Factors Influencing Sustainable Distribution: A Framework of Co-opetition, Freight Consolidation, and Collaborative Freight Distribution in the Thailand's Newspaper Industry

By

Chattharn Limoubpratum

This thesis is presented in fulfilment of
the requirements of the degree of

Doctor of Business Administration

Supply Chain and Logistics Discipline
College of Business

Victoria University
Melbourne, Australia
2015

ABSTRACT

Sustainability in the Thailand newspaper supply chain is currently affected by ineffective freight distribution practices. Ineffective newspaper distribution yields negative effects due to issues such as half-loaded vehicles, suboptimal routing problems and substantial fuel consumption. Logisticians in the field of freight movement and transportation have argued for 'sustainable freight distribution' through a triple bottom line approach. Among the potential solutions, most notable are co-opetition strategy, freight consolidation and collaborative freight distribution. However, neither has received sufficient interest among academic researchers, as the studies on their joint influence on sustainability are limited. Thus, a question arises as to whether sustainability in freight distribution in the newspaper industry can be achieved through co-opetitive relationship, freight consolidation and collaborative freight distribution approaches. This study, therefore, aims to explore whether co-opetition, freight consolidation and collaborative freight distribution have positive impact on sustainable freight distribution.

A survey-based research methodology was employed to collect data from newspaper companies, news vendors and transporters in Thailand. The survey resulted in a final sample of 239 firms, representing a 23.9% response rate. The measurement items were subjected to a non-response bias test, multicollinearity and a common method variance (CMV) test before exploratory and confirmatory analyses were carried out. Structural equation modeling (SEM) analysis was employed to establish the structural model and test hypothesised relationships among the variables. Alternative structural models were also evaluated to investigate the saturated model.

The results yielded by the SEM/path analysis indicate that a co-opetition strategy is a critical enabler of collaborative freight distribution and can positively influence sustainable freight distribution indirectly through collaborative freight distribution approach. Moreover, freight consolidation is a critical enabler of collaborative freight distribution and can influence sustainable freight distribution, both directly and indirectly.

The study findings can benefit academic communities, logisticians and related industries by achieving sustainable freight distribution through co-opetition strategy, freight consolidation and collaborative freight distribution. The work carried out in this research expands the

current knowledge of logistics and supply chain models aimed at improving logistics movement toward a sustainable distribution, thus enhancing overall sustainability. The results reported here also offer practical implications, as the findings are relevant to improving distribution and freight consolidation, as well as making logistics and supply chain operations more efficient and cost effective, while caring for economic, social and natural environment.

As any study of this type, this too has some limitations. On the methodological side, all constructs and sub-constructs in this study have good theoretical support. Nonetheless, future research using longitudinal data is recommended, as this would improve the understanding of the framework over time. In addition, the research survey conducted in this study was undertaken in one industry and country. Thus, the data it yielded could limit the generalizability of the study findings toward sustainable freight distribution. On the theoretical side, as logistics distribution sustainability is increasingly taking centre stage among researchers and practitioners, management of co-opetition strategy, freight consolidation and collaborative freight distribution needs follow-up action over time. It is thus logical to investigate and include the changes occurring in the industry, and further examine the changes in the relationship between the variables that might affect sustainable freight distribution.

DECLARATION

I, Chattharn Limoubpratum, declare that the DBA thesis entitled " Factors Influencing Sustainable Distribution: A Framework of Co-opetition, Freight Consolidation, and Collaborative Freight Distribution in the Thailand's Newspaper Industry" is no more than 65,000 words in length including quotes and exclusive of tables, figures, appendices, bibliography, references, and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work.

Chattharn Limoubpratum.…………………..……………....Date June, 2015

ACKNOWLEDGEMENT

Completion of this study is a significant achievement and an excellent foundation for my future career. As any thesis is a result of hard work, both on behalf of the author and his/her colleagues and supervisors, I would like to take this opportunity to express my appreciation to my principal supervisor, Dr. Himanshu K. Shee and my co-supervisor, Dr. Kamrul Ahsan, for their professional guidance during the preparation of this thesis. Their efforts and insightful inputs in providing guidance and knowledge were instrumental in the completion of my studies. This thesis would have not been successfully completed without their assistance.

I would also like to express my appreciation to Professor Dr. Sitthichai Pokai-Udom, the founder of the Mahanakorn University of Technology, who was a Minister of Information and Communication Technology of Thailand, for the unceasing support and invaluable information he shared during the data collection phase of my study. Data collection would have not been a success without his kindness and support.

Finally, I would like to thank my family, who has always given me encouragement and support. Without them, I would not have had the opportunity to pursue my educational and career goals.

Table of Contents

Table of Tables

Table of Figures

Table of Equations

PUBLICATIONS ASSOCIATED WITH THIS THESIS

Journal Article

Limoubpratum, C., Shee, HK, and Ahsan, K. 2015. Sustainable distribution through co-opetition strategy. International Journal of Logistics: Research and Applications (IJLRA), paper Accepted for publication. (forthcoming).

Conference Papers

Limoubpratum, C., Shee, HK, and Ahsan, K. 2012. Factors influencing the adoption of co-opetition and collaborative freight consolidation: effect on sustainable environment. Paper published in the proceeding of 10 ANZAM-OM Symposium, Melbourne 13-15 June.

Limoubpratum, C., Shee, HK, and Ahsan, K. 2013. Collaborative Freight Consolidation: Review of Literature for Framework Development and Future Research Directions. Paper published in the proceeding of 11 ANZAM-OM Symposium, Brisbane 20-21 June.

Limoubpratum, C., Shee, HK, and Ahsan, K. (2013), Coopetition enhances sustainable distribution: An Empirical investigation, Paper published in the proceedings of 7th ISDSI & 5th OSCM International Conference, Dec. 28-30, 2013, IMI, New Delhi, India.

Limoubpratum, C., Shee, HK (corresponding author), and Ahsan, K. (2015), Influence of Coopetition and Freight Consolidation on Sustainable Distribution, Paper accepted for presentation at Academy of Management (AOM) Conference Canada, August 2015.

CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter presents an overview of the study. The discussion of research background, context overview, and theoretical context pertaining to co-opetition, freight consolidation, collaborative freight distribution, and sustainability in the freight distribution process is undertaken. It also presents the significance of the study and the thesis structure.

1.1 Research aim and background

Sustainability research has increasingly progressed to incorporate economic, social, and environmental aspects of business. While firms are inherently competing with each other in logistics distribution, the main aim of this study is to investigate whether co-opetition, freight consolidation, and collaborative freight distribution can lead to achieving sustainable distribution in the context of the Thai newspaper industry. This industry is undertaken because of its urgent need for a new strategy that would ensure its survival in an era of electronically-driven communications. Unfortunately, the newspaper industry is collapsing, due to a significant decline in demand of its hard copies, on one hand, and the emergence of advanced telecommunication technologies, such as the Internet, cable news, and personal communication devices (i.e., smart phone and smart tablet) etc. on the other (Parr 2010). The newspaper industry needs to identify and adopt new business strategies for improving its business performance and profitability through its supply chain strategies. Moreover, as sustainability issues are becoming a growing concern, the newspaper industry needs to take sustainability dimensions into consideration in order to secure its economic/financial assets, improve social capital, and preserve environmental assets.

1.2 Justification of the research/context overview

Environmental and social impacts are becoming more globalised and severe in this decade. According to NASA's Goddard Institute for Space Studies (GISS), 2010 was the warmest year since 1850 and was a part of the warmest decade on record (Nasa 2011). These environmental problems mainly arise due to greenhouse gas emissions, while carbon dioxide (CO_2) is the main cause of global warming (Akyelken 2011). According to the EPA (2011), the transportation sector accounts for 13 % of the total CO_2 emission worldwide. Ribeiro et al.

(2007) asserted that freight transport accounts for 8 % of energy-related CO_2 emissions globally. However, social and environmental sustainability issues are interrelated with economic sustainability, as the economic development generates profits, employment, and social welfare (Parr 2010). Therefore, further improvement of freight transport management in logistics movement is critical in enhancing sustainability as a whole (McKinnon 2000).

Firms need to understand the costs associated with sustainability issues. Economic costs are most evident in providing social welfare and meeting resource scarcity; increased costs of health and safety; waste management; carbon tax; the cost of new technology acquisition; fuel cost; and cost of business operation. Environmental costs are related to global warming because of CO_2 emissions and thinning of the ozone layer, the disappearance of rain forests, acid rain, and the cost of complying with environmental regulations (Akyelken 2011). Finally, social costs are associated with issues like unemployment, diminished consumer satisfaction, and human illnesses (e.g., asthma, reactive airways disease, hypertension, and other respiratory conditions) (McKinnon et al. 2010; VTPI 2011). Therefore, sustainable development in logistics transport and distribution would eliminate the issues of economic, environmental, and social costs (Azapagic 2003).

Focusing on the Thai context of sustainability issues, Thailand ranked 23rd in the world for CO_2 emissions, based on 2009 data (253.38 million tonnes per annum) (Guardian 2011). The same publication also reported that CO_2 emissions had increased by 56.6 % from 2000 to 2009, due to economic and industrial growth. The Thailand transport sector accounts for 52.838 million tonnes of annual CO_2 emissions, and logistics activities account for approximately 24.361 tonnes per annum (Khamkaew & Somhom 2009). Maniwan et al. (2005) argued that Thailand must reduce the level of CO_2 emissions reported in 1990 by 20% (27,653,443 tonnes) to comply with the Tokyo Protocol. However, the aim of reducing the level of emissions can only be achieved if the participation of the Royal Government of Thailand and all industrial sectors is ensured.

This study specifically focuses on logistics distribution issues currently facing the Thai newspaper industry. The problem associated with the newspaper distribution is most pronounced at the distribution centres and drop-off points (Russell, Chiang & Zepeda 2008). Further, the distribution must be as efficient as possible, at minimum operational cost, fuel consumption, truck usage, and distance coverage, while delivering the right news edition within the allowed time frame to meeting customer requirements (Boonkleaw, Suthikarnnarunai & Srinon 2009; Chiang et al. 2009; Hurter & Van Buer 1996; Runhaar & van der Heijden 2003; Russell, Chiang & Zepeda 2008). However, studies conducted thus far (i.e., Eraslan & Derya (2010), Moberg et al. (2010), Parr (2010), Böhnlein, Schweiger & Tuma (2011)) have inadequately explored managerial factors for enabling joint activities among competing firms in the newspaper industry in Thailand that strive toward sustainability in freight distribution. Therefore, this study aims to accomplish the following:

- extend the knowledge of the exiting literature on Thai freight logistics, and
- develop a freight distribution model that could improve business performance while improving economic, social, and environmental sustainability.

