fairly traditional manner (Perry, 1998; Uncles, 1998).

Chapter 1 is the Introduction. This is the current chapter that has provided a broad background sketch of the major arguments and an overview of the study.

Chapter 2 presents the theoretical and research literature relevant to the topics covered in the thesis via a broad Literature Review. The research questions are re-stated in this section and the hypotheses are listed at the end of this chapter. A graphical representation of the relationships linking the hypotheses is presented within this chapter.

Chapter 3 presents the Research Methodology. This chapter discusses the population of interest, the sample, and data collection procedures. The chapter also has a brief discussion of structural equation modeling and the choice of approach used to model the relevant relationships. The contents of the survey instrument are examined in extensive detail in this section.

Chapter 4 details the Results. Data preparation, descriptive statistics, and congeneric tests of each factor are presented prior to the detailed analyses of the structural equation models. Model fit for each of the nested structural equation models is presented. The results related to tests of each hypothesis are presented toward the end of this chapter. A graphical portrayal of the supported relationships is presented to help the reader visualize the results. Extensive tables of results are also provided for the interested reader. A summary table of the acceptance of the hypotheses is presented towards the end of this chapter.

Chapter 5 is the Discussion of the results as they relate to each hypothesis. A short answer to each research question is provided at the end of this chapter.

Chapter 6 provides a summary of the study and a brief answer to the high-level research question. This chapter also presents the key contributions to knowledge and management practice that the research has made. The key limitations of the study are listed and recommendations for future studies are presented at the end of this chapter.

CHAPTER 2: LITERATURE REVIEW

2.1 Overview of Chapter 2

This chapter presents the literature that supports key arguments within the thesis. The chapter opens with an exploration of outsourcing and the nature of 3PL environments, which provide the context for the study. The historical background of inter-organizational integration is briefly examined as a prelude to an extensive exploration of customer integration and organizational performance. The first research question is then placed into the context of the research literature. An examination of learning components and learning mechanisms follows. This literature also provides the context within which the remaining research questions are presented. The research hypotheses are presented in the final section of the chapter; with links to the research questions, and a graphical perspective of the hypotheses, shown at the end of the chapter.

2.2 Logistics outsourcing is extensive in scale and scope

Outsourcing non-core operations led to significant growth in many industries during the late twentieth century and the early twenty first century. Sales by firms involved with information technology business process outsourcing alone reached almost one trillion US dollars by 2009 (Narayanan et al. 2011). Firms in the transport industry were known to have grown to combined global revenues exceeding half a trillion US dollars in 2009 (Langley and Capgemini, 2010). Outsourcing is also widespread in manufacturing industries (Antelo and Bru, 2010). The breadth and continued growth in scale of outsourcing across many sectors suggests that companies with focus on the provision of outsourcing services will have abundant markets within which to satisfy their search for expansion.

Logistics operations within manufacturing, retail and industrial companies are among the non-core operations that have been part of the outsourcing wave (Large, 2007). Outsourced logistics operations generally include transport and distribution activities (Zhou and Lee, 2009). Facilities such as distribution centers and warehouses are often outsourced (Maloni and Carter, 2006). Information management technologies, inventory management, and in some cases, key aspects of supply chain management may also be outsourced (Marasco, 2008). These examples suggest that all aspects of the logistics value chain seem to be amenable to outsourcing.

2.3 Logistics outsourcing firms need capabilities to adapt to client-specific environments

The scope and scale of companies supplying logistics outsourcing services, called third-party logistics service providers or 3PLs, has focused interest on the underlying mechanisms of the 3PL-outsourcer relationships (Marasco, 2006) and the capacities of the 3PLs to meet performance expectations of their clients (Wallenburg et al., 2010). The scope and scale of operations involved in logistics outsourcing has led some 3PLs to grow to the extent their annual sales revenues exceed billion US dollar levels (Lieb and Lieb, 2010). 3PLs require capabilities to manage the scope and scale of the outsourced environments at least to the levels prevalent within outsourcing firms prior to the introduction of outsourcing arrangements. This is true because of the significant negative performance implications for outsourcing firms associated with capability loss in outsourcing environments (Handley, 2012). Billion dollar revenue streams suggest 3PLs possess substantive capabilities enabling them to maintain, if not extend, performance within outsourcing firms. Published research provides support for this perception by highlighting that 3PLs bring capabilities to the relationship that are perceived to support and extend performance within the outsourcing firms (Knemeyer and Murphy, 2004, 2005; Wilding and Juriado, 2004), even though relationship failures are known to occur even in very large outsourcing arrangements (Lambert et al, 1999).

Large (2007) pointed out that 3PL companies must adapt to the operating environments of their clients in order to be successful. He analyzed invitations to tender issued by companies seeking 3PL services. Large highlighted that there were significant levels of customer specific investments expected of 3PLs by the issuers of the tenders. He argued these investments were required because 3PL-outsourcing services "… are customer-specific service packages, which replace the previous systems and processes of the customer…" (Large, 2007, p124). So 3PL service providers are generally highly entangled with their clients. Growing to the scale of billion US dollar enterprises suggests that some 3PL companies effectively develop the capability to concurrently adapt to many different environments despite their need to supply client specific services in each case.

Lee (2004) demonstrated the need for companies to adapt their supply chains as markets change structurally due to demographic, technological, political or economic reasons. He gave examples in the telecommunications, computing, fashion and automotive industries. These examples demonstrated either loss of market share or significant growth as companies either failed to adapt to shifting trends or adapted to trends ahead of the major structural shifts in the markets. The adaptations that Lee described ranged from shifts in geographic locations of factories, to changing suppliers, to changing technologies or the cost-quality trade-off for products. Lee's (2004) examples suggest that adaptations to structural shifts can become company-making or company-ending actions, depending upon their levels of success.

Whitten et al. (2012) used Lee's ideas to examine the effects of adaptability on supply chain performance of companies in manufacturing, oil and gas, and logistics. However, the results from Whitten et al's study are constrained in their direct applicability to the study of adaptability on its own because they used a second-level non-measured latent variable, termed "Triple-A Supply Chain", to measure direct effects on the latent variable, "Supply Chain Performance". They did not report the direct factor loading of "Adaptability" on "Supply Chain Performance", only the correlation of the two variables, which was 0.546 (Whitten et al., 2012, Table II). The "Triple-A Supply Chain" latent variable reflected three first level latent variables: "Adaptability", "Agility", and "Alignment". While the correlation of "Alignment" with each of these two other latent variables approached or exceeded 0.9, suggesting that it could have been discarded (Cunningham, 2010), the correlation of the latent variables "Adaptability" and "Agility" was 0.78 (see Whitten et al, 2012, Figure 2). This latter correlation suggests the two variables were measuring different, if aligned, constructs (Kline, 2011). Nevertheless, the "Triple-A Supply Chain" factor loading on "Supply Chain Performance" was 0.72, which was significant at .001 with a t-value of 6.41 (Whitten et al., 2012, p40). These results suggest "Triple-A Supply Chain" explains more than 50% of the variance of "Supply Chain Performance" and that "Adaptability" is a major contributor to performance.

Hertz and Alfredsson (2003) used four case studies to explore the need for adaptability and general problem solving ability in order to succeed as a 3PL. These researchers interviewed the 3PL operators, their clients and their clients' clients. They split the dimensions of adaptability and problem solving ability into high, medium and low. Their work highlighted that 3PLs offer degrees of service integration, from totally dedicated and integrated warehousing to multi-use, industry standard scheduled transport operations. The firms that fall into the high categories for both adaptability and problem solving ability take on more advanced activities for customers, becoming "customer developers" (Hertz and Alfredsson, 2003, p147). Less well-integrated firms, termed either "service developer" or "customer adapter", depending upon their strategic orientation, nevertheless required either high levels of adaptation or problem solving ability. Only "standard 3PL provider" was held to require "relatively high" levels of either capability. Thus, Hertz and Alfredsson (2003) showed that adaptability is an integral requirement for success as a 3PL.

Lambert et al. (1999) argued that the degree of integration between the outsourcer and the service provider should be context specific. This means that integration between the two organizations should become progressively greater as the reasons to partner, which they termed "drivers", and the degree of compatibility between the firms, which they termed "facilitators", shift from "low" to "medium" to "high". Lambert and his colleagues used interviews with outsourcers and their partners to develop case studies that provided a framework for analyzing outsourcing relationships. They argued, based on their case studies, that there was no point having a highly integrated relationship, which they termed Type 3, when the drivers and facilitators were "low", or when either of the two factors were "low" or "medium" and neither were "high". In the case where both factors were "low", the authors suggested an arm's length relationship (Lambert et al., 1999, Figure 2). Coordination was held to be suitable in those situations where one factor was "medium" and the other was "low" (Lambert et al., 1999, p169). The authors asserted that the Type 2 partnership, where both factors were "medium" or one factor was "high", was the level at which integration first becomes suitable (Lambert et al., 1999, p169). Thus, the level of adaptation required of 3PLs appears to some degree be contingent upon the motives of the outsourcing firm, and the degree to which the two firms are compatible based on shared clients, competitors and corporate cultures.

Fabbe-Costes and Roussat (2011) examined the role of the 3PL within supply chain integration using a case study approach within a large European 3PL. Their research supported the foregoing arguments of Lambert et al. (1999). Their work also demonstrated that 3PLs sought to be integrated into their customers' supply chains and that evidence of this integration included having multiple means of integrating, including IT systems, processes and shared resources. Further, their research showed that 3PLs developed specific skills to support the integration. Surprisingly, Fabbe-Costes and Roussat (2011, Table 8) found a lack of clarity related to customized services providing evidence of integration. Finally, their research suggested that 3PL integration had a positive relationship with performance.

Wallenburg (2009) introduced innovation as another factor of importance to the survival of complex, longer-term outsourcer – 3PL relationships. His analyses focused on customer retention, extension and referrals as a function of proactive cost and performance improvement. His research demonstrated that more complex service environments and longer-term relationships benefitted substantially from proactive performance improvement (Wallenburg, 2009, p86). Other researchers have echoed his position (e.g., Deepen et al., 2008; Stank et al., 2003; Wagner, 2008). Thus, adaptation is not a one-shot game for 3PLs expecting to build sustainable businesses. Rather, integration efforts of 3PLs need to reflect the demand for ongoing adaptation to the outsourcers' businesses and to the changes in their environments.

Third party logistics companies may face more complex issues in adapting to change within industries than manufacturing and retail companies. 3PLs that grow beyond serving a single client must integrate their operations with multiple partners to sufficient levels of effectiveness that they are able to adapt to change in multiple supply chains when structural shifts occur, such as those highlighted by Lee (2004). This may, of course, also be true for those 3PLs serving clients that operate in multiple product segments with different (e.g. Fisher, 1997) or shifting demand characteristics (e.g., Childerhouse et al., 2002; Pagh and Cooper, 1998). Operating within two or more disparate industries at the same time may also be analogous to adapting to turbulence caused by structural shifts within a single industry. Those 3PL companies that focus on more than one industry or major market sector may therefore also face the additional complexity of needing to adapt to different drivers of structural change that affect different industries (Porter, 2008) or to the responses to those drivers by their clients (Nelson, 1991). Discussing organizational requirements for capabilities to adapt, termed dynamic capabilities (Teece et al., 1997), Zollo and Winter (2002) pointedly argued against the specific requirement for "… the presence of "rapidly changing environments" … [*since*] firms obviously do integrate, build, and reconfigure their competencies even in environments subject to lower rates of change …" (Zollo and Winter, 2002, p340, emphasis in parenthesis added). Adapting to an early understanding of deeper customer requirements than has been provided for within a market (Slater and Narver, 1995), or adapting to changes within supplier bases earlier than other actors in the market (Lee, 2004), would reflect examples of such situations. So 3PL companies that have grown beyond a single client, and beyond a single industry, are likely to face very complex management challenges in order to maintain effective levels of integration that meaningfully enable them to adapt to their disparate operating environments and maintain acceptable levels of operating performance, whether environments are changing rapidly or not.

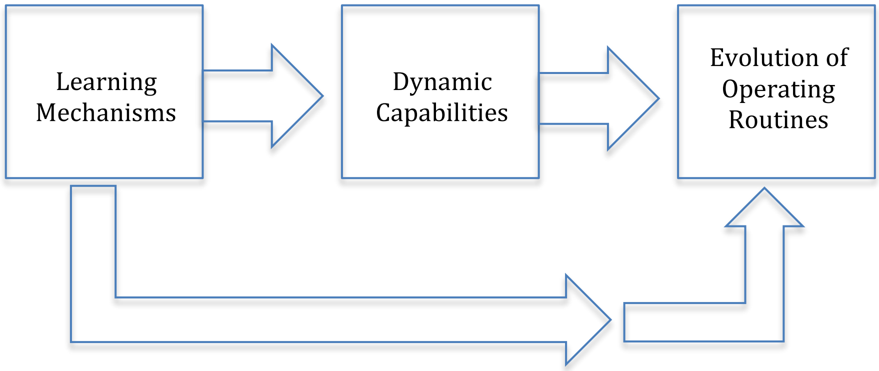
Overarching High-level Research Question

How do 3PL companies serving multiple customers maintain effective levels of integration with their customers to positively influence operational performance?

2.4 Relationships enabling the evolution of operating capabilities

The evolution of operating capabilities and dynamic capabilities are actively discussed in the research literature. The model proposed by Zollo and Winter (2002) is shown in Figure 2.1. Presenting this model, Zollo and Winter argued for long term, stable causal relationships linking learning mechanisms, dynamic capabilities and operational capabilities. They wrote: "… A dynamic capability is a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness …" (Zollo and Winter, 2002, p340). They argued a four-stage learning process was associated with the evolution of dynamic capabilities. Their proposition was that "…Dynamic capabilities emerge from the coevolution of tacit experience accumulation processes with explicit knowledge articulation and codification activities …" (Zollo and Winter, 2002, p344).

Figure 2.1 Relationship between Learning Mechanisms, Dynamic Capabilities and Evolution of Operating Routines proposed by Zollo and Winter (2002)



Similarly, arguing for a process-theory based explanation of the relationships, Vera et al.presented their model "… as a cascading series of rectangles to highlight the idea of different levels ('orders') of capabilities …" (Vera et al., 2011, p169). Their model assumed learning at three levels: single-loop learning at the base within which operational capabilities were located; double-loop learning at the first level, at which dynamic capabilities, including absorptive capacities, were located; and, deutero-learning at the second level. Single loop learning retains existing routines whereas double-loop learning and deutero-learning create new routines based on new understanding of the environment (Argyris, 2003). Argyris (1976) used the analogy of a thermostat controlling room temperature to describe single loop learning; a thermostat will rebalance the temperature of the room it controls when a limit is passed. Whether the temperature should be set at a particular level, or whether the mechanism of measuring temperature is the best one, are double-loop issues (Argyris, 1976). Questioning design or purpose demonstrates the capacity for double-loop learning (Argyris, 1976, p638). Deutero-learning "… is simply learning to learn …" (Schon, 1975, p8) but involves significant levels of complexity when related to double-loop learning (see Argyris, 2003). So, the model presented by Vera et al. (2011) implies dynamic capabilities create new operating routines and that deutero-learning enables dynamic capabilities to evolve. In this sense, it closely matches in concept the proposition for learning mechanisms put forward by Zollo and Winter (2002) that enable dynamic capabilities to evolve.

Drawing on Bunge's (1997, 2004) ideas of systems and mechanisms that bring about changes within systems, the learning system that emerges from the foregoing discussion related to the factors of interest within the present research is composed of three levels:

1. A zero-order level at which customer integration acts to directly influence operational performance
2. A first-order level from which dynamic capabilities directly influence customer integration and indirectly influence operational performance
3. A second-order level from which learning processes directly affect dynamic capabilities and indirectly influence customer integration and operational performance.

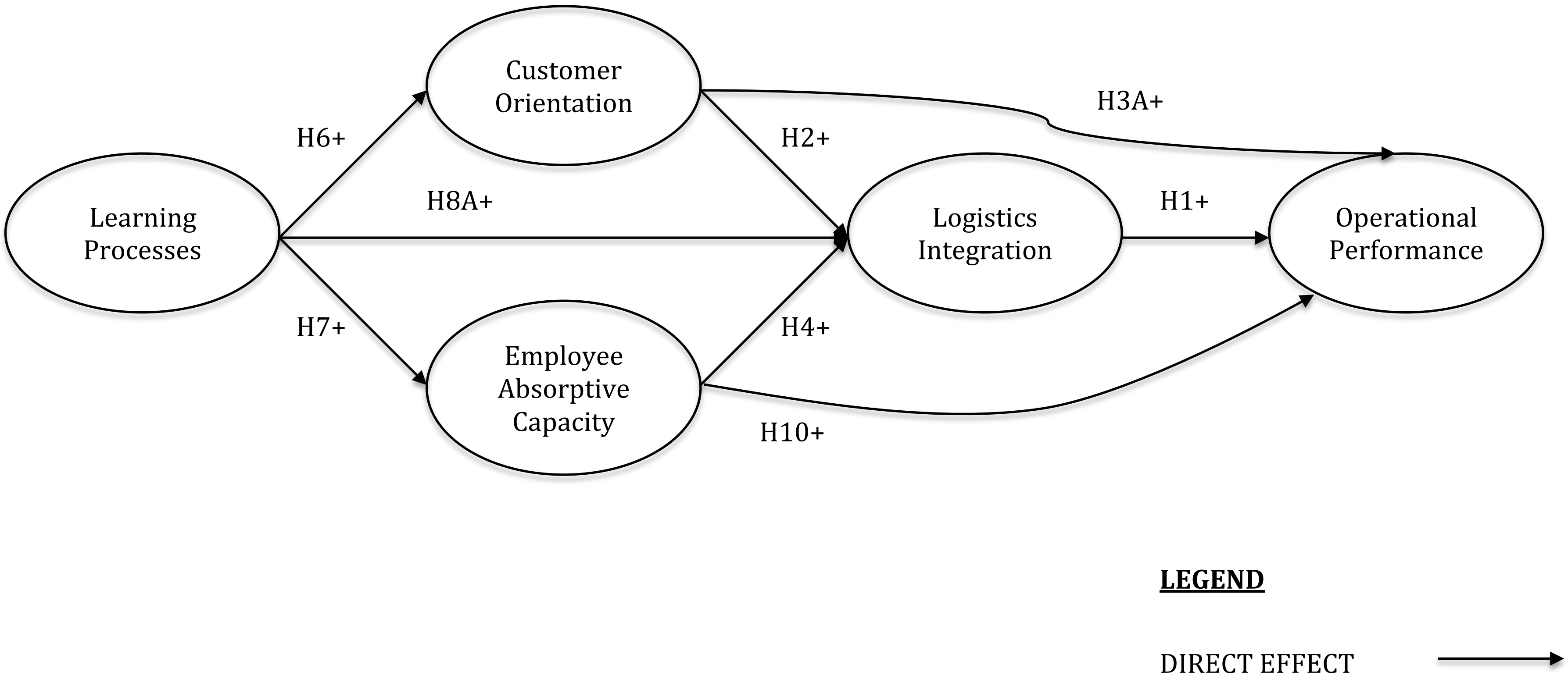
Note that in this learning system, the notions of change associated with each level within Zollo and Winter's (2002) framework are retained, but the explicit emphasis on learning brought to bear by Vera et al. (2011) comes to the fore. Reflecting on the model in the context of 3PL environments suggests the presence of both learning mechanisms and dynamic capabilities are required to enable the maintenance of effective performance linked customer integration. Dynamic capabilities come in many guises (Eisenhardt and Martin, 2000; Helfat and Winter, 2011), which suggests a specific search may be required within 3PLs. Later sections of this literature review present arguments that customer orientation and absorptive capacities of 3PL employees may act as dynamic capabilities. Zollo and Winter's (2002) model suggests learning processes associated with experience accumulation, knowledge articulation and codification in 3PLs will directly influence these dynamic capabilities.

Research Question 1

How do the relationships linking learning processes, dynamic capabilities, customer integration, and operational performance function in 3PL companies?

Figure 2.2, shown on the next page, depicts the relationships between the factors to be examined in this study. The sections that follow this present section will present details relating to each factor and the theoretical relationships between the factors. Research questions and hypotheses will also be presented as they emerge from the literature review following the advice of Perry (1998, p76), who argued they should 'grow out' of the review.

Figure 2.2 Graphical portrayal of the relationships between the key variables and the related hypotheses



2.5 Origins of inter-organizational integration

Integration of physical distribution operations only began to receive serious attention by managers in the late 1950s and 1960s (Forrester, 1958; La Londe, 1969), though the idea of doing so had been developed much earlier by Durant at General Motors (Childerhouse and Towill, 2003). The search for new sources of profitability to support increasingly competitive environments led companies to consider ways in which costs could be reduced within their physical distribution operations and provided researchers with justification to extend their analytical frameworks by focusing on the benefits of integrating multiple functional areas (La Londe et al., 1970). The great majority of interest during this period seems to have been related to intra-company operations, as evidenced by cost related studies of the time (e.g., Lambert and Mentzer, 1980; Shapiro, 1992) and content of surveys of the prevalence of integration among US corporations (Bowersox and Daugherty, 1987; Gustin, 1984), though examples of inter-company integration initiatives did emerge from time to time (see Gill and Allerheiligen, 1981, for references in books published at the time). Heskett (1973) provided a wide-ranging overview of productivity-improving inter-company integration initiatives, which he predicted would form a wave of innovation to supplant the innovation that had occurred post-war in physical distribution technologies. Among these were early examples of 3PL initiatives, collaboration among shippers of low volume goods via consolidation centers, and multiple manufacturer-retailer collaborations to consolidate inbound goods in jointly owned or coordinated distribution centers for consolidated deliveries of goods directly to stores. But Heskett's examples were early views of a trend that had trouble taking hold. Gustin (1984), when reporting consolidated results of surveys of physical distribution practices in the US from 1971, 1976 and 1982, observed that integration practices had dropped off in the latter part of the decade the surveys had been conducted; his results indicated that there was significant confusion among survey participants about the meaning and practices associated with integration (see Gustin, 1984, Figure 1). He stated that the only significant trends in the surveys were increasing levels of non-recognition of the concept of integration and increasing levels of failures of implementations (Gustin, 1984, p6). So while there were green shoots emerging by the 1970s, inter-company integration practices and use of 3PLs among shippers, were yet to become established corporate practices in most industries.

2.6 Analytical support for inter-organizational integration gained momentum in the 1980s

Arguments supporting the beneficial effects of integration of channel partners gained analytical support during the 1980s. Bowersox and Daugherty (1987) reported on a qualitative study of sixteen Fortune 500 companies in which inter-organizational integration was seen to be critical in vertical marketing systems employing dealers and distributors wherein manufacturers controlled significant amounts of downstream inventories. Interestingly, in this study, other forms of logistical organization, which the authors termed process and marketing strategy-oriented forms of organization, did not reflect any inter-organizational integration. Kenderdine and Larson (1988) used a quality model to demonstrate that an integrated view of the manufacturer – retailer chain could reduce total system costs by correcting quality issues upstream. They argued that "… looking at the issue of quality from the perspective of a single level or member of the system may not provide the best possible, lowest cost solution … Our contention is that the present competitive environment requires integrated logistics management throughout the entire channel system …" (Kenderdine and Larson, 1988, p9). In an early study of the benefits of information sharing between suppliers and buyers, Landeros and Lyth (1989) modeled costs associated with the supply of economic inventory-lot sizes. Their work showed that the total combined inventory costs across supplier – buyer dyads could be reduced when the partners shared information about demand and relevant costs. McGinnis and Kohn (1990) surveyed 525 logistics managers in the US in 1989 to explore the nature of logistics strategies at that time, including those that relied upon inter-organizational integration. Their results demonstrated that logistics strategies that included a focus on inter-organizational integration demonstrated higher competitive responsiveness and logistics system responsiveness (McGinnis and Kohn, 1990, Exhibit 5). So there was already analytical evidence that benefits associated with the practice included lower total system costs, lower total inventory costs and higher levels of logistics system responsiveness when Bowersox provided a view of logistics alliances, and the integration of 3PL service providers within the business operations of shippers, for more broadly-oriented managers through an article in a 1990 edition of Harvard Business Review. Bowersox provided numerous examples of 3PL based logistics alliances that had emerged during the late 1980s and attributed a proportion of the shift in total US logistics costs from an estimated 15.1% of GNP to 10.2% of GNP to these types of logistics partnerships (Bowersox, 1990, p45).

Stock (1988) gave extensive examples of transport companies that had adapted to the newly deregulated US transport environments of the 1980s (see Harper and Johnson, 1987, for a discussion of deregulation during the 1980s). He discussed the evolving nature of transportation companies as they expanded their range of services to include warehousing, multi-modal transportation, fleet specialization, and integration into the just-in-time manufacturing operations of some of their clients. He also gave examples of information systems integration, whereby transport companies gave shippers direct access to transport systems in order for them to more productively use administrative systems without handling paper documentation (Stock, 1988, p16). Stock positioned the shifting arrangements between shippers and transportation companies as part of a new wave where the latter were emerging as "logistics service companies" that integrate "… their strategic, tactical and operational expertise with that of their customers and their customers' customers …" (Stock, 1988, p17).

Warehousing was also emerging as a strategic element at this time. McGinnis and Kohn (1988) surveyed managers, educators and consultants who were knowledgeable in warehousing to assess the strategic importance of warehousing. Their results indicated that warehousing was emerging as a strategic capability and that this capability provided links with buyer value chains (McGinnis and Kohn, 1988, p47). This survey also provided an early view of the emerging importance of warehouse information technologies, though somewhat surprisingly, the respondents seemed to have limited support for the partial replacement of warehousing with "… Better communications, information, transportation, and other techniques …" (McGinnis and Kohn, 1988, Table 5) despite the emerging trend at the time to use "… information instead of inventory … to buffer uncertainty in the marketplace …" (La Londe, 1983, p8). The authors concluded "… increased interdependencies have required that warehousing activities must be fully coordinated with other areas of logistics, other areas of the firm, suppliers and buyers…" (McGinnis and Kohn, 1988, p51).

Ellram and Cooper (1990) also observed closer interactions between shippers and third party logistics services companies during this period. Their study of supply chain partnerships highlighted the high levels of interactions between outsourcers and third parties that ensured both parties conducted ongoing studies on of how their partners operated in order for the partnerships to become more efficient (see Ellram and Cooper, 1990, p5). Their results suggested longer-term partners assisted each other in difficult situations (Ellram and Cooper, 1990, Table 6) and had begun the shift to high levels of technology-based interconnectedness (see Ellram and Cooper, 1990, Table 7). Nevertheless, these authors emphasized both the benefits and the risks of the partnerships and encouraged managers to be aware of, and to consider, both when entering longer term partner-based relationships (see Ellram and Cooper, 1990, p8).

2.7 Performance benefits of integrating with customers

Though studies with a focus on the performance benefits of the integration concept *within* companies had begun to emerge by the early 1990s (e.g., Shapiro, 1992; Stank, Daugherty and Gustin, 1994), studies relating to performance benefits of inter-organizational integration were less prevalent at this time. Studies of the performance effects of inter-organizational integration began to emerge in the mid-1990s and gained momentum in the two decades that followed. One of the issues in the related literature that emerged during this period was the importance of the distinction between supplier, internal and customer integration (see Flynn et al., 2010 for arguments) and the effects of each type of integration on organizational performance. The area of interest in this thesis is customer integration. From the perspective of the 3PL companies, it is the capability to integrate effectively with their clients that enables 3PL companies to engage effectively with them in order to ensure they maintain acceptable levels of performance under multiple environmental conditions. This section consequently presents customer integration research that has examined performance effects to the degree that it is possible to do so, in the process covering more than forty studies sourced through database searches in Business Source Premier, Emerald and EBSCO, and by reviewing articles covered in the reference lists of relevant articles. This number of studies compares favorably to those used by Fabbe-Costes and Jahre (2008) and Van der Vaart and Van Donk (2008) in their reviews of articles addressing the broader topic of supply chain integration and performance, and with the number of articles included in Leuschner et al's (2013) meta-analysis of customer and external integration within their broader study of supply chain integration. Many of the studies reviewed in this section have not distinguished between supplier and customer integration activities, instead using the term "external integration", or some similar term, to indicate a difference from inter-departmental, intra-company, integration. The results of these studies are presented to the degree that they are relevant to the development of an understanding of the performance effects of customer integration. Those studies that focus exclusively on intra-company integration activities or exclusively on supplier-oriented integration have not been reviewed.

Studies of the relationship between customer integration and organizational performance have reported conflicting results. Many studies demonstrate a positive direct impact (e.g., Chen et al., 2009b; Droge et al., 2004; Flynn et al., 2010; Germain and Iyer, 2006; Stank et al, 2001a; Wong, Boon-itt, and Wong, 2011). Other studies report a lack of impact (Deveraj et al., 2007) or both positive and negative impacts (Swink et al., 2007). There are also studies that demonstrate an indirect positive impact (Stank et al., 2001b; Wong, 2013). Clearly, an issue that emerges from the review of the research-based articles is the confusion relating to effects of customer integration on organizational performance. The relationships between specific integration factors and specific performance factors is not widely discussed in the research literature on customer integration as yet, despite the fact that these relationships sit at the core of any true understanding of the overall topic (see Leuschner et al., 2013, for a recent meta-analysis). The current review will highlight this very important issue by examining integration – performance relationships at the level of the indicators of constructs, and by building a research-grounded view of which customer integration factors affect which performance factors.

2.7.1 Financial effects of customer and external integration

The relationships observed in the research literature between customer integration or external integration constructs and various financial performance constructs have been summarized in Tables 2.1 – 2.3. Substantially more data is provided in Appendix 6. The first point of clarity to emerge from these tables is the effect of customer integration on financial performance. It is clear from Table 2.1 that many of the studies that have examined the effects of customer integration on financial performance have found positive effects in relation to *logistics or operational* financial performance, but no significant effects at all, or negative effects, on *company or firm-related* financial performance. This is an important point because the distinction suggests that customer integration is capable of affecting financial outcomes, despite the fact that its effects are often clouded or hidden at the corporate level. Ray et al. (2004), commenting on their study designed specifically to examine differences in performance at process and firm level within the insurance industry, argued that firm level outcomes are often aggregates of results from many different operations or business units, some with positive results and others with negative results. They went onto argue that examining outcomes directly related to resources and business processes within a business unit, rather than the outcomes at the aggregated firm level, provides a more effective model for testing theoretical relationships (Ray et al., 2004, p35). The results that emerge from the present literature review support their position.

Table 2.2 presents relationships identified in the research literature related to external integration and performance. The results of the research that has aggregated customer and supplier integration (e.g., Dyer, 1997; Stock et al., 2000) provides support for positive effects in relation to *logistics or operational* financial performance, while providing equivocal results at the firm level. The results of research that has examined external integration effects on financial performance at the level of the firm provide positive (e.g., Flynn et al., 2010; Paulraj et al., 2012; Rajaguru and Matanda, 2009), negative (Stock et al., 2000), and no significant effects at all (e.g., Droge et al., 2004; Green et al., 2008). Again, these results support the view that there is a need to focus performance related research at the level at which the operational processes have direct effects.

Table 2.3 provides further reinforcement for the foregoing arguments. This short table summarizes research that has examined performance effects of customer or external integration and their interactions with internal integration. Again, the link to financial performance at an *operating* level is supported (Rodrigues et al., 2004) while performance at the firm level is equivocal, being either positive (Droge et al., 2004) or non-significant (Germain and Iyer, 2006). These results also reinforce the argument that integration does have a positive effect on financial performance but that it needs to be measured at the business unit or business process level, rather than at the level of the firm.

Table 2.1 Summary of financial performance effects of customer integration

Financial performance variables and indicators	**Effect (P=positive, N=negative; s=significant, ns=non-significant)**	**Reference**
Firm financial performance	P, s	Wong (2013), Singh and Power (2009), Stank, Keller and Closs (2001), Lorenzoni and Lipparini (1999)
Operations financial performance	P, s	Wong, Boon-itt and Wong (2011)
Logistics financial performance	P, s	Lee, Kwon and Severance (2007), Rodrigues, Stank and Lynch (2004), Daugherty, Myers and Autry (1999), Lorenzoni and Lipparini (1999)
Firm financial performance	N, s	Swink, Narasimhan and Wang (2007)
Firm financial performance	ns	Huo (2012), Flynn, Huo and Zhao (2010), Germain and Iyer (2006)
Logistics financial performance	ns	Lee, Kwon and Severance (2007)

Table 2.2 Summary of financial performance effects of external integration

Financial performance variables and indicators	Effect (P=positive, N=negative; s=significant, ns=non-significant)	Reference
Firm financial performance	P, s	Paulraj, Chen and Lado (2012), Flynn, Huo and Zhao (2010), Chen, Daugherty and Roath (2009), Rajaguru and Matanda (2009), Green, Whitten and Inman (2008), Kim (2006), Seggie, Kim and Cavusgil (2006), Droge, Jayaram, and Vickery (2004), Frohlich and Westbrook (2001), Stock, Greis and Kasarda (2000), Dyer (1996a), Dyer (1996b)
Brand equity	P, s	Kim and Cavusgil (2009)
Operations financial performance	P	Dyer (1997)
Logistics financial performance	P, s	Dyer (1996b)
Firm financial performance	N, s	Stock, Greis and Kasarda (2000), Larson (1994)
Financial performance	N, s	
Brand equity	ns	Kim and Cavusgil (2009)
Firm financial performance	ns	Paulraj, Chen and Lado (2012), Green, Whitten and Inman (2008), Quesada, Rachamadugu, Gonzalez and Martinez (2008), Droge, Jayaram, and Vickery (2004), Frohlich and Westbrook (2001), Stock, Greis and Kasarda (2000)
Logistics performance	ns	Rodrigues, Stank and Lynch (2004), Stank, Crum and Arango (1999)

Table 2.3 Performance effects of customer or external integration interacting with internal integration

External or customer integration variables and indicators	**Operational performance variables and indicators**	**Financial performance variables and indicators**	**Effect (P=positive, N=negative; s=significant, ns=non-significant)**	**Reference**
Interaction effects of internal and external integration		Firm financial performance	ns	Germain and Iyer (2006)
Interaction effects of internal and external integration		Logistics financial performance	P, s	Rodrigues, Stank and Lynch (2004)
Interaction effects of internal and external integration		Firm financial performance	P, s	Droge, Jayaram, and Vickery (2004)
Interaction effects of internal and external integration	Logistical performance		P, s	Germain and Iyer (2006)
Interaction effects of internal and customer integration	Logistical performance		P, s	Germain and Iyer (2006), Stank, Keller and Closs (2001)
Interaction effects of internal and external integration	Operational performance		P, s	Flynn, Huo and Zhao (2010)

2.7.2 Customer and external integration effects on operational performance

Table 2.4 presents a summary of the results of sixteen studies that have examined operational performance effects of customer integration. Thirteen of those studies identified positive operational performance effects, two studies found no significant effects, and one study found a negative relationship between a customer integration variable and an operational performance variable.

The operational performance effects of external integration are summarized in Table 2.5. The results from twenty-nine studies are included in this table. Twenty-one of those studies found significant positive relationships between operational performance variables and external integration variables. Three studies identified negative relationships between the variables that reflected positive outcomes; for example, greater levels of EDI integration were associated with greater levels of reductions in inventory levels and order cycle times (Stank et al., 1999); and, greater levels of integration were associated with lower levels of supply chain uncertainty (Childerhouse and Towill, 2003). Three studies found negative relationships. Two studies found insignificant relationships between the variables, though one of these studies demonstrated an interaction effect between the key exogenous variables, supply chain information technologies and operational initiatives in the supply chain, that was a significant cause of supply chain agility, the endogenous variable in the structural equation model (Vickery et al., 2010).

The latter section of Table 2.3 presents studies that have examined relationships between customer integration and operational performance in the context of interaction effects with internal integration. Three studies examined these interaction effects. All found positive relationships between the variables.

In summary, the results of the studies that have examined customer or external integration and operational performance are overwhelmingly weighted towards demonstrating positive relationships: thirty-seven studies have identified positive effects or relationships; four studies have identified negative effects; and, four studies have identified insignificant effects in the relationships.

Table 2.4 Summary of operational performance effects of customer integration

Operational performance variables and indicators	**Effect (P=positive, N=negative; s=significant, ns=non-significant)**	**Reference**
Improvement capability	P, s	Peng et al. (2013)
Environmental performance	P, s	Wong (2013)
Customer-oriented performance	P, s	Huo (2012)
Customer delivery performance	P, s	Wong, Boon-itt and Wong (2011)
Product quality	P, s	Wong, Boon-itt and Wong (2011)
Production flexibility	P, s	Wong, Boon-itt and Wong (2011)
Operational performance	P, s	Iyer (2011), Flynn, Huo and Zhao (2010), Daugherty, Myers and Autry (1999)
Reliability	P, s	Lee, Kwon and Severance (2007)
Overall performance	P, s	Lee, Kwon and Severance (2007)
Customer satisfaction	P, s	Swink, Narasimhan and Wang (2007)
Customer service performance	P, s	Closs and Savitskie (2003), Stank, Keller and Closs (2001)
Enhanced trust	P	Lorenzoni and Lipparini (1999)
Information timeliness	P, s	Daugherty, Myers and Autry (1999)
Information compatibility	P, s	Daugherty, Myers and Autry (1999)
R&D performance	P, d, s	Souder, Sherman and Davies-Cooper (1998)
Customer delivery performance	ns	Boon-itt and Wong (2011)
Operational Performance	ns	Devaraj, Krajewski and Wei (2007)
Product customization	N,s	Stank, Keller and Closs (2001)

Table 2.5 Summary of operational performance effects of external integration

Operational performance variables and indicators	**Effect (P=positive, N=negative; s=significant, ns=non-significant)**	**Reference**
Contingency planning effectiveness	P, s	Hall, Skipper, Hazen and Hanna (2012)
Operational performance	P, s	Paulraj, Chen and Lado (2012), Zacharia, Nix and Lusch (2011), Zacharia, Nix and Lusch (2011), Vickery, Droge, Setia and Sambamurthy (2010), Flynn, Huo and Zhao (2010), Kim and Cavusgil (2009), Rajaguru and Matanda (2009), Green, Whitten and Inman (2008), Quesada, Rachamadugu, Gonzalez and Martinez (2008), Devaraj, Krajewski and Wei (2007), Gimenez and Ventura (2005), Frohlich and Westbrook (2002), Frohlich and Westbrook (2001), Stank, Keller and Daugherty (2001)
Relational outcomes	P, s	Zacharia, Nix and Lusch (2011)
Customer responsiveness	P, s	Rajaguru and Matanda (2009), Stank, Daugherty and Ellinger (1996)
Customer service	P,s	Quesada, Rachamadugu, Gonzalez and Martinez (2008), Frohlich and Westbrook (2001), Stock, Greis and Kasarda (2000), Stank, Daugherty and Ellinger (1996)
Flexibility in product range	P, s	Quesada, Rachamadugu, Gonzalez and Martinez (2008)
Brand equity	P, s	Seggie, Kim and Cavusgil (2006)
Competitive capability	P, s	Kim (2006)
Product development	P, s	Droge, Jayaram, and Vickery (2004), Frohlich and Westbrook (2001)
Enhanced trust	P	Dyer (1997), Dyer (1996b)
Quality	P, s	Dyer (1996a, b)
Product range flexibility	N, s	Quesada, Rachamadugu, Gonzalez and Martinez (2008)
Uncertainty	N, s	Childerhouse and Towill (2003)

Customer service performance	N, s	Closs and Savitskie (2003), Stock, Greis and Kasarda (2000)
Inventory levels	N, s	Stank, Crum and Arango (1999), Dyer (1996a)
Order cycle performance	N, s	Stank, Crum and Arango (1999)
Product development cycle times	N, s	Dyer (1996a, b)
Contract protection	N, s	Dyer (1996b)
Agility	ns	Vickery, Droge, Setia and Sambamurthy (2010)
Number of new products developed	ns	Frohlich and Westbrook (2001)
Operational performance	ns	Frohlich and Westbrook (2001)

2.8 The key elements of customer integration that have been shown to positively affect organizational performance

Given the breadth of indicators used to identify customer and external integration in the studies reviewed here, a categorization process was used to identify the key elements that were shown to positively affect organizational performance with the objective of consolidating the research that has linked customer or external integration and organizational performance variables. The aim of the categorization process was to identify the group of high-level integration variables that have been shown to improve organizational performance. To do so, the indicators and variables of customer and external integration that were shown to improve organizational performance were categorized using an adaptation of the process used in grounded theory studies (see Thornberg, 2012; Strauss and Corbin, 1998). In this categorization process the variables used in the studies reported in the foregoing sections were re-examined and grouped in line with the aggregated loadings of their indicators. When the breadth of indicators used within a study was extensive and of mixed content, the classic question, "What is going on here?" (Thornberg, 2012, p253), was used to tease out each variable's classification. In a number of instances (e.g., Flynn et al., 2010; Paulraj et al., 2012) that meant classifying a latent variable in a study within multiple categories because, on balance, it was measuring elements of multiple emerging categories with roughly equal weights. For example, Flynn et al. (2010) used eleven indicators to measure the latent variable, "Customer Integration". Three of these indicators reflect information systems integration with major customers. Five indicators reflect information sharing related to inventory, planning, sales or market information with major customers. And the remaining three indicators reflect a more general engagement construct related to major customers. By comparison, Germain and Iyer (2006) used three measured indicators of information sharing to reflect their latent variable, "Downstream

Integration". The classification process led Flynn et al. (2010) to be allocated to three emerging categories, and Germain and Iyer (2006) to be allocated to a single emerging category. In some instances, this process also led to some indicators being excluded from categorization because their contribution to overall loadings on latent variables was relatively small. The categorization process is likely to have captured the majority of the key contributors to performance because the density of evidence should have led to theoretical saturation (Strauss and Corbin, 1998), though the reader should be aware that the categorization scheme is based principally on subjective assessments. The categorization helps answer the call by Fabbe-Costes and Jahre (2008) to clarify the theoretical foundations of the integration – performance relationship. It also brings into view opportunities to extend those foundations because it provides a basis from which to identify areas of customer integration that may not yet have been fully examined.

Five key high-level variables of customer and external integration were shown to positively affect organizational performance. These high-level variables and the authors that used them are summarized in Tables 2.6, 2.7 and 2.8. The high-level variables include:

1. Information sharing with customers in relation to forecasting, planning, order management, operational execution, or market knowledge
2. Integration of information technologies with customers in order to facilitate information exchange or information sharing
3. Extended contact with customers in order to effectively understand their evolving strategic and operational requirements, to agree on expectations, and to obtain feedback on performance
4. Development of specialized assets, services or location-based commitments that are oriented to specific customers

5. Capacities to learn from customer engagements in order to more effectively manage ongoing and future engagements.

The first four of the foregoing high-level variables have been shown to affect financial performance, both at the level of supply chain operations, and at the level of the firm (see Tables 2.6 and 2.7 for references). All five high-level variables of customer or external integration have been shown to affect supply chain operational performance (see Table 2.8). The most extensive literature provides support for information sharing as a high level variable of customer or external integration that improves organizational performance. There is also extensive support for integration of information technologies, extended levels of contact with customers, and the development of specialized assets, services or location-based commitments as high-level variables that affect organizational performance. The performance enhancing effects of capacities to learn from customer engagements has only been sparsely investigated; in fact, this variable was not used to examine financial performance in either of the studies that examined its effects on organizational performance (Zacharia et al., 2011; Stank et al., 1999).

Table 2.6 High level customer or external integration variables that have demonstrated improvements in operational financial performance

High Level Variable of Customer or External Integration	Reference
Information sharing with customers in relation to forecasting, planning, order management, operational execution, or market knowledge	Wong, Boon-itt and Wong (2011), Stock, Greis and Kasarda (2000), Daugherty, Myers and Autry (1999)
Integration of information technologies with customers in order to facilitate information exchange or information sharing	Lee, Kwon and Severance (2007), Stock, Greis and Kasarda (2000)
Extended contact with customers in order to effectively understand their evolving strategic and operational requirements, to agree on expectations, and to obtain feedback on performance	Rodrigues, Stank and Lynch (2004), Larson (1994)
Development of specialized assets, services or location-based commitments that are oriented to specific customers	Rodrigues, Stank and Lynch (2004), Lorenzoni and Lipparini (1999), Dyer (1997), Dyer (1996b)

Table 2.7 High level customer or external integration variables that have demonstrated improvements in organizational financial performance

High Level Variable of Customer or External Integration	**Reference**
Information sharing with customers in relation to forecasting, planning, order management, operational execution, or market knowledge	Paulraj, Chen and Lado (2012), Flynn, Huo and Zhao (2010), Rajaguru and Matanda (2009), Frohlich and Westbrook (2001)
Integration of information technologies with customers in order to facilitate information exchange or information sharing Integration of information technologies with customers in order to facilitate information exchange or information sharing	Paulraj, Chen and Lado (2012), Flynn, Huo and Zhao (2010), Kim and Cavusgil (2009), Rajaguru and Matanda (2009), Seggie, Kim and Cavusgil (2006)
Extended contact with customers in order to effectively understand their evolving strategic and operational requirements, to agree on expectations, and to obtain feedback on performance	Flynn, Huo and Zhao (2010), Singh and Power (2009), Kim (2006), Droge, Jayaram, and Vickery (2004), Stank, Keller and Closs (2001)
Development of specialized assets, services or location-based commitments that are oriented to specific customers	Chen, Daugherty and Roath (2009), Green, Whitten and Inman (2008), Frohlich and Westbrook (2001), Lorenzoni and Lipparini (1999), Dyer (1996a), Dyer (1996b)

Table 2.8 High level customer or external integration variables that have demonstrated improvements in operational performance

High Level Variable of Customer or External Integration	**Reference**
Information sharing with customers in relation to forecasting, planning, order management, operational execution, or market knowledge	Hall, Skipper, Hazen and Hanna (2012), Huo (2012), Paulraj, Chen and Lado (2012), Iyer (2011), Wong, Boon-itt and Wong (2011), Zacharia, Nix and Lusch (2011), Flynn, Huo and Zhao (2010), Lee, Kwon and Severance (2007), Kim and Cavusgil (2009), Rajaguru and Matanda (2009), Devaraj, Krajewski and Wei (2007), Germain and Iyer (2006), Frohlich and Westbrook (2001), Stock, Greis and Kasarda (2000), Stank, Crum and Arango (1999), Stank, Daugherty and Ellinger (1996),
Integration of information technologies with customers in order to facilitate information exchange or information sharing	Hall, Skipper, Hazen and Hanna (2012), Huo (2012), Paulraj, Chen and Lado (2012), Flynn, Huo and Zhao (2010), Vickery, Droge, Setia and Sambamurthy (2010), Kim and Cavusgil (2009), Rajaguru and Matanda (2009), Lee, Kwon and Severance (2007), Seggie, Kim and Cavusgil (2006), Daugherty, Myers and Autry (1999), Frohlich and Westbrook (2002), Stock, Greis and Kasarda (2000), Stank, Crum and Arango (1999)
Extended contact with customers in order to effectively understand their evolving strategic and operational requirements, to agree on expectations, and to obtain feedback on performance	Hall, Skipper, Hazen and Hanna (2012), Huo (2012), Zacharia, Nix and Lusch (2011), Flynn, Huo and Zhao (2010), Green, Whitten and Inman (2008), Swink, Narasimhan and Wang (2007), Kim (2006), Droge, Jayaram, and Vickery (2004), Stank, Crum and Arango (1999), Souder, Sherman and Davies-Cooper (1998),

Development of specialized assets, services or location-based commitments that are oriented to specific customers	Vickery, Droge, Setia and Sambamurthy (2010), Quesada, Rachamadugu, Gonzalez and Martinez (2008), Gimenez and Ventura (2005), Childerhouse and Towill (2003), Closs and Savitskie (2003), Frohlich and Westbrook (2001), Stank, Keller and Closs (2001), Daugherty, Myers and Autry (1999), Lorenzoni and Lipparini (1999), Souder, Sherman and Davies-Cooper (1998), Dyer (1997), Dyer (1996a), Dyer (1996b)
Capacities to learn from customer engagements in order to more effectively manage ongoing and future engagements.	Zacharia, Nix and Lusch (2011), Stank, Crum and Arango (1999)

2.9 Links between theoretical perspectives of customer integration and key elements of customer integration shown to positively affect organizational performance

Many theoretical perspectives have motivated studies of integration. These perspectives have included process reengineering theory (Frohlich and Westbrook, 2001), rational efficiency theory (Frohlich and Westbrook, 2002), structural contingency theory (Flynn et al., 2010), the combination of contingency theory and organizational information processing theory (Wong et al., 2011), dynamic capabilities theory (Wong, 2013), and the knowledge based view and the relational view (Zacharia et al., 2011a). While the broader theoretical framework of this study builds on a learning framework that encompasses multiple theoretical perspectives (Zollo and Winter, 2002), the foregoing analysis of performance effects of extant customer integration research will be examined within the context of the key drivers of the *Relational View* (Dyer and Singh, 1998), which has a specific focus on '… *interfirm linkages* …' (Dyer and Singh, 1998, p661). The focus on the degree to which inter-firm linkages influence performance makes the Relational View a particularly relevant theory for analysis of potential performance effects of customer integration within 3PL environments. A core insight provided by the Relational View is the point that there are potential performance benefits associated with exchange relationships that cannot be generated by firms on their own (Dyer and Singh, 1998, p662). This feature of exchange relationships is critical to understanding *why* 3PLs should focus on customer integration. The mechanisms that potentially generate the benefits provide researchers and managers with understanding of *how* those benefits can be accessed. Examining the fit between known drivers of performance identified within the Relational View with the results of extant customer integration research should highlight whether observed performance effects are likely to be sustainable.

Dyer and Singh (1998) presented four key drivers relating inter-firm linkages to supernormal profits, the profits available solely within effective exchange relationships:

- investments in relation-specific assets
- investments in inter-firm knowledge-sharing routines
- combined synergy-sensitive resources
- alignment of governance structures.

The first three of these drivers align closely with the results of studies of customer integration and performance. The alignment is depicted in Table 2.9. The principal concern with the relationships shown in Table 2.9 in the context of the present study is the lack of research specifically focusing on 3PLs that has contributed to extant knowledge of the performance links of customer integration (Fabbe-Costes et al., 2008). This gap in knowledge provides the motivation for the second research question.

Research Question 2

How is the known positive relationship between customer integration and operational performance achieved in a 3PL environment?

Table 2.9 Alignment of key drivers relating inter-firm linkages and supernormal profits identified by Dyer and Singh (1998) and key high-level variables of customer and external integration that have been shown to positively affect organizational performance.

	Information sharing with customers in relation to forecasting, planning, order management, operational execution, or market knowledge	Integration of information technologies with customers in order to facilitate information exchange or information sharing	Extended contact with customers in order to effectively understand their evolving strategic and operational requirements, to agree on expectations, and to obtain feedback on performance	Development of specialized assets, services or location-based commitments that are oriented to specific customers	Capacities to learn from customer engagements in order to more effectively manage ongoing and future engagements
Investments in relation-specific assets				X	
Investments in inter-firm knowledge-sharing routines	X		X		X
Combined synergy-sensitive resources		X			

2.9.1 Logistics integration is one mechanism by which customer integration is achieved

Logistics integration is one of the least analyzed mechanisms for achieving customer integration (Gimenez, 2006). Logistics integration relies on investments in inter-firm knowledge sharing routines that extend the boundary of firms through comprehensive use of logistics-related communications activities with customers, high levels of coordination of logistics operations with customers, blurring of boundaries relating to management of logistics activities on behalf of customers and a commitment to customer orientation (Chen and Paulraj, 2004; Gimenez, 2006; Stevens, 1989). These activities build understanding and empathy with customers (Dyer, 1997; Lorenzoni and Lipparini, 1999) generating insights and customer-specific knowledge to enhance performance (Dyer and Singh, 1998, p665). Given the emphasis on logistics operations within 3PL environments (Selviaridis and Spring, 2007; Marasco, 2008), the customer integration function of logistics integration (Chen and Paulraj, 2004; Paulraj and Chen, 2007) provides particular interest in the present study (Fabbe-Costes et al., 2009, p83). Accordingly, Hypothesis 1 is

> *3PL Logistics Integration directly influences 3PL Operational Performance in a positive manner*

2.10 Understanding mechanisms that enable logistics outsourcing firms to maintain effective integration as strategies or environments change

2.10.1 Customer integration is critical but insufficient on its own

The causes or antecedents that help explain why the largely positive relationship between customer integration and organizational performance persists are less well documented than the relationship itself (Chen et al., 2009b; Zhao et al., 2008), especially under conditions of environmental uncertainty (Wong, Boon-itt, and Wong, 2011), or in the environments where organizations are required to adapt to multiple client environments as appears to be the case for 3PL organizations (Panayides, 2007). Some studies demonstrate the positive impact of internal integration as a mediator (Stank, Keller, and Daugherty, 2001), facilitator (Droge et al., 2004; Flynn et al., 2010) or moderator (Germain and Iyer, 2006) of customer integration and organizational performance. The authors of many of these studies argue that internal integration is critical to the success of customer integration (Flynn et al., 2010; Germain and Iyer, 2006; Stank et al., 2001b). Droge et al. (2004) argue the two forms of integration act synergistically. Stank et al. (2001b) suggest the mediation effect of internal integration effectively means that it is the precursor of customer integration and suggest further research is required to understand the underlying mechanisms. Stevens (1998) and Flynn et al. (2010) also support the argument that internal integration is the base for customer integration; they argue for a sequential development path for the two capabilities, in contrast with Droge et al. (2004), who contend the two capabilities should be built in parallel. The relevance of these studies in the context 3PL adaptation to its clients' supply chains, most likely multiple supply chains, as well as to changes within those supply chains, is to highlight that customer integration may not, on its own, facilitate sustainable organizational performance (Boon-iit and Wong, 2011; Wong et al., 2011).

2.10.2 The contributing factor of organizational learning

Internal integration has also been held to be important to market orientation, like customer integration, another externally focused construct known to affect organizational performance (e.g., Hult, Ketchen and Slater, 2005; Morgan Vorhies, and Mason, 2009). Narver and Slater (1990) argued internal integration was critical to the market orientation construct and included it as one of three factors in their well-known and extensively used (see Deshpande and Farley, 1998) model. Kohli and Jaworski (1990) argued that many departments within a company were responsible for market intelligence, its dissemination, and the consequent responses of the organization. This was one of the reasons they preferred the term "market" orientation to "marketing" orientation (Kohli and Jaworski, 1990, p3) when publishing their equally well-known (see Langerak, 2001) model of market orientation. But Slater and Narver (1995) held market orientation to be insufficient, on its own, to enable organizations to adapt effectively to all environments, despite its inclusion of the internal integration construct. These researchers felt the development of a shared view of opportunities, threats or required actions was an outcome of a learning organization; where information from multiple sources is acquired, and disseminated, and where a shared interpretation of the multiple-source information's relevance is developed as part of the broader organizational fabric prior to action being taken (see Slater and Narver, 1995, Figure 1).

Work to test Slater and Narver's ideas suggest that a learning orientation is important to customer integration. Hurley and Hult (1998) followed up the work of Slater and Narver to examine how market and learning orientations affected firm innovativeness and organizational performance. They argued that market and learning orientations were necessary antecedents of innovativeness that provided the underlying cultural orientation for innovation (see Hurley and Hult, 1998, Figure 1). Baker and Sinkula (1999) sought to clarify whether market orientation was sufficient to support innovation, or whether a broader learning orientation was truly also required to ensure sustained success. They felt a learning orientation was especially important in relation to more radical innovations relevant to fast or radically changing environments (e.g., type writer to word processor or oven to microwave oven (Baker and Sinkula, 1999, p297)). Their research used structural equation modeling to demonstrate that market orientation influenced organizational performance through innovation, and learning orientation influenced organizational performance both directly and through innovation (see Baker and Sinkula, 1999, Table 2). Moreover, the effect of the learning orientation on innovation was greater than the effect of the market orientation. Baker and Sinkula (1999, p305) argued that the generative learning effect, whereby organizations assess information from multiple sources within a broader system to come to conclusions (Senge, 2006), is more important than reliance on information from a limited range of sources of information as may be the case when relying on customer and market scans alone, as is the case in a market orientation. The relevance of these studies to the present focus on customer integration and internal integration is this: internal integration will most likely reinforce learning from customer integration as Flynn, Huo, and Zhao (2010), Stank, Keller and Closs (2001), and others have shown, enabling the organization to adapt to changes affecting its clients. The point of concern is that this learning may be limited in its value if clients lack relevant comprehensive and cohesive market views (Winter, 2000) or if changes in related but currently non-competing markets generate structural changes that effectively blind-side market incumbents as Lee (2004) described. Extrapolating the results of the work by Baker and Sinkula (1999) suggests customer integration should be placed within a framework of generative learning in order to ensure its effectiveness in both stable and changing environments. Doing so should further extend the customer-specific learning that occurs when investments are made in knowledge-sharing routines relating to logistics integration.

2.10.3 Are customer integration and internal integration separate capabilities?

The question of whether customer integration and internal integration are separate capabilities is worthy of brief examination before moving to a deeper analysis of the role generative learning plays with respect to customer integration. Winter has argued that a capability comprises one or many stable, goal oriented routines (Winter, 2003), and is substantial enough that it "… enables outputs that clearly matter to the organization's survival and prosperity …" (Winter, 2000, p983). He has made the point that an operational capability is one that enables the organization "… to make a living …" (Winter, 2003, p991) though there is an argument that a capability can play multiple roles (Helfat and Winter, 2011). He has also made the point that while information plays a critical role to the functioning of a capability, it also requires the input services (see Penrose, 1959/2009) of relevant resources (Winter, 2003). Arguments and evidence in support of a single organizational capability would suggest customer and internal integration are part of the same capability whereas those that separate the two types of integration would suggest the existence of two separate capabilities.

The research literature suggests the existence of two separate capabilities. Chen, Daugherty and Roath (2009) have highlighted the differences in the resource bases of those parts of a business that integrate with clients and those that perform other functions. Moreover, they point to the extensive literature that laments the difficulty of inter-functional integration; arguing "… that it is easier for buyers to integrate with their suppliers and for logistics managers to integrate with their customers than it is for either group to integrate within the firm across various functional areas …" (Chen, Daugherty and Roath, 2009, p66). Elsewhere, Chen and colleagues have asserted that internal "… and external integration are distinct though closely related concepts …" (Chen, Daugherty and Landry, 2009, p28). This assertion resonates with the research propositions and arguments in many studies (e.g., Droge, Jayaram, and Vickery, 2004; Flynn, Huo, and Zhao, 2010; Stank, Keller, and Daugherty, 2001).

Many researchers have identified internal integration capabilities. Flynn, Huo, and Zhao (2010), examining integration within a manufacturing context, posited, "… internal integration recognizes that the departments and functions within a manufacturer should function as part of an integrated process …" (Flynn, Huo, and Zhao, 2010, p59). Germain and Iyer (2006) referred to internal integration as the "… unifying functions and processes inside the firm …" (Germain and Iyer, 2006, p32). Others have taken similar views (e.g., Pagell, 2004; Stank, Keller and Daugherty, 2001; Wong, Boon-itt, and Wong, 2011). All these authors were able to confirm a role for the independent constructs that also had material effects on performance suggesting that internal integration is capable of taking the form of an independent capability.

Studies have also examined the independent effects of customer integration. Stank, Keller and Closs (2001) used a framework that presented customer integration as "…the competence firms use to create lasting distinctiveness with customers of choice …" (Stank, Keller and Closs, 2001, p33). Their results showed that customer integration was independent of internal integration and significantly related to logistics performance. Germain and Iyer (2006) focused on customer integration at the level of information exchange, arguing, "…information exchange of the sort measured often occurs when processes are integrated across firms …" (Germain and Iyer, 2006, p42). Their results demonstrated that customer integration had a significant effect on logistical performance. However, their results showed that customer integration was moderated by internal integration such that it only had an effect on performance in the presence of high levels of internal integration (see Germain and Iyer, 2006, p47). Swink, Narasimhan, and Wang (2007) examined strategic customer integration, using a customer intimacy, communication and satisfaction construct, and its effects on organizational performance. This construct demonstrated a significant effect on customer satisfaction but was negatively associated with a composite construct of market performance and profitability. Frohlich and Westbrook (2001) examined levels of integration and their effects on performance in international firms in the fabricated metals industry. They demonstrated that firms had strategies that focused on supplier and customer integration to lesser or greater degrees. Their results showed that firms that reported integrating suppliers and customers at levels in the top quartile for the sample on both sides of the supply chain demonstrated substantial outperformance compared with other firms. However, this was not true for firms that constrained their integration to customers or suppliers alone. Flynn, Huo, and Zhao (2010) defined customer integration as a construct with information systems integration, information sharing and communication. Their results showed that customer integration was a distinct construct and that it had a direct effect on operational performance. Wong, Boon-itt, and Wong (2011) examined the effects of customer integration on performance in turbulent environments. Their customer integration construct combined information sharing, use of technologies and collaborative planning. Their results demonstrated that this construct was independent of internal and supplier integration constructs. Their results also showed that customer integration had a direct effect on supply chain related performance factors, and that most of these relationships were relevant under environmental uncertainty. Taken together, the foregoing studies suggest that customer integration is an independent capability that is able to contribute meaningfully to organizations' objectives to "make a living" (with due reference to Winter, 2003).

The final question is then whether the distinction between internal integration customer integration is also relevant for 3PLs that operate logistics and other services on behalf of their clients, as discussed in previous sections. 3PLs have functional departments that purchase the trucks and other operating resources, human resource functions that hire their staff, finance functions that manage financials and so on (Baykasoglu and Kaplanoglu, 2007). 3PLs clearly also operate logistics functions that are integral to the operations of their customers. These may be full warehouse functions, transport functions or combinations of these functions, as has been discussed in earlier sections. This means 3PLs have both internal functions that serve normal corporate administrative roles, and customer oriented functions that deliver services to 3PL customers. So a distinction at this level of granularity between 3PLs and other organizations is unlikely to be relevant. Summarizing, then, the research on internal and customer integration presented in foregoing sections has shown that the two types of integration can be demonstrated to be different capabilities both in concept and in practice.

2.10.4 Organizational learning, customer integration and performance

There is an established body of work that addresses organizational learning (see reviews by Crossan, Lane and White, 1999; and, Crossan, Maurer and White, 2011), and more recently, its relationship with organizational performance (see Easterby-Smith and Prieto, 2008, or Vera et al., 2011, for summaries). Studies of organizational learning have included supply chain contexts (Cheung, Myers and Mentzer, 2010; Fugate, Stank and Mentzer, 2009; Hult, Ketchen, Cavusgil and Calantone, 2006) and 3PL contexts (Panayides, 2007). Generally, the studies have hypothesized and observed a positive relationship between organizational learning and performance.

2.10.4.1 Organizational learning processes and organizational change

Recent definitions of organizational learning focus on the processes associated with learning and the attendant effects on organizational change. Key arguments presented by leading scholars in the field (see Kale and Singh, 2007; Crossan et al., 2011) are summarized in Table 2.10. While this table is unlikely to be exhaustive, it does serve to highlight key aspects of thinking and the uniformity of much of the thinking over time. The table serves to highlight that organizational learning:

- is perceived to be a multi-step process (Crossan et al., 1999, Zollo and Winter, 2002; Kale and Singh, 2007)
- affects both individuals and groups (Cangelosi and Dill, 1965; Crossan et al., 1999; Kale and Singh, 2007), by
- provides the *potential* for changes (Cohen and Levinthal, 1989; Huber, 1991), or
- results in changes to organizational routines (Levitt and March, 1988; Zollo and Winter, 2002) or other "… non-human repositories …" (Vera et al., 2011), as well as
- results in potential changes (Huber, 1991) or actual changes (Argyris, 2003; Crossan et al., 2011) within individuals.

Learning processes are thought to require both cognitive and social activities (Crossan et al., 2011). Different authors emphasize slightly different processes, though they are likely to involve

- "… intuiting, interpreting, integrating, and institutionalizing …" processes (Crossan et al., 1999, p523), or
- accumulating experience then articulating and codifying knowledge (Zollo and Winter, 2002, Figure 1), or
- articulating, codifying, sharing and internalizing knowledge (Kale and Singh, 2007).

Table 2.10 Recent definitions of organizational learning

Authors	Definition of organizational learning	Key points
Vera et al. (2011, p154)	"… organizational learning is the process of change in individual and shared thought and action, which is affected by and embedded in the institutions of the organization. When individual and group learning becomes institutionalized, organizational learning occurs and knowledge is embedded in non-human repositories such as routines, systems, structures, culture, and strategy …"	• Learning is a process • Learning affects individuals and groups • Learning embeds knowledge in non-human repositories
Easterby-Smith and Prieto (2008, pp241-242)	"… learning can be defined in terms of the processes of knowledge creation, retention, application …"	• Learning is a process
Kale and Singh (2007, p984)	"…We see the alliance learning process as a process that is directed toward helping a firm (and its managers) learn, accumulate, and leverage alliance management know-how and best practices… such a process involves deliberate efforts to articulate, codify, share, and internalize alliance management know-how in firms…"	• Learning process involves articulation, codification, sharing and internalization of know-how
Zollo and Winter (2002, pp339-340)	"… We describe a set of learning mechanisms encompassing both the relatively passive experiential processes of learning ("by doing") and more deliberate cognitive processes having to do with the articulation and codification of collective knowledge. These learning processes are responsible for the evolution in time of two sets of organizational activities: one geared towards the operational functioning of the firm (both staff and line activities), which we will refer to as operating routines; the other dedicated to the modification of operating routines, which we identify with the notion of dynamic capabilities..."	• Learning is a process that can be passive (by doing) or active, involving articulation and codification

Crossan et al. (1999, pp522-523)	"… we develop an organizational learning framework to address the phenomenon of [strategic] renewal... Four key premises or assumptions form the underpinnings of this framework and support one central proposition: Premise 1: Organizational learning involves a tension between assimilating new learning (exploration) and using what has been learned (exploitation). Premise2:Organizational learning is multi- level: individual, group, and organization. Premise 3: The three levels of organizational learning are linked by social and psychological processes: intuiting, interpreting, integrating, and institutionalizing (4I's). Premise 4: Cognition affects action (and vice versa). Proposition: The 4I's are related in feed-forward and feedback processes across the levels.	• Organizational learning is about strategic renewal • It involves a tension between assimilating new knowledge and using established knowledge • It is multi-level • It is linked by social and psychological processes that are related in feed-forward and feedback processes • Cognition and action reinforce each other
Huber (1991, p89)	"… learning need not be conscious or intentional … an entity learns if, through its processing of information, the range of its potential behaviors is changed. This definition holds whether the entity is a human or other animal, a group, an organization, an industry, or a society. The information processing can involve acquiring, distributing or interpreting information.' When the entity is an organization, these processes are frequently interpersonal or social, but they are occasionally more mechanical, and they can often be usefully viewed as logistical processes. More meaning is given to organizational learning by characterizing it in terms of attributes. Four seem especially germane-existence, breadth, elaborateness, and thoroughness…."	• Learning as information processing that enables the range of *potential* behaviours to be changed. • Learning can be characterized by four attributes: existence, breadth, elaborateness, and thoroughness

Argyris (2003, p1178-1179)	"Single-loop learning occurs when a mismatch is detected and corrected without changing the underlying values and status quo that govern the behaviors. Double-loop learning occurs when a mismatch is detected and corrected by first changing the underlying values and other features of the status quo. Single-loop learning remains within the accepted routines. Double- loop learning requires that new routines be created that were based on a different conception of the universe … we also made a distinction between double-loop learning and deutero-learning. We understood deutero-learning to mean second-order learning, reflecting on the first-order actions. Deutero- learning can occur by going meta on single or double-loop learning. The distinction is important because the knowledge and skills required to produce double-loop learning are significantly greater and more complicated than those required for deutero-learning on single-loop issues…"	• Learning induces change • Learning may or may not affect underlying values and other features of the status quo
Cohen and Levinthal (1989, pp569-570)	"…we argue that while R&D obviously generates innovations, it also develops the firm's ability to identify, assimilate, and exploit knowledge from the environment—what we call a firm's 'learning' or 'absorptive' capacity. While encompassing a firm's ability to imitate new process or product innovations, absorptive capacity also includes the firm's ability to exploit outside knowledge of a more intermediate sort, such as basic research findings that provide the basis for subsequent applied research and development. Also, in light of the dependence of industrial innovation upon extramural knowledge, absorptive capacity represents an important part of a firm's ability to create new knowledge. In this regard, the exercise of absorptive capacity represents a sort of learning that differs from learning-by-doing, the focus of industrial economists' work on firm learning in recent years … Learning-by-doing typically refers to the automatic process by which the firm becomes more practiced, and, hence, more efficient at doing what it is already doing. In contrast, with absorptive capacity a firm may acquire outside knowledge that will permit it to do something quite different.	• The firm's learning or absorptive capacity is its ability to identify, assimilate, and exploit knowledge from the environment … and is an important part of a firm's ability to create new knowledge.

Levitt and March (1988, p320)	"Our interpretation of organizational learning builds on three classical observations drawn from behavioral studies of organizations. The first is that behaviour in organizations is based on routines … The second observation is that organizational actions are history-dependent … The third observation is that organizations are oriented to targets … Within such a framework, organizations are seen as learning by encoding inferences from history into routines that guide behavior …"	• Organizational learning is a process that induces changes to routines
Schon (1975, p6)	"… Organizations are artifacts designed for human purposes. Their effectiveness depends on their continuing redesign in response to changing values and a changing context for action. Organizational learning would then refer to this process of continuing redesign … Learning, then, is that particular sort of change in which a subject as a result of past experience evidences a pattern of behavior—new for him—that signifies knowledge—also new for him—and that can be expressed—at least in principle—in propositional form…"	• Learning is related to change and the process of redesign
Cangelosi and Dill (1965, p200 and Figure 4)	"… organizational learning must be viewed as a series of interactions between adaptation at the individual or subgroup level and adaptation at the organizational level. Adaptation occurs as the result of three kinds of stress [discomfort stress, performance stress, disjunctive stress], one of which stimulates subsystem learning, one total-system learning, and one both subsystem and total-system learning…"	• Organizational learning as interaction between adaptation at the individual or subgroup level and adaptation at the organizational level.

2.10.4.2 Organizational learning within environments subject to change

Organizational learning appears to play a particularly important role in environments subject to change. In a series of studies, Hult and Ketchen initially worked with colleagues to examine how organizational learning, which they termed knowledge development, affected supply chain performance (Hult, Ketchen and Slater, 2004). They then examined how a "culture of competitiveness", defined as having a blend of learning, entrepreneurial and innovativeness orientations, interacted with knowledge development to affect performance when the environments were moderated by turbulence (Hult, Ketchen, and Arrfelt, 2007). The latter study demonstrated that the competitiveness culture outperformed under relatively stable market conditions but that knowledge development led to better performance in highly turbulent environments. In this respect, they echoed the results of Baker and Sinkula (1999) within a supply chain context.

Hanvanich, Sivakumar and Hult (2006) examined the effects of learning orientation and organizational memory on innovation and purchasing performance under conditions of environmental and technological turbulence. Their results showed that learning orientation is more important than organizational memory under conditions of high environmental turbulence, especially for innovation. The learning orientation affected performance in a positive manner equally under conditions of low and high market turbulence. The results from the market orientation – learning orientation studies, and the studies conducted by Hult, and his colleagues, reinforce each other to suggest that generative learning within the organization is a foundation for dealing with rapidly changing market environments.

Available research has a positive leaning to suggest organizational learning is important to customer integration and its effects on organizational performance but it is not conclusive. Counteracting the positive side of the argument are the results of Wong, Boon-itt and Wong (2011) reported in an earlier section. These authors presented results demonstrating customer integration was effective in influencing performance of a number of supply chain performance indicators under conditions of high environmental uncertainty. Unfortunately, they did not study organizational learning so it is not clear whether this factor was an antecedent to customer integration. Panayides (2007) used structural equation modeling to study the relationship between organizational learning, relationship orientation and performance in 3PLs. His relationship orientation construct reflected a cultural view of customer integration. His results showed that organizational learning had a direct effect on both relationship orientation and logistics service quality, which in turn had a positive effect on a multi-indicator measure of company performance (see Panayides, 2007, Figure 2). Panayides did not present indirect effects within the modeling so it is not possible to know whether organizational learning or relationship orientation were responsible for the effects on company performance. In another study, Panayides and So (2005) examined the effects of both relationship orientation and organizational learning on innovation and organizational performance in 3PLs. This study supported the positive effects of organizational learning on supply chain effectiveness via innovation. Relationship orientation also affected supply chain effectiveness in a positive manner but not through a direct effect on innovation. Cheung, Myers and Mentzer (2010) conducted a very interesting study of what they termed relationship learning and its effects on relationship value in 126 pairs of international trading partners. Their measure of relationship learning had three latent variables, termed, "exchange of information", "joint sense making", and "knowledge integration". These variables reflected aspects of customer integration deployed in various studies by other researchers reviewed in previous sections of this document, as well as learning constructs. Relationship value was also a second level latent variable with five first level latent variables. They also included environmental uncertainty and environmental dissimilarity as antecedents to relationship learning. Their results showed that relationship learning had a strong positive effect on relationship value. Their results also demonstrated that environmental uncertainty and dissimilarity increased relationship learning. The authors interpreted the outcomes to suggest that environmental uncertainty and dissimilarity may "…facilitate relationship learning despite (or perhaps due to) the risks and dilemma associated with these phenomena … (Cheung, Myers and Mentzer, 2010, p481). Thus, to some degree, the jury is still out with regard to whether organizational learning plays an influential role to enhance the efficacy of customer integration and its effects on organizational performance, but the available evidence suggests it has a positive effect.

2.10.5 Adaptation in turbulent fields

One may ask the question of why organizational learning is important or even relevant to customer integration, and the capacity to adapt to multiple, or changing, environments. Emery and Trist (1965) first introduced the concept of "turbulent fields" by describing the rapid fall of a market-leading provider of canned vegetables. Their description of the deterioration of the manufacturer's business, which had maintained a steady 65% market share for decades, highlighted that it was not developments within that company's traditional markets that caused its downfall, but changes in a multitude of other segments that led participants in those segments to respond for reasons related to their own survival. The consequences of their actions led to the emergence of supply of new products by some of the participants that, in turn, became lower cost alternatives to the canned vegetable manufacturer's traditional products at such a speed that the company was unable to respond. Emery and Trist commented that "… The changed texture of the environment was not recognized by an able but traditional management until it was too late. They failed entirely to appreciate that a number of outside events were becoming connected with each other in a way that was leading up to irreversible general change …" (Emery and Trist, 1965, p24). The "turbulent fields" generate their own dynamics, such that "… The 'ground' is in motion …" (Emery and Trist, 1965, p26) inducing "… autochthonous processes in the environment …" (Emery and Trist, 1965, p26). Terreberry (1968) argued that this characteristic requires organizations to implement formal search functions. She also put forward the hypothesis that adaptability "… is a function of ability to learn and to perform according to changing environmental contingencies …" (Terreberry, 1968, pp611-612). The point of relevance of the existence of "turbulent fields" in the context of the discussion related to customer integration, organizational learning and adaptation is this: the potential effects of turbulence on business prosperity are so catastrophic that the potential presence of turbulence most likely *causes* companies to implement learning mechanisms and external search functions in order to ensure their customer integration capabilities operate effectively and are capable of rapidly adapting to environmentally induced changes. This explanation fits the results of Cheung et al. (2010) highlighted in the previous section and suggests that managers make the investments in organizational learning whether markets are changing rapidly or not (Zollo and Winter, 2002, p340).

Research Question 3

How do learning processes positively influence (a) 3PL customer integration and (b) 3PL operational performance?

2.10.6 The case for a place for dynamic capabilities

Hult et al. (2007) argued for a very important point that had previously been raised in the market orientation – learning orientation debate by Farrell and Oczkowski (2002): the combination of a culture of competitiveness (or market orientation) and organizational learning may provide a robust defense against a broad array of market conditions (Hult et al., 2007, p1047). It may be true that an understanding of the existing market is critical for success in stable or slow moving markets, but that generative learning needs to be in place when markets are changing more rapidly.

The insights of Farrell and Oczkowski (2002) in relation to the role of market orientation, and Hult et al. (2007) in relation to the role of the culture of competitiveness, mirrors the positioning of dynamic capabilities within the strategic management and learning literatures (e.g., Zollo and Winter, 2002; Vera et al., 2011) as the capabilities that enable change within operational capabilities. That is, Hult and his colleagues, and Farrell and Oczkowski, were likely to have been describing instances of dynamic capabilities where they report the roles that the culture of competitiveness and market orientation play in stable or slow moving markets. In fact, Farrell and Oczkowski (2002) went so far as to claim that the "causal flow" follows the sequence, Learning Orientation > Market Orientation > Operating Performance, "… (LO>MO>OP) … In other words, the effect of LO is mediated by MO …" (Farrell and Oczkowski, 2002, p210). This interpretation fits the relationship between learning mechanisms, dynamic capabilities and the evolution of operating capabilities initially proposed by Zollo and Winter (2002) and expanded upon by Winter (2003), as well as recent extensions of that work (Easterby-Smith and Prieto, 2008; Vera et al., 2011; Verona and Zollo, 2011). The learning framework of Argyris (2003) provides a similar perspective. Zollo and Winter's (2002) multi-level framework positions organizational learning mechanisms and dynamic capabilities as causal factors in the evolution of operational capabilities. Winter (2003) used the language of differential calculus to name operational capabilities as zero-order capabilities and dynamic capabilities as first-order capabilities, reflecting the perspective that dynamic capabilities are responsible for changing the zero-order operational capabilities. The extensions of Zollo and Winter's (2002) framework by Easterby-Smith and Prietio (2008), Vera et al. (2011) and Verona and Zollo (2011), identified links to organizational performance and added greater granularity within some elements of the framework. Of particular relevance to the present study, Vera et al. (2011) tied the levels of learning of Argyris (2003) to Zollo and Winter's (2002) framework, and to Winter's (2003) ideas related to differential calculus, to reflect an integrated layering of capabilities within a learning framework. As such, these theoretical frameworks provide significant promise in the search for factors that could help explain how customer integration enables 3PL organizations to adapt in stable environments, more rapidly changing environments, and new environments encountered when they offer their services to clients in new industries as part of their growth strategies.

2.10.7 Is customer orientation a dynamic capability?

Dynamic capabilities are now accepted to be the capabilities that enable change in operating capabilities (see Helfat et al., 2007, for a comprehensive review; or Helfat and Winter, 2011, for a succinct summary). Teece (2007) positioned dynamic capabilities as those capabilities that scan the environment to enable organizations to adapt to environmental changes over time. More specifically, he argued that dynamic capabilities are the "… high-level activities that link to management's ability to sense and then seize opportunities, navigate threats, and combine and reconfigure specialized and cospecialized assets to meet changing customer needs …" (Teece, 2007, p1344). This argument presents the possibility that customer orientation, one of the core components of market orientation (see Narver and Slater, 1990; Deshpande and Farley, 1998), may be a dynamic capability that provides managers of 3PLs with the ability to effectively adapt its integration with customers on an ongoing basis.

Customer orientation is the sustained learning effort of suppliers, 3PLs in the present context, to ensure they have a sufficiently deep understanding of their customers to provide them with superior value over time (Narver and Slater, 1990). Customer orientation is the customer-focused component of the broader market orientation construct that represents a specific cultural orientation within organizations. Slater and Narver (1995, p67) defined market orientation "… as the culture that (I) places the highest priority on the profitable creation and maintenance of superior customer value while considering the interests of other key stakeholders; and (2) provides norms for behavior regarding the organizational development of and responsiveness to market information…". Other researchers have reinforced that view (Hult et al., 2005). Customer orientation requires suppliers to put sufficient effort into their search activities to understand their customers' full value chains in the present as well as how they "… will evolve over time subject to internal and market dynamics …" (Narver and Slater, 1990, p21). Customer orientation may provide 3PL managers with the ability to "sense opportunities" and "navigate threats" as Teece (2007) puts it, enabling 3PLs to adapt as their customer environments evolve.

The existing literature is relatively thin with respect to the role of customer orientation, or indeed, market orientation, as a dynamic capability. Braunscheidel and Suresh (2009) tested the effects of market orientation on internal and external integration using structural equation modeling. They found positive direct effects were significant.

They did not test for indirect effects using statistical tests of significance (e.g., Cheung and Lau, 2008). However, using the tracing rule of effect loadings (see Kline, 2011) suggests there was also an indirect effect of market orientation on firm supply chain agility, the measure of performance used in the study. Braunscheidel and Suresh (2009, Table 7) used multiple analysis of variance tests to demonstrate that firms displaying high levels of supply chain agility were significantly different from firms displaying low levels of supply chain agility with respect to both internal and external integration. Thus, while the study of Braunscheidel and Suresh (2009) was not examining dynamic capabilities, their study provides some evidence to suggest that market orientation acts through the 'levers' (Hult et al, 2005) of internal and external integration to affect supply chain performance.

Other evidence of the customer orientation acting as a dynamic capability affecting customer integration and operational performance is more indirect than that of Braunscheidel and Suresh (2009). Ali et al. (2010), believed market orientation and dynamic capabilities to be separate entities and modeled them that way (see their Figure 1). Their paper was a theoretical paper so it is unclear whether their propositions have been tested. Menguc and Auh (2006) positioned market orientation together with organizational innovativeness as a dynamic capability. These researchers demonstrated that the market orientation – performance relationship was moderated by organizational innovativeness. They based their argument that market orientation was a dynamic capability on the basis of the fact that it was complemented by innovativeness thereby lifting its competitive value (Menguc and Auh, 2006, p65). Morgan et al. (2009) extended the examination of complementary resources by exploring the effects of market orientation, a range of marketing capabilities, and their interactions on organizational performance. They argued, as did Menguc and Auh

(2006), that resources that may be valuable on their own, gain leverage by being combined with complementary resources "…that match the market conditions faced in order to drive firm performance …" (Morgan et al., 2009, p910). Their results demonstrated strong interaction effects suggesting market orientation grows in effect on organizational performance as marketing capabilities increase in intensity (see interaction effects in Morgan et al., 2009, Table 3). They argued that their results demonstrated support for the dynamic capabilities theory (Morgan et al., 2009, p917) using the mechanism called complementarity of resources (see Zhu and Kraemer, 2002 or Zhu, 2004, for further discussions regarding this mechanism). Song et al. (2005) examined complementarity of marketing capabilities and technological capabilities in joint ventures operating in turbulent and less turbulent environments. Their construct of marketing capabilities included a market sensing indicator as well as customer and channel relationship indicators. Their results provided support for complementarity of resources and also demonstrated that marketing capabilities had greater direct effects on performance in less turbulent environments than in highly turbulent environments (Song et al., 2005, p269). In summary, there is evidence that market orientation acts as a dynamic capability, providing the possibility that its customer orientation component may provide the sensing mechanism by which it has an effect.

The question of how customer orientation acts to influence customer integration and operational performance is worth exploring to draw this section of the Literature Review to a conclusion. If customer orientation truly is a dynamic capability then it will act through an operating capability. This is what Hult et al. (2005) argued in relation to market orientation. They demonstrated that market orientation had a direct effect on organizational responsiveness but no significant direct effect on organizational performance. Hult and his colleagues argued that because market orientation is a cultural orientation it needs "… a 'lever' that can be pulled to directly increase performance…" (Hult et al, 2005, p1179). This argument implies that customer orientation needs the same. Taking this perspective in the context of the current research lens suggests that customer orientation will affect operational performance by influencing customer integration. That is, customer integration is the 'lever' that is pulled to affect operational performance when 3PL operators learn that the supply chains of their customers require some levels of change. The alternative perspective is provided by the argument of Helfat and Winter (2011) that some capabilities are capable to taking multiple roles, depending upon context and time frame. Following the alternative route, customer orientation would somehow act directly to affect operational performance. Helfat and Winter (2011, Footnote 3) used the example of strategic planning capabilities taking multiple roles as one example; including a market-signaling role to influence the behaviour of competitors based on adjustments in production capacities of manufacturers. Drawing these ideas together provides for the prospect that customer orientation affects customer integration directly, and that it affects operational performance either directly or indirectly via customer integration.

Research Question 4

How does customer orientation influence (a) 3PL customer integration and (b) 3PL operational performance?

A customer orientation is a fundamental element of logistics integration with customers (Stevens, 1998, p8). This point emphasizes that customer orientation could influence operational performance and the actions required to achieve and maintain high performance *both* through its role as a dynamic capability (Narver and Slater, 1990; Teece, 2007) and via its role in maintaining effective logistics integration. This point also reinforces the argument of Helfat and Winter (2011) that capabilities may act in multiple roles under different circumstances. Hypothesis 2 states that

> *Customer Orientation directly influences 3PL Logistics Integration in a positive manner.*

Hypothesis 3A follows directly from the same theoretical argument:

> *Customer Orientation directly influences 3PL Operational Performance in a positive manner.*

In this form, the relationship between the two factors may also be mediated by some other factor that is not measured in this study (Baron and Kenny, 1986).

Hypothesis 3B is related to both the first research question and the fourth research question. This hypothesis reflects the positioning of Customer Orientation as a dynamic capability with indirect effects on Operational Performance (see the model presented by Vera et al., 2011). Hypothesis 3B states that

> *Customer Orientation positively indirectly influences 3PL Operational Performance.*

Hypothesis 3C reflects the additive effects of direct and indirect influences (Sobel, 1987) of Customer Orientation on Operational Performance. This theoretical technical point is important because it emphasizes the multi-factor influence of the theories informing research questions one and four. Hypothesis 3C is

Customer Orientation positively influences 3PL Operational Performance.

2.10.8 Employee absorptive capacities are thought to be dynamic capabilities

Absorptive capacity is the ability to recognize, adapt and exploit external knowledge for commercial purposes (Cohen and Levinthal, 1989, 1991). The absorptive capacity construct has evolved over time (e.g., Cohen and Levinthal, 1989, 1991; Zahra and George, 2002; Lane et al., 2006; Todorova and Durisin, 2007; Easterby-Smith et al., 2008) but has retained its core elements of an organization recognizing and understanding information in external environments, assimilating and adapting the information to suit the capabilities of the organization, and then exploiting it effectively (Zahra and George, 2002; Todorova and Durisin, 2007). The mechanisms that support absorptive capacities within organizations are located both at individual and at organizational levels (Cohen and Levinthal, 1991). Individuals bring with them to organizations levels of knowledge, which enable them to interpret external environments (Jones, 2006). This knowledge can be further developed through internal R&D and spillovers from the R&D of others (Cohen and Levinthal, 1989, 1991). Internal communication mechanisms (Cohen and Levinthal, 1991) and social integration mechanisms (Zahra and George, 2002; Todorova and Durisin, 2007) are used to transfer knowledge and for teams to deploy that knowledge (Nemanich et al., 2010) within organizations, although many factors can affect the success of the knowledge transfers (Easterby-Smith et al., 2008; van Wijk et al., 2011). In essence, absorptive capacities are "… 'learning capacities' …" (Cohen and Levinthal, 1989, p569) that organizations deploy to enable them to interpret and effectively adapt to external environments.

Zahra and George (2002) argued that absorptive capacities are dynamic capabilities that companies use to drive change within their resource bases. The capacities to recognize and acquire, then assimilate information or transform existing knowledge based on new information (Todorova and Durisin, 2007), together with the capacity to exploit the resultant information (Zahra and George, 2002), provide the bases for this argument. Vera et al. (2011) also positioned absorptive capacities as dynamic capabilities arguing they represent "… one specific type of learning: learning from external sources …" (Vera et al., 2011, p166) and are "… instrumental in changing and reconfiguring routines and resources …" (Vera et al., 2011, p166).

Absorptive capacities place individuals at the heart of dynamic capabilities deployed by organizations seeking to adapt to changes in their environments. Assimilating information or transforming existing knowledge to accommodate new information occurs initially at the level of the individual and only later at the level of the business unit or organization (Crossan, Lane and White, 1999). Exploiting the new information often also resides at the level of the individual (Teece and Al-Aali, 2011) or with groups of individuals (Nemanich et al., 2010), though Zahra and George (2002, p190) argue, "… Exploitation as an organizational capability is based on the routines that allow firms to refine, extend, and leverage existing competencies or to create new ones by incorporating acquired and transformed knowledge into its operations …". This argument highlights the point that capabilities are never based on "… brilliant improvisation …" (Winter, 2003, p991) though dynamic capabilities may be "… rooted in creative managerial and entrepreneurial acts (Teece and Al-Aali, 2011, p509). Nevertheless, it is individuals who take action (Winter, 2000) in a repeatable and reliable manner (Helfat and Winter, 2011, p1244) to generate routines that accomplish the desired goals, though there may clearly be automated routines associated with the deployment of relevant technologies, such as network optimization software used by 3PLs to design new supply chain networks or simulation software used by 3PLs to design new advanced distribution centers. The term, Employee Absorptive Capacity, will be used within the present study to differentiate the specific focus on the capacities and actions of individuals from the broader concept of Absorptive Capacity.

Lane et al. (2006), in an extensive review, argued reification of absorptive capacity had constrained research perspectives related to the topic. They highlighted that researchers had generally overlooked the role of individuals within the broader construct of absorptive capacity. They felt this to be troubling both from practical and theoretical perspectives. From a practical perspective, they felt it suggested that individuals "… are not important to knowledge processing …" (Lane et al., 2006, p853). From a theoretical perspective, the argued that it suggested that learning capacities are "… algorithmic …" (Lane et al., 2006, p853) and fail to account for the fact that it is individuals who combine and apply knowledge in "… unique and valuable ways …" (Lane et al., 2006, p854) that create competitive advantage. They went on to argue that understanding the relationships and interactions between the absorptive capacity of individuals, and structures and processes within their organizations, is likely to "… shed new light on how a firm develops and uses its absorptive capacity …" (Lane et al., 2006, p854).

Volberda et al. (2010, pp944-945), in their extensive review of absorptive capacity, made a similar point to that of Lane et al. (2006) that there is insufficient focus on the individual within the research on absorptive capacity. Volbeda et al. (2010) identified research gaps in the literature related to absorptive capacity following a bibliometric analysis of the published literature on the topic. They argued that their analysis identified "… a gap in the current research and call for additional research that integrates the microfoundations of individual learning and intraorganizational level constructs in the hope that understanding these components of AC will enhance our understanding of AC …" (Volbeda et al., 2010, p944).

Crossan et al. (2011) provide extensive coverage of the importance individual learning within the context of a broader learning model. They argue that "… there may be a danger in isolating levels [of learning] … We see no value in the type of discourse that aims to identify the critical level responsible for [organization learning]. Instead, we maintain that processes at all levels are important to explain the phenomenon … " (Crossan et al., 2011; p449; wording in brackets added). The present research supports this perspective while seeking to elucidate the contribution of individual learning capacities to operational performance.

Research Question 5

How does learning capacity, in the form of employee absorptive capacity, influence (a) 3PL customer integration and (b) 3PL operational performance?

The literature relating to the fourth and fifth research questions inform Hypothesis 4. Learning capacities are thought to enable absorption of new information (Cohen and Levinthal, 1989) and influence the effectiveness of existing capabilities (Vera et al., 2011). Employee Absorptive Capacity, as a learning capacity, takes the form of a dynamic capability (Zahra and George, 2002) in Hypothesis 4, which states that

Employee Absorptive Capacity directly influences 3PL Logistics Integration in a positive manner.

Hypothesis 5 is based on the same literature as Hypothesis 4 and states that

Employee Absorptive Capacity indirectly influences 3PL Operational Performance in a positive manner.

2.10.9 Why is the "learning system approach" different from internal integration?

On the surface, the difference between internal integration and the "learning systems approach" as support mechanisms for customer integration may seem similar. Both approaches require strong levels of intra-organizational communication: internal integration constructs include cross-functional teams and meetings (e.g., Flynn et al., 2010; Germain and Iyers, 2006; Stank et al., 2001a), as do learning process constructs (e.g., Kale and Singh, 2007). Both internal integration (e.g., Droge et al., 2004; Stank et al., 2001a) and the "learning systems approach" (e.g., Kale and Singh, 2007; Zollo and Winter, 2002) emphasize standardization of procedures. And both internal integration (e.g, Germain and Iyers, 2006) and the "learning systems approach" (e.g., Cohen and Levinthal., 1991; Nemanich et al., 2010) emphasize the need for boundary spanning individuals. So many of the process elements are similar for internal integration and the "learning systems approach".

The differences relate to content. Internal integration is concerned with common understanding and integration of processes to reduce cost and time to market. For example, Droge et al. (2004) argued, "… Our internal design-process integration construct encompasses practices concerned with matching design requirements and process capabilities (i.e., product-process integration). These practices integrate manufacturing expertise with design engineering activities to ensure a seamless transition from drawing board to factory floor …" (Droge et al., 2004, p560). Flynn et al. (2010) held that internal integration "… is the degree to which a manufacturer structures its own organizational strategies, practices and processes into collaborative, synchronized processes, in order to fulfill its customers' requirements … and efficiently interact with its suppliers …" (Flynn et al., 2010, p59). And Stank et al. (2001a) held that internal integration is the "… competency of linking internally performed work into a seamless process to support customer requirements …" (Stank et al., 2001a, p33). The "learning systems approach" is concerned with adjustments to the core operating capability, viz., customer integration, to ensure it continues to be effective (Zollo and Winter, 2002), with strategic renewal in the face of change (Crossan et al., 1999), and with "… adapting, integrating, and reconfiguring internal and external organizational skills, resources, and functional competences to match the requirements of a changing environment …" (Teece et al., 1997, p515). So the "learning systems approach" provides a way for organizations to maintain the relevance and effectiveness of its core operating capabilities as its environments change and evolve.

The initial development of the framework linking learning processes with dynamic capabilities by Zollo and Winter (2002) and the subsequent extension of this work (e.g., Vera et al., 2011; Verona and Zollo, 2011) informs research question one and provides the background to the direction of the relationship between the factors, Learning Processes and Customer Orientation, in Hypothesis 6. The selection of Customer Orientation as a search function within the learning system was informed by the research on market orientation starting with Narver and Slater (1990), as well as Slater and Narver's (1995) work on market orientation and learning culture, the work of Hult et al. (2005) to tease out process and cultural components of market orientation, and the work of Teece (2007), who examined the micro-foundations of the theoretical construct of dynamic capabilities. Hypothesis 6 states that

> *Learning Processes directly influence Customer Orientation in a positive manner.*

The structure of the relationship between the factors, Learning Processes and Employee Absorptive Capacity, in Hypothesis 7 is drawn from the same sources as Hypothesis 6. The work initiated by Zahra and George (2002) to examine the nature of Absorptive Capacity as a dynamic capability, and Lane et al. (2006), Tu et al. (2006) and Volberda et al. (2010) to identify the independent construct, Employee Absorptive Capacity, also informs Hypothesis 7, which states that

> *Learning Processes directly influence Employee Absorptive Capacity in a positive manner*

Hypothesis 8 has three parts. Hypothesis 8A reflects the literature that provides the background to research question two that asks whether Learning Processes positively influence both Customer Integration and Operational Performance. Hypothesis 8A is not measured in all models tested in this research project; being constrained to zero in one of the models (see Methodology section of this Thesis; or Anderson and Gerbing, 1988). Hypothesis 8A states that

> *Learning Processes directly influence 3PL Logistics Integration in a positive manner*

Hypothesis 8B is linked to both research question one and research question three, reflecting the indirect effects of learning processes on operating capabilities via mediating dynamic capabilities within the learning system, as initially developed by Zollo and Winter (2002) and then extended by Vera et al. (2011). Hypothesis 8B states that

> *Learning Processes indirectly influence 3PL Logistics Integration in a positive manner*

Hypothesis 8C is further informed by insights relating to structural equation modeling that highlight the independent and additive effects of direct and indirect influences (Sobel, 1987; Cheung and Lau, 2008). Hypothesis 8C states that

> *Learning Processes positively influence 3PL Logistics Integration*

Hypothesis 9 is informed by the same literature as Hypothesis 8B and states that

> *Learning Processes indirectly influence 3PL Operational Performance in a positive manner*

Hypothesis 10 is derived from Research Question 5(b) and reflects the thinking of Helfat and Winter (2011) that capabilities can play different roles at different times. Using this perspective, it is conceivable that Employee Absorptive Capacity acts directly on Operational Performance rather than through the mediator, Logistics Integration. It may also be true that Employee Absorptive Capacity acts via an unmeasured mediator (see Barron and Kenny, 1986) to influence Operational Performance. Note that this hypothesis is framed to enable the measurement of an unconstrained structural equation model and is not measured in all models tested in this research (see Anderson and Gerbing, 1988; or Methodology section of this Thesis). Hypothesis 10 states that

Employee Absorptive Capacity directly influences 3PL Operational Performance in a positive manner

2.11 Summary of Chapter

Chapter 2 provides a summary of the extant literature of relevance to this study, and presents the research questions and hypothesis that emerge from the review. Five research questions relating to the overarching research question are presented. Ten key hypotheses are formulated on the basis of these questions.

Table 2.11 Relationships between Research Questions and Research Hypotheses

Research Hypotheses	**Research Questions**
1. 3PL Logistics Integration positively directly influences 3PL Operational Performance	2. How is the known positive relationship between customer integration and operational performance achieved in a 3PL environment?
2. Customer Orientation positively directly influences 3PL Logistics Integration	4. How does customer orientation influence (a) 3PL customer integration and (b) 3PL operational performance?
3A. Customer Orientation positively directly influences 3PL Operational Performance	4. How does customer orientation influence (a) 3PL customer integration and (b) 3PL operational performance?
3B. Customer Orientation positively indirectly influences 3PL Operational Performance	4. How does customer orientation influence (a) 3PL customer integration and (b) 3PL operational performance? 1. How do the relationships linking learning processes, dynamic capabilities, customer integration, and operational performance function in 3PL companies?
3C. Customer Orientation positively influences 3PL Operational Performance	
4. Employee Absorptive Capacity positively directly influences 3PL Logistics Integration	5. How does learning capacity, in the form of employee absorptive capacity, influence (a) 3PL customer integration and (b) 3PL operational performance? 1. How do the relationships linking learning processes, dynamic capabilities, customer integration, and operational performance function in 3PL companies?
5. Employee Absorptive Capacity positively indirectly influences 3PL Operational Performance	
6. Learning Processes positively directly influence Customer Orientation	1. How do the relationships linking learning processes, dynamic capabilities, customer integration, and operational performance function in 3PL companies?

<table>
<tr><th>Research Hypotheses</th><th>Research Questions</th></tr>
<tr><td>7. Learning Processes positively directly influence Employee Absorptive Capacity</td><td>1. How do the relationships linking learning processes, dynamic capabilities, customer integration, and operational performance function in 3PL companies?</td></tr>
<tr><td>8A. Learning Processes positively directly influence 3PL Logistics Integration</td><td>3. How do learning processes positively influence (a) 3PL customer integration and (b) 3PL operational performance?</td></tr>
<tr><td>8B. Learning Processes positively indirectly influence 3PL Logistics Integration</td><td rowspan="3">3. How do learning processes positively influence (a) 3PL customer integration and (b) 3PL operational performance?
1. How do the relationships linking learning processes, dynamic capabilities, customer integration, and operational performance function in 3PL companies?</td></tr>
<tr><td>8C. Learning Processes positively influence 3PL Logistics Integration</td></tr>
<tr><td>9. Learning Processes positively indirectly influence 3PL Operational Performance</td></tr>
<tr><td>10. Employee Absorptive Capacity positively directly influences 3PL Operational Performance</td><td>5. How does learning capacity, in the form of employee absorptive capacity, influence (a) 3PL customer integration and (b) 3PL operational performance?</td></tr>
</table>

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Overview of Chapter 3

This chapter presents the methodology used to collect data and to analyze that data as part of the study. Background information relating to the sample frame and the sample are provided to present the context in which the study was conducted. The rationale for the selection of variables is presented to provide additional context. A short, general, background to structural equation modeling, with attention to both direct and indirect effects, is presented because the data in the study was analyzed using a recent development (Cheung and Lau, 2008) of this technique that facilitates analyses of the significance of indirect effects. All sections of the survey instrument are presented, and the associated exhibits provide details relating to the data collection process. Formal methods for assessment of late and non-response bias, common method variance, missing data, assessment of univariate normality, multivariate normality and the search for outliers, and assessment of construct reliability and validity, are presented prior to a more detailed discussion of the procedures used to analyze structural equation models. Fit indices for models are also presented.

3.2 Population and sample

3.2.1 Population

Third party logistics companies can be characterized by their orientation to supply specialized and customized logistics services to their clients (Large, 2007; Marasco, 2008). Structurally, 3PLs comprise business operations designed to integrate with individual clients (Fabbe-Costes et al., 2009). Thus, while 3PLs may service many clients, as has been identified in other sections of this document, the literature review related to this study highlights the fact that a defining feature of 3PLs is their orientation to integrate their operations with their clients. The organizational unit of interest in the present study is the operational unit at which this integration occurs. The population of interest is the group of managers and supervisors responsible for ensuring the operations function effectively at this level within 3PL businesses. These personnel will be members of both 3PL businesses and their customers because of the high levels of entanglement between 3PLs and their customers. Fabbe-Costes and her colleagues point out that this area of study has had little attention in the research literature (Fabbe-Costes et al., 2009, p85), so one contribution to knowledge of this study is to point the spotlight on the area.

3.2.2 Organizational sources of sample

The 3PL selected for study was a major Asia-Pacific-based 3PL with many operating units in Australia. These operating units provided logistics services to many of Australia's largest companies. Each operating unit functioned in a stand-alone manner, with minimal operational interactions with other members of the 3PL. Where operational interactions occurred, they were generally, though not always, conducted using formal or semi-formal agreements to ensure costs were distributed equitably, and to ensure adequate service levels were maintained within each operating unit. Costs were allocated on a user-pays type basis to the operating units in all known instances. Though finance systems were based on the same information technology (IT) platform across the operating units, the vehicles, distribution centers, IT systems supporting operations (warehouse management systems and transport management systems), and staff members working in the operating units were generally independent. Centralized functions, such as IT, provided the equivalent of consulting or professional services to the operating businesses. The nature of the 3PL was such that each operating unit was much more closely linked with a client and that client's operations than it was with other operations within the 3PL. This way of working is a defining feature of 3PLs that has previously been discussed at length by Large (2007).

3.2.3 Rationale for selection of sample

The selection of the sample specifically addressed arguments presented by Ray et al. (2004). These researchers called for studies of capabilities and their effects on organizational performance to be conducted at fine-grained levels within organizations. The authors encouraged researchers to link strategic organizational capability elements with operating performance at levels that are sufficiently granular to remove the effects of non-operating overheads and the averaging effects on performance of multiple operating units or business units. Key arguments for this level of analysis relate to the ability to examine the performance effects of the capabilities at the levels at which they are actually operating rather than having to infer their effects from analyses at more aggregated levels, where performance is likely to be confounded by irrelevant effects introduced by parts of organizations that have not been subject to the influence of the capabilities under study (Ray et al., 2004, pp34-35). The present research was designed to examine performance effects at operational levels of an organization.

3.2.4 Organizational roles included in sample

The sample was drawn from executives, managers and supervisors of the 3PL and its clients, using organizational charts and client contact lists within the 3PL. Recruitment of employees from the focal 3PL organization, as well as those within its customer organizations, was justified on the basis of two well reported features of 3PL engagement: the high levels of entanglement between 3PLs and their customers; and, the high levels of knowledge sharing between 3PLs and their customers (Hertz and Alfredsson, 2003; Large, 2007; Cui and Hertz, 2011). By using responses from both employees of the focal organization and its customers it is likely that the spread of responses will be broader than if only employees from one source were engaged. However, the theoretical issue of relevance is the influence of, and effects on, the inter-firm linkages of the relationships between the 3PL and its customers and their effects on operational performance. The embeddedness of 3PL companies within their customers' supply chains relies on high levels of knowledge sharing and mutual understanding (Panayides, 2007; Cui and Hertz, 2011); thus, while it is unusual to group responses from inside and outside a focal organization, the approach links directly with the theoretical basis for the existence of supernormal performance outcomes which only emerge because of the entanglement of the firms (Dyer and Singh, 1998). The population of relevance, then, is the 'community' of employees engaged in the delivery of logistics services to the 3PL customers, including operational staff from the 3PL and the relevant managers from the customer organizations that ensure 3PL services are contracted and integrated effectively.

All participants were based in Australia to minimize cultural biases related to the interpretation of the questionnaires (Byrne and Campbell, 1999). Prospective participants were selected from relevant knowledgeable stakeholder groups: the 3PL's business unit operations managers and supervisors; managers of the 3PL's clients that had direct interaction with the 3PL; and, executives within the 3PL's clients that were directly affected by the 3PL service because they were senior supply chain managers responsible for managing the contracted 3PL service. Titles of the staff surveyed within the 3PL included: business unit Vice Presidents; National Managers of segments within business units; Site Managers responsible for operating specific client operations; and, Site Supervisors responsible for supervising specific aspects of client operations, such as shifts for specific transport operations or warehouse operations related to receiving or despatch. Titles of clients also represented a spread of roles including Supply Chain Director, Supply Chain Manager, Transport Manager, General Manager Logistics, and National Operations Manager. These prospective participant roles represented a reasonable spread of roles with experience of the 3PL services.

3.2.5 Identification of prospective participants

A Research Assistant was employed to assist with the development of the contact list of prospective survey participants. The rationale for using an assistant was based on the time-consuming nature of identifying roles and contact details of personnel employed in those roles. The 3PL company did not have a centralized database of employees that identified relevant roles. This was also true in relation to its clients; there was no central customer database that could be used to access contact details for relevant client personnel. For these reasons, the Researcher and the Research Assistant contacted senior executives within the 3PL and requested access to organizational charts and customer contact lists. The contact process was approved by the Macquarie University Ethics Review Committee (Human Research).

3.2.6 Sample size and data collection

More than 400 participants were surveyed using email and web-based methods, in order to ensure the final sample size was sufficiently large to deal with stability issues for parameter estimates of structural equation models (Cunningham, 2008). The contact method was based on the recommendations of Cook et al. (2000); their meta-analysis of web-based and internet-based surveys suggested that three contacts appear to provide an optimal response rate. A total of 378 3PL staff members and 135 client staff members were initially identified and sent a pre-survey notification via email (see Appendix 1A and Appendix 1B). This notification informed prospective respondents that they would be soon be invited to participate in a research project. Nineteen emails directed to clients of the 3PL were returned with notes that indicated the email addresses were no longer active and 36 potential respondents opted out of the study at this stage. A formal invitation was sent to 458 potential respondents via email a week later (see Appendix 2A and Appendix 2B). This invitation contained a link to a web-based survey. Reminders were sent to those prospective respondents who had not answered the survey and not notified the researcher that they had opted out of the study four weeks after the formal invitation to participate in the survey had been distributed (see Appendix 3). The survey was closed off three weeks after the reminder was issued. The pre-survey contact, the survey, and the follow-up contact were used to induce the optimal response rate identified by Cook et al. (2000).

3.2.7 Late response and non-response bias

There are various approaches that can be used to address late response and non-response bias (e.g., Armstrong and Overton, 1977; Lambert and Harrington, 1990). The key issue to address is whether there are differences between those respondents who answer the survey early or without prompting, and those who answer late, following prompts, or not at all (Armstrong and Overton, 1977). In this study, this type of bias was examined with t-tests using scores from two groups: those respondents who answered the survey without prompting; and, those respondents who answered the survey once the follow up email was sent, four weeks after the first email. Armstrong and Overton (1977) suggested that it is unnecessary to test all elements of the model, arguing that only those items that are likely to demonstrate bias need to be tested. However, for completeness, in this study all measured variables were examined for bias. Items that demonstrated significant mean differences across the groups were removed from the analysis.

3.3 Rationale for selection of measured variables and examination of causal mechanisms of customer integration and operational performance

3.3.1 Rationale for selection of extant items as measured variables

Measured variables were selected from the literature related to each of the five latent variables within the theoretical model: organizational performance; customer integration; employee absorptive capacity; customer orientation; and, learning processes. The rationale for using published scales rather than developing new measured indicators follows the arguments of Grover (1996) and Deshpande and Farley (1998) to integrate extant knowledge in the field of marketing because of the significant amount of development work that was already in place. Fabbe-Costes and Jahre (2008, p143) followed a similar line of thought to call for the stabilization of conceptual definitions in supply chain integration research in order to "… contribute to theory building …". The key objective of the current research is to synthesize conceptual work from several streams of management research to obtain a better understanding of the factors that contribute to the performance effects of customer integration than is currently available in the research literature. In order to meet this objective, the current research will heed the call of the foregoing researchers and place emphasis on the structure of relationships between the variables rather than on the composition of the variables themselves. Where practicable, extant constructs have been used; and where this was impractical because of the size of the structural model, measured indicators tested in the literature to form specific constructs were rotated to identify the highest factor loadings on the latent variables (Bollen and Lennox, 1991).

3.3.2 Mechanisms that help explain performance effects of customer integration

The relevance of the orientation to extend our understanding of the performance effects of extant conceptualizations of customer integration by focusing on the *mechanisms* that support their foundations emerged during the review of related literature presented earlier in this document. Two related studies by Stank and his colleagues present the opportunity to provide an explicit example of this underlying rationale, though it is not a topic that was directly addressed by the authors of either study. Stank et al. (2001a) studied multiple integration constructs and identified that "Relationship Integration" was unrelated to logistics performance measures such as delivery speed, delivery dependability, order flexibility, and delivery flexibility. The performance factor in the related study by Stank et al. (2001b) used measured variables with very similar terminology. Indicators of "External Collaboration" in the latter study also used references to information sharing, and the sharing of risk and reward, as was done in the Stank et al. (2001a) study to build the "Relationship Integration" construct. So, given the non-significant results of Stank et al. (2001a), the lack of a direct effect of "External Collaboration" on logistics performance in the Stank et al. (2001b) study should not have been a surprise to any reader who reviewed both papers. The interesting point is that these latter authors clearly showed an indirect effect of "External Collaboration" on logistics performance that was not apparent in the Stank et al. (2001a) study. This example demonstrates that there is a case to be made to ensure that *mechanisms* relating customer integration to performance are effectively isolated and examined. This is equally true of the pursuit to identify the underlying causes of customer integration than has been reflected in the literature to date.

Understanding the mechanisms that support customer integration and its relationship with organizational performance appears to be a methodological issue on the one hand, that enables the mechanisms to be identified, by structural equation modeling or similarly advanced techniques, and a definitional issue, on the other, that establishes a common terminology and a common set of constructs within the literature. The overall supply chain construct, which emerged during the 1980s (Lambert and Cooper, 2000), and many of its core variables, including integration, are now at a point of development where consolidation of the many research definitions related to key constructs is justified (e.g., Flynn et al., 2010). Fabbe-Costes and Jahre (2008, p143) argued for the issue to be addressed by all researchers by proposing that they should ensure clarity in their definitions in order to more effectively contribute to construction of coherent theories. While the issue settles, there is clearly a case to cross-reference definitions of integration and collaboration to ensure they are not subject to reification in the manner identified by Lane et al. (2006) in relation to absorptive capacity. The present study makes a contribution to knowledge by following the arguments of Grover (1996), Deshpande and Farley (1998), and Fabbe-Costes and Jahre (2008), and focusing on the *roles* of the latent variables, and the *mechanisms* that explain the relationships among them.

3.3.3 Research literature dealing with roles of variables affecting customer integration

There has been a limited focus in the research literature on the roles of variables, and mechanisms that link them, that help explain the performance effects of customer integration. Many studies have used structural equation modeling to explore the relationship between customer or external integration and performance, as was shown in the literature review of this thesis. However, few studies have examined an extensive model that reflects factors that support customer integration, enabling it to positively affect organizational performance.

The major "causal factor" or antecedent of customer or external integration that has been studied in structural equation modeling studies is some variant of internal integration. Generally, internal integration has been modeled as an exogenous factor acting directly on customer or external integration, either in a reciprocal relationship (Stank et al., 2001b; Gimenez and Ventura, 2005) or in a unidirectional relationship (Chen et al, 2009b; Huo, 2012). Germain and Iyer (2006) demonstrated that the interaction of internal integration and an external integration factor significantly affected performance. Wong et al. (2011) examined the performance effects of customer integration under environmental uncertainty; however, these researchers did not test effects of internal integration or supplier integration, their other exogenous variables, on customer integration. So, it is known that internal integration is an effective contributor to the performance effects of customer integration.

There are researchers who have examined alternative causal factors of customer or external integration. Rodrigues et al. (2004) demonstrated that a relational strategy had a positive effect on structural elements of organizations that subsequently positively affected integrated operations and their effects on organizational performance. Kim

(2006) identified that supply chain management practices in small Japanese and Korean firms positively support the performance effects of supply chain integration. Seggie et al. (2006) identified three factors that significantly influenced inter-firm system integration and its effects on brand equity, which in turn affected organizational performance. These were a relational factor called partner dependence, IT alignment and, IT appropriability, which is likely to have had an indirect effect, though its significance was not reported (see Seggie et al., 2006, Figure 1). Singh and Power (2009) highlighted the significant indirect effects of supplier involvement on firm performance in the presence of strong customer relationships. Vickery et al. (2010) demonstrated the positive effects of the complementarity of a customer integration factor and a supply chain information technology factor on organizational agility, which in turn directly affected firm financial performance. And Zacharia et al. (2011a), in a study of episodic collaboration among 473 US businesses, identified three factors that significantly affected collaborative engagement, which led to enhanced operational and relational outcomes. These factors were perceived interdependence, collaborative process competence, and absorptive capacity, which had a significant indirect effect (see Zacharia et al., 2011a, Table 4). So, in the two decades since Larson (1994) first demonstrated a performance effect of a customer integration factor using structural equation modeling, less than ten studies published in major journals have examined organizational performance effects of causal factors of customer or external integration other than internal integration. Only Zacharia et al. (2011a) used some measure of learning competencies as a causal factor for customer or external integration. And Rodrigues et al. (2004) is the only research team to date to examine the relevance of a deeper understanding of customers as a driver of the performance effects of external integration. The model to be tested in the present study therefore contributes significantly to our knowledge of the influence of potential causal factors of customer integration and its effects on organizational performance, given the theoretical importance of learning competencies and customer understanding to customer integration highlighted in previous sections of this document.

3.3.4 Structural equation modeling facilitates analyses of *how* variables relate to each other within a process or causal model

The development of structural equation modeling was a significant methodological innovation that enabled factor analyses and path modeling to be combined in a single model (Kaplan and Elliott, 1997). At a conceptual level, structural equation modeling is based on factor analyses that examine the relationships between measured variables and some underlying theoretical factors, and the path modeling that examines the relationships between those underlying factors (Anderson and Gerbing, 1988). Structural equation modeling allows both direct and indirect relationships between the factors to be explored. Indeed, Sobel (1987, p159) argued that "…Direct and indirect effects tap different (though related) aspects of the process, and the failure to distinguish between these two types of effects can create needless confusion and controversy …". Finch et al. (1997, p88) were adamant the "… failure to consider both types of effects can obscure the true nature of a causal process and lead to incorrect causal inferences …". The technique enables examination of *how* variables relate to each other to produce an effect (Judd and Kenny, 1981) within a process (Browne and Cudeck, 1992), and is used to study causal relationships, most often without the use of experimental designs (Kenny, 2008). This is obviously a controversial area in science; the arguments in support of its use in organizational studies rely on strong a priori use of theory to justify the relationships under examination (see James, 2008, for non-technical arguments and for a list of references presenting the technical arguments). There are arguments to support the use of simple mediation models as well as more complex models; methodologists have identified preferred technical approaches to the more complex mediation and second-order models (Taylor et al., 2008; Wood et al., 2008; Koufteros et al., 2009; Martinez-Lopez et al., 2013). In the present study, the significance of the theoretical relationships between the latent variables will be examined using both direct and indirect paths within the structural models. The aim of using both direct and indirect paths will be to understand the significance of total effects, as well as the segmented effects (Cheung and Lau, 2008), of variables that theoretically support the performance effects of customer integration.

3.4 Content of survey instrument

3.4.1 Format of survey instrument

Likert-type statements were used to collect all data to be used in the structural equation models. Likert scales were standardized with a range of 1 – 7 using the statements shown below in Tables 3.1A and 3.1B. The first set of statements relate to indicators of Performance, Customer Integration, Employee Absorptive Capacity, and Learning Processes. The second set of statements relate to indicators of Customer Orientation. The order of the scales is also shown (Table 3.1C), though it was not displayed to survey participants.

Responses to the answer, ‘Do Not Know”, were treated as missing data (see discussion of missing data in Analysis of Data section).

Some level of bias is likely to be present in analyses because of the type of data used in the study. Likert data is ordinal (Olsson, 1979), causing correlations to be significantly attenuated when six or less categories are used (Aguinis et al., 2009, Figure 1), though there will be a degree of bias even at fifteen categories (Aguinis et al., 2009, Table 2). Seven categories were used in the present study to minimize the bias, which Aguinis et al. (2009, p643) argue is present in almost all of the published works that have used these types of scales.

Table 3.1A Scaling used for statements relating to Performance, Customer Integration, Employee Absorptive Capacity, and Learning Processes

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree	Do not know

Table 3.1B Scaling used for statements relating to Customer Orientation

Not at all	To a very slight extent	To a small extent	To a moderate extent	To a considerable extent	To a great extent	To an extreme extent	Do not know

Table 3.1C Order for scales used to convert responses for modeling purposes

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(0)

3.4.2 Common Method Variance

A number of measures were taken to reduce the likelihood of common method variance significantly affecting the results, because this may be an issue of relevance when using single survey instruments (Podsakoff et al., 2003). The complexity of the mediated structural equation models used in this study contributes to reducing the likelihood of respondents being able to maintain mental maps of the relationships being investigated, which in turn, should reduce the likelihood of common method variance (Chang et al., 2010). However, it is still necessary to take multiple precautions because there are many factors that may introduce the bias (Podsakoff et al., 2003), even though some authors argue the issue is an urban myth (Brannick et al., 2010). One measure taken to reduce the bias was to randomize the sequence of questions within each section of the questionnaire (Chang et al., 2010). Another measure taken was to ensure the format of the survey was designed to protect the anonymity of respondents, by providing up front assurance that their information would remain anonymous, and by providing them with the option of whether to supply their personal details (Podsakoff et al, 2003, p888). A third measure taken was to ensure sections of the survey were clearly marked, and a fourth, and complementary measure, was to ensure definitions of the key areas of study were provided via the glossary (Brannick et al., 2010, pp412-413; see Appendix 5). Finally, procedures were also developed to statistically test for common method variance using one of the procedures recommended by Podsakoff et al. (2003). The selected procedure introduces an unmeasured common method variance variable to the theoretical model to examine whether doing so improves the fit of the model and whether the adjusted model explains a greater proportion of variance (Williams et al., 1989; Carlson and Perrewe, 1999; Carlson and Kacmar, 2000).

3.4.3 Operational performance

Mason-Jones et al. (2000a) formalized the use of the concepts of lean and agile to identify market winners of relevance in supply chain contexts. Their analysis demonstrated that cost was the sole market winner in lean supply chains and that service was the sole market winner in agile supply chains (Mason-Jones et al., 2000a, Figure 2). The consistent market qualifiers in their analysis were quality and lead-time (Mason-Jones et al., 2000a, Figure 2). Cost and service dropped in to the qualifier group in the instances when they were not market winners (Mason-Jones et al., 2000a, Figure 2). Their analysis suggests that a focus on operational performance at supply chain levels can reasonably be restricted to cost or service performance without significant loss of commercial relevance.

The literature review highlighted the extensive range of studies that have demonstrated the positive effects of customer integration in relation to operational performance indicators such as service, lead-time and quality, and financial performance indicators, such as cost, when measured at operating levels rather than at firm levels. Cost is known to be a major determinant of 3PL selection (Wilding and Juriado, 2004; Fabbe-Costes et al., 2009; Handley, 2012). And evidence suggests service is emerging as an important factor in the 3PL selection process (Wilding and Juriado, 2004; Wang et al., 2010), as one would also expect from the analysis of Mason-Jones et al. (2000). The current study will therefore use a performance measure that accounts for both service and cost.

The measurement items for the performance factor were adapted from Hult et al. (2006), who were also interested in the effect of knowledge capabilities on operational performance. These researchers used essentially the same statements to examine responses relating to the variables, “cost”, “speed”, “quality”, and, “flexibility”. The statements used to develop the measurement model in the current study are shown in Table 3.2 together with the original source statements. The definitions of all variables are also re-stated in Appendix 8 for easy reference by the reader. The adjustment of each statement was minimal, though reliability and validity measures were thoroughly assessed as part of the subsequent data analysis relating to each measured and latent variable (see section on reliability and validity). Adjustments were restricted to the addition of the company name for statements related to cost. Adjustments for statements related to service included substitution of the phrase, “service level”, for the word, “cost’, the addition of the company name, and the replacement of the phrase, “we think it is cost efficient”, with the phrase, “we think service levels are high”, for the third statement in that category.

Instructions relating to the statements were as follows:

"The following statements have to do with logistics outcomes. Based on current logistics practice, market-winning performance related to the order fulfillment process is assessed here as a function of service level and cost. The following statements address those issues as they relate to the order fulfillment process. Please provide a rating using the scale "Strongly Disagree" to "Strongly Agree" for the statement in each row below. If you do not believe you know the answer, please click the button in the column "Do not know". Please provide the rating you believe is most suitable for the profit centre you know best."

Table 3.2 Comparison of original statements relating to operational performance from Hult et al. (2006) and those selected for use in this study

Original statements in Hult et al. (2006, Appendix A)	**Statements used in present survey (abbreviations used in models shown in brackets)**
The cost associated with the order fulfillment process is getting better every time	(P-C1) The cost associated with the [COMPANY] order fulfillment process is getting better every time
	(P-S1) The service level of the [COMPANY] order fulfillment process is getting better every time
We have seen an improvement in the cost associated with the order fulfillment process recently	(P-C2) We have seen an improvement in the cost associated with the [COMPANY] order fulfillment process recently
	(P-S2) We have seen an improvement in the service level of the [COMPANY] order fulfillment process recently
Based on our knowledge of the order fulfillment process, we think it is cost efficient	(P-C3) Based on our knowledge of the [COMPANY] order fulfillment process, we think it is cost efficient
	(P-S3) Based on our knowledge of the [COMPANY], order fulfillment process, we think service levels are high

3.4.4 Customer integration

The review of more than forty research studies discussed in the Literature Review section of this thesis identified five key components of customer integration that have been shown to affect organizational performance: information sharing with customers; integration of information technologies with customers; extended contact with customers to understand their strategic and operational requirements; development of specialized assets, services and facilities to service customers; and, capacities to learn from previous customer engagements. The performance effects of logistics integration of 3PL service providers with their customers are less well researched. The present study was used to extend our understanding of how logistics integration with customers affects the performance of 3PL operations by adapting indicators for logistics integration developed by Chen and Paulraj (2004). These researchers developed an extensive set of indicators for key supply chain constructs based on analyses of more than 400 articles and a subsequent survey that generated 221 respondents who were members of the US Institute of Supply Management (Chena and Paulraj, 2004). The factor loadings from the indicators ranged from 0.64 to 0.83.

A comparison of the original indicators for logistics integration developed by Chen and Paulraj (2004) and the measured indicators used in this study are shown in Table 3.3. The changes to the measured indicators were minimal; consisting of the substitution of the name of the company for the word, "our"; and, the word, "customers", for the word, "suppliers". Instructions relating to the statements were as follows:

"This section presents statements about COMPANY capabilities. There are two pages of statements you will be asked to rate. Together the two pages will take about 5 minutes to complete. Please relate the statements to the COMPANY profit centre you know best."

“Please provide a rating using the scale "Strongly Disagree" to "Strongly Agree" for the statement in each row below. If you do not believe you know the answer, please click the button in the column "Do not know". Please provide the rating you believe is most suitable for the profit centre you know best.”

Table 3.3 Comparison of original statements relating to logistics integration from Chen and Paulraj (2004) and statements selected for use in this study

Original statements in Chen and Paulraj (2004, Appendix B)	**Statements used in present survey (abbreviations used in models shown in brackets)**
Interorganizational logistic activities are closely coordinated	(LI1) Inter-organizational logistics activities are closely coordinated.
Our logistics activities are well integrated with the logistics activities of our suppliers.	(LI2) [THE COMPANY’S] logistics activities are well integrated with the logistics activities of its customers.
Our logistics integration is characterized by excellent distribution, transportation and/or warehousing facilities	(LI3) [COMPANY] logistics integration is characterized by excellent distribution, transportation and/or warehousing facilities.
The inbound and outbound distribution of goods with our suppliers is well integrated	(LI4) The inbound and outbound distribution of goods with [THE COMPANY’S] customers is well integrated.
Information and materials flow smoothly between our supplier firms and us	(LI5) Information and materials flow smoothly between [THE COMPANY’S] customer firms and [THE COMPANY].

3.4.5 Employee absorptive capacity

The scales developed by Tu et al. (2006) for employee absorptive capacity were adapted to suit the present study. The indicators developed by Tu et al.specifically address the existing knowledge of managers and first line operational staff. As discussed in the literature review, existing knowledge is a critical faculty that facilitates further learning (Cohen and Levinthal, 1990; Tu et al., 2006). The rationale for using the indicators developed by Tu et al.was based on their insight that statements relating to the domain knowledge of managers and first line operational staff needed to be different. The employee absorptive capacity faculty was embedded in the model to be tested as a dynamic capability that enabled change within the customer integration capability. For this reason, employee absorptive capacity was modeled with a direct effect on logistics integration (see Zollo and Winter, 2002).

A comparison of the original indicators for employee absorptive capacity developed by Tu et al. (2006) and the measured indicators used in this study are shown in Table 3.4. The changes to the measured indicators were marginal; the name of the company was used in place of the word, "our"; and, the word, "logistics", was added as an adjective in three statements relating to managers' knowledge of technologies, operations and technical problems. Instructions relating to the statements were as follows:

"This is the second page of statements about COMPANY capabilities. Again, please relate the statements to the COMPANY profit centre you know best."

"Please provide a rating using the scale "Strongly Disagree" to "Strongly Agree" for the statement in each row below. If you do not believe you know the answer, please click the button in the column "Do not know". Please provide the rating you believe is most suitable for the profit centre you know best."

Table 3.4 Comparison of original statements relating to employee absorptive capacity developed by Tu et al. (2006) and statements selected for use in this study

Original statements in Tu et al. (2006, Table 3)	Statements used in present survey (abbreviations used in models shown in brackets)
The knowledge of our managers is adequate when making business decisions	(MK1) The knowledge of [THE COMPANY'S] managers is adequate when making business decisions.
The knowledge of our managers is adequate when dealing with new technologies	(MK2) The knowledge of [THE COMPANY'S] managers is adequate when dealing with new logistics technologies.
The knowledge of our managers is adequate when managing daily operations	(MK3) The knowledge of [THE COMPANY'S] managers is adequate when managing daily logistics operations.
The knowledge of our managers is adequate when solving technical problems	(MK4) The knowledge of [THE COMPANY'S] managers is adequate when solving technical logistics problems.
The general knowledge level of our first-line workers is high	(WK1) The general knowledge level of [THE COMPANY'S] first-line workers is high.
The overall technical knowledge of our first-line workers is high	(WK2) The overall technical knowledge of [THE COMPANY'S] first-line workers is high.
The general educational level of our first-line workers is high	(WK3) The general educational level of [THE COMPANY'S] first-line workers is high.
The overall job competence of our first-line workers is high	(WK4) The overall job competence of [THE COMPANY'S] first-line workers is high.

3.4.6 Customer orientation

Customer orientation is a core construct of market orientation (Narver and Slater, 1990; Deshpande and Farley, 1998). As discussed quite extensively in the literature review, customer orientation may be framed as a dynamic capability that enables change in the core operating capability, modeled as logistics integration with customers within the current study. The construct developed by Narver and Slater (1990) is the most extensively used construct of customer orientation (Kirca et al., 2005). Deshpande and Farley (1998) developed an alternative construct, which incorporated other elements of market orientation. The current study will use indicators developed by Narver and Slater (1990) because they reflect a single factor rather than the broader market orientation construct.

A comparison of the original indicators for customer orientation developed by Narver and Slater (1990) and the measured indicators used in this study are shown in Table 3.5. The only adjustments to the original indicators were the replacement of the words, "we" or "our", with the company name or the word, "its", and the addition of an "s" to maintain correct grammar. Instructions relating to the statements were as follows:

"This section of the survey seeks your views of the customer and competitor orientations of [THE COMPANY]. Please relate your answer to the profit centre you know best."*

"Please provide a rating using the scale "Not at all" to "To an extreme extent" for the statement in each row below. If you do not believe you know the answer, please click the button in the column "Do not know". Please provide the rating you believe is most suitable for the profit centre you know best."

Table 3.5 Comparison of original statements relating to customer orientation developed by Narver and Slater (1990) and statements selected for use in this study.

Original statements in Narver and Slater (1990, Table 1)	Statements published by Deshpande and Farley (1998, Appendix 1**) attributed to Narver and Slater (1990)	Statements used in present survey (abbreviations used in models shown in brackets)
Customer satisfaction objectives	Our business objectives are driven primarily by customer satisfaction.	(CO1) COMPANY'S business objectives are driven primarily by customer satisfaction.
Customer commitment	We constantly monitor our level of commitment and orientation to serving customers needs.	(CO2) COMPANY constantly monitors its level of commitment and orientation to serving customers needs.
Understand customer needs	Our strategy for competitive advantage is based on our understanding of customers needs.	(CO3) COMPANY'S strategy for competitive advantage is based on its understanding of customers needs.
Create customer value	Our business strategies are driven by our beliefs about how we can create greater value for our customers.	(CO4) COMPANY'S business strategies are driven by its beliefs about how it can create greater value for its customers.
Measure customer satisfaction	We measure customer satisfaction systematically and frequently.	(CO5) COMPANY measures customer satisfaction systematically and frequently.
After-sales service	We give close attention to after-sales service.	(CO6) COMPANY gives close attention to after-sales service.

Notes: * Statements relating to a Competitor Orientation construct based on Narver and Slater (1990) had missing data exceeding acceptable levels so it was deleted from the analysis and will not be discussed further (see Downey and King, 1998, or Cunningham, 2010, for discussions regarding missing data relating to Likert-type scales). **(The indicators are taken from those referenced by Deshpande and Farley (1998, Appendix 1) in their review of market orientation indicators because the original article by Narver and Slater did not report them in full.)

3.4.7 Learning processes

Learning process frameworks have generated significant interest over the past decade within the community of academics focused on strategic management theories (Crossan, Maurer and White, 2011). The learning process framework developed by Kale and Singh (2007) was used in the present study. This framework extended the work of Nonaka (1994), Grant (1996), and Zollo and Winter (2002), and linked learning processes to organizational performance. The learning process variable in their model is a second-level latent variable reflecting four first-level latent variables termed: "Articulation", "Codification", "Sharing", and "Internalization" (Kale and Singh, 2007, Figure 1). Each of the first level variables is fully identified in the model (Bollen, 2000) with a minimum of four indicators, making this section substantial in relation to the number of statements presented to participants.

Kale and Singh tested their model in the context of an alliance learning process. Alliances are similar in nature to the present research context in many broader respects (e.g., Dyer and Singh, 1998; Chen and Paulraj, 2004). However, aspects of indicators were adapted to suit the present research agenda to ensure participants retained a focus on logistics operations when thinking about learning processes. A comparison of the original indicators for customer orientation developed by Kale and Singh (2007) and the measured indicators used in this study are shown in Table 3.6. The adjustments to the original indicators were limited where possible to word changes such as replacement of the word, "alliance", with the words, "logistics operations", or the company name, depending upon the context of the statement. In a number of instances, grammar of the original statements demanded a slight change in the sentence structure; however, the core wording of each statement was always retained to the extent possible.

Instructions relating to the statements were as follows:

"This section seeks your views of learning and skills development processes within [THE COMPANY]. The section is split into two pages which together will take about five minutes to complete. Please answer for the profit centre you know best."

“Please provide a rating using the scale "Strongly Disagree" to "Strongly Agree" for the statement in each row below. If you do not believe you know the answer, please click the button in the column "Do not know". Please provide the rating you believe is most suitable for the profit centre you know best.”

Table 3.6 Comparison of original statements relating to learning processes developed by Kale and Singh (2007) and statements selected for use in this study.

Original statements in Kale and Singh (2007, Appendix 1)	**Statements used in present survey (abbreviations used in models shown in brackets)**
Managers involved with the company’s alliances are regularly debriefed about their prior and/or current alliance experience.	(LP-KA1) [THE COMPANY’S] managers involved with the company’s logistics operations are regularly debriefed about their prior and/or current logistics experience.
Managers responsible for the company’s alliances maintain a record (in the form of a memo, note, report, or presentation) of all major incidents, decisions, or actions associated with their respective alliance(s).	(LP-KA2) [THE COMPANY’S] managers responsible for the company’s logistics operations maintain a record (in the form of a memo, note, report, or presentation) of all major incidents, decisions, or actions associated with their respective logistics operations.
Alliance managers regularly report on the progress and performance of their respective alliance(s).	(LP-KA3) [THE COMPANY’S] managers regularly report on the progress and performance of their respective logistics operations.
The company maintains a ‘repository’ or database containing factual information of each of its alliances (e.g., date and purpose of alliance formation, name of the alliance partner, names of managers/executives who manage that alliance, etc.).	(LP-KA4) [THE COMPANY] maintains a ‘repository’ or database containing factual information of each of its logistics operations (e.g., contracts and agreements, performance measures, standard operating procedures, customer and supplier contacts, etc.).
The company maintains a directory or ‘contact list’ of individuals from within the company or outside who can potentially provide inputs or assistance on alliance management.	(LP-KA5) [THE COMPANY] maintains a directory or ‘contact list’ of individuals from within the company or outside who can potentially provide inputs or assistance on logistics management.
Company managers follow a well-defined ‘process’ to guide the formation or management of any alliance.	(LP-KC1) [THE COMPANY’S] managers follow a well-defined ‘process’ to guide the formation or management of

	any logistics operation.
Resources such as checklists or guidelines are developed and used to assist managerial decision making and actions while forming or managing strategic alliances.	(LP-KC2) Resources such as checklists or guidelines are developed and used to assist managerial decision making and actions while forming or managing [THE COMPANY'S] logistics operations.
Resources such as alliance manuals (containing tools, templates, or frameworks) are developed and used to assist managerial decision making and/or actions while forming or managing alliances.	(LP-KC3) Resources such as logistics operations manuals (containing tools, templates, or frameworks) are developed and used to assist managerial decision making and/or actions while forming or managing [THE COMPANY'S] logistics operations.
The company updates the alliance checklists, guidelines or manuals that have been developed and are in use.	(LP-KC4) [THE COMPANY] updates the logistics operations checklists, guidelines or manuals that have been developed and are in use.
Company management conducts a 'collective review' to assess the progress and performance of its strategic alliances.	(LP-KS1) [THE COMPANY] management conducts a 'collective review' to assess the progress and performance of its logistics operations.
Alliance managers participate in forums such as committees or task forces to take stock of their alliance management experience and practices.	(LP-KS2) [THE COMPANY'S] managers participate in forums such as committees or task forces to take stock of their logistics operations management experience and practices.
Company managers participate in forums such as meetings, seminars, or retreats to exchange alliance-related information, experiences, war stories, etc.	(LP-KS3) [THE COMPANY] managers participate in forums such as meetings, seminars, or retreats to exchange logistics-related information, experiences, war stories, etc.
Company managers engage in informal sharing and exchange of alliance-related information and know-how with peers or colleagues within the organization.	(LP-KS4) [THE COMPANY] managers engage in informal sharing and exchange of logistics-related information and know-how with peers or colleagues within the organization.
Company managers with substantial prior experience in managing alliances are usually rotated across some of the company's key alliances.	(LP-KS5) [THE COMPANY] managers with substantial prior experience in managing logistics are usually rotated across some of the company's key logistics operations.

Managerial incentives are used to encourage individual managers to share their personal alliance management experience and know-how with other managers within the company.	(LP-KS6) Managerial incentives are used to encourage individual managers to share their personal logistics management experience and know-how with other managers within [THE COMPANY].
Company managers attend 'in-house' training programs on 'alliance management' whenever they are assigned to manage or work with any alliance.	(LP-KI1) [THE COMPANY] managers attend 'in-house' training programs on 'logistics management' whenever they are assigned to manage or work with any logistics operation.
Company managers attend externally conducted training programs on 'alliance management' whenever they are assigned to manage or work with any alliance.	(LP-KI2) [THE COMPANY] managers attend externally conducted training programs on 'logistics management' whenever they are assigned to manage or work with any logistics operation.
The company provides opportunities for 'on-the-job' alliance training to individuals who are relatively new to managing alliances. Here, individuals are assigned to work in existing alliances, especially with managers who have substantial experience in managing such relationships.	(LP-KI3) [THE COMPANY] provides opportunities for 'on-the-job' logistics training to individuals who are relatively new to managing logistics operations. Here, individuals are assigned to work in existing logistics operations, especially with managers who have substantial experience in managing such operations.
The company provides managers access to documented and codified information and know-how on its prior and ongoing alliance experience.	(LP-KI4) [THE COMPANY] provides managers access to documented and codified information and know-how on its prior and ongoing logistics operations experience.

3.4.8 Background information related to respondents

Participants were introduced to the survey through a brief introductory section that also sought brief background information from them to assist with classifications, where relevant.

The introduction, which followed approval of the informed consent form (see Appendix 4), provided the following information:

"This section seeks information that will assist with classification of responses to survey questions. No answer in the survey will be published at a level that identifies individual respondents.

We are asking you to participate in this research project because we are interested in understanding your views of the logistics industry. Please note that all responses to the *survey questionnaires will be kept confidential. No individual responses to this survey will be published. Results will only be published in grouped formats.*

All of the questions in the survey refer to a profit centre. A profit centre is what we call the logistics service operation responsible for delivering services to [COMPANY] clients. The profit centre will often have a responsible manager who will report to a National Manager, a Group Manager or a Vice-President within [THE COMPANY].

In general, you should answer for the profit centre you know best. If you have a corporate or Business Unit position, answer for the one profit centre that you know best. If you are answering this survey as a client of [THE COMPANY], please answer the questions based on your knowledge of the logistics services operation that provides services to your company.

Please remember that it is important that your answers consistently apply to the same profit centre throughout the survey."

The data shown in Table 3.7 was sought from each participant.

Table 3.7 Background information sought from each survey respondent

Information request	**Response categories (where relevant)**
Indicate the one category that best describes the profit centre for which you are responding to this questionnaire.	Transport Operation
	Distribution Centre Operation
	Both Transport and Distribution Centre Operations
Please provide the following information regarding the profit centre for which you are responding	What is the name of the profit centre for which you are responding?
	What is the name of the Business Unit of which the profit centre is a part?
	Please briefly describe in your own words the major product / product group for which the profit centre provides logistics services
Please indicate whether you are an employee of [Company] or an employee of a [Company] client	I am an employee of [Company]
	I am an employee of a [Company] client. Please provide the name of your company
Please name your present position and indicate the number of years you have been in your present position	Name of present position
	Number of years in present position
Please indicate the number of years you have been employed by your company	

3.5 Procedures for analyzing data

3.5.1 Missing data

Missing data was addressed using the procedure recommended by Schafer and Graham (2002). Missing values were imputed (Allison, 2003; Enders and Bandalos, 2001; Schafer and Graham, 2002) using the regression imputation algorithm for pre-defined Confirmatory Factor Analysis variables in the statistical program Amos 18. This algorithm uses the available data for survey statements generated by those survey respondents who provided responses to impute data for missing cases. It is a full information maximum likelihood (FIML) method that produces superior results to case deletion methods, which are more commonly used to manage missing data (Enders and Bandalos, 2001; Shah and Goldstein, 2006).

Guidelines in regard to the indicators that could be used were taken from Downey and King (1998), who examined bias related to missing data using Likert-type scales. Their analyses suggested that missing data for up to 20 per cent of items for up to 35 per cent of respondents was unlikely to affect correlations. In the present study, no measured indicator had more than seven per cent of cases missing, and the percentage of respondents with more than 20 per cent of missing data was also less than seven per cent. When the "Do Not Know" responses were removed and also treated as missing data, these percentages shifted to 29 per cent and 25 per cent. While on the surface these levels provide for some level of discomfort, Table 2 and the associated comments on p189 of Downey and King (1998), suggest that this level of missing data is unlikely to cause material bias. For these reasons, the "do not know" responses were treated as missing data in the measurement and structural models, rather than deleting the relevant cases or seeking to interpret their meaning separately. This approach is consistent with the underlying philosophical reasoning supporting the use of FIML missing data methodologies (see Schafer and Graham, 2002, for a discussion related to this topic).

3.5.2 Analysis of normality and outliers

Selection of appropriate statistics for analysis of normality reflected the fact that structural equation modeling is based on the use of normal data, though a range of deviations from normality create relatively benign levels of bias (Lei and Lomax, 2005; Gao et al., 2008). Non-normality can be expected to increase the Chi-square statistic (Curran et al, 1996). The choice of statistics for analysis of normality is disputed in the statistics literature (e.g., Bollen, 1987; Finch et al., 1997; Hopkins and Weeks, 1990; Shapiro et al., 1968); a fact also true for the choice of critical values for selection of outliers (De Maesschalck et al. 2000; Gao et al., 2008; Penny, 1996; Yuan and Hayashi, 2010; Yuan and Zhong, 2008). The recommendations of DeCarlo (1997), Lei and Lomax (2005), and Gao et al. (2008), and the insights of Yuan and colleagues in relation to outliers (Yuan and Hayashi, 2010; Yuan and Zhong, 2008) were therefore selected to assess normality and outliers, and used in a progressive manner (De Maesschalck et al. 2000), with the ultimate objective of identifying the data sets with the least number of cases removed.

The analyses focused initially on examination of normality and detection of outliers for each measured indicator, and subsequently on multivariate normality. Univariate normality was examined manually via the statistical program SPSS 18 using histograms and Q-Q plots (Johnson and Wichern, 2002), and numerically using scores for skewness and kurtosis. Multivariate normality was examined in the statistical program Amos 18 using the critical ratio for kurtosis (Mardia, 1970; Bollen and Stine, 1992). Each multivariate data set was examined in Amos 18 for outliers with cases removed based on the significance of values of Mahalanobis d-squared (De Maesschalck et al., 2000).

Criteria used to assess univariate normality followed DeCarlo (1997), who suggested the use of a univariate kurtosis score of -1.2 as the dividing line for bi-modality, and Lei and Lomax (2005), who demonstrated that univariate kurtosis values up to 3.8 and univariate skew values up to 1.76 have less than 10% effect on the bias of the parameter estimates in SEM. Gao et al. (2008) argued for a relaxation of the critical ratio for multivariate normality on practical grounds; they demonstrated the alternative to be a significant reduction in power with minimal improvements in statistical performance (Gao et al., 2008, p13). They were able to demonstrate acceptable control of bias and standard errors of parameter estimates in their results with critical ratios approaching 30 when univariate skew values were less than 2 and kurtosis was less than 8 (Gao et al., 2008, p13). For these reasons, critical values in ranges close to those used by Gao et al.for multivariate normality were accepted as long as the univariate scores approached the range shown to be acceptable by Lei and Lomax (2005). In those instances where critical values for multivariate kurtosis were in the ranges accepted by Gao et al, the assessment of model fit relied on the use of the Bollen-Stine bootstrap procedure (see Cunningham, 2010, p5-23), which was developed to enable hypotheses to be tested using non-normal data or moderate sample sizes (Bollen and Stine, 1992, p227).

3.5.3 Reliability and validity

Multiple tests of reliability and validity were performed on the data sets. Initially, data for Confirmatory Factor Analysis (CFA) measurement models were examined in Amos 18 to ensure uni-dimensionality, via the use of sample correlation Eigenvalues with one item exceeding 1. The corresponding variables were also analyzed in SPSS 18 for Cronbach's alpha with a threshold of .7 being used (Hinkins, 1995; MacKenzie et al., 2005). Correlations among measured indicators for each factor were examined using Amos 18 to ensure there was no item redundancy using $r < 0.8$ (Cunningham, 2010), but that they were of sufficient magnitude that they were at the higher end of the scale (Bollen and Lennox, 1991). A similar test was also used to assess factor redundancies in multi-level, multi-factor, CFA models where inter-factor correlations were in excess of 0.9 (Kline, 2011). Psychometric properties were deemed acceptable if standardized regression weights for measured variables approached 0.7 (Kline, 2011) or higher. Tests of construct reliability, variance extraction and discriminant validity for the latent variables were based on the recommendations of Fornell and Larcker (1981) using the process presented by Cunningham (2010). Cunningham's (2010, p6-4) process for analyzing pattern and structure coefficients of latent variables was also applied to establish discriminant validity of latent variables.

3.5.4 Procedures for structural equation modeling

There are multiple strategies that can be used to model theories of interest using structural equation modeling. Bollen (2000) reviewed these strategies in depth. In essence, structural equation modeling is attractive because it enables measurement models, comprising measured indicators linked to latent variables that represent the constructs of theoretical interest, and their theoretical relationships represented by estimated paths, to be modeled "… *simultaneously* … in one step …" (Bollen, 2000, p74). The relevant literature has an extended debate relating to whether the ability to perform the modeling in one step means that it is reasonable to do so. There is substantial support for the idea of independently testing the individual measurement model prior to testing the overall structural model, to ensure the latent variables in the structural model are valid and reliable measures of the constructs of theoretical interest (Anderson and Gerbing, 1988; Bollen, 2000; Mulaik and Millsap, 2000; Kline, 2011). "…That is, good measurement of the latent variables is prerequisite to the analysis of the causal relations among the latent variables …" (Anderson and Gerbing, 1982, p453). This is the approach used in the present study.

3.5.4.1 Anderson and Gerbing's (1988) two-step process

The approach used in the present study followed Anderson and Gerbing (1988), who proposed a two-step modeling process, in which the measurement model is first assessed for fit, validity and reliability using a CFA approach, and the structural model is then assessed using a series of nested models. The nested models compare the theoretical model with four alternative models: a fully saturated model in which all possible paths are measured, a null model in which no paths are measured, a model where the constraints on one or more paths of the theoretical model are removed enabling the paths to be measured, and a model where one or more paths of the theoretical model are constrained (Anderson and Gerbing, 1988, p418). Models are compared using a sequential Chi-square difference test to identify the most parsimonious model with acceptable fit (Anderson and Gerbing, 1988, p419).

There are multiple benefits associated with the use of a two-step process compared with the one-step model. Firstly, if any misspecification of the measurement model were present, it would be difficult to identify where that misspecification would be located in a full structural model. This is so since it would not be clear whether misspecification was caused by the failure to use latent variables that were unidimensional, or whether the purported relationships between the latent variables were incorrectly specified

(Anderson and Gerbing, 1988, p418). Testing a full confirmatory measurement model ahead of testing the structural model removes the focus from the hypothesized relationships to enable researchers to understand whether fit will be possible at all, since the saturated confirmatory model will always have the best fit among the tested models (Anderson and Gerbing, 1988, p418). Secondly, the comparison of the theoretical model with the fully saturated model provides an independent test of nomological (see Cronbach and Meehl, 1955, p290) validity (Anderson and Gerbing, 1988, p419). Thirdly, the examination of shifts in degrees of freedom from the saturated model to the theoretical model provides a measure of

> *"… inferential strength. That is, the ability to make any causal inferences about construct relations from correlational data depends directly on the available degrees of freedom. Thus, for example, a researcher who specifies a substantive model in which each construct is related by direct causal paths to all others would realize from this test the inability to make any causal inferences. This is because no degrees of freedom would exist for the SCDT [sequential Chi-square difference test]; the theoretical "causal" model is indistinguishable from a confirmatory measurement model, and any causal interpretation should be carefully avoided. To the extent, however, that a "considerable" proportion of possible direct causal paths are specified as zero and there is acceptable fit, one can advance qualified causal interpretations..." (Anderson and Gerbing, 1988, p419; italics and explanatory term for SCDT in brackets added).*

Finally, their approach encourages tests of alternative theories within the same study (Anderson and Gerbing, 1988, p419). This is another positive attribute (James, 2008) when the selection of paths that will be constrained, or added for measurement, in the models chosen as alternatives to the theoretical model, are based on sound theoretical grounds (Kline, 2011). Another alternative model will also be tested to extend this perspective. Ali et al. (2010, Figure 1) proposed that the effects of market orientation on firm performance were mediated by learning processes. That is, in their model market orientation had a direct effect on learning processes, which, in turn, had indirect effects on dynamic capabilities, substantive capabilities, and firm performance. Their perspective contradicts causal chains tested in the hypothesized theoretical model presented in this thesis, as well as its derivative unconstrained and constrained models, since the relationship between customer orientation, a construct within the market orientation model proposed by Narver and Slater (1990), and learning processes is reversed by Ali et al's proposal. Moreover, the proposal by Ali et al.explicitly fails to recognize customer orientation as a dynamic capability since they theorize that market orientation indirectly influences such capabilities. A variant of their model, in which customer orientation is specified as exogenous with a direct effect on learning processes will be tested as an alternative model. In total, three alternatives to the core hypothesized theoretical model will be tested.