1.3 Theoretical context

Following the call from Flint et al. (2005) for the development of theory in the field of supply chain management (SCM), this research is founded on three main theories: game theory, resources-based view, and population ecology. First, game theory implies that the cooperation between oligopolies can lead to the improvements in value-added services and result in a non-zero sum game or produce the co-opetitive game theory (Brandenburger & Nalebuff 2002). Second, resource-based view theory asserts that the firm can improve its competitive advantage through the acquisition of valuable, rare, imperfectly imitable, and non-substitutable resources (Barney 1991; Barney, Ketchen & Wright 2011). Thus, the firm can acquire complementary resources through participation in inter-firm networks and, in doing so, generate competitive advantage (Jenkins, Ambrosini & Collier 2007). Finally, population ecology focuses on the interaction between species and the environment, recognizing that limited resources can constrain development and prosperity of populations. Therefore, firms operating within populations must conserve environmental resources in order to survive (Hannan & Freeman 1993). Thus, co-opetitive game theory, resource-based view, and population ecology are the key foundations for improving logistics distribution while achieving sustainability.

Several concepts/approaches emerged as a result of a series of studies on sustainability, including triple-bottom line, sustainable supply chain, sustainable distribution, co-opetition, freight consolidation, and collaborative transportation management (or collaborative freight distribution). Generally, sustainability is defined as the current consumption of resources that meets the needs of the present generation while ensuring that future generations will be able to consume the same resources to meet their own needs (Brundtland 1987; Linton, Klassen & Jayaraman 2007). Elkington (1998) and Montiel (2008) argued that firms need to focus on three dimensions of sustainability, namely economic, social and environmental sustainability, known as the ‘Triple Bottom Line’. In other words, firms should be viewed as one of the organisms in the society, as it consumes a substantial quantities of natural and human resources that would otherwise be available to the society. Thus, firms must reduce the consumption of social and environmental resources in order to sustain them for the future generations, while maximizing welfare and satisfaction of the current society.

Sustainable supply chain refers to the management of information flows and movement of raw materials, semi-finished products, and final products along the supply chain by incorporating sustainability dimensions into its business strategy and operations (Andersen & Skjoett-Larsen 2009; Carter & Rogers 2008; Croom et al. 2009; Darnall, Jolley & Handfield 2008; Pedersen 2009; Seuring et al. 2008). Hence, sustainability dimensions in every stage of the supply chain are vital in order to enhance the performance of the entire chain, as sustainable performance may otherwise be diminished (Carter & Rogers 2008; Darnall, Jolley & Handfield 2008; Kovacs 2008).

Sustainable distribution refers to the management of distribution and transportation processes implicit in order processing, warehousing, packaging, and delivery, as well as product returns in order to minimize social and environmental impact while sustaining economic/organizational performance status (Belz & Peattie 2009; McKinnon 2000; Wu & Dunn 1995). Specifically, green logistics, a subset of sustainable distribution (McKinnon et al. 2010), is crucial and refers to the mode of transportation, minimization of fuel consumption, truck usage, and travel distance. These components are yielding negative impacts on the social and natural environment such as noise and air pollution (Hui et al. 2007). McKinnon et al. (2010) asserted that sustainable distribution can be achieved by establishing co-opetitive relationships and collaborative freight distribution.

Co-opetition is an establishment of a cooperative relationship among competitors to achieve common goal. It refers to organisations being able to achieve optimal balance between pure collaboration and pure competition (Brandenburger & Nalebuff 1998; Hamel, Doz & Prahalad 1989; Nalebuff & Brandenburger 1996). Blomqvist et al. (2005) asserted that firms tend to collaborate with their competitors for leveraging and gaining contemporary resources, capabilities, and mutual interests, while competing for their own best interests. Specifically, Cruijssen et al. (2007) defined logistics horizontal cooperation as a cooperation in logistics functions between firms that operate at the same level of the logistics process and within the supply chain they participate in.

Freight consolidation refers to management of the entire distribution process, ending with the final destination, with minimal product storage at the distribution centre (Lewis, Fell & Palmer 2010). Freight consolidation can substaintailly reduce transportation cost, delivery time, vehicle usage, fuel consumption and pollutant emissions arising from distribution activities (Apte & Viswanathan 2000; Sung & Song 2003). Cross-dock terminals enhance freight consolidation by allowing products to be collected and consolidated from various suppliers at different locations prior to transport to nearby destinations (Schultz 2000). In this arrangement, a single truck can carry products of various suppliers (Liao, Lin & Shih 2010).

According to Sutherland (2003), firms and supply chain partners can horizontally collaborate in their distribution management through the concept of collaborative transportation management (CTM). CTM is a process of integrating all supply chain partners in the field of transportation and distribution to eliminate any inefficiency in the transport and distribution process. Co-opetitive relationship and freight consolidation management can be combined to achieve collaborative freight distribution (Chen, Yeh & Chen 2010; Zhou, Hui & Liang 2011). This approach allows the firm and its competitors to derive maximum benefits from collaborative freight distribution. Details about these theoretical concepts are discussed in literature review (chapter 3). This context will be subsequently used to identify the correlation among co-opetitive relationship, freight consolidation, collaborative freight distribution, and sustainable distribution.

1.4 Research questions and aims

Focusing on the Thai newspaper industry distribution issues, the main research question guiding this study was "How the sustainable distribution in Thailand newspaper industry can be improved?" In order to answer it, the investigation focused on establishing whether co-opetition, freight consolidation and collaborative freight distribution can lead to improving sustainable freight distribution. Thus, this study aimed to answer the following specific questions:

- Would the co-opetition influence sustainable distribution in the context of Thai newspaper industry?

- Would freight consolidation influence sustainable distribution in the context of Thai newspaper industry?
- Would co-opetition influence collaborative freight consolidation?
- Would freight consolidation influence collaborative freight consolidation in the context of Thai newspaper industry?
- Would collaborative freight consolidation influence sustainable distribution in the context of Thai newspaper industry?

Therefore, the aims of this research were to examine:

- the co-opetition strategy and the extent to which it can help with sustainable distribution,
- the freight consolidation process that can be applied for achieving sustainable distribution, and
- the collaborative freight distribution process and its impact on sustainable distribution.

1.5 Significance of the study

The implementation of co-opetition, freight consolidation and collaborative freight distribution is critical for firms aiming to achieve sustainability in supply chain and logistics management. Collaboration in the supply chain would allow participating firms to share and acquire complementary resources and capabilities for sustaining organizational performance and improving environmental and social sustainability (Gold, Seuring & Beske 2010). Specifically, strategic alliance in freight distribution could improve freight movement performance (Zhou, Hui & Liang 2011). Moreover, horizontal cooperation in logistics could improve productivity of core activities, reduce costs of non-core activities, reduce purchasing costs, broaden service level at a lower cost, and protect market share (Cruijssen, Cools & Dullaert 2007).

The findings of this study will benefit academic communities, logisticians, related industries, economists, socialists and environmentalists by extending the current knowledge of sustainable freight logistics literature; will help government organisations in policy making; and providing insights of newspaper logistics to professionals in the newspaper, transporter, and newsagent industry. It would provide academic contributions by enhancing the understanding of sustainability in supply chain and logistics management; enhancing the understanding of co-opetitive relationship, freight consolidation and collaborative freight distribution for achieving sustainability in freight distribution process; providing new approaches to Thai newspaper industry, which will enable improving logistics strategies, facilitate joint logistics activities and enhance economic, social and environmental capitals through logistics theory.

The findings of this study will also provide practical implications by helping firms to reconfigure business policies, strategies, processes, and operations toward sustainable supply chain; helping firms to recognize critical factors for enabling development of co-opetitive relationships with competitors, introducing the freight consolidation process, and achieving collaborative freight distribution. This study will also improve sustainable distribution practices of Thailand's newspaper industry; enhance the capacity of logistics, transportation management, and freight consolidation activities for improving distribution operations, thus promoting sustainability in Thailand; promote sustainable distribution through the reduction in transport usage, fuel consumption and transport mods utilization in newspaper distribution process; enhance the capacity for co-opetitive distribution operations, leading towards sustainable distribution and overall business sustainability.

1.6 The structure of the thesis

This study aims to expand the extant knowledge of newspaper, transporter, and newsagent industries. In particular, it provides critical review of the concepts of co-opetition, freight consolidation, collaborative freight distribution, and sustainable distribution particularly relating to Thai context. Afterward, the study presents the research methodology employed in this study, the aim of which is to examine the hypothesised relationship between the concepts and the conceptual framework. This was achieved through preliminary data analysis, measurement modeling and path analysis through structural equation modeling. The research findings, discussions, conclusions, and study implications are carried out towards the end of the thesis. The details of the chapterisations are discussed below.

Chapter 1: Introduction

Chapter 1 contains a brief research background, as well as a contextual overview of co-opetition, freight consolidation approach, collaborative freight distribution, and sustainable distribution. Moreover, the significance of the study and the study's expected contributions to the literature also included in this chapter.

Chapter 2: Contextual background / The newspaper, transporter, and newsagent industry

This chapter consists of background information on the newspaper, transporter and newsagent industry. It focuses on general aspects, current conditions, and key challenges pertaining to each industry in relation to co-opetitive relationships, freight consolidation, collaborative freight distribution, and sustainability.

Chapter 3: Literature review

This chapter presents a review of pertinent literatures addressing sustainability in supply chain and logistics management. The researcher also reviews literature sources of particular relevance in the context of co-opetition, freight consolidation, collaborative freight distribution, and sustainable distribution.

Chapter 4: Hypotheses and conceptual framework

In this chapter, research hypotheses are identified and conceptual framework is proposed. The framework is comprised of critical determinants that were expected to influence sustainable distribution in the Thai newspaper industry.