3.5.4.2 Cheung and Lau's (2008) process for mediation analysis

Analyses of mediation effects of latent variables relied on the procedure developed for use in AMOS by Cheung and Lau (2008). This procedure utilizes bootstrapping to provide bias-corrected confidence intervals. The procedure shown in Figure 2 and described on p319 of Cheung and Lau (2008) was followed, though 2000 bootstrap samples were used to ensure stability of the confidence intervals (see discussion in Cheung and Lau, 2008, p321). This procedure is relatively easy to implement since it simply relies on ticking the relevant boxes in AMOS, specifying the bootstrap sample size and the confidence interval, and then re-running the structural equation model. The procedure allows for tests of both direct and indirect effects. AMOS provides output tables presenting direct, indirect and total effects; including confidence intervals for all parameters. The study will test for both types of effects for theoretical reasons relating to causal effects within multi-factor models (Sobel, 1987); and, specifically, because the learning mechanisms within the theoretical models of interest are likely to reflect both direct and indirect effects (Zollo and Winter, 2002; Vera et al., 2011).

3.5.4.3 Assessment of model fit

Model fit in structural equation modeling represents the degree to which the discrepancy between the implied variance-covariance matrix of the specified model and the variance-covariance matrix of the data approaches zero (Joreskog, 1971; Bentler and Bonnet, 1980). The goodness of fit is measured by the chi-square statistic (Joreskog, 1971; Bollen and Stine, 1992). Note that the test for model fit is a search for lack of significant differences between the variance-covariance matrix implied by the model and the matrix generated by the data (Bentler and Bonnet, 1980; Shah and Goldstein, 2006).

Model fit statistics that measure relative fit between different nested models have also been developed (e.g., Bentler and Bonnet, 1980). Generally, these measure differences between a null model or an ideal model and the hypothesized model (Shah and Goldstein, 2006, p159). Unfortunately, there is little agreement in the literature in relation to which is the most appropriate of these to use (Shah and Goldstein, 2006; Klein, 2011). Reviewers of this statistics literature therefore recommend using multiple indices so that readers can make their own evaluations (Shah and Goldstein, 2006, p160).

In the present study, data were accepted as fitting specified models using the following measures, which were based on the recommendations of Shah and Goldstein (2006), Cunningham (2010) and Kline (2011):

a. Chi-square scores were not significant at $p=.05$, or the Bollen-Stine bootstrap $p > .05$ for multivariate non-normal data
b. chi-square/degrees of freedom <2,
c. the root mean square error of approximation (RMSEA) <.05 with the lower and upper bounds of the 90% confidence interval below .05 and .1 respectively, with a p value that exceeds .05 (Pclose)
d. the comparative fit index (CFI) >.95,
e. the Tucker-Lewis coefficient (TLI) > .95,
f. the standardized root mean square residual (SRMS) <.05, and
g. there were no standardized residual covariances above 2.

3.6 Ethics Approval

The research project was subject to approval by the Macquarie University Ethics Review Committee (Human Research). This approval was received on 10 August 2009.

3.7 Summary of Chapter

Chapter 3 provides a detailed view of the research methodology. The chapter presents significant detail to help the reader understand the population of interest, the selection of the sample and the approach taken to address issues such as late response and non-response bias. An extensive discussion of the rationale for selection of the sample is provided followed by discussion of the selection and content of all measured variables. Procedures for analyzing the data are also presented in the chapter.

CHAPTER 4: RESULTS

4.1 Overview of Chapter 4

Chapter 4 presents the results the research project. The chapter opens with a brief description of data preparation techniques. Descriptive statistics, extensive descriptions of results associated with confirmatory factor analysis and structural equation modeling, are presented in separate sections of the chapter. The results relating to each hypothesis are presented within the section addressing structural equation modeling. A summary of results relating to each hypothesis is presented at the end of the chapter.

4.2 Data preparation

4.2.1 Data cleaning

The survey data were collected using a web site and then exported to an Excel spreadsheet for analysis. The original Excel report had several columns of information related to the management of the data collection procedure that were unrelated to the formal survey and the present study. These were removed as part of an initial administration procedure.

Each column heading in the Excel spreadsheet containing the raw data was examined to ensure the original survey labels were present. Once this was confirmed, the data were reviewed manually for consistency to ensure the export procedure from the web site had transferred data correctly. The search for missing data was subsequently initiated.

4.2.2 Missing data

Missing data were analyzed and cases were retained based on the principles set out by Schafer and Graham (2002) and tested using the guidelines presented by Downey and King (1998), as reported in the Methodology section. In essence, cases were retained to the extent it was possible to do so within the guidelines presented by these researchers. There were 26 respondents who accepted the informed consent, three of which also added a profit center code, but then elected to go no further with the survey. There were 11 respondents who accepted the informed consent and provided background information about themselves but then decided not to answer any more questions. Simple t-tests for independent samples for number of years in their role (mean = 2.96 vs 3.25, $t = -.371$, two-tailed $p > 0.05$) and years with their present employer (mean = 8.19 vs 9.25, $t = -.496$, two-tailed $p > 0.05$) were not significantly different for this group and the remaining respondents. The relative mix of respondents in each of the role groups was also not different. Chi-square and Fisher's Exact Test were used to examine whether there were differences in proportions of the focal company's employees within the two groups (Cooper and Schindler, 2003, Exhibit 17-7). These tests were also non-significant ($\chi^2 = 2.061$, df=1, two-sided $p > 0.05$; two-sided Exact significance = .233). Accordingly all 37 cases were removed from the data set. The data set was also reviewed for overlaps in responses among groups of respondents. Where respondents answered on behalf of the same general contract as another respondent, examination of areas of responsibilities suggested the respondents were accountable for different profit centers related to the contracts. Accordingly, no cases were deleted in relation to responsibility overlaps. The principal researcher had checked access to the survey and identified himself in the answers for two rows. These response rows were removed from the data set. A total of 230 respondents' answers remained available for further analysis after these procedures were completed.

A visual inspection of the data suggested that missing data in the form of no data point available demonstrated both monotone and arbitrary patterns (Schafer and Graham, 2002). There were 197 respondents who responded to all statements, though some of these respondents used the response category, “Do Not Know”, as an answer to one or more statements. This response category was deemed to represent missing data (see Schafer and Graham, 2002, p151). The score of 0, which represented the answer ‘Do Not Know”, was removed from each respondent’s data set for each question against which it presented. This meant that all remaining responses had numerical answers above zero, corresponding to the relevant scores on the scales employed.

As reported in the Methodology section, no measured indicator had more than seven per cent of cases missing. The percentage of respondents with more than 20 per cent of missing data was also less than seven per cent. These results are well within the ranges identified as acceptable by Downey and King (1998). When the “Do Not Know” responses were removed and also treated as missing data, these percentages shifted to 29 per cent and 25 per cent, respectively. Again, as reported earlier, Table 2 and the associated comments on p189 of Downey and King (1998), suggest that these levels of missing data are unlikely to introduce significant levels of bias.

4.3 Descriptive statistics

4.3.1 Response rate

A total of 267 respondents provided informed consent to participate in the study. As previously highlighted, 37 of the responses were unusable because respondents elected to opt out of the survey prior to answering survey questions. Table 4.1 provides data relating to the usable responses.

There were a total of 230 usable responses, representing an overall effective response rate of 50.2%. Due to the fact that prospective participants were sought from both within the 3PL and from its clients, the response rates relating to each group were also examined. There were 187 responses from 3PL staff members, representing an effective response rate of 51.9%, and 43 responses from staff members of the 3PL's clients, representing an effective response rate of 43.9% for this group. A chi-square test for differences in response rates between the 3PL staff members and the staff members of the 3PL clients returned a $\chi^2 = 2.01$ indicating there was no significant difference ($p > 0.10$) in response rates between the two groups. The overall response rate and the response rates from each of the participating groups were quite high compared with expected response rates from web based surveys (Sauermann and Roach, 2013). The response rates also compare favorably with surveys examining customer integration (e.g., Stank et al., 2001; Droge et al., 2004; Flynn et al., 2010; Huo, 2012), and knowledge based topics within 3PL (e.g., Panayides, 2007) and supply chain environments (e.g., Hult et al., 2006; Hult et al., 2007).

Table 4.1 Response rate statistics for the survey

Organizational membership of participants	**Survey links issued**	**Usable responses**	**Effective response rate (%)**
3PL	360	187	51.9
3PL client	98	43	43.9
Total	458	230	50.2

4.3.2 Characteristics of respondents

Respondents were recruited from a broad range of roles. Position names included Vice President, Contract Manager, Distribution Centre Manager, National Operations Manager, Supply Chain Director, Operations Supervisor, Logistics Manager, and Shift Supervisor. The respondents had spent an average of 2.96 years in their present positions and an average of 8.19 years in their present companies.

Roles were divided into three groups to obtain a deeper understanding of the mix of respondents. A total of 31.7% of respondents held national level multi-site management roles. The average number of years spent in their present positions was 3.02, with a maximum of 13 years. 51.7% of respondents held site-level management roles. These staff members had spent an average of 2.93 years in their roles with a maximum of 12 years. And 16.5% of respondents held supervisory roles at specific operational sites. These respondents had spent an average of 3.14 years in their current roles with a maximum of 11 years. These percentage splits reflect a reasonable balance of respondents with high-level views compared with those respondents who have detailed views of day-to-day operations. Respondents also appear to have sufficient experience in their roles to be able to answer questions related to their work with a level of authority.

The relative split of focus on different elements of logistics environments by respondents was also examined. 44.3% of respondents were focused on operations related to transport. 21.7% of respondents were focused on operations related to warehousing and distribution centers. And 33.9% of respondents worked within environments that supported both warehousing and transport operations. These percentages suggest respondents reflected a balance of operations experience across key areas of 3PL services.

Respondents represented are range of different industry sectors. 21.1% of respondents worked in food retail environments. 38.2% of respondents worked for fast-moving consumer goods manufacturers. 22.4% of respondents were employed in non-food manufacturing industries. 6.6% of respondents worked in non-food retail environments. And 11.8% of respondents worked in environments supplying petroleum products or bulk supplies to resources companies. These splits suggest the respondents represented a broad range of environments within the Australian economy.

4.3.3 Means, standard deviations and standard errors of measured variables

The means, standard deviations and standard errors of means of measured variables are shown in Tables 4.2 – 4.10.

Descriptive measures for Logistics Integration, shown in Table 4.2, suggest a small degree of variability across the measured variables. The means of these variables range from 5.15 to 5.90. The standard deviations for the variables range from 1.073 to 1.471, providing standard errors in the range .071 to .097. The means of the variables do not seem to be clustered at one end of the range or the other.

Table 4.2 Means, standard deviations and standard errors of means of measured variables of Logistics Integration

Statistic	LI1	LI2	LI3	LI4	LI5
Mean	5.15	5.68	5.90	5.37	5.40
Standard deviation	1.410	1.309	1.073	1.471	1.343
Standard error	.093	.086	.071	.097	.089

The means of the measured variables of Absorptive Capacities of managers, displayed in Table 4.3, also display a small range of variation. The scores range from 5.22 to 6.06. Standard deviations range from 0.992 to 1.290, providing standard errors from .065 to .085. Again, there are no clear clusters of means scores at one end of the range or the other.

Table 4.3 Means, standard deviations and standard errors of means of measured variables of Absorptive Capacities of managers

Statistic	MK1	MK2	MK3	MK4
Mean	5.65	5.22	6.06	5.55
Standard deviation	1.176	1.290	0.992	1.213
Standard error	.078	.085	.065	.080

Table 4.4 displays the means of the measured variables of Absorptive Capacities of first line workers. These means display a similar range of variability as that of the managers, but scores at the extremities are lower. The means range from 4.96 to 5.74. Standard deviations range from 1.003 to 1.196, with standard errors ranging from .066 to .079.

Table 4.4 Means, standard deviations and standard errors of means of measured variables of Absorptive Capacities of first line workers

Statistic	WK1	WK2	WK3	WK4
Mean	5.57	5.18	4.96	5.74
Standard deviation	1.041	1.196	1.196	1.003
Standard error	.069	.079	.079	.066

The means of measured variables of Learning Processes associated with Knowledge Articulation, shown in Table 4.5, display a range that exceeds one full point, with a low of 4.80 and a high of 6.20. Differences in standard deviations and standard errors are also higher with lows of .811 and .054, and highs of 1.336 and .088, respectively.

Table 4.5 Means, standard deviations and standard errors of means of measured variables of Learning Processes associated with Knowledge Articulation

Statistic	LP-KA1	LP-KA2	LP-KA3	LP-KA4	LP-KA5
Mean	4.80	5.97	6.20	5.37	5.17
Standard deviation	1.261	1.071	.811	1.315	1.336
Standard error	.083	.071	.054	.087	.088

Table 4.6 shows the means of measured variables of Learning Processes associated with Knowledge Codification. These scores display greater clustering, with a small range from 5.19 to 5.45. The differences in standard deviations are also smaller, with a range from 1.128 to 1.310, and standard errors from .074 to .086.

Table 4.6 Means, standard deviations and standard errors of means of measured variables of Learning Processes associated with Knowledge Codification

Statistic	LP-KC1	LP-KC2	LP-KC3	LP-KC4
Mean	5.26	5.34	5.19	5.45
Standard deviation	1.247	1.128	1.310	1.245
Standard error	.082	.074	.086	.082

The means of measured variables of Learning processes associated with Knowledge Sharing, displayed in Table 4.7, again show a relatively large range exceeding a single point, with a low of 4.30 and a high of 5.40. Variables LP-KS5 and LP-KS6 seem to be located at the lower end and the other variables at the upper end. There does not seem to be the same visually discernable difference between these groups of variables with respect to standard deviations, which range from 1.115 to 1.431, though scores for the cluster of two variables are located at the higher end of the range. The range of standard errors is .074 to .094.

Table 4.7 Means, standard deviations and standard errors of means of measured variables of Learning Processes associated with Knowledge Sharing

Statistic	LP-KS1	LP-KS2	LP-KS3	LP-KS4	LP-KS5	LP-KS6
Mean	5.40	5.20	5.20	5.33	4.55	4.30
Standard deviation	1.158	1.232	1.325	1.115	1.431	1.313
Standard error	.076	.081	.087	.074	.094	.087

The means of measured variables of Learning Processes associated with Knowledge Internalization, shown in Table 4.8, are more tightly clustered than previous variables, in a range from 4.80 to 5.40. Standard deviations range from 1.164 to 1.400, with standard errors in the range .077 to .092.

Table 4.8 Means, standard deviations and standard errors of means of measured variables of Learning Processes associated with Knowledge Internalization

Statistic	LP-KI1	LP-KI2	LP-KI3	LP-KI4
Mean	5.30	5.12	5.40	4.80
Standard deviation	1.278	1.400	1.169	1.164
Standard error	.084	.092	.077	.077

Table 4.9 displays the means of the measured variables of Customer Orientation. The means range from 4.85 to 5.28. The standard deviations for these variables range from 1.063 to 1.280, with standard errors ranging from .070 to .084.

Table 4.9 Means, standard deviations and standard errors of means of measured variables of Customer Orientation

Statistic	CO1	CO2	CO3	CO4	CO5	CO6
Mean	4.98	5.08	5.28	5.23	4.85	4.95
Standard deviation	1.144	1.136	1.063	1.068	1.280	1.166
Standard error	.075	.075	.070	.070	.084	.077

Means of measured variables of Service Performance, shown in Table 4.10, range from 5.03 to 5.53 and those of Cost Performance, also shown in Table 4.10, are somewhat lower at 4.73 to 4.94. The standard deviations for Service Performance range from 1.110 to 1.188, with standard errors from .073 to .078. The standard deviations of Cost Performance range from 1.151 to 1.188, with standard errors from .076 to .078.

Table 4.10 Means, standard deviations and standard errors of means of measured variables of Service and Cost Performance

Statistic	P-S1	P-S2	P-S3	P-C1	P-C2	P-C3
Mean	5.09	5.03	5.53	4.74	4.73	4.94
Standard deviation	1.110	1.174	1.188	1.167	1.188	1.151
Standard error	.073	.077	.078	.077	.078	.076

4.3.4 Late response and non-response bias

Two measured variables were identified to have significant differences among means for early and late respondents. The two variables are shown in Table 4.11. These two variables were removed from further analysis.

Table 4.11 Mean differences between self-responding and prompted respondents for measured variables where differences were significant

Measured Variable	Mean difference	Standard error difference	t	Two-tailed significance
WK1	.344	.151	2.273	.024
WK4	.430	.156	2.749	.007

4.3.5 Skewness, kurtosis and outliers of measured variables

Scores for skewness and kurtosis for the measured variables are shown in Tables 4.12 to 4.20). The criteria for acceptable kurtosis scores were based on those identified by DeCarlo (1997), who suggested the use of -1.2 as the dividing line for bi-modality, and

Lei and Lomax (2005), who demonstrated that univariate kurtosis values up to 3.8 had less than 10% bias on the parameter values of structural equation models. The threshold for acceptable skewness values was based on Lei and Lomax (2005), who showed that univariate values up to 1.76 had less than 10% bias on parameters of structural equation models.

Scores in Table 4.12 demonstrate that the measured variables of Logistics Integration have acceptable levels of skewness and kurtosis. The peak kurtosis score is 3.124, well below the 3.8 cut-off point. There were no negative kurtosis scores. All skewness values are negative and none exceed the score of 1.76.

The histograms and normal Q-Q plots for the variables are shown in Appendix 7. The normal Q-Q plot for measured variable LI3 supports the perception gained from the kurtosis and skewness scores that some cases may be outliers in relation to this variable. The plots for the other Logistics Integration variables display characteristics one would expect to see, given the higher negative skewness scores.

Table 4.12 Skewness and kurtosis of measured variables of Logistics Integration

Statistic	**LI1**	**LI2**	**LI3**	**LI4**	**LI5**
Skewness	-1.030	-1.238	-1.439	-1.273	-1.254
Kurtosis	.484	1.318	3.124	1.038	1.220

Skewness scores and kurtosis scores for the measured variables of Absorptive Capacities of managers are shown in Table 4.13. The values for variable MK3 exceed both the skewness and the kurtosis criteria. All other scores fall below the cut-off points. There were no negative kurtosis scores. The high scores for variable MK3 require further analysis for examination of outliers.

The histograms and normal Q-Q plots shown in Appendix 7 for the MK variables support the statistics in Table 4.13. The histograms and normal Q-Q plots for MK3 are particularly extreme, reinforcing the suggestion that some cases are acting as outliers for this variable. The plots also support the view that outliers may affect the variable MK1.

Table 4.13 Skewness and kurtosis of measured variables of Absorptive Capacities of managers

Statistic	MK1	MK2	MK3	MK4
Skewness	-1.612	-.991	-2.021	-1.382
Kurtosis	3.439	.798	6.726	2.051

Table 4.14 displays the skewness and kurtosis of the remaining measured variables of Absorptive Capacities of first line workers. All scores for the measured variables are within the acceptable limits. The histograms and normal Q-Q plots for these variables, shown in Appendix 7, are also acceptable.

Table 4.14 Skewness and kurtosis of measured variables of Absorptive Capacities of first line workers

Statistic	WK2	WK3
Skewness	-1.028	-.580
Kurtosis	1.017	.240

Skewness and kurtosis scores of measured variables of Learning Processes associated with Knowledge Articulation are shown in Table 4.15. The values for variables LP-KA2 and LP-KA3 exceed acceptable criteria for both skewness and kurtosis. The skewness scores for these variables are both slightly above the acceptable threshold. The kurtosis scores for the two variables are substantially above the acceptable level. The histograms and normal Q-Q plots shown in Appendix 7 also demonstrate large deviations from normal; this is especially true for LP-KA3. Further examination of the data is required to identify the likely outliers that are causing these scores. Values for the other three variables are within the acceptable ranges, and their histograms and normal Q-Q plots are also benign.

Table 4.15 Skewness and kurtosis of measured variables of Learning Processes associated with Knowledge Articulation

Statistic	LP-KA1	LP-KA2	LP-KA3	LP-KA4	LP-KA5
Skewness	-.350	-1.831	-1.816	-1.031	-.987
Kurtosis	-.473	4.583	7.625	.830	.593

Table 4.16 displays skewness and kurtosis values of measured variables of Learning Processes associated with Knowledge Codification. All scores are within acceptable ranges. The graphics displaying histograms and normal Q-Q plots in Appendix 7 also support the conclusion that they appear unaffected by outliers.

Table 4.16 Skewness and kurtosis of measured variables of Learning Processes associated with Knowledge Codification

Statistic	LP-KC1	LP-KC2	LP-KC3	LP-KC4
Skewness	-.852	-.882	-.786	-1.020
Kurtosis	.105	.743	.002	.895

Scores for skewness and kurtosis of measured variables of Learning Processes associated with Knowledge Sharing, shown in Table 4.17, are also within acceptable ranges. Variables LP-KS5 and LP-KS6 have a negative kurtosis scores, but they are not at levels that approach or exceed the acceptable threshold of -1.2. The histograms and normal Q-Q plots shown in Appendix 7 display normal characteristics for all variables in this group, though the Q-Q plot for LP-KS4 shown some deviation from the straight line, most likely reflective of the large negative skewness.

Table 4.17 Skewness and kurtosis of measured variables of Learning Processes associated with Knowledge Sharing

Statistic	LP-KS1	LP-KS2	LP-KS3	LP-KS4	LP-KS5	LP-KS6
Skewness	-.918	-.764	-1.080	-.958	-.458	-.251
Kurtosis	.515	.198	.810	1.286	-.323	-.409

Table 4.18 displays values for skewness and kurtosis of measured variables of Learning Processes associated with Knowledge Internalization. All scores are within acceptable ranges. The histograms and normal Q-Q plots shown in Appendix 7 also showing acceptable shapes.

Table 4.18 Skewness and kurtosis of measured variables of Learning Processes associated with Knowledge Internalization

Statistic	LP-KI1	LP-KI2	LP-KI3	LP-KI4
Skewness	-.831	-.865	-1.087	-.668
Kurtosis	.007	.257	.993	.244

Skewness and kurtosis scores of measured variables of Customer Orientation, shown in Table 4.19, are also well below acceptable thresholds. The Q-Q plots and histograms for the majority of these variables are also acceptable, as is shown in Appendix 7. The only variable of some concern is CO4, which displays some deviation from the straight line. Its histogram suggests that a single case may be an outlier.

Table 4.19 Skewness and kurtosis of measured variables of Customer Orientation

Statistic	CO1	CO2	CO3	CO4	CO5	CO6
Skewness	-.459	-.686	-.673	-.633	-.565	-.665
Kurtosis	.286	.290	.246	.722	-.044	.318

Skewness and kurtosis values of measured variables of Service Performance and Cost Performance are displayed in Table 4.20. The peak skewness scores of -1.242 for Service Performance and of -.835 for Cost Performance are well below the acceptable threshold. The peak kurtosis scores of 1.656 for Service Performance and

.876 for Cost Performance are also within acceptable ranges. The histograms and normal Q-Q plots shown in Appendix 7 suggest that variables P-S1, P-S2, and P-S3 may each be affected by outlying cases. However, the deviation in these plots is not extreme when compared with the plots for MK3 or LP-KA3.

Table 4.20 Skewness and kurtosis of measured variables of Service and Cost Performance

Statistic	P-S1	P-S2	P-S3	P-C1	P-C2	P-C3
Skewness	-.811	-.835	-1.242	-.685	-.772	-.835
Kurtosis	1.383	.942	1.656	.666	.876	.641

4.3.6 Univariate outliers and case deletion

Yuan and Zhong (2008) and Yuan and Hayashi (2010) argued that there are outliers with either positive leverage or negative leverage. The positive leverage outliers are likely to be members of the same common factor as the majority of responses whereas the outliers with negative leverage are most likely caused by other factors. Thus it is reasonable to retain the positive leverage outliers and to remove the negative leverage outliers.

De Maesschalck et al. (2000) argued for the importance of retaining cases where possible and to progressively test for the effects of removing potential outlying cases. This is the approach adopted in the present investigation. Descriptive statistics for each of the variables identified in the previous section as having larger than acceptable skewness or kurtosis scores, or as having non-normal looking histograms or non-normal Q-Q plots, were re-examined as outlying cases were progressively removed, either individually or as groups where clusters of cases were evident, to understand the effects of their removal. Table 4.21 displays the number of cases that were removed and the cases retained at this stage of the analysis.

Table 4.21 The number of cases removed following examination of univariate normality

Cases removed due to lack of univariate normality	14
Cases remaining following outlier analysis	216

4.4 Confirmatory Factor Analysis

Confirmatory factor analysis of the measurement model is the initial step in the Anderson and Gerbing's (1988) two-step structural equation modeling process. A key objective of this initial step is to confirm that the relationship between the relevant measured variables and the related latent variable is unidimensional (Anderson and Gerbing, 1988, pp414-415). This means that each measured variable only loads on a single latent variable (Anderson and Gerbing, 1988, pp414-415). The tests for single traits are known as congeneric tests (Joreskog, 1971, p109). The approach used in this study focused initially on congeneric tests of each individual construct where that was possible, and then on tests of the overall measurement model, where relationships among all latent variables were able to be freely estimated.

4.4.1 Congeneric tests of the model of operational performance

Operational performance was initially specified as a second-level latent variable. This variable had three measured variables to assess the first level latent variable, cost performance, and three indicators to assess the first-level latent variable, service performance. The fact that each first-level latent variable only had three measured variables meant that the fit of each of these models can not be assessed using factor analysis tests because each model is just-identified (Kline, 2011, p138). However, the fit of the model with the second-level latent variable is possible to assess by fixing the parameters from it to the first-level latent variables to equality, making it equivalent to a confirmatory factor analysis model (Kline, 2011, pp246-247). The initial operational performance model was over-identified with eight degrees of freedom. The model is shown in Figure 4.1.

The model was specified in the statistical program Amos 18. The discrepancy between the unbiased covariances of the data set and the implied covariances of the specified model was analyzed using the maximum likelihood estimation method. The Bollen-Stine bootstrap p, employing 2000 bootstrap samples, was also used to measure fit for non-normal multivariate data (Bollen and Stine, 1992). The fit of the model was very good. The relevant statistics are shown in Table 4.22.

Figure 4.1 The initial confirmatory factor analysis model of operational performance

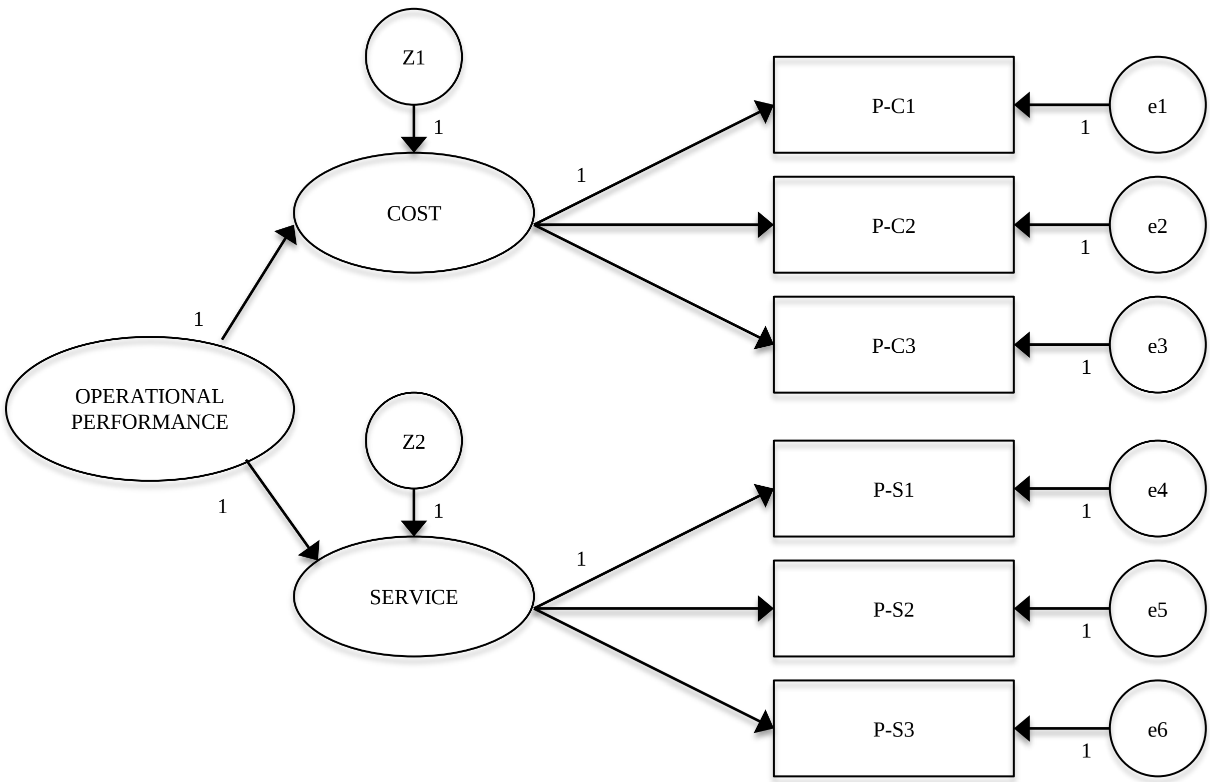


Table 4.22 Fit statistics for the model of operational performance

Fit statistic	Model statistic	Criteria	Acceptable (Not)
Chi-square	11.295		
Degrees of freedom	8		

(DF)			
P	.186	Equal or > .05	Acceptable
Bollen-Stine (B-S) p	.906	> .05	Acceptable
Mean of B-S distribution	24.033		
Chi-square / DF	1.412	< 2	Acceptable
TLI	.990	Equal or > .95	Acceptable
CFI	.995	Equal or > .95	Acceptable
SRMR	.0250	< .05	Acceptable
Standardized residual covariances	Peak = 1.122	< 2	Acceptable
RMSEA	.044	< .05	Acceptable
Lower bound of 90% CI*	.000	< .05	Acceptable
Upper bound of 90% CI*	.098	< .1	Acceptable
Pclose	.512	> .05	Acceptable

(*CI = two-sided confidence interval)

All fit statistics in Table 4.22 met relevant criteria. Multivariate kurtosis for the data was 21.427 with a critical ratio of 16.07, suggesting that the relevant p to use was the Bollen-Stine p (Bollen and Stine, 1992; Cunningham, 2010). This level of multivariate kurtosis is still within the range that Gao et al. (2008) found acceptable for structural equation models, with relatively low levels of bias of parameter estimates. The multivariate kurtosis may have been caused by two potential outlying cases: 84 and 159. Both of these cases had Mahalanobis d-squared scores exceeding 27 with the nearest neighbor at 22.8. This level of difference suggests a substantial shift away from the centroid compared with the majority of the data points, and the potential to remove them if there are issues of fit relating to the more complex models (De Maesschalck et al., 2000).

The correlations among measured variables are shown in Table 4.23. These values are all within a range that is acceptable, with no values at extremely low or high levels. The associated Eigenvalues were 3.730, .649, .608, .458, .334, and .221. These Eigenvalues suggest the presence of a single explanatory variable (Cunningham, 2010), supporting the proposed structure of the model.

Table 4.23 Correlations among measured variables for operational performance

Measured Variable	P-C1	P-C2	P-C3	P-S1	P-S2	P-S3
P-C1	1					
P-C2	.735	1				
P-C3	.589	.450	1			
P-S1	.689	.598	.465	1		
P-S2	.614	.590	.458	.699	1	
P-S3	.475	.426	.407	.511	.429	1

Cronbach's Alpha was computed for the first-level latent cost variable, the first-level latent service variable, and the aggregated second-level latent operational performance variable using the statistical program SPSS 18. The score for the service variable was .775. The score for the cost variable was .813. And the score for the aggregated operational performance score with six measured variables was .876. All scores were acceptable given that they exceeded the threshold score of .7 (Hinkin, 1995).

Table 4.24 displays the unstandardized regression weights in the model. All parameters that were free to vary were significant ($P < .001$). Table 4.25 displays the standardized regression weights. All standardized regression weights were significant. Four variables, P-C2, P-C1, P-S2, and P-S1 had very good factor loadings. Variables P-C3 and P-S3 had estimates below .7, though the upper bounds of the 95% confidence levels were above .7 for both variables. All variables were therefore retained in the model at this stage of the analysis.

Table 4.24 Regression weights in the model of operational performance

Latent or Measured Variable	Latent Variable	Factor Loading Estimate	Standard Error	Critical Ratio	Significant (P < .001)
COST	OPERATIONAL PERFORMANCE	1.000			
SERVICE	OPERATIONAL PERFORMANCE	1.000			
P-C3	COST	.782	.083	9.393	Yes
P-C2	COST	1.000			
P-C1	COST	1.145	.080	14.275	Yes
P-S3	SERVICE	.759	.091	8.366	Yes
P-S2	SERVICE	1.000			
P-S1	SERVICE	1.056	.085	12.458	Yes

Table 4.25 Standardized regression weights in the model of operational performance

Latent or Measured Variable	Latent Variable	Factor Loading Estimate	Lower Bound of 95% Bias-corrected Confidence Level	Upper Bound of 95% Bias-corrected Confidence Level	P
COST	OPERATIONAL PERFORMANCE	.918	.821	1.009	.002
SERVICE	OPERATIONAL PERFORMANCE	.963	.867	1.072	.001
P-C3	COST	.629	.504	.727	.002
P-C2	COST	.797	.709	.866	.001
P-C1	COST	.917	.845	.975	.001
P-S3	SERVICE	.588	.448	.707	.001
P-S2	SERVICE	.777	.683	.850	.002
P-S1	SERVICE	.856	.784	.914	.001

Table 4.26 presents the squared multiple correlations in the model. The estimates for all parameters with the exception of P-C3 and P-S3 exceed .5. The upper bound of the 95% confidence level is .5 or greater for these two variables. These results also suggest that all variables should be retained within the model.

Table 4.26 Squared multiple correlations in the model of operational performance

Parameter	Squared multiple correlation estimate	Lower Bound of 95% Bias-corrected Confidence Level	Upper Bound of 95% Bias-corrected Confidence Level	P

COST	.842	.674	1.019	.002
SERVICE	.927	.752	1.150	.001
P-C3	.395	.254	.529	.002
P-C2	.636	.502	.750	.001
P-C1	.841	.713	.951	.001
P-S3	.346	.201	.500	.001
P-S2	.604	.467	.722	.002
P-S1	.732	.614	.835	.001

Removing the potentially outlying cases 84 and 159 did not improve the fit of the model. Chi-square increased to 12.733, TLI reduced to .986, CFI reduced to .993, and both RMSEA (.053) and the upper boundary of its 90% confidence interval (.104) shifted above acceptable thresholds. Both cases were therefore retained in the data set at this stage of the analysis.

An alternative model of operational performance in which the first-order variables for cost and service were removed was tested for comparison purposes. Testing of alternative models is held to be good practice though their comparison can be complex unless they are nested (Bentler and Bonnet, 1980). The alternative model failed to meet thresholds for multiple criteria, including Chi-square / DF (3.232), TLI (.947), RMSEA (.102), and the low (.062) and high (.144) boundaries of the RMSEA 90% confidence interval. The Akaike Information Criterion (AIC) can be used to compare non-hierarchical models (Kline, 2011). The equation used in AMOS 18 for AIC is

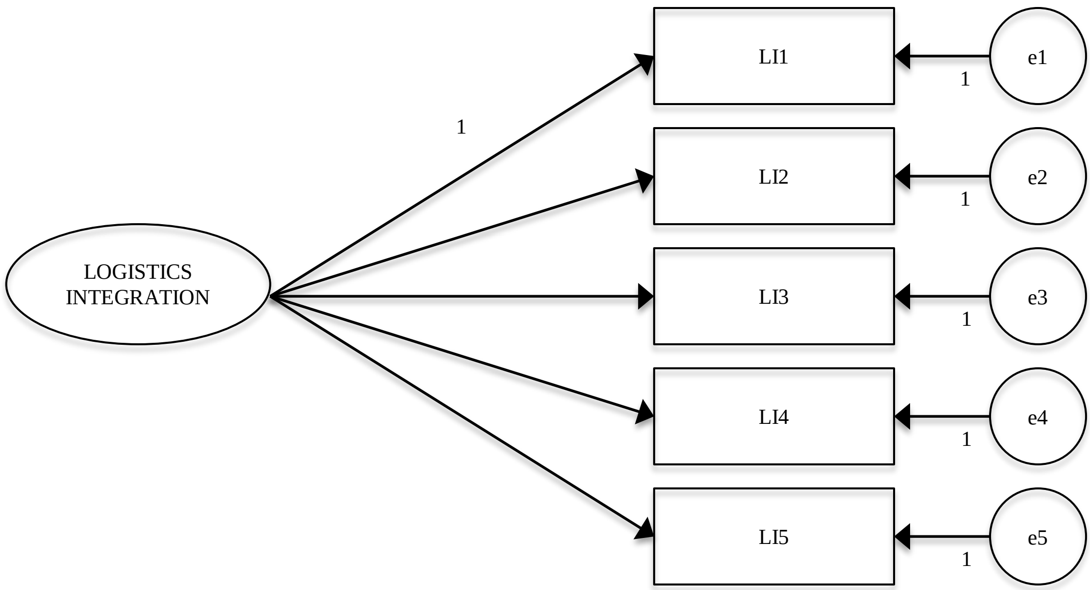
$$\text{AIC} = \text{Chi-square} + 2q$$

where q is the number of parameters in the model. The alternative model of operational performance had an AIC of 65.090 whereas the original theoretical model had an AIC of 49.295. The lower AIC is preferred (Anderson et al., 2000; Kline, 2011, p220). The original theoretical model was therefore retained as the preferred model of operational performance.

4.4.2 Congeneric tests of the model of customer integration

Customer integration was measured as a first-order latent variable termed Logistics Integration. This variable had five measured variables adapted from Chen and Paulraj (2004), as identified in the Methodology section of this thesis. The initial model was specified in AMOS 18 and is shown in Figure 4.2.

Figure 4.2 Initial confirmatory factor analysis model of Logistics Integration



Consistent with the analysis of operational performance, the discrepancy between the unbiased covariances of the data set and the implied covariances of the model was analyzed using the maximum likelihood estimation method. The Bollen-Stine bootstrap p was used to measure fit for non-nomal multivariate data, using 2000 bootstrap samples. The fit statistics for the confirmatory factor analysis model of logistics integration are shown in Table 4.27. Measures obtained in relation to all criteria met the acceptable thresholds. The multivariate kurtosis was 17.475 with a critical ratio of 15.348. This score is within the range that Gao et al. (2008) found to produce relatively small amounts of bias in structural equation models and was therefore deemed acceptable. There was one outlier of potential significance, case 46. The fact that a level of multivariate non-normality is found in the data means that the Bollen-Stine p is the relevant statistic to use for assessment of significance (Bollen and Stine, 1992; Cunningham, 2010). The model was accepted without adjustment at this stage.

Table 4.27 Fit statistics for the confirmatory factor analysis model of logistics integration

Fit statistic	**Model statistic**	**Criteria**	**Acceptable (Not)**
Chi-square	2.462		
Degrees of freedom (DF)	5		
P	.782	Equal or > .05	Acceptable
Bollen-Stine (B-S) p	1.000	> .05	Acceptable
Mean of B-S distribution	8.166		
Chi-square / DF	.492	< 2	Acceptable
TLI	1.013	Equal or > .95	Acceptable
CFI	1.000	Equal or > .95	Acceptable
SRMR	.0131	< .05	Acceptable
Standardized residual covariances	Peak = .388	< 2	Acceptable
RMSEA	.000	< .05	Acceptable
Lower bound of 90% CI*	.000	< .05	Acceptable
Upper bound of 90% CI*	.063	< .1	Acceptable
Pclose	.914	> .05	Acceptable

(*CI = two-sided confidence interval)

The correlations among the measured variables for the model are shown in Table 4.28. All are in the moderate range and are acceptable for the purposes of structural equation modelling (Kline, 2011). The related Eigenvalues were 3.113, .568, .487, .449, and .383, suggesting the presence of a single explanatory variable (Cunningham, 2010).

Table 4.28 Correlations among measured variables for logistics integration

	LI1	LI2	LI3	LI4	LI5
LI1	1				
LI2	.517	1			

LI3	.461	.498	1		
LI4	.553	.605	.545	1	
LI5	.534	.556	.456	.548	1

The Cronbach's Alpha for the five variables was acceptable. The Alpha was computed using SPSS 18 and provided a score of .844. This score was accepted because it was above the threshold of 0.7 (Hinkin, 1995).

Tables 4.29 and 4.30 present the regression weights for the logistics integration model. All unstandardized parameters that were free to vary had statistically significant regression weights (P < .001). All standardized regression weights in the model were significant. Four of the five standardized factor loadings exceeded .7 and one variable, LI3, had a standardized regression weight of .663, with an upper bound of the 95% bias-corrected confidence level at .755. All variables in the model were retained at this stage of the analysis.

Table 4.29 Regression weights in the confirmatory factor analysis model of logistics integration

Latent or Measured Variable	Latent Variable	Factor Loading Estimate	Standard Error	Critical Ratio	Significant (P < .001)
LI1	LOGISTICS INTEGRATION	1.000			
LI2	LOGISTICS INTEGRATION	1.020	.105	9.687	Yes
LI3	LOGISTICS INTEGRATION	.641	.074	8.651	Yes
LI4	LOGISTICS INTEGRATION	1.188	.118	10.047	Yes
LI5	LOGISTICS INTEGRATION	.970	.103	9.400	Yes

Table 4.30 Standardized regression weights in the confirmatory factor analysis model of logistics integration

Latent or	Latent	Factor	Lower	Upper	P

Measured Variable	Variable	Loading Estimate	Bound of 95% Bias-corrected Confidence Level	Bound of 95% Bias-corrected Confidence Level	
LI1	LOGISTICS INTEGRATION	.703	.569	.799	.001
LI2	LOGISTICS INTEGRATION	.759	.671	.827	.002
LI3	LOGISTICS INTEGRATION	.663	.551	.755	.001
LI4	LOGISTICS INTEGRATION	.791	.687	.868	.002
LI5	LOGISTICS INTEGRATION	.717	.614	.801	.001

Table 4.31 presents the squared multiple correlations for the model. Three of the five scores were above .5, one variable, LI1, had a score of .495, with an upper bound for the 95% bias-corrected confidence interval of .639, and one variable, LI3, had a score of .439, with an upper bound for the 95% bias-corrected confidence interval of .570. These results also suggest that all variables should be retained.

Table 4.31 Squared multiple correlations in the confirmatory factor analysis model of logistics integration

Parameter	Squared multiple correlation estimate	Lower Bound of 95% Bias-corrected Confidence Level	Upper Bound of 95% Bias-corrected Confidence Level	P
LI1	.495	.324	.639	.001
LI2	.575	.450	.684	.002
LI3	.439	.303	.570	.001
LI4	.626	.473	.753	.002
LI5	.514	.377	.642	.001

In order to confirm that the model should be retained as initially specified and shown in Figure 4.2, two procedures were performed. First, variables LI1 and LI3 were independently removed to test whether the model fit improved. The model deteriorated in both cases, with the upper bound of the RMSEA 90% confidence interval shifting to

.109 and .122, respectively. The model can be improved when this score moves beyond .10 (Kline, 2011, p206), so neither of these actions were accepted. The potentially outlying case 46 was then removed and the full model reanalysed using the maximum likelihood estimation method. This procedure improved the fit of the model, and both the standardized regression weight and the squared multiple correlation for variable LI1, the latter shifting above the ideal thresholds. The new results are shown in Tables 4.32 – 4.36. The Eigenvalues associated with the correlations shifted marginally to 3.133, .569, .472, .427, and .399. The Cronbach Alpha improved marginally to .847. The enhancements to the model were accepted and case 46 was removed from further analyses.

Table 4.32 Fit statistics for the confirmatory factor analysis model of logistics integration with case 46 removed

Fit statistic	**Model statistic**	**Criteria**	**Acceptable (Not)**
Chi-square	2.073		
Degrees of freedom (DF)	5		
P	.839	Equal or > .05	Acceptable
Bollen-Stine (B-S) p	1.000	> .05	Acceptable
Mean of B-S distribution	7.564		
Chi-square / DF	.415	< 2	Acceptable
TLI	1.014	Equal or > .95	Acceptable
CFI	1.000	Equal or > .95	Acceptable
SRMR	.0120	< .05	Acceptable
Standardized residual covariances	Peak = .351	< 2	Acceptable
RMSEA	.000	< .05	Acceptable
Lower bound of 90% CI*	.000	< .05	Acceptable
Upper bound of 90% CI*	.054	< .1	Acceptable
Pclose	.940	> .05	Acceptable

(*CI = two-sided confidence interval)

Table 4.33 Correlations among measured variables for logistics integration with case 46 removed

	LI1	LI2	LI3	LI4	LI5

LI1	1				
LI2	.545	1			
LI3	.466	.497	1		
LI4	.574	.583	.544	1	
LI5	.535	.569	.456	.555	1

Table 4.34 Regression weights in the confirmatory factor analysis model of logistics integration with case 46 removed

Latent or Measured Variable	Latent Variable	Factor Loading Estimate	Standard Error	Critical Ratio	Significant ($P < .001$)
LI1	LOGISTICS INTEGRATION	1.000			
LI2	LOGISTICS INTEGRATION	.954	.095	10.043	Yes
LI3	LOGISTICS INTEGRATION	.616	.070	8.797	Yes
LI4	LOGISTICS INTEGRATION	1.116	.107	10.395	Yes
LI5	LOGISTICS INTEGRATION	.949	.098	9.704	Yes

Table 4.35 Standardized regression weights in the confirmatory factor analysis model of logistics integration with case 46 removed

Latent or Measured Variable	Latent Variable	Factor Loading Estimate	Lower Bound of 95% Bias-corrected Confidence Level	Upper Bound of 95% Bias-corrected Confidence Level	P
LI1	LOGISTICS INTEGRATION	.727	.612	.814	.001
LI2	LOGISTICS INTEGRATION	.757	.664	.829	.002
LI3	LOGISTICS INTEGRATION	.659	.538	.751	.001
LI4	LOGISTICS INTEGRATION	.785	.679	.864	.002
LI5	LOGISTICS INTEGRATION	.724	.624	.809	.001

Table 4.36 Squared multiple correlations in the confirmatory factor analysis model of logistics integration with case 46 removed

Parameter	Squared multiple correlation estimate	Lower Bound of 95% Bias-corrected Confidence Level	Upper Bound of 95% Bias-corrected Confidence Level	P
LI1	.528	.374	.663	.001
LI2	.573	.441	.687	.002
LI3	.434	.289	.563	.001
LI4	.616	.461	.747	.002
LI5	.524	.389	.655	.001

A final test of whether the model could be improved was performed by removing variable LI3, which still had a squared multiple correlation estimate below .5. When model fit was compared using the AIC, the alternative model with four measured variables was found to produce a lower score. The original specification had an AIC = 32.073 and the alternative specification had an AIC = 24.503. The upper bound of the RMSEA 90% confidence interval increased to .089 with the new specification, suggesting only a minor relative reduction in fit for the new model. For these reasons, the alternative specification of the model was accepted (Anderson et al., 2000).

The model fit statistics for the accepted specification of the model of logistics integration are shown in Table 4.37. All model statistics meet targeted criteria.

Table 4.37 Fit statistics for the confirmatory factor analysis model of logistics integration with case 46 and variable LI3 removed

Fit statistic	Model statistic	Criteria	Acceptable (Not)
Chi-square	.503		
Degrees of freedom (DF)	2		
P	.778	Equal or > .05	Acceptable
Bollen-Stine (B-S) p	1.000	> .05	Acceptable
Mean of B-S distribution	2.911		
Chi-square / DF	.251	< 2	Acceptable
TLI	1.014	Equal or > .95	Acceptable
CFI	1.000	Equal or > .95	Acceptable
SRMR	.0067	< .05	Acceptable
Standardized residual covariances	Peak = .147	< 2	Acceptable
RMSEA	.000	< .05	Acceptable
Lower bound of 90% CI*	.000	< .05	Acceptable
Upper bound of 90% CI*	.089	< .1	Acceptable
Pclose	.861	> .05	Acceptable

(*CI = two-sided confidence interval)

The sample correlations among the retained measured variables were unaffected by the change. However, the associated Eigenvalues shifted to 2.682, .473, .438, and .408. These values still reflected the presence of a single explanatory variable (Cunningham, 2010). The Cronbach Alpha for the four variables, calculated in SPSS 18, was .835, which is acceptable as it is above the threshold of .7 (Hinkin, 1995).

Table 4.38 shows that the regression weights shifted only marginally in the alternative specification of the model compared with the original specification of the model. This is also true for the estiates of standardized regression weights, as shown in Table 4.39. These results are positive and support the specification of the model (Bollen, 2000).

Table 4.38 Regression weights in the confirmatory factor analysis model of logistics integration with case 46 and variable LI3 removed

Latent or Measured Variable	Latent Variable	Factor Loading Estimate	Standard Error	Critical Ratio	Significant (P < .001)
LI1	LOGISTICS INTEGRATION	1.000			
LI2	LOGISTICS INTEGRATION	.950	.097	9.757	Yes
LI4	LOGISTICS INTEGRATION	1.087	.108	10.021	Yes
LI5	LOGISTICS INTEGRATION	.955	.100	9.550	Yes

Table 4.39 Standardized regression weights in the confirmatory factor analysis model of logistics integration with case 46 and variable LI3 removed

Latent or Measured Variable	Latent Variable	Factor Loading Estimate	Lower Bound of 95% Bias-corrected Confidence Level	Upper Bound of 95% Bias-corrected Confidence Level	P
LI1	LOGISTICS INTEGRATION	.732	.606	.823	.001
LI2	LOGISTICS INTEGRATION	.759	.659	.839	.002
LI4	LOGISTICS INTEGRATION	.770	.648	.865	.002
LI5	LOGISTICS INTEGRATION	.734	.632	.825	.001

Table 4.40 displays the squared multiple correlations of the alternative specification of logistics integration. All estimates are above the the threshold of .5 suggesting the parameters are acceptable. The logistics integration model was therefore accepted with four measured variables.

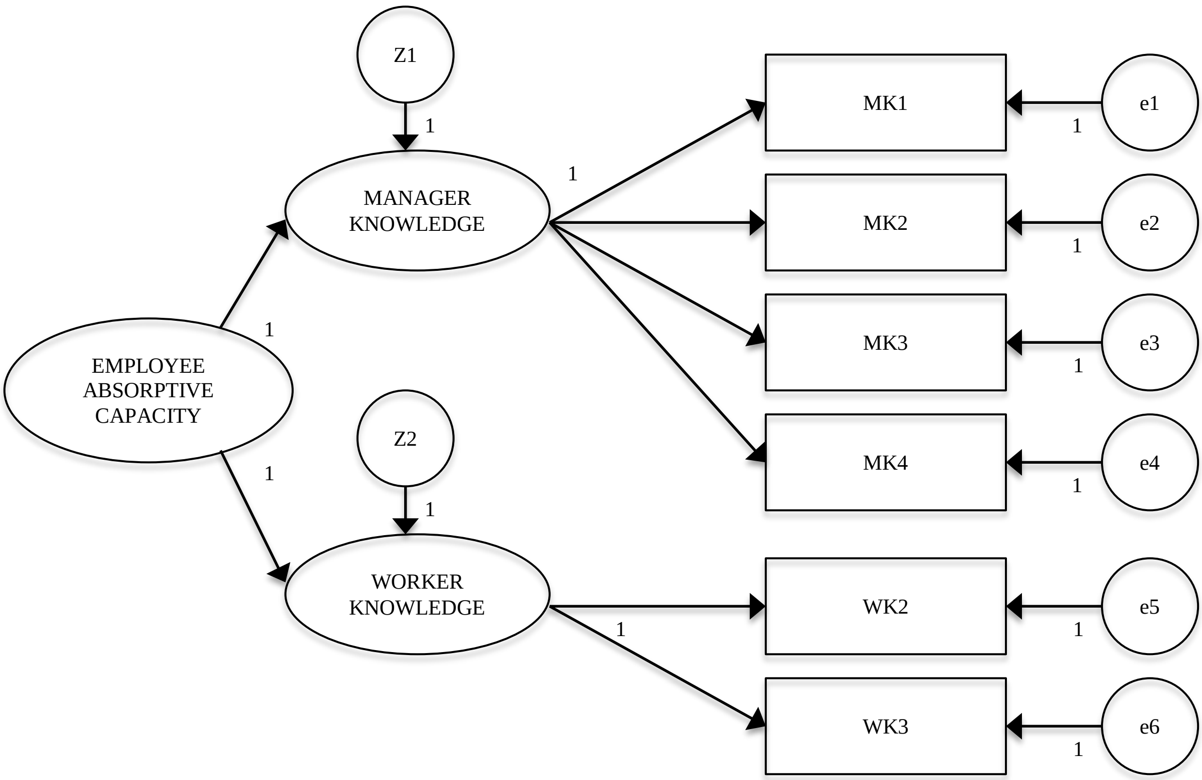
Table 4.40 Squared multiple correlations in the confirmatory factor analysis model of logistics integration with case 46 and variable LI3 removed

Parameter	Squared multiple correlation estimate	Lower Bound of 95% Bias-corrected Confidence Level	Upper Bound of 95% Bias-corrected Confidence Level	P
LI1	.535	.368	.677	.001
LI2	.577	.435	.703	.002
LI4	.593	.420	.749	.002
LI5	.539	.399	.681	.001

4.4.3 Congeneric tests of the model of employee absorptive capacity

The absorptive capacity of employees was modeled as a second-level latent variable with two first-level latent variables, reflecting absorptive capacities of managers and first-line workers. The model was specified in AMOS 18 and fitted to the covariance structure of the data with 215 cases, reflecting the removal of case 46. The specified model, which is depicted in Figure 4.3, was analyzed using the maximum likelihood estimation method. The Bollen-Stine bootstrap p, based on 2000 bootstrap samples, was also estimated in AMOS 18.

Figure 4.3 Initial specified model of Employee Absorptive Capacity



The fit of the model, shown in Table 4.41, was reasonable with an acceptable significance level for Chi-square but two criteria were not met. The RMSEA was above .5, and the upper boundary of the RMSEA 90% confidence interval was above .1. Both scores are borderline acceptable with small lifts above the targeted thresholds that make the results suggestive of less than ideal fit (Kline, 2011). The multivariate kurtosis was measured at 24.404 with a critical ratio of 18.260, which is acceptable using the guidelines of Gao et al. (2008). These scores suggest that the Bollen-Stine bootstrap p is the appropriate measure of statistical significance. Two cases appear to be outlying cases: case 83 with a Mahalanobis d-squared score of 37.453; and, case 165 with a Mahalanobis d-squared score of 36.950. The nearest neighbor is case 100 with a score of 31.175. The fit of the model was therefore reassessed with cases 83 and 165 progressively removed.

Table 4.41 Fit statistics for the model of employee absorptive capacity with n = 215

Fit statistic	Model statistic	Criteria	Acceptable (Not)
Chi-square	13.819		
Degrees of freedom (DF)	8		
P	.087	Equal or > .05	Acceptable
Bollen-Stine (B-S) p	.705	> .05	Acceptable
Mean of B-S distribution	11.739		
Chi-square / DF	1.727	< 2	Acceptable
TLI	.982	Equal or > .95	Acceptable
CFI	.990	Equal or > .95	Acceptable
SRMR	.0245	< .05	Acceptable
Standardized residual covariances	Peak = .762	< 2	Acceptable
RMSEA	.058	< .05	(Borderline)
Lower bound of 90% CI*	.000	< .05	Acceptable
Upper bound of 90% CI*	.109	< .1	(Borderline)
Pclose	.344	> .05	Acceptable

(*CI = two-sided confidence interval)

The fit of the model was initially examined with case 83 removed. The model was analyzed using the same procedures as the first model. Model fit deteriorated substantially following the removal of case 83. This result suggested that the case was an outlier with positive leverage (Yuan and Zhong, 2008).

The fit of the model was then assessed with case 165 removed, using the maximum likelihood estimation method and the Bollen-Stine bootstrap p, employing 2000 bootstrap samples. This time the model improved substantially as is shown in Table 4.42. The model fit improved on almost all criteria and now demonstrated acceptable fit. The multivariate kurtosis also improved slightly with a score of 21.310 and a critical ratio of 15.908. The specified model was therefore accepted at this stage of the analysis with case 165 removed.

Table 4.42 Fit statistics for the model of employee absorptive capacity with n = 214

Fit statistic	Model statistic	Criteria	Acceptable (Not)
Chi-square	9.478		
Degrees of freedom (DF)	8		
P	.304	Equal or > .05	Acceptable
Bollen-Stine (B-S) p	.945	> .05	Acceptable
Mean of B-S distribution	10.877		
Chi-square / DF	1.185	< 2	Acceptable
TLI	.995	Equal or > .95	Acceptable
CFI	.997	Equal or > .95	Acceptable
SRMR	.0203	< .05	Acceptable
Standardized residual covariances	Peak = -.711	< 2	Acceptable
RMSEA	.029	< .05	Acceptable
Lower bound of 90% CI*	.000	< .05	Acceptable
Upper bound of 90% CI*	.089	< .1	Acceptable
Pclose	.644	> .05	Acceptable

(*CI = two-sided confidence interval)

The sample correlations are shown in Table 4.43. There are no excessively high correlations with a peak of .674 for the variables MK1 and MK4. The related Eigenvalues were 3.634, .769, .570, .400, .332, and .296 suggesting the presence of a single explanatory variable (Cunningham, 2010). Cronbach Alpha statistics were computed in SPSS 18: the Alpha for the first-level latent variable, Worker Knowledge, was .750; the Alpha for the first-level latent variable, Manager Knowledge, was .850; and the Alpha for the second-level latent variable, Employee Absorptive Capacity, was .866. All three Alphas met the criteria of exceeding .7 (Hinkin, 1995).

Table 4.43 Correlations among measured variables for the model of employee absorptive capacity with n = 214

	MK1	MK2	MK3	MK4	WK2	WK3
MK1	1					
MK2	.639	1				
MK3	.566	.442	1			
MK4	.674	.693	.525	1	.	
WK2	516	.491	.359	.482	1	
WK3	.517	.480	.372	.491	.6	1

Table 4.44 displays unstandardized regression weights for the specified model. The regression weights for the parameters that were free to vary were significant (P < .001). Note that both the direct effect of Employee Absorptive Capacity on Manager Knowledge and that on Worker Knowledge were set to unity (see Little et al., 1999, or Kline 2011, for discussions relating to this approach). This is not required for the reflective indicators of Worker Knowledge because the overall model is still identified (Kline, 2011, p138). However, it is important to note that this specification makes the model equivalent to a confirmatory factor analysis model where the second-order latent variable "… provides a specific account of *why* the two lower-order factors … covary…" (Kline, 2011, p246).

Table 4.44 Regression weights in the model of employee absorptive capacity (EAC) with n = 214

Latent or Measured Variable	Latent Variable	Factor Loading Estimate	Standard Error	Critical Ratio	Significant (P < .001)
MANAGER KNOWLEDGE	EAC	1.000			
WORKER KNOWLEDGE	EAC	1.000			
MK1	MANAGER KNOWLEDGE	1.000			
MK2	MANAGER KNOWLEDGE	1.127	.091	12.373	Yes
MK3	MANAGER KNOWLEDGE	.609	.064	9.550	Yes
MK4	MANAGER KNOWLEDGE	1.145	.087	13.116	Yes
WK2	WORKER KNOWLEDGE	1.000			
WK3	WORKER KNOWLEDGE	1.003	.109	9.196	Yes

Table 4.45 presents the standardized regression weights for the specified model. All regression weights were statistically significant. Variable MK3 had a factor loading of .626, which is below the targeted threshold of .7. However, the upper bound of its 95% bias-corrected confidence level was .730. All other factor loadings were above .7.

Table 4.45 Standardized regression weights in the model of employee absorptive capacity (EAC) with n = 214

Latent or Measured Variable	Latent Variable	Factor Loading Estimate	Lower Bound of 95% Bias-corrected Confidence Level	Upper Bound of 95% Bias-corrected Confidence Level	P
MANAGER KNOWLEDGE	EAC	.927	.825	1.027	.001
WORKER KNOWLEDGE	EAC	.840	.709	.964	.001
MK1	MANAGER KNOWLEDGE	.825	.728	.894	.001
MK2	MANAGER KNOWLEDGE	.792	.725	.852	.002
MK3	MANAGER KNOWLEDGE	.626	.505	.730	.001
MK4	MANAGER KNOWLEDGE	.836	.751	.891	.002
WK2	WORKER KNOWLEDGE	.773	.658	.881	.001
WK3	WORKER KNOWLEDGE	.776	.676	.854	.003

Table 4.46 presents the squared multiple correlations of the specified model of employee absorptive capacity. All results are statistically significant; however, variable MK3 has a score of .392, which is well below the threshold criteria of .5, though the upper bound of its 95% bias-corrected confidence level is .532. All other variables recorded scores well in excess of the targeted threshold level. For these reasons, the model was retested with variable MK3 removed.

Table 4.46 Squared multiple correlations in the model of employee absorptive capacity (EAC) with n = 214

Parameter	Squared multiple correlation estimate	Lower Bound of 95% Bias-corrected Confidence Level	Upper Bound of 95% Bias-corrected Confidence Level	P
MANAGER KNOWLEDGE	.860	.680	1.056	.001
WORKER KNOWLEDGE	.706	.502	.929	.001
MK1	.681	.531	.799	.001
MK2	.627	.525	.727	.002
MK3	.392	.255	.532	.001
MK4	.699	.564	.793	.002
WK2	.598	.433	.777	.001
WK3	.603	.458	.729	.003

Comparison of the the initial specification of employee absorptive capacity with the alternative specification, in which variable MK3 was removed, was done using the change in AIC (Anderson et al., 2000; Kline, 2011). The AIC for the original specification with six measured variables was 47.478 and the AIC for the alternative specification with five measured variables was 34.757. The difference favours the alternative specification of the model of employee absorptive capacity, because of its lower score (Anderson et al., 2000; Kline, 2011). The alternative specification of the model was therefore accepted at this stage of the analysis.

Table 4.47 displays the fit statistics for the model with five measured variables. Clearly, all fit statistics are very good. The fit statistics suggest the alternatiive specification of the model is acceptable.

Table 4.47 Fit statistics for the model of employee absorptive capacity with n = 214 and variable MK3 removed

Fit statistic	Model statistic	Criteria	Acceptable (Not)
Chi-square	2.757		
Degrees of freedom (DF)	4		
P	.599	Equal or > .05	Acceptable
Bollen-Stine (B-S) p	1.000	> .05	Acceptable
Mean of B-S distribution	6.263		
Chi-square / DF	.689	< 2	Acceptable
TLI	1.006	Equal or > .95	Acceptable
CFI	1.000	Equal or > .95	Acceptable
SRMR	.0141	< .05	Acceptable
Standardized residual covariances	Peak = .379	< 2	Acceptable
RMSEA	.000	< .05	Acceptable
Lower bound of 90% CI*	.000	< .05	Acceptable
Upper bound of 90% CI*	.087	< .1	Acceptable
Pclose	.792	> .05	Acceptable

(*CI = two-sided confidence interval)

The correlations among measured variables did not change but the Eigenvalues for the correlations among the measured variables of the model shifted to 3.239, .703, .401, .359, and .298. These values support the proposal of a single explanatory variable for the model (Cunningham, 2010). The Cronbach Alpha for the three measured variables for Manager Knowledge was .856, and for five measured variables for Employee Absorptive Capacity was .861. The Alpha for the two measured variables of Worker Knowledge was .750, and did not change. All scores were higher than the threshold of .7 (Hinkin, 1995).

Table 4.48 displays unstandardized regression weights for the alternative specification of the employee absorptive capacity model. These scores are very similar to those obtained in the original specification of the model. This is also true for the standardized regression weights, which are shown in Table 4.49.

Table 4.48 Regression weights in the model of employee absorptive capacity (EAC) with n = 214 and variable MK3 removed

Latent or Measured Variable	Latent Variable	Factor Loading Estimate	Standard Error	Critical Ratio	Significant (P < .001)
MANAGER KNOWLEDGE	EAC	1.000			
WORKER KNOWLEDGE	EAC	1.000			
MK1	MANAGER KNOWLEDGE	1.000			
MK2	MANAGER KNOWLEDGE	1.178	.097	12.187	Yes
MK4	MANAGER KNOWLEDGE	1.174	.093	12.692	Yes
WK2	WORKER KNOWLEDGE	1.000			
WK3	WORKER KNOWLEDGE	.999	.109	9.148	Yes

Table 4.49 Standardized regression weights in the model of employee absorptive capacity (EAC) with n = 214 and variable MK3 removed

Latent or Measured Variable	Latent Variable	Factor Loading Estimate	Lower Bound of 95% Bias-corrected Confidence Level	Upper Bound of 95% Bias-corrected Confidence Level	P
MANAGER KNOWLEDGE	EAC	.939	.834	1.046	.001
WORKER KNOWLEDGE	EAC	.831	.702	.959	.001
MK1	MANAGER KNOWLEDGE	.807	.703	.883	.001
MK2	MANAGER KNOWLEDGE	.810	.749	.866	.002
MK4	MANAGER KNOWLEDGE	.839	.744	.897	.002
WK2	WORKER KNOWLEDGE	.775	.657	.883	.001
WK3	WORKER KNOWLEDGE	.775	.673	.856	.003

Table 4.50 presents the squared multiple correlations of the specified model of employee absorptive capacity. All results are statistically significant and above the

threshold of .5. The present specification of employee absorptive capacity, with five measured variables, was therefore accepted at this stage of the analysis.

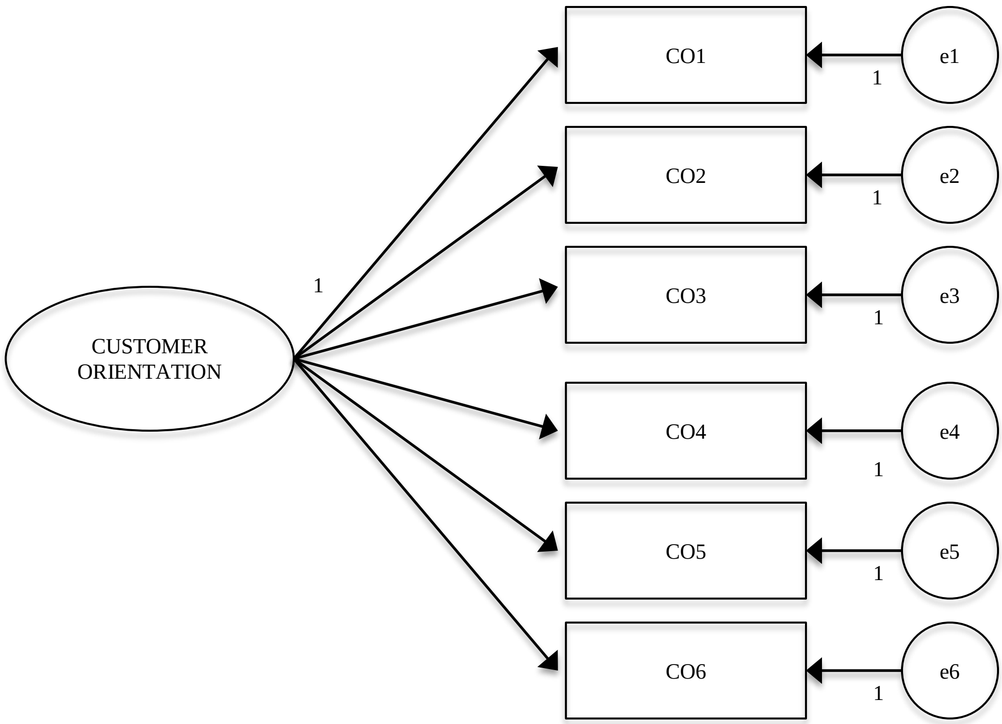
Table 4.50 Squared multiple correlations in the model of employee absorptive capacity (EAC) with n = 214 and variable MK3 removed

Parameter	Squared multiple correlation estimate	Lower Bound of 95% Bias-corrected Confidence Level	Upper Bound of 95% Bias-corrected Confidence Level	P
MANAGER KNOWLEDGE	.883	.696	1.093	.001
WORKER KNOWLEDGE	.690	.493	.920	.001
MK1	.651	.494	.779	.001
MK2	.656	.561	.750	.002
MK4	.702	.554	.805	.002
WK2	.600	.431	.780	.001
WK3	.600	.454	.733	.003

4.4.4 Congeneric tests of the model of customer orientation

Customer orientation was modelled as a first-level latent variable with six measured indicators. The model is shown in Figure 4.4. The model was fitted to the data with n = 214, which reflected the removal from the sample of cases 46 and 165. The model was analysed with the same method as previous models, using maximum likelihood estimation and the Bollen-Stine bootstrap p, employing 2000 bootstrap samples. The fit statistics for the model are shown in Table 4.51.

Figure 4.4 The confirmatory factor analysis model of customer orientation



The fit of the model was acceptable on all criteria with the exception of RMSEA and the upper bound of its 90% confidence interval. This suggested that the potential outlier identified in the histogram of the customer orientation variable CO4 may actually be causing an issue. The Mahalanobis d-squared score identified three cases that were slightly away from the remaining groupings. Case 181 had a score of 32.186, case 45 had a score of 30.948 and case 90 had a score of 28.880 compared with the next closes case 179 with a score of 25.965. The model was fitted to data sets where each of the three cases were removed progressively and analyzed using the same procedure as was used to analyze the original theoretical model of customer orientation.

Table 4.51 Fit statistics for the model of customer orientation with n = 214

Fit statistic	Model statistic	Criteria	Acceptable (Not)
Chi-square	14.593		
Degrees of freedom (DF)	9		
P	.103	Equal or > .05	Acceptable
Bollen-Stine (B-S) p	.748	> .05	Acceptable
Mean of B-S distribution	13.639		
Chi-square / DF	1.621	< 2	Acceptable
TLI	.985	Equal or > .95	Acceptable
CFI	.991	Equal or > .95	Acceptable
SRMR	.0244	< .05	Acceptable
Standardized residual covariances	Peak = .825	< 2	Acceptable
RMSEA	.054	< .05	(Borderline)
Lower bound of 90% CI*	.000	< .05	Acceptable
Upper bound of 90% CI*	.103	< .1	(Borderline)
Pclose	.395	> .05	Acceptable

(*CI = two-sided confidence interval)

The procedure followed the suggestion of De Maesschalck et al. (2000) to remove the cases progressively in order to conserve the sample size. Removal of case 181 failed to improve model fit with the RMSEA measures scoring substantially worse. Removal of case 45 had a very small beneficial effect on RMSEA (.053) and the upper bound of its 90% confidence interval (.102). Removal of case 90 made model fit worse with the RMSEA measures again deteriorating. For these reasons the sample was retained at n = 214 at this stage of the analysis.

The factor loadings were used as a basis for assessing whether there were any measured indicators that should be removed to improve the fit of the model (Anderson and Gerbing, 1988). The indicator, CO3, had the lowest regression weight (.885), the lowest standardized regression weight (.722) and the lowest squared multiple correlation (.521). Note that the latter two scores are reasonable (Hinkin, 1995); however, the

RMSEA scores suggest that the fit of the model could be improved (Kline, 2011, p206). And, in fact, the fit of the model improved materially when this indicator was removed. The fit statistics are shown in Table 4.52; they are all well within acceptable thresholds. The difference between the AIC for the original model and the AIC for this alternative model was 16.718. The AIC for the original specification of the model was 50.593 and the AIC for the alternative specification, with variable CO3 removed, was 33.875. The RMSEA in the alternative model was .000 and the upper bound of its 90% confidence interval was .084, below the threshold of .1, suggesting the model fit was acceptable. The alternative customer orientation model with the indicator CO3 removed was therefore accepted.

Table 4.52 Fit statistics for the model of customer orientation with n = 214 and variable CO3 removed

Fit statistic	Model statistic	Criteria	Acceptable (Not)
Chi-square	3.875		
Degrees of freedom (DF)	5		
P	.567	Equal or > .05	Acceptable
Bollen-Stine (B-S) p	1.000	> .05	Acceptable
Mean of B-S distribution	7.505		
Chi-square / DF	.775	< 2	Acceptable
TLI	1.005	Equal or > .95	Acceptable
CFI	1.000	Equal or > .95	Acceptable
SRMR	.0143	< .05	Acceptable
Standardized residual covariances	Peak = .331	< 2	Acceptable
RMSEA	.000	< .05	Acceptable
Lower bound of 90% CI*	.000	< .05	Acceptable
Upper bound of 90% CI*	.084	< .1	Acceptable
Pclose	.791	> .05	Acceptable

(*CI = two-sided confidence interval)

Table 4.53 presents the correlations among the variables in the accepted model of customer orientation. These are all in the moderate range and within the limits for structural equation modeling (Kline, 2011). The associated Eigenvalues are 3.344, .463, .458, .436, and .300 suggesting there is a single explanatory variable (Cunningham, 2010). The Cronbach Alpha was calculated using SPSS18 and provided a score of .880 for the five variables. This score is well over the targeted threshold of .7 (Hinkin, 1995).

Table 4.53 Correlations among measured variables for the model of customer orientation with n = 214 and variable CO3 removed

	CO1	CO2	CO4	CO5	CO6
CO1	1				
CO2	.578	1			
CO4	.546	.589	1		
CO5	.586	.696	.565	1	
C06	.548	.612	.552	.581	1

Table 4.54 displays unstandardized regression weights for the customer orientation model with five measured variables. All parameters that were free to vary had statistically significant regression weights (P<.001).

Table 4.54 Regression weights in the model of customer orientation with n = 214 and variable CO3 removed

Latent or Measured Variable	**Latent Variable**	**Factor Loading Estimate**	**Standard Error**	**Critical Ratio**	**Significant (P < .001)**
CO1	CUSTOMER ORIENTATION	1.000			
CO2	CUSTOMER ORIENTATION	1.153	.104	11.139	Yes
CO4	CUSTOMER ORIENTATION	.903	.091	9.928	Yes
CO5	CUSTOMER ORIENTATION	1.286	.117	11.021	Yes
CO6	CUSTOMER ORIENTATION	1.029	.101	10.152	Yes

Table 4.55 presents the standardized regression weights for the model of customer orientation with five measured variables. All standardized regression weights were statistically significant. They were also all above the targeted threshold of .7. All these measured variables were therefore retained at this stage of the analysis.

Table 4.55 Standardized regression weights in the model of customer orientation with n = 214 and variable CO3 removed

Latent or Measured Variable	Latent Variable	Factor Loading Estimate	Lower Bound of 95% Bias-corrected Confidence Level	Upper Bound of 95% Bias-corrected Confidence Level	P
CO1	CUSTOMER ORIENTATION	.722	.622	.803	.001
CO2	CUSTOMER ORIENTATION	.831	.755	.883	.002
CO4	CUSTOMER ORIENTATION	.720	.622	.795	.002
CO5	CUSTOMER ORIENTATION	.811	.721	.878	.001
CO6	CUSTOMER ORIENTATION	.739	.637	.819	.002

Table 4.56 presents the squared multiple correlations of the model of customer orientation with five measurted variables. All squared multiple correlations were above the .5 threshold. This suggests that all five measured variables should be retained in the model.

Table 4.56 Squared multiple correlations in the model of customer orientation with n = 214 and CO3 removed

Parameter	Squared multiple correlation estimate	Lower Bound of 95% Bias-corrected Confidence Level	Upper Bound of 95% Bias-corrected Confidence Level	P
CO1	.522	.387	.644	.001
CO2	.691	.570	.780	.002
CO4	.519	.387	.632	.002
CO5	.658	.520	.771	.001
CO6	.546	.406	.671	.002

4.4.5 Congeneric tests of the model of learning processes

The model of learning processes was initially specified in AMOS 18 as a confirmatory factor analysis model with four first-order latent variables: knowledge articulation, knowledge codification, knowledge sharing, and knowledge internalization. The measured variables associated with each latent variable were examined in previous sections of this thesis. The model was analysed using the same protocol as previous models; using maximum likelihood to estimate discrepancies between the unbiased covariances of the data and those implied by the model. The Bollen-Stine bootstrap p was also used to estimate significance in the instances where the data were non-normal. The boostrapping procedure used 2000 bootstrap samples. Table 4.57 displays model fit statistics, which are almost uniformly unacceptable.

Table 4.57 Fit statistics for the model of learning process with n = 214 and four latent variables

Fit statistic	Model statistic	Criteria	Acceptable (Not)
Chi-square	323.415		
Degrees of freedom (DF)	146		
P	.000	Equal or > .05	Not Acceptable
Bollen-Stine (B-S) p	.010	> .05	Not Acceptable
Mean of B-S distribution	208.875		
Chi-square / DF	2.215	< 2	Not Acceptable
TLI	.909	Equal or > .95	Not Acceptable
CFI	.923	Equal or > .95	Not Acceptable
SRMR	.0586	< .05	Not Acceptable
Standardized residual covariances	Peak = 3.165, multiple > 2	< 2	Not Acceptable
RMSEA	.076	< .05	Not Acceptable
Lower bound of 90% CI*	.064	< .05	Not Acceptable
Upper bound of 90% CI*	.087	< .1	Acceptable
Pclose	.000	> .05	Not Acceptable

(*CI = two-sided confidence interval)

One of the issues causing problems with the model seemed to be the correlations between the latent variables. These are shown in Table 4.58. The correlations between the latent variables, knowledge sharing and knowledge internalization, was .920, and the correlation between the latent variables, knowledge codification and knowledge articulation, was .996. These correlations are so high that each pair of latent variables effectively represents a single factor (Cunningham, 2010; Kline, 2011). The discriminant validity, using the approach recommended by Fornell and Larker (1981), is also shown in Table 4.58. This is positive for those values where the average variance extracted is larger than the square of the correlation between the latent variables (Fornell and Larker, 1981, p46). The data in Table 4.58 suggests that there are only two pairs of latent variables that display discriminant validity: knowledge articulation and knowledge internalization; and, knowledge codification and knowledge internalization.

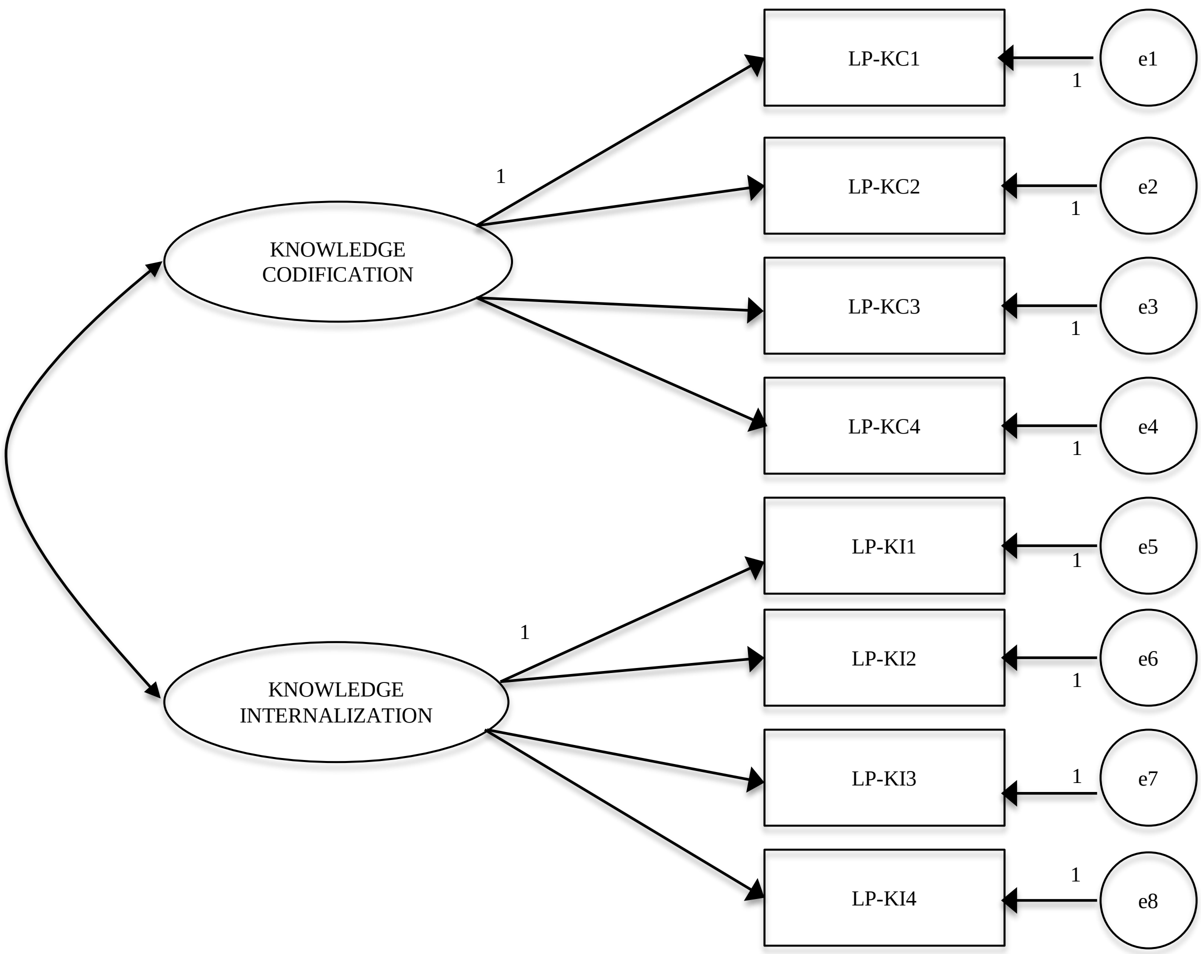
Table 4.58 Correlations (C), the square of correlations (C^2), average variance extracted (AVE), and discriminant validity (DV) among latent variables of the confirmatory factor analysis model of learning processes

LATENT VARIABLE	LATENT VARIABLE	C	C^2	AVE	DV
KNOWLEDGE SHARING	KNOWLEDGE INTERNALIZATION	.920	.846	.539	No
KNOWLEDGE SHARING	KNOWLEDGE ARTICULATION	.827	.684	.445	No
KNOWLEDGE SHARING	KNOWLEDGE CODIFICATION	.789	.623	.550	No
KNOWLEDGE ARTICULATION	KNOWLEDGE INTERNALIZATION	.685	.469	.510	Yes
KNOWLEDGE CODIFICATION	KNOWLEDGE INTERNALIZATION	.654	.428	.615	Yes
KNOWLEDGE CODIFICATION	KNOWLEDGE ARTICULATION	.996	.992	.522	No

Two latent variables were removed from the learning process model because of the high correlations between the two pairs of latent variables. The latent variable, knowledge articulation, was removed because two of its factor loadings were well below the threshold of .7: LP-KA2 had an estimate of .477; and, LP-KA3 had an estimate of .438. This meant the variance extracted was only .416, below the targeted threshold of .5 (Fornell and Larcker, 1981). All factor loadings for the latent variable, knowledge codification, were above .7. The variance extracted for this latent variable was .627.

The latent variable, knowledge sharing, was removed for three reasons: it failed to demonstrate discriminant validity with any of the other latent variables, as shown in Table R58; it had measured variables with factor loadings below the targeted threshold of .7, LP-KS4 having an estimate of .559 and LP-KSA5 having an estimate of .683, providing a variance extracted of .473; and, its correlation with the latent variable, knowledge codification, was approaching the upper level of acceptability of .8 (Cunningham, 2010) with an estimate of .789. By comparison, the variance extracted for the latent variable, knowledge internalization, was .604. The correlation between it and the latent variable, knowledge codification, was acceptable with an estimate of .654. Finally, knowledge internalization also demonstrated discriminant validity when compared with knowledge codification. The revised specification of the model is shown in Figure 4.5.

Figure 4.5 The re-specified confirmatory factor analysis model of learning processes, with two latent variables, knowledge codification and knowledge articulation



The confirmatory factor analysis model of learning processes with two latent variables, knowledge codification and knowledge internalization, was re-specified in AMOS 18 and analyzed in the same manner as the previous model. This model also had poor fit. The model fit statistics are shown in Table 4.59.

Table 4.59 Fit statistics for the model of learning process with n = 214 and two latent variables, knowledge codification and knowledge internalization

Fit statistic	Model statistic	Criteria	Acceptable (Not)
Chi-square	55.569		
Degrees of freedom (DF)	19		
P	.000	Equal or > .05	Not Acceptable
Bollen-Stine (B-S) p	.047	> .05	Not Acceptable
Mean of B-S distribution	27.668		
Chi-square / DF	2.925	< 2	Not Acceptable
TLI	.942	Equal or > .95	Not Acceptable
CFI	.961	Equal or > .95	Acceptable
SRMR	.0625	< .05	Not Acceptable
Standardized residual covariances	Peak = 3.327, multiple > 2	< 2	Not Acceptable
RMSEA	.095	< .05	Not Acceptable
Lower bound of 90% CI*	.067	< .05	Not Acceptable
Upper bound of 90% CI*	.125	< .1	Not Acceptable
Pclose	.006	> .05	Not Acceptable

(*CI = two-sided confidence interval)

One option for further re-specification of the model was to remove the measured variable or variables associated with excessively high residuals (Anderson and Gerbing, 1988). The model's standardized residual covariances exceeding 2 were related to the measured variable LP-KI4 and its relationships with the measured variables LP-KC3 and L-KC4. The variable LP-KI4 was therefore removed and the new model was reanalyzed using the same approach as had been used when analyzing previous models. The results are shown in Table 4.60. The fit of the re-specified model was very good. The multivariate kurtosis was 23.186 with a critical ratio of 15.109 suggesting the Bollen-Stine p is the appropriate measure of statistical significance. All fit statistics were within acceptable bounds leading the model to be accepted at this stage of the analysis.

Table 4.60 Fit statistics for the model of learning process with n = 214 and two latent variables, knowledge codification and knowledge internalization. Variable LP-KI4 was removed.

Fit statistic	**Model statistic**	**Criteria**	**Acceptable (Not)**
Chi-square	18.967		
Degrees of freedom (DF)	13		
P	.124	Equal or > .05	Acceptable
Bollen-Stine (B-S) p	.731	> .05	Acceptable
Mean of B-S distribution	16.950		
Chi-square / DF	1.459	< 2	Acceptable
TLI	.988	Equal or > .95	Acceptable
CFI	.992	Equal or > .95	Acceptable
SRMR	.0343	< .05	Acceptable
Standardized residual covariances	Peak = 1.406	< 2	Acceptable
RMSEA	.046	< .05	Acceptable
Lower bound of 90% CI*	.000	< .05	Acceptable
Upper bound of 90% CI*	.089	< .1	Acceptable
Pclose	.506	> .05	Acceptable

(*CI = two-sided confidence interval)

The correlations for the model are shown in Table 4.61. The Eigenvalues related to the correlations were 4.005, 1.123, .561, .522, .324, .279, and .187. This result suggests there were two independent factors (Cunningham, 2010). The Cronbach Alphas for the two factors were calculated in SPSS 18. The Alpha for the latent variable, knowledge codification, was .866, and the Alpha for the latent variable, knowledge internalization, was .834. Using the Fornell and Larker (1981) test for discriminant validity between the two factors, where the average of the variance extracted for the two factors needs to exceed the square of the correlation between the two factors, provides further evidence for the independence of the two factors: the average variance extracted was .642 and the square of the correlation was .375.

Table 4.61 Correlations among measured variables for the model of learning processes with n = 214 and two latent variables, knowledge codification and knowledge internalization. Variable LP-KI4 was removed.

	LP-KC1	LP-KC2	LP-KC3	LP-KC4	LP-KI1	LP-KI2	LP-KI3
LP-KC1	1						
LP-KC2	.539	1					
LP-KC3	.635	.696	1				
LP-KC4	.505	.694	.646	1			
LP-KI1	.406	.468	.487	.481	1		
LP-KI2	.353	.400	.384	.435	.797	1	
LP-KI3	.297	.368	.390	.396	.577	.496	1

Table 4.62 displays unstandardized regression weights for the model of learning processes with two latent variables. All parameters that were free to vary within this model had statistically significant regression weights.

Table 4.62 Regression weights in the model of learning processes with n = 214 and two latent variables, knowledge codification and knowledge internalization. Variable LP-KI4 was removed.

Latent or Measured Variable	**Latent Variable**	**Factor Loading Estimate**	**Standard Error**	**Critical Ratio**	**Significant (P < .001)**
LP-KC1	KNOWLEDGE CODIFICATION	1.000			
LP-KC2	KNOWLEDGE CODIFICATION	1.103	.106	10.401	Yes
LP-KC3	KNOWLEDGE CODIFICATION	1.323	.120	10.992	Yes
LP-KC4	KNOWLEDGE CODIFICATION	1.140	.114	10.003	Yes
LP-KI1	KNOWLEDGE INTERNALIZATION	1.705	.177	9.654	Yes
LP-KI2	KNOWLEDGE INTERNALIZATION	1.590	.166	9.553	Yes
LP-KI3	KNOWLEDGE INTERNALIZATION	1.000			

Table 4.63 presents the standardized regression weights for the model of learning processes with two latent variables. All standardized regression weights were

statistically significant. The factor loading on the measured variable, LP-KC1, was .686 with the upper bound of the 95% bias-corrected confidence level at .778. The factor loading on the measured variable, LP-KI3, was .609 with the upper bound of the 95% bias-corrected confidence level at .714. All of the other factor loadings were above the targeted threshold of .7. The measured variables for both latent variables were therefore retained at this stage of the analysis.

Table 4.63 Standardized regression weights in the model of learning processes with n = 214 and two latent variables, knowledge codification and knowledge internalization. Variable LP-KI4 was removed.

Latent or Measured Variable	Latent Variable	Factor Loading Estimate	Lower Bound of 95% Bias-corrected Confidence Level	Upper Bound of 95% Bias-corrected Confidence Level	P
LP-KC1	KNOWLEDGE CODIFICATION	.686	.565	.778	.002
LP-KC2	KNOWLEDGE CODIFICATION	.832	.744	.899	.001
LP-KC3	KNOWLEDGE CODIFICATION	.844	.764	.905	.001
LP-KC4	KNOWLEDGE CODIFICATION	.793	.705	.861	.001
LP-KI1	KNOWLEDGE INTERNALIZATION	.954	.902	1.005	.001
LP-KI2	KNOWLEDGE INTERNALIZATION	.833	.754	.894	.001
LP-KI3	KNOWLEDGE INTERNALIZATION	.609	.488	.714	.001

Table 4.64 presents the squared multiple correlations of the model of learning processes with two latent variables. The measured variables, LP-KC1 and LP-KI3, had squared multiple correlations below the .5 threshold, though the upper bounds of their 95% bias-corrected confidence levels were above the threshold. All other squared multiple correlations were above the .5 threshold. All estimates were statistically significant. All

seven measured variables were retained in the model for these reasons at this stage of the analysis.

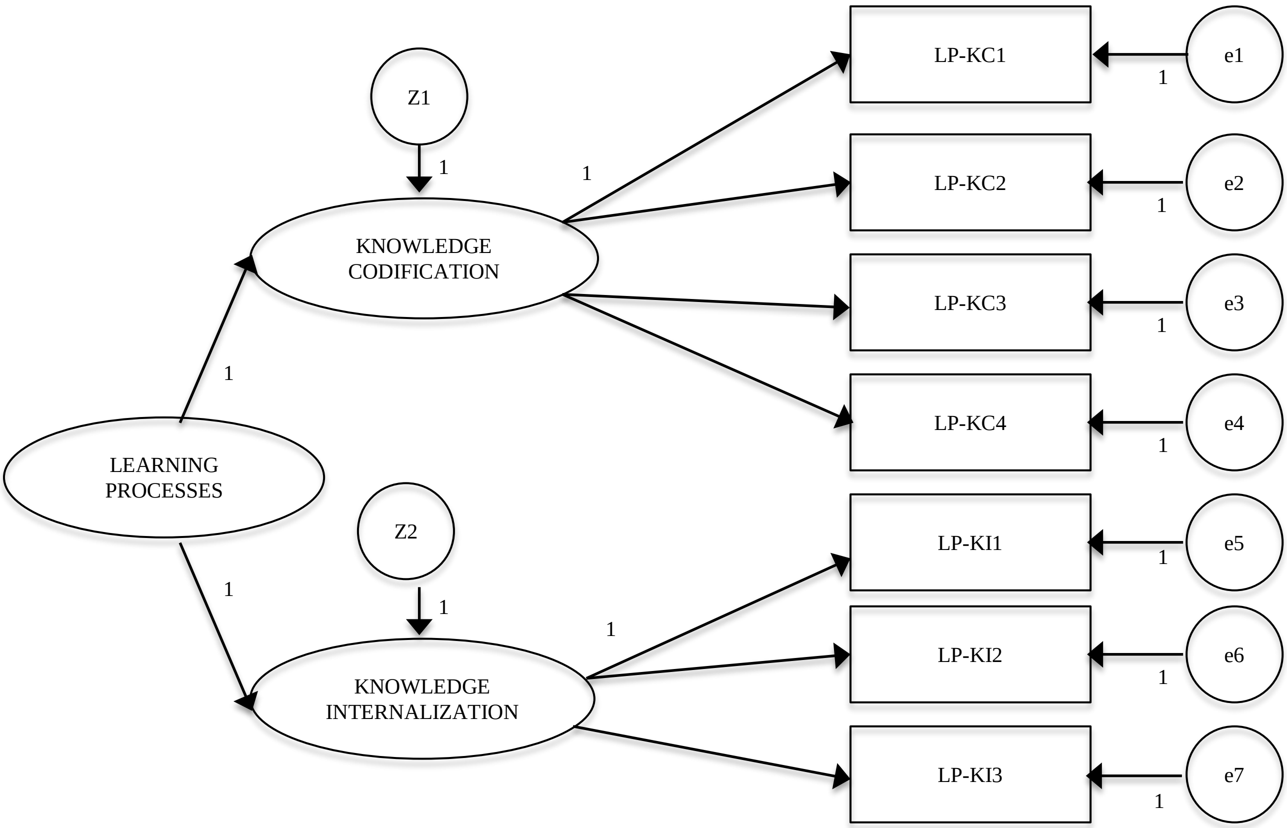
Table 4.64 Squared multiple correlations in the model of learning processes with n = 214 and two latent variables, knowledge codification and knowledge internalization. Variable LP-KI4 was removed.

Parameter	Squared multiple correlation estimate	Lower Bound of 95% Bias-corrected Confidence Level	Upper Bound of 95% Bias-corrected Confidence Level	P
LP-KC1	.471	.319	.606	.002
LP-KC2	.692	.505	.808	.001
LP-KC3	.712	.584	.818	.001
LP-KC4	.629	.498	.742	.001
LP-KI1	.911	.813	1.010	.001
LP-KI2	.694	.568	.800	.001
LP-KI3	.370	.239	.510	.001

A final step in the analysis of the learning processes model was to respecify the model with the addition of a second order latent variable, termed Learning Processes, with no measured variables that replaces the "…unanalyzed association between the factors of the original model…" (Kline, 2011, p246). This model constrained the direct effects on the two first-order factors to be equal to one. The model is shown in Figure 4.6.

The model fit of the revised specification was analyzed using the same procedures that were used to analyze the other models. The model fit was exactly the same as the preceding confirmatory factor analysis model. The correlations between the measured variables, the regression weights in both unstandardized and standardized forms, and the squared multple correlations were also all the same for the variables in the confirmatory factor analysis model.

Figure 4.6 Model of learning processes with two first order latent variables and a second order latent variable with no measured variables



The new specification provided estimates of standardized regression weights and squared multiple correlations for the relationships between the second order latent variable, learning processes, and the two first order latent variables, knowledge codification and knowledge internalization. The standardized regression weights are shown in Table 4.65. The estimates were .744 and .823 for the factor loadings on knowledge codification and knowledge internalization, respectively. Table 4.66 displays the squared multiple correlations. These were .553 for knowledge codification and .678 for knowledge internalization. This specification of the model was consequently accepted for use for structural equation modelling purposes.

Table 4.65 Standardized regression weights in the model of learning processes with n = 214, a single second order latent variable, learning processes, and two first order latent variables, knowledge codification and knowledge internalization.

Latent or Measured Variable	Latent Variable	Factor Loading Estimate	Lower Bound of 95% Bias-corrected Confidence Level	Upper Bound of 95% Bias-corrected Confidence Level	P
KNOWLEDGE CODIFICATION	LEARNING PROCESSES	.744	.605	.887	.001
KNOWLEDGE INTERNALIZATION	LEARNING PROCESSES	.823	.678	.962	.002

Table 4.66 Squared multiple correlations in the model of learning processes with n = 214, a single second order latent variable, learning processes, and two latent variables, knowledge codification and knowledge internalization. Variable LP-KI4 was removed.

Parameter	Squared multiple correlation estimate	Lower Bound of 95% Bias-corrected Confidence Level	Upper Bound of 95% Bias-corrected Confidence Level	P
KNOWLEDGE CODIFICATION	.553	.366	.787	.001
KNOWLEDGE INTERNALIZATION	.678	.460	.925	.002

4.4.6 Measurement model: Higher-level Confirmatory Factor Analysis

A confirmatory factor analysis model using the five latent variables Learning Processes, Customer Orientation, Employee Absorptive Capacity, Logistics Integration, and Operational Performance was specified in AMOS 18 and fitted to the covariance matrix of the data set with 214 cases. Each of the latent variables was specified using the accepted structures identified in the preceding sections of this document. The model was analyzed using maximum likelihood estimation and the Bollen-Stine bootstrap p, utilizing 2000 bootstrap samples. The model fit statistics are shown in Table 4.67.

The fit of the model was good using the Bollen-Stine bootstrap p as the measure of significance. This statistics is the appropriate one because the multivariate kurtosis was 179.895 with a critical ratio of 33.251, which is close to the range that Gao et al. (2008) showed produced less than five per cent bias of the model parameters. The Chi-square / DF, the TLI, CFI, and the RMSEA statistics were also acceptable. However, SRMR and the standard residual covariances were not acceptable, suggesting that the fit of the model could be improved.

Table 4.67 Model fit statistics for the confirmatory factor analysis model with covariances analyzed between five latent variables using n=214.

Fit statistic	Model statistic	Criteria	Acceptable (Not)
Chi-square	434.274		
Degrees of freedom (DF)	311		
P	.000	Equal or > .05	
Bollen-Stine (B-S) p	.425	> .05	Acceptable
Mean of B-S distribution	401.203		
Chi-square / DF	1.396	< 2	Acceptable
TLI	.956	Equal or > .95	Acceptable
CFI	.961	Equal or > .95	Acceptable
SRMR	.0592	< .05	Not Acceptable
Standardized residual covariances	Peak = 3.548, 12 pairs > 2	< 2	Not Acceptable
RMSEA	.043	< .05	Acceptable
Lower bound of 90% CI*	.033	< .05	Acceptable
Upper bound of 90% CI*	.052	< .1	Acceptable
Pclose	.883	> .05	Acceptable

(*CI = two-sided confidence interval.)

Two multivariate outlying cases were evident by examining the Mahalanobis d-squared scores. Case 14 had a score of 80.434 and case 83 had a score of 74.372, compared with their nearest neighbor, case 182, with a score of 60.929. Each case was removed progressively to examine whether it provided positive or negative leverage (Yuan and

Zhong, 2008). Removing case 83 increased SRMR to .0595, and reduced TLI and CFI to .952 and .958, respectively. It also increased the RMSEA statistics marginally to .045 (.035 - .054, .822). The Bollen-Stine bootstrap p reduced to .366 and Chi-square increased to 442.668. These results suggested case 83 provided positive leverage and should be retained (Yuan and Zhong, 2008). Removing case 14 increased SRMR to .0598, and shifted TLI to .949 and CFI to .955. The RMSEA statistics increased slightly to .046 (.037 - .055, .743) and the Bollen-Stine bootstrap p reduced to .302. These changes did not suggest that case 14 should be permanently removed either. The search for improved fit was therefore shifted to the measured variables.

Examination of the unacceptable standardized residual covariances identified clusters of variables that were associated with multiple excessive residuals. The variables LI1, CO4, LP-KI3, and P-C3 had multiple interactions with excessively large residuals. The pairs of measured variables with standardized residual covariances greater than two are shown in Table 4.68.

Table 4.68 Variables with significant differences between the sample and implied covariances resulting in standardized residual covariances greater than 2

Latent variable cluster	Measured variable	Measured variable
Operational Performance	P-C3	MK1
	P-C3	WK2
	P-C3	LI1
	P-C2	LI2
	P-S3	CO4
Learning Processes	LP-KI1	LI1
	LP-KI3	LI1
	LP-KI3	CO1
	LP-KI3	CO2
	LP-KI3	CO4
	LP-KI3	CO5
	LP-KI3	CO6

Measured variables, which had relationships with multiple other variables that displayed excessive standardized residual covariances, were deleted to identify whether they had larger effects than variables with single relationships. This approach was hypothesized to reduce the loss of variables in the model. The re-specified model, with the measured variables CO4, LI1, LP-KI3, and P-C3 removed, was fitted to the data set with n = 214 reanalyzed using the same maximum likelihood analysis and Bollen-Stine bootstrap procedures as had been used previously. The analysis revealed substantial improvement in overall model fit and that there were no longer any pairs of measured variables with standardized residual covariances above an absolute score of 2. The AIC also shifted to 424.240 from 622.274. The model fit statistics are shown in Table 4.69.

Table 4.69 Model fit statistics for the confirmatory factor analysis model with covariances analyzed between five latent variables using n=214. Variables LI1, CO4, LP-KI3, and P-C3 were removed.

Fit statistic	Model statistic	Criteria	Acceptable (Not)
Chi-square	260.240		
Degrees of freedom (DF)	217		
P	.024	Equal or > .05	
Bollen-Stine (B-S) p	.833	> .05	Acceptable
Mean of B-S distribution	278.031		
Chi-square / DF	1.199	< 2	Acceptable
TLI	.981	Equal or > .95	Acceptable
CFI	.983	Equal or > .95	Acceptable
SRMR	.438	< .05	Acceptable
Standardized residual covariances	Peak = 1.872	< 2	Acceptable
RMSEA	.031	< .05	Acceptable
Lower bound of 90% CI*	.012	< .05	Acceptable
Upper bound of 90% CI*	.044	< .1	Acceptable
Pclose	.995	> .05	Acceptable

(*CI = two-sided confidence interval.)

The multivariate kurtosis for the variables in the model was 138.670 with a critical ratio of 29.910, which is in the range Goa et al. (2008) argued to be acceptable for structural equation modeling. The multivariate kurtosis score suggests the relevant measure of statistical significance is the Bollen-Stine bootstrap p. This score was acceptable at .833.

The correlations between the measured variables are shown in Table 4.70 and the correlations between the higher-level latent variables are shown in Table 4.71. The peak correlation between measured variables was .797, between LP-KI1 and LP-KI2, and the second highest correlation was .735, between P-C1 and P-C2. The peak correlation between the higher-level latent variables was .742 between Learning Processes and Employee Absorptive Capacity. These estimates approach the higher end of acceptable correlations (Kline, 2011). However, the peak variance inflation factor calculated in SPSS 18 using each measured variable, in turn, as a dependent variable and the other 22 measured variables as independent variables in regression tests (Kline, 2011, p53), was only 3.366 between the variable P-C1 and each of the variables CO1, LP-KI2, LP-KC1, LI4, MK2, and WK2, and their tolerances were .297. The peak squared multiple correlation calculated using the same approach was .703, and the peak adjusted squared multiple correlation was .669, for the measured variable, P-C1. These results suggest there was no extreme multivariate collinearity (Kline, 2011, pp53-54). Finally, the fit of the model was very good with no excessively high residuals, so the model was retained in its current specification at this stage of the analysis.

Table 4.70 Correlations among measured variables for the retained confirmatory factor analysis model with covariances measured between five latent variables using n=214.

	Logistics Integration (LI)			Employee Absorptive Capacity				
				Manager Knowledge (MK)			Worker Knowledge (WK)	
	LI2	LI4	LI5	MK1	MK2	MK4	WK2	WK3
LI2	1							
LI4	.584	1						
LI5	.568	.555	1					
MK1	.264	.295	.307	1				
MK2	.406	.469	.408	.639	1			
MK4	.353	.283	.292	.674	.693	1		
WK2	.412	.384	.274	.516	.491	.482	1	
WK3	.387	.315	.289	.517	.480	.491	.600	1
LP-KC1	.250	.240	.163	.361	.361	.309	.350	.340
LP-KC2	.397	.325	.278	.343	.402	.357	.347	.434
LP-KC3	.335	.266	.241	.330	.363	.316	.396	.417
LP-KC4	.373	.284	.354	.324	.387	.375	.382	.419
LP-KI1	.249	.328	.236	.362	.346	.289	.356	.352
LP-KI2	.242	.322	.240	.338	.369	.303	.356	.327
CO1	.329	.290	.254	.228	.328	.245	.315	.306
CO2	.330	.275	.295	.292	.330	.293	.248	.385
CO5	.372	.325	.241	.200	.224	.221	.229	.247
CO6	.379	.276	.260	.312	.334	.342	.330	.309
P-S1	.294	.229	.304	.105	.173	.128	.134	.139
P-S2	.203	.246	.270	.167	.214	.177	.150	.204
P-S3	.330	.214	.337	.107	.210	.208	.183	.091
P-C1	.426	.333	.378	.207	.272	.211	.269	.282
P-C2	.244	.192	.219	.177	.179	.156	.185	.110

Table 4.70 (continued) Correlations among measured variables for the retained confirmatory factor analysis model with covariances measured between five latent variables using n=214.

	Learning Processes						Customer Orientation (CO)				Performance				
	Knowledge Codification (LP-KC)				Knowledge Internalization (LP-KI)						Service (P-S)			Cost (P-C)	
LI1	LP-KC 1	LP-KC 2	LP-KC 3	LP-KC 4	LP-KI1	LP-KI2	CO1	CO2	CO5	CO6	P-S1	P-S2	P-S3	P-C1	P-C2
LP-KC1	1														
LP-KC2	.539	1													
LP-KC3	.635	.696	1												
LP-KC4	.505	.694	.646	1											
LP-KI1	.406	.468	.487	.481	1										
LP-KI2	.353	.400	.384	.435	.797	1									
CO1	.249	.328	.289	.299	.234	.211	1								
CO2	.296	.412	.323	.393	.357	.304	.578	1							
CO5	.306	.349	.314	.337	.301	.229	.586	.696	1						
CO6	.312	.379	.335	.417	.335	.308	.548	.612	.581	1					
P-S1	.196	.274	.221	.282	.190	.241	.203	.269	.284	.227	1				
P-S2	.229	.302	.281	.256	.258	.243	.301	.267	.296	.227	.665	1			
P-S3	.107	.225	.119	.220	.181	.170	.242	.292	.304	.246	.503	.412	1		
P-C1	.246	.391	.312	.314	.265	.270	.334	.344	.328	.296	.691	.620	.482	1	
P-C2	.146	.276	.195	.165	.140	.164	.298	.237	.219	.225	.605	.606	.443	.735	1

Table 4.71 Correlations between latent variables in the retained confirmatory factor analysis model with covariances measured between five latent variables using n=214.

Latent Variable	Latent Variable	Correlation Estimate	Lower Bound of 95% Bias-corrected Confidence Level	Upper Bound of 95% Bias-corrected Confidence Level	P
LOGISTICS INTEGRATION	OPERATIONAL PERFORMANCE	.492	.345	.629	.001
EMPLOYEE ABSORPTIVE CAPACITY	OPERATIONAL PERFORMANCE	.330	.177	.479	.001
CUSTOMER ORIENTATION	OPERATIONAL PERFORMANCE	.451	.313	.591	.001
LEARNING PROCESSES	OPERATIONAL PERFORMANCE	.460	.328	.603	.001
LOGISTICS INTEGRATION	EMPLOYEE ABSORPTIVE CAPACITY	.652	.467	.823	.001
LOGISTICS INTEGRATION	CUSTOMER ORIENTATION	.517	.390	.639	.001
LOGISTICS INTEGRATION	LEARNING PROCESSES	.562	.413	.713	.001
EMPLOYEE ABSORPTIVE CAPACITY	CUSTOMER ORIENTATION	.516	.364	.655	.001
EMPLOYEE ABSORPTIVE CAPACITY	LEARNING PROCESSES	.742	.548	.895	.001
LEARNING PROCESSES	CUSTOMER ORIENTATION	.605	.455	.732	.002

Table 4.72 displays the regression weights for the specified model. All parameters that were free to vary had statistically significant regression weights at $p<.001$.

Table 4.72 Regression weights in the retained confirmatory factor analysis model with covariances measured between five latent variables using n=214.

Latent or Measured Variable	Latent Variable	Factor Loading Estimate	Standard Error	Critical Ratio	Significant (P < .001)
MANAGER KNOWLEDGE	EMPLOYEE ABSORPTIVE CAPACITY	1.000			
WORKER KNOWLEDGE	EMPLOYEE ABSORPTIVE CAPACITY	1.000			
KNOWLEDGE CODIFICATION	LEARNING PROCESSES	1.000			
KNOWLEDGE INTERNALIZATION	LEARNING PROCESSES	1.000			
COST	OPERATIONAL PERFORMANCE	1.000			
SERVICE	OPERATIONAL PERFORMANCE	1.000			
LI2	LOGISTICS INTEGRATION	1.058	.109	9.704	Yes
LI4	LOGISTICS INTEGRATION	1.113	.117	9.516	Yes
LI5	LOGISTICS INTEGRATION	1.000			
MK1	MANAGER KNOWLEDGE	.836	.062	13.418	Yes
MK2	MANAGER KNOWLEDGE	1.019	.074	13.795	Yes
MK4	MANAGER KNOWLEDGE	1.000			
WK2	WORKER KNOWLEDGE	1.038	.095	10.815	Yes
WK3	WORKER KNOWLEDGE	1.000			
LP-KC1	KNOWLEDGE CODIFICATION	1.000			
LP-KC2	KNOWLEDGE CODIFICATION	1.084	.092	11.749	Yes
LP-KC3	KNOWLEDGE CODIFICATION	1.271	.105	12.070	Yes
LP-KC4	KNOWLEDGE CODIFICATION	1.122	.100	11.213	Yes
LP-KI1	KNOWLEDGE INTERNALIZATION	1.086	.084	13.000	Yes
LP-KI2	KNOWLEDGE INTERNALIZATION	1.000			
CO1	CUSTOMER ORIENTATION	.771	.071	10.802	Yes
CO2	CUSTOMER ORIENTATION	.902	.069	13.093	Yes
CO5	CUSTOMER ORIENTATION	1.000			
CO6	CUSTOMER	.805	.072	11.126	Yes

	ORIENTATION				
P-S1	SERVICE	1.000			
P-S2	SERVICE	.920	.071	12.940	Yes
P-S3	SERVICE	.696	.078	8.918	Yes
P-C1	COST	1.000			
PC2	COST	.906	.065	13.888	Yes

The standardized regression weights of the specified model are shown in Table 4.73. The estimates were all statistically significant and generally very high. Three factor loading estimates were below .7, though the upper bound of the 95% bias-corrected confidence levels was above that threshold for all factor loading estimates: Service to P-S3 was .589 with an upper bound of .708; Knowledge Codification to LP-KC1 was .697 with an upper bound of .781; and, Learning Processes to Knowledge Internalization was .660 with an upper bound of .747. All measured variables were therefore retained at this stage of the analysis.

Table 4.73 Standardized regression weights in the retained confirmatory factor analysis model with covariances measured between five latent variables using n=214.

Latent or Measured Variable	Latent Variable	Factor Loading Estimate	Lower Bound of 95% Bias-corrected Confidence Level	Upper Bound of 95% Bias-corrected Confidence Level	P
MANAGER KNOWLEDGE	EMPLOYEE ABSORPTIVE CAPACITY	.850	.781	.922	.001
WORKER KNOWLEDGE	EMPLOYEE ABSORPTIVE CAPACITY	.919	.814	1.021	.001
KNOWLEDGE CODIFICATION	LEARNING PROCESSES	.900	.788	1.003	.001
KNOWLEDGE INTERNALIZATION	LEARNING PROCESSES	.660	.560	.747	.001
COST	OPERATIONAL PERFORMANCE	.911	.838	.974	.001
SERVICE	OPERATIONAL PERFORMANCE	.983	.914	1.065	.001
LI2	LOGISTICS INTEGRATION	.795	.710	.859	.002
LI4	LOGISTICS INTEGRATION	.742	.616	.835	.002
LI5	LOGISTICS INTEGRATION	.722	.612	.807	.002
MK1	MANAGER KNOWLEDGE	.799	.688	.877	.001
MK2	MANAGER KNOWLEDGE	.829	.769	.886	.002
MK4	MANAGER KNOWLEDGE	.837	.754	.895	.002
WK2	WORKER KNOWLEDGE	.773	.666	.856	.001
WK3	WORKER KNOWLEDGE	.767	.681	.846	.001
LP-KC1	KNOWLEDGE CODIFICATION	.697	.589	.781	.002
LP-KC2	KNOWLEDGE CODIFICATION	.839	.766	.898	.001
LP-KC3	KNOWLEDGE CODIFICATION	.832	.748	.895	.001
LP-KC4	KNOWLEDGE CODIFICATION	.801	.719	.861	.001
LP-KI1	KNOWLEDGE INTERNALIZATION	.956	.857	1.038	.001
LP-KI2	KNOWLEDGE INTERNALIZATION	.827	.757	.894	.001
CO1	CUSTOMER ORIENTATION	.715	.610	.795	.001
CO2	CUSTOMER ORIENTATION	.835	.763	.887	.002
CO5	CUSTOMER	.810	.725	.872	.001

	ORIENTATION				
CO6	CUSTOMER ORIENTATION	.742	.643	.814	.002
P-S1	SERVICE	.854	.789	.914	.001
P-S2	SERVICE	.773	.677	.848	.001
P-S3	SERVICE	.589	.454	.708	.001
P-C1	COST	.904	.841	.962	.001
P-C2	COST	.806	.714	.875	.001

The squared multiple correlations of the specified model are shown in Table 4.74. These estimates were generally very good, though the variables with lower standardized regression weights had low squared multiple correlations as would be expected from the examination of standardized regression weights. The squared multiple correlation of the measured variable P-C1 was .817 based on the output structural equation model of Amos 18, which is substantially higher than the value reported earlier from the linear regression calculations in SPSS that were used to examine extreme collinearity. These differences reflect the additional effects of the intercorrelations in the the confirmatory factor analysis model (see Kline, 2011, pp169-171 for a discussion relating to the tracing rule that demonstrates the manual calculation of all model-implied correlations). All parameters were statistically significant with the upper bound of their 95% bias-corrected confidence levels above the threshold of .5. The model was retained in its present specification at this stage of the analysis for these reasons.

Table 4.74 Squared multiple correlations in the retained confirmatory factor analysis model with covariances analyzed between five latent variables using n=214.

Parameter	Squared multiple correlation estimate	Lower Bound of 95% Bias-corrected Confidence Level	Upper Bound of 95% Bias-corrected Confidence Level	P
MANAGER KNOWLEDGE	.722	.610	.850	.001
WORKER KNOWLEDGE	.845	.662	1.042	.001
KNOWLEDGE CODIFICATION	.811	.621	1.006	.001
KNOWLEDGE INTERNALIZATION	.436	.313	.559	.001
COST	.829	.702	.949	.001
SERVICE	.967	.835	1.135	.001
LI2	.633	.505	.738	.002
LI4	.551	.379	.697	.002
LI5	.522	.375	.651	.001
MK1	.638	.474	.769	.001
MK2	.687	.591	.785	.002
MK4	.700	.569	.801	.002
WK2	.598	.444	.732	.001
WK3	.588	.463	.715	.001
LP-KC1	.486	.347	.610	.002
LP-KC2	.704	.587	.806	.001
LP-KC3	.692	.559	.801	.001
LP-KC4	.642	.517	.742	.001
LP-KI1	.914	.734	1.078	.001
LP-KI2	.684	.573	.799	.001
CO1	.511	.372	.632	.001
CO2	.697	.582	.786	.002
CO5	.657	.526	.760	.001
CO6	.550	.414	.663	.002
P-S1	.730	.622	.836	.001
P-S2	.598	.458	.719	.001
P-S3	.347	.206	.502	.001
P-C1	.817	.707	.925	.001
P-C2	.649	.510	.766	.001

Table 4.75 displays the covariances between the five higher-level latent variables in the specified model. All covariances were statistically significant at $p<.05$.

Table 4.75 Covariances between latent variables in the retained confirmatory factor analysis model with covariances analyzed between five latent variables using n=214.

Latent Variable	Latent Variable	Covariance Estimate	Lower Bound of 95% Bias-corrected Confidence Level	Upper Bound of 95% Bias-corrected Confidence Level	P
LOGISTICS INTEGRATION	OPERATIONAL PERFORMANCE	.402	.244	.596	.001
EMPLOYEE ABSORPTIVE CAPACITY	OPERATIONAL PERFORMANCE	.230	.126	.348	.001
CUSTOMER ORIENTATION	OPERATIONAL PERFORMANCE	.403	.270	.568	.001
LEARNING PROCESSES	OPERATIONAL PERFORMANCE	.294	.197	.412	.001
LOGISTICS INTEGRATION	LEARNING PROCESSES	.378	.255	.525	.001
EMPLOYEE ABSORPTIVE CAPACITY	LEARNING PROCESSES	.426	.299	.571	.001
LEARNING PROCESSES	CUSTOMER ORIENTATION	.445	.316	.603	.001
EMPLOYEE ABSORPTIVE CAPACITY	CUSTOMER ORIENTATION	.415	.286	.579	.001
LOGISTICS INTEGRATION	CUSTOMER ORIENTATION	.487	.336	.691	.000
LOGISTICS INTEGRATION	EMPLOYEE ABSORPTIVE CAPACITY	.479	.336	.665	.000

4.4.7 Validity and reliability of latent variables

The discriminant validity of the constructs was evaluated using two approaches: the use of structure coefficients (Cunningham, 2010, p6-4 and p6-5); and, the use of the test for discriminant validity proposed by Fornell and Larker (1981). Structure coefficients are identified by comparing the inter-correlations of the measured variables hypothesized to load on a given construct with those of the measured variables hypothesized to be unrelated to the construct. In this test, the inter-correlations of the measured variables of the proposed construct are theorized to be higher than those hypothesized to be unrelated to the construct (Cunningham, 2010, p6-4). In the test for discriminant validity proposed by Fornell and Larker (1981, p46), the average variance extracted from the measured variables of two latent variables must be greater than the square of the correlations between the two variables. Each pair of latent variables in the model was tested independently to assess discriminant validity. The use of the two different approaches to test for discriminant validity provided assessments of the relative strength of inter-correlations of the measured variables, and an assessment of the effects of measurement error on the relationships between the latent variables (Fornell and Larker, 1981, p46).

Table 4.76 displays the implied correlations for measured variables and the highest-level latent variables. The data shows that correlations between the measured variables hypothesized to load on each specified latent variable exceed the correlations between measured variables hypothesized to be unrelated to the each specified latent variable. These tests support the discriminant validity of the latent variables.

Table 4.76 Implied correlations between measured variables and latent variables in the specified measurement model with n = 214.

Measured Variable	Operational Performance	Employee Absorptive Capacity	Customer Orientation	Logistics Integration	Learning Processes
LI2	.391	.518	.411	**.795**	.447
LI4	.365	.484	.384	**.742**	.417
LI5	.356	.471	.373	**.722**	.406
MK1	.224	**.679**	.350	.442	.503
MK2	.232	**.704**	.363	.459	.523
MK4	.235	**.711**	.367	.459	.523
WK2	.234	**.711**	.367	.463	.527
WK3	.232	**.704**	.363	.459	.523
LP-KC1	.289	.466	.380	.352	**.628**
LP-KC2	.348	.561	.457	.424	**.756**
LP-KC3	.345	.556	.453	.421	**.749**
LP-KC4	.332	.535	.436	.405	**.721**
LP-KI1	.290	.468	.382	.355	**.631**
LP-KI2	.251	.405	.330	.307	**.546**
CO1	.322	.369	**.715**	.370	.432
CO2	.376	.431	**.835**	.432	.505
CO5	.365	.418	**.810**	.419	.490
CO6	.334	.383	**.742**	.384	.449
P-S1	**.840**	.277	.378	.413	.386
P-S2	**.761**	.251	.343	.374	.350
P-S3	**.579**	.191	.261	.285	.266
P-C1	**.823**	.272	.371	.405	.379
P-C2	**.734**	.242	.331	.361	.338

(Measured variables hypothesized to load on each specified latent variable are highlighted in bold.)

Table 4.77 displays the results of the tests of discriminant validity of the specified latent variables in the full measurement model using the method of Fornell and Larker (1981). The data in the table confirms that all latent variables display discriminant validity using this method. Taken together, the results displayed in Tables 4.76 and 4.77 support the conclusion that the latent variables measure different constructs.

Table 4.77 Tests of discriminant validity among the specified highest-level latent variables of the full confirmatory factor analysis measurement model with n = 214.

Latent Variable	Latent Variable	Correlation between Latent Variables	Square of the Correlation between Latent Variables	Average Variance Extracted (AVE)	AVE less Square of Correlation	DV*
Logistics Integration	Operational Performance	.492	.242	.598	.356	Yes
Logistics Integration	Employee Absorptive Capacity	.652	.425	.605	.180	Yes
Logistics Integration	Customer Orientation	.517	.267	.586	.319	Yes
Logistics Integration	Learning Processes	.562	.316	.628	.312	Yes
Employee Absorptive Capacity	Operational Performance	.330	.109	.635	.526	Yes
Customer Orientation	Operational Performance	.451	.203	.616	.413	Yes
Learning Processes	Operational Performance	.460	.212	.658	.446	Yes
Customer Orientation	Employee Absorptive Capacity	.516	.266	.623	.357	Yes
Learning Processes	Employee Absorptive Capacity	.742	.551	.665	.114	Yes
Learning Processes	Customer Orientation	.605	.366	.645	.279	Yes

*DV = discriminant validity

The variances extracted and the internal reliabilities of the higher-level latent variables are shown in Table 4.78. All variances extracted are above the target threshold of .5 identified by Fornell and Larker (1981, p46) that ensures the construct captures a greater amount of the variance than is due to measurement error. All internal reliabilities are above the target threshold of .7 (Hinkin, 1995). These results suggest the higher-level latent variables in the measurement models display convergent validity (Fornell and Larker, 1981, p45).

Table 4.78 Measures of internal reliability of the higher-level latent variables in the measurement model with n = 214.

Latent Variable	Variance Extracted*	Construct Reliability*	Cronbach's Alpha**
Operational Performance	.628	.892	.872
Logistics Integration	.568	.798	.797
Employee Absorptive Capacity	.642	.900	.861
Customer Orientation	.604	.859	.856
Learning Processes	.687	.929	.867

*Based on the formula presented by Fornell and Larker (1981) using estimates from Amos 18; **Calculated in SPSS 18

4.4.8 Common Method Variance

Common method variance was tested using one of the procedures recommended by Podsakoff et al. (2003). The procedure introduces an unmeasured variable to the measurement model with direct effects on each of the measured variables. The aim is to examine whether the introduction of the common method variance variable improves the fit of the model and whether the re-specified model explains a substantially greater proportion of variance than the theoretical measurement model (Williams et al., 1989; Carlson and Perrewe, 1999; Carlson and Kacmar, 2000).

Table 4.79 displays the fit of the common method variance model. All fit statistics are acceptable and the overall model seems to display very good fit. The AIC was 419.705, which was lower than the accepted measurement model's previously reported estimate of 424.240, suggesting the common method variance variable improved the fit of the model marginally. This is consistent with the findings of other researchers (Carlson and Perrewe, 1999; Carlson and Kacmar, 2000). The variance extracted by the common method variance variable was 13% of the total. This proportion of extracted variance is also consistent with research that suggests the influence of common method variance is relatively benign in the present measurement model (Carlson and Perrewe, 1999; Carlson and Kacmar, 2000).

Table 4.79 Model fit statistics for the common method variance model using n=214.

Fit statistic	Model statistic	Criteria	Acceptable (Not)
Chi-square	209.705		
Degrees of freedom (DF)	194		
P	.209	Equal or > .05	
Bollen-Stine (B-S) p	.943	> .05	Acceptable
Mean of B-S distribution	NA		
Chi-square / DF	1.081	< 2	Acceptable
TLI	.994	Equal or > .95	Acceptable
CFI	.992	Equal or > .95	Acceptable
SRMR	NA	< .05	Acceptable
Standardized residual covariances	Peak = -1.433	< 2	Acceptable
RMSEA	.019	< .05	Acceptable
Lower bound of 90% CI*	.000	< .05	Acceptable
Upper bound of 90% CI*	.036	< .1	Acceptable
Pclose	1.000	> .05	Acceptable

*CI = two-sided confidence interval.

4.5 Structural Equation Modeling

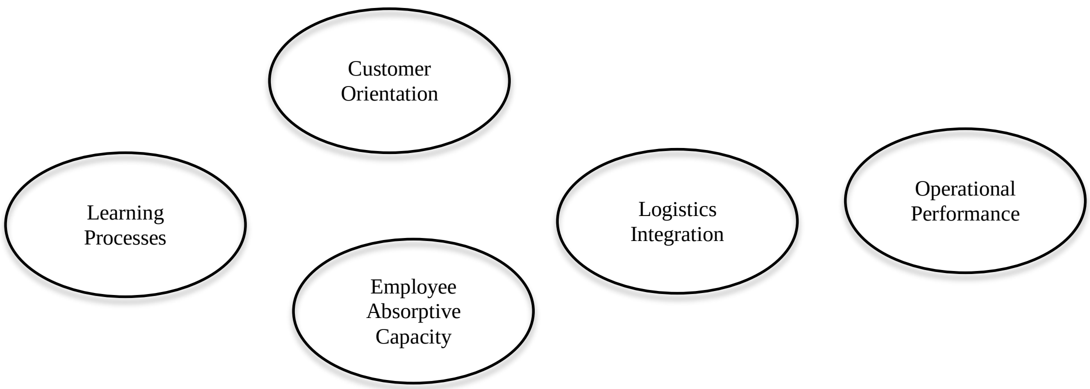
4.5.1 Analysis of fit of nested models

The null model and four nested models were tested as part of the structural equation modeling process. All models were based on the use of the latent variables and measured variables found to be acceptable during the process of testing the components of the measurement model. The difference in fit between the models was tested using the Chi-square difference test and AIC. The model with the best fit was selected as the accepted model (Anderson and Gerbing, 1988). This model was analyzed in detail as part of the hypothesis testing. Doing so provided an understanding of the relationships between the latent variables and their effects on operational performance.

4.5.2 The Null Model

The null model is the model in which all paths between latent variables of interest are set to zero (Anderson and Gerbing, 1988, p418). The null model initially produced a negative variance for a single error residual. This issue was resolved using the Rindskopf method presented by Dillon et al. (1987, p131). In this method, the variance of the offending error residual was fixed to one and the residual's factor loading was freely estimated. Figure 4.7 depicts the high-level latent variables in this this model.

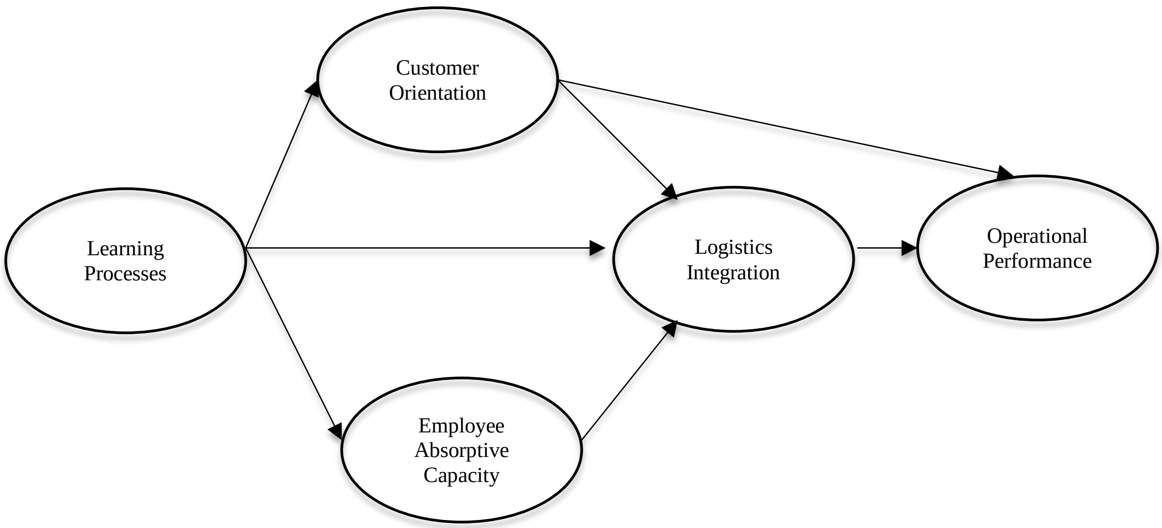
Figure 4.7 The Null Model depicting the high-level latent variables. Note there are no measured direct effects between the high-level latent variables.



4.5.3 The Theoretical Model

The theoretical model is the model in which all the hypothesized relationships presented in the literature review are freely estimated. The theoretical model is shown in Figure 4.8.

Figure 4.8 The theoretical model depicting the paths that were freely estimated between high-level latent variables.

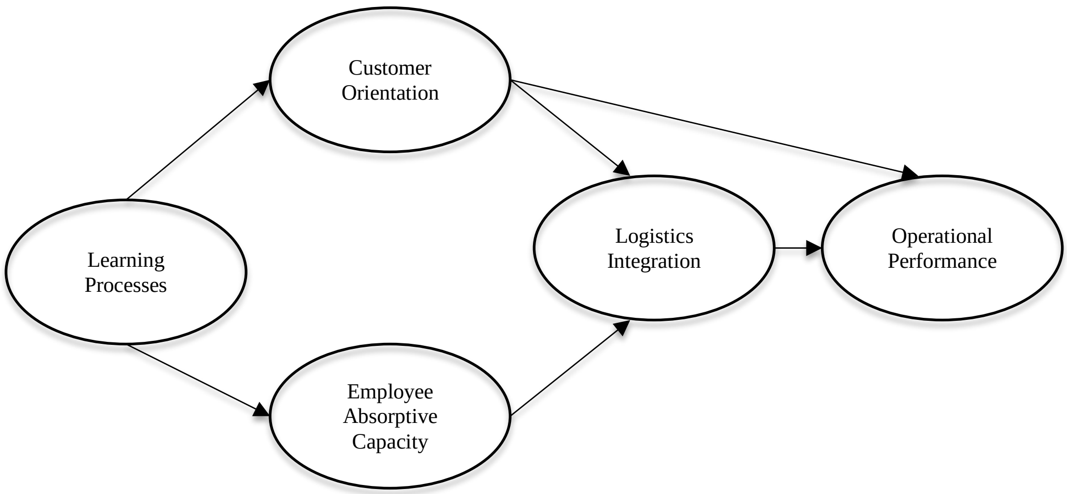


*Note that both direct and indirect relationships within the model were tested.

4.5.4 The Constrained Model

The freely estimated path from Learning Processes to Logistics Integration in the theoretical model was set to zero in the Constrained Model based on the work presented by Verona and Zollo (2011, Figure 24.1). In their model, dynamic capabilities have direct effects on the operating routines. Their model does not show direct effects from learning processes to operating routines. In the constrained model developed for the current research, customer orientation and employee absorptive capacity were modeled as dynamic capabilities, and Logistics Integration was modeled as the equivalent of the operating routines in the Verona and Zollo (2011) model. The constrained model is depicted in Figure 4.9.

Figure 4.9 The constrained model showing the hypothesized freely estimated paths between the high-level latent variables.

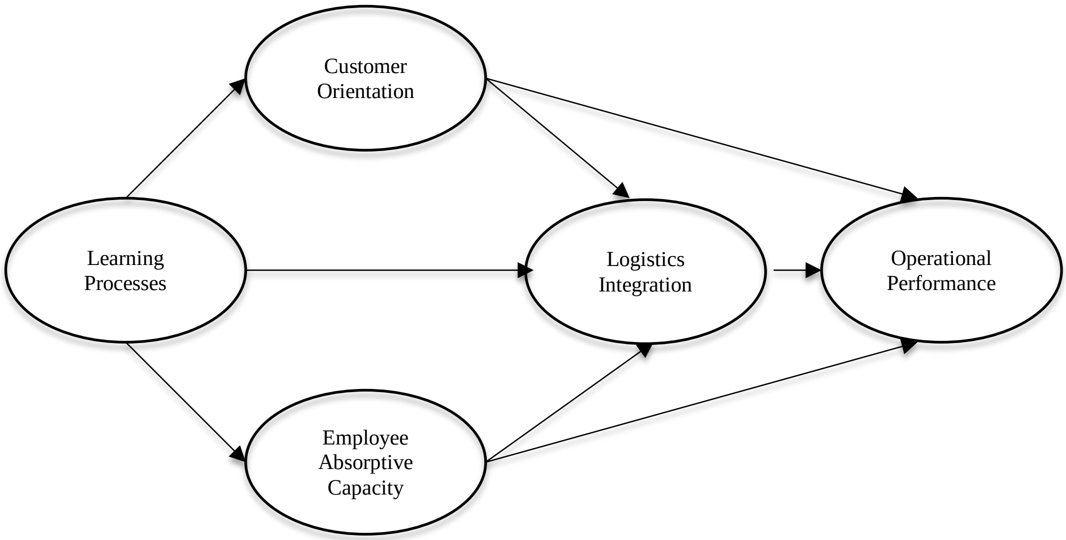


*Note that both direct and indirect relationships within the model were tested.

4.5.5 The Unconstrained Model

The unconstrained model extended the theoretical model by adding a direct effect from Employee Absorptive Capacity to Operational Performance. The addition of this direct effect was based on the ideas of Zahra and George (2002, Figure 1) and Todorova and Durisin (2007, Figure 3) who positioned absorptive capacities as dynamic capabilities with direct effects on performance. The idea that a dynamic capability can have a direct effect on operational performance is inconsistent with the strict theoretical idea that dynamic capabilities only directly influence zero-order operational capabilities (Zollo and Winter, 2002; Vera et al., 2011, Figure 8.3); however, it is consistent with recent thinking that some capabilities may take either dynamic or operational forms at different times (Helfat and Winter, 2011). In the context of a 3PL organization, one could envisage that employee absorptive capacities related to logistics or logistics technologies could directly influence cost or service parameters in ways that are unrelated to logistics integration. The unconstrained model is shown in Figure 4.10.

Figure 4.10 The unconstrained model showing freely estimated hypothesized paths between high-level latent variables.

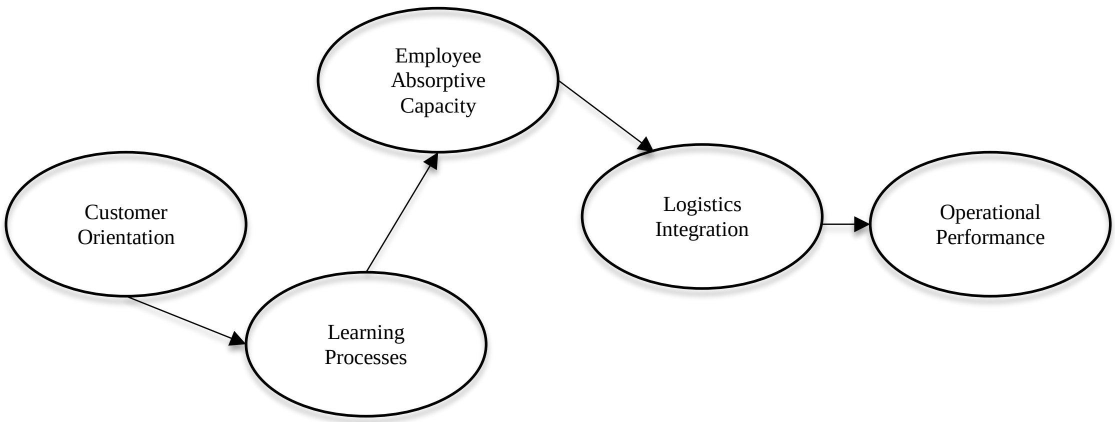


*Note that both direct and indirect relationships within the model were tested.

4.5.6 A variant of the model proposed by Ali et al. (2010)

Ali et al. (2010) presented a multi-level model to explain firm performance within a learning and capabilities environment. They hypothesized that market orientation had direct effects on learning processes and indirect effects on dynamic capabilities. Learning processes, in turn, had direct effects on dynamic capabilities, which had direct effects on substantive capabilities and indirect effects on firm performance. In their model, only substantive capabilities had direct effects on firm performance (Ali et al., 2010, Figure 1). The current research employed the customer orientation construct that formed one of three constructs in Narver and Slater's (1990) model of market orientation. The customer orientation construct could therefore be used as a proxy for market orientation to test whether the causal chain proposed by Ali et al.provided a better model fit than the fit of the other three models. The model presented by Ali et al. (2010, Figure 1) was based on the proposition that all direct effects on performance were generated via substantive capabilities, which in the present research were modeled using the latent variable, Logistics Integration. The model is shown in Figure 4.11.

Figure 4.11 Model based on Ali at al (2010), showing freely estimated hypothesized paths between high-level latent variables.



*Note that both direct and indirect relationships within the model were tested.

4.5.7 Identification of acceptable model

The fit of the five models is shown in Table 4.80. The multivariate score for kurtosis was 138.670 with a critical ratio of 29.10, which is in the range Gao et al. (2008) suggested was acceptable for structural equation modeling. The score suggests the Bollen-Stine p is the measure of significance that should be used to assess model fit. This score is in the range .810 to .821 for the Theoretical Model and its two derivative models indicating the fit for all three models was good. The score for the null model was .000 suggesting it had poor fit, which is what would be expected. The model based on propositions presented by Ali et al.recorded a Bollen-Stine p of .662 suggesting this model also had reasonable fit. However, its SRMR was excessive and the number of standardized residual covariances above 2 was substantial at 19, suggesting the model specification was causing problems with fit. In fact, the Chi-square difference of 21.205 between this model and the best of the other models, the Constrained Model, was significant both for the conventional calculation (DF difference = 2, p < .001), and at p < .01 using the differences in the bootstrap test statistics (Bollen and Stine, 1992, pp 217-221). The difference in AIC also favored the Constrained Model, as is shown in Table 4.80.

Table 4.80 Fit statistics of the (1) Null Model, (2) Theoretical Model, (3) Constrained Model, (4) Unconstrained Model, and (5) model based on Ali et al. (2010)

Fit statistic	**Criteria**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Chi-square		552.278	265.443	265.649	265.391	286.854
Degrees of freedom (DF)		227	220	221	219	223
P	Equal or > .05	.000	.019	.021	.018	.003
Bollen-Stine (B-S) p	> .05	.000	.815	.821	.810	.662
Mean of B-S distribution		287.985	281.092	282.797	280.068	285.150
Chi-square / DF	< 2	2.433	1.207	1.202	1.212	1.286
TLI	Equal or > .95	.861	.980	.980	.979	.972
CFI	Equal or > .95	.875	.983	.983	.982	.975
SRMR	< .05	.2541	.0466	.0469	.0468	.0715
Standardized residual covariances	< 2	>200 pairs exceed 2	1 pair exceeds 2	1 pair exceeds 2	1 pair exceeds 2	19 pairs exceed 2
RMSEA	< .05	.082	.031	.031	.032	.037
Lower bound of 90% CI*	< .05	.073	.013	.013	.014	.023
Upper bound of 90% CI*	< .1	.091	.044	.044	.044	.048
Pclose	> .05	.000	.994	.995	.993	.970
AIC	Lowest score is best	696.330	423.443	421.649	425.391	438.854

The Constrained Model had the lowest AIC. It was also the most parsimonious of the three models related to the Theoretical Model's specification. There were no significant Chi-square differences (p > .05) using the differences in the bootstrap test statistics (Bollen and Stine, 1992, pp 217-221), nor using the conventional Chi-square difference test (Unconstrained Model to Theoretical Model, DF difference = 1, p = .820; Unconstrained Model to Constrained Model, DF difference = 2, p = .879; Theoretical Model to Constrained Model, DF difference = 1, p = .649). This model was therefore selected for further analysis.

4.5.8 Tests of hypotheses

Tables R81, R82, R83 and R84 present unstandardized regression weights, standardized direct effects, standardized indirect effects, and standardized total effects for the Constrained Model, respectively. Tables R82A, R83A, and R84A present the lower bounds of the 95% confidence intervals for standardized direct effects, standardized indirect effects, and standardized total effects for the Constrained Model, respectively; tables R82B, R83B, and R84B present their upper bounds. The confidence intervals were calculated using 2000 bootstrap samples. Figure 4.12 depicts the supported relationships between the key variables in the Constrained Model. The results presented in the tables and in Figure 4.12 relating to the hypothesized relationships will be discussed in the sections that follow.

Table 4.81 shows that all parameters that were free to vary were statistically significant. Table 4.82 shows that all standardized factor loadings for latent variables were statistically significant at least at the level of .05. The standardized factor loadings on all measured variables were above .7 with the exception of P-S3, which had an estimate of 0.590. This estimate was within 0.001 of the factor loading estimate for the accepted confirmatory factor analysis model presented in Table 4.73. Similar trivial changes were observed for all measured variables, with the largest difference being .004 for LP-KI2, suggesting all constructs remained stable as the specification of the overall model changed (Anderson and Gerbing, 1988, p418). Table 4.83 shows that the indirect effects on the latent variables were also statistically significant to at least the level of .05; this was also true for the total effects on the latent variables, which are shown in Table 4.84.

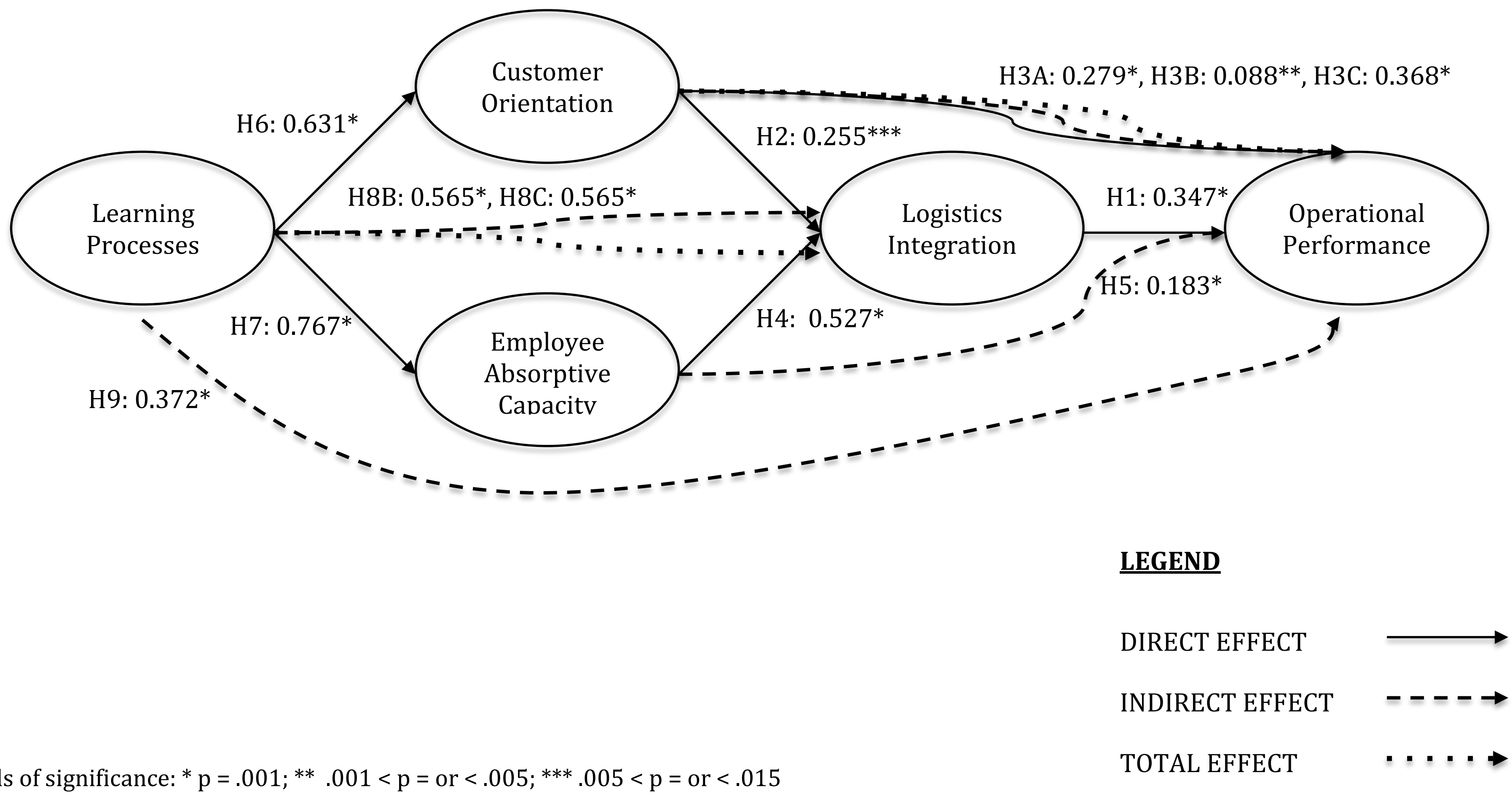
Table 4.81 Regression weights for direct effects in the Constrained Model

Latent or Measured Variable	Direction of Effect	Latent Variable	Factor Loading Estimate	Standard Error	Critical Ratio	Significance
CUSTOMER ORIENTATION	<	LEARNING PROCESSES	0.894	0.126	7.065	0.001
EMPLOYEE ABSORPTIVE CAPACITY	<	LEARNING PROCESSES	0.844	0.105	8.047	0.001
LOGISTICS INTEGRATION	<	CUSTOMER ORIENTATION	0.232	0.079	2.949	0.003
LOGISTICS INTEGRATION	<	EMPLOYEE ABSORPTIVE CAPACITY	0.618	0.116	5.341	0.001
OPERATIONAL PERFORMANCE	<	CUSTOMER ORIENTATION	0.242	0.076	3.179	0.001
OPERATIONAL PERFORMANCE	<	LOGISTICS INTEGRATION	0.329	0.089	3.711	0.001
MANAGER KNOWLEDGE	<	EMPLOYEE ABSORPTIVE CAPACITY	1			
WORKER KNOWLEDGE	<	EMPLOYEE ABSORPTIVE CAPACITY	1			
COST	<	OPERATIONAL PERFORMANCE	1			
SERVICE	<	OPERATIONAL PERFORMANCE	1			
KNOWLEDGE INTERNALIZATION	<	LEARNING PROCESSES	1			

Latent or Measured Variable	Direction of Effect	Latent Variable	Factor Loading Estimate	Standard Error	Critical Ratio	Significance
KNOWLEDGE CODIFICATION	<	LEARNING PROCESSES	1			
LI2	<	LOGISTICS INTEGRATION	1.059	0.109	9.7	0.001
LI4	<	LOGISTICS INTEGRATION	1.114	0.117	9.517	0.001
LI5	<	LOGISTICS INTEGRATION	1			
MK1	<	MANAGER KNOWLEDGE	0.837	0.062	13.411	0.001
MK2	<	MANAGER KNOWLEDGE	1.02	0.074	13.803	0.001
MK4	<	MANAGER KNOWLEDGE	1			
WK2	<	WORKER KNOWLEDGE	1.026	0.095	10.826	0.001
WK3	<	WORKER KNOWLEDGE	1			
CO1	<	CUSTOMER ORIENTATION	0.767	0.071	10.806	0.001
CO2	<	CUSTOMER ORIENTATION	0.899	0.069	13.122	0.001
CO5	<	CUSTOMER ORIENTATION	1			
CO6	<	CUSTOMER ORIENTATION	0.802	0.072	11.139	0.001
P-C1	<	COST	1			
P-C2	<	COST	0.911	0.066	13.87	0.001
P-S1	<	SERVICE	1			
P-S2	<	SERVICE	0.918	0.071	12.931	0.001

Latent or Measured Variable	Direction of Effect	Latent Variable	Factor Loading Estimate	Standard Error	Critical Ratio	Significance
P-S3	<	SERVICE	0.697	0.078	8.926	0.001
LP-KI1	<	KNOWLEDGE INTERNALIZATI ON	1.096	0.085	12.889	0.001
LP-KI2	<	KNOWLEDGE INTERNALIZATI ON	1			
LP-KC1	<	KNOWLEDGE CODIFICATION	1			
LP-KC2	<	KNOWLEDGE CODIFICATION	1.075	0.091	11.85	0.001
LP-KC3	<	KNOWLEDGE CODIFICATION	1.264	0.104	12.203	0.001
LP-KC4	<	KNOWLEDGE CODIFICATION	1.116	0.099	11.311	0.001

Figure 4.12 Graphical portrayal of the supported relationships between the key variables and the related hypotheses in the Constrained Model. Standardized direct, indirect and total effects are shown.