Chapter 5: Methodology

This chapter presents the research methodology adopted in this study. Furthermore, the chapter presents the research design and process; pilot study; population and sampling used for the actual mail survey; mail survey procedure; development of final questionnaire process; data analysis methods; test for reliability and validity; limitations of the research methodology; and ethical issues.

Chapter 6: Preliminary data analysis

This chapter presents and discusses the preliminary analysis of representative sample, demographic profile of respondents, missing value assessment, multivariate outlier assessment, comparison of respondents' characteristics, non-response bias assessment, multivariate normality assessment, multicollinearity test, unidimensionality test, common method variance assessment, and exploratory factor analysis (EFA), all of which are employed prior to structural equation modeling (SEM).

Chapter 7: Structural equation modeling analysis

In this chapter, the researcher presents and evaluates the data set via confirmatory factor analysis (CFA) and SEM. This facilitates the development of the measurement models. The structural model was run using AMOS to test the hypothesized relationships among the study variables.

Chapter 8: Discussion

The purpose of this chapter is to discuss the research results found in Chapters 6 and 7, with respect to the research questions and research hypotheses. The researcher particularly focuses on the path model for achieving sustainable distribution in Thailand’s newspaper industry.

Chapter 9: Conclusions and implications

Finally in chapter 9, the researcher concludes the study with summaries of the research findings from the CFA and SEM. The study implications and significance of the research are acknowledged. The chapter outlines the limitations of the current study and recommends future research agenda.

1.7 Conclusion

This chapter provided the background, context, overview, and theoretical context of this study. It demonstrated the study significance, reflected in the enhancement of current knowledge and potential for improvement of current business operations. The researcher also provided the structure of the thesis, reflecting the work performed as a part of this research.

CHAPTER 2

CONTEXTUAL BACKGROUND: THE NEWSPAPER, TRANSPORTER, AND NEWSAGENT INDUSTRY

2.0 Introduction

The overview and importance of supply chain of newspaper industry is presented in the previous chapter. Newspaper, transporter, and newsagent industries are interconnected in the newspaper distribution process in Thailand. Hence chain members in newspaper supply chain in Thailand must be justified. This chapter aims to provide an overview of the current status and challenges of newspaper, transporter, and newsagent industry.

2.1 Overview of the newspaper industry

Newspaper was the first tool used for disseminating information and making news available to a wider population. In 105 A.D., a Chinese man named Silan introduced a paper made from wood, aiming to record events and information. In the Western society, newspaper history began in Renaissance Europe. Newspaper first emerged in the form of newsletter written by hand, containing information about human interests, war, economy and weather. In the late 1400's, the first printed newspaper appeared in Germany in the form of pamphlets (Braber 2012).

In Thailand, newspaper was first introduced by Dan Beach Bradley, M.D., in the era of Phra Bat Somdet Phra Poramadhiworasettha Maha Jessadabodindra Phra Nangklao Chao Yu Hua or Rama III (the third monarch of Thailand). He was a doctor as well as a missionary, associated with American Board of Commissioners of Foreign Mission (ABCFM). In 1839, Bradley firstly printed 9,000 copies of news in the form of pamphlets for promoting the prohibition of the consumption and trading of opium, in line with the requirements of Rama III. In 1842, he invented a printing mould containing Thai characters. In 1844, Bradley printed a first formal monthly newspaper in Thai language, which he named "Bangkok Recorder" (Veerudh 2011).

According to The Press Association of Thailand, currently approximately 400 newspaper companies are operating nationwide. They print approximately 955 issues monthly which is equivalent to 32 issues published daily. However, the demand for newspapers is declining due to the increased awareness of environmental/social issues, emergence of new communication technologies, online publishing and rising cost of production (Veerudh 2011).

2.2 Threats facing the newspaper industry

The global demand for printed newspapers is declining (Mahlburg 2012). In Thailand, the market value of newspaper industry was 18,000 million baht in 2005. The newspaper industry growth declined from 17.34% in 2005 to -11.84% in 2006, -19.88% in 2007, -15.00% in 2008, -20.88% in 2009 and -0.24% in 2010 (PUBAT 2013). There are several reasons behind the falling demand for newspapers. The first threat is widespread usage of the Internet, as it facilitates rapid access to information, made possible due to advances in computer technology and emergence of personal electronic devices (i.e., smart phone and portable tablet). Moreover, unlike the Internet, newspaper does not allow readers to search for more information on the topics covered by the current publication. The second threat to the newspaper industry is cable news, as this service provides news and information much faster than newspapers, which are typically delivered once or twice a day. Moreover, cable news can share information and images in real time, and make the content more vivid through the motion or animation on the screen. Nonetheless, in Thailand, newspapers are read every morning before 6 a.m. by the newsreaders on the cable news. Thus, households do not need to purchase newspapers because they receive summarized version of its content through the newsreader's early morning report.

The third threat to sustainability of the newspaper industry stems from the lack of news reporters. New graduates tend to find matching-paying jobs that require less work, and are thus not motivated to become news reporters. The fourth threat is wasteful overhead. Newspaper companies use substantial resources and funds on raw materials (i.e., ink, oil and paper) every day. Due to the raising price of oil and paper, newspaper companies are suffering from the increasing cost of production. In contrast, cable news and the Internet require fewer tangible resources for delivering news.

The fifth threat is literacy. Readers need to be literate or have the ability to read in order to benefit from printed news. However, being uneducated or illiterate does not inhibit individual's alibility to follow cable news. The sixth threat is costs associated with printed media. Households are able to consume free news from the Internet and cable news or even share newspapers with neighbours. In other words, they can still consume news without generating any expense. The last threat to the newspaper industry is impracticality and inconvenience. Newspaper can be an inconvenience to carry around. Moreover, as noted before, the nature of newspaper does not allow the reader to search for more information, which is not an issue for technology-based news sources (Thomas 2011).Thus, newspaper companies need new business strategies to cope with the declining sales, demand and profits.

2.3 General characteristics of newspaper distribution

An overview of newspaper distribution's characteristics is critical for understanding its process. Bohnlein et al. (2009) described the newspaper production and distribution process as follow. First, the editorial department creates different newspaper editions, according to upcoming news, different geographical area and demography of readers. Next, the editorial department assigns the production schedule. Blueprints of each edition are then sent to the printing facility. The printing facility will print each edition while inserting the pre-printed advertisement pages. Once editions are printed, newspapers will be assigned to delivery trucks, assigned according to their destinations, or so called 'drop-off points'. However, newspapers are sometimes delivered directly to the readers or subscribers via the mail service.

Newspaper production and distribution are inseparable (Van Buer, Woodruff & Olson 1999). For a metropolitan morning editions of a newspaper, Van Buer, Woodruff and Olson ((1999) noted that the production starts approximately after midnight, as the last newspaper must be delivered to the subscribers before 6.00 am. Therefore, production and delivery operations must be completed within 5-6 hours. According to Garcia, Centeno, and Penaloza (1999), the newspaper production consists of a number of editions, each with different content. Each edition is further differentiated according to geographical areas and their respective resident demographics. Moreover, content may change based on the occurrence of news at the time of the day. During the production process, newspaper distribution is usually scheduled for the longest route first, as this takes the longest time. For instance, once the first edition is completed for the longest route, truck will be assigned and newspaper delivery will be scheduled, according to the drop-off points. The foiled papers are then loaded to the truck at the facility. The truck delivers the newspapers to drop-off points, which could be a front porch, street corners or newsagents. Moreover, newspapers are sometimes delivered directly to book stores. At the drop-off point, news carriers will come to pick up the newspapers for distributing to assigned motorcycles, newsboys, local stores, houses, and subscribers. Fortunately, sometimes a drop-off point may serve several carriers. In short, the formulation of the delivery time frame (i.e. total lead time of production and distribution) is a function of:

> Total production time for the edition + production time for all previous editions (with set-up time) + pick up and loading time + stem travel time to news carriers + carrier delivery time to end customer

The key issue associated with this process is that the distribution centre location, number of assigned trucks, the utilization of truck space, the vehicle routing, the drop-off point location(s), and the number of drop-off points must be determined in order to minimize delivery times and maximize reader satisfaction (Van Buer, Woodruff & Olson 1999).

2.4 Newspaper distribution chain in Thailand

In general, the newspaper production starts approximately at 9.00-9.30 pm. Printed newspapers are assigned to their respective trucks, approximately at 10 pm, and once they are loaded, the truck starts the tour at around 10.30 pm. For instance, referring to Figure 2.1, the truck moves from the distribution centre to the first drop-off point. News carriers and local motorcycles pick up the delivered newspapers from the drop-off point for distribution to newsstands, book stores, houses, and subscribers. From the first drop-off point, the truck moves to the second drop-off point. From this location, assigned news carriers pick up the newspapers and deliver them to two other drop-off points. The truck, finally, moves to the last drop-off point and returns to the distribution centre, carrying any unsold newspapers (typically unsold yesterday’s edition). As demonstrated, the delivery process is compatible with the formulation of the delivery time frame proposed by Van Buer et al (1999). However, most newspaper companies distribute newspapers to the same drop-off points, as depicted in Figure 2.2.