Levels of significance: * p = .001; ** .001 < p = or < .005; *** .005 < p = or < .015

Table 4.82 Standardized direct effects of the Constrained Model

Latent or Measured Variable	Latent Variables										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
EMPLOYEE ABSORPTIVE CAPACITY	0.767*	0	0	0	0	0	0	0	0	0	0
CUSTOMER ORIENTATION	0.631*	0	0	0	0	0	0	0	0	0	0
LOGISTICS INTEGRATION	0	0.527*	0.255***	0	0	0	0	0	0	0	0
OPERATIONAL PERFORMANCE	0	0	0.279**	0.347*	0	0	0	0	0	0	0
KNOWLEDGE CODIFICATION	0.884**	0	0	0	0	0	0	0	0	0	0
KNOWLEDGE INTERNALIZATION	0.658*	0	0	0	0	0	0	0	0	0	0
SERVICE	0	0	0	0	0.981*	0	0	0	0	0	0
COST	0	0	0	0	0.914*	0	0	0	0	0	0
WORKER KNOWLEDGE	0	0.917*	0	0	0	0	0	0	0	0	0
MANAGER KNOWLEDGE	0	0.848*	0	0	0	0	0	0	0	0	0

(Levels of significance shown as asterisks – see definitions at end of table). Latent Variables: 1 = Learning Processes, 2 = Employee Absorptive Capacity, 3 = Customer Orientation, 4 = Logistics Integration, 5 = Operational Performance, 6 = Knowledge Codification, 7 = Service, 8 = Cost, 9 = Knowledge Internalization, 10 = Worker Knowledge, 11 = Manager Knowledge. Levels of significance: * $p = .001$; ** $.001 < p$ = or $< .005$; *** $.005 < p$ = or $< .015$

Table 4.82A Standardized Direct Effects of the Constrained Model - Lower Bounds of 95% confidence interval calculated using 2000 bootstrap samples. * Variables as per previous table

Latent or Measured Variable	**Latent Variables***										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
EMPLOYEE ABSORPTIVE CAPACITY	0.604	0	0	0	0	0	0	0	0	0	0
CUSTOMER ORIENTATION	0.491	0	0	0	0	0	0	0	0	0	0
LOGISTICS INTEGRATION	0	0.299	0.071	0	0	0	0	0	0	0	0
OPERATIONAL PERFORMANCE	0	0	0.082	0.149	0	0	0	0	0	0	0
KNOWLEDGE CODIFICATION	0.78	0	0	0	0	0	0	0	0	0	0
KNOWLEDGE INTERNALIZATION	0.559	0	0	0	0	0	0	0	0	0	0
SERVICE	0	0	0	0	0.913	0	0	0	0	0	0
COST	0	0	0	0	0.841	0	0	0	0	0	0
WORKER KNOWLEDGE	0	0.813	0	0	0	0	0	0	0	0	0
MANAGER KNOWLEDGE	0	0.782	0	0	0	0	0	0	0	0	0

Table 4.82B Standardized Direct Effects of the Constrained Model - Upper Bounds of 95% confidence interval calculated using 2000 bootstrap samples. * Variables as per previous table

Latent or Measured Variable	Latent Variables*										
	1	2	3	4	5	6	7	8	9	10	11
EMPLOYEE ABSORPTIVE CAPACITY	0.906	0	0	0	0	0	0	0	0	0	0
CUSTOMER ORIENTATION	0.752	0	0	0	0	0	0	0	0	0	0
LOGISTICS INTEGRATION	0	0.749	0.445	0	0	0	0	0	0	0	0
OPERATIONAL PERFORMANCE	0	0	0.462	0.529	0	0	0	0	0	0	0
KNOWLEDGE CODIFICATION	0.975	0	0	0	0	0	0	0	0	0	0
KNOWLEDGE INTERNALIZATION	0.746	0	0	0	0	0	0	0	0	0	0
SERVICE	0	0	0	0	1.060	0	0	0	0	0	0
COST	0	0	0	0	0.979	0	0	0	0	0	0
WORKER KNOWLEDGE	0	1.019	0	0	0	0	0	0	0	0	0
MANAGER KNOWLEDGE	0	0.919	0	0	0	0	0	0	0	0	0

Table 4.83 Standardized indirect effects of the Constrained Model

Latent or Measured Variable	Latent Variables										
	1	2	3	4	5	6	7	8	9	10	11
EMPLOYEE ABSORPTIVE CAPACITY	0	0	0	0	0	0	0	0	0	0	0
CUSTOMER ORIENTATION	0	0	0	0	0	0	0	0	0	0	0
LOGISTICS INTEGRATION	0.565*	0	0	0	0	0	0	0	0	0	0
OPERATIONAL PERFORMANCE	0.372*	0.183*	0.088**	0	0	0	0	0	0	0	0
KNOWLEDGE CODIFICATION	0	0	0	0	0	0	0	0	0	0	0
KNOWLEDGE INTERNALIZATION	0	0	0	0	0	0	0	0	0	0	0
SERVICE	0.365*	0.179*	0.361*	0.340*	0	0	0	0	0	0	0
COST	0.340*	0.167*	0.336*	0.317*	0	0	0	0	0	0	0
WORKER KNOWLEDGE	0.704*	0	0	0	0	0	0	0	0	0	0
MANAGER KNOWLEDGE	0.651*	0	0	0	0	0	0	0	0	0	0

(Levels of significance shown as asterisks – see definitions at end of table). Latent Variables: 1 = Learning Processes, 2 = Employee Absorptive Capacity, 3 = Customer Orientation, 4 = Logistics Integration, 5 = Operational Performance, 6 = Knowledge Codification, 7 = Service, 8 = Cost, 9 = Knowledge Internalization, 10 = Worker Knowledge, 11 = Manager Knowledge. Levels of significance: * p = .001; ** .001 < p = or < .005; *** .005 < p = or < .015

Table 4.83A Standardized Indirect Effects of the Constrained Model - Lower Bounds of 95% confidence interval calculated using 2000 bootstrap samples. *Variables as per previous table

Latent or Measured Variable	**Latent Variables***										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
EMPLOYEE ABSORPTIVE CAPACITY	0	0	0	0	0	0	0	0	0	0	0
CUSTOMER ORIENTATION	0	0	0	0	0	0	0	0	0	0	0
LOGISTICS INTEGRATION	0.427	0	0	0	0	0	0	0	0	0	0
OPERATIONAL PERFORMANCE	0.267	0.073	0.029	0	0	0	0	0	0	0	0
KNOWLEDGE CODIFICATION	0	0	0	0	0	0	0	0	0	0	0
KNOWLEDGE INTERNALIZATION	0	0	0	0	0	0	0	0	0	0	0
SERVICE	0.262	0.071	0.180	0.150	0	0	0	0	0	0	0
COST	0.244	0.065	0.174	0.133	0	0	0	0	0	0	0
WORKER KNOWLEDGE	0.568	0	0	0	0	0	0	0	0	0	0
MANAGER KNOWLEDGE	0.511	0	0	0	0	0	0	0	0	0	0

Table 4.83B Standardized Indirect Effects of the Constrained Model - Upper Bounds of 95% confidence interval calculated using 2000 bootstrap samples. *Variables as per previous table

Latent or Measured Variable	**Latent Variables***										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
EMPLOYEE ABSORPTIVE CAPACITY	0	0	0	0	0	0	0	0	0	0	0
CUSTOMER ORIENTATION	0	0	0	0	0	0	0	0	0	0	0
LOGISTICS INTEGRATION	0.699	0	0	0	0	0	0	0	0	0	0
OPERATIONAL PERFORMANCE	0.477	0.335	0.191	0	0	0	0	0	0	0	0
KNOWLEDGE CODIFICATION	0	0	0	0	0	0	0	0	0	0	0
KNOWLEDGE INTERNALIZATION	0	0	0	0	0	0	0	0	0	0	0
SERVICE	0.47	0.327	0.531	0.523	0	0	0	0	0	0	0
COST	0.442	0.308	0.493	0.480	0	0	0	0	0	0	0
WORKER KNOWLEDGE	0.836	0	0	0	0	0	0	0	0	0	0
MANAGER KNOWLEDGE	0.765	0	0	0	0	0	0	0	0	0	0

Table 4.84 Standardized total effects of the Constrained Model

Latent or Measured Variable	Latent Variables										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
EMPLOYEE ABSORPTIVE CAPACITY	0.767*	0	0	0	0	0	0	0	0	0	0
CUSTOMER ORIENTATION	0.631*	0	0	0	0	0	0	0	0	0	0
LOGISTICS INTEGRATION	0.565*	0.527*	0.255***	0	0	0	0	0	0	0	0
OPERATIONAL PERFORMANCE	0.372*	0.183*	0.368*	0.347*	0	0	0	0	0	0	0
KNOWLEDGE CODIFICATION	0.884**	0	0	0	0	0	0	0	0	0	0
KNOWLEDGE INTERNALIZATION	0.658**	0	0	0	0	0	0	0	0	0	0
SERVICE	0.365*	0.179*	0.361*	0.340*	0.981*	0	0	0	0	0	0
COST	0.340*	0.167*	0.336*	0.317*	0.914*	0	0	0	0	0	0
WORKER KNOWLEDGE	0.704*	0.917*	0	0	0	0	0	0	0	0	0
MANAGER KNOWLEDGE	0.651*	0.848*	0	0	0	0	0	0	0	0	0

(Levels of significance shown as asterisks – see definitions at end of table). Latent Variables: 1 = Learning Processes, 2 = Employee Absorptive Capacity, 3 = Customer Orientation, 4 = Logistics Integration, 5 = Operational Performance, 6 = Knowledge Codification, 7 = Service, 8 = Cost, 9 = Knowledge Internalization, 10 = Worker Knowledge, 11 = Manager Knowledge. Levels of significance: * p = .001; ** .001 < p = or < .005; *** .005 < p = or < .015

Table 4.84A Standardized Total Effects of the Constrained Model - Lower Bounds of 95% confidence interval calculated using 2000 bootstrap samples. *Variables as per previous table

Latent or Measured Variable	Latent Variables*										
	1	2	3	4	5	6	7	8	9	10	11
EMPLOYEE ABSORPTIVE CAPACITY	0.604	0	0	0	0	0	0	0	0	0	0
CUSTOMER ORIENTATION	0.491	0	0	0	0	0	0	0	0	0	0
LOGISTICS INTEGRATION	0.427	0.299	0.071	0	0	0	0	0	0	0	0
OPERATIONAL PERFORMANCE	0.267	0.073	0.184	0.149	0	0	0	0	0	0	0
KNOWLEDGE CODIFICATION	0.780	0	0	0	0	0	0	0	0	0	0
KNOWLEDGE INTERNALIZATION	0.559	0	0	0	0	0	0	0	0	0	0
SERVICE	0.262	0.071	0.18	0.150	0.913	0	0	0	0	0	0
COST	0.244	0.065	0.174	0.133	0.841	0	0	0	0	0	0
WORKER KNOWLEDGE	0.568	0.813	0	0	0	0	0	0	0	0	0
MANAGER KNOWLEDGE	0.511	0.782	0	0	0	0	0	0	0	0	0

Table 4.84B Standardized Total Effects of the Constrained Model - Upper Bounds of 95% confidence interval calculated using 2000 bootstrap samples.

Latent or Measured Variable	**Latent Variables**										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
EMPLOYEE ABSORPTIVE CAPACITY	0.906	0	0	0	0	0	0	0	0	0	0
CUSTOMER ORIENTATION	0.752	0	0	0	0	0	0	0	0	0	0
LOGISTICS INTEGRATION	0.699	0.749	0.445	0	0	0	0	0	0	0	0
OPERATIONAL PERFORMANCE	0.477	0.335	0.53	0.529	0	0	0	0	0	0	0
KNOWLEDGE CODIFICATION	0.975	0	0	0	0	0	0	0	0	0	0
KNOWLEDGE INTERNALIZATION	0.746	0	0	0	0	0	0	0	0	0	0
SERVICE	0.470	0.327	0.531	0.523	1.06	0	0	0	0	0	0
COST	0.442	0.308	0.493	0.480	0.979	0	0	0	0	0	0
WORKER KNOWLEDGE	0.836	1.019	0	0	0	0	0	0	0	0	0
MANAGER KNOWLEDGE	0.765	0.919	0	0	0	0	0	0	0	0	0

Table 4.85 displays the squared multiple correlations of the Constrained Model. Results relevant to the higher-level latent variables, as they relate to the hypothesized relationships, will be discussed in the sections that follow. The table highlights that the estimates for all measured variables with the exceptions of the variables, LP-KC1 and P-S3, are above .5, and that the upper bound of the 95% confidence interval reaches at least this level for all variables. The table also shows that all estimates are statistically significant at least at the level of .002.

Table 4.85 Squared multiple correlations of the Constrained Model

Latent or Measured Variable	Estimate	Lower Bound of 95% Confidence Interval	Upper Bound of 95% Confidence Interval	P
EMPLOYEE ABSORPTIVE CAPACITY	0.589	0.365	0.821	0.001
CUSTOMER ORIENTATION	0.398	0.241	0.565	0.001
LOGISTICS INTEGRATION	0.472	0.294	0.655	0.002
OPERATIONAL PERFORMANCE	0.297	0.162	0.444	0.002
KNOWLEDGE CODIFICATION	0.781	0.608	0.951	0.002
SERVICE	0.962	0.834	1.124	0.001
COST	0.835	0.708	0.958	0.001
KNOWLEDGE INTERNALIZATION	0.433	0.312	0.556	0.001
WORKER KNOWLEDGE	0.841	0.660	1.038	0.001
MANAGER KNOWLEDGE	0.719	0.612	0.844	0.001
LP-KC1	0.490	0.360	0.615	0.002
LP-KC2	0.702	0.583	0.805	0.001
LP-KC3	0.694	0.561	0.805	0.001
LP-KC4	0.643	0.518	0.741	0.001
LP-KI1	0.920	0.740	1.086	0.001
LP-KI2	0.678	0.568	0.794	0.001
P-S1	0.730	0.620	0.832	0.001
P-S2	0.597	0.459	0.720	0.001
P-S3	0.349	0.209	0.500	0.001
P-C1	0.813	0.705	0.921	0.001
P-C2	0.651	0.512	0.766	0.001
CO1	0.509	0.366	0.631	0.001

Latent or Measured Variable	Estimate	Lower Bound of 95% Confidence Interval	Upper Bound of 95% Confidence Interval	P
CO2	0.696	0.584	0.784	0.002
CO5	0.659	0.536	0.761	0.001
CO6	0.549	0.412	0.662	0.002
WK2	0.600	0.443	0.738	0.001
WK3	0.586	0.461	0.710	0.001
MK1	0.638	0.477	0.769	0.001
MK2	0.688	0.592	0.786	0.002
MK4	0.699	0.568	0.801	0.002
LI2	0.632	0.503	0.736	0.002
LI4	0.551	0.380	0.698	0.002
LI5	0.521	0.375	0.646	0.001

4.5.8.1 Hypothesis 1: 3PL Logistics Integration positively directly influences 3PL Operational Performance

The Constrained Model was specified with Logistics Integration acting directly on Operational Performance. Logistics Integration was positioned as the operational capability within the theoretical frameworks of Zollo and Winter (2002), Vera et al. (2011) and Verona and Zollo (2011). As such, Logistics Integration was hypothesized to have a positive effect on Operational Performance.

Table 4.81 presents the unstandardized direct effect factor loading estimate of Logistics Integration on Operational Performance. The estimate was 0.329 with a standard error of .089, a critical ratio of 3.711, and a level of significance of .001. Table 4.82 shows that the standardized direct effect factor loading estimate of Logistics Integration on Operational Performance was 0.347, which was also significant at the level of .001. Since there were no indirect effects of Logistics Integration on Operational Performance, the total effects were equivalent to the direct effect, supporting the acceptance of hypothesis 1.

4.5.8.2 Hypothesis 2: Customer Orientation positively directly influences 3PL Logistics Integration

The Constrained Model was specified with a direct effect from Customer Orientation to Logistics Integration. This form of the model reflected the theoretical position of Customer Orientation as a dynamic capability and the hypothesis that a more effective understanding of customer requirements and strategies would enhance the alignment and effectiveness of Logistics Integration capabilities (Narver and Slater, 1990; Teece, 2007). Table 4.81 shows that the unstandardized regression weight was 0.232, with a standard error of 0.079, a critical ratio of 2.949 and a significance of 0.003. Table 4.82 presents the standardized regression weight at 0.255, which was significant at the level of 0.015. Table 4.84 shows the same results for the standardized total effects of Customer Orientation on Logistics Integration. These results led to the acceptance of hypothesis 2.

4.5.8.3 Hypothesis 3

4.5.8.3.1 H3A: Customer Orientation positively directly influences 3PL Operational Performance

The specification of Customer Orientation with a direct effect on Operational Performance was justified on the basis of the hypothesis that its influence on performance extends beyond its effects on Logistics Integration. The theoretical position that capabilities may take multiple forms from time to time (Helfat and Winter, 2011) supports this hypothesis whereas the results of Hult et al. (2005) fails to support it. If the hypothesis were incorrect, the results would imply that Logistics Integration fully mediates the effects of Customer Orientation on Operational Performance, whereas if it were correct it would suggest other factors also mediate the relationship (see Baron and Kenny, 1986, p1176).

Table 4.81 displays the unstandardized direct effect regression weight for Customer Orientation on Operational Performance. The factor loading estimate was 0.242, with a standard error of 0.076, a critical ratio of 3.179, and a significance level of .001. Table 4.82 presents the standardized regression weight for the relationship, which was 0.279 and was significant at .005. Hypothesis 3A was accepted based on these results.

4.5.8.3.2 H3B: Customer Orientation positively indirectly influences 3PL Operational Performance

The indirect effects of Customer Orientation on Operational Performance were hypothesized to be the result of mediating effects of Logistics Integration. Table 4.83 shows that the standardized indirect effect estimate was 0.088. This effect was significant at .005, supporting the acceptance of hypothesis 3B.

4.5.8.3.3 H3C: Customer Orientation positively influences 3PL Operational Performance

The total effects of Customer Orientation on Operational Performance are the sum of its direct and indirect effects. Table 4.84 shows that the standardized total effects estimate was 0.368 with a significance level of .001. Reflecting on the contributions of both the direct effect and the indirect effect of Customer Orientation on Operational Performance to its total effects highlights that the direct effect is substantially larger than that of its indirect effect via Logistics Integration. Overall, the total effects were significant and positive, supporting the acceptance of hypothesis 3C.

4.5.8.4 Hypothesis 4: Employee Absorptive Capacity positively directly influences 3PL Logistics Integration

The Constrained Model was specified with a direct effect from Employee Absorptive Capacity on Logistics Integration on the basis that the former was acting as a dynamic capability (Zahra and George, 2002). This approach conforms to the broader strategic framework discussed previously where dynamic capabilities act to effect change to operating capabilities (Zollo and Winter, 2002; Helfat and Winter, 2011; Vera et al., 2011).

Table 4.82 shows that the direct effect factor loading estimate was 0.527, which was significant at 0.001. There were no indirect effects of Employee Absorptive Capacity on Logistics Integration so the total effects were equivalent to the direct effect, as are highlighted in Table 4.84. Hypothesis 4 was accepted on the basis of these results.

4.5.8.5 Hypothesis 5: Employee Absorptive Capacity positively indirectly influences 3PL Operational Performance

Employee Absorptive Capacity was hypothesized to have an indirect effect on Operating Performance via the mediator, Logistics Integration. No direct effect of Employee Absorptive Capacity on Operating Performance was specified in the Constrained Model. This specification was consistent with Employee Absorptive Capacity acting as a dynamic capability within the theoretical framework discussed previously (see especially Vera et al., 2011).

Table 4.83 shows that the standardized indirect effect of Employee Absorptive Capacity on Operating Performance was 0.183, which was significant at the level of .001. The fact that no direct effect was specified meant that the total effect was equivalent to the indirect effect, which is highlighted in Table 4.84. These results supported the acceptance of hypothesis 5.

4.5.8.6 Hypothesis 6: Learning Processes positively directly influence Customer Orientation

Tables 4.81 and 4.82, 4.82A and 4.82B display the results for the direct effects of Learning Processes on Customer Orientation in the Constrained Model. Both the unstandardized direct effect and the standardized direct effect were significant at .001. The standardized direct effect was .631. Table 4.85 shows that the squared multiple correlation for Customer Orientation was .398, again significant at .001, indicating that Learning Processes explain 39.8% of its variance (Dillon et al, 1987, p131). These data support hypothesis 6, which was therefore accepted.

4.5.8.7 Hypothesis 7: Learning Processes positively directly influence Employee Absorptive Capacity

Learning Processes were also specified to act directly on Employee Absorptive Capacity in the Constrained Model. Tables 4.81 and 4.82 highlight that both the unstandardized direct effect and the standardized direct effects were significant at .001, with loadings of 0.844 and 0.767, respectively. The direct effect of Learning Processes on Employee Absorptive Capacity was therefore greater than direct effect of Learning Processes on Customer Orientation. The direct effect of Learning Processes explained a total of 58.9% of the variance of Employee Absorptive Capacity (see Table 4.85). These results led to the acceptance of hypothesis 7.

4.5.8.8 Hypothesis 8

4.5.8.8.1 H8A: Learning Processes positively directly influence 3PL Logistics Integration (Theoretical and Unconstrained Models only)

Direct effects of Learning Processes on Logistics Integration were only modeled in the Theoretical and Unconstrained Models. The effect was constrained to zero in the Constrained Model. The Theoretical and Unconstrained models were consequently less parsimonious than the Constrained Model, though the fit statistics of all three models were acceptable, as was highlighted in Table 4.80. The unstandardized and standardized results for the Theoretical and Unconstrained Models are shown in Tables 4.86 and 4.87 for completeness. The factor loading estimates are very close for the two models, providing further confirmation of the unidimensional characteristics of the latent variables (Anderson and Gerbing, 1988, p418). The tables highlight that the direct effect of Learning Processes on Logistics Integration is not significant in either model, leading to the rejection of hypothesis 8A.

Table 4.86 Regression weights in the Theoretical Model and the Unconstrained Model for the direct effect of Learning Processes on Logistics Integration

Latent or Measured Variable	Direction of Effect	Latent Variable	Factor Loading Estimate	Standard Error	Critical Ratio	Significance
LOGISTICS INTEGRATION (Theoretical Model)	<	LEARNING PROCESSES	0.102	0.223	0.457	0.648
LOGISTICS INTEGRATION (Unconstrained Model)	<	LEARNING PROCESSES	0.107	0.223	0.478	0.633

Table 4.87 Standardized direct effects in the Theoretical Model and the Unconstrained Model for the direct effect of Learning Processes on Logistics Integration

Latent Variable	LOGISTICS INTEGRATION (Theoretical Model)		LOGISTICS INTEGRATION (Unconstrained Model)	
	Factor Loading Estimate	Significance	Factor Loading Estimate	Significance
LEARNING PROCESSES	0.079	0.676	0.082	0.685

4.5.8.8.2 H8B: Learning Processes positively indirectly influence 3PL Logistics Integration

The standardized indirect effects of Learning Processes on Logistics Integration in the Unconstrained Model are shown in Tables 4.83, 4.83A and 4.83B. These effects were generated through the direct effects of Learning Processes on Customer Orientation and Employee Absorptive Capacity. The loading estimate for the indirect effects was 0.565, which was significant at .001, and led to hypothesis 8B being accepted.

4.5.8.8.3 H8C: Learning Processes positively influence 3PL Logistics Integration

The total effects of Learning Processes on Logistics Integration in the Constrained Model were equal to the indirect effects since the direct effects were constrained to zero. This result is confirmed in Tables 4.84, 4.84A and 4.84B and led to the acceptance of hypothesis 8C.

Table 4.85 displays the squared multiple correlation for Logistics Integration. The estimate was 0.472 with a significance level of 0.002. These results suggest that together Learning Processes, Customer Orientation, and Employee Absorptive Capacity have a substantial impact on Logistics Integration and explain 47.2% of its variance.

4.5.8.9 Hypothesis 9: Learning Processes positively indirectly influence 3PL Operational Performance

Learning Processes have indirect effects on Operational Performance but no direct effects since the Constrained Model was specified without the latter effects. This specification was the same for all models that were tested during this research project. The rationale for specifying the models in this way was based on the same theoretical concept for all models. To recap, this concept reflects the theoretical structural function of Learning Processes. They are conceptualized as drivers of change in dynamic capabilities. These capabilities, in turn, enable adjustments in operational capabilities, as required by changes within operational, competitive, environmental or technological environments, or as anticipated by managers to be required when executing new strategies, in order to generate positive effects on operational performance (Zollo and Winter, 2002; Ali et al., 2010; Vera et al, 2011; Verona and Zollo, 2011). In this context, the effects of Learning Processes on Operational Performance are generated through complex mechanisms that are unlikely to be identified using statistical approaches that fail to test for indirect effects (Sobel, 1987), and justify the use of structural equation modeling (Cheung and Lau, 2008).

Tables 4.83, 4.83A, 4.83B, 4.84, 4.84A and 4.84B display the results of the effects of Learning Processes on Operational Performance in the Constrained Model. The indirect loading estimate and the total effects were the same at 0.372, which was significant at .001, and led to the acceptance of Hypothesis 9.

Table 4.85 highlights that the squared multiple correlation of Operational Performance was 0.297, and that its 90% confidence interval ranged from 0.162 to 0.444, which was significant at .002. The results suggest that almost 30% of the variance of Operational

Performance was explained by the influence of Learning Processes, Customer Orientation, Employee Absorptive Capacity, and Logistics Integration. These results provide material support for the overall theoretical framework, as well as for its operationalization using the selected constructs, within the context of a 3PL environment.

4.5.8.10 Hypothesis 10 (Unconstrained Model only): Employee Absorptive Capacity positively directly influences 3PL Operational Performance

The Unconstrained Model tested an additional hypothesis that was not included in the Constrained or the Theoretical models. The hypothesis was based on the work of Zahra and George (2002, Figure 1) and Todorova and Durisin (2007, Figure 3). These authors presented absorptive capacities as dynamic capabilities with direct effects on performance. Hypothesis 10 therefore relates exclusively to the Unconstrained Model and is presented here only for completeness, given that the Constrained Model was the accepted model. Hypothesis 10 stated that Employee Absorptive Capacity positively directly influences Operational Performance.

Hypothesis 10 was not supported by the data. Table 4.88 shows that the unstandardized regression weight in the Unconstrained Model for the direct effect of Employee Absorptive Capacity on Operational Performance was -0.029, with a significance of 0.820. Table 4.89 shows that the standardized direct effect was -0.026, with a significance of 0.778. Hypothesis 10 was therefore not accepted.

Table 4.88 Regression weight in the Unconstrained Model for the direct effect of Employee Absorptive Capacity on Operational Performance

Latent or Measured Variable	Direction of Effect	Latent Variable	Factor Loading Estimate	Stan-dard Error	Critical Ratio	Significance
OPERATIONAL PERFORMANCE	<	EMPLOYEE ABSORPTIVE CAPACITY	-0.029	0.128	-0.228	0.820

Table 4.89 Standardized direct effect of Employee Absorptive Capacity on Operational Performance in the Unconstrained Model

Latent Variable	OPERATIONAL PERFORMANCE	
	Factor Loading Estimate	Significance
EMPLOYEE ABSORPTIVE CAPACITY	-0.026	0.778

4.6 Summary of support for hypotheses

Table 4.90 provides a summary of the research hypotheses and whether each was supported. Two hypotheses were not supported by the results; these were hypotheses restricted to the Theoretical Model and the Unconstrained Model. All hypotheses tested within the Constrained Model were supported.

4.7 Summary of Chapter

Chapter 4 provides an extensive level of detail relating to the analysis of the data that was collected from the participants. The early part of the chapter outlines how the data was initially examined and presents extensive descriptive statistics related to the sample. Appendix 7 provides additional graphics for the interested reader. The chapter presents detailed analyses of the confirmatory factor analyses associated with each construct. The structural equation modeling and testing of hypotheses associated with the preferred model is then presented in some detail. The chapter closes with a table summarizing the support for each hypothesis.

Table 4.90 Summary of support for hypotheses tested using structural equation modeling

Research Hypotheses	**Support for Hypothesis**
1. 3PL Logistics Integration directly influences 3PL Operational Performance in a positive manner	*Supported*
2. Customer Orientation directly influences 3PL Logistics Integration in a positive manner	*Supported*
3A. Customer Orientation directly influences 3PL Operational Performance in a positive manner	*Supported*
3B. Customer Orientation indirectly influences 3PL Operational Performance in a positive manner	*Supported*
3C. Customer Orientation positively influences 3PL Operational Performance	*Supported*
4. Employee Absorptive Capacity directly influences 3PL Logistics Integration in a positive manner	*Supported*
5. Employee Absorptive Capacity indirectly influences 3PL Operational Performance in a positive manner	*Supported*
6. Learning Processes directly influence Customer Orientation in a positive manner	*Supported*
7. Learning Processes directly influence Employee Absorptive Capacity in a positive manner	*Supported*
8A. Learning Processes directly influence 3PL Logistics Integration in a positive manner	*Not Supported*
8B. Learning Processes indirectly influence 3PL Logistics Integration in a positive manner	*Supported*
8C. Learning Processes positively influence 3PL Logistics Integration	*Supported*
9. Learning Processes indirectly influence 3PL Operational Performance in a positive manner	*Supported*
10. Employee Absorptive Capacity directly influences 3PL Operational Performance in a positive manner	*Not Supported*

CHAPTER 5: DISCUSSION OF RESULTS

5.1 Overview of Chapter 5

Chapter 5 examines the research results within the context of the relevant research literature and the key arguments presented in previous sections of the thesis. The discussion includes a brief examination of the relevance of model fit as well as the relevance of the results of each hypothesis. There is a brief section that provides short answers to the research questions. Contributions to knowledge and to management practice are presented in the Chapter that follows together with a discussion of the study's limitations and recommendations for further research.

5.2 Model fit

Five structural models and a fully saturated model were tested using the concept of tests of nested models presented by Anderson and Gerbing (1988). The models included

(1) the Null Model, which was specified as a model without structural paths between the high-level latent variables

(2) the core Theoretical Model

(3) the Unconstrained Model, in which an additional path was estimated

(4) the Constrained Model, which had a path set to zero

(5) a model based on the work of Ali et al. (2010), in which the direction of the relationship between Customer Orientation and Learning Processes was altered, and the direct effects of Customer Orientation on Logistics Integration and Operational Performance were removed, when compared with the Constrained Model, in which were specified to vary freely

(6) a fully saturated model that was tested as part of the confirmatory factor analysis assessments, as was recommended by Anderson and Gerbing (1988).

The results showed that the Constrained Model had the better model fit of the structural models. This was true using the AIC measures and using the assessment of model parsimony compared with the Theoretical Model and the Unconstrained Model. The Constrained Model displayed no significant differences in fit using the differences in the bootstrap test statistics or the conventional Chi-square difference test compared with the Theoretical Model and the Unconstrained Model. The Constrained Model had significantly better fit than the model based on the work of Ali et al, which displayed significant issues of model fit; the Ali et al.model was therefore not analyzed in detail. The Null Model had very poor fit, as might be expected (Anderson and Gerbing, 1988), and was consequently not examined in detail. These results justified the selection of the Constrained Model as the model to be used for assessment of the hypotheses for those paths that were tested in that model (Anderson and Gerbing, 1988). However, for completeness, the results of Hypotheses 8A and 10 were also presented in the results section, given the fit of the models, in which the relevant direct paths were estimated, were acceptable. The results for these hypotheses will also be discussed in this section of the thesis.

5.3 Relevance of results: research questions, hypothesis testing, and related literature

The accepted Constrained Model was presented graphically in Figure 4.12. The figure portrays the supported relationships between the key variables and the related hypotheses. The figure shows standardized direct, indirect and total effects. The relevance of these relationships will be discussed in the following sections.

5.3.1 3PLs affect operational performance by integrating their services with customers

Hypothesis 1 was accepted with the present research confirming that Logistics Integration has a direct positive effect on Operational Performance. The result corroborates recently published research relating to Logistics Integration (Paulraj and Chen, 2007; Olhager and Prajogo, 2012; Prajogo and Olhager, 2012) and extends the results obtained in those studies to customer integration and 3PL environments. The present result provides a positive answer to Research Question 2, which asked how the relationship between customer integration and operational performance holds in a 3PL environment; the results confirm that customer integration is critical to the performance of 3PL operations. In doing so, the present result supports the argument of Fabbe-Costes et al. (2009, p83) that 3PLs are capable of affecting supply chain performance by integrating their services effectively with their customers.

5.3.2 Customer oriented learning culture positively affects customer integration

The results section showed that Customer Orientation had a significant direct effect on Logistics Integration, which led to the acceptance of Hypothesis 2. This outcome suggests that when 3PLs have a good understanding of explicit and latent customer requirements, including the factors that affect customer satisfaction, and then orient their business objectives towards the delivery of services to meet those requirements, they are able to significantly influence the effectiveness of their integration of logistics operations with their customers. This result is similar to that recently reported by Rapp et al. (2010) for marketing based operations, where customer orientation had a significant direct effect on a “customer-linking capability” based on relationship management type indicators. Similarly, Braunscheidel and Suresh (2009) found that market orientation had positive direct effects on both internal and external integration, supporting the result within a supply chain environment. Viewed from a slightly different perspective, this result suggests that the efficacy of 3PL customer integration is significantly and directly affected by the degree to which the 3PL organization is oriented to satisfying the explicit and latent requirements of its customers. Narver et al. (1998) argued that the success of this orientation is reliant upon it being a core value of the organization (see also Deshpande et al., 1993; Narver and Slater, 1998; Hult et al., 2005). Braunscheidel and Suresh (2009, p135) made a similar point, arguing market orientation represented a cultural perspective. With the exception of these latter authors, such a culturally based influence on customer integration is not one that has been broadly discussed in the supply chain integration literature to date. The present result therefore reinforces an important perspective on our understanding of the mechanisms that enhance the efficacy of the customer integration capability.

The second aspect of this result that is interesting is the confirmation that Customer Orientation acts in the manner one would expect a dynamic capability to act to affect the operational capability of Customer Integration (see Zollo and Winter, 2002; Vera et al., 2011). This answers Research Question 1 and Research Question 4a. Eisenhardt and Martin (2000) sought to identify examples of dynamic capabilities within specific processes and routines that enable organizations to "…achieve new resource configurations as markets emerge, collide, split, evolve, and die …" (Eisenhardt and Martin, 2000, p1107). Their examples included product development routines, replication or adaptation of existing routines for new services, and the development of new thinking within firms (Eisenhardt and Martin, 2000, pp1107-1108). Teece (2007, pp1322-1323) also recognized this perspective within organizations as is evidenced in his discussion of the nature of dynamic capabilities. He stated quite explicitly that, "While certain individuals in the enterprise may have the necessary cognitive and creative skills, the more desirable approach is to embed scanning, interpretative, and creative processes inside the enterprise itself …" (Teece, 2007, p1323). Understanding explicit and latent customer requirements, the satisfaction of customers, and orienting business objectives to satisfy customer requirements clearly reflect such routines within 3PL operations and appear to positively affect the configurations of the operational capabilities associated with Customer Integration.

5.3.3 3PL investments in a customer oriented culture provide performance benefits

Hypothesis 3 comprised three parts relating to direct, indirect and total effects of Customer Orientation on Operational Performance. All three effects were positive and significant, thereby also elucidating mechanisms sought by asking Research Question 1 and Research Question 4(b).

The fact that the direct positive effect was present suggests that Logistics Integration does not fully mediate the effect of Customer Orientation on Operational Performance (Baron and Kenny, 1986). This result suggests there may be a direct role for Customer Orientation to influence Operational Performance or for the potential that other unmeasured factors mediate its effects (Baron and Kenny, 1986). Researchers have argued that market orientation has no "… 'lever' that can be pulled to directly increase performance. Thus, studies should cast market orientation within broader models, not simply link market orientation directly with performance ..." (Hult et al., 2005, p1179). This argument aligns with the idea that Logistics Integration, and one or more unmeasured factors, mediate the effects of Customer Orientation on Operational Performance observed in the present study. The measures of Customer Orientation used in the present study relate to: the degree to which business objectives reflect an orientation to customer satisfaction; monitoring of commitment to customer needs; measurement of customer satisfaction; and, attention to after sales service. These are all management activities and cultural levers that affect the consistency of behaviours within an organization (Narver and Slater, 1998, p235). Consistency sits at the heart of any true functional capability (Winter, 2003; Helfat and Winter, 2011) and is clearly relevant to operational performance within supply chains (Mason-Jones et al., 2000a, 2000b). The idea that cultural influences of Customer Orientation affect Operational Performance directly can therefore not be ruled out, since culture has long been known to have an influence on organizational performance (Deshpande et al., 1993; Deshpande and Farley, 2004).

The significant positive indirect effect of Customer Orientation on Operational Performance, via the mediator Logistics Integration, extends the argument that the performance effects of 3PL customer integration are materially affected by the degree to which the 3PL organization is oriented to satisfying the requirements of its customers. This indirect effect implies Logistics Integration is partly responsible for the Operational Performance effects of Customer Orientation; or put differently, Logistics Integration is a "lever" of the type to which Hult et al. (2005) referred when explaining performance effects of market orientation. The results confirm the causal sequence whereby Customer Orientation affects Logistics Integration, which, in turn, affects Operational Performance (Sobel, 1987, pp158-159). Drawing on Bunge's (1997, 2004) notions of a system, in this case a learning system, this sequence of effects reflects a learning mechanism within the broader learning system.

The foregoing sequence of effects provides further reinforcement for the idea that Customer Orientation acts in the manner of a dynamic capability. The sequence of effects answers part of Research Question 1. Customer Orientation acts as a first-order capability with direct effects on 3PL Logistics Integration, and indirect effects on 3PL Operational Performance, as the model of Vera et al. (2011) suggested would occur if Customer Orientation were a dynamic capability. Helfat and Winter (2011) made the point that building and retaining dynamic capabilities may involve significant investments in infrastructure, resources and specialized routines, that must lead to reductions in costs, increases in revenues or improvements in service levels to pay off. Results from the present research suggest 3PL investments in resources that build a customer oriented culture do pay off in performance terms, in part, by their effects on Logistics Integration. These effects may be derived from the knowledge that is gained through the investments in a deeper understanding of expressed or underlying needs of customer that lead to more effective integration with customers, or a more comprehensive perspective of the relevance of customer satisfaction that leads to adjustments in the services provided as part of the customer integration process, or a more effective perspective of the follow up that is required to smooth transitional initiatives (see Lieb and Miller, 2002, for a discussion of issues related to poor 3PL transitions).

5.3.4 Employee absorptive capacity positively affects customer integration

Hypothesis 4 proposed a direct positive effect of Employee Absorptive Capacity on Logistics Integration. This hypothesis was supported by the results of the present research, answering adding to the answer to Research Question 1 and providing a direct answer to Research Question 5(a).

Employee Absorptive Capacity is a key component of the broader construct of Absorptive Capacity, which also incorporates organizational communication networks, social integration networks and moderators that affect the efficacy of investments in learning capacities (Cohen and Levinthal, 1990; Zahra and George, 2002, Todorova and Durisin, 2007). A key rationale for limiting the focus of this study to Employee Absorptive Capacity was to better understand the specific contribution of individuals within a broader learning system. Lane et al. (2006, p853) specifically highlighted that this aspect of the absorptive capacity construct had received limited attention in the research literature to date. In a call to focus on the roles of individuals when examining absorptive capacity they stated that

"… what creates competitive advantage out of knowledge is the unique and valuable ways in which it is combined and applied. This uniqueness arises from the personal knowledge and mental models of the individuals within the firm, who scan the knowledge environment, bring the knowledge into the firm, and exploit the knowledge in products, processes, and services. In short, it is the firm's individual members who add the creativity needed to help the firm uniquely create value from new knowledge …" (Lane et al., 2006, p854).

Support for hypothesis 4 in this study reinforces the importance of Employee Absorptive Capacity within the overall learning system.

5.3.5 Performance effects of employee absorptive capacity are mediated by customer integration

Employee Absorptive Capacity had a positive indirect effect on Operational Performance. This result supports Hypothesis 5, extends the answer to Research Questions 1 and and answers Research Question 5(b). The result provides further reinforcement for the relevance of Employee Absorptive Capacity within the learning system and its importance to operational performance.

The result provides empirical evidence within a 3PL environment to support the argument of Jones (2006, p368) that organizational absorptive capacity relies upon individuals to exploit their knowledge effectively. Jones (2006) presented a case study in a manufacturing environment that highlighted the importance of using the knowledge of specific individuals effectively to implement change within well-established organizations. The present results imply that Logistics Integration mediates the operational performance effects of Employee Absorptive Capacity within 3PL environments. This causal chain (Sobel, 1987; Finch et al., 1997) highlights that deployment of knowledge of 3PL managers and first-line workers affects operational performance by influencing operational capabilities within the organization. The result therefore contributes empirical evidence to the close the critical gaps in our knowledge of the relationship between individual level absorptive capacity and the performance effects of organizational level constructs identified by Lane et al. (2006) and Volberda et al. (2010).

5.3.6 Learning processes positively influence customer oriented learning culture

Learning Processes had a significant direct effect on Customer Orientation supporting Hypothesis 6 and extending the answer to Research Question 1. The present model represents Customer Orientation as a dynamic capability (Zollo and Winter, 2002) that is positioned as a first-order capability within the broader learning system (Argyris, 2003; Vera et al., 2011) that forms a basis for the research in the present thesis. This positioning was initially supported by the results relating to hypotheses 2 and 3 in this study. The results relating to Hypothesis 6 extend that support. The results imply that organizational learning processes, reflecting knowledge codification and knowledge internalization, strongly influence organizational perspectives on customer needs and requirements, and organizational responses to those needs and requirements.

5.3.7 Learning processes positively influence knowledge stocks of employees

Learning Processes also had a very strong significant direct effect on Employee Absorptive Capacity, which supported Hypothesis 7 and adds further to the answer to Research Question 1. The positioning of Employee Absorptive Capacity as a dynamic capability at the first-order level within the broader learning system was initially supported by results relating to hypotheses 4 and 5. The result supporting Hypothesis 7 provides further evidence for the veracity of that positioning. The result supporting Hypothesis 7 suggests that organizational learning processes have a significant effect on employee knowledge used to deal with issues affecting the 3PL business.

The significant direct effect of Learning Processes on Employee Absorptive Capacity also addresses research gap 2 identified by Volberda et al. (2010, pp944-945). These researchers argued that the research literature lacked work that addressed the links between "managerial antecedents", such as knowledge development, and absorptive capacity, including the links to knowledge stocks of individuals. The present research directly links organizational learning processes with individual absorptive capacity to provide evidence that individual knowledge stocks are positively affected by knowledge codification and knowledge internalization processes.

5.3.8 Customer integration is indirectly influenced by learning processes

Hypothesis 8 examined the effects of Learning Processes acting on 3PL Logistics Integration. Both direct and indirect effects were examined, though not in the

Constrained Model. Hypothesis 8A was only modeled in the Theoretical and the Unconstrained Models; not in the Constrained Model, where the direct effect of Learning Processes on Logistics Integration was set to zero. Hypothesis 8A stated that, "Learning Processes positively directly influence 3PL Logistics Integration". The results did not support the hypothesized relationship in either the Theoretical Model or in the Unconstrained Model; both models presented statistically insignificant factor loading estimates (see Table 4.86 and Table 4.87). Hypotheses 8B and 8C were supported by the results in the Constrained Model. These hypotheses stated that, "Learning Processes positively indirectly influence 3PL Logistics Integration", and "Learning Processes positively influence 3PL Logistics Integration", respectively. Overall, these results provide an answer to Research Question 3(a) by demonstrating that the influence of Learning Processes on 3PL Customer Integration is positive; and demonstrates that this influence is indirect, via the mediation of Customer Orientation and Employee Absorptive Capacity, expanding the answer to Research Question 1.

As discussed in the literature review of this thesis, most of the research examining antecedents to customer integration focuses on the roles of internal or supplier integration. These types of analyses reinforce the concept of integrated supply chains (Schoenherr and Swink, 2012) but do not address the mechanisms that support change and evolution of customer integration in the way that learning mechanisms do (Argyris, 1976, 2003). Conceptually, internal and supplier integration form part of the integrated zero-order operating capability that is able to deal with low-level perturbations but is largely unable to change its form in the face of impending or explicit changes in external environments. Panayides (2007) is one of the few researchers to examine the effects of organizational learning on customer integration. His research demonstrated a positive direct effect of a second-level construct, "organizational learning", on "relationship orientation", a second-level relational construct with five first-level constructs, "trust", "bonding", "communication", "shared values", and "empathy". Panayides did not include any mediators within his framework relating organizational learning and relationship orientation. Braunscheidel and Suresh (2009) examined the effect of learning orientation on internal integration and external integration, comprising supplier integration and customer integration. Their results showed that learning orientation had a positive direct effect on internal integration but no significant direct effect on external integration. The authors argued that the strong positive link from internal integration to external integration made it likely that there was an indirect effect of learning orientation on external integration (Braunscheidel and Suresh, 2009, p130) but unfortunately the significance of this effect was not tested statistically. The present results therefore provide new insights into the mechanisms that cause and enable customer integration to function effectively.

The present results are also important at theoretical levels because they confirm that Learning Processes impact Logistics Integration through indirect mechanisms. The results align with the frameworks of multiple theoreticians who have drawn on the concepts of differential calculus to represent levels of capabilities that influence rates of change within organizations (see Winter, 2003). These academics have argued that second-order learning processes directly affect first-order capabilities, such as dynamic capabilities, which, in turn, affect zero-order operating capabilities. The learning framework presented by Zollo and Winter (2002) is one such framework supported by the present results. The results also support the arguments of Argyris (2003) that a key property of second-order, deutero-learning mechanisms is their influence on first-order, double-loop learning mechanisms, based on new perspectives of external environments; which, in turn, flow on to affect the single loop issues. The framework of Vera et al.

(2011, Figure 8.3) also presents the multi-level cascading influence of learning processes, merging the concepts of Argyris (2003) and Zollo (2003) to develop a learning model that influences operating capabilities. The present results provide empirical evidence these theoretical structures hold within 3PL environments.

5.3.9 Learning processes indirectly influence operational performance

Hypothesis 9 was based on the theoretical idea that Learning Processes act indirectly through mediators to affect Operational Performance (e.g., Vera et al., 2011). The results of the present study were positive and statistically significant, extending the answer to Research Question 1 and answering Research Question 3(b). Learning Processes act to influence Operational Performance through the levers of Customer Orientation, Employee Absorptive Capacity and Logistics Integration.

This is the first study the author is aware of that statistically confirms the indirect effects of Learning Processes on Operational Performance within the context of customer integration in general; and, Logistics Integration and 3PL environments, more specifically. Hult et al. (2006), using an interesting approach based on a resource-based view framework, tested knowledge elements within different strategy types to examine which combination of those knowledge elements affected various aspects of supply chain performance. However, these authors did not include any mediating levers that could explain how the application of the knowledge elements actually affected the supply chain performance factors. Hult et al. (2007) examined how knowledge development and a culture of competitiveness, which included a Learning Orientation construct, affected cycle time performance. Again, these authors tested for direct effects, including interactions and the moderating effect of market turbulence, but did not examine mediators that could explain the performance effects. Panayides (2007) measured direct effects of Organizational Learning on Logistics Service Quality in 3PL environments, but did not test the significance of the indirect effect via the mediator, Relationship Orientation. Braunscheidel and Suresh (2009) demonstrated a positive direct effect of Learning Orientation on Internal Integration in a sample of firms using the Institute of Supply Management database but failed to test for flow-on indirect effects on External Integration and Firm Supply Chain Agility to fully explain the active mechanisms enabling performance (see Sobel, 1987). Cheung et al. (2010) tested the direct effects of Relationship Learning on Relationship Value but did not examine any mediating levers. The theoretical models that inform the present study (e.g., Argyris, 2003; Vera et al., 2011) suggest Learning Processes act as second-order influences on Operational Performance and imply the need to examine the mechanisms (Bunge, 1997) or levers (as Hult et al, 2005, suggests for market orientation) that affect performance. The present study identified three such levers in Customer Orientation, Employee Absorptive Capacity, and Logistics Integration; though the study results suggest that only Customer Orientation and Logistics Integration affect Operational Performance directly. A key contribution of the present study is therefore the confirmation that the indirect effects of Learning Processes on Operational Performance are important. It follows that future studies should test for other potential mediators that can extend the explanation of how Learning Processes affect Operational Performance.

5.3.10 Employee absorptive capacity does not directly influence operational performance

Hypothesis 10 tested whether Employee Absorptive Capacity acts directly on Operational Performance, as well as through the mediator, Logistics Integration, which was examined via Hypotheses 4 and 5. Hypothesis 10 was only tested in the Unconstrained Model, where the relationship was found to be marginally negative and non-significant (see Tables 4.88 and 4.89). This result, in combination with the positive support for Hypotheses 4 and 5, suggests that Logistics Integration fully mediates the Operational Performance effects of Employee Absorptive Capacity (Baron and Kenny, 1986; Cheung and Lau, 2008). This result is interesting because it suggests there is a need to explicitly extend the theoretical models of Zahra and George (2002, Figure 1), Todorova and Durisin (2007, Figure 3), and Volberda et al. (2010, Figure 6), to explicitly include mediators that identify how absorptive capacity affects organizational performance. Again, drawing on the ideas of Bunge (1997, 2004), the result highlights the need to identify the mechanisms by which absorptive capacity affects organizational performance. The limitation in the present research model is, of course, that organizational elements, such as the social integration mechanisms of absorptive capacity proposed by Zahra and George (2002), were not included in the study. Nevertheless, the result reinforces the model proposed by Vera et al. (2011) that explicitly highlights the positioning of Absorptive Capacity as a first-order learning mechanism that acts on zero-order operating capabilities. By extension, the result also reinforces the need for researchers to reflect on the roles of absorptive capacity within a broader learning and sensing framework by highlighting that the knowledge of individuals is used indirectly to affect operational performance.

5.4 Short answers to Research Questions

Table 5.1 presents short answers to Research Questions raised in the Literature Review.

5.5 Summary of Chapter

Chapter 5 outlines how the research results fit in the context of the extant research literature and the theories presented in the literature review of the thesis. The discussion includes a summary of the relevance of model fit and of the results of each hypothesis. The chapter closes with a table containing short answers to the five ancillary research questions.

Table 5.1 Short answers to Research Questions

Research Question	Question	Short answer based on the present research
1	How do the relationships linking learning processes, dynamic capabilities, customer integration, and operational performance function in 3PL companies?	The present research has shown that there are both direct and indirect effects linking the factors of interest. Learning processes form the foundation for influence, reinforcing the effects of dynamic capabilities on customer integration and operational performance.
2	How is the known positive relationship between customer integration and operational performance achieved in a 3PL environment?	The present research found a direct, positive relationship. See results and discussions related to hypothesis H1.
3	How do learning processes positively influence (a) 3PL customer integration and (b) 3PL operational performance?	The research found positive indirect effects of learning processes on both of these dependent variables. See results and discussions related to hypotheses H8B and H9.
4	How does customer orientation influence (a) 3PL customer integration and (b) 3PL operational performance?	Customer orientation was found to directly affect both customer integration and operational performance. Customer orientation was also found to indirectly affect operational performance. See results and discussions related to hypotheses H2, H3A, H3B, and H3C.
5	How does learning capacity, in the form of employee absorptive capacity, influence (a) 3PL customer integration and (b) 3PL operational performance?	Employee absorptive capacity was found to positively directly affect customer integration and to positively, indirectly, affect operational performance. See results and discussions related to hypotheses H4 and H5.

CHAPTER 6: CONCLUDING REMARKS

6.1 Overview of Chapter 6

This chapter provides a summary of the overall study in section 6.2, and provides a brief answer to the high-level research question in section 6.3. Section 6.4 outlines the major contributions and section 6.5 presents the limitations of the study. Finally, section 6.6 presents proposals for further research.

6.2 Summary of the study

The third-party logistics industry is now embedded into the fabric of resources, industrial, manufacturing and retail industries across the world. The 3PL industry continues to grow in response to ongoing structural changes within the host industries. The motivation for initiating the present study grew from reflecting on the Relational View (Dyer and Singh, 1998) as a theory that could explain the benefits of customer integration in 3PL environments. The Relational View suggests inter-firm linkages make available ‘relational rents’, super-normal profits that emerge from specific arrangements between trading partners that eschew traditional transactional relationships in preference for exchange relationships. Research reviewed in the literature review of this thesis suggests the Relational View explains many of the observed benefits of customer integration. However, the combination of a group of observations highlighted below suggested that the Relational View might be insufficient, on its own, to explain why 3PLs are able to grow and prosper. These observations include that:

- 3PLs replace and manage large important logistics assets and resources within their customers’ supply chains (Large, 2007)

- 3PLs need to manage the outsourced assets and resources at least as well as their customers (Large, 2007; Handley, 2012)
- 3PLs must integrate with, and adapt to changes within, multiple supply chains to grow (Hertz and Alfredsson, 2003; Cui and Hertz, 2011; Huemer, 2012),
- there are many 3PLs that have grown to generate revenues of hundreds of millions of US dollars or more (Lieb, 2008; Lieb and Lieb, 2012), suggesting many of these companies manage hundreds of logistics operations for many different customers (e.g., Fabbe-Costes and Roussat, 2011)
- many traditional companies struggle to deal with major organizational changes (Lee, 2004), yet 3PLs must address these routinely to be able to grow
- 3PLs that have grown to generate hundreds of millions of US dollars or more need to be able to deal with significant organizational changes on an ongoing basis as their existing customers either initiate change within their core industries or respond to changes within those industries.

These observations led to the high-level research question that spawned subsidiary research questions and hypotheses:

> *How do 3PL companies serving multiple customers maintain effective levels of integration with their customers to positively influence operational performance?*

Theories of organizational evolution and learning were used to address the high-level research question (Zollo and Winter, 2002; Argyris, 2003; Winter, 2003; Vera et al., 2011). These theories move beyond the scope of the Relational View to advance the ideas that operating capabilities respond well to minor perturbations but are unable to deal with larger market or environmental changes. The latter changes need to be managed using dynamic capabilities, which have the role of adapting operating capabilities as major changes in markets or external environments are anticipated or addressed directly. The theories include the proposition that organizational learning mechanisms provide the underlying basis for organizations to adapt or anticipate changes in markets and external environments.

The theoretical foundations for the study were operationalized in a cross-sectional research design using five constructs, for which direct and indirect relationships were tested in order to answer the high-level research question and five subsidiary research questions. These constructs were operationalized using simple adaptations of items previously used in other research studies:

- 3PL learning processes
- 3PL customer orientation
- 3PL employee absorptive capacity
- 3PL logistics integration
- 3PL operational performance

More than 450 prospective participants were surveyed using an email and web-based survey technique in order to test the hypotheses and answer the research questions. These prospective participants were employees of a very large 3PL firm and its customers in Australia. A total of 214 responses were usable and employed in the final analyses. These analyses employed a recently developed structural equation modeling technique to test both direct and indirect relationships between five latent variables, which represented the constructs of interest.

6.3 Answer to the high-level research question

The study identified that 3PLs rely on logistics integration to drive operational performance. Logistics integration has a significant direct effect on operational performance. Three knowledge-related constructs, customer orientation, employee absorptive capacity, and learning processes have significant influence on both logistics integration and 3PL operational performance.

The results of the study suggest that 3PLs use learning mechanisms to maintain effective levels of integration with their customers. The core of these learning mechanisms is a set of effective learning processes that encourage employees and managers to articulate, document and share relevant, effective, ways of working. The learning processes have a significant positive influence on a customer oriented learning culture within 3PLs. This culture enables 3PLs to adapt their logistics integration capabilities in line with a deep understanding their customers to effectively influence operational performance. The learning processes also influence the knowledge stores of 3PL employees, enabling employees to positively influence logistics integration and operational performance. The study suggests that the combined effects of the learning mechanisms, and logistics integration with customers, enable 3PLs to maintain effective operational performance.

6.4 Key contributions of the study

6.4.1 Contributions to knowledge

The results of the current research project make multiple contributions to knowledge. The key contributions include the following:

1. The present study is, to the author's knowledge, the first study to examine the influence of an established theoretical learning framework on customer integration and performance. As mentioned in a previous section of this thesis, other studies have examined organizational learning effects on supply chain integration variables (e.g., Panayides, 2007, Braunsheidel and Suresh, 2009). However, this is the first study to systematically test whether specific learning variables and mechanisms act in accordance with extant organizational learning theories and frameworks (e.g., Argyris, 2003; Vera et al., 2011) to influence customer integration and performance. This finding is important to the customer integration literature because it provides a causal perspective of how organizations manage the evolution of their customer integration capabilities in order to maintain operational performance, in this particular case within a 3PL environment, but possibly more generally in other environments subject to ongoing change. The present results suggest that organizations adapt integration capabilities as they learn more about their customers' strategies and ways of working. These results substantially extend a body of work relating knowledge of customers to operational performance initiated almost twenty years ago by Slater and Narver (1995) by providing evidence of the direct and indirect mechanisms that generate the influence of customer orientation on operational performance. The indirect effects point to logistics integration as a 'lever' that is deployed when a customer-oriented culture is implemented, in the manner suggested by Hult et al. (2005). This result reinforces their argument that studies of performance effects of customer orientation, and market orientation more broadly, should include operational capabilities that directly influence operational performance. It is not sufficient to assume that customer orientation directly influences performance. However, the direct effects

observed in the current study are interesting because they suggest customer-oriented cultural influences affect performance independently of the 'lever'. One suggestion discussed in a foregoing section is that the cultural mechanism driving performance is the consistency that is engendered within the organization through the development of a strong customer oriented culture. This consistency may drive a self-reinforcing set of behaviours that enables the organization to deal effectively with market related perturbations in a way that is not possible in their absence. Unusual or unexpected changes within the customer base may be addressed more routinely, and beyond normal operational responses, within customer-oriented organizations than within those that do not reinforce this culture. These changes may not directly affect the operating capability. Instead these changes may influence cost related performance directly by reducing expenditure during planning periods on the basis of perceived changes within markets. Or they may affect achieved service levels by influencing changes in customer behaviour that improve operational scheduling or measurement of service levels. The point here is that the internal and external signaling effects of a strong customer-oriented culture potentially results in positive and powerful self-organizing behaviour that influences operational performance.

The results suggest learning processes form the foundation for the evolution of operational capabilities; it is the presence of effective learning processes that enables 3PLs to adapt to integrate effectively with their customers. This is a major contribution of the present study. Implementing learning processes within 3PL environments enables the 3PL operating capabilities to maintain relevance. In other words, the learning processes influence the manner in which logistics integration is deployed in 3PL environments. Sharing knowledge, both explicitly by articulating and documenting that knowledge, and tacitly, through the use of active mentoring, coaching and role transfers, has significant effects on the way in which logistics integration performs in 3PL environments. The present results imply that these learning processes do not stand-alone in some training universe with unknowable influences on operational performance. The learning processes influence performance by enhancing the knowledge of the 3PL employees. And they influence performance by enhancing the customer-oriented culture of 3PLs. Importantly, the learning processes act *through* organizational levers rather than directly on logistics integration or operational performance. This result means models and theories relating learning to operational performance should include the levers through which that effect occurs.

2. The accepted Constrained Model had very good model fit supporting the a priori theoretical causal sequence of effects. The sequence of effects was based on theoretical arguments relating learning mechanisms to operational capabilities and performance (Zollo and Winter, 2002; Argyris, 2003, Vera et al., 2011). To the author's knowledge, the present study is the first to demonstrate empirically that the sequence of relationships hold in a general manner, and specifically within a 3PL environment. The present results confirm the theoretical arguments linking the evolution of operational capabilities, dynamic capabilities and learning processes initiated by Zollo and Winter (2002), albeit in a limited 3PL context. Nevertheless, they provide empirical evidence of the mechanisms that link the factors. These results are important because they reinforce theoretical arguments that operational capabilities are subject to significant

influence by exogenous learning mechanisms. Put differently, the combination of the theory and the present results imply that there is substantial value associated with taking an integrated view of operational performance, operational capabilities and learning mechanisms. The two former variables do not operate independently of learning mechanisms within 3PL environments. The learning mechanisms reinforce and adapt the operating capabilities that enable 3PLs to integrate effectively with their customers. These effects, in turn, have a significant influence on operational performance.

3. Extending the foregoing point, the present study used a relatively recently developed statistical method (Cheung and Lau, 2008) to demonstrate the critical indirect effects of learning processes on logistics integration and operational performance, as well as the important indirect effects of customer orientation and employee absorptive capacity on operational performance. The results of the study demonstrated that it is not sufficient to simply link variables directly to performance because doing so fails to identify key causal mechanisms and levers. This contribution is very important because a substantial number of studies of learning mechanisms, within supply chain environments (e.g., Hult et al, 2006, 2007; Panayides, 2007; Braunscheidel and Suresh, 2009; Setia and Patel, 2013), and in other environments (e.g., Kale and Singh, 2007), as well as key theoretical contributions (e.g., Zahra and George, 2002; Todorova and Durisin, 2007), exclude the explanatory levers (Hult et al., 2005) or fail to test the critical indirect effects (Sobel, 1987; Finch et al., 1997) to fully explain how learning mechanisms influence operational performance. The present results suggest that theoretical models of dynamic capabilities (e.g., Zahra and George, 2002; Todorova and Durisin, 2007) should be adjusted to include the

explanatory mechanisms. They also suggest that theoretical frameworks of organizational learning and performance must include the mechanisms of influence in order to contribute to our understanding. Discussions of theories in these areas should also acknowledge the indirect effects of relevant variables, thereby enriching our understanding by acknowledging that mediation may include multiple factors and a sequence of steps. Modern structural equation modeling techniques are quite capable of dealing with these extended theoretical frameworks (Taylor et al., 2008).

4. Taking the point a step further still, the study also highlights the importance of closely considering the theoretical causal flows when building models and ensuring that alternative models are examined. Comparing the model fit of the accepted Constrained Model with that of the model based on the arguments of Ali et al. (2010) highlights that theoretical causal flows must be considered in a critical manner when examining direct and indirect effects. The model based on the arguments Ali et al. (2010), which reversed the effects of Learning Processes on Customer Orientation and removed the direct effects of Customer Orientation on Logistics Integration and Operational Performance, had acceptable model fit statistics using many accepted measures of model fit (see Shah and Goldstein, 2006); however, its fit was significantly poorer than that of the Constrained Model. This result presents a clear example in support of the argument of James (2008) that competing models based on alternative theories should be assessed as part of model testing. The important theoretical point here is that these results suggest that the mechanisms deployed in the Constrained Model should be used for further theory development rather than the mechanisms promoted by Ali et al. (2010). In this regard, the results support the logic of Farrell and

Oczkowski (2002), who argued that the values that underpin organizational learning 'shape' the manner in which organizations learn about their customers. To paraphrase these researchers, organizational learning processes cause 3PL organizations to 'tune' their customer orientation and customer integration practices. This insight is important in multiple literatures: it corroborates the original theorizing of Slater and Narver (1995), as well as subsequent related works by other researchers, about the relative influence of organizational learning and market orientation that was discussed in the literature review of this thesis; it reinforces the recent theorizing in the organizational learning literatures (e.g., Vera et al., 2011) relating learning mechanisms to dynamic capabilities and absorptive capacities; and, it extends the operations management literature that has embraced the role of learning (e.g., Panayides, 2007) and market orientation within a customer integration framework (e.g., Braunscheidel and Suresh, 2009).

5. Another contribution of the study is that it extends results demonstrating a positive effect of logistics integration on operational performance within supplier integration studies (Paulraj and Chen, 2007; Olhager and Prajogo, 2012; Prajogo and Olhager, 2012) to customer integration environments and 3PL environments. This result supports the relevance of the Relational View (Dyer and Singh, 1998) in 3PL environments: part of the reason 3PLs are successful is because their interaction with their customers creates value on its own. The Relational View suggests that this value is additional to that which logistics outsourcing companies would have created by remaining purely transaction oriented entities. The research literature support this interpretation. For example, Cui and Hertz (2011) report on the evolution of transport firms as they

become more entangled with their customers. Their observations suggest that these firms eventually build 3PL entities to ensure they are able to extract full value from their customer relationships.

6. The study specifically demonstrates the positive indirect influence of Employee Absorptive Capacity on Operational Performance; it shows that Logistics Integration mediates the significant effect of employee knowledge on operational performance. This result answers the calls of Lane et al. (2006) and Volberda et al. (2010) to explain how individual level knowledge influences organizational level variables and the outcomes influenced by those variables. The results also suggest that selection and ongoing development of employees are critical factors organizations must manage to ensure their integration capabilities continue to evolve. While this point seems obvious to any seasoned organizational researcher or manager, extant research literature does not reflect this importance with respect to contributions to performance (see Lane et al., 2006; Volberda et al., 2010). The results of the present study suggest that appropriately selected and trained employees interpret and adapt to 3PL operating environments more effectively than other employees. Employee knowledge matters in 3PL environments: 3PL operational performance is reliant on the knowledge employees apply to the underlying 3PL operating capabilities, in this case the logistics integration capabilities. Operating performance of 3PL companies is not simply reflective of investments in fixed assets and technologies. The results of the present study point to the potential high level returns from investments in appropriate employees as well. The present results therefore demonstrate the direct relevance of theoretical discussions relating

absorptive capacity to customer integration presented earlier in this thesis.

7. The results of the study highlight the strength of the influence of Learning Processes on Customer Orientation and Employee Absorptive Capacity. Since the latter variables reflect cultural aspects of knowledge (see Narver and Slater, 1998; Hult et al, 2005; Braunscheidel and Suresh, 2009) and knowledge stores (e.g., Tu et al., 2006; Volberda et al, 2010), respectively, the results imply Learning Processes have significant influences on both aspects of organizational knowledge. This result extends the work of Hult et al. (2004) who identified that 'information distribution activities' had a direct effect on 'shared meaning' in supply chain environments. While the development of knowledge stores through learning processes seems to be an obvious path, the development of cultural aspects of knowledge through the same mechanism seems less obvious. The results imply that organizations can extend their organizational culture in a very structured and methodical way. Articulating preferred ways of working, documenting them, then sharing them broadly through an array of knowledge sharing initiatives and structured programs within the organization will effectively embed the culture, making it sufficiently consistent that it has an performance enhancing impact upon operational capabilities.

8. Finally, extending the discussion relating to the first contribution, the present study highlights that learning mechanisms have substantial levels of influence on customer integration activities associated with Logistics Integration and the flow-on effects on Operational Performance. Many studies have previously examined the contributions of internal integration to customer integration and performance (for discussions see Chen et al., 2009, or Flynn et al., 2010). Some

work has also been completed related to organizational learning (Panayides, 2007; Braunscheidel and Suresh, 2009). However, the combined effects of direct and indirect influences of learning mechanisms on these variables have not previously been examined at a detailed level. The present study provides a view of the total effects (Sobel, 1987, Finch et al., 1997) of learning mechanisms on logistics integration and operational performance. The results imply that learning mechanisms play important roles with respect to the relevance of logistics integration in 3PL companies, and its consequent influence on operational performance. The results suggest structured learning processes will have substantial impact on the well being of 3PL firms. They imply that 3PL firms benefit from thinking deeply about how they operate and integrate with their customers. The results suggest that 3PL firms that formally use this developed knowledge in structured programs to ensure widespread dispersion of the insights will benefit substantially by driving down their cost structures and improving their service level performance. Extending these benefits suggests that such firms will also grow because of the market winning nature of these performance characteristics. Clearly, resourcing and building effective learning mechanisms therefore begins to generate a virtuous cycle of improvements that suggests these investments will be self-funding.

6.4.2 Contributions to management practice

The study also makes a number of key contributions to management practice. The key contributions include the following:

1. The study highlights the valuable contribution to operational performance of logistics integration in a 3PL environment. This result is important to 3PL managers who must consider the financial impacts as well as the service level

impacts of their investment decisions. The insights provided by the Relational View suggests that appropriate investments in logistics integration generate benefits beyond those available to 3PL firms operating on their own (see Dyer and Singh, 1998, p662). The integration investments enable access to new sources of innovation for 3PLs that tap into the innovation programs of their customers, new sources of cost reduction activities for 3PLs that collaborate with customers to remove complexity and inefficiencies from extended supply chains, and new sources of revenue for 3PLs that better understand the true needs and strategic initiatives of their customers.

2. The results of the study clearly demonstrate that investments in learning mechanisms have material positive operational and performance effects in 3PL environments. These results should provide 3PL managers with comfort that their investments in learning processes have positive, though indirect, effects on both factors. The foregoing argument that investments in learning mechanisms drive self-funding virtuous cycles of improvements should encourage 3PL managers to invest in appropriate learning mechanisms. Investments that grow revenues, reduce costs and enhance relationships with customers are difficult to identify in most stages of normal business cycles, which suggests that 3PL managers should spend strategically important investment dollars building effective internal learning mechanisms.

3. The results of the study highlight that efforts to understand customer requirements and to orient company culture to use that understanding effectively pay off in terms of logistics integration efficacy as well as operational performance. The results of the study showed that customer orientation has

significant positive effects on both logistics integration and operational performance. Managers of 3PL companies can use the insights from this study to implement more effective customer orientation practices. The present research suggests that managers should combine the use of customer satisfaction objectives with the development of specific business strategies that reflect their understanding of how to most effectively create value for their customers. They should also ensure they allocate resources to monitor their commitment to those objectives and strategies. Specifically, they would benefit from ensuring that they follow up on commitments to their customers. For example, this can be done through formal meetings and workshops with customers that are constituted to jointly improve specific aspects of 3PL operations or 3PL customers' supply chain operations. The current research suggests 3PL companies would also benefit from ongoing, routine, monitoring of customer satisfaction. Formal customer satisfaction surveys, individual interviews with executives of customers, and ongoing satisfaction tracking using operational staff may help build understanding of how well satisfied customers remain with respect to specific 3PL services. Overall, such comprehensive programs of management practices focusing on customers should drive broader cultural practices over time to facilitate and embed customer orientation within 3PL businesses.

4. The results point to the benefits of 3PL managers ensuring that business practices are focused on recruiting and retaining employees with high levels of skills (see Lieb and Lieb, 2012, for 3PL CEO perspectives on this issue). Employee knowledge had a significant positive direct effect on logistics integration and a significant indirect effect on operational performance. The critical relevance of these effects has been made earlier in this Chapter.

Nonetheless, there is value in reflecting on the practical issues relating to finding, selecting, inducting and orienting, and ensuring 3PL employees are retained within the business once they have been recruited. Done properly, this is a very time consuming and expensive process. The results of the present study suggest that employee knowledge is important to operational performance of 3PLs and to effective logistics integration with 3PL customers. The selection and retention process should therefore be given significant management support. Importantly, the fact that learning processes have a significant influence on the knowledge stores of employees suggests that it is critical that employees are provided with appropriate levels of support on an ongoing basis. Recruiting knowledgeable employees is a starting point. The learning processes are likely to continue to build valuable knowledge over time. The results of the current study make it clear that this knowledge is valuable to 3PL firms because it supports both integration with 3PL customers and 3PL operational performance.

5. Finally, the results should make it clear there is a need to build strong capabilities that enable skilled personnel to affect operational performance in a positive manner. The results of the study highlight that employees influence organizational performance indirectly, by acting to influence operational capabilities that have a direct influence on operational performance. Capabilities that support logistics integration are important capabilities for 3PLs to develop. The present results suggest that they have a significant influence on operational performance. The theory supporting the Relational View also implies that these capabilities provide a source of benefits unavailable through other means (Dyer and Singh, 1998). This knowledge should encourage 3PL managers to explore options to expand logistics integration capabilities. The literature review

presented earlier in the thesis provides many leads that 3PL managers can follow to do so. For example, the Relational View suggests that, subject to appropriate contractual safeguards being put in place, and subject to transaction volumes being supportive, managers will benefit from developing customer specific assets and services. These might be IT systems that enhance services for 3PL customers or materials handling systems that facilitate product shipments or safeguard product quality. Building knowledge sharing processes that facilitate deep development of employee knowledge is another avenue of enhancing customer integration capabilities. The knowledge sharing processes should encourage inter-organizational transparency and could leverage internal learning mechanisms, such as management workshops and conferences. The Relational View also suggests customer integration could be enhanced by effective provision of knowledge or skills that complement those that exist within the 3PL customers' organizations (see Dyer and Singh, 1998, Figure 1). Third-party logistics companies can use a customer-oriented culture to truly understand how they can build skills to complement those of their customers. The results of the current study suggest that investments in both the complementary skills and the customer-oriented culture will pay off for the 3PL firms.

6.5 Limitations of the study

This study has made important contributions to our knowledge of how learning mechanisms affect customer integration and operational performance. These contributions should influence both researchers and managers interested in the topics of study. Nevertheless, the study has a number of limitations.

The study focused on 3PL operations within a very large 3PL company in Australia. This approach was used in preference to a more general industry survey to address a very specific challenge by Ray et al. (2004): testing performance outcomes of the factors of interest at operational units within an organization. Doing so may remove the bias introduced by aggregation of positive and negative outcomes at operational levels that may be observed at business unit or higher levels of organizational aggregation (Ray et al., 2004, p25). However, the approach may place specific limitations on the generalizability of the results. The results may reflect practices unique to the individual organization studied. They may also reflect practices that were unique within the organization in 2010 when the data were collected. Counteracting these concerns are the strong levels of reinforcement of extant theory evidenced in the results. The study provides an initial step toward a broader understanding of the importance of learning mechanisms within customer integration research. The results should be examined within more extensive settings to confirm their generalizability to other 3PLs and other operations environments.

Business practices are known to vary across countries (e.g., Wallenburg et al., 2010; Childerhouse et al., 2011). Practices in Australian 3PLs may differ from those in other countries making the results specifically applicable only to Australian 3PL operations. Given the important contributions of the study, the author believes there is value in replicating the study in other countries. This is particularly relevant in 3PL settings since the outsourcing segment continues to grow globally, as was highlighted in the Introduction of this thesis.

Data access restrictions meant that measures of operational performance were reliant on the judgment of participants rather than objective data sets. This issue was addressed by closely managing issues related to common method variance (Podsakoff et al., 2003). The results suggested that common method variance was not a meaningful problem in this research. Nevertheless, it is an issue that readers should be aware of and provides an opportunity to extend or replicate the study.

The possibly controversial approach of aggregating the responses of 3PL employees with those of the employees of 3PL customers may have created doubt in the minds of some readers, despite the theoretical justification for the approach. Alternative research approaches, such as multi level structural equation modeling (Kline, 2011), may possibly be used to tease out the effects of the two types of employees while retaining a grouped perspective. The issue to consider will be one related to retaining the insights presented by the Relational View while accessing insights derived from the separate groups of participants.

The cross-sectional research design is usually more practical to implement than a longitudinal design. Yet it presents a number of limitations that are relevant to the current study. First, there is no opportunity to examine the actual evolution of operating capabilities associated with logistics integration when a cross sectional design is used. This lack of a temporal signal limits the degree to which we can advise practicing 3PL managers. Second, there is no opportunity to examine the time-phased nature of learning processes and the influence of time on the efficacy of learning mechanisms. We can only comment on the effect on covariance of factors associated with existing operations. Finally, the cross-sectional design does not enable us to tease out the time it takes organizational learning processes to influence the knowledge stores brought into the company by its employees. So there is a clear case to extend the study by using a longitudinal design rather than a cross-sectional design.

6.6 Recommendations for further research

There are a number of opportunities to extend this current research, some of which have already been presented in the foregoing section. Additional opportunities are presented in this section.