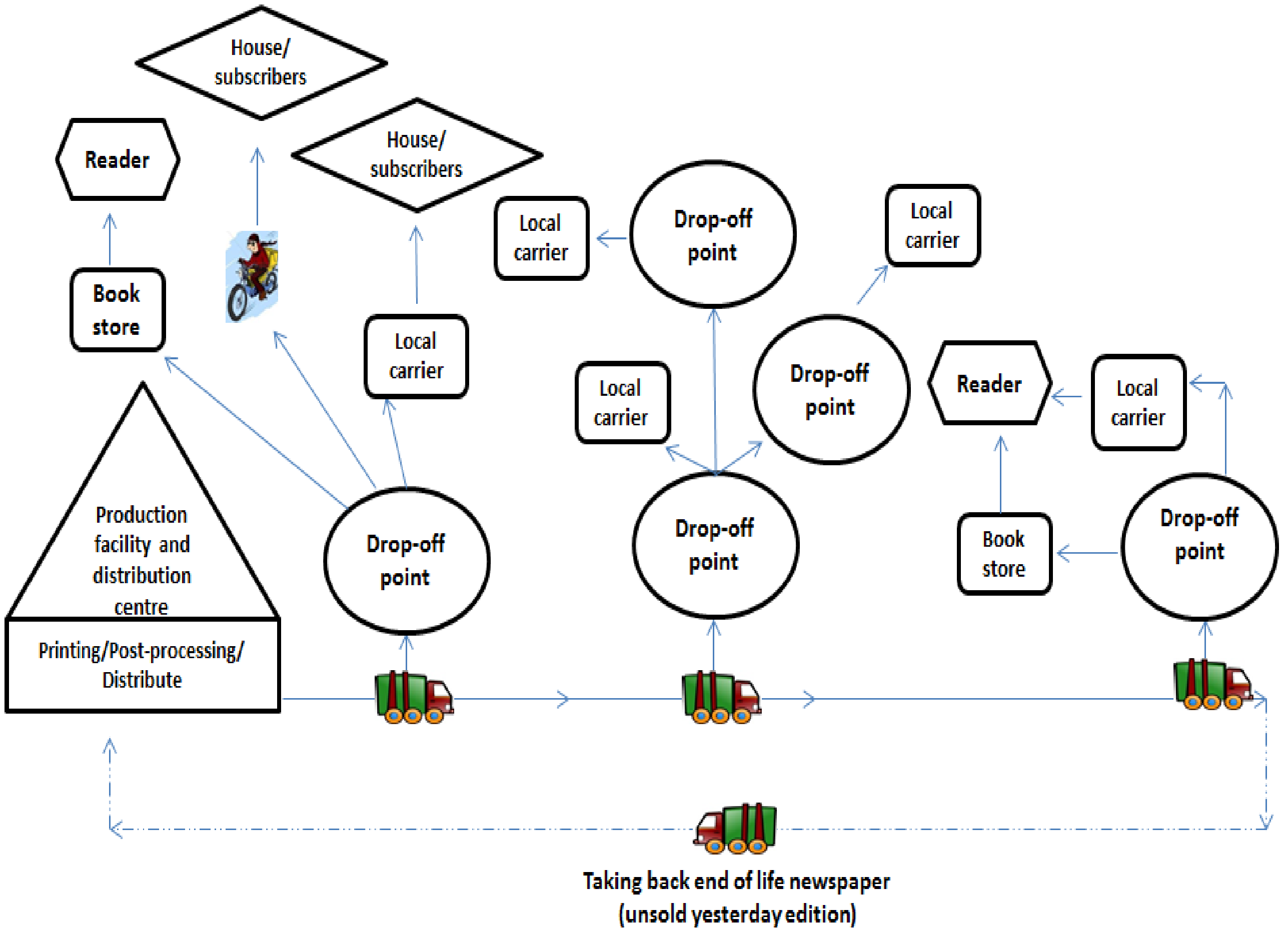


Figure 2.1: Newspaper distribution in Thailand

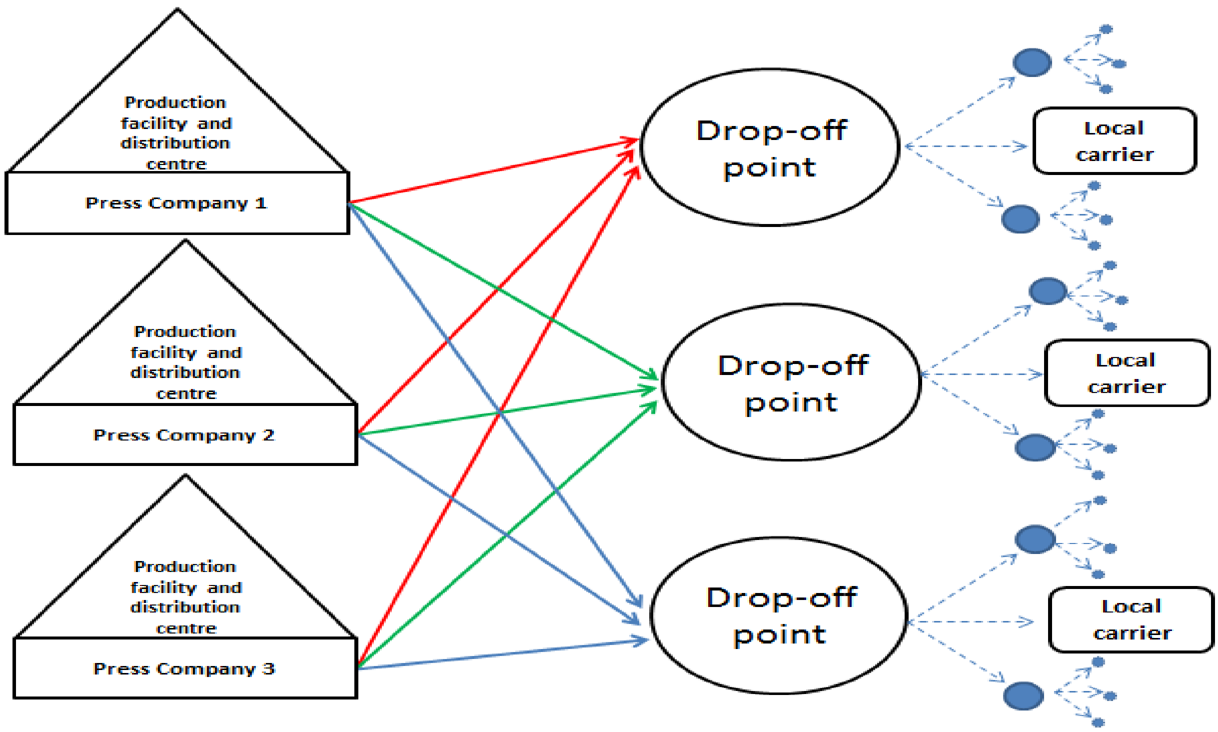


Figure 2.2: Different press company delivery newspapers to the same drop-off points

Newspaper distribution faces several issues related to sustainability of the operations. First, press companies use significant number of trucks for distribution, and the vehicles are in operation for 365 days of the year. Trucks incur substantial fuel and maintenance costs, and emit substantial quantities of toxic chemicals. Second, as shown in Figure 2.2, different newspaper companies distribute newspapers to the same drop-off points, generating waste in fuel, driver requirements, and cost of vehicle maintenance. According to Cruijssen et al. (2007), products could be consolidated into the same truck when they are distributed along the same route to reduce waste and optimize vehicle utilization. Crujssen et al. (2007) proposed 'horizontal cooperation in transport and logistics', as a means to mitigate waste during logistics and transportation activities. Horizontal cooperation refers to the collaboration between the focal firm and its competitors on joint logistics activities, such as co-distribution and co-route planning. Thus, as shown in Figure 2.3, the newspaper distribution issues could be addressed by press companies delivering newspapers to the consolidation centre prior to their distribution to drop-off points. In this scenario, trucks are re-scheduled and re-loaded with multiple products from different press companies, all delivering their products to the same drop-off points. Sutherland (2006) observed benefits of collaborative freight distribution and concluded that it can improve on-time service, reduce lead time, reduce inventory, increase sales, reduce freight cost, reduce administrative cost, reduce deadhead mile, reduce dwell-time, improve fleet utilization, and reduce driver turnover. Hence, collaborative newspaper distribution would be a potential strategy that can assist in improving newspaper distribution efficiency.

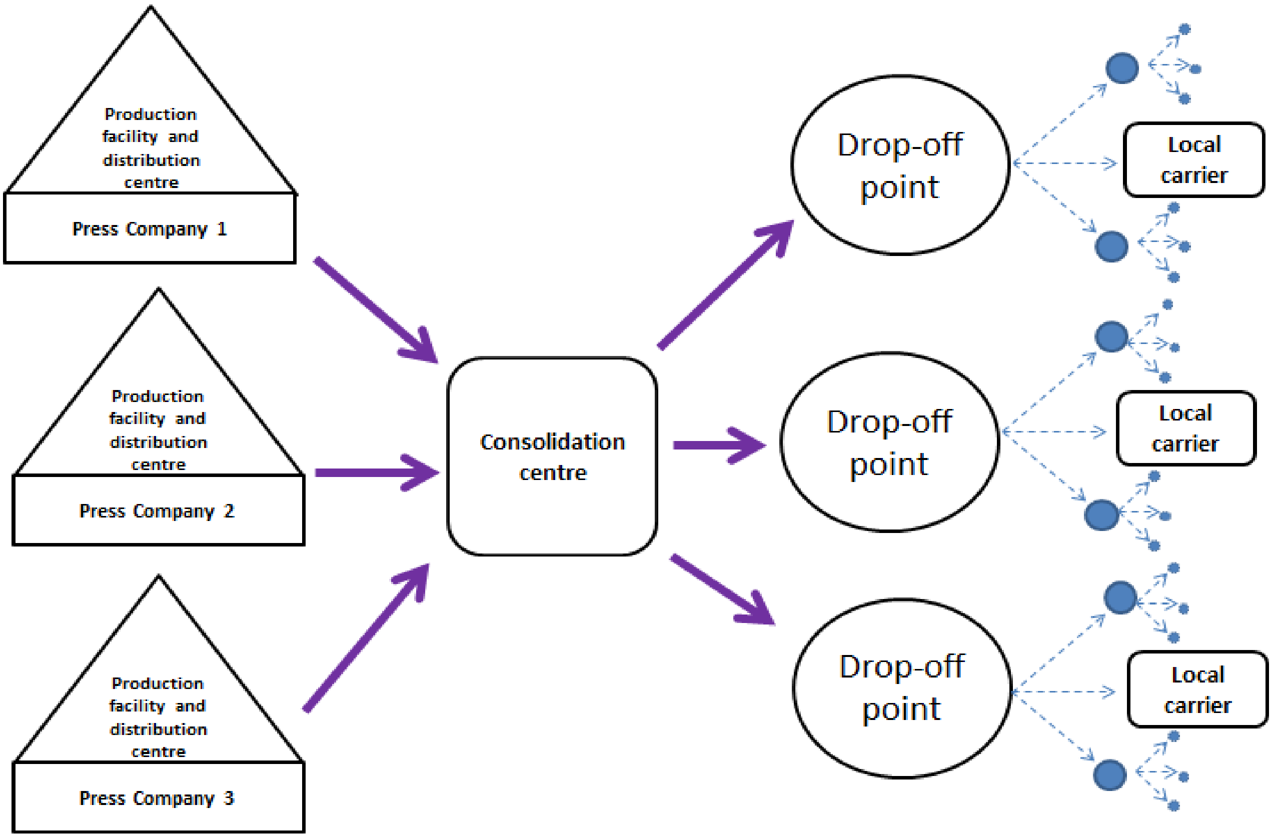


Figure 2.3: Collaborative freight distribution

In summary, the current distribution process adopted in the newspaper industry is inefficient and ineffective due to the substantial usage of vehicles, high operating costs, and substantial emissions. Collaborative freight distribution is the potential solution where competitors collaborate for delivery and distribution process that very likely improves sustainability performance (McKinnon et al. 2010).

2.5 Newspaper distribution problem (NDP), sustainability issues, and research gap

2.5.1 Environmental and social sustainability issues

Newspaper distribution process yields substantial negative effects on the society and natural environment. Hautanen et al. (2009) stated that only 30% of print media (i.e., magazines and newspapers) are actually sold whereby the remaining 70% are wasted and often sent to the landfill. This means that every unit of printed media has 70% probability of being unsold. Those unsold products consume approximately 2.45 million trees per annum. Moreover, every tonne of paper produced requires approximately 98 tonnes of other resources. Clearly, printed products negatively affect society and environment due to the substantial emission of pollution during their life cycle. Hautanen et al. (2009) further stated that every metric tonne of printed media releases approximately 1.17 metric tonnes of CO_2, of which 61% stem from paper mill emissions, 16% from the final fate (i.e. incineration and landfill), 2% form forest management and harvesting, 8% from transportation and distribution, 8% from transportation of wood fibres and clay to paper mill, 4% from printing, and 1% from transportation of paper to the printer . Detail distribution is presented in Figure 2.4.

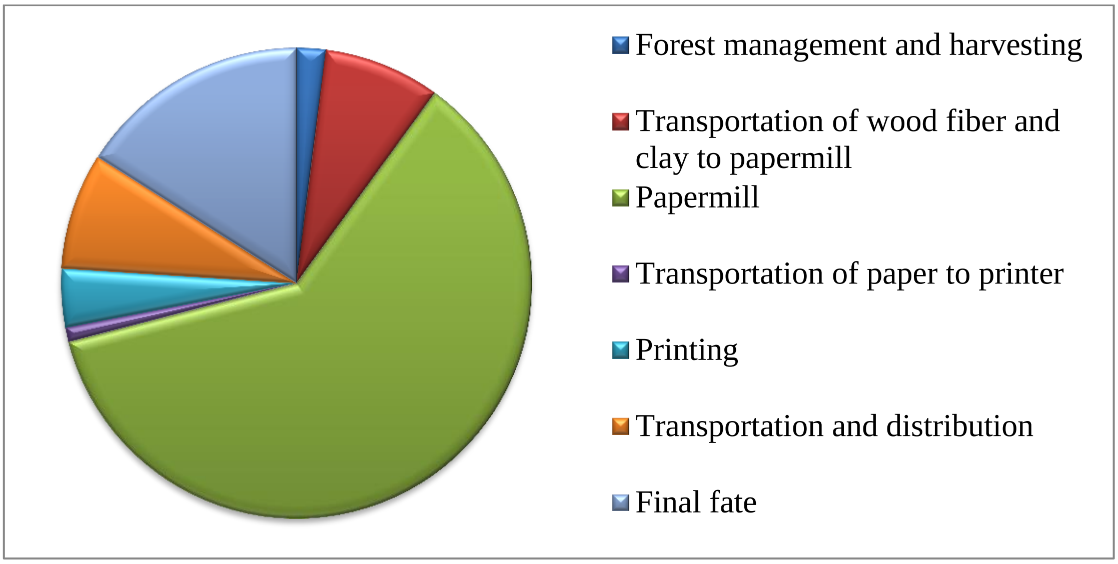


Figure 2.4: CO_2 emission contribution from production and distribution of print media

Literature highlights environmental issues arising from newspaper production. Moberg et al. (2010) illustrated environmental effects arising from the production and distribution of printed newspapers in Europe in general, with a specific focus on Sweden. In Europe, the newspaper production and distribution are responsible for approximately 45% of the global warming, which is significantly higher than 30% in Sweden. The total annual CO_2 equivalent (CO_2e) emissions are estimated at 28 kg CO_2e in Europe. This amount comprises 3 kg CO_2e from editorial operations, 12 kg CO_2e from paper production, 2 kg CO_2e from paper transportation, 2 kg CO_2e from prepress, 3 kg CO_2e from printing, 3 kg CO_2e from newspaper distribution and 3 kg CO_2e from newspaper disposal. Sweden on the other hand experiences annual estimate of 20 kg CO_2e, of which 1 kg CO_2e is due to editorial operations, 6 kg CO_2e from paper production, 1 kg CO_2e from paper transportation, 2 kg CO_2e from prepress, 3 kg CO_2e from printing, 6 kg CO_2e from newspaper distribution and 1 kg CO_2e from newspaper disposal (Figure 2.5). Therefore, CO_2 emission as well as others such as water pollution, visual pollution, odour pollution and solid waste must be eliminated from newspaper distribution process to improving social and environmental sustainability.

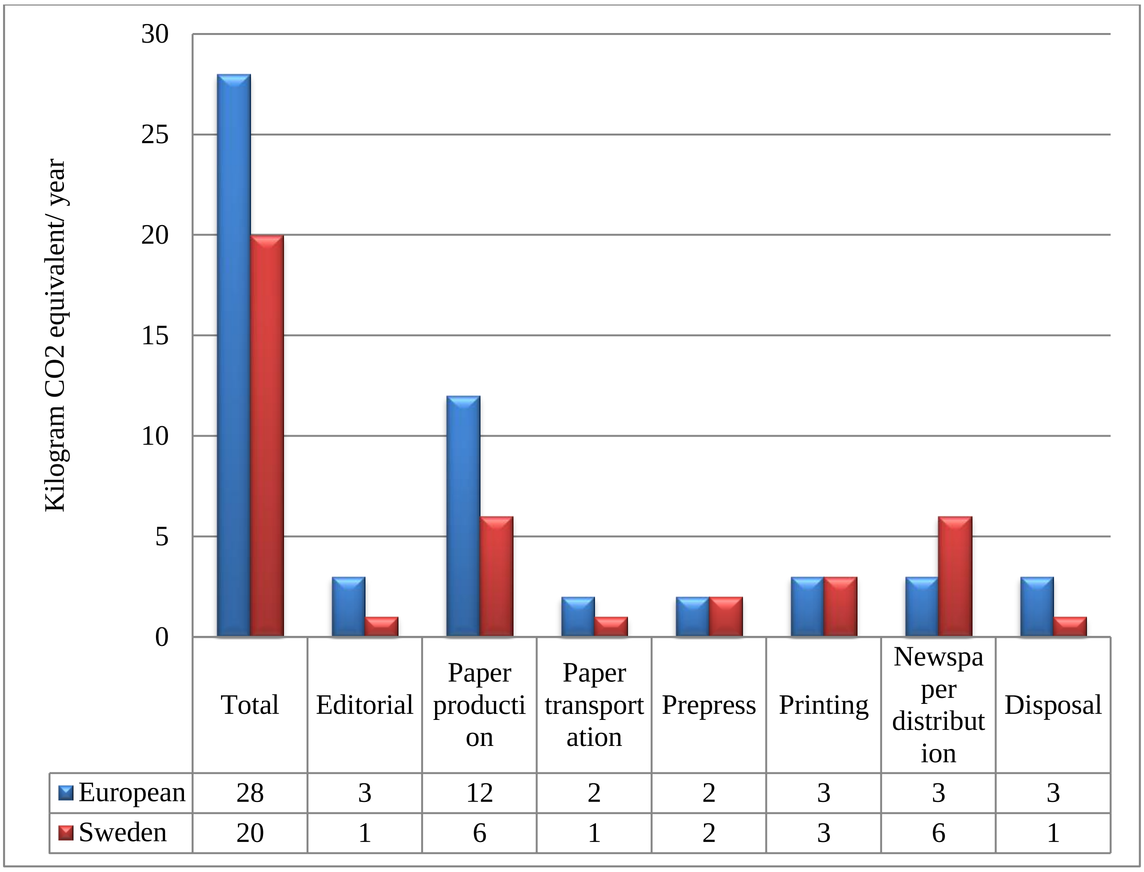


Figure 2.5: The printed newspaper global warming potential in Europe and Sweden

2.5.2 Economic sustainability

Production and distribution functions are one of the core business processes of the newspaper industry.(Mantel & Fontein 1993; Russell, Chiang & Zepeda 2008). Newspaper companies could improve its competitive advantage, services and profitability by improving feasibility, flexibility, efficiency, viability, and reliability of its production and distribution operations. (Chiang et al. 2009). Eraslan and Dery (2010) claimed that newspapers have at most 24 hours lifetime. Thus, the faster the distribution process, the better the customer satisfaction and competitive advantage of the newspaper provider. The main challenges of newspaper distribution involve the minimization of the costs incurred by distribution operations while delivering the right edition to the drop-off points or directly to the reader on time (Hurter & Van Buer 1996). However, the authors further state that newspapers are perishable goods and would cause economic loss if distributed and delivered late. Bohnlein et al. (2009) argued that effective distribution can prevent economic loss associated with perishable products like newspaper.

Scholars have proposed solutions to the aforementioned issues, mostly addressing the vehicle routing problem (VRP) through optimization and heuristics search methods (Bohnlein, Gahm & Tuma 2009). VRP identifies the shortest route of drop-off and pick-up (Mantel & Fontein 1993), focuses on minimising transportation time and cost (Eraslan & Derya 2010; Garcia, Centeno & Penaloza 1999), and improvement of customer satisfaction through on-time delivery. For the Thailand newspaper industry, Boonkleaw et al. (2009) studied vehicle routing problem with time window (VRPTW) by employing VRP model. The outcome was reduced distribution cost of morning newspaper delivery without exceeding truck capacity and breaching time constraints.