First, given the research was restricted to the 3PL environment, there are clear opportunities to extend the work to the broader supply chain environment. In a sense, this is a reversal of the call by Fabbe-Costes et al. (2009) to focus more closely on customer integration and operational performance in 3PLs, but in line with the recommendations of Selviaridis and Spring (2007, p140) for a bi-directional flow of theoretical ideas and perspectives. The rationale for extending the work into a broader environment is related to the fact that the framework tested in the present research has not been examined in a broader supply chain environment, yet is likely to provide important insights because of its broad theoretical base.

Second, examination of effects of environmental and market turbulence are natural extensions of the model that was tested. Such extensions will link the model directly with its theoretical origins within the literature focusing on change and strategic renewal (see Crossan et al., 1999; Zollo and Winter, 2002). Turbulence can be tested explicitly within 3PL environments as well as in more general supply chain environments. In a sense, this will explicitly prove the operational thesis that provided a major justification for the present study.

Third, the model that was tested was restricted to customer integration. Given that zero-order operating capabilities related to integration are likely to include aspects of internal integration and supplier integration (e.g., Flynn et al., 2010), additional insights relating the operational capabilities to the learning mechanisms are likely to be gained by also including these aspects into the model. This approach would also extend the insights of applying the Relational View within a broader set of environments.

Fourth, expansion of the range of constructs used to test learning mechanisms to include organizational components of absorptive capacity (see Lane et al., 2006; Volberda et al., 2010) are likely to provide greater insights into the nature of the mechanisms and how they affect integration and performance. Tests of interactions among key model variables may provide further insight into how the model behaves, especially under conditions of turbulence (Wong et al., 2011).

Finally, as raised in the previous section, longitudinal studies using more advanced statistical techniques should be considered, where resources to conduct such studies are available. Doing so should provide significant insights into the roles that are played by the learning mechanisms and how these differ over time from the roles of the different types of integration that affect operational performance.

APPENDICES

Appendix 1A - Pre-survey email notification to clients of 3PL Company

Invitation to participate in university research into the logistics industry

Hi

I am inviting you to participate in a university research project designed to increase our understanding of the logistics industry. I will be conducting a survey during September – October to better understand how to most effectively improve performance of logistics companies. The purpose of the study is to identify the relationship between organisational capabilities, market orientation, knowledge development and performance in supply chains of a third party logistics service provider. I am asking you to participate in the research because I am interested in understanding your views of the industry.

You are one of the selected customers of [3PL Company] invited to participate in the project. [NAME], the CEO of [3PL Company], has approved the involvement of [3PL Company] in the research project. My name is Chris Hemstrom. I am a research student of the Macquarie Graduate School of Management in the Macquarie University in Sydney. I am also [ROLE], at [3PL Company]. My telephone number is +61 2 9316 0501.

If you decide to participate in this study you will be asked to answer a survey which is likely to take 20 minutes to complete. You may also be asked to participate in two face-to-face interviews. These will take place after the Christmas peak season in early 2011. You are welcome to participate in the survey without participating in the interviews. The interviews may last for up to one hour each and will be recorded to ensure we interpret your answers correctly. You are free to withdraw from further participation in the study at any time without having to give a reason and without consequence. You will be provided with a copy of the report in return for participating in the study.

The research is being conducted to meet the requirements for the degree of Doctor of Philosophy in Management under the supervision of Professor Norma Harrison of the Macquarie Graduate School of Management in the Macquarie University, Sydney, Australia. Information and personal details gathered in the course of the study will remain confidential. No individual will be identified in any publication of the results. The ethical aspects of this study have been approved by the Macquarie University Ethics Review Committee (Human Research).

I will issue a survey to you in the coming week and hope that you will participate in the research.

Please let me know if you do not wish to participate in the research by return email and simply use the heading, Opting Out of Study

Thank you for your interest and participation in this project. I look forward to including your views of the industry in the research.

Regards

Chris

Appendix 1B - Pre-survey email notification to staff members of 3PL Company

Invitation to participate in university research into the logistics industry

Hi

I am inviting you to participate in a university research project designed to increase our understanding of the logistics industry. I will be conducting a survey during September – October to better understand how to most effectively improve performance of logistics companies. The purpose of the study is to identify the relationship between organisational capabilities, market orientation, knowledge development and performance in supply chains of third party logistics service providers. I am asking you to participate in the research because I am interested in understanding your views of the industry.

You are one of the selected staff members of [3PL Company] and its customers invited to participate in the project. [NAME] has approved the involvement of [3PL Company] in the research project.

If you decide to participate in this study you will be asked to answer a survey which is likely to take 20 minutes to complete. You may also be asked to participate in two face-to-face interviews. These will take place after the Christmas peak season in early 2011. You are welcome to participate in the survey without participating in the interviews. The interviews may last for up to one hour each and will be recorded to ensure we interpret your answers correctly. You are free to withdraw from further participation in the study at any time without having to give a reason and without consequence. You will be provided with a copy of the report in return for participating in the study.

The research is being conducted to meet the requirements for the degree of Doctor of Philosophy in Management under the supervision of Professor Norma Harrison of the Macquarie Graduate School of Management in the Macquarie University, Sydney, Australia. Information and personal details gathered in the course of the study will remain confidential. No individual will be identified in any publication of the results. The ethical aspects of this study have been approved by the Macquarie University Ethics Review Committee (Human Research).

I will issue a survey to you in the coming week and hope that you will participate in the research.

Please let me know if you do not wish to participate in the research by return email and simply use the heading, Opting Out of Study

Thank you for your interest and participation in this project. I look forward to including your views of the industry in the research.

Regards, Chris

Appendix 2A - Formal email invitation issued to prospective participants from clients of 3PL

Your invitation to participate in university research into the logistics industry

Hello again

I wrote to you recently to invite you to participate in a university research project designed to increase our understanding of the logistics industry. My original email is attached below. Today I am issuing you the formal invitation and the link to the survey questionnaire.

https://www.surveymonkey.com/s/X7PGYRN

Please take the time to complete the survey by **31 October 2010.**

The research is designed to help us to better understand how to most effectively improve performance of logistics companies. The purpose of the study is to identify the relationship between organisational capabilities, market orientation, knowledge development and performance in supply chains of third party logistics service providers. I am asking you to participate in the research because I am interested in understanding your views of the industry.

If you decide to participate in the survey you will be asked to answer questions which, in total, are likely to take 20 minutes to complete.

Information and personal details gathered in the course of the study will remain confidential. No individual will be identified in any publication of the results. The ethical aspects of this study have been approved by the Macquarie University Ethics Review Committee (Human Research).

Please click on the link above to access and answer questions in the survey questionnaire. There is also an informed consent form that provides more details about the survey; a copy of this form is also attached with this email for your personal records. I have also attached a glossary that may enhance your understanding of the study.

Please let me know if you do not wish to participate in the research by return email and simply use the heading, Opting Out of Study

Thank you for your interest and participation in this project. I look forward to including your views of the industry in the research.

Regards,
Chris

Appendix 2B - Formal email invitation issued to prospective participants from the 3PL company

Your invitation to participate in university research into the logistics industry

Hello again

I wrote to you recently to invite you to participate in a university research project designed to increase our understanding of the logistics industry. My original email is attached below. Today I am issuing you the formal invitation and the link to the survey questionnaire.

https://www.surveymonkey.com/s/X7PGYRN

Please take the time to complete the survey by **31 October 2010.**

The research is designed to help us to better understand how to most effectively improve performance of logistics companies. The purpose of the study is to identify the relationship between organisational capabilities, market orientation, knowledge development and performance in supply chains of third party logistics service providers. I am asking you to participate in the research because I am interested in understanding your views of the industry.

If you decide to participate in the survey you will be asked to answer a series of questions which, in total, are likely to take 20 minutes to complete.

Please click on the link above to access and answer questions in the survey questionnaires. There is also an informed consent form that provides more details about the survey; a copy of this form is also attached with this email for your personal records. I have also attached a glossary that may enhance your understanding of the study.

Please let me know if you do not wish to participate in the research by return email and simply use the heading, Opting Out of Study

Thank you for your interest and participation in this project. I look forward to including your views of the industry in the research.

Regards,
Chris

Appendix 3 – Follow-up email reminder

Final invitation to participate in university research into the logistics industry

I wrote to you late last month to invite you to participate in a university research project designed to increase our understanding of the logistics industry. I am sending you this follow up invitation to participate in the research because I am interested in understanding your views of the industry. If you have already submitted your views and I have been unable to remove your name from our survey database, please ignore this invitation. I will be providing you with a report of the research output as long as you have given me your contact details.

If you have not had a chance to add your views of the logistics industry to the research yet, please do so via the link below.

https://www.surveymonkey.com/s/X7PGYRN

Please take the time to complete the survey by **31 October 2010**.

The research is designed to help us to better understand how to most effectively improve performance of logistics companies. The purpose of the study is to identify the relationship between organisational capabilities, market orientation, knowledge development and performance in supply chains involving third party logistics service providers.

Please click on the link above to access and answer questions in the survey questionnaire. There is also an informed consent form that provides more details about the survey; a copy of this form is also attached with this email for your personal records. It will take about 20 minutes to complete the survey.

Please remember that information and personal details gathered in the course of the study will remain confidential. No individual will be identified in any publication of the results. The ethical aspects of this study have been approved by the Macquarie University Ethics Review Committee (Human Research) and the study is subject to a confidentiality agreement between [3PL company] and Macquarie University.

Please let me know if you do not wish to participate in the research by return email and simply use the heading, Opting Out of Study

Thank you for your interest and participation in this project. I look forward to including your views of the industry in the research.

Regards,
Chris

Appendix 4 – Informed Consent Form

Informed consent and information about the study

DETAILS OF STUDY:

The purpose of the study is to identify the relationship between organizational capabilities, market orientation, knowledge development and performance in supply chains of third party logistics service providers. Please refer to the glossary attached to your email invitation for definitions of key words used in the research.

A summary of the results of the study as they relate to practising managers will be prepared at the end of the study. Simply answer the survey, then provide your name and relevant contact details in Section 8 of the survey, and you will be sent a copy of the report. The survey and interviews will seek information relevant to [THE COMPANY'S] third party logistics services. [NAME], the CEO of [3PL Company], has approved the involvement of [3PL Company] in the study.

The study is being conducted by Chris Hemstrom, a research student of the Macquarie Graduate School of Management in the Macquarie University in Sydney. Chris is also [ROLE], at [3PL Company]. His telephone number is +61 2 9316 0501. Please note that [3PL Company] staff members invited to participate in this study ultimately report through to Presidents with direct reporting lines to the CEO of [3PL Company]. None of these reporting lines pass through staff members within Chris's span of control.

The research is partly funded by a grant from the MGSM Research Student Fund and is being conducted to meet the requirements for the degree of Doctor of Philosophy in Management under the supervision of Professor Norma Harrison of the Macquarie Graduate School of Management in the Macquarie University, Sydney, Australia. The research is subject to a non-disclosure agreement between [3PL Company] and Macquarie University. Information and personal details gathered in the course of the study are confidential. No individual will be identified in any publication of the results. Only the principal researcher, Chris Hemstrom, and his supervisor, Professor Norma Harrison, will have access to the raw data in a form that will identify any specific individual. Other researchers may perform statistical analyses of the data; however, they will not have access to information that enables them to identify individuals unless it is required by law or you provide your written consent for them to gain that access.

The ethical aspects of this study have been approved by the Macquarie University Ethics Review Committee (Human Research). If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Ethics Review Committee through its Secretary (telephone 9850 7854; email ethics@mq.edu.au). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

If you decide to participate in this study you will be asked to answer a survey which is likely to take 20 minutes to complete. You may also be asked to participate in two face-to-face interviews in early 2011. You are welcome to participate in the survey without participating in the interviews. The interviews may last for up to one hour each and will be recorded to ensure we interpret your answers correctly. You are free to withdraw from further participation in the study at any time without having to give a reason and without consequence. You will be provided with a copy of the report in return for participating in the study.

Please note that there is a copy of the informed consent document attached to your invitation, which you should keep for your personal reference.

INFORMED CONSENT:

I have read (or, where appropriate, have had read to me) and understand the information above and any questions I have asked have been answered to my satisfaction. I agree to participate in this research, knowing that I can withdraw from further participation in the research at any time without consequence. I have been given a copy of this form to keep.

[opt in survey button] I agree to participate in this study

By continuing to the next section of the survey you agree to participate in the study. Please remember that you are free to withdraw from further participation in the research at any time without having to give a reason and without consequence.

[opt in continue button]

Appendix 5 – Glossary issued to prospective participants in the study

Glossary

Our definitions of the key terms are presented here to enhance understanding of the study.

- **The purpose of the study** is to help us better understand how supply chain performance is affected by supply chain capabilities, market orientation and knowledge development.
- **Supply chain capabilities** will be those capabilities used to deliver or support delivery of goods to customers.
- **Market orientation** is reflected by the level of customer and competitor understanding within a company, and the degree to which that understanding is shared by staff within a company.
- **Knowledge development** is the process by which company staff members come to share knowledge; in the present study we are interested in how well supply chain knowledge is shared.
- **Performance in supply chains** reflects the level to which goods delivered meet the condition, timing and quantity requests of customers in a safe and cost effective manner.

Appendix 6 – Summary of research addressing customer integration, external integration and performance

Customer integration (CI) variables and indicators	Financial performance variables and indicators	Statistical method	Effect (P=positive, N=negative; d=direct, i=indirect; s=significant, ns=non-significant)	Reference
CI: Customer integration: four indicators reflecting information sharing and the use of IT systems to obtain information from customers – in this case specifically focusing on environmental management information	Firm financial performance: five indicators reflecting financial and market performance, including returns from environmentally oriented products	SEM	P, i, s	Wong (2013)
CI: Customer integration: five indicators reflecting information sharing and involvement in the product development process	Production cost: three indicators reflecting low costs and one indicator reflecting low price relative to competitors	SEM	P, d, s	Wong, Boon-itt and Wong (2011)

CI: Customer relationship construct specified with eight indicators reflecting understanding of customer requirements, measurement of customer satisfaction, process and activity design to account for customer satisfaction, and customer feedback related items	Firm performance: seven indicators reflecting financial and market related items, as well as product quality and product time to market, delivery performance, and demand for the company's products	SEM	P, d, s	Singh and Power (2009)
CI: Electronic ordering systems, interactive demand forecasting and information sharing related to order processing	"Cost-containment": four indicators with a focus on cost reduction in various stages of the logistics process, and a fifth indicator addressing increases in net income to net assets ratio	Multiple regression	P, s	Lee, Kwon and Severance (2007)
CI: Relational strategy: use of risk-reward principles with supply chain partners, sharing of strategic information with supply chain partners, and use of complementary objectives with supply chain partners	Logistics performance: cost, delivery capacity and performance, inventory turns, and customer satisfaction	SEM	P, i, s	Rodrigues, Stank and Lynch (2004)
CI: Relationship Integration	Return on assets	Regression	P,s	Stank, Keller and Closs (2001)
CI: automated replenishment programs - implementation of forecasting/planning, and information timeliness	Automated replenishment program cost effectiveness	Multiple regression analysis	P, d, s	Daugherty, Myers and Autry (1999)
CI: increasingly more specialized and cost efficient	Gained substantially more work	Longitudinal study	P, qualitative report	Lorenzoni and Lipparini (1999)

CI: increasingly more specialized and cost efficient	Reductions in transaction costs	Longitudin al study	P, qualitative report	Lorenzoni and Lipparini (1999)
CI: increasingly more specialized and cost efficient	Reductions in coordination costs	Longitudin al study	P, qualitative report	Lorenzoni and Lipparini (1999)
CI: Strategic customer integration reflected four indicators exploring customer interaction and customer satisfaction	Market performance: three indicators reflecting growth, market share and profitability	SEM	N, d, s	Swink, Narasimhan and Wang (2007)
CI: Customer integration: eleven indicators reflecting computerized integration with customers, periodical contact, feedback and information sharing with customers in relation to market information, forecasts, inventory, production plan, and point of sale information	Financial performance: five financial growth indicators reflecting focus on sales, profit, market share, and returns on investment and sales	SEM	d, ns P, i, s	Huo (2012)
CI: Customer integration: eleven indicators reflecting IT integration related to ordering, information sharing related to demand forecasts, production plans, inventories, and sales and market activities, and degree of ongoing communication with customers	Business performance variable was measured using seven indicators reflecting return on sales and investments, and growth in various financial performance indicators	Hierarchica l regression analysis	ns	Flynn, Huo and Zhao (2010)
CI: "Customer linkage" had	"Cost-containment", had four indicators with a focus	Multiple	ns	Lee, Kwon and

seven indicators: these reflected information sharing at various stages of the supply chain, including forecasting demand and order placement, using electronic systems	on cost reduction in various stages of the logistics process, and a fifth indicator addressing increases in net income to net assets ratio	regression		Severance (2007)
CI: “Downstream integration”: a customer oriented latent variable with three indicators reflecting information sharing relating to inventory management	Financial performance: three indicators relating to profitability, growth in profitability and return on investment	SEM	d, ns	Germain and Iyer (2006)

External integration (EI) variables and indicators	Financial performance variables and indicators	Statistical method	Effect (P=positive, N=negative; d=direct, i=indirect; s=significant, ns=non-significant)	Reference
EI: Identified clusters representing different supply chain management constructs: transactional, translational, and relational clusters.	Improvements in buyer financial performance	Hierarchical cluster analysis, multivariate analysis of variance, and the Scheffe method	s, The relational cluster was superior to the other two clusters	Paulraj, Chen and Lado (2012)

EI: Cluster analysis was used to form five integration configurations, based on the degree of integration among the companies in each cluster. Supply chain integration strength, reflecting low, medium and high levels of integration, and supply chain integration balance, reflecting the level of uniformity of strength within each cluster was used to discriminate between the clusters.	Business performance variable was measured using seven indicators reflecting return on sales and investments, and growth in various financial performance indicators	Cluster analysis, canonical discriminant analysis, analysis of variance	s; The high uniform cluster, and the cluster with high levels of internal and customer integration, were significantly different from the low and medium leaning clusters. The high uniform leaning cluster also scored significantly higher from the medium customer leaning cluster.	Flynn, Huo and Zhao (2010)
EI: "Systems integration": three indicators reflecting information systems capabilities to support collaborative planning	Brand equity: four indicators referencing brand elements and promotions	SEM	P, d, s	Kim and Cavusgil (2009)
EI: "Inter-organizational activity integration", specified with three indicators reflecting physical, financial and marketing information integration	"Financial performance": five indicators reflecting growth in sales volume and market share, gross and net profit, and a measure of return on investment		P, d, s. P, i, s	Rajaguru and Matanda (2009)

EI: "Inter-organizational information systems integration", specified with four indicators that reflected inter-organizational collaboration and planning using information systems	"Financial performance": five indicators reflecting growth in sales volume and market share, gross and net profit, and a measure of return on investment		P, d, s. P, i, s	Rajaguru and Matanda (2009)
EI: External *process* integration as a second order variable with two first-order variables: process connectivity (development of common goals, compatibility, strategic planning processes, use of common process standards, and timely sharing of information) and process simplification (five indicators referencing reduction in process and operational complexity)	Firm performance referenced financial, customer satisfaction, and competitiveness indicators	SEM	P, d, s	Chen, Daugherty and Roath (2009)
EI: A supply chain management strategy variable with six indicators reflecting non-IT related integration activities stretching across the supply chain, including "searching for new ways to integrate SCM activities"	"Marketing performance": three indicators reflecting three-year market share growth, sales volume growth, and sales dollar growth	SEM	P, d, s	Green, Whitten and Inman (2008)

EI: Systems integration: a latent variable with three indicators measuring inter-organizational systems integration in relation to collaborative planning	Market performance: three indicators comparing sales growth, market share and market development with competitors	SEM	P, i: significance of indirect effect not reported	Seggie, Kim and Cavusgil (2006)
EI: Systems integration: a latent variable with three indicators measuring inter-organizational systems integration in relation to collaborative planning	" Financial performance", was specified with three indicators comparing profitability, return on investment and cash flows from operations with competitors	SEM	P, i: significance of indirect effect not reported	Seggie, Kim and Cavusgil (2006)
EI: Supply chain integration: second order latent variable with three first order latent variables addressing supplier integration with six indicators, internal cross-functional integration with eight indicators, and customer integration with seven indicators	Second order latent variable, "firm performance", had three first order latent variables: "market performance", with two growth oriented indicators; "financial performance", with five financially oriented indicators; and, "customer satisfaction", with five time-oriented indicators and one order process accuracy indicator	SEM	P, d , s: for both small and large firms. P, I, s: for large firms only	Kim (2006)
EI: External integration	A market share index	Regression and hierarchical regression analyses	P, s	Droge, Jayaram, and Vickery (2004)
EI: Relative degree of supplier and customer integration (arcs of integration) among five strategies	"Marketplace" indicators: market share, profitability	ANOVA and the Scheffe method	P, s for companies with high levels of both supplier and customer integration	Frohlich and Westbrook (2001)

EI: Fit between "enterprise" logistics integration and geographic dispersion	Cost performance	Cluster analysis, t-tests	P, s, d	Stock, Greis and Kasarda (2000)
EI: information sharing In turn, co-investment in specialized production assets	Transaction costs reduced	Grounded theory	Improved performance	Dyer (1997)
EI: information sharing In turn, co-investment in specialized production assets	Production costs reduced	Grounded theory	Improved performance	Dyer (1997)
EI: Resource specificity: site specificity, employee-contact time and co-location, and sharing of sensitive information, including production costs	Higher returns on assets	Rank order correlation	P, s	Dyer (1996a)
EI: physical asset specificity, shared task-related and cost-related information	Return on assets	Comparison of ten-year averages for groups	P	Dyer (1996b)
EI: physical asset specificity, shared task-related and cost-related information	Inventory cost reductions		P, d, s	Dyer (1996b)
EI: cooperative sentiments	Perceived total costs	SEM	N, d, s	Larson (1994)
EI: Fit of "enterprise" logistics integration and channel governance	Financial performance	Cluster analysis, t-tests	N, s	Stock, Greis and Kasarda (2000)
EI: "Activity integration": three indicators reflecting collaborative planning activities	Brand equity: four indicators referencing brand elements and promotions	SEM	d, ns	Kim and Cavusgil (2009)

EI: A supply chain management strategy variable with six indicators reflecting non-IT related integration activities stretching across the supply chain, including “searching for new ways to integrate SCM activities”	Financial performance: four indicators reflecting financial returns and profit growth over three years in comparison with industry or competitors	SEM	d, ns	Green, Whitten and Inman (2008)
EI: Four mutually exclusive groups were formed reflecting the respondents’ relative claimed levels of integration for both customer and supplier integration.	Price	ANOVA and post hoc tests	ns, between the groups	Quesada, Rachamadugu, Gonzalez and Martinez (2008)
EI: Integrated External Operations was modelled as an endogenous variable with four indicators reflecting cross-organizational information sharing, collaboration and standardization	Logistics performance: cost, delivery capacity and performance, inventory turns, and customer satisfaction	SEM	ns	Rodrigues, Stank and Lynch (2004)
EI: External integration	Financial performance	Regression and hierarchical regression analyses	ns	Droge, Jayaram, and Vickery (2004)
EI: Relative degree of supplier and customer integration (arcs of integration) among five strategies	“Marketplace” indicator: return on investment	ANOVA and the Scheffe method	ns	Frohlich and Westbrook (2001)

EI: Interfirm supply chain coordination	Logistics cost	multiple regression analysis	ns	Stank, Crum and Arango (1999)
EI: Fit between "enterprise" logistics integration and geographic dispersion	A financial performance variable measured by indicators of sales growth, ROI, and market share	Cluster analysis, t-tests	ns	Stock, Greis and Kasarda (2000)
EI: Fit of "enterprise" logistics integration and channel governance	Cost performance		ns	Stock, Greis and Kasarda (2000)
EI: Identified clusters representing different supply chain management constructs: transactional, translational, and relational clusters.	Improvements of buyer cost performance	Hierarchical cluster analysis, multivariate analysis of variance, and the Scheffe method	There were no differences across the three clusters	Paulraj, Chen and Lado (2012)

External or customer integration variables and indicators	Operational performance variables and indicators	Financial performance variables and indicators	Statistical method	Effect (P=positive, N=negative; d=direct, i=indirect; s=significant, ns=non-significant)	Reference
CI/II: Interaction effects of internal and external integration		Financial performance: three indicators relating to profitability, growth in profitability and return on investment	SEM	d, ns	Germain and Iyer (2006)
EI/II: “Integrated Operations”: a second order, non-measured latent variable, with the external and internal integration variables as its first order latent variables		Logistics performance: cost, delivery capacity and performance, inventory turns, and customer satisfaction	SEM	P, d, s	Rodrigues, Stank and Lynch (2004)
EI/II: Interaction term for external and internal integration		A market share index and financial performance	Regression and hierarchical regression analyses	P, s	Droge, Jayaram, and Vickery (2004)

CI/II: Interaction effects of internal and external integration	Logistical performance had three indicators reflecting delivery lead times, inventory turnover rates and on-time deliveries		SEM	P, d, s	Germain and Iyer (2006)
CI/II: "Downstream integration": a customer oriented latent variable with three indicators reflecting information sharing relating to inventory management	Logistical performance had three indicators reflecting delivery lead times, inventory turnover rates and on-time deliveries		SEM, moderated regression	P, d, s. However, external integration was only found to be significantly correlated with logistical performance for the group with high internal integration scores.	Germain and Iyer (2006)
CI/II: Customer integration and internal integration	Performance measure representing an aggregate of twelve logistics performance measures plus return on assets		Multiple regression	P,s	Stank, Keller and Closs (2001)

EI/II: Cluster analysis was used to form five integration configurations, based on the degree of integration among the companies in each cluster. Supply chain integration strength, reflecting low, medium and high levels of integration, and supply chain integration balance, reflecting the level of uniformity of strength within each cluster was used to discriminate between the clusters.	Operational performance: six indicators reflecting rapid responses to changes in external environments, the degree of on-time and lead-time performance, and the level of customer service to the major customer		Cluster analysis, canonical discriminant analysis, analysis of variance	s; The high uniform cluster, and the cluster with high levels of internal and customer integration, were significantly different from the other clusters	Flynn, Huo and Zhao (2010)

Customer integration (CI) variables and indicators	Operational performance variables and indicators	Statistical method	Effect (P=positive, N=negative; d=direct, i=indirect; s=significant, ns=non-significant)	Reference
CI: Customer integration: five indicators reflecting customer contact, feedback, and responsiveness to customer needs	Improvement capability: three first level factors reflecting continuous improvement, process management and the involvement of managers in the quality improvement process	Moderated regression analysis	P, d – moderated by rate of product introductions, s	Peng et al. (2013)
CI: Customer integration: four indicators reflecting information sharing and the use of IT systems to obtain information from customers – in this case specifically focusing on environmental management information	Environmental performance: eight indicators reflecting operational aspects of environmental performance, including use of electricity, fuel consumption, packaging materials, and waste disposal.	SEM	P, i, s	Wong (2013)
CI: Customer integration: eleven indicators reflecting computerized integration with customers, periodical contact, feedback and information sharing with customers in relation to market information, forecasts, inventory, production plan, and point of sale information	Customer-oriented performance: six indicators reflecting operational capacity to quickly change or introduce products, respond to changes in market demand, to manage delivery performance with respect to reliability and lead-time, and to maintain high levels of customer service levels	SEM	P, d, s	Huo (2012)
CI: Customer integration: five indicators reflecting	Customer delivery performance: five indicators reflecting delivery speed and	SEM	P, d, s	Wong, Boon-itt and Wong (2011)

information sharing and involvement in the product development process	accuracy, timeliness and reliability of delivery, and reductions in customer order cycle time			
CI: Customer integration: five indicators reflecting information sharing and involvement in the product development process	Product quality: three indicators reflecting customer needs for high performance, quality and reliability, as well as one reflecting products with low defects	SEM	P, d, s	Wong, Boon-itt and Wong (2011)
CI: Customer integration: five indicators reflecting information sharing and involvement in the product development process	Production flexibility: four indicators reflecting the capability to change product mix and volume rapidly, provide for a broad product mix and for product customization	SEM	P, d, s This relationship strengthened under conditions of environmental uncertainty (four indicators reflecting variable customer demand and supplier performance conditions, unpredictable competitor promotions, and rapid change in core production technologies	Wong, Boon-itt and Wong (2011)
CI: Demand chain collaboration: four indicators	Operational performance: five indicators reflecting change over a three-year period in	Stepwise multiple	P, s	Iyer (2011)

reflecting collaborative practices relating to joint management of inventories	logistics performance, rates of inventory turnover, production flexibility, and reject / scrap / rework levels	regression analysis and linear regression analysis		
CI: Customer integration: eleven indicators reflecting IT integration related to ordering, information sharing related to demand forecasts, production plans, inventories, and sales and market activities, and degree of ongoing communication with customers	Operational performance: six indicators reflecting rapid responses to changes in external environments, the degree of on-time and lead-time performance, and the level of customer service to the major customer	Hierarchical regression analysis	P, s; an internal integration variable had already been entered into the equation	Flynn, Huo and Zhao (2010)
CI: "Customer linkage" had seven indicators: these reflected information sharing at various stages of the supply chain, including forecasting demand and order placement, using electronic systems	"Reliability", had five indicators, three of which reflected reliability of product and inventory within the supply chain, and two addressing increases in order fill rate and inventory turns	Multiple regression	P, s	Lee, Kwon and Severance (2007)

CI: "Customer linkage" had seven indicators: these reflected information sharing at various stages of the supply chain, including forecasting demand and order placement, using electronic systems	"Overall performance": a composite of "cost-containment" and "reliability"	Multiple regression	P, s	Lee, Kwon and Severance (2007)
CI: Interactive demand forecasting and a fast and easy ordering system	"Reliability", had five indicators, three of which reflected reliability of product and inventory within the supply chain, and two addressing increases in order fill rate and inventory turns	Multiple regression	P, s	Lee, Kwon and Severance (2007)
CI: Strategic customer integration reflected four indicators exploring customer interaction and customer satisfaction	A single item for customer satisfaction	SEM	P, d, s	Swink, Narasimhan and Wang (2007)
CI: Customer integration	Customer service performance: speed, flexibility and logistics capacity, customer responsiveness and overall customer satisfaction	SEM	P, d, s	Closs and Savitskie (2003)
CI: Customer integration	Customer satisfaction, product customization, delivery speed, responsiveness, order flexibility and delivery flexibility	Regression	P,s	Stank, Keller and Closs (2001)
CI: Increasingly more specialized and cost efficient	Enhanced trust	Longitudinal study	P	Lorenzoni and Lipparini (1999)

CI: automated replenishment programs - implementation of forecasting/planning and delivery functionality	Information timeliness	Multiple regression analysis	P, d, s	Daugherty, Myers and Autry (1999)
CI: automated replenishment programs - implementation of forecasting/planning, delivery functionality and implementation of barcoding/scanning	Information compatibility	Multiple regression analysis	P, d, s	Daugherty, Myers and Autry (1999)
CI: automated replenishment programs - information timeliness and delivery implementation	Automated replenishment program service effectiveness	Multiple regression analysis	P, d, s	Daugherty, Myers and Autry (1999)
CI: customer integration into the R&D processes	R&D cycle time	Moderated regression analysis	P, d, s	Souder, Sherman and Davies-Cooper (1998)
CI: customer integration into the R&D processes	R&D technical effectiveness	Moderated regression analysis	P, d, s	Souder, Sherman and Davies-Cooper (1998)
CI: customer integration into the R&D processes	R&D commercialization effectiveness	Moderated regression analysis	P, d, s	Souder, Sherman and Davies-Cooper (1998)
CI: interaction terms of customer integration and market uncertainty	Design change frequency	Moderated regression analysis	P, d, s	Souder, Sherman and Davies-Cooper (1998)
CI: interaction terms of customer integration and technical uncertainty	Design change frequency	Moderated regression analysis	P, d, s	Souder, Sherman and Davies-Cooper (1998)

CI: Customer integration: five indicators reflecting information sharing and involvement in the product development process	Customer delivery performance: five indicators reflecting delivery speed and accuracy, timeliness and reliability of delivery, and reductions in customer order cycle time	Hierarchical regression analysis	ns	Boon-itt and Wong (2011)
CI: Customer integration, called “production information integration”: used three indicators reflecting collaborative behaviours related to inventory management	Operational Performance: eight indicators of product quality, delivery and production performance	SEM,	d, ns.	Devaraj, Krajewski and Wei (2007)
CI: Relationship Integration	Product customization	Regression	N,s	Stank, Keller and Closs (2001)

External integration (EI) variables and indicators	Operational performance variables and indicators	Statistical method	Effect (P=positive, N=negative; d=direct, i=indirect; s=significant, ns=non-significant)	Reference
EI: Inter-organizational IT use: three indicators reflecting availability of inter-organizational IT systems and use of inter-organizational IT for contingency planning	Contingency planning effectiveness: three indicators reflecting organizational capacity to deal with unexpected events, improved performance through integrated contingency planning with partners, and enhanced planning responsiveness through collaboration	Partial least squares analysis	P, i, s	Hall, Skipper, Hazen and Hanna (2012)
EI: Inter-organizational collaboration: four indicators reflecting sharing of contingency plans, risks and rewards, and the use of benchmarks that are also shared with partners	Contingency planning effectiveness: three indicators reflecting organizational capacity to deal with unexpected events, improved performance through integrated contingency planning with partners, and enhanced planning responsiveness through collaboration	Partial least squares analysis	P, d, s	Hall, Skipper, Hazen and Hanna (2012)
EI: Cooperative attitude: four indicators reflecting cooperation with external parties related to change, coordination of planning activities with partners, and an organizational view that partners are value adding	Contingency planning effectiveness: three indicators reflecting organizational capacity to deal with unexpected events, improved performance through integrated contingency planning with partners, and enhanced planning responsiveness through collaboration	Partial least squares analysis	P, d, s P, i, s	Hall, Skipper, Hazen and Hanna (2012)

EI: Identified clusters representing different supply chain management constructs: transactional, translational, and relational clusters.	Improvements in performance related buyer flexibility	Hierarchical cluster analysis, multivariate analysis of variance, and the Scheffe method	The relational cluster was superior to the transactiona l cluster	Paulraj, Chen and Lado (2012)
EI: Identified clusters representing different supply chain management constructs: transactional, translational, and relational clusters.	Improvements in performance related to buyer quality, buyer delivery, buyer customer responsiveness, buyer customer satisfaction	Hierarchical cluster analysis, multivariate analysis of variance, and the Scheffe method	The relational cluster was superior to the other two clusters	Paulraj, Chen and Lado (2012)
EI: Collaborative engagement: seven indicators reflecting joint decision making, sharing of information and ideas, and an openness to new ways of thinking and working in order to improve performance of collaborative partners	Operational outcomes: five indicators reflecting reduced cycle times, improved quality, customer service and customer value, and reductions in the time to project outcomes	SEM	P, d, s	Zacharia, Nix and Lusch (2011)

EI: Collaborative engagement: seven indicators reflecting joint decision making, sharing of information and ideas, and an openness to new ways of thinking and working in order to improve performance of collaborative partners	Relational outcomes: seven indicators reflecting greater levels of respect and honesty among collaborating parties, and improved levels of information sharing and willingness to collaborate in future projects	SEM	P, d, s P, i, s	Zacharia, Nix and Lusch (2011)
EI: Collaborative process competence: four indicators reflecting the ability to select partners, learn from collaborations, manage collaborative processes, and conflicts within collaborative environments	Operational outcomes: five indicators reflecting reduced cycle times, improved quality, customer service and customer value, and reductions in the time to project outcomes	SEM	P, d, s P, i, s	Zacharia, Nix and Lusch (2011)
EI: Collaborative process competence: four indicators reflecting the ability to select partners, learn from collaborations, manage collaborative processes, and conflicts within collaborative environments	Relational outcomes: seven indicators reflecting greater levels of respect and honesty among collaborating parties, and improved levels of information sharing and willingness to collaborate in future projects	SEM	P, d, s P, i, s	Zacharia, Nix and Lusch (2011)

EI: Complementarity, an interaction term for IT (three indicators reflecting integrated IT and IT based production systems) and organizational initiatives (three indicators reflecting various operational initiatives)	Agility: five indicators reflecting flexibility, responsiveness and speed related to new product introductions, manufacturing and delivery	SEM	P, d, s	Vickery, Droge, Setia and Sambamurthy (2010)
EI: Interaction effect between customer integration (eleven indicators reflecting IT integration related to ordering, information sharing related to demand forecasts, production plans, inventories, and sales and market activities, and degree of ongoing communication with customers) and supplier integration eight indicators reflecting similar components to customer integration together with five indicators reflecting collaborative process elements such as participation in design, sourcing and production processes	Operational performance: six indicators reflecting rapid responses to changes in external environments, the degree of on-time and lead-time performance, and the level of customer service to the major customer	Hierarchical regression analysis	P, s; an internal integration variable and the customer integration variable had already been entered into the equation	Flynn, Huo and Zhao (2010)
EI: "Activity integration": three indicators reflecting collaborative planning activities	"Supply chain responsiveness": two indicators reflecting supply chain responsiveness to changes within customers, suppliers and competitors and one related to the competitiveness of the supply chain	SEM	P, d, s	Kim and Cavusgil (2009)
EI: "Systems integration": three indicators reflecting information systems capabilities to support	"Supply chain responsiveness": two indicators reflecting supply chain responsiveness to changes within customers, suppliers and competitors and	SEM	P, d, s	Kim and Cavusgil (2009)

collaborative planning	one related to the competitiveness of the supply chain			
EI: "Inter-organizational activity integration", specified with three indicators reflecting physical, financial and marketing information integration	"Operational/logistics performance": six indicators reflecting reductions in supply chain inventory, use of just-in-time processes, supply chain product traceability, supply chain flexibility, and reductions in cycle times of operations	Multiple regression and mediation analyses	P, d, s.	Rajaguru and Matanda (2009)
EI: "Inter-organizational activity integration", specified with three indicators reflecting physical, financial and marketing information integration	"Customer responsiveness": five indicators reflecting measures of effectiveness related to order fulfilment, supply chain partner enquiries, and acceptance and processing of payments, time reductions related to corrective actions from complaints, and an overall measure of improvement in responsiveness	Multiple regression and mediation analyses	P, d, s. P, i, s	Rajaguru and Matanda (2009)
EI: "Inter-organizational information systems integration", specified with four indicators that reflected inter-organizational collaboration and planning using information systems	"Customer responsiveness": five indicators reflecting measures of effectiveness related to order fulfilment, supply chain partner enquiries, and acceptance and processing of payments, time reductions related to corrective actions from complaints, and an overall measure of improvement in responsiveness	Multiple regression and mediation analyses	P, d, s. P, i, s	Rajaguru and Matanda (2009)
EI: "Inter-organizational information systems integration", specified with four indicators that reflected inter-organizational collaboration and planning using information systems	"Operational/logistics performance": six indicators reflecting reductions in supply chain inventory, use of just-in-time processes, supply chain product traceability, supply chain flexibility, and reductions in cycle times of operations	Multiple regression and mediation analyses	P, d, s.	Rajaguru and Matanda (2009)
EI: A supply chain management strategy variable with six indicators reflecting non-IT related integration activities	Logistics performance: five indicators reflecting delivery–related performance elements, "responsiveness", and "order fill capacity"	SEM	P, d, s	Green, Whitten and Inman (2008)

stretching across the supply chain, including “searching for new ways to integrate SCM activities”				
EI: Four mutually exclusive groups were formed reflecting the respondents’ relative claimed levels of integration for both customer and supplier integration.	Customer service	ANOVA and post hoc tests	P,s; for low and high integration groups, and supplier and customer integration groups	Quesada, Rachamadugu, Gonzalez and Martinez (2008)
EI: Four mutually exclusive groups were formed reflecting the respondents’ relative claimed levels of integration for both customer and supplier integration.	Flexibility in product range	ANOVA and post hoc tests	P, s: for the high and low integration groups	Quesada, Rachamadugu, Gonzalez and Martinez (2008)
EI: Four mutually exclusive groups were formed reflecting the respondents’ relative claimed levels of integration for both customer and supplier integration.	Delivery speed and reliability, and quality	ANOVA and post hoc tests	P, s; between the low and high integration groups	Quesada, Rachamadugu, Gonzalez and Martinez (2008)

EI: Interaction effect of supplier and customer integration where each factor was measured using "production information integration": three indicators reflecting collaborative behaviours related to inventory management	Operational Performance: eight indicators of product quality, delivery and production performance	Ordinary least squares regression	P, s. Significant difference in performance for the high customer integration group at low and high levels of supplier integration.	Devaraj, Krajewski and Wei (2007)
EI: Systems integration: a latent variable with three indicators measuring inter-organizational systems integration in relation to collaborative planning	Brand equity: three measured indicators reflecting brand attributes and one indicator reflecting promotional impact	SEM	P, d, s	Seggie, Kim and Cavusgil (2006)
EI: Supply chain integration: second order latent variable with three first order latent variables addressing supplier integration with six indicators, internal cross-functional integration with eight indicators, and customer integration with seven indicators	A second order latent variable, "competition capability" with four first order latent variables: "cost leadership", with six indicators reflecting a mix of cost reduction capabilities; "customer service", with five indicators focusing on delivery and service capability and one indicator reflecting price competitiveness; "innovative marketing technology", which had five marketing oriented indicators; and, "differentiation", which used three indicators focusing on capabilities to innovative at the product level	SEM	P, d, s. For large firms only.	Kim (2006)

EI: External integration using eight indicators relating to information sharing, teamwork, joint planning and decision-making with two types of clients: those that were most likely to collaborate; and, those that were least likely to collaborate	Performance: five measured variables reflecting achieved cost reductions, stock-out and lead time reductions	SEM	P, d, s	Gimenez and Ventura (2005)
EI: External integration	Time-to-market, time-to-product, and responsiveness	Regression and hierarchical regression analyses	P, s	Droge, Jayaram, and Vickery (2004)
EI: Four strategies based on high and low internet-based demand and supply integration	Performance was a factor reflecting improvements in inventory turnover, delivery time, transaction costs and profitability	Cluster analysis, ANOVA and the Scheffe method	P, s. Service companies that employed demand integration outperformed service companies that used low integration strategies	Frohlich and Westbrook (2002)

EI: Four strategies based on high and low internet-based demand and supply integration	Performance was a factor reflecting improvements in inventory turnover, delivery time, transaction costs and profitability	Cluster analysis, ANOVA and the Scheffe method	P,s Manufacturing companies using the combination of high supply and high demand integration strategies outperformed other manufacturers	Frohlich and Westbrook (2002)
EI: Four strategies based on high and low internet-based demand and supply integration	Performance was a factor reflecting improvements in inventory turnover, delivery time, transaction costs and profitability	Cluster analysis, ANOVA and the Scheffe method	P,s Manufacturers that used one but not both supply and demand integration outperformed those with low levels of integration	Frohlich and Westbrook (2002)

EI: External integration reflecting many characteristics of relationship integration	Logistics performance	SEM, post-hoc multi-step multiple regression	P, i, s	Stank, Keller and Daugherty (2001)
EI: Relative degree of supplier and customer integration (arcs of integration) among five strategies	"Non-productivity" indicators: speed of product development	ANOVA and the Scheffe method	P, s for companies with both supplier and customer integration, and for companies with customer integration	Frohlich and Westbrook (2001)
EI: Relative degree of supplier and customer integration (arcs of integration) among five strategies	"Non-productivity" indicators: customer service and satisfaction, product variety, supplier quality, on-time delivery	ANOVA and the Scheffe method	P, s for companies with both supplier and customer integration	Frohlich and Westbrook (2001)

EI: Relative degree of supplier and customer integration (arcs of integration) among five strategies	"Non-productivity" indicators: conformance quality	ANOVA and the Scheffe method	P, s for companies with both supplier and customer integration, and for companies with customer integration	Frohlich and Westbrook (2001)
EI: Relative degree of supplier and customer integration (arcs of integration) among five strategies	"Productivity" indicators: direct labour productivity	ANOVA and the Scheffe method	P, s for companies with both supplier and customer integration compared with companies with ONLY one type of integration	Frohlich and Westbrook (2001)
EI: Relative degree of supplier and customer integration (arcs of integration) among five strategies	"Productivity" indicators: procurement lead time	ANOVA and the Scheffe method	P, s for companies with both supplier and customer integration	Frohlich and Westbrook (2001)

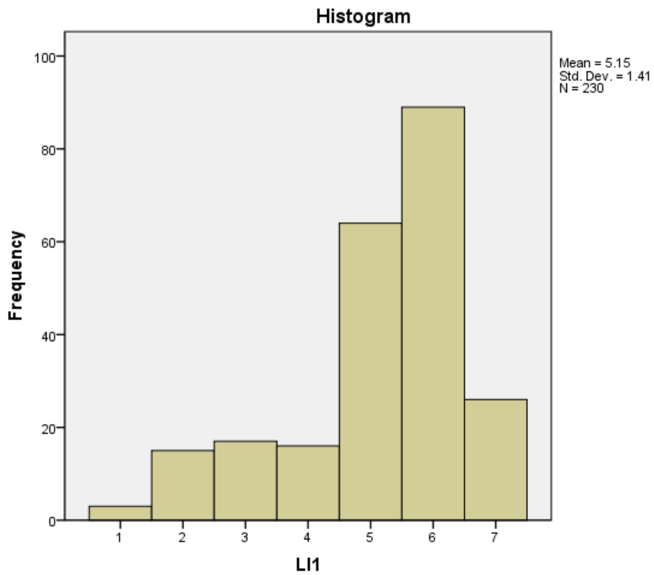
EI: Relative degree of supplier and customer integration (arcs of integration) among five strategies	"Productivity" indicators: manufacturing lead time, delivery lead time	ANOVA and the Scheffe method	P, s for companies with both supplier and customer integration compared with customer integration or no integration	Frohlich and Westbrook (2001)
EI: Fit between "enterprise" logistics integration and geographic dispersion	Service performance	Cluster analysis, t-tests	P, s, d	Stock, Greis and Kasarda (2000)
EI: information sharing In turn, co-investment in specialized production assets	Enhanced trust	Grounded theory	P	Dyer (1997)
EI: information exchange	Responsiveness	SEM	P, d, s	Stank, Daugherty and Ellinger (1996)
EI: information exchange	Perceived service performance	SEM	P, d, s	Stank, Daugherty and Ellinger (1996)
EI: responsiveness	Perceived service performance	SEM	P, d, s	Stank, Daugherty and Ellinger (1996)

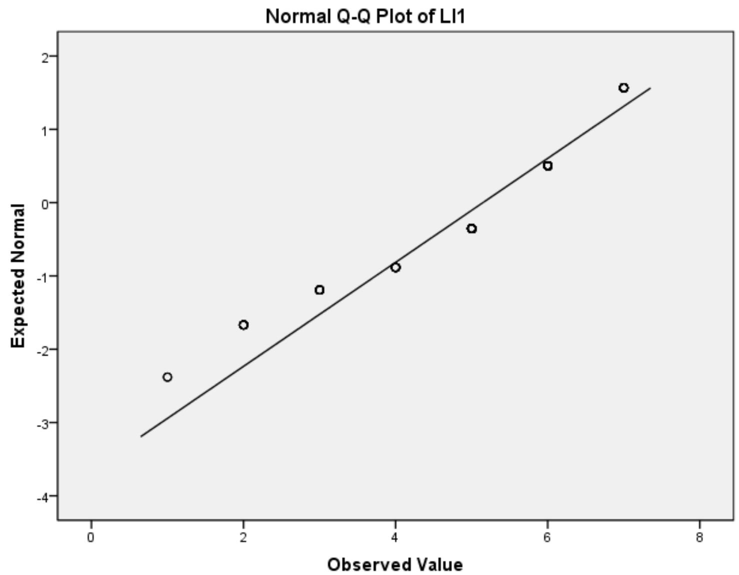
EI: physical asset specificity, shared task-related and cost-related information	Trust higher		P, d, s	Dyer (1996b)
EI: physical asset specificity, shared task-related and cost-related information	Quality		P, d, s	Dyer (1996b)
EI: Resource specificity: site specificity, employee-contact time and co-location, and sharing of sensitive information, including production costs	Higher product quality		P, d, s	Dyer (1996a)
EI: Four mutually exclusive groups were formed reflecting the respondents' relative claimed levels of integration for both customer and supplier integration.	Flexibility in product range	ANOVA and post hoc tests	N, s: for the high and customer integration groups	Quesada, Rachamadugu, Gonzalez and Martinez (2008)
EI: Twelve rules of supply chain simplicity	Uncertainty in areas of supply, internal controls, internal value-added processes, and demand	Correlation	N, s	Childerhouse and Towill (2003)
EI: External logistics information sharing	Customer service performance: speed, flexibility and logistics capacity, customer responsiveness and overall customer satisfaction	SEM	N, d, s	Closs and Savitskie (2003)
EI: Fit of "enterprise" logistics integration and channel governance	Service performance	Cluster analysis, t-tests	N, s	Stock, Greis and Kasarda (2000)
EI: EDI construct	Inventory levels	Multiple regression analysis	N, s, d	Stank, Crum and Arango (1999)

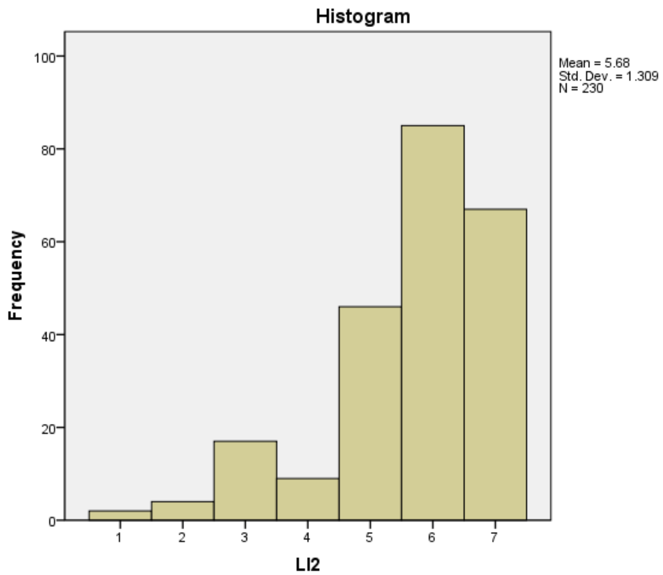
EI: EDI construct	Order cycle time	Multiple regression analysis	N, s, d	Stank, Crum and Arango (1999)
EI: EDI construct	Order cycle variance	Multiple regression analysis	N, s, d	Stank, Crum and Arango (1999)
EI: Performance monitoring	Order cycle time	Multiple regression analysis	N, s, d	Stank, Crum and Arango (1999)
EI: Performance monitoring	Order cycle variance	Multiple regression analysis	N, s, d	Stank, Crum and Arango (1999)
EI: Communication	Inventory levels	Multiple regression analysis	N, s, d	Stank, Crum and Arango (1999)
EI: Partnering	Order cycle time	Multiple regression analysis	N, s, d	Stank, Crum and Arango (1999)
EI: Resource specificity: site specificity, employee-contact time and co-location, and sharing of sensitive information, including production costs	Product development cycle times		N, d, s	Dyer (1996a)
EI: Resource specificity: site specificity, employee-contact time and co-location, and sharing of sensitive information, including production costs	Levels of inventories		N, d, s	Dyer (1996a)

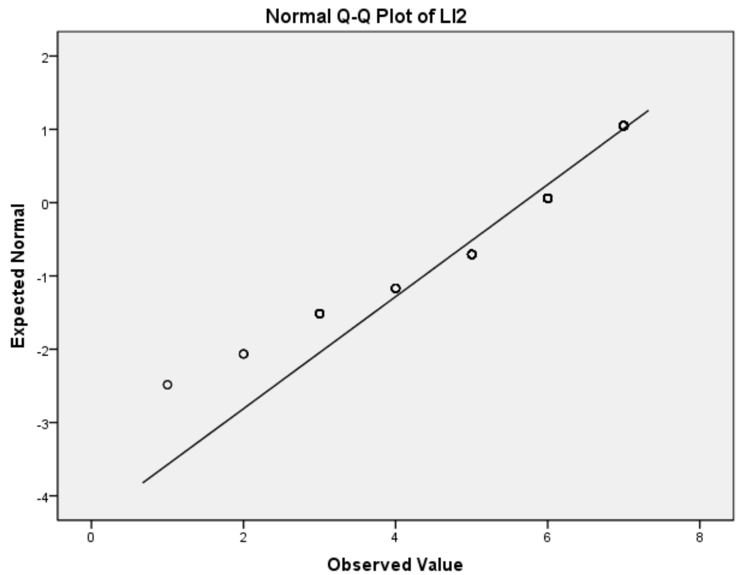
EI: physical asset specificity, shared task-related and cost-related information	Use of contracts to protect interests		N, d, s	Dyer (1996b)
EI: physical asset specificity, shared task-related and cost-related information	New model cycle time		N, d, s	Dyer (1996b)
EI: Supply chain information technology: three indicators reflecting integrated IT and IT based production systems	Agility: five indicators reflecting flexibility, responsiveness and speed related to new product introductions, manufacturing and delivery	SEM	d, ns	Vickery, Droge, Setia and Sambamurthy (2010)
EI: Supply chain organizational initiatives: three indicators reflecting various operational initiatives	Agility: five indicators reflecting flexibility, responsiveness and speed related to new product introductions, manufacturing and delivery	SEM	d, ns	Vickery, Droge, Setia and Sambamurthy (2010)
EI: Relative degree of supplier and customer integration (arcs of integration) among five strategies	"Non-productivity" indicators: number of new products developed	ANOVA and the Scheffe method	ns	Frohlich and Westbrook (2001)
EI: Relative degree of supplier and customer integration (arcs of integration) among five strategies	"Productivity" indicators: Manufacturing, materials and overhead costs, equipment changeover time, inventory turnover	ANOVA and the Scheffe method	ns	Frohlich and Westbrook (2001)

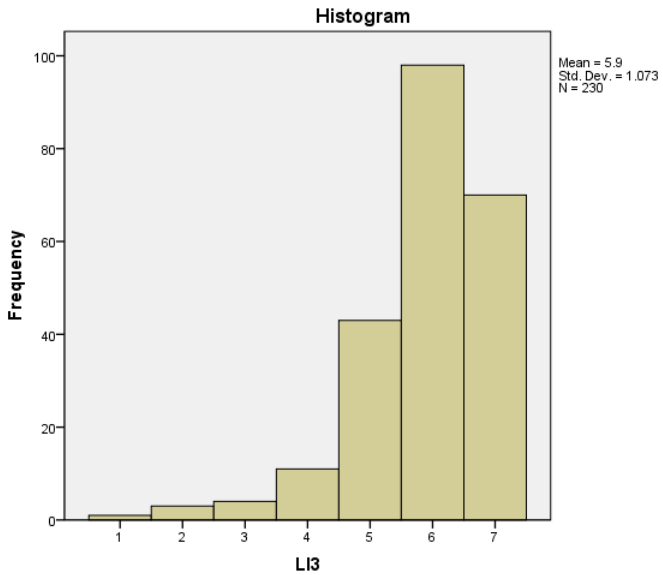
Appendix 7 - Histograms and Normal Q-Q plots of Measured Variables

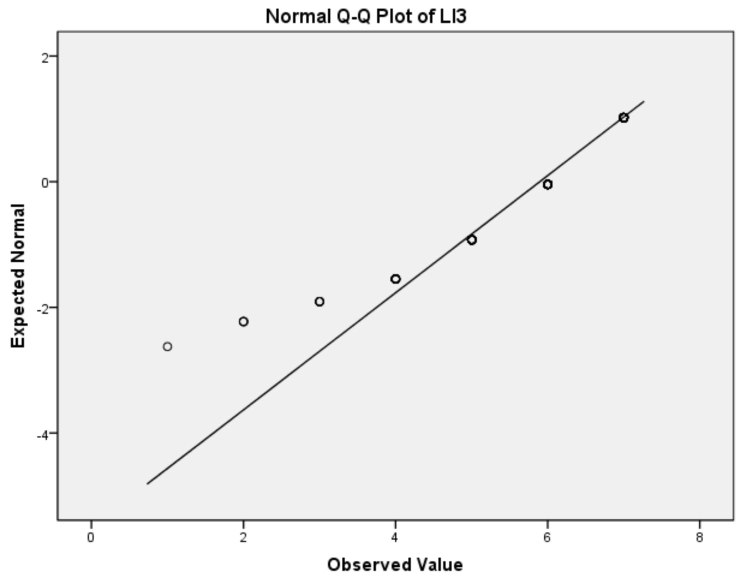

Histogram
Mean = 5.15
Std. Dev. = 1.41
N = 230
Frequency
0
20
40
60
80
100
1
2
3
4
5
6
7
LI1

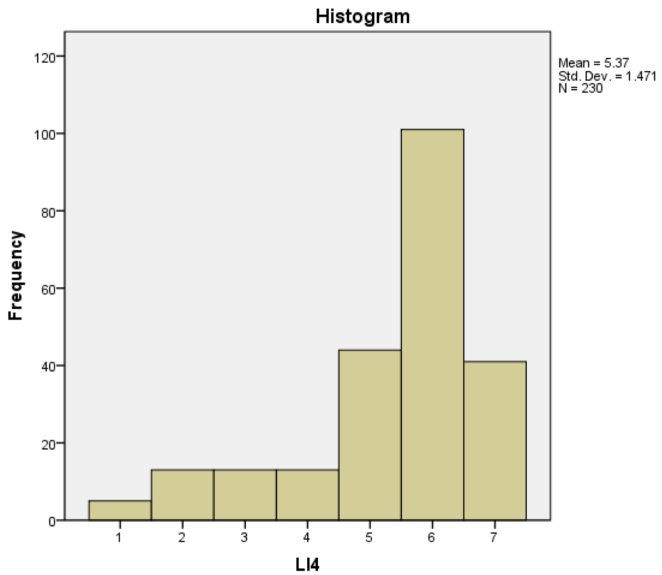

Normal Q-Q Plot of LI1
Expected Normal
2
1
0
-1
-2
-3
-4
0
2
4
6
8
Observed Value

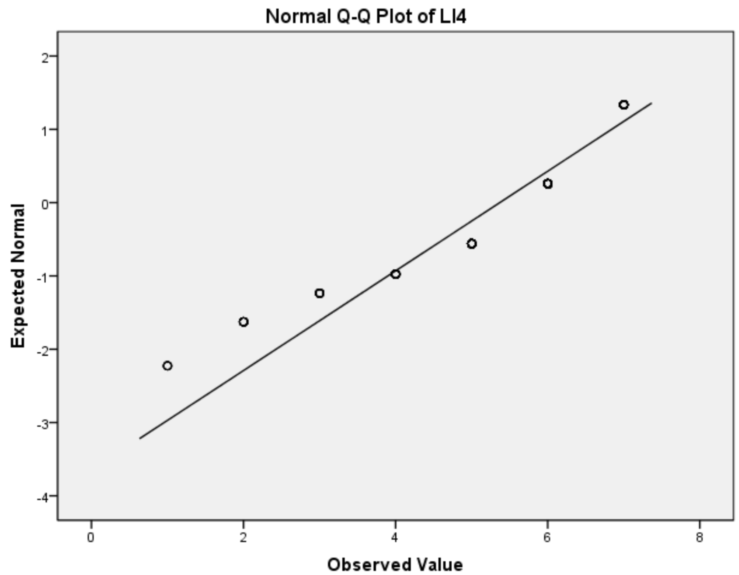

Histogram
Mean = 5.68
Std. Dev. = 1.309
N = 230
Frequency
LI2

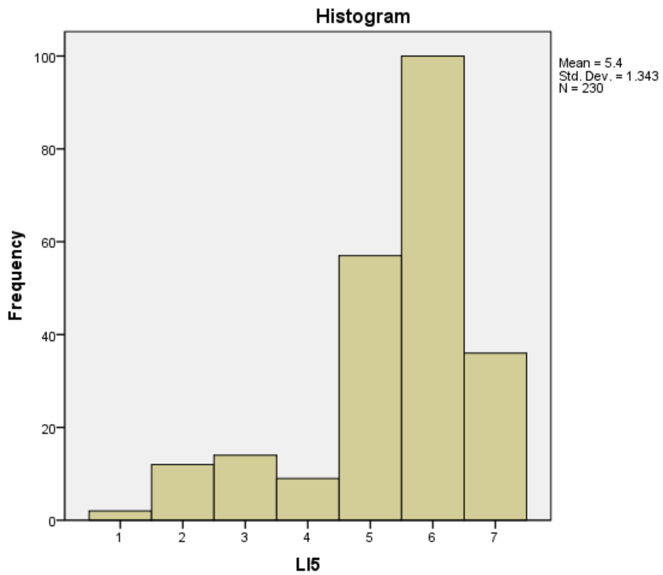

Normal Q-Q Plot of LI2
Expected Normal
Observed Value


Histogram
Mean = 5.9
Std. Dev. = 1.073
N = 230
Frequency
LI3
0
20
40
60
80
100
1
2
3
4
5
6
7


Normal Q-Q Plot of LI3
Expected Normal
Observed Value
2
0
-2
-4
0
2
4
6
8


Histogram
Mean = 5.37
Std. Dev. = 1.471
N = 230
Frequency
LI4


Normal Q-Q Plot of LI4
Expected Normal
Observed Value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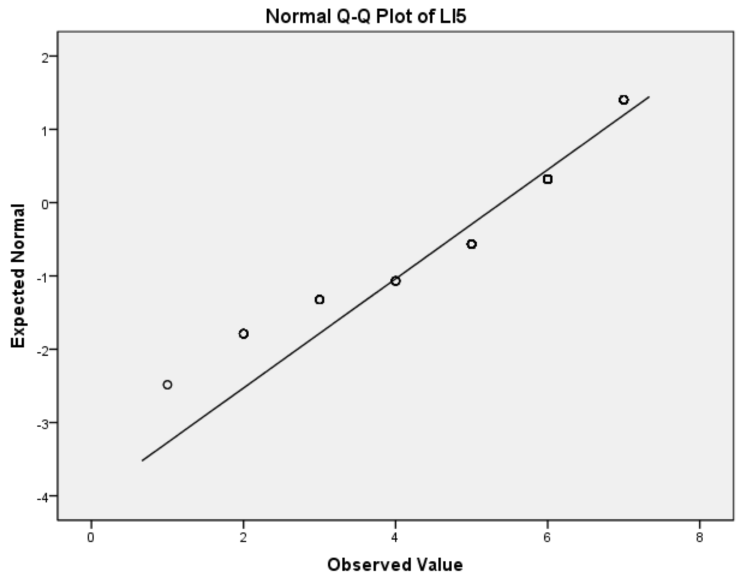
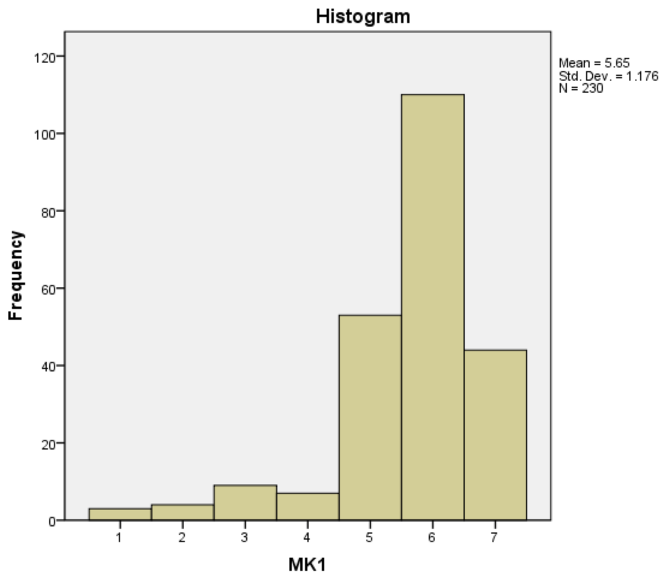
Mean = 5.4
Std. Dev. = 1.343
N = 230
Frequency
LI5


Normal Q-Q Plot of LI5
Expected Normal
Observed Value


Histogram
Mean = 5.65
Std. Dev. = 1.176
N = 230
Frequency
MK1
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20
40
60
80
100
120
1
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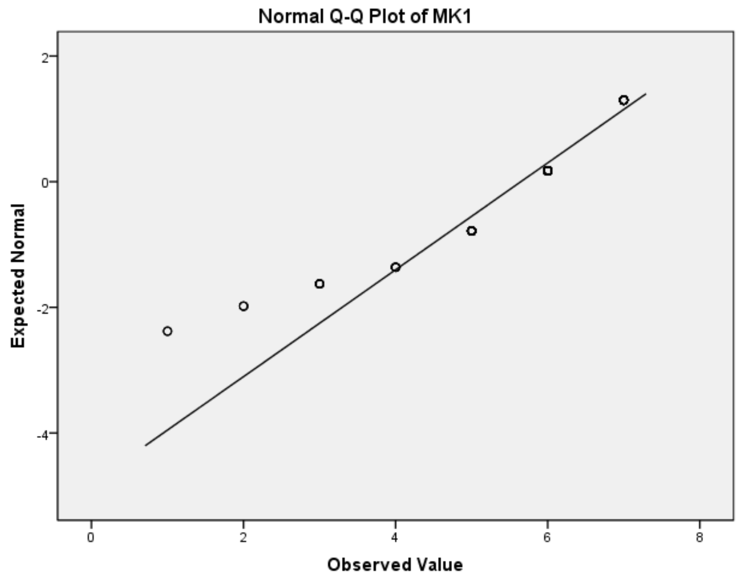
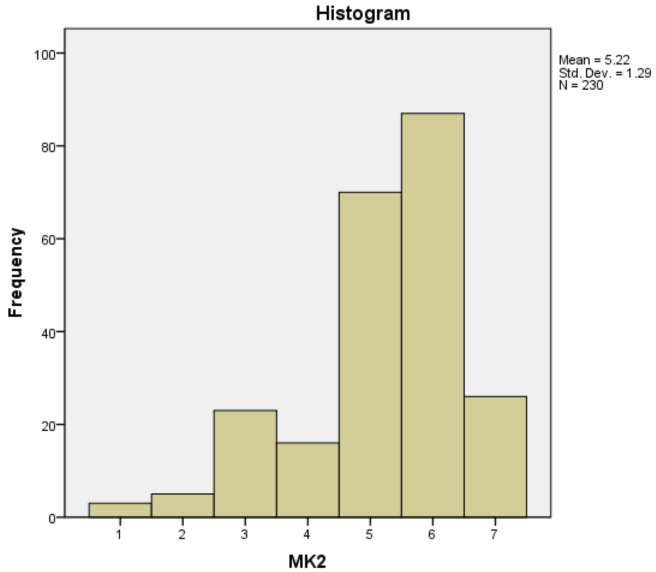
3
4
5
6
7


Normal Q-Q Plot of MK1
Expected Normal
Observed Value
2
0
-2
-4
0
2
4
6
8


Histogram
Mean = 5.22
Std. Dev. = 1.29
N = 230
Frequency
MK2
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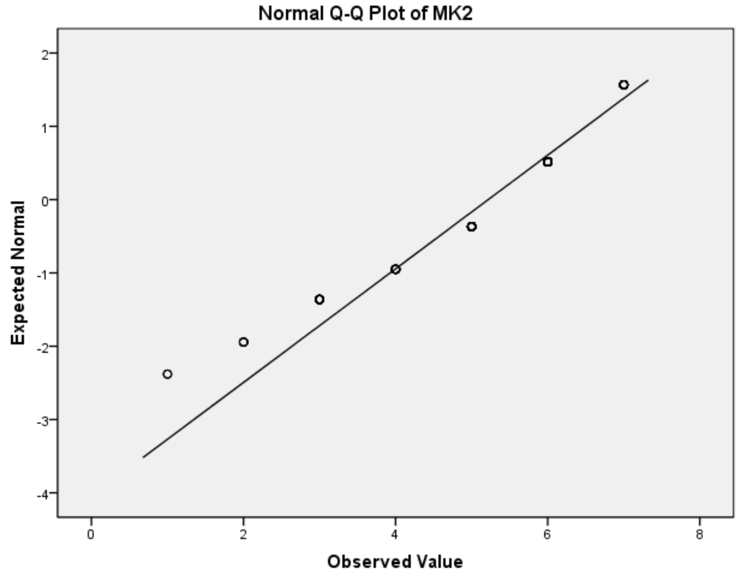
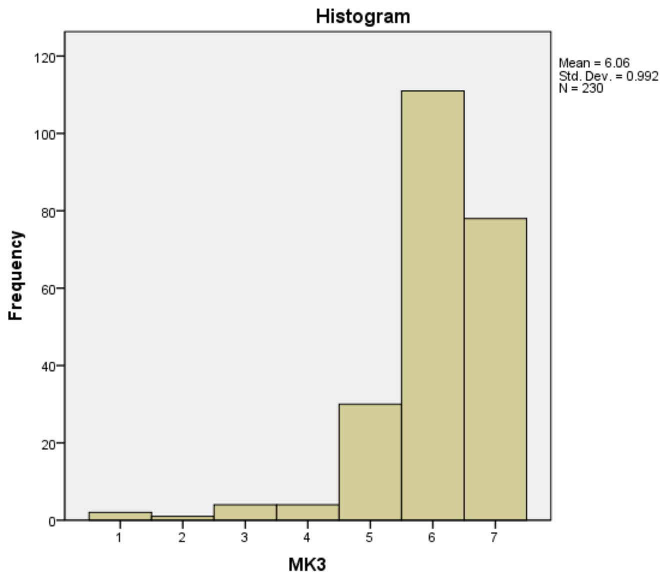
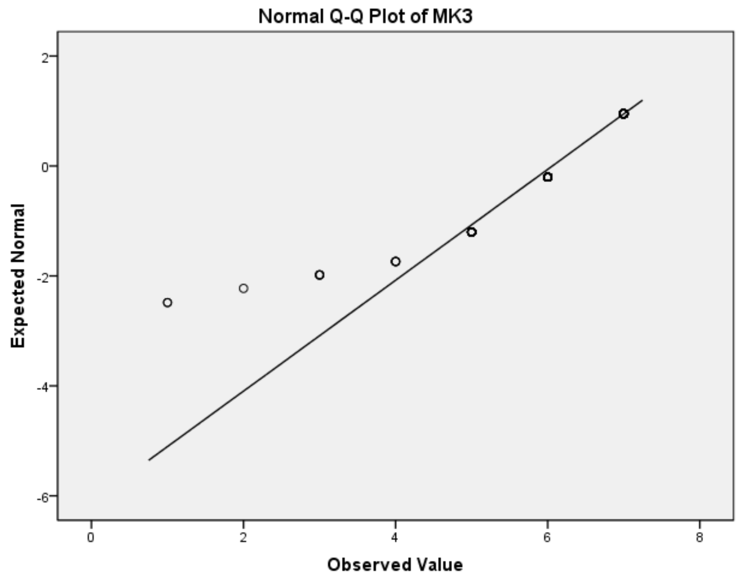
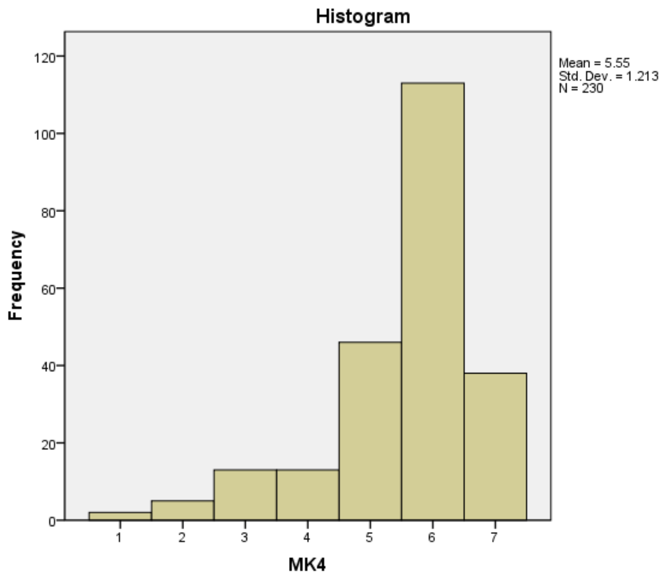
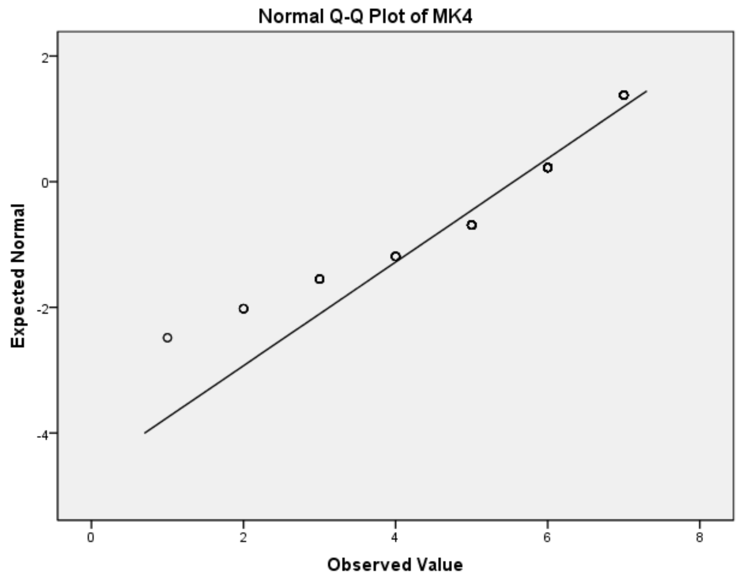
20
40
60
80
100
1
2
3
4
5
6
7

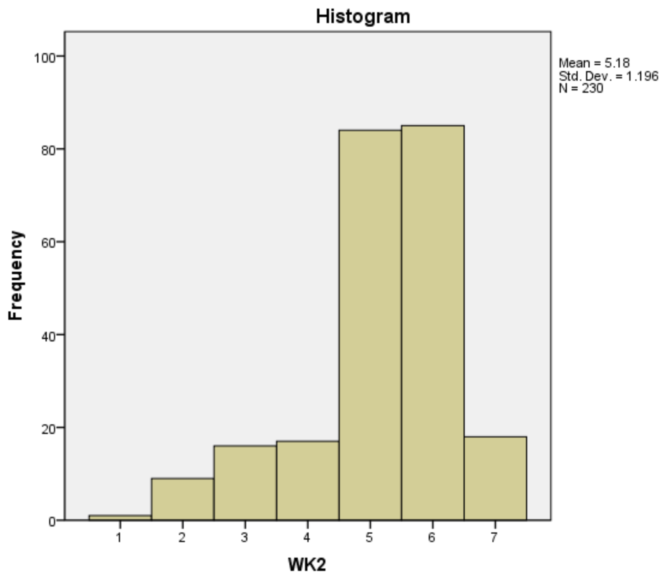

Normal Q-Q Plot of MK2
Expected Normal
Observed Value
2
1
0
-1
-2
-3
-4
0
2
4
6
8