Thus, the majority of extant literature focused on solving vehicle routing problem in order to minimize distribution costs, truck usage, route and distance, while improving service level and customer satisfaction. However, the issues of newspaper distribution process through freight consolidation management, horizontal cooperation (i.e. co-opetition), and collaborative newspaper distribution and their effects on sustainability are less researched and are hardly documented.

2.6 Transporter or third-party logistics (3PL) industry

The outsourcing of logistics activities, such as freight distribution, is not a new phenomenon (Skjoett-Larsen 2000). Newspapers are usually delivered to customers by carriers, contracted transporters or logistics service providers (Boonkleaw, Suthikarnnarunai & Srinon 2010). Thus, the involvement of third-party logistics (3PL), unless the contracts with the master company forbid this, is a critical consideration for improving newspaper distribution activities towards sustainability.

The term third-party logistics (3PL) must be defined prior the discussion of issues facing transporter industry. Lieb, Millen, and Van Wassenhove (1993) stated that "third-party logistics involve the use of external companies to perform logistics functions that have traditionally been performed within the firm. The functions performed by the third party can encompass the entire logistics process or selected activities within that process" (Skjoett-Larsen 2000, pp.113). According to Hum (2000), firms employ 3PL when seeking competitive advantages, while they lack internal resources and capabilities to carry out the same functions. Thus, firms consider employment of 3PL when attempting to improve their business operations.

The most frequently outsourced logistics activities are freight distribution and transportation (Sohail & Sohal 2003; Van Laarhoven, Berglund & Peters 2000). Banomyong and Supatn (2011) highlighted that 3PL in Thailand is not only responsible for freight distribution but also for providing value-added services, such as freight consolidation, negotiation with customers and co-ordination with other parties in the supply chain. As stated by TTLA (2012), transport and 3PL industry is growing in Thailand; thus, the nation is developing logistics infrastructure to support an upcoming regional cooperation in security, as well as sociocultural and economic integration among South-East Asian countries, or known as 'ASEAN'. Mentzer, Flint, and Kent (1999) proposed nine dimensions for assessing logistics service quality—information quality, ordering procedure, ordering release quantity, timeliness, order accuracy, order quality, order condition, order discrepancy handling, and personal contact quality. Rafele (2004) proposed alternative service quality model comprising of tangible components, ways of fulfilment, and information actions. Moreover, Aktas and Ulengin (2005) proposed seven dimensions, i.e., reliability of the carrier, prompt response in the delivery cycle, prestige of the carrier, financial opportunities and flexibility to customer requirements, reliability and quality of operations management and delivery cycle, ease of collaboration, and accurate order receipt and follow-up. Despite different assessment strategies, all authors agree that the service quality provided by third-party logistics must be ensured in order to improve business sustainability.

The benefits related to sustainability arising from involvement of 3PL in freight distribution and transportation are numerous. Skjoett-Larsen (2000) posited that 3PL can help the firm to improve market coverage, increase flexibility to satisfy customer requirements, and improve service level. Moreover, the firm can also gain value-added services, such as packing and quality control. Millen et al. (1997) stated 3PL can help the firm to reduce delivery lead-time, improve logistics services, reduce operation costs, improve customer satisfaction, and enhance competitive advantages. Importantly, employment of 3PL could also improve environmental and social sustainability. According to Lieb and Lieb (2010), firms could improve environmental and social sustainability by selecting 3PL that facilitates promoting freight consolidation, purchasing more fuel-efficient vehicles, reducing vehicle mileage operated, distributing freight to more fuel efficient modes of transport, sharing delivery vehicles with others, and reducing vehicle idle time, supporting customers in reducing carbon footprint, reducing water, fuel, and electricity consumption, developing recycling program and utilizing renewable energy resources. As a result, firms could reduce pollution, improve energy and natural resource conservation, promote social welfare, and increase employee motivation and satisfaction. Thus, involvement of 3PL in freight distribution could help firm to improve economic, social and environmental sustainability.

2.7 The newsagents industry

Newsagents are another important player in supply chain of newspaper distribution. There are three main types of newsagents—those responsible for distribution only, facilitating retail and distribution, and retail only (ANF 2011). Newsagent is a term that usually refers to a business that sells newspapers, magazines, books, and other items of local interest (Cambridgedictionary 2013). Most customers are supplied newspapers via these newsagencies (ANF 2011; Garcia, Centeno & Penaloza 1999). The newspaper company distributes circulations to contracted newsagencies. The newsagency is thus responsible for distribution to sub-agents, as well as home delivery. Costs of distribution and margins are dependent on geographical coverage and location of the newsagency.

Presently, newsagencies are suffering from business downturn due to the threat from the Internet and digital media providing similar content in electronic form. Newsagencies and bookstores in the United States and Australia all agreed that sales, margins, and customers of printed media (i.e., newspaper and book) are rapidly declining due to the increasing consumption of electronic media (i.e., e-books and e-newspapers) and online access to print media (ANF 2011; Neary 2010). Mike Shatzkin, the head of Ideal Logistics Company consultancy and an organizer of the Digital Book World, stated that, in the US, the sales of e-books and other e-media doubled from 2009 to 2011, while the contribution of traditional paper media (i.e., magazines and newspapers) to the total sale declined from 72 percent to 25 percent. This trend will result in lower prices of print media, reducing the margin (Redorbit 2011). With regard to the online purchases of e-books and online newspaper subscriptions, Greenfield (2011) stated that the tablet contributes 30%, smartphone 15%, and e-reader approximately 55%. Moreover, it is estimated that the revenue of e-media will reach $10 billion by 2016 and the traditional newsagencies that do not adapt their business operations accordingly will likely become insolvent. There are several reasons behind the decline in the traditional newsagency sales. First, business operation costs include increasing costs of labour and logistics (i.e., cost of distribution). Second, electronic commerce companies can set lower selling price due to lower cost of business operations. Third, electronic commerce companies benefit from allowing customers to order e-books and online newspapers at the convenience of their own homes (Nisbet 2010). As a result, the traditional newsagencies need to adopt new strategy to survive in this increasingly competitive market.

In Thailand, Mr. Warapan Lokitsataphorn, the president of the Publisher and Booksellers Association of Thailand (PUBAT), reported that newsagent industry grew by 5%, reaching the total value of 22,600 million baht (approximately $750 million Australian dollars) between 2012 and 2013. Moreover, by the end of 2014, it is expected to grow by 7%, corresponding to the total value of 24,200 million baht (approximately $800 million Australian dollars). However, the industry is facing increasing total costs that derive from the minimum wage policy, first car subsidy policy, and an increase of smartphone, tablet, and e-reader consumption. The president further stated that the increase in total cost led to the bankruptcy of approximately 60 small and medium newsagencies between 2012 and 2013 (Matichon 2013). Moreover, AECnews (2013) and Dailynews (2013) have reported that costs also derive from an increase of logistics and product distribution costs. Fortunately, Mr. Sukachai Sakulsuttawong, the owner of Doungkamon newsagency, stated that a better logistics and warehouse operation can compensate for 30-35% of the total distribution cost (Sakulsuttawong 2013). Thus, an identification of better logistics operation is critical for reducing total cost.

Since newsagencies are facing lack of commercial viability, as their former customers are increasingly consuming news via electronic devices, in addition to their products being charged at the cover price, newsagents are facing higher competition with department stores, supermarkets and other convenience stores. Thus, they must improve their business operations by considering six main key success factors—effective stock management, identification of best price for each product, reconfiguration of business strategy in line with changing customer requirements, improving attractiveness of product presentation, employment of skilled workers, and consideration of strategic alliance (QLD 2013). Moreover, Fletcher (2008) suggested five opportunities for improving newsagent business, namely changing the layout of the current store, refreshing the relationship with suppliers, introducing new stores, focusing on new product range, and improving business management and operation.

Despite many challenges, there are number of strategies that could be implemented by a newsagency in the digital era. First, traditional newsagencies need to consider identifying and adopting a win-win strategy, which implies collaboration with other local businesses to provide more appreciation of their services to customers (Boog 2011; Godelnik 2010). Second, the distribution network must be reconfigured and cheaper methods for delivering goods and services must be identified. This would lead to cost saving and margin improvement (Horwitz 2011). Third, the framework of sustainability must be introduced into the core of business, such as making the store more energy efficient, making business operations more environmentally-friendly, and contributing to the community by increasing customer awareness on green issues. These strategies would help secure the future success of the business, as improvements in sustainability and reduction of pollution are increasingly demanded by the society (Godelnik 2011). In short, newsagents play an important role in newspaper distribution chain. However, they must improve their business operation models in order to sustain the business. Therefore, inclusion of newsagents into this study is critical, since their opinion is equally important in the collaborative decision-making.

2.8 Conclusion

This chapter discussed the history and background of newspaper industry. Also discussed the threats currently facing newspaper distribution, specifically those related to sustainability issues and provided an overview of the current status of business operations. General information about the transporter and newsagent industries are outlined since they play important roles in the newspaper supply chain and their opinion is critical for decision-making pertaining to co-opetition, freight consolidation, and collaborative freight distribution toward sustainability issues.

CHAPTER 3

THEORETICAL BACKGROUND AND LITERATURE REVIEW

3.0 Introduction

The purpose of this chapter is to present and critique state-of-the art literatures on sustainability, sustainable freight distribution, co-opetition, freight consolidation and collaborative freight distribution, thus helping to identify gaps in the current knowledge in this field and develop a conceptual framework outlined in Chapter 4.

3.1 Literature sources

A systematic literature review was undertaken to identify, select and formalize the research constructs and measurement items used in this research (Seuring & Müller 2008). Systematic literature review is employed with the goal of identifying pertinent research studies that can inform the particular research questions and use explicit methods to identify what can reliably be said on the basis of these studies. In the context of the current study, to focus was on extant works in the supply chain context (i.e., Teuteberg & Wittstruck 2010 and Wilding et al. 2012). Four main steps are typically taken when conducting a systematic review. More specifically, it commences by defining the search terms, after which the relevant databases, search engines and hard copy journals are identified. Next, the researcher must decide on, and apply, filters for inclusion and exclusion. Lastly, the resulting articles and journals are assessed in order to ensure that they are representative (King's College 2014).

When selecting the literature for inclusion in review, it is also essential to consider the issues of time horizon, journals and article selection, article classification and analyses employed within the study (Soni & Kodali 2011). Based on the research aims and objectives, in this study, it was appropriate to focus the literature review on articles in the areas of co-opetition, cooperation and competition, transportation, freight consolidation, collaborative freight distribution, sustainability in supply chains, carbon footprint, environmental and social issues, green issues and sustainable performance. Thus, the researcher examined literature sources in order to assess the extent and scope of research previously undertaken by scholars.

Keywords used for searching literature sources included collaboration, co-opetition, horizontal collaboration, horizontal cooperation, horizontal competition, co-opetitive relationship, competition and cooperation, freight consolidation, logistics consolidation, product consolidation, collaborative distribution, collaborative freight distribution, cooperative freight consolidation, collaborative freight distribution, collaborative transportation management, cooperative transportation, collaborative transportation, co-opetitive transportation, sustainable distribution, sustainable transportation, corporate social responsibility, green freight distribution, green transportation, green logistics, logistics social responsibility, sustainable logistics, Thailand, newspaper industry, third-party logistics, newsagents, etc. The selected literature sources were related to logistics and supply chain management, transportation management, freight distribution and sustainability. Literature sources were searched through e-journals and databases, namely Business Sources Premier, Emerald, SCOPUS, Econlit, Business Source Complete, books and electronic copies of journals from Victoria University, Melbourne.

3.2 Sustainablity

3.2.1 Corporate social responsibility

Firms are reconfiguring towards a sustainability of economics, social and natural environment to improving and sustaining their business performance. Organizational policies and practices towards organizational ecology, corporate social responsibility and corporate sustainability have been under change due to severe institutional pressure and rapid environmental impacts (BRS 2006). Fenwick (2007) studied the development of organizational ecology and ecological sustainability in particular. It is the study of population of firms (i.e. organizational field) and the adaptation of organizational structure in the changing environment. In this sense, environment refers to community, nation, ecosystem and planet (Hansen 2004). Organizational ecology intends to explain the impact of changing political, economic, social and natural environment conditions on the compositions of firms (Baum 1999). In order to grow and survive, firms must have capability to adapt their organizational structure according to the changing environment. Firms could either adapt their current structure and functions, or generate new organizational structure according to the environment characteristics (Péli et al. 1994). Hence, firms are suggested to balance, retain and conserve social and natural environment resources in order to sustain the existence of firms, improve organizational performance and support ecological systems in which firms function.

There are several principles for developing organizational strategies towards ecological sustainability (Lange 2003). First, firms should switch from non-renewable energy resources (i.e., oil and coal) to renewable energy resources (i.e., solar power). Second, toxic effluents must be eliminated from production and distribution process. Third, organizational strategies must aim to restore and conserve biodiversity. Fourth, the chosen strategy must aim to reduce waste generated from all stages of product lifecycle. Fifth, employees' health and safety at workplace must be safeguarded. Finally, firms must aim towards zero-emission operations. Thus, ecological sustainability requires firms to focus on social and natural environment responsibility in order to sustain and improve the ecological system as a whole.

A study on ecologically responsible corporations was conducted by Shrivastava (1995). The author asserted that firms must be restructured, redesigned and reformed in order to achieve effective responsibility. As firms' activities are the main source of ecology and social impacts, they are responsible for sustaining and conserving the ecology. Hence, corporate social responsibility (CSR) framework must be taken into consideration as a restructuring guidance (Fenwick 2007). CSR mainly focuses on firm's business operations that yield positive outcomes and avoid negative effects on the environment, the community, and the direct and indirect stakeholders, including owners, directors, manager, employees, suppliers, customers, governments, and non-government organizations (NGOs) (Matten & Moon 2007). CSR is defined as, "a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis" (Matten & Moon 2007, pp.180) and "continuing commitment by business to behave ethically and contribute to economic development while improving the quality of life of workforce and their families as well as the local community and society at large" (Dahlsrud 2008, pp.2).

CSR principles can improve socio-economic sustainability performance of the firm. CSR would allow firms to satisfy socials requirements and expectations, which in turn lead to lower the potential risks of business operations, and extend the market and sales, while generating and improving its production capability, innovation, and reputation (Juš ius & Snieška 2008). CSR activities could also generate a positive reputation from customer loyalty (Bhattacharya & Sen 2007). This is because customers are influencing the firms that practice CSR (Castaldo et al. 2009; McWilliams & Siegel 2001). They tend to consume products and services that exhibit socially responsible attributes even if the price is slightly higher. Thus, a firm could enhance its financial performance by charging a premium price. Stanaland, Lwin, and Murphy (2011) agreed that positive reputation stemming from customer loyalty always leads to positive financial performance, as reputation is one of competitive advantages that competitors could not imitate.

According to Alberti et al. (2000), CSR principles can improve environmental-economic (eco-efficiency) sustainability performance. One of the CSR mechanisms is environmental management system (EMS), defined as a system that enables firms to control and monitor negative environmental impacts generated by their business activities. EMS consists of policy, vision and mission and objective-setting of all organizational levels towards natural environmental resource conservation (Darnall & Edwards Jr 2006). Environmental-economic sustainability performance improvements include reduction of production costs due to raw material conservation. Cost reduction stems from the ability to recycle production resources and utilize resources used in production processes. This, in turn, leads to productivity improvement. Secondly, cost of energy is reduced due to the implementation of new technologies and usage of renewable energy resources (i.e., wind and solar power). Finally, cost of logistics is reduced due to the reduction of fuel usage derived from an effective material handling management, more optimal vehicle capacity utilization, and effective route scheduling (Alberti et al. 2000). Clearly, CSR principles are critical in achieving sustainability performance.

3.2.2 Corporate sustainability

Another critical framework for achieving sustainability is corporate sustainability (CS). It was studied and asserted that firms must sustain social and environmental resources in order to sustain/maximize benefits of stakeholders (Sisaye 2011). CS is defined as "meeting the needs of a firm's direct and indirect stakeholders (such as shareholders, employees, clients, pressure groups, communities etc.), without compromising its ability to meet the need of future stakeholders." (Dyllick & Hockerts 2002, pp.131). Thus, a firm needs to focus on three main sustainability dimensions -- economic, social, and environmental sustainability -- known as the 'Triple Bottom Line' or '3Ps', in order to achieve long-term corporate sustainability (Montiel 2008). Azapagic (2003) justified this view by stating that a firm is one of the organisms in the society that consumes substantial natural and human resources from the society. Therefore, a firm must act proactively to sustain environmental resources and societies for the future generations and, at the same time, sustain its financial performance.

Firms need to balance between social, environment and economic to achieve corporate sustainability (Elkington 1998). First, human capital and social capital must be considered, as social performance is of paramount importance in any business. Human capital refers to knowledge and skills of employees, personnel and business partners, whereas social capital comprises social welfare and quality of public goods and services, such as education and infrastructure. Thus, firms must add value to society within which they operate by optimizing human and society capital. Second, two types of natural capital must be addressed for environmental sustainability performance -natural resources and ecosystem services. Natural resources comprise renewable resources (e.g. weed, crops, and animals) and non-renewable resources (e.g. oil, water, and soil quality). Ecosystem services, such as soil remediation and climate stabilization, should also be evaluated. In short, firm must consume natural capital at the rate below the natural reproduction to avoid the degradation of eco-system service. Finally, economic sustainability performance includes three types of capital -- financial capital (e.g. profit and loss), tangible capital (e.g. stock of products, land, and machines) and intangible capital (e.g. knowledge, goodwill, inventions and brand). A firm must improve economic performance in order to meet expectations of its stakeholders. Thus, all sources of capital must be addressed when attempting to achieve corporate sustainability performance (Dyllick & Hockerts 2002).

Responsible characteristics of sustainable firms was summarized (Dyllick & Hockerts 2002). Economically sustainable firms must “guarantee at any time cash flow sufficient to ensure liquidity while producing a persistent above average return to their shareholders” (Dyllick & Hockerts 2002, pp.133). Secondly, ecologically sustainable companies must “use only natural resources that are consumed at a rate below the natural reproduction, or at a rate below the development of substitutes. They must not cause emissions that accumulate in the environment at a rate beyond the capacity of the natural system to absorb and assimilate these emissions. Finally they must not engage in activity that degrades eco-system services” (Dyllick & Hockerts 2002, pp.133). Finally, socially sustainable companies must “add value to the communities within which they operate by increasing the human capital of individual partners as well as furthering the society capital of these communities. They must manage social capital in such a way that stakeholder can understand its motivations and can broadly agree with the company’s value system” (Dyllick & Hockerts 2002, pp.134).

In order to achieve holistic corporate sustainability, sustainability in SCM must be considered (Carter & Rogers 2008; Croom et al. 2009; Linton, Klassen & Jayaraman 2007; Seuring & Müller 2008; Svensson 2007). Prior to discussing sustainable supply chain, principles of SCM must be articulated. SCM is defined as “the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole" (Mentzer et al. 2001, pp.18). SCM also defined as "a business philosophy that strives to integrate the dependent activities, actors, and resources between the different levels of the points of origin and consumption in channels. This means that SCM comprises different kinds of dependencies in, between and across companies in channels from manufacturers/suppliers to customers/consumers." (Svensson 2007, pp.263). Seuring and Müller (2008, pp.1700) stated that "the supply chain encompasses all activities associated with the flow and transformation of goods from raw materials stage (extraction), through the end user, as well as the associated information flow. Material and information flow both up and down the supply chain. Supply chain is the integration of these activities through improved supply chain relationship to achieve a sustainable competitive advantage." In sum, SCM implies management of the flow of goods and services, from the origin of sources to end users.

3.2.3 Sustainable supply chain management

Linking corporate social responsibility and corporate sustainability with SCM, firms have to consider economic, social and environmental sustainability in their supply chain (Svensson 2007). CSR and CS conceptual framework and practices are suggested to be implemented by all interrelated firms (i.e., both upstream and downstream parties) in all stage of supply chain to achieve complete sustainability (Darnall, Jolley & Handfield 2008). Hence, sustainable SCM is defined as "the management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e., economic, environmental and social, into account which are derived from customer and stakeholder requirements. In sustainable supply chain, environmental and social criteria need to be fulfilled by the members to remain within the supply chain, while it is expected that competitiveness would be maintained through meeting customer needs and related economic criteria." (Seuring & Müller 2008, pp.1700). Maloni and Brown (2006), Linton, Klassen, and Jayaraman (2007) and Seuring and Müller (2008) agreed that firms must emphasise CSR and CS concepts in their SCM practices because firms are not isolated entities, but rather interconnected with other firms along the supply chain. Thus, an individual firm is unable to accomplish sustainable supply chain as a whole. Therefore, as sustainable SCM is critical to achieve holistic sustainability performance (Andersen & Skjoett-Larsen 2009), 3Ps must be incorporated into SCM to achieve sustainability.