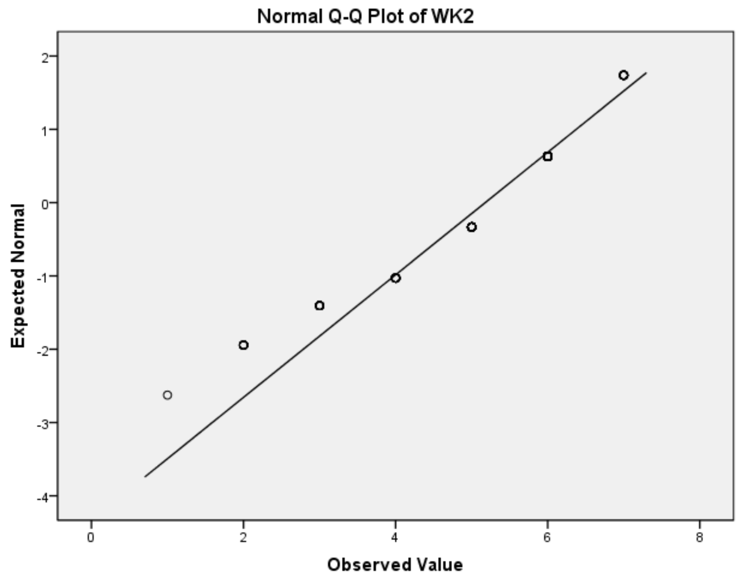

Histogram
Mean = 6.06
Std. Dev. = 0.992
N = 230
Frequency
MK3

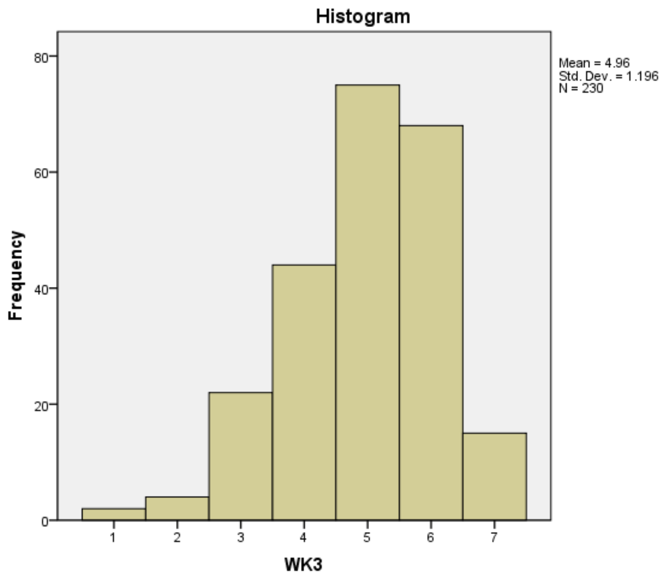

Normal Q-Q Plot of MK3
Expected Normal
Observed Value

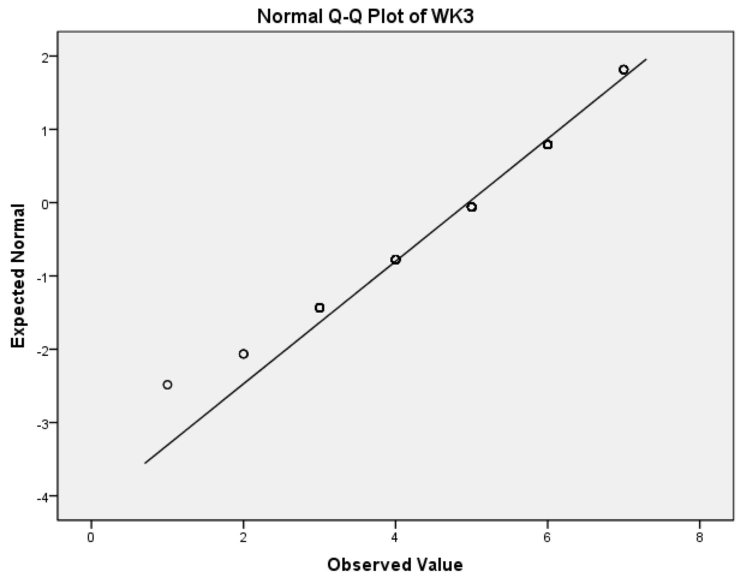

Histogram
Mean = 5.55
Std. Dev. = 1.213
N = 230
Frequency
MK4

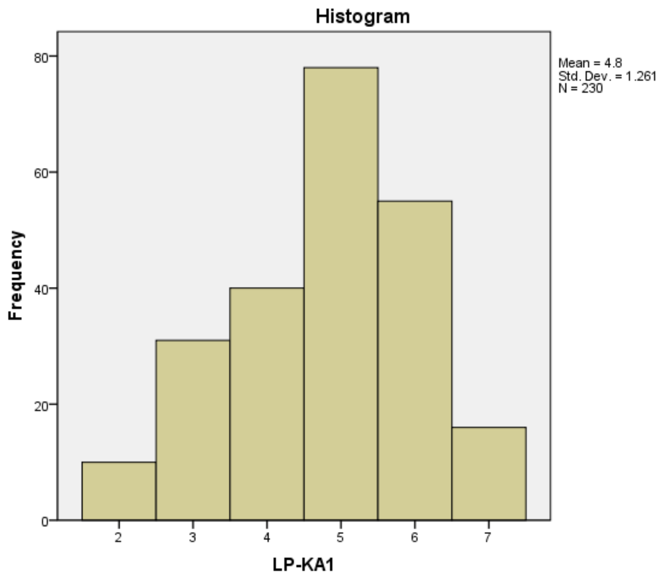

Normal Q-Q Plot of MK4
Expected Normal
Observed Value

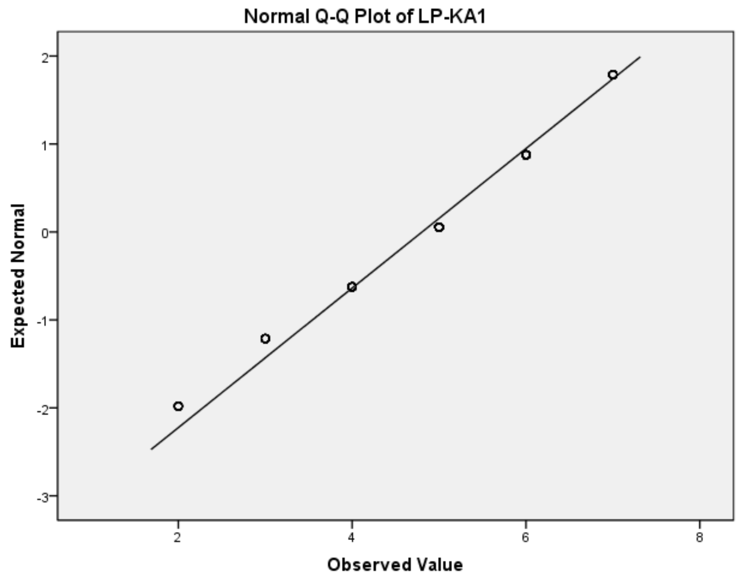

Histogram
Mean = 5.18
Std. Dev. = 1.196
N = 230
Frequency
0
20
40
60
80
100
1
2
3
4
5
6
7
WK2

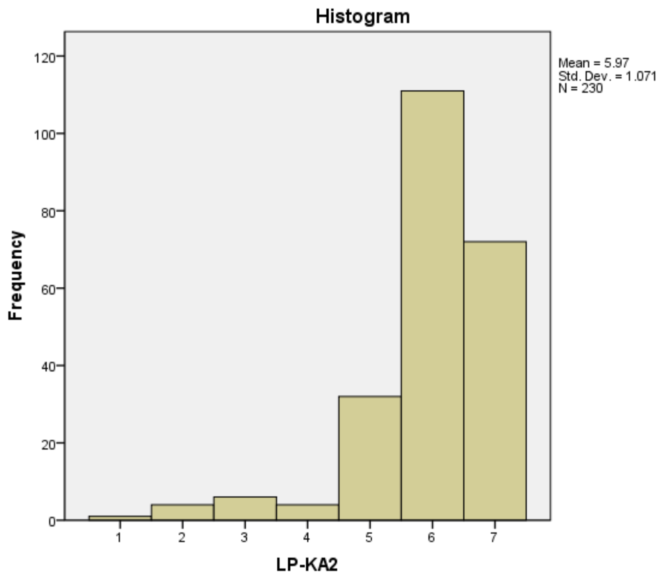

Normal Q-Q Plot of WK2
Expected Normal
2
1
0
-1
-2
-3
-4
0
2
4
6
8
Observed Value

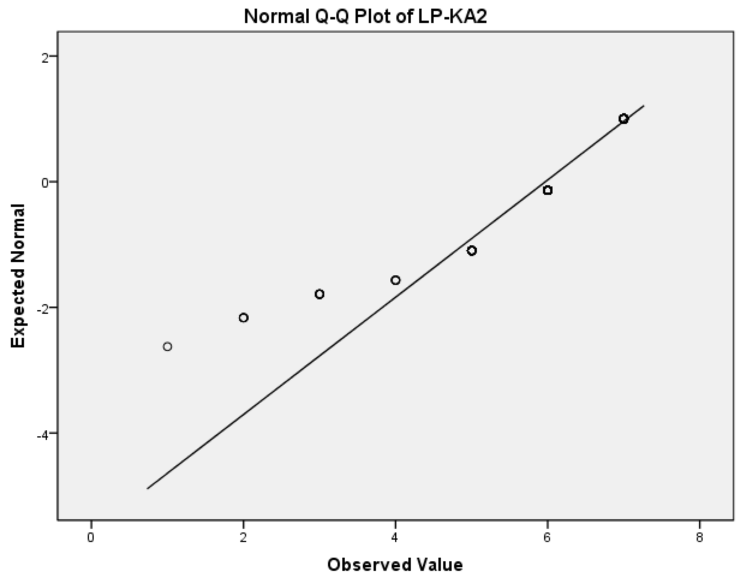

Histogram
Mean = 4.96
Std. Dev. = 1.196
N = 230
Frequency
WK3
0
20
40
60
80
1
2
3
4
5
6
7

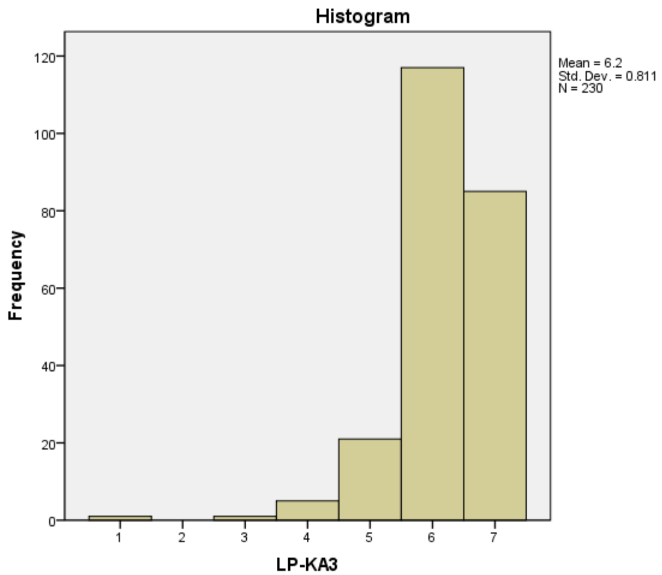

Normal Q-Q Plot of WK3
Expected Normal
Observed Value
2
1
0
-1
-2
-3
-4
0
2
4
6
8

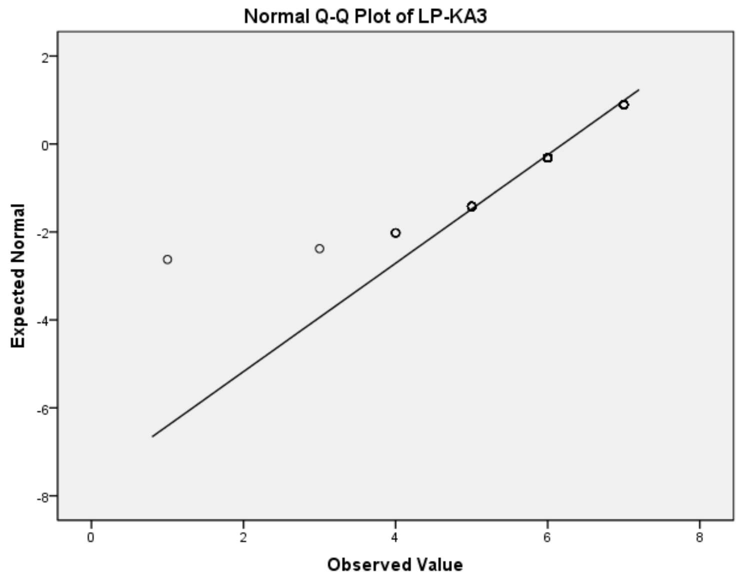

Histogram
Frequency
LP-KA1
Mean = 4.8
Std. Dev. = 1.261
N = 230

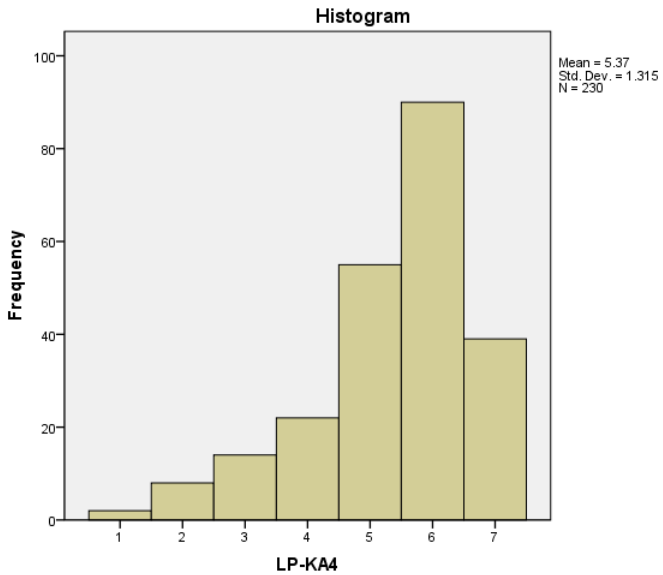

Normal Q-Q Plot of LP-KA1
Expected Normal
Observed Value

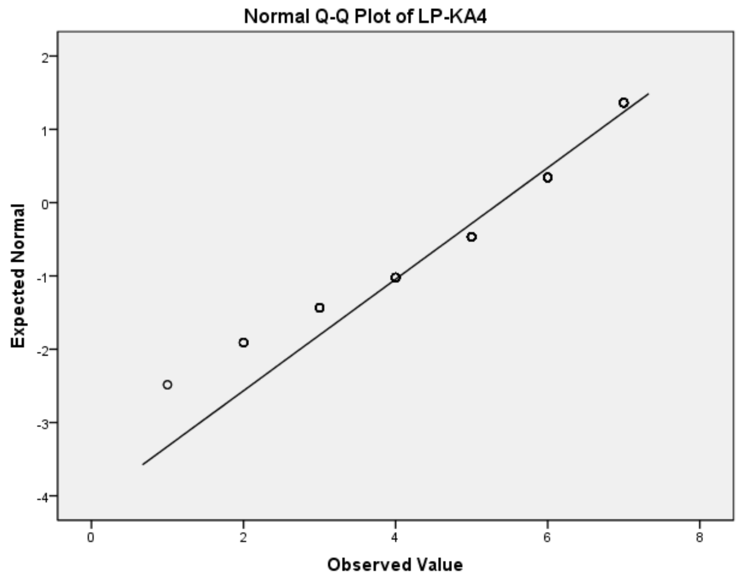

Histogram
Mean = 5.97
Std. Dev. = 1.071
N = 230
Frequency
LP-KA2

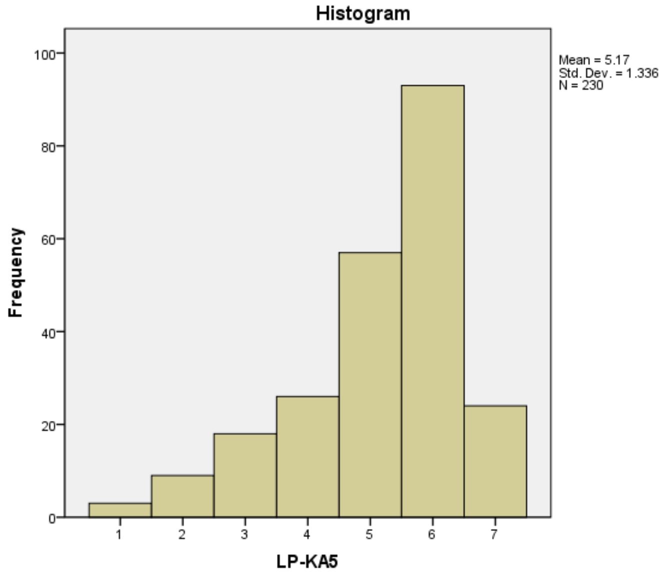

Normal Q-Q Plot of LP-KA2
Expected Normal
Observed Value

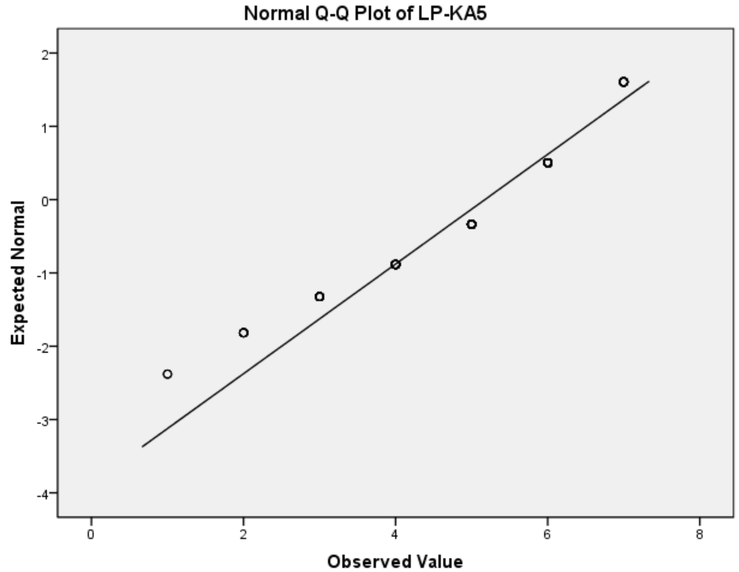

Histogram
Mean = 6.2
Std. Dev. = 0.811
N = 230
Frequency
LP-KA3

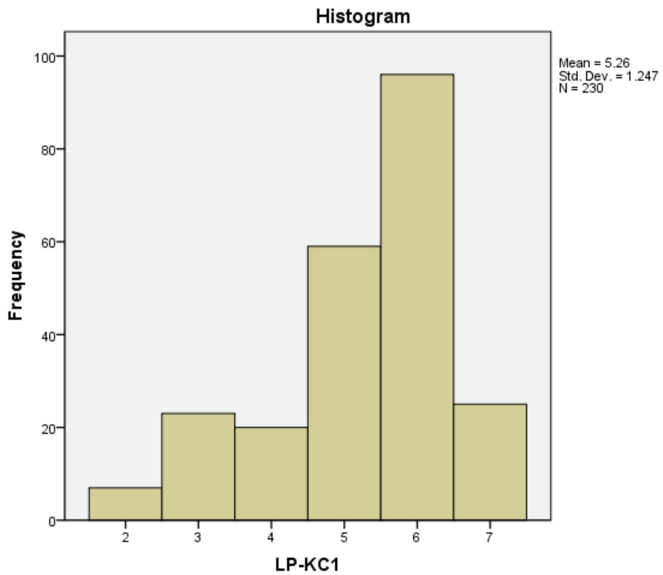

Normal Q-Q Plot of LP-KA3
Expected Normal
Observed Value

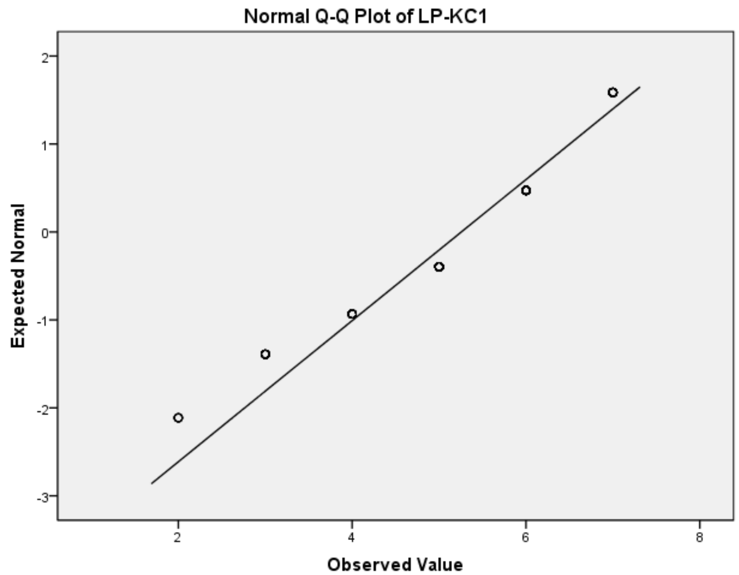

Histogram
Mean = 5.37
Std. Dev. = 1.315
N = 230
Frequency
LP-KA4

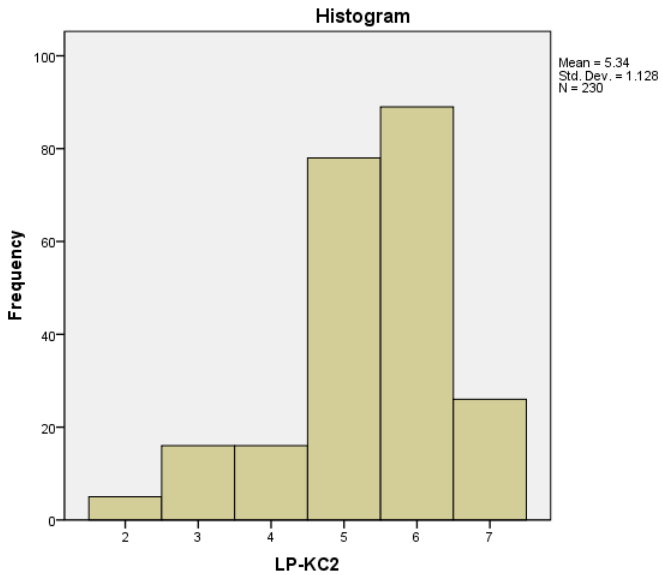

Normal Q-Q Plot of LP-KA4
Expected Normal
Observed Value


Histogram
Mean = 5.17
Std. Dev. = 1.336
N = 230
Frequency
LP-KA5
0
20
40
60
80
100
1
2
3
4
5
6
7

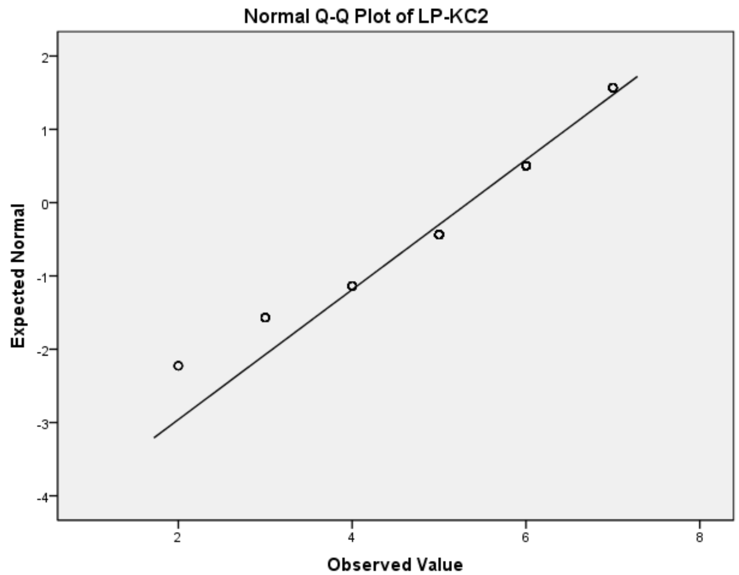

Normal Q-Q Plot of LP-KA5
Expected Normal
Observed Value
2
1
0
-1
-2
-3
-4
0
2
4
6
8


Histogram
Mean = 5.26
Std. Dev. = 1.247
N = 230
Frequency
LP-KC1

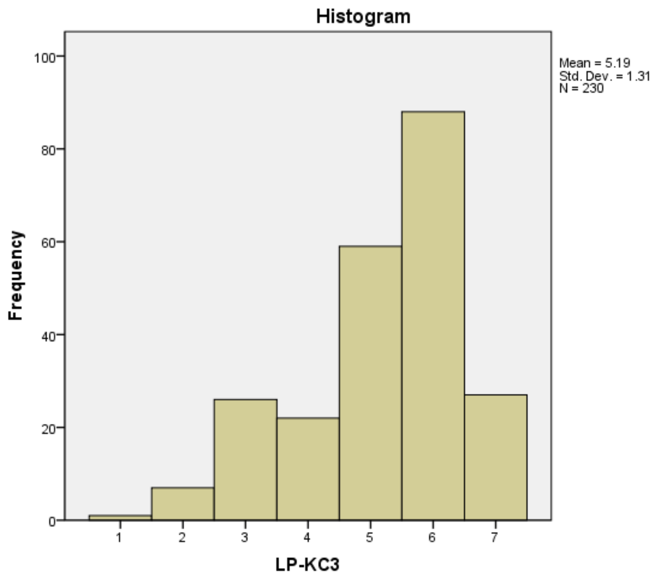

Normal Q-Q Plot of LP-KC1
Expected Normal
Observed Value

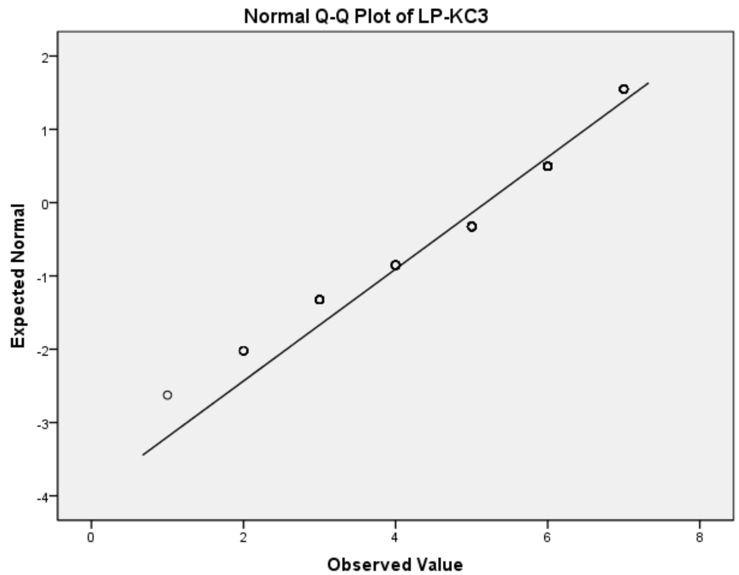


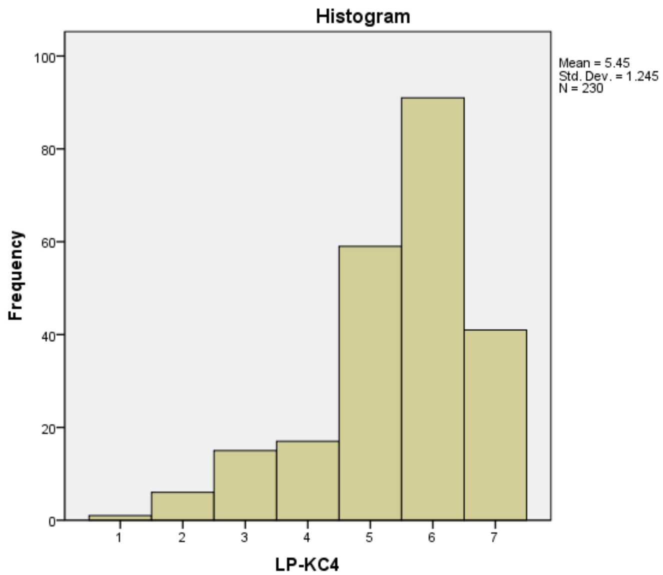
Histogram
Mean = 5.34
Std. Dev. = 1.128
N = 230
Frequency
LP-KC2

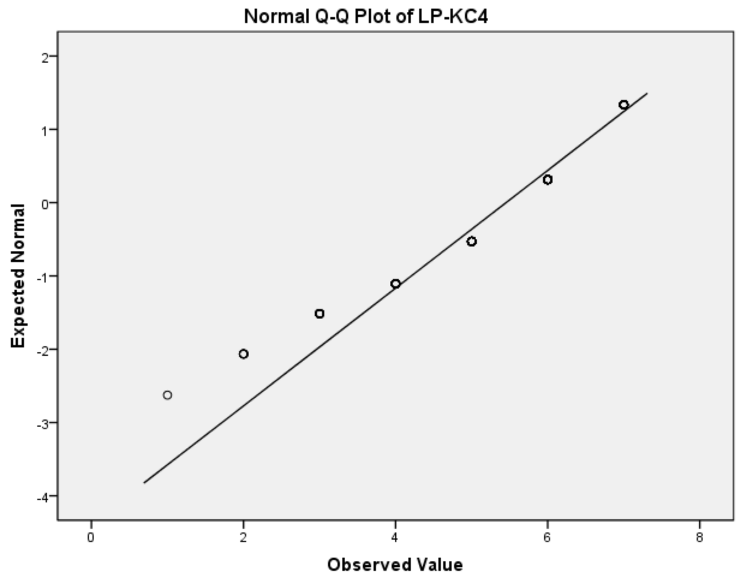


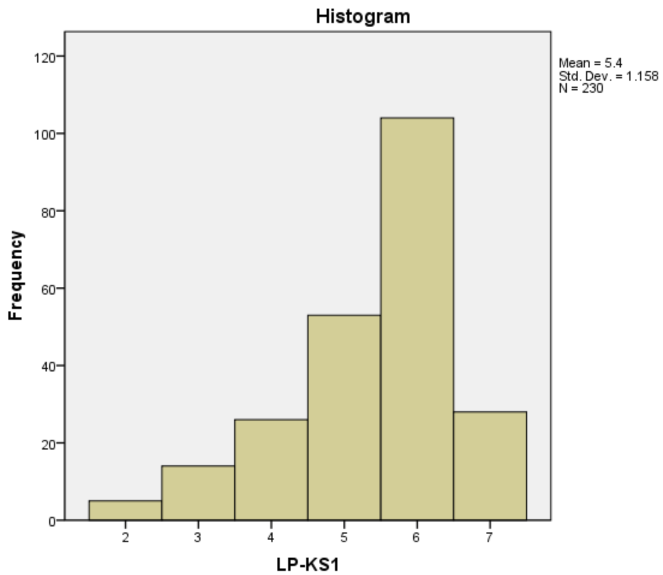
Normal Q-Q Plot of LP-KC2
Expected Normal
Observed Value

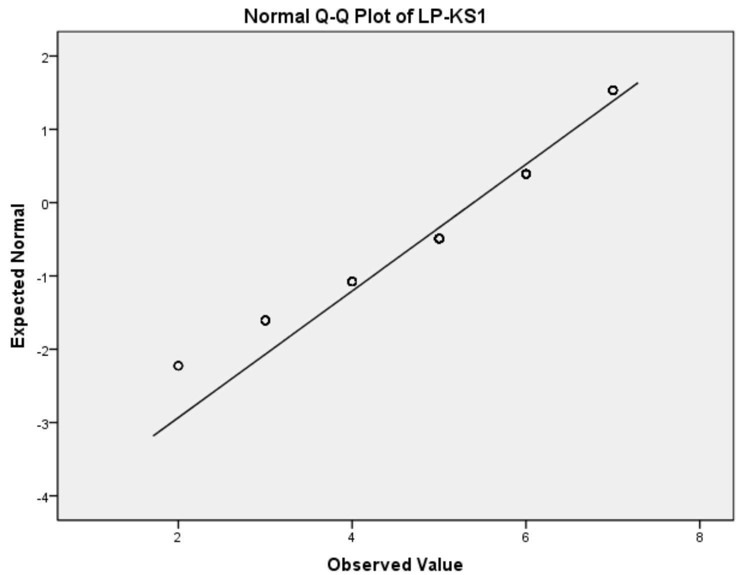

Histogram
Mean = 5.19
Std. Dev. = 1.31
N = 230
Frequency
LP-KC3

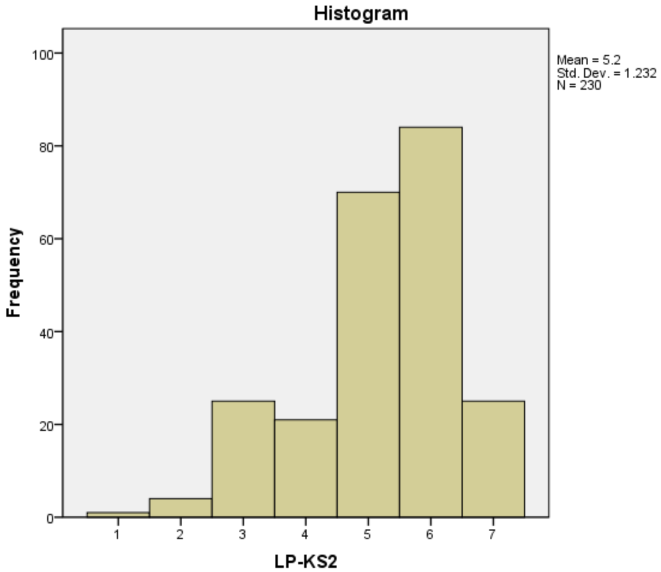

Normal Q-Q Plot of LP-KC3
Expected Normal
Observed Value

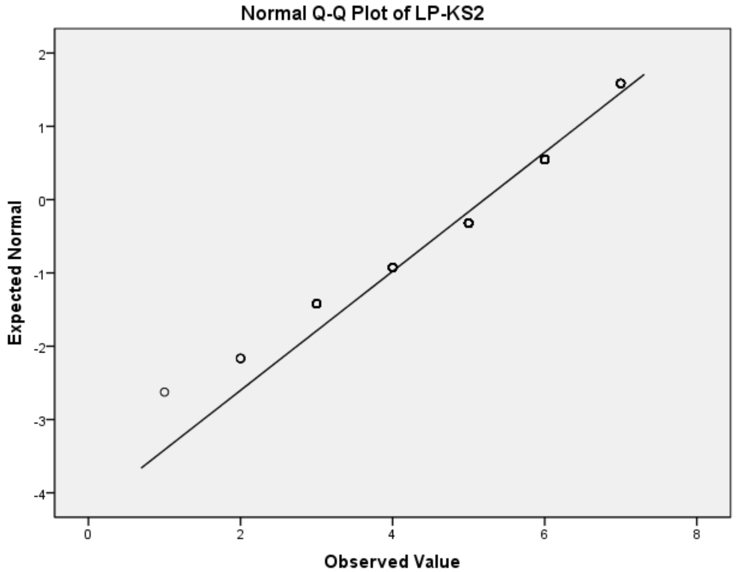

Histogram
Mean = 5.45
Std. Dev. = 1.245
N = 230
Frequency
LP-KC4

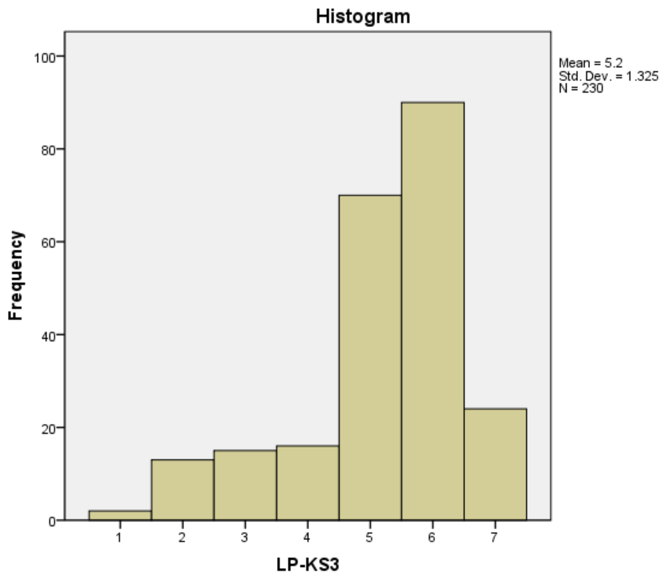

Normal Q-Q Plot of LP-KC4
Expected Normal
Observed Value

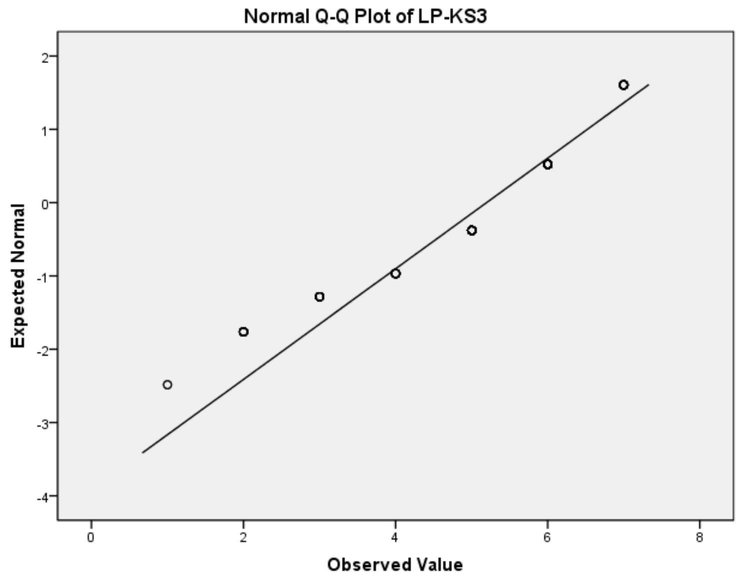

Histogram
Mean = 5.4
Std. Dev. = 1.158
N = 230
Frequency
LP-KS1

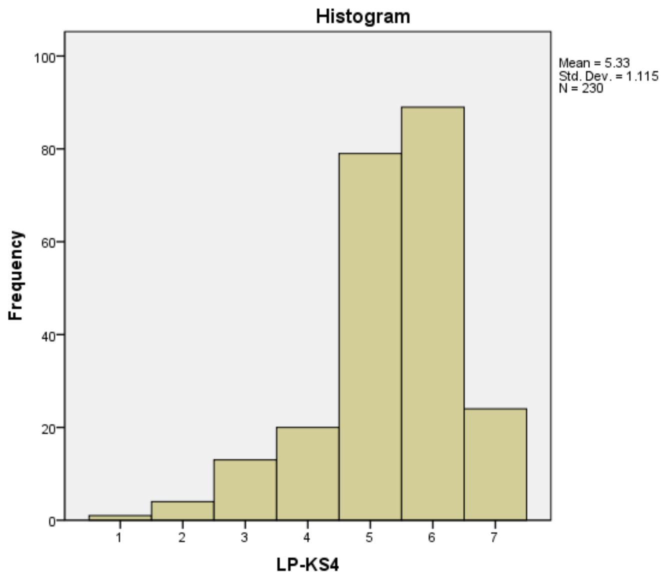

Normal Q-Q Plot of LP-KS1
Expected Normal
Observed Value

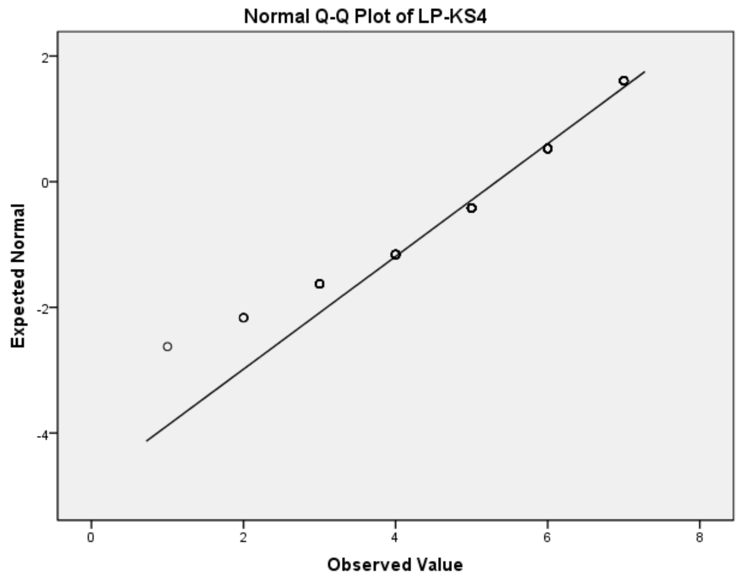

Histogram
Mean = 5.2
Std. Dev. = 1.232
N = 230
Frequency
LP-KS2
0
20
40
60
80
100
1
2
3
4
5
6
7

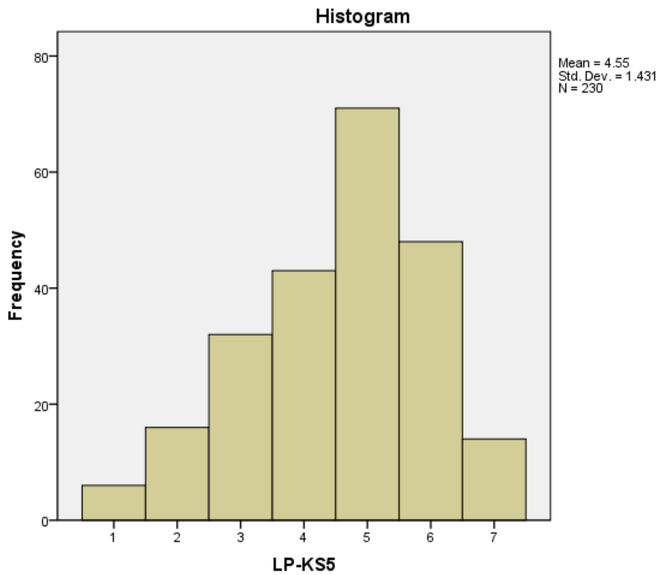

Normal Q-Q Plot of LP-KS2
Expected Normal
Observed Value
2
1
0
-1
-2
-3
-4
0
2
4
6
8

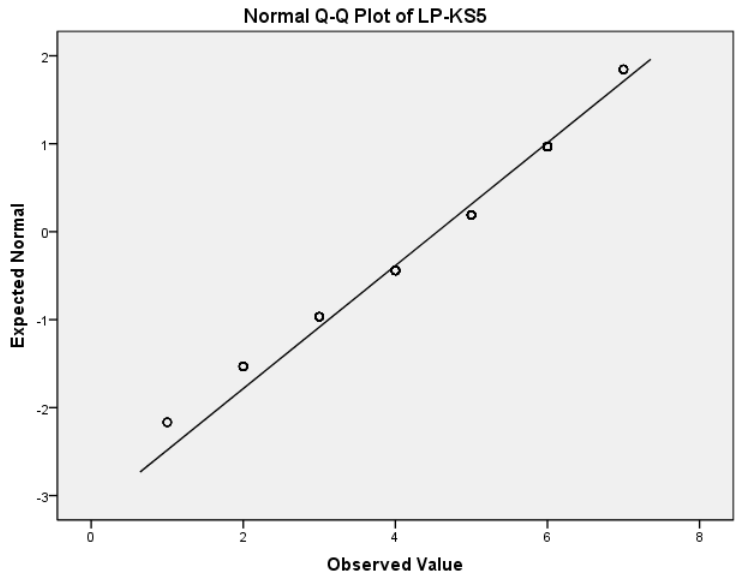

Histogram
Mean = 5.2
Std. Dev. = 1.325
N = 230
Frequency
100
80
60
40
20
0
1
2
3
4
5
6
7
LP-KS3

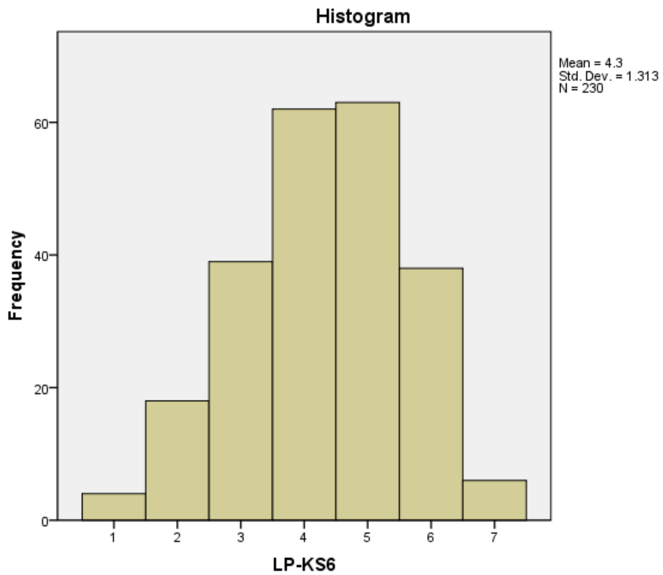

Normal Q-Q Plot of LP-KS3
Expected Normal
2
1
0
-1
-2
-3
-4
0
2
4
6
8
Observed Value

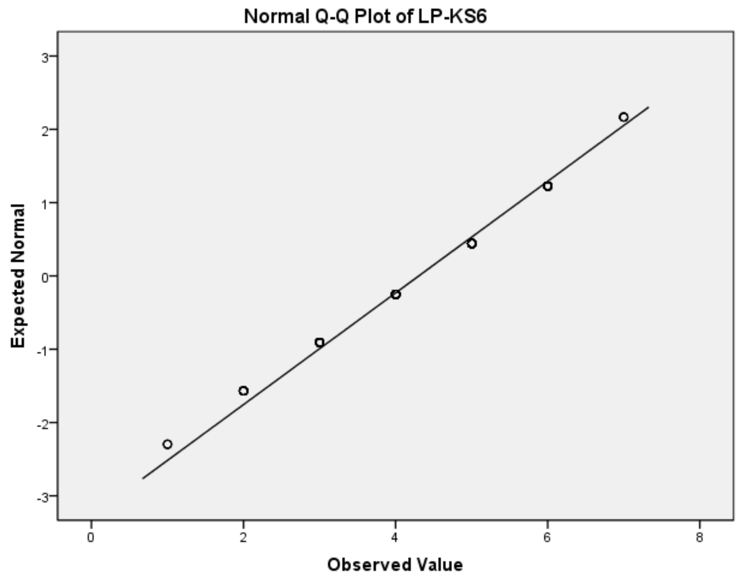

Histogram
Mean = 5.33
Std. Dev. = 1.115
N = 230
Frequency
100
80
60
40
20
0
1
2
3
4
5
6
7
LP-KS4

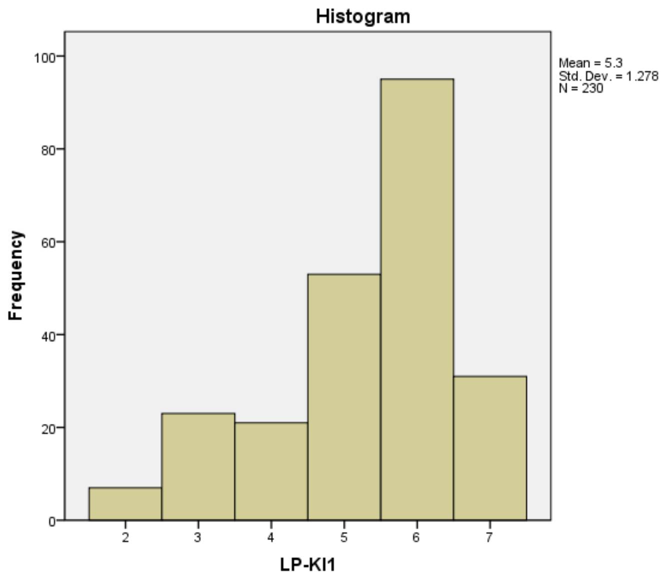

Normal Q-Q Plot of LP-KS4
Expected Normal
2
0
-2
-4
0
2
4
6
8
Observed Value

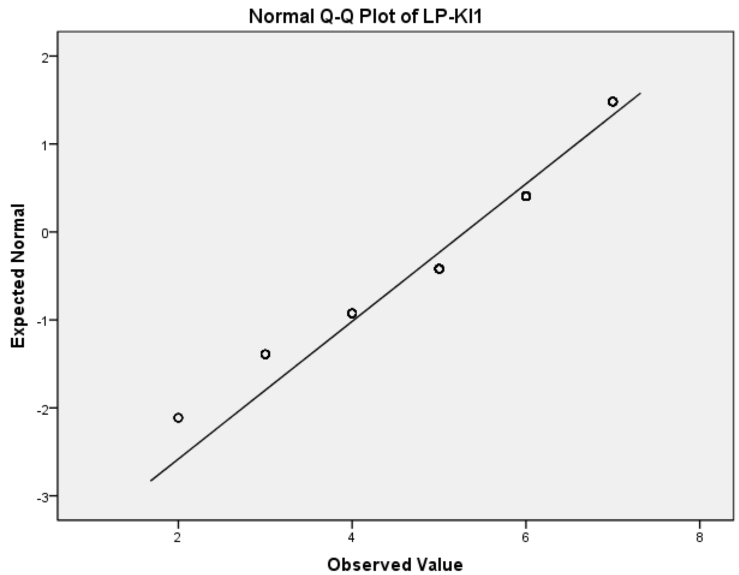

Histogram
Mean = 4.55
Std. Dev. = 1.431
N = 230
Frequency
LP-KS5

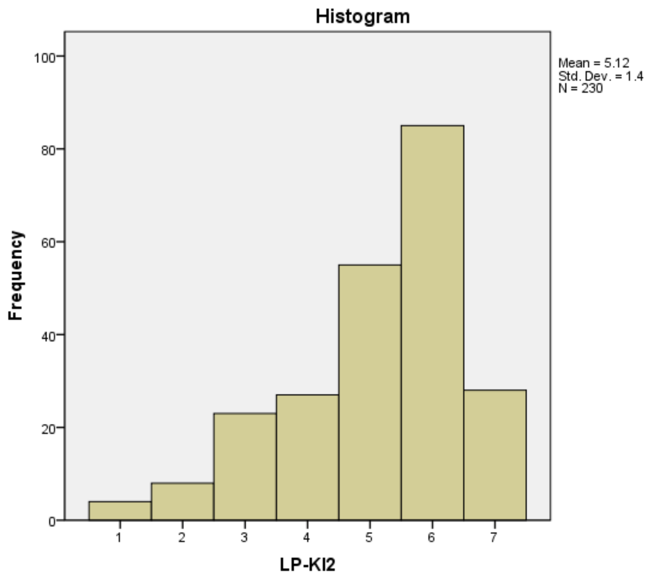

Normal Q-Q Plot of LP-KS5
Expected Normal
Observed Value

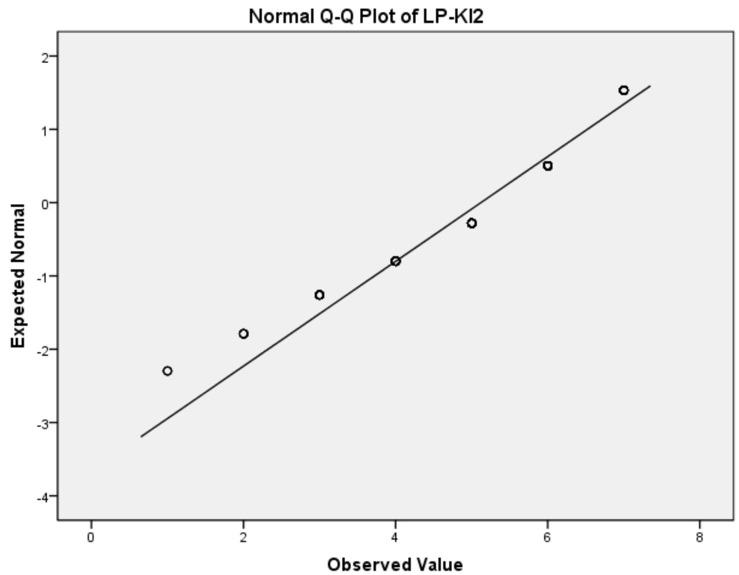

Histogram
Mean = 4.3
Std. Dev. = 1.313
N = 230
Frequency
0
20
40
60
1
2
3
4
5
6
7
LP-KS6

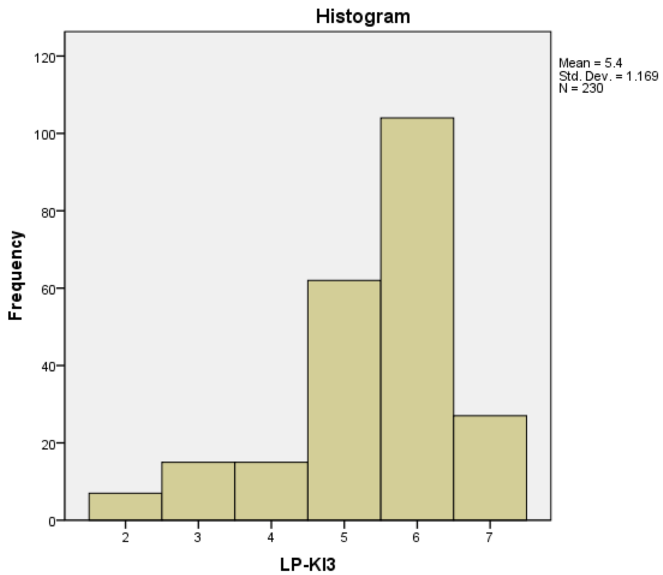

Normal Q-Q Plot of LP-KS6
Expected Normal
3
2
1
0
-1
-2
-3
0
2
4
6
8
Observed Value


Histogram
Frequency
LP-KI1
Mean = 5.3
Std. Dev. = 1.278
N = 230

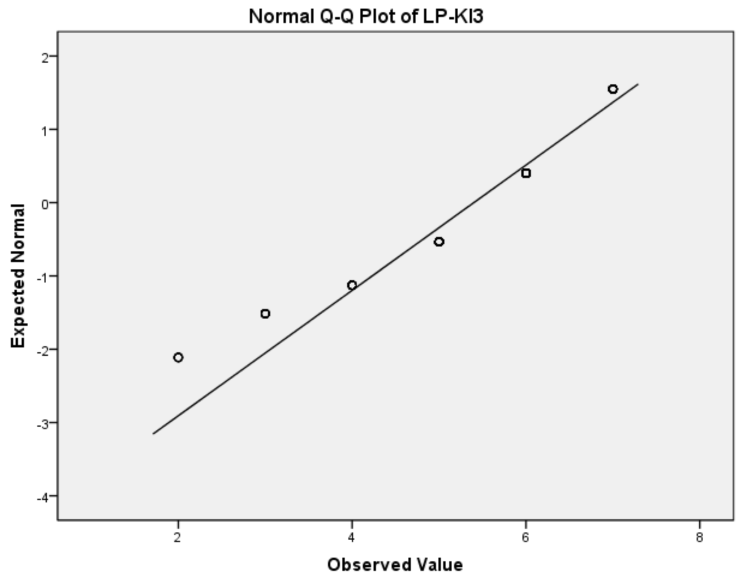

Normal Q-Q Plot of LP-KI1
Expected Normal
Observed Value


Histogram
Mean = 5.12
Std. Dev. = 1.4
N = 230
Frequency
LP-KI2

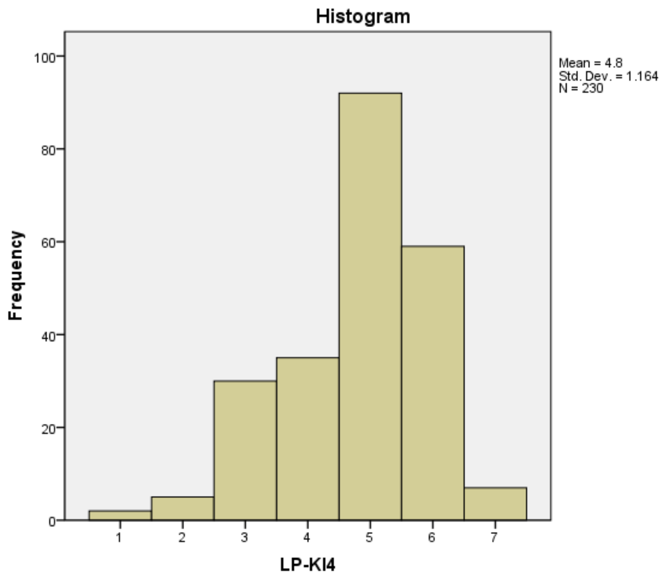

Normal Q-Q Plot of LP-KI2
Expected Normal
Observed Value

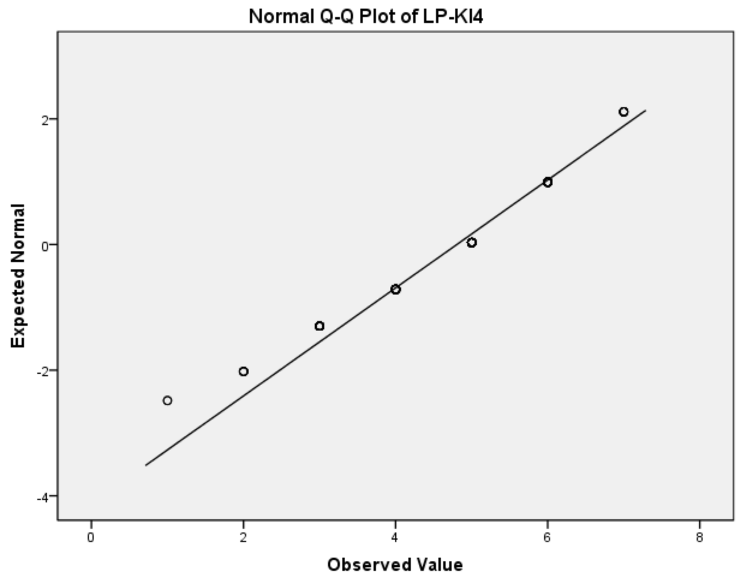


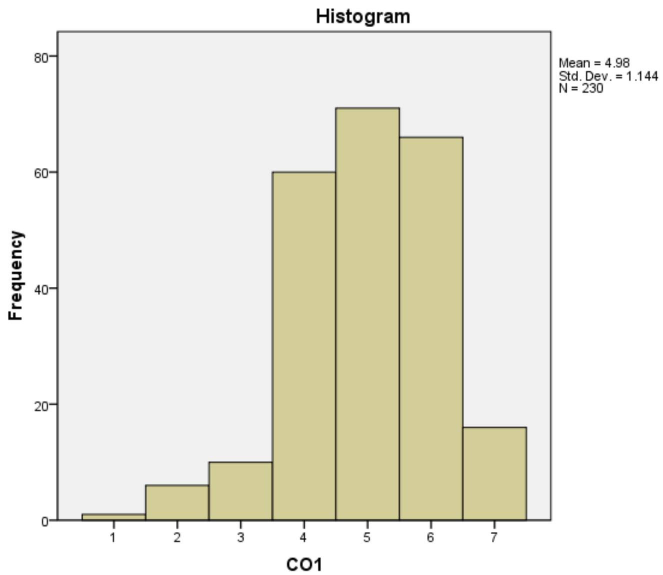
Histogram
Mean = 5.4
Std. Dev. = 1.169
N = 230
Frequency
LP-KI3

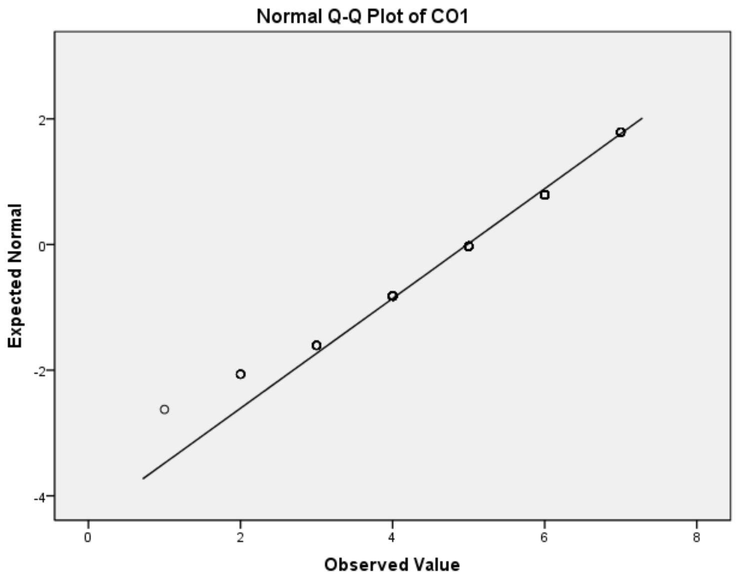


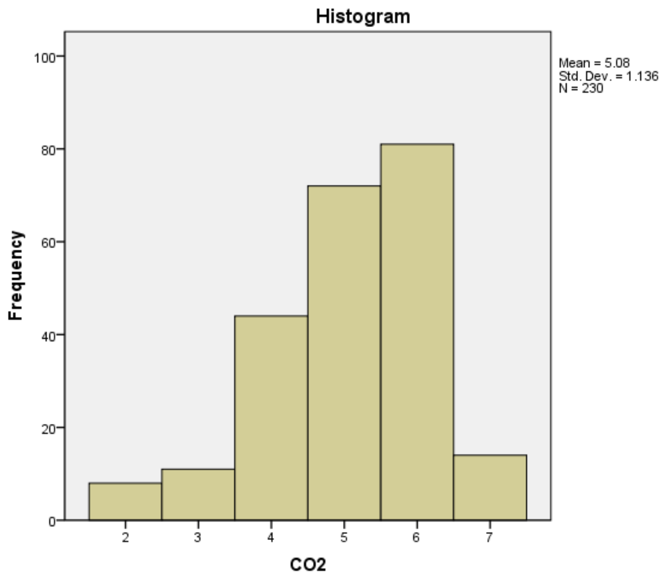
Normal Q-Q Plot of LP-KI3
Expected Normal
Observed Value

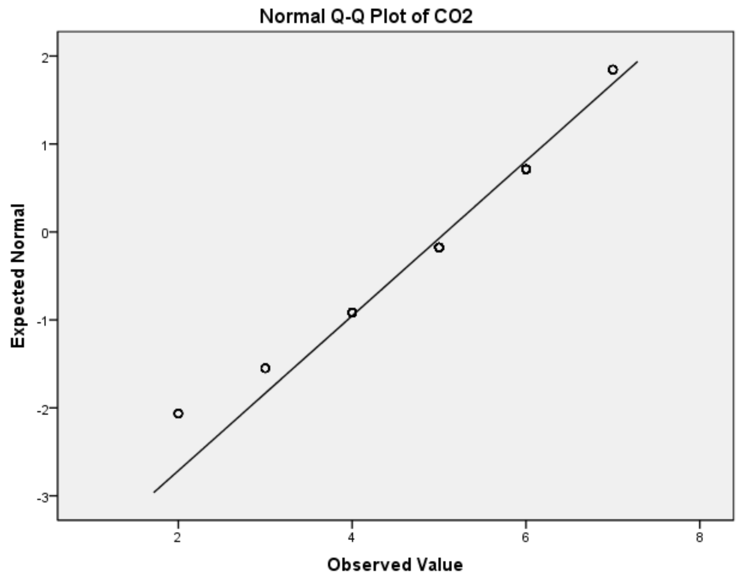

Histogram
Mean = 4.8
Std. Dev. = 1.164
N = 230
Frequency
LP-KI4

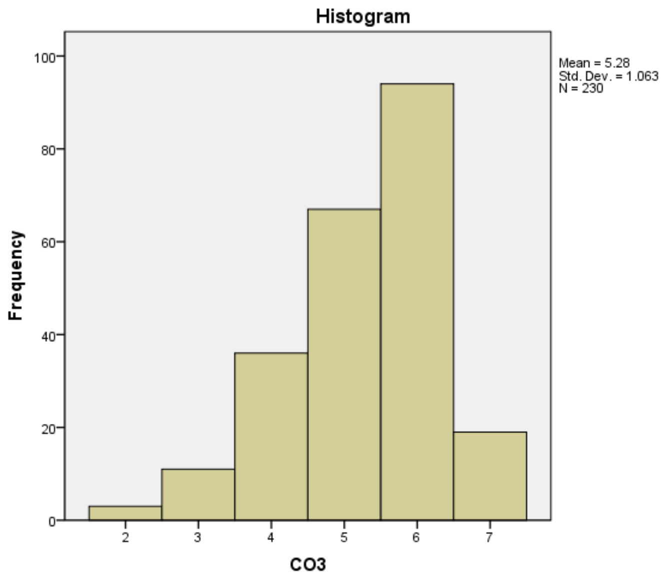

Normal Q-Q Plot of LP-KI4
Expected Normal
Observed Value

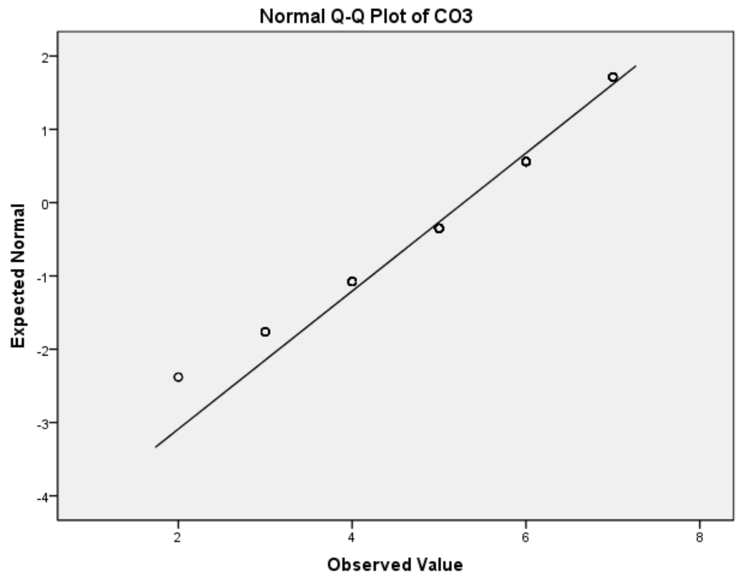

Histogram
Mean = 4.98
Std. Dev. = 1.144
N = 230
Frequency
0
20
40
60
80
1
2
3
4
5
6
7
CO1

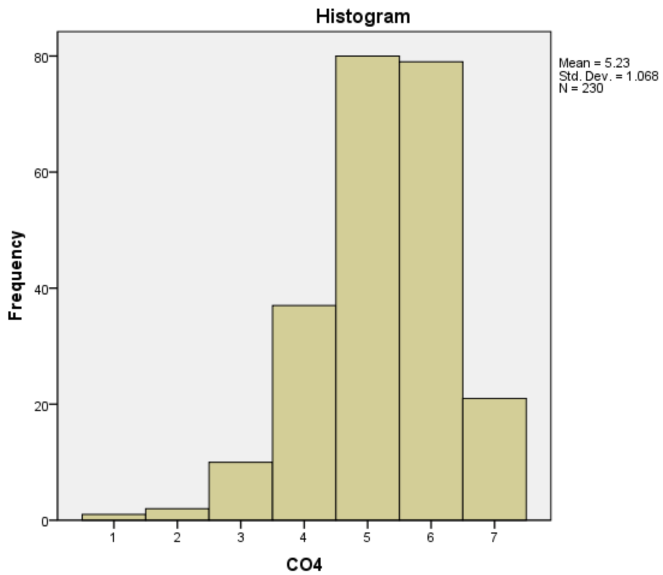

Normal Q-Q Plot of CO1
Expected Normal
2
0
-2
-4
0
2
4
6
8
Observed Value

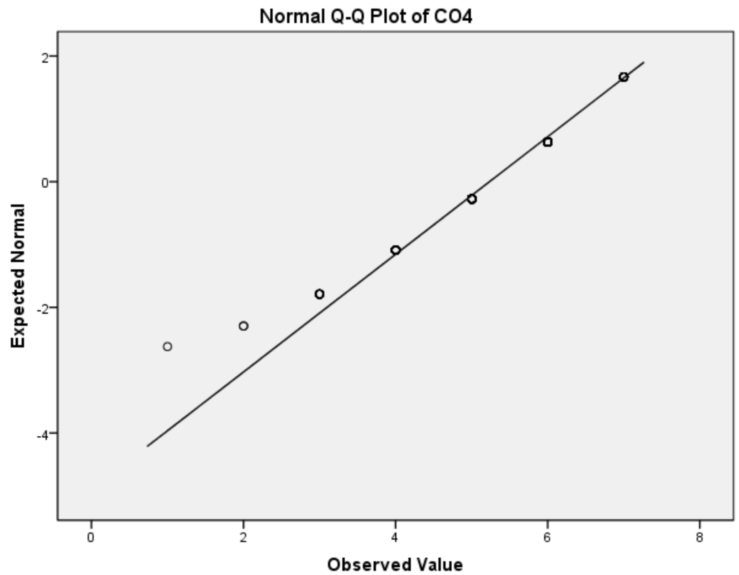

Histogram
Mean = 5.08
Std. Dev. = 1.136
N = 230
Frequency
CO2
0
20
40
60
80
100
2
3
4
5
6
7

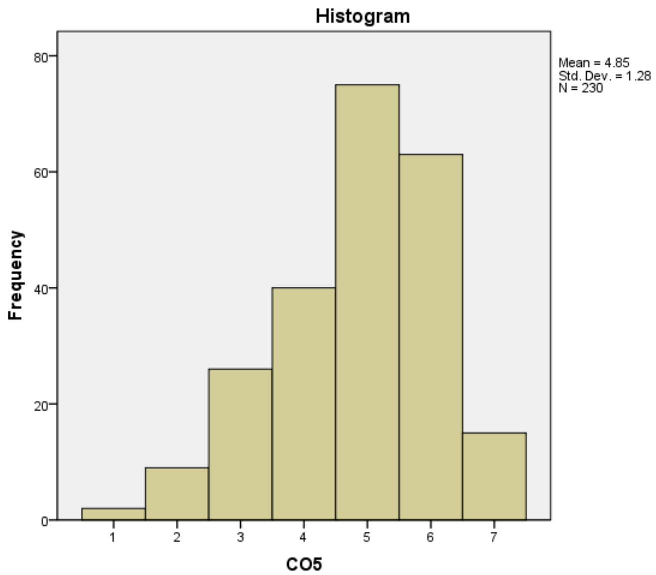

Normal Q-Q Plot of CO2
Expected Normal
Observed Value
2
1
0
-1
-2
-3
2
4
6
8

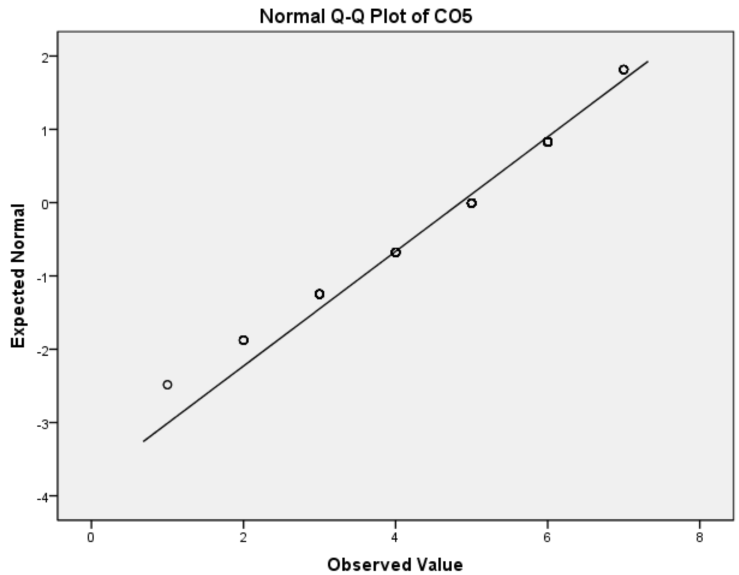

Histogram
Mean = 5.28
Std. Dev. = 1.063
N = 230
Frequency
CO3
0
20
40
60
80
100
2
3
4
5
6
7

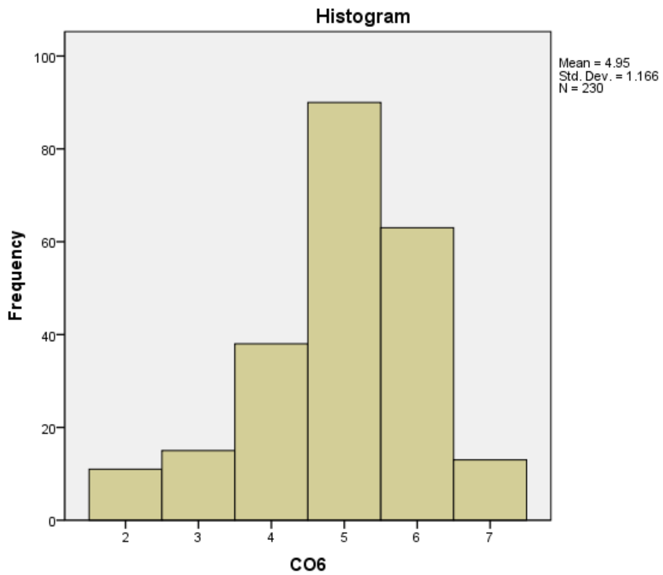

Normal Q-Q Plot of CO3
Expected Normal
Observed Value
2
1
0
-1
-2
-3
-4
2
4
6
8

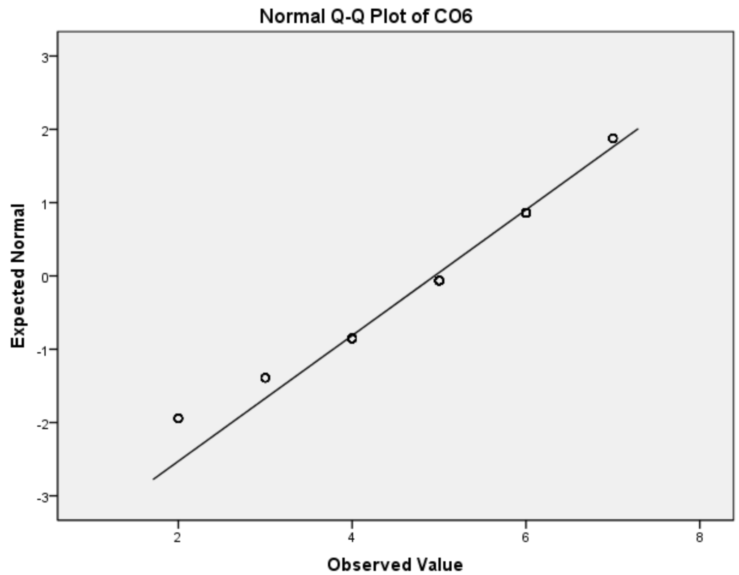

Histogram
Mean = 5.23
Std. Dev. = 1.068
N = 230
Frequency
CO4

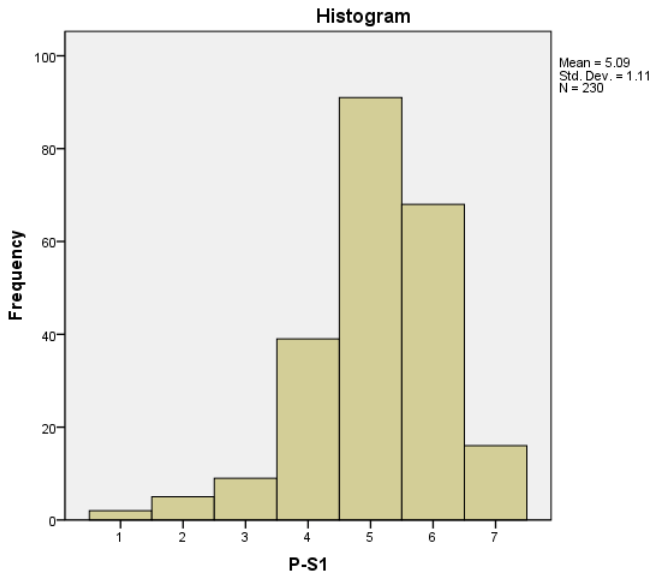

Normal Q-Q Plot of CO4
Expected Normal
Observed Value

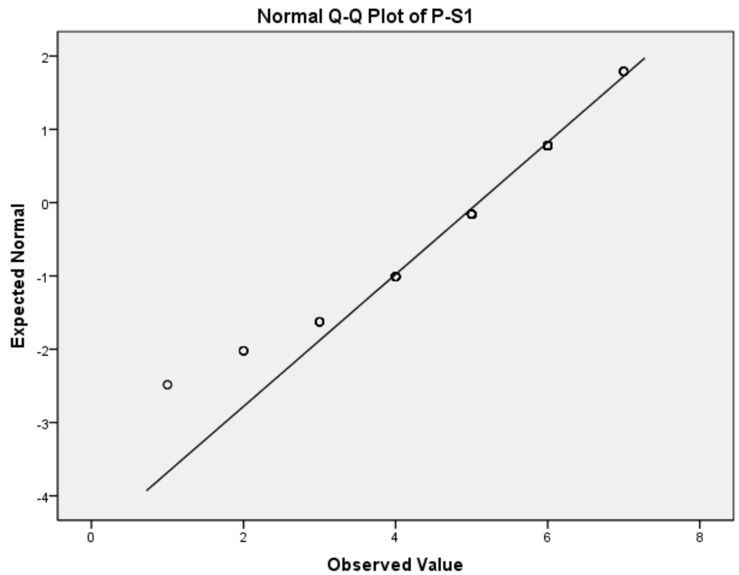

Histogram
Mean = 4.85
Std. Dev. = 1.28
N = 230
Frequency
80
60
40
20
0
1
2
3
4
5
6
7
CO5

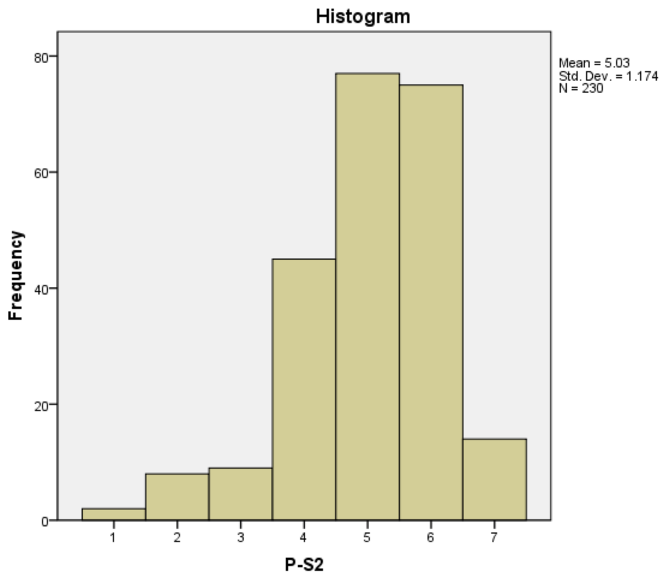

Normal Q-Q Plot of CO5
Expected Normal
2
1
0
-1
-2
-3
-4
0
2
4
6
8
Observed Value

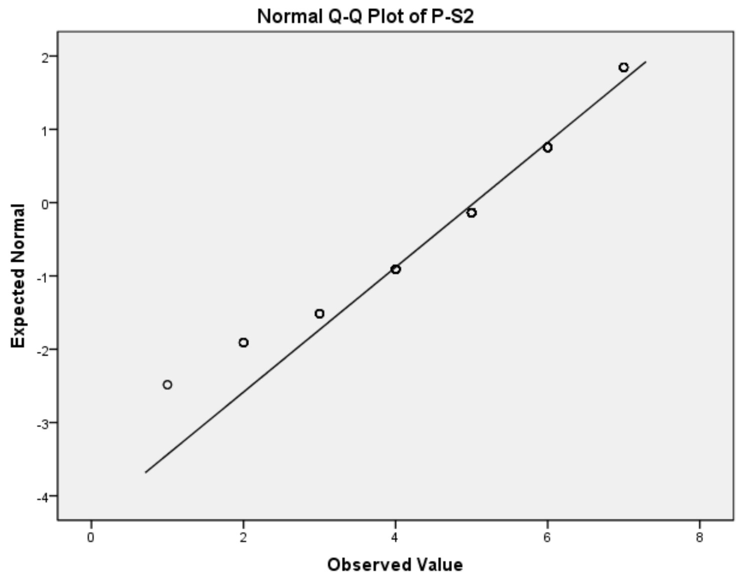

Histogram
Mean = 4.95
Std. Dev. = 1.166
N = 230
Frequency
CO6

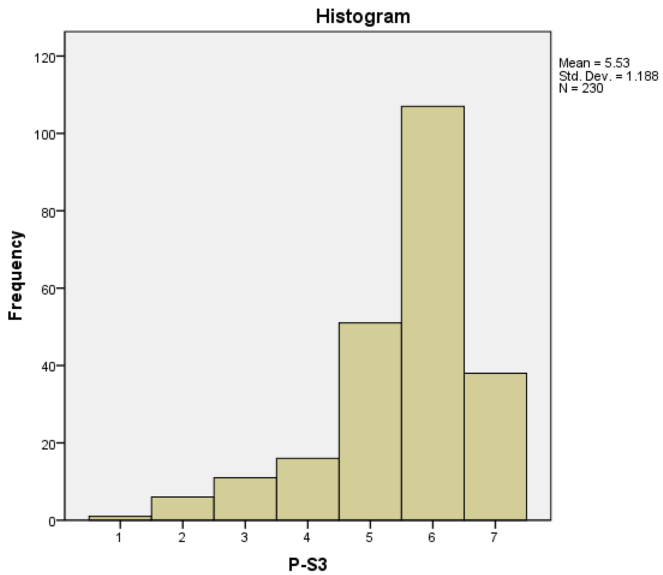

Normal Q-Q Plot of CO6
Expected Normal
Observed Value

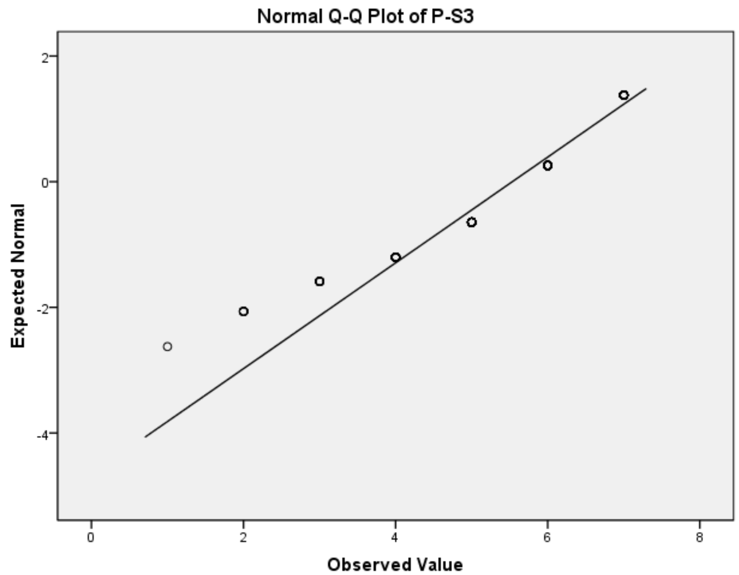

Histogram
Mean = 5.09
Std. Dev. = 1.11
N = 230
Frequency
P-S1

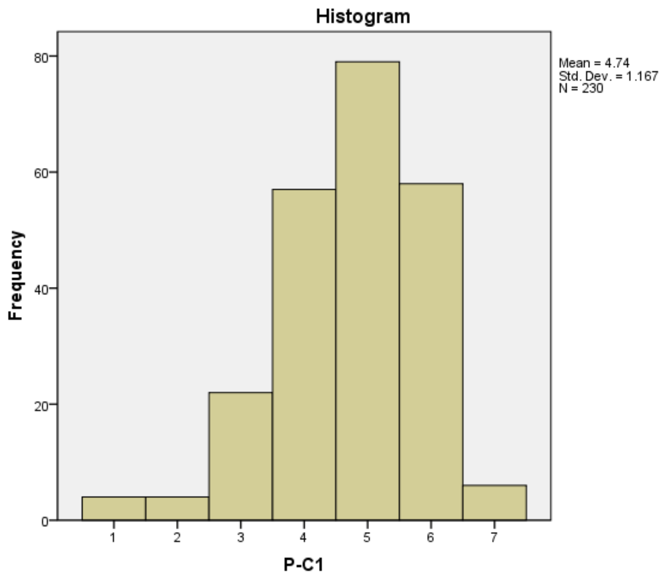

Normal Q-Q Plot of P-S1
Expected Normal
Observed Value

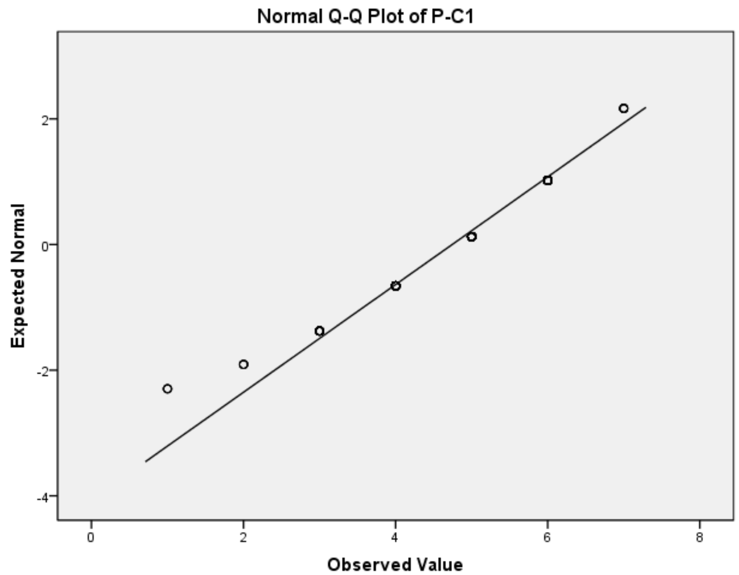

Histogram
Mean = 5.03
Std. Dev. = 1.174
N = 230
Frequency
0
20
40
60
80
1
2
3
4
5
6
7
P-S2

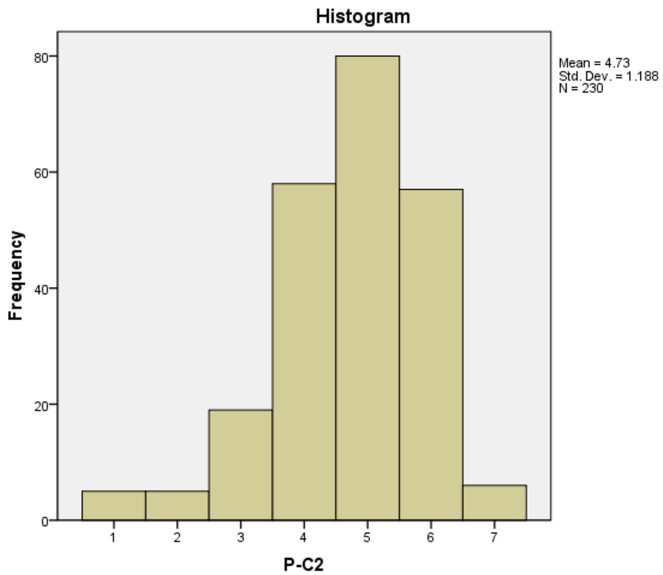

Normal Q-Q Plot of P-S2
Expected Normal
2
1
0
-1
-2
-3
-4
0
2
4
6
8
Observed Value

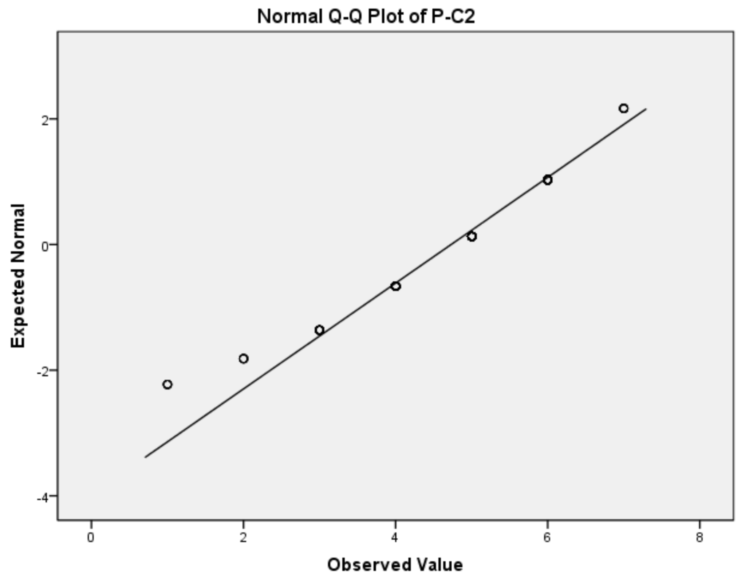

Histogram
Mean = 5.53
Std. Dev. = 1.188
N = 230
Frequency
P-S3
0
20
40
60
80
100
120
1
2
3
4
5
6
7


Normal Q-Q Plot of P-S3
Expected Normal
Observed Value
2
0
-2
-4
0
2
4
6
8


Histogram
Frequency
P-C1
Mean = 4.74
Std. Dev. = 1.167
N = 230
0
20
40
60
80
1
2
3
4
5
6
7


Normal Q-Q Plot of P-C1
Expected Normal
Observed Value
2
0
-2
-4
0
2
4
6
8


Histogram
Mean = 4.73
Std. Dev. = 1.188
N = 230
Frequency
80
60
40
20
0
1
2
3
4
5
6
7
P-C2


Normal Q-Q Plot of P-C2
Expected Normal
2
0
-2
-4
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4
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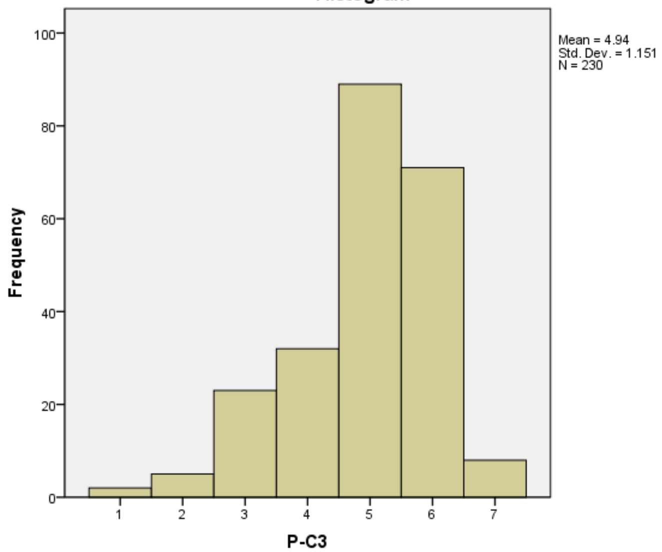
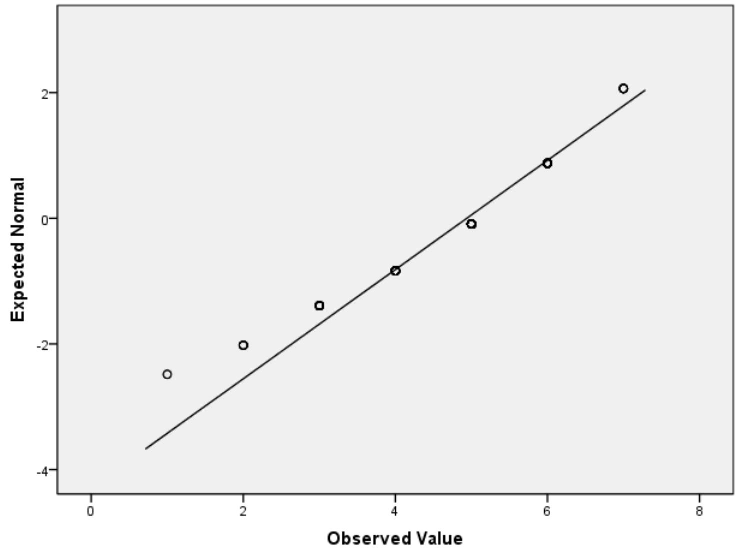
8
Observed Value

Histogram



Normal Q-Q Plot of P-C3



Appendix 8 – Refereed conference papers associated with this research project

Hemstrom, C. and N. Harrison 2012. Modeling the Operational Performance of Third Party Logistic Providers (3PLs). *41st Annual Meeting of the Western Decision Sciences Institute, 3-6 April 2012, Hawaii*

Hemstrom, C. and N. Harrison 2012. Do learning processes, absorptive capacity and integration capabilities drive 3PL performance*? POMS 23rd Annual Conference, 20-23 April 2012, Chicago*

Hemstrom, C. and N. Harrison 2013. Managing market turbulence: Organizational performance effects of customer integration in 3PLs. *POMS 24th Annual Conference, 3-6 May 2013, Denver, Colorado*

Harrison, N. and C. Hemstrom 2013. Customer and external integration improves organizational performance: Evidence from the research literature published between 1994 and 2012. *20th EurOMA Conference, 7-12 June 2013, Dublin, Ireland*

Hemstrom, C. and N. Harrison 2013. Factors Influencing the Effects of Customer Integration under Conditions of Market Turbulence. *73rd Annual Meeting of the Academy of Management, 9-13 August 2013, Orlando, Florida*

Appendix 9 – List of definitions of measured variables

The following table is a re-statement of the variable definitions and is provided for easy reference by the reader.

Variable	Definition	Source
P-C1	The cost associated with the [COMPANY] order fulfillment process is getting better every time	Hult et al. (2006)
P-S1	The service level of the [COMPANY] order fulfillment process is getting better every time	Hult et al. (2006)
P-C2	We have seen an improvement in the cost associated with the [COMPANY] order fulfillment process recently	Hult et al. (2006)
P-S2	We have seen an improvement in the service level of the [COMPANY] order fulfillment process recently	Hult et al. (2006)
P-C3	Based on our knowledge of the [COMPANY] order fulfillment process, we think it is cost efficient	Hult et al. (2006)
P-S3	Based on our knowledge of the [COMPANY], order fulfillment process, we think service levels are high	Hult et al. (2006)
LI1	Inter-organizational logistics activities are closely coordinated.	Chen and Paulraj, 2004
LI2	[THE COMPANY'S] logistics activities are well integrated with the logistics activities of its customers.	Chen and Paulraj, 2004
LI3	[COMPANY] logistics integration is characterized by excellent distribution, transportation and/or warehousing facilities.	Chen and Paulraj, 2004
LI4	The inbound and outbound distribution of goods with [THE COMPANY'S] customers is well integrated.	Chen and Paulraj, 2004
LI5	Information and materials flow smoothly between [THE COMPANY'S] customer firms and [THE COMPANY].	Chen and Paulraj, 2004
MK1	The knowledge of [THE COMPANY'S] managers is adequate when making business decisions.	Tu et al., 2006
MK2	The knowledge of [THE COMPANY'S] managers is adequate when dealing with new logistics technologies.	Tu et al., 2006
MK3	The knowledge of [THE COMPANY'S] managers is adequate when managing daily logistics operations.	Tu et al., 2006

MK4	The knowledge of [THE COMPANY'S] managers is adequate when solving technical logistics problems.	Tu et al., 2006
WK1	The general knowledge level of [THE COMPANY'S] first-line workers is high.	Tu et al., 2006
WK2	The overall technical knowledge of [THE COMPANY'S] first-line workers is high.	Tu et al., 2006
WK3	The general educational level of [THE COMPANY'S] first-line workers is high.	Tu et al., 2006
WK4	The overall job competence of [THE COMPANY'S] first-line workers is high.	Tu et al., 2006
CO1	COMPANY'S business objectives are driven primarily by customer satisfaction.	Deshpande and Farley (1998) attributed to Narver and Slater (1990)
CO2	COMPANY constantly monitors its level of commitment and orientation to serving customers needs.	Deshpande and Farley (1998) attributed to Narver and Slater (1990)
CO3	COMPANY'S strategy for competitive advantage is based on its understanding of customers needs.	Deshpande and Farley (1998) attributed to Narver and Slater (1990)
CO4	COMPANY'S business strategies are driven by its beliefs about how it can create greater value for its customers.	Deshpande and Farley (1998) attributed to Narver and Slater (1990)
CO5	COMPANY measures customer satisfaction systematically and frequently.	Deshpande and Farley (1998) attributed to Narver and Slater (1990)
CO6	COMPANY gives close attention to after-sales service.	Deshpande and Farley (1998) attributed to Narver and Slater (1990)
LP-KA1 about their prior and/or current logistics experience.	[THE COMPANY'S] managers involved with the company's logistics operations are regularly debriefed	Kale and Singh, 2007

LP-KA2	[THE COMPANY'S] managers responsible for the company's logistics operations maintain a record (in the form of a memo, note, report, or presentation) of all major incidents, decisions, or actions associated with their respective logistics operations.	Kale and Singh, 2007
LP-KA3	[THE COMPANY'S] managers regularly report on the progress and performance of their respective logistics operations.	Kale and Singh, 2007
LP-KA4	[THE COMPANY] maintains a 'repository' or database containing factual information of each of its logistics operations (e.g., contracts and agreements, performance measures, standard operating procedures, customer and supplier contacts, etc.).	Kale and Singh, 2007
LP-KA5	[THE COMPANY] maintains a directory or 'contact list' of individuals from within the company or outside who can potentially provide inputs or assistance on logistics management.	Kale and Singh, 2007
LP-KC1	[THE COMPANY'S] managers follow a well-defined 'process' to guide the formation or management of any logistics operation.	Kale and Singh, 2007
LP-KC2	Resources such as checklists or guidelines are developed and used to assist managerial decision making and actions while forming or managing [THE COMPANY'S] logistics operations.	Kale and Singh, 2007
LP-KC3	Resources such as logistics operations manuals (containing tools, templates, or frameworks) are developed and used to assist managerial decision making and/or actions while forming or managing [THE COMPANY'S] logistics operations.	Kale and Singh, 2007
LP-KC4	THE COMPANY] updates the logistics operations checklists, guidelines or manuals that have been developed and are in use.	Kale and Singh, 2007
LP-KS1	[THE COMPANY] management conducts a 'collective review' to assess the progress and performance of its logistics operations.	Kale and Singh, 2007
LP-KS2	[THE COMPANY'S] managers participate in forums such as committees or task forces to take stock of their logistics operations management experience and practices.	Kale and Singh, 2007
LP-KS3	[THE COMPANY] managers participate in forums such as meetings, seminars, or retreats to exchange logistics-related information, experiences, war stories, etc.	Kale and Singh, 2007
LP-KS4	[THE COMPANY] managers engage in informal sharing and exchange of logistics-related information and know-how with peers or colleagues within the organization.	Kale and Singh, 2007

LP-KS5	[THE COMPANY] managers with substantial prior experience in managing logistics are usually rotated across some of the company's key logistics operations.	Kale and Singh, 2007
LP-KS6	Managerial incentives are used to encourage individual managers to share their personal logistics management experience and know-how with other managers within [THE COMPANY].	Kale and Singh, 2007
LP-KI1	[THE COMPANY] managers attend 'in-house' training programs on 'logistics management' whenever they are assigned to manage or work with any logistics operation.	Kale and Singh, 2007
LP-KI2	[THE COMPANY] managers attend externally conducted training programs on 'logistics management' whenever they are assigned to manage or work with any logistics operation.	Kale and Singh, 2007
LP-KI3	[THE COMPANY] provides opportunities for 'on-the-job' logistics training to individuals who are relatively new to managing logistics operations. Here, individuals are assigned to work in existing logistics operations, especially with managers who have substantial experience in managing such operations.	Kale and Singh, 2007
LP-KI4	[THE COMPANY] provides managers access to documented and codified information and know-how on its prior and ongoing logistics operations experience.	Kale and Singh, 2007

Appendix 10 – Copy of final ethics approval letter

MACQUARIE UNIVERSITY

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Ethics
Phone **+61 (0)2 9850 6848**
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10 August 2009

Mr Stig Christer Hemstrom
PO Box R1792
Royal Exchange
NSW 1225

Reference: HE26JUN2009-D06624

Dear Mr Hemstrom,

FINAL APPROVAL

Title of project: The relationship between capabilities, market orientation, knowledge development and performance in third party logistics services

Thank you for your recent correspondence. Your response has addressed the issues raised by the Ethics Review Committee (Human Research) and you may now commence your research.

Please note the following standard requirements of approval:

1. The approval of this project is **conditional** upon your continuing compliance with the *National Statement on Ethical Conduct in Human Research (2007)*.

2. Approval will be for a period of five (5 years) subject to the provision of annual reports. **Your first progress report is due on 01 August 2010.**

If you complete the work earlier than you had planned you must submit a Final Report as soon as the work is completed. If the project has been discontinued or not commenced for any reason, you are also required to submit a Final Report on the project.

Progress Reports and Final Reports are available at the following website:
http://www.research.mq.edu.au/researchers/ethics/human_ethics/forms

3. If the project has run for more than five (5) years you cannot renew approval for the project. You will need to complete and submit a Final Report and submit a new application for the project. (The five year limit on renewal of approvals allows the Committee to fully re-review research in an environment where legislation, guidelines and requirements are continually changing, for example, new child protection and privacy laws).

4. Please notify the Committee of any amendment to the project.

5. Please notify the Committee immediately in the event of any adverse effects on participants or of any unforeseen events that might affect continued ethical acceptability of the project.

6. At all times you are responsible for the ethical conduct of your research in accordance with the guidelines established by the University. This information is available at: http://www.research.mq.edu.au/policy

ETHICS REVIEW COMMITTEE (HUMAN RESEARCH)
MACQUARIE UNIVERSITY

http://www.research.mq.edu.au/researchers/ethics/human_ethics

www.mq.edu.au

If you will be applying for or have applied for internal or external funding for the above project it is your responsibility to provide Macquarie University's Research Grants Officer with a copy of this letter as soon as possible. The Research Grants Officer will not inform external funding agencies that you have final approval for your project and funds will not be released until the Research Grants Officer has received a copy of this final approval letter.

Yours sincerely

Dr Karolyn White
Director of Research Ethics
Chair, Ethics Review Committee (Human Research)

Cc: Professor Norma Harrison, Macquarie Graduate School of Management

REFERENCES

AGUINIS, H., PIERCE, C.A., AND S.A. CULPEPPER 2009. Scale coarseness as a methodological artifact. *Organizational Research Methods,* 12, 623-652.

ALI, S., PETERS, L.D., HE, H-W., AND F. LETTICE 2010. Market based organisational learning, dynamic, and substantive capabilities: an integrative framework. *Journal of Strategic Marketing,* 18, 363-377.

ALLISON, P. 2003. Missing Data Techniques for Structural Equation Modeling. *Journal of Abnormal Psychology,* 112, 545–557.

ANDERSON, D. R., BURNHAM, K.P., AND W.L. THOMPSON 2000. Null hypothesis testing: Problems, prevalence, and an alternative. *The Journal of Wildlife Management,* 64, 912-923.

ANDERSON, J. C., AND D.W. GERBING 1982. Some methods for respecifying measurement models to obtain unidimensional construct measurement. *Journal of Marketing Research,* XIX, 453-50.

ANDERSON, J. C., AND D.W. GERBING 1988. Structural equation modeling in practice: a review and recommended two-step approach. *Psychological Bulletin,* 103, 411-423.

ANTELO, M., AND L. BRU 2010. Outsourcing or restructuring: The dynamic choice. *International Journal of Production Economics,* 123, 1-7.

ARGYRIS, C. 1976. Theories of action that inhibit individual learning. *American Psychologist,* 31, 638-654.

ARGYRIS, C. 2003. A life full of learning. *Organization Studies,* 24, 1178-1192.

ARMSTRONG, J. S., AND T.S. OVERTON 1977. Estimating nonresponse bias in mail surveys. *Journal of Marketing Research,* XIV, 396-402.

BAKER, W. E., AND J.M. SINKULA 1999. Learning Orientation, Market Orientation, and Innovation: Integrating and extending models of organizational performance. *Journal of Market Focused Management,* 4, 295-308.

BANOMYONG, R., AND N. SUPATN 2011. Selecting logistics providers in Thailand: a shippers' perspective. *European Journal of Marketing,* 45, 419-437.

BARON, R. M., AND D.A. KENNY 1986. The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology,* 51, 1173-1182.

BAYKASOGLU, A., AND V. KAPLANOGLU 2007. A service-costing framework for logistics companies and a case study. *Management Research News,* 30, 621-633.

BENTLER, P. M., AND D.G. BONETT 1980. Significance tests of goodness of fit in the analysis of covariance structures. *Psychological Bulletin,* 88, 588-606.

BOLLEN, K. A. 1987. Outliers and Improper Solutions: A Confirmatory Factor Analysis Example. *Sociological Methods & Research,* 15, 375-384.

BOLLEN, K. A. 2000. Modeling Strategies: in Search of the Holy Grail. *Structural Equation Modeling,* 7, 74-81.

BOLLEN, K., AND R. LENNOX 1991. Conventional Wisdom on Measurement, A Structural Equation Perspective. *Psychological Bulletin,* 110, 305-314.

BOLLEN, K. A., AND R.A. STINE 1992. Bootstrapping goodness-of-fit measures in structural equation models. *Sociological Methods & Research,* 21, 205-229.

BOON-ITT, S., AND C.Y. WONG 2011. The moderating effects of technological and demand uncertainties on the relationship between supply chain integration and customer delivery performance. *International Journal of Physical Distribution & Logistics Management,* 41, 253-276.

BOURLAKIS, M., AND T.C. MELEWAR 2011. Marketing perspectives of logistics service providers: Present and future research directions. *European Journal of Marketing,* 45**,** 300-310.
BOWERSOX, D. J. 1990. The strategic benefits of logistics alliances. Harvard Business Review, 36-45.
BOWERSOX, D. J., AND P.J. DAUGHERTY 1987. Emerging patterns of logistical organization. *Journal of Business Logistics,* `8**,** 46-60.
BRANNICK, M. T., CHAN, D., CONWAY, J.M., LANCE, C.E., AND P.E. SPECTOR 2010. What is method variance and how can we cope with it? A panel discussion. *Organizational Research Methods,* 13**,** 407-420.
BRAUNSCHEIDEL, M. J., AND N.C. SURESH 2009. The organizational antecedents of a firm's supply chain agility for risk mitigation and response. *Journal of Operations Management,* 27**,** 119-140.
BREALEY, R. A., MYERS, S.C., AND F. ALLEN 2011. *Principles of Corporate Finance,* New York, NY, McGraw-Hill/Irwin.
BROWNE, M. W., AND R. CUDECK 1992. Alternative ways of assessing model fit. *Sociological Methods & Research,* 21**,** 230-258.
BUNGE, M. 1997. Mechanism and Explanation. *Philosophy of the Social Sciences,* 27**,** 410-465.
BUNGE, M. 2004. Clarifying some misunderstandings about social systems and their mechanisms. *Philosophy of the Social Sciences,* 34**,** 371-381.
BYRNE, B. M., AND T.L. CAMPBELL 1999. Cross-cultural comparisons and the preseumtion of equivalent measurement and theoretical structure: A look beneath the surface. *Journal of Cross-Cultural Psychology*, 30, 555-574.
CANGELOSI, V. E., AND W.R. DILL 1965. Organizational learning: Observations toward a theory. *Administrative Science Quarterly,* 10**,** 175-203.
CARLSON, D. S., AND K.M. KACMAR 2000. Work-family conflict in the organization: Do life role values make a difference? *Journal of Management* 26**,** 1031-1054.
CARLSON, D. S., AND P.L. PERREWE 1999. The role of social support in the stressor-strain relationship: An examination of work-family conflict. *Journal of Management,* 25**,** 513-540.
CHANG, S.-J., WITTELOOSTUIJN, A. VAN, AND L. EDEN 2010. From the Editors: Common method variance in international business research. *Journal of International Business Studies,* 41**,** 178-184.
CHEN, H., DAUGHERTY, P.J., AND T.D. LANDRY 2009a. Supply Chain Process Integration: A Theoretical Framework. *Journal of Business Logistics,* 30**,** 27-46.
CHEN, H., DAUGHERTY, P.J., AND A.S. ROATH 2009b. Defining and operationalizing supply chain process integration. *Journal of Business Logistics,* 30**,** 63-84.
CHEN, I. J., AND A. PAULRAJ 2004. Towards a Theory of Supply Chain Management: the Constructs and Measurements. *Journal of Operations Management,* 22**,** 119-150.
CHEUNG, G. W., AND R.S. LAU 2008. Testing the Mediation and Suppression Effects of Latent Variables – Bootstrapping with Structural Equation Models. *Organizational Research Methods,* 11**,** 296-325.
CHEUNG, M.-S., MYERS, M.B., AND J.T. MENTZER 2010. Does relationship learning lead to relationship value? A cross-national supply chain investigation. *Journal of Operations Management,* 28**,** 472-487.
CHILDERHOUSE, P., AITKEN, J. AND D.R. TOWILL 2002. Analysis and design of focused demand chains. *Journal of Operations Management,* 20**,** 675-689.

CHILDERHOUSE, P., DEAKINS, E., BOHME, T., TOWILL, D.R., AND S.M. DISNEY 2011. Supply chain integration: an international comparison of maturity. *Asia Pacific Journal of Marketing and Logistics,* 23**,** 531-552.

CHILDERHOUSE, P., AND D.R. TOWILL 2003. Simplified material flow holds the key to supply chain integration. *Omega,* 31**,** 17-27.

CHRISTOPHER, M., PECK, H., AND D. TOWILL 2006. A taxonomy for selecting global supply chain strategies. *The International Journal of Logistics Managament,* 17**,** 277-287.

COHEN, W. M., AND D.A. LEVINTHAL 1989. Innovation and learning: The two faces of R&D. *The Economic Journal,* 99**,** 569-596.

COHEN, W. M., AND D.A. LEVINTHAL 1990. Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly,* 35**,** 128-152.

COOK, C., HEATH, F. AND R.L. THOMPSON 2000. A Meta-Analysis of Response Rates in Web- or Internet-based Surveys. *Educational and Psychological Measurement*, 60, 821-836.

COOPER, D. R., AND P.S. SCHINDLER 2003. *Business Research Methods,* New York, McGraw-Hill/Irwin.

CLOSS, D. J., AND K. SAVITSKIE 2003. Internal and external logistics information technology integration. *The International Journal of Logistics Management,* 14**,** 63-76.

CROSSAN, M. M., LANE, H.W., AND R. E. WHITE 1999. An Organizational Learning Framework: From Intuition to Institution. *The Academy of Management Review,* 24**,** 522-537.

CRONBACH, L. J., AND P.E. MEEHL 1955. Construct validity in psychological tests. *Psychological Bulletin,* 52**,** 281-302.

CROSSAN, M. M., MAURER, C.C., AND R.E. WHITE 2011. Reflections on the 2009 AMR Decade Award: Do We Have a Theory of Organizational Learning *Academy of Management Review,* 363**,** 446-460.

CUI, L., AND S. HERTZ 2011. Networks and capabilities as characteristics of logistics firms. *Industrial Marketing Management,* 40**,** 1004-1011.

CUNNINGHAM, E. 2008. Structural Equation Modeling Using AMOS, Brunswick, Victoria, Australia Statsline.

CUNNINGHAM, E. 2010. *A Practical Guide To Structural Equation Modeling Using AMOS,* Melbourne, Victoria, Statsline.

CURRAN, P. J., WEST, S.G., AND J.F. FINCH 1996. The robustness of test statistics to nonnormality and specification error in confirmatory factor analysis. *Psychological Methods,* 1**,** 16-29.

DAUGHERTY, P. J., MYERS, M.B., AND C.W. AUTRY 1999. Automatic replenishment programs: An empirical investigation. *Journal of Business Logistics,* 20**,** 63-82.

DECARLO, L. T. 1997. On the Meaning and Use of Kurtosis. *Psychological Methods,* 2**,** 292-307.

DEEPEN, J. M., GOLDSBY, T.J., KNEMEYER, A.M., AND C.M. WALLENBURG 2008. Beyond expectations: An examination of logistics outsourcing goal achievement and goal exceedance. *Journal of Business Logistics,* 29**,** 75-105.

DE MAESSCHALCK, R., JOUAN-RIMBAUD, D. AND D.L. MASSART 2000. The Mahalanobis distance. *Chemometrics and Intelligent Laboratory Systems,* 50**,** 1-18.

DESHPANDE, R., AND J.U. FARLEY 1998. Measuring Market Orientation: Generalization and Synthesis. *Journal of Market Focused Management,* 2**,** 213-232.

DESHPANDE, R., AND J.U. FARLEY 2004. Organizational culture, market orientation, innovativeness, and firm performance: an international research odyssey. *International Journal of Research in Marketing,* 21**,** 3-22.

DESHPANDE, R., FARLEY, J.U., AND F.E. WEBSTER JR 1993. Corporate culture, customer orientation, and innovativeness in Japanese firms: A quadrad analysis. *Journal of Marketing,* 57, 23-27.
DEVERAJ, S., KRAJEWSKI, L., AND J.C. WEI 2007. Impact of eBusiness technologies on operational performance: The role of production information integration in the supply chain. *Journal of Operations Management,* 25, 1199-1216.
DILLON, W. R., KUMAR, A., AND N. MULANI 1987. Offending estimates in covariance structure analysis: Comments on the causes of and solutions to Heywood cases. *Psychological Bulletin,* 101, 126-135.
DOWNEY, R. G., AND C.V. KING 1998. Missing data in Likert ratings: A comparison of replacement methods. *The Journal of General Psychology,* 125, 175-191.
DROGE, C., JAYARAM, J., AND S.K. VICKERY 2004. The effects of internal versus external integration practices on time-based performance and overall firm performance. *Journal of Operations Management,* 22, 557-573.
DYER, J. H. 1996a. Specialized supplier networks as a source of competitive advantage: Evidence from the auto industry *Strategic Management Journal,* 17, 271-291.
DYER, J. H. 1996b. Does governance matter? Keiretsu alliances and asset specificity as sources of Japanese competitive advantage. *Organization Science,* 7, 649-666.
DYER, J. H. 1997. Effective interfirm collaboration: How firms minimize transaction costs and maximize transaction value. *Strategic Management Journal,* 18, 535-556.
DYER, J. H., AND H. SINGH 1998. The Relational View: Cooperative Strategy and Sources of Interorganizational Competitive Advantage. *Academy of Management Review,* 23, 660-679.
EASTERBY-SMITH, M., GRACA, M., ANTONACOPOULOU, E., AND J. FERDINAND 2008. Absorptive capacity: A process perspective. *Management Learning,* 29.
EASTERBY-SMITH, M., AND I.M. PRIETO 2008. Dynamic Capabilities and Knowledge Management: an Integrative Role for Learning? *British Journal of Management,* 19, 235-249.
EISENHARDT, K. M., AND J.A. MARTIN 2000. Dynamic capabilities: What are they? *Strategic Management Journal,* 21, 1105-1121.
ELLRAM, L. M., AND M.C. COOPER 1990. Supply chain management, partnerships, and the shipper-third party relationship. *The International Journal of Logistics Management,* 1, 1-10.
EMERY, F. E., AND E.L. TRIST 1965. The causal texture of organizational environments. *Human Relations,* 18, 21-32.
ENDERS, C. K., AND D.L. BANDALOS 2001. The Relative Performance of Full InformationMaximum Likelihood Estimation for Missing Data in Structural Equation Modeling. *Structural Equation Modeling: A Multidisciplinary Journal,* 8, 430 — 457.
FABBE-COSTES, N., AND M. JAHRE 2008. Supply chain integration and performance: a review of the evidence. *The International Journal of Logistics Managament,* 19, 130-154.
FABBE-COSTES, N., JAHRE, M. AND C. ROUSSAT 2009. Supply chain integration: the role of logistics service providers. *International Journal of Productivity and Performance Management,* 58, 71-91.
FABBE-COSTES, N., AND C. ROUSSAT 2011. Supply chain integration: Views from a logistics service provider. *Supply Chain Forum: An International Journal,* 12 (2), 20-30

FARRELL, M. A., AND E. OCZKOWSKI 2002. Are Market Orientation and Learning Orientation Necessary for Superior Organizational Performance? *Journal of Market Focused Management,* 5**,** 197-217.

FINCH, J. F., WEST, S.G., AND D.P. MACKINNON 1997. Effects of Sample Size and Nonnormality on the Estimation of Mediated Effects in Latent Variable Models. *Structural Equation Modeling: A Multidisciplinary Journal,* 4**,** 87-107.

FISHER, M. L. 1997. What is the right supply chain for your product? *Harvard Business Review***,** 105-116.

FLYNN, B. B., HUO, B., AND X. ZHAO 2010. The impact of supply chain integration on performance: A contingency and configuration approach. *Journal of Operations Management,* 28**,** 58-71.

FORNELL, C., AND D.F. LARCKER 1981. Evaluating Structural Equation Models with Unobserved Variables and Measurement Error. *Journal of Marketing Research,* 18**,** 39-50.

FORRESTER, J. W. 1958. Industrial Dynamics: A Major Breakthrough for Decision Makers. *Harvard Business Review***,** 37-66.

FROHLICH, M. T., AND R. WESTBROOK 2001. Arcs of integration: an international study of supply chain strategies. *Journal of Operations Management,* 19**,** 185-200.

FROHLICH, M. T., AND R. WESTBROOK 2002. Demand chain management in manufacturing and services: web-based integration, drivers and performance. *Journal of Operations Management,* 20**,** 729-745.

FUGATE, B. S., STANK, T.P., AND J.T. MENTZER 2009. Linking improved knowledge management to operational and organizational performance. *Journal of Operations Management,* 27**,** 247-264.

GAO, S., MOKHTARIAN, P.L., AND R.A. JOHNSTON 2008. Non-normality of Data in Structural Equation Models. *Transportation Research Board's 87th Annual Meeting.* Washington, D.C.: downloaded from http://www.uctc.net/papers/839.pdf , 4 January 2011.

GERMAIN, R., AND K.N.S. IYER 2006. The interaction of internal and downstream integration and its association with performance. *Journal of Business Logistics,* 27**,** 29-52.

GILL., L. E., AND R.P. ALLERHEILIGEN 1981. Co-operation in channels of distribution: Physical distribution leads the way. International Journal of Physical Distribution & Logistics Management, 11, 56-70.

GIMENEZ, C. 2006. Logistics integration processes in the food industry. *International Journal of Physical Distribution & Logistics Management,* 36**,** 231-249

GIMENEZ, C., AND E. VENTURA 2005. Logistics-production, logistics-marketing and external integration: Their impact on performance. *International Journal of Operations & Production Management,* 25**,** 20-38.

GRANT, R. M. 1996. Toward a knowledge-based theory of the firm. *Strategic Management Journal,* 17**,** 109-122.

GREEN, K. W. J., WHITTEN, D., AND R.A. INMAN 2008. The impact of logistics performance on organizational performance in a supply chain context. *Supply Chain Management: An International Journal,* 13**,** 317-327.

GROVER, R. 1996. Editorial: Market-Focused: Some Fundamental Issues. *Journal of Market Focused Management*, 1, 115-117.

GUSTIN, C. M. 1984. A re-examination of the integrated distribution concept. *Journal of Business Logistics,* 5**,** 1-15.

HALL, D. J., SKIPPER, J.B., HAZEN, B.T., AND J.B. HANNA 2012. Inter-organizational IT use, cooperative attitude, and inter-organizational collaboration as antecendents

to contingency planning effectiveness. *The International Journal of Logistics Managament,* 23, 50-76.
HANDLEY, S. M. 2012. The perilous effects of capability loss on outsourcing management and performance. *Journal of Operations Management,* 30, 152-165.
HANVANICH, S., SIVAKUMAR, K. AND G.T.M. HULT 2006. The relationship of learning and memory with organizational performance: The moderating role of turbulence. *Journal of the Academy of Marketing Science,* 34, 600-612.
HARPER, D. V., AND J.C. JOHNSON 1987. The potential consequences of deregulation of transportation revisited. *Land Economics,* 63, 137-146.
HELFAT, C. E., FINKELSTEIN, S., MITCHELL, W., PETERAF, M.A., SINGH, H. TEECE, D.J., AND S. G. WINTER (ed.) 2007. *Dynamic Capabilities: Understanding Strategic Change In Organizations,* Malden, MA: Blackwell Publishing.
HELFAT, C. E., AND S.G. WINTER 2011. Untangling dynamic and operational capabilities: Strategy for the (N)ever-changing world. *Strategic Management Journal,* 32, 1243-1250.
HERTZ, S., AND M. ALFREDSSON 2003. Strategic development of third party logistics providers. *Industrial Marketing Management,* 32, 139-149.
HESKETT, J. L. 1973. Sweeping changes in distribution. *Harvard Business Review*, 123-132.
HINKIN, T. R. 1995. A Review of Scale Development Practices in the Study of Organizations. *Journal of Management Studies,* 21, 967-988.
HOPKINS, K. D., AND D.L. WEEKS 1990. Tests for Normality and Measures of Skewness and Kurtosis: Their Place in Research Reporting. *Educational and Psychological Measurement,* 50, 717-729.
HUBER, G. P. 1991. Organizational Learning: The Contributing Processes and the Literatures. *Organization Science,* 2, 88-115.
HUEMER, L. 2006. Supply management: Value creation, coordination and positioning in supply relationships. *Long Range Planning,* 39, 133-153.
HUEMER, L. 2012. Unchained from the chain: Supply management from a logistics service provider perspective. *Journal of Business Research,* 65, 258-264.
HULT, G. T. M., KETCHEN JR, D.J., AND M. ARRFELT 2007. Strategic Supply Chain Management: Improving Performance Through a Culture of Competitiveness and Knowledge Development. *Strategic Management Journal,* 28, 1035-1052.
HULT, G. T. M., KETCHEN JR, D.J., AND S.F. SLATER 2004. Information Processing, Knowledge Development, and Strategic Supply Chain Performance. *Academy of Management Journal,* 47, 241-253.
HULT, G. T. M., KETCHEN JR, D.J., AND S.F. SLATER 2005. Market Orientation and Performance: An integration of disparate approaches. *Strategic Management Journal,* 26, 1173-1181.
HULT, G. T. M., KETCHEN, JR., D.J., CAVUSGIL, S.T., AND R.J. CALANTONE 2006. Knowledge as a strategic resource in supply chains. *Journal of Operations Management,* 24, 458-475.
HUO, B. 2012. The impact of supply chain integration on company performance: An organizational capability perspective. *Supply Chain Management: An International Journal,* 17 (EarlyCite prepublication, downloaded 15 September 2012).
HURLEY, R. F., AND G.T.M. HULT 1998. Innovation, Market Orientation, and Organizational Learning: An integration and empirical examination. *Journal of Marketing,* 62, 42-54.
IYER, K. N. S. 2011. Demand chain collaboration and operational performance: role of IT analytic capability and environmental uncertainty. *Journal of Business & Industrial Marketing,* 26, 81-91.

JAMES, L. R. 2008. On the path to mediation. *Organizational Research Methods,* 11, 359-363.
JAWORSKI, B. J., AND A.K. KOHLI 1993. Market Orientation: Antecedents and Consequences. *Journal of Marketing*, 57, 53-70.
JOHNSON, R. A., AND D.W. WICHERN 2002. *Applied Multivariate Statistical Analysis,* Upper Saddle River, N.J., Prentice-Hall, Inc.
JONES, O. 2006. Developing absorptive capacity in mature organizations: The change agent's role. *Management Learning,* 37.
JORESKOG, K. G. 1971. Statistical analysis of sets of congeneric tests. *Psychometrika,* 36, 109-133.
JUDD, C. M., AND D.A. KENNY 1981. Process analysis: estimating mediation in treatment evaluations. *Evaluation Review,* 5, 602-619.
KALE, P., AND H. SINGH 2007. Building firm capabilities through learning: The role of the alliance learning process in alliance capability and firm-level alliance success. *Strategic Management Journal,* 28, 981-1000.
KAPLAN, D., AND P.R. ELLIOTT 1997. A didactic example of multilevel structural equation modeling applicable to the study of organizations. *Structural Equation Modeling,* 4, 1-24.
KENDERDINE, J. M., AND P.D. LARSON 1988. Quality and logistics: A framework for strategic integration. *International Journal of Physical Distribution & Logistics Management,* 18, 5-10.
KENNY, D. A. 2008. Reflections on mediation. *Organizational Research Methods,* 11, 353-358.
KIM, D., AND E. CAVUSGIL 2009. The impact of supply chain integration on brand equity. *Journal of Business & Industrial Marketing,* 24, 496-505.
KIM, S. W. 2006. Effects of supply chain management practices, integration and competition capability on performance. *Supply Chain Management: An International Journal,* 11, 241-248.
KIRCA, A. H., JAYACHANDRAN, S., AND W.O. BEARDEN 2005. Market Orientation: A meta-analytic review and assessment of its antecedents and impact on performance. *Journal of Marketing,* 69, 24-41.
KLINE, R. B. 2011. *Principles and Practice of Structural Equation Modeling (3rd Ed.),* New York, The Guilford Press.
KOLLER, T., GOEDHART, M., AND D. WESSELS 2010. *Valuation: Measuring and managing the value of companies,* Hoboken, New Jersey, John Wiley & Sons, Inc.
KNEMEYER, A. M., AND P.R. MURPHY 2004. Evaluating the performance of third party logistics arrangements: A relationship marketing perspective. *The Journal of Supply Chain Management* 35-51.
KNEMEYER, A. M., AND P.R. MURPHY 2005. Exploring the potential impact of relationship characteristics and customer attributes on the outcomes of third-party logistics arrangements. *Transportation Journal*, 5-19.
KOHLI, A. K., AND B.J. JAWORSKI 1990. Market Orientation: The Construct, Research Propositions, and Managerial Implications. *Journal of Marketing* 54, 1-18.
KOUFTEROS, X., BABBAR, S., AND M. KAIGHOBADI 2009. A paradigm for examining second-order factor models employing structural equation modeling. *International Journal of Production Economics,* 120, 633-652.
LA LONDE, B. J. 1969. Integrated distribution management - The American perspective. Long range Planning, 61-71.
LA LONDE, B. J. 1983. A reconfiguration of logistics systems in the 80s: Strategies and challenges. *Journal of Business Logistics,* 4, 1-11.

LA LONDE, B. J., GRABNER, J.R. AND J.F. ROBESON 1970. Integrated distribution systems: a management perspective. International Journal of Physical Distribution & Logistics Management, 1, 43-49.
LAMBERT, D. M., EMMELHAINZ, M.A., AND J.T. GARDNER 1999. Building successful logistics partnerships. *Journal of Business Logistics,* 20**,** 165-181.
LAMBERT, D. M., AND J.T. MENTZER 1980. Is integrated physical distribution management a reality? Journal of Business Logistics, 2, 18-34.
LAMBERT, D. M., AND M.C. COOPER 2000. Issues in supply chain management. *Industrial Marketing Management,* 29**,** 65-83.
LAMBERT, D. M., AND T.C. HARRINGTON 1990. Measuring nonresponse bias in customer service mail surveys. *Journal of Business Logistics,* 11**,** 5-25.
LANDEROS, R., AND D.M. LYTH 1989. Economic-lot-size models for cooperative inter-organizational relationships. Journal of Business Logistics, 10, 146-158.
LANE, P. J., KOKA, B.R., AND S. PATHAK 2006. The reification of absorptive capacity: A critical review and rejuvination of the construct. *Academy of Management Review,* 31**,** 833-863.
LANGERAK, F. 2001. Effects of market orientation on the behaviors of salespersons and purchasers, channel relationships, and performance of manufacturers. *International Journal of Research in Marketing,* 18**,** 221-234.
LANGLEY, J. J., AND CAPGEMINI 2010. 2010 Third-Party Logistics: The State of Logistics Outsourcing - Results and Findings of the 15th Annual Study.
LARGE, R. O. 2007. The influence of customer-specific adaptations on the performance of third-party-logistics relationships - document studies and propositions. *International Journal of Logistics Research and Applications,* 10**,** 123-133.
LARSON, P. D. 1994. An empirical study of inter-organizational functional integration and total costs. Journal *of Business Logistics,* 15**,** 153-169.
LEE, H. L. 2004. The Triple-A Supply Chain. *Harvard Business Review,* October**,** 102-112.
LEE, C. W., KWON, I-W.G., AND D. SEVERANCE 2007. Relationship between supply chain performance and degree of linkage among supplier, internal integration, and customer. *Supply Chain Management: An International Journal,* 12**,** 444-452.
LEI, M., AND R.G. LOMAX 2005. The Effect of Varying Degrees of Nonnormality in Structural Equation Modeling. *Structural Equation Modeling: A Multidisciplinary Journal,* 12**,** 1-27.
LEUSCHNER, R., ROGERS, D.S., AND F.F. CHARVET 2013. A meta-analysis of supply chain integration and firm performance. *Journal of Supply Chain Management,* 49 (2), 34-57
LEVITT, B., AND J.G. MARCH 1988. Organizational learning. *Annual Review of Sociology,* 14**,** 319-340.
LIEB, R. C., AND K.J. LIEB 2010. The North American third-party logistics industry in 2008: The provider CEO perspective. *Transportation Journal***,** 54-65.
LIEB, R. C., AND K.J. LIEB 2012. The North American third-party logistics industry in 2011: The provider CEO perspective. *Transportation Journal,* 51**,** 353-367.
LIEB, R., AND J. MILLER 2002. The use of third-party logistics services by large US manufacturers, the 2000 survey. *International Journal of Logistics Research and Applications,* 5**,** 1-12.
LITTLE, T. D., LINDENBERGER, U., AND J.R. NESSELROADE 1999. On selecting indicators for multivariate measurement and modeling with latent variables: when "good" indicators are bad and "bad" indicators are good. *Psychological Methods,* 4**,** 192-211.

LIU, X. 2011. Competitiveness of logistics service providers: a cross-national examination of management practices in China and the UK. *International Journal of Logistics: Research and Applications,* 14, 251-269.
LORENZONI, G., AND A. LIPPARINI 1999. The leveraging of interfirm relationships as a distinctive organizational capability: A longitudinal study. *Strategic Management Journal,* 20, 317-338.
MACKENZIE, S. B., PODSAKOFF, P.M., AND C.B. JARVIS 2005. The Problem of Measurement Model Misspecification in Behavioral and Organizational Research and Some Recommended Solutions. *Journal of Applied Psychology,* 90, 710-730.
MALONI, M., AND C.R. CARTER 2006. Opportunities for Research in Third Party Logistics. Transportation Journal, 24-38.
MARASCO, A. 2008. Third-party logistics: A literature review. *International Journal of Production Economics,* 113, 127-147.
MARDIA, K. V. 1970. Measures of Multivariate Skewness and Kurtosis with Applications. *Biometrika,* 57, 519-530.
MARTINEZ-LOPEZ, F. J., GAZQUEZ-ABAD, J.C., AND C.M.P. SOUSA 2013. Structural equation modelling in marketing and business research: Critical issues and practical recommendations. *European Journal of Marketing,* 47, 115-152.
MASON-JONES, R., NAYLOR, B., AND D. R. TOWILL 2000a. Lean, agile or leagile? Matching your supply chain to the marketplace. *International Journal of Production Research,* 38, 4061-4070.
MASON-JONES, R., NAYLOR, B., AND D. TOWILL 2000b. Engineering the leagile supply chain. *International Journal of Agile Management Systems,* 2, 54-61.
MCGINNIS, M. A., AND J.W. KOHN 1988. Warehousing, competitive advantage, and competitive strategy. *Journal of Business Logistics,* 9, 32-54.
MCGINNIS, M. A., AND J.W. KOHN 1990. A factor analytic study of logistics strategy. *Journal of Business Logistics,* 11, 41-63.
MENGUC, B., AND S. AUH 2006. Creating a firm-level dynamic capability through capitalizing on market orientation and innovativeness. *Journal of the Academy of Marketing Science,* 34, 63-73.
MORGAN, N. A., VORHIES, D.W., AND C.H. MASON 2009. Market Orientation, Marketing Capabilities, and Firm Performance. *Strategic Management Journal,* 30, 909-920.
MOTHILAL, S., GUNASEKARAN, A., NACHIAPPAN, S.P., AND J. JAYARAM 2012. Key success factors and their performance implications in the Indian third-party logistics (3PL) industry. *International Journal of Production Research,* 50, 2407-2422.
MULAIK, S. A., AND R.E. MILLSAP 2000. Doing the four-step right. *Structural Equation Modeling,* 7, 36-73.
NARAYANAN, S., JAYARAMAN, V., LUO, Y., AND J. M. SWAMINATHAN 2011. The antecedents of process integration in business process outsourcing and its effect on firm performance. *Journal of Operations Management,* 29, 3-16.
NARVER, J. C., AND S.F. SLATER 1990. The Effect of a Market Orientation on Business Profitability. *Journal of Marketing,* October, 20-35.
NARVER, J. C., AND S.F. SLATER 1998. Additional thoughts on the measurement of Market Orientation: A comment on Deshpande and Farley. *Journal of Market Focused Management,* 2, 233-236.
NARVER, J. C., SLATER, S.F., AND B. TIETJE 1998 Creating a Market Orientation. *Journal of Market Focused Management,* 2, 241-255.
NELSON, R. R. 1991. Why do firms differ, and how does it matter? *Strategic Management Journal,* 12, 61-74.

NEMANICH, L. A., KELLER, R.T., VERA, D., AND W.W. CHIN 2010. Absorptive capacity in R&D project teams: A conceptualization and emperical test. *IEEE Transactions on Engineering Management,* 57, 674-688.
NONAKA, I. 1994. A Dynamic Theory of Organizational Knowledge Creation. *Organization Science,* 5, 14-37.
OLHAGER, J., AND D.I. PRAJOGO 2012. The impact of manufacturing and supply chain improvement initiatives: A survey comparing make-to-order and make-to-stock firms. *Omega,* 40, 159-165.
PAGELL, M. 2004. Understanding the factors that enable and inhibit the integration of operations, purchasing and logistics. *Journal of Operations Management,* 22, 459-487.
PAGH, J. D., AND M.C. COOPER 1998. Supply chain postponement and speculation strategies: How to choose the right strategy. *Journal of Business Logistics,* 19, 13-33.
PANAYIDES, P. M. 2007. Effect of Organizational Learning in Third-Party Logistics *Journal of Business Logistics,* 28, 133-158.
PANAYIDES, P. M., AND M. SO 2005. Logistics service provider - client relationships. *Transportation Research Part E,* 41, 179-200.
PATEL, P. C., TERJESEN, S., AND D. LI 2012. Enhancing effects of manufacturing flexibility through operational absorptive capacity and operational ambidexterity. *Journal of Operations Management*, 30, 201-220.
PAULRAJ, A., AND I.J. CHEN 2007. Strategic buyer-supplier relationships, information technology and external logistics integration. *The Journal of Supply Chain Management: A Global Review of Purchasing and Supply*, Spring, 2-14.
PAULRAJ, A., CHEN, I.J., AND A.A. LADO 2012. An empirical taxonomy of supply chain management practices. *Journal of Business Logistics,* 33, 227-244.
PENG, D.X., VERGHESE, A., SHAH, R., AND R.G. SCHROEDER 2013. The relationships between external integration and plant improvement and innovation capabilities: The moderation effect of product clockspeed. *Journal of Supply Chain Management,* 49 (3), 3-24.
PENNY, K. I. 1996. Appropriate Critical Values When Testing for a Single Multivariate Outlier by Using the Mahalanobis Distance. *Journal of the Royal Statistical Society Series C (Applied Statstics),* 45, 73-81.
PENROSE, E. 2009, originally published 1959. *The Theory of the Growth of the Firm,* Oxford, Oxford University Press.
PODSAKOFF, P. M., MACKENZIE, S.B., LEE, J-Y., AND N.P. PODSAKOFF 2003. Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies. *Journal of Applied Psychology,* 88, 879-903.
PORTER, M. 2008. The five competitive forces that shape strategy. *Harvard Business Review*, 78-93.
PRAJOGO, D. I., AND J. OLHAGER 2012. Supply chain integration and performance: The effects of long-term relationships, information technology and sharing, and logistics integration. *International Journal of Production Economics,* 135, 514-522.
OLSSON, U. 1979. On the robustness of factor analysis against crude classification of the observations. *Multivariate Behavioural Research,* 14, 485-500.
QUESADA, G., RACHAMADUGU, R., GONZALEZ, M., AND J.L. MARTINEZ 2008. Linking order winning and external supply chain integration strategies. *Supply Chain Management: An International Journal,* 13, 296-303.
RAJAGURU, R., AND M.J. MATANDA 2009. Influence of inter-organizational on business performance: The mediating role of organizational-level supply chain functions. *Journal of Enterprise Information Management,* 22, 456-467.

RAPP, A., TRAINOR, K.J., AND R. AGNIHOTRI 2010. Performance implications of customer-linking capabilities: Examining the complementary role of customer orientation and CRM technology. *Journal of Business Research*, 1229-1236.
RAY, G., BARNEY, J.B., AND W.A. MUHANNA 2004. Capabilities, Business Processes, and Competitive Advantage: Choosing the Dependent Variable in Emperical Tests of the Resource-Based View. *Strategic Management Journal*, 25, 23-37.
RODRIGUES, A. M., STANK, T.P., AND D.F. LYNCH 2004. Linking strategy, structure, process, and performance in integrated logistics. *Journal of Business Logistics,* 25, 65-94.
SAUERMANN, H., AND M. ROACH 2013. Increasing web survey response rates in innovation research: An experimental study of static and dynamic contact design features. *Research Policy,* 42, 273-286.
SCHAFER, J. L., AND J.W. GRAHAM 2002. Missing Data: Our View of the State of the Art. *Psychological Methods,* 7, 147-177.
SCHON, D. A. 1975. Deutero-learning in organizations: Learning for increased effectiveness. *Organization Dynamics,* 4, 2-16.
SEGGIE, S. H., KIM, D., AND S.T. CAVUSGIL 2006. Do supply chain IT alignment and supply chain interfirm system integration impact upon brand equity and firm performance? *Journal of Business Research,* 59, 887-895.
SELVIARIDIS, K. & SPRING, M. 2007. Third party logistics: a literature review and research agenda. *The International Journal of Logistics Management*, 18, 125-150.
SENGE, P. M. 2006. *The Fifth Discipline: The art and practice of the learning organization,* New York, Random House Inc.
SETIA, P., AND P.C. PATEL 2013 How information systems help create OM capabilities: Consequents and antecedents of operational absorptive capacity. *Journal of Operations Management,* 31, 409-431
SHAH, R., AND S.M. GOLDSTEIN 2006. Use of structural equation modeling in operations management research: Looking back and forward. *Journal of Operations Management,* 24, 148-169.
SHAPIRO, J. F. 1992. Integrated logistics management, total cost and optimization modelling. *International Journal of Physical Distribution & Logistics Management,* 22, 33-36.
SHAPIRO, S. S., WILK, M.B., AND H.J CHEN 1968. A Comparative Study of Various Tests for Normality. *Journal of the American Statistical Association,* 63, 1343-1372.
SINGH, P. J., AND D. POWER 2009. The nature and effectiveness of collaboration between firms, their customers and suppliers: a supply chain perspective. *Supply Chain Management: An International Journal,* 14, 189-200.
SLATER, S. F., AND J.C. NARVER 1994. Does Competitive Environment Moderate the Market Orientation-Performance Relationship? *Journal of Marketing* 58, 46-55.
SLATER, S. F., AND J.C. NARVER 1995. Market Orientation and the Learning Organization. *Journal of Marketing,* 59, 63-74.
SOBEL, M. E. 1987. Direct and indirect effects in linear structural equation models. *Sociological Methods & Research,* 16, 155-176.
SOLAKIVI, T., TOYLI, J., AND L. OJALA 2013. Logistics outsourcing, its motives and the level of logistics costs in manufacturing and trading companies operating in Finland. *Production Planning & Control: The Management of Operations,* 24, 388-398.
SONG, M., DROGE, C., HANVANICH, S., AND R. CALANTONE 2005. Marketing and technology resource complementarity: an analysis of their interaction effect in two environmental contexts. *Strategic Management Journal,* 26, 259-276.

SOUDER, W. E., SHERMAN, J.D., AND R. DAVIES-COOPER 1998. Environmental uncertainty, organizational integration, and new product development effectiveness: A test of contingency theory. *Journal of Product Innovation Management,* 15, 520-533.
STANK, T. M., CRUM, M., AND M. ARANGO 1999. Benefits of interfirm coordination in food industry supply chains. *Journal of Business Logistics,* 20, 21-41.
STANK, T. P., DAUGHERTY, P.J., AND A.E. ELLINGER 1996. Information exchange, responsiveness and logistics provider performance. *The International Journal of Logistics Management,* 7, 43-58.
STANK, T. P., DAUGHERTY, P.J., AND C.M. GUSTIN 1994. Organizational structure: influence on logistics integration, costs, and information system performance. *The International Journal of Logistics Management,* 5, 41-52.
STANK, T. P., GOLDSBY, T.J., VICKERY, S.K., AND K. SAVITSKIE 2003. Logistics service performance: Estimating its influence on market share. *Journal of Business Logistics,* 24, 27-55.
STANK, T. P., KELLER, S.B., AND CLOSS, D.J. 2001a. Performance benefits of supply chain logistical integration. *Transportation Journal*, 32-46.
STANK, T. P., KELLER, S.B., AND DAUGHERTY 2001b. Supply chain collaboration and logistical service performance. *Journal of Business Logistics,* 22, 29-48.
STEVENS, G. C. 1989. Integrating the supply chain. *International Journal of Physical Distribution & Logistics Management,* 19, 3-8
STOCK, G. N., GREIS, N.P., AND J.D. KASARDA 2000. Enterprise logistics and supply chain structure: the role of fit. *Journal of Operations Management,* 18, 531-547.
STOCK, J. R. 1988. The maturing of transportation: An expanded role for freight carriers. *Journal of Business Logistics,* 9, 15-31.
STRAUSS, A., AND J. CORBIN 1998. *Basics of qualitative research (2nd Ed.),* Thousand Oaks: Sage
SWINK, M., NARASIMHAN, R., AND C. WANG 2007. Managing beyond the factory walls: Effects of four types of strategic integration on manufacturing plant performance. *Journal of Operations Management,* 25, 148-164.
TAYLOR, A. B., MACKINNON, D.P., AND J-Y. TEIN 2008. Tests of the three-path mediated effect. *Organizational Research Methods,* 11, 241-269.
TEECE, D. J. 2007. Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal,* 28, 1319-1350.
TEECE, D. J., AND A. AL-AALI 2011. Kowledge assets, capabilities and the theory of the firm. *In:* EASTERBY-SMITH, M., AND M.A. LYLES (ed.) *Handbook of organizational learning and knowldge management.* 2nd ed. Chichester: John Wiley & Sons.
TEECE, D. J., PISANO, G., AND A. SHUEN 1997. Dynamic Capabilities and Strategic Management. *Strategic Management Journal,* 18, 509-533.
TERREBERRY, S. 1968. The evolution of organizational environments. *Administrative Science Quarterly,* 12, 590-613.
THORNBERG, R. 2012. Informed Grounded Theory. *Scandanavian Journal of Educational Research,* 56, 243-259.
TODOROVA, G., AND B. DURISIN 2007. Absorptive Capacity: Valuing a Reconceptualisation. *Academy of Management Review,* 32, 774-786.
TU, Q., VONDEREMBSE, M.A., RAGU-NATHAN, T.S., AND T.W. SHARKEY 2006. Absorptive capacity: Enhancing the assimilation of time-based manufacturing practices. *Journal of Operations Management,* 24, 692-710.

VAN DER VAART, T., AND D.P. VAN DONK 2008. A critical review of survey-based research in supply chain integration. *International Journal of Production Economics*, 111, 42-55
VAN WIJK, R., VAN DEN BOSCH, F.A.J., H.W. VOLBERDA 2011. Absorptive capacity: Taking stock of its progress and prospects. *In:* EASTERBY-SMITH, M., AND M.A. LYLES (ed.) *Handbook of Organizational Learning & Knowledge Management.* Second Edition ed. Chichester: John Wiley & Sons.
VERA, D., CROSSAN, M., AND M. APAYDIN 2011. A Framework for Integrating Organizational Learning, Knowledge, Capabilities and Absorptive Capacity. *In:* EASTERBY-SMITH, M., AND M.A. LYLES (ed.) *Handbook of Organizational Learning and Knowledge Management.* 2nd ed. Chichester, West Sussex: John Wiley & Sons.
VERONA, G., AND M. ZOLLO 2011. The Human Side of Dynamic Capabilities: a Holistic Learning Model. *In:* EASTERBY-SMITH, M., AND M.A. LYLES (ed.) *Handbook of Organizational Learning & Knowledge Management.* Second ed. Chichester: John Wiley & Sons Ltd.
VICKERY, S. K., DROGE, C., SETIA, P., AND V. SAMBAMURTHY 2010. Supply chain information technologies and organisational initiatives: complementary versus independent effects on agility and firm performance. *International Journal of Production Research,* 48**,** 7025-7042.
VOLBERDA, H. W., FOSS, N.J. AND M.A. LYLES 2010. Absorbing the concept of Absorptive Capacity: How to realize its potential in the organization field. *Organization Science,* 21**,** 931-951.
WAGNER, S. M. 2008. Innovation management in the German transportation industry. *Journal of Business Logistics,* 29**,** 215-231.
WALLENBURG, C. M. 2009. Innovation in logistics outsourcing relationships: proactive improvement by logistics service providers as a driver of customer loyalty. *Journal of Supply Chain Management,* April**,** 75-93.
WALLENBURG, C. M., CAHILL, D.L., GOLDSBY, T.J., AND A.M. KNEMEYER 2010. Logistics outsourcing performance and loyalty behavior: Comparisons between Germany and the United States. *International Journal of Physical Distribution & Logistics Management* 40**,** 579-602.
WANG, Q., HUO, B., LAI, F., AND Z. CHU 2010. Understanding performance drivers of third-party logistics providers in mainland China: A replicated and comparative study. *Industrial Management & Data Systems,* 110**,** 1273-1296.
WHITTEN, G. D., GREEN, K.W., AND P.J. ZELBST 2012. Triple-A supply chain performance. *Journal of Operations & Production Management,* 32**,** 28-48.
WILDING, R., AND R. JURIADO 2004. Customer perceptions on logistics outsourcing in the European consumer goods industry. *International Journal of Physical Distribution & Logistics Management,* 34**,** 628-644.
WILLIAMS, L. J., BUCKLEY, R.M., COTE, J.A., AND M.R. BUCKLEY 1989. Lack of method variance in self-reported affect and perceptions at work: reality or artifact. *Journal of Applied Psychology,* 74**,** 462-468.
WINTER, S. G. 2000. The Satisficing Principle in Capability Learning *Strategic Management Journal,* 21**,** 981-996.
WINTER, S. G. 2003. Understanding dynamic capabilities. *Strategic Management Journal,* 24**,** 991-995.
WONG, C.W.Y. 2013. Leveraging environmental information integration to enable environmental management capability and performance, *Journal of Supply Chain Management,* 49 (2), 114-136
WONG, C. W. Y., LAI, K-H., AND E.W.T. NGAI 2009. The role of supplier operational adaptation on the performance of IT-enabled transport logistics under

environmental uncertainty. *International Journal of Production Economics*, 122, 47-55.
WONG, C. Y., BOON-ITT, S., AND C.W.Y. WONG 2011. The contingency effects of environmental uncertainty on the relationship between supply chain integration and operational performance. *Journal of Operations Management,* 29**,** 604-615.
WOOD, R. E., GOODMAN, J.S., BECKMANN, N., AND A. COOK 2008. Mediation testing in management research. *Organizational Research Methods,* 11**,** 270-295.
YUAN, K.-H., AND K. HAYASHI 2010. Fitting Data to Model: Structural Equation Modeling Diagnosis Using Two Scatter Plots. *Psychological Methods,* 15**,** 335 - 351.
YUAN, K.-H., AND X. ZHONG 2008. Outliers, Leverage Observations, and Influential Cases in Factor Analysis: Using Robust Procedures to Minimize Their Effect. *Sociological Methodology,* 38**,** 329 - 368.
ZACHARIA, Z. G., NIX, N. W., AND R.F. LUSCH 2011a. Capabilities that enhance outcomes of an episodic supply chain collaboration. *Journal of Operations Management,* 29**,** 591-603.
ZACHARIA, Z. G., SANDERS, N.R., AND N.W. NIX 2011b. The emerging role of the third-party logistics provider (3PL) as an orchestrator. *Journal of Business Logistics,* 32**,** 40-54.
ZAHRA, S. A., AND G. GEORGE 2002. Absorptive Capacity: A Review, Reconceptualization, and Extension. *The Academy of Management Review,* 27**,** 185-203.
ZHAO, X., HUO, B., FLYNN, B.B., AND J.H.Y. YEUNG 2008. The impact of power and relationship commitment on the integration between manufacturers and customers in a supply chain. *Journal of Operations Management,* 26**,** 368-388.
ZHOU, W.-H., AND C-Y. LEE 2009. Pricing and competition in a transportation market with empty equipment repositioning. *Transportation Research Part B,* 43**,** 677-691.
ZHU, K. 2004. The complementarity of information technology infrastructure and e-commerce capability: A resource-based assessment of their business value. *Journal of Management Information Systems,* 21**,** 167-202.
ZHU, K., AND K.L. KRAEMER 2002. e-Commerce metrics for net-enhanced organizations: Assessing the value of e-commerce to firm performance in the manufacturing sector. *Information Systems Research,* 13**,** 275-295.
ZOLLO, M., AND S.G. WINTER 2002. Deliberate Learning and the Evolution of Dynamic Capabilities. *Organization Science,* 13**,** 339-351.