Firms are challenged to improve their supply chain performance by focusing on the mix of cost reduction, responsiveness, security, sustainability, resilience and innovation. By taking part in a sustainable supply chain, firms could improve organizational performance (Melnyk et al. 2010). Carter and Rogers (2008) stated that sustainable supply chain is positively associated with economic performance or organizational performance when firm incorporate 3Ps into their business activities. Firms acting according to these principles could enhance market boundaries, improve market penetration, enhance customer satisfaction, reduce cost of production, mitigate risks from institutional pressure, and charge higher prices, when their products and services are accepted by societies. Moreover, Holmes, Power and Walter (1996) stated that labour costs could be reduced due to the better working incentives and motivation, which result in higher productivity. Carter, Ellram, and Tate (2007) stated that labour costs could be reduced due to the decrease in health and safety costs due to creating safer workplace. Moreover, firms could reduce production costs due to reduced packaging waste and recyclability of materials used in production (Mollenkopf et al. 2005). According to Carter and Dresner (2001), a firm could also prevent costs of compliance with government regulations. Hanson, Melnyk and Calantone (2010) posited that the implementation of environmental management system could reduce cost of production, improve product quality, and reduce product lead time. Ellen, Webb, and Mohr (2006) found that firms could enhance their reputation, as sustainable behaviors make them more attractive to their customers, suppliers and other stakeholders. In short, sustainability in the supply chain could improve organizational performance.

Enablers of sustainable supply chains must be identified prior commencing any sustainability programmes at any stage of the supply chain (Faisal & Akhtar 2011). They are including top management commitment, strategic planning, competitive advantages, collaborative relationships, trust among supply chain partners, support to partners in the supply chain, and information sharing. These enablers are discussed in more detail. First, top management commitment is one of the most critical drivers. In order to achieve the objectives of sustainability, top management (i.e., chief executive officer, board of directors, and managers) must redesign, reform and restructure their vision towards sustainability. They must design and implement policies and strategies in line with sustainability objectives. They have to persuade employees to perceive the future organizational success when working towards sustainability based dimensions and encourage employees to act accordingly. Hanna, Newman, and Johnson (2000) indicated that sustainable supply chain is positively related to employees involvement.

Moreover, top management must encourage partners along the supply chain to be actively involved in the sustainability program. As Robert (2003) insisted, sustainability initiative is likely to be successful, if sustainability programmes are supported by all supply chain members and other stakeholders.

Second, strategic planning plays an important role in sustainable supply chain because it can improve understating of sustainable practices of supply chain partners. Organizational strategies, tactic and operations must be planned towards 3Ps (Kytle & Ruggie 2005). Organizations and partners are sometimes challenged by identifying means to achieve sustainability and resources that need to be devoted to sustainable activities. To solve the problem, 3Ps must become intrinsic parts of strategic planning, allowing organizations and other partners to create policy aligned with sustainability objectives (Walton, Handfield & Melnyk 1998).

Third, the objective of gaining competitive advantage simultaneously with social and environmental sustainability is important for strategic planning. The incentives provided by competitive advantage encourage top management to create new strategy that aims to consume fewer natural resources and ensure minimal environmental and social impacts, which in turn decreases operation costs (Faisal & Akhtar 2011).

Fourth, as Robert (2003) stated above, the involvement of partners is critical. Faisal and Akhtar (2011) argued that working collaboratively with supply chain partners can enhance sustainability performance. In terms of risk management, Kovacs (2008) stated that the most efficient approach towards preventing potential pressure from downstream stakeholders is establishing a collaborative relationship with wholesalers, retailers, and customers in order to collaboratively work towards sustainability issues. However, Brandenburger and Nalebuff (1998) argued that collaboration between competitors can enhance the boundaries of sustainable supply chain. This is because they can share complementary and substitute resources when aiming to achieve the same objectives. Thus, collaboration between competitors can potentially enhance sustainability performance.

Fifth, developing trust between supply chain partners is critical to sustain long-term collaborative activity. Unfortunately, opportunistic behavior will occur during collaborative agreement that lacks trust. Thus, in order to develop and sustain collaborative relationships, knowledge and information sharing, and support from firms are necessary (Hall 2000). This leads to the sixth and seventh enablers (information sharing) of sustainable supply chain. Information sharing is critical in ensuring that vertical and horizontal supply chain partners are behaving sustainably. Information regarding sustainable practices, therefore, must be shared along the supply chain. Information sharing also allows partners to share knowledge and information pertaining to product development, new technologies, inventory, production forecast and planning, and distribution scheduling to assure the effectiveness of sustainable activities. Moreover, support from the focal firm is necessary for achieving sustainable supply chain and collaborative relationship development. Support activities include joint planning, joint problem solving, and information and knowledge sharing pertaining to sustainability practices. Thus, information sharing and support from the focal firm is critical for trust development (Vachon & Klassen 2006). In conclusion, firms must identify sustainable supply chain enablers in order to accomplish the successful sustainability.

Growing interest in sustainability in supply chain and logistics management has resulted in the increase in research conducted in many parts of the world. (See Table 3.1) As seen from this small sample of extant studies, practitioners and academics are increasingly interested in sustainability dimensions implicit in supply chain and logistics management. However, there are very few literatures concerned sustainability in SCM and logistics in Thailand context. For example, Setthasakko (2007) studied on keys determinants for achieving corporate sustainability as well as barriers that obstruct its development in Thai frozen seafood processors context. Setthasakko (2009) specifically studied on primary barriers to implementing corporate environmental responsibility in Thailand's seafood supply chain. Kantabutra & Siebenhuner (2011) studied on factors for achieving corporate sustainability in Thai organizations context. As presented, literatures in Thai context overlooked the concept of co-opetition, freight consolidation and collaborative freight distribution simultaneously for achieving sustainability in freight distribution. (See Table 3.2) Thus, knowledge in these areas of sustainable supply chain in Thailand should be further extended.

Table 3.1 and 3.2 present the research methods employed in previous studies in this field. Postal questionnaire survey and structural equation modelling was successfully used in a number of empirical studies in the area of sustainable supply chain in Spain, South-East Asia, and Thailand. Therefore, it is appropriate for this research to employ survey method to capture perceptions of Thai respondents.

Table 3.1: Sustainability in SCM context

Author	Country	Research Methods	Findings
Hall (2006)	United Kingdom	- Qualitative - Case study	- Sphere of influence Model - Environmental management in the supply chain and logistics is critical to improving suppliers' environmental initiative and customer satisfaction.
Bansal (2005)	Canada	- Qualitative - Interview	- Resource-based and institutional pressure influence forestry industry, as well as oil, gas and mining industry in Canada to invest in sustainable supply chain and logistics development.
González-Benito and Gonzalez-Benito (2006)	Spain	- Quantitative - Postal questionnaire	- Customers, suppliers, employees, shareholders, financial institutions, social groups, non-governmental organizations, competitors and media can influence an implementation of environmental logistics practices.
Miao, Cai, and Xu (2011)	China	- Quantitative - Postal questionnaire	- Pressures from suppliers, regulation, organizational culture, and business ethics are the main factors in enabling corporate social responsibility in logistics.
Rao and Holt (2005)	South East Asian	- Quantitative - Postal questionaries and structural equation modeling (SEM)	- Penetration of sustainability dimensions in every stage of supply chain can generate long-term competitive advantage and improve economic performance.
Carter & Dresner (2001)	United States	- Qualitative - Interview	- Drivers, barriers and techniques to overcoming barriers of successful environmental projects
Andersen & Skjoett-Larsen (2009)	Sweden	- Qualitative - Case study	- Corporate social responsibility should be embedded into entire firm to achieve sustainable supply chain

Maloni & Brown (2006)	United States	- Qualitative - Literature review	- Proposed a corporate social responsibility framework in food supply chain

Table 3.2: Sustainability in SCM in Thailand context

Author	**Country**	**Methods**	**Findings**
Setthasakko (2007)	Thailand	- Qualitative - Case study, interview and site observation	- Top management leadership, government, local communities, and customers can influence an integration of social and environmental responsibility into firm's supply chain strategies and practice. Barriers are including limited holistic view of seafood supply chain, inefficient knowledge about sustainable business practices and high production cost.
Setthasakko (2009)	Thailand	- Qualitative - Interview and site observation	- The lack of a system perspective on sustainability, the lack of top management commitment, and absence of culture diversity are barriers to implementing corporate environmental responsibility
Kantabutra & Siebenhuner (2011)	Thailand	- Quantitative - Postal questionnaire and structural equation modeling (SEM)	- Perseverance, geosocial development, broad stakeholder focus, resilience and moderation are factors that can influence corporate sustainability

3.3 Sustainable freight distribution

The concept of sustainability is increasingly being applied in many stages of product life cycle. Sustainability in supply chain must be considered throughout the supply chain life cycle (Chaabane, Ramudhin & Paquet 2010; French 2008; Lee 2011). Sustainable supply chain life cycle assessment refers to "a process for evaluating economic, social, environmental impacts associated with a product, process or activity. It identifies and quantifies the energy and materials used and the waste released to the environment and communities, and evaluates and implements opportunities for environmental improvement. These assessments cover the entire life cycle of product, process or activity, including extracting and processing raw material, manufacturing, transportation and distribution, reuse and maintenance, recycling and final disposal" (Chaabane, Ramudhin & Paquet 2010, pp.2). Moreover, economic, social and environmental sustainability dimension must be monitored and controlled from the beginning stages (i.e., sources of raw material) through the end of the supply chain (i.e., products usage by end users and product disposal) (Frota Neto et al. 2008; Hugo & Pistikopoulos 2005). Firms need to integrate sustainability dimensions in every stage of their business activities (Carroll 1999). Watt (1999) concluded that sustainability dimensions are essential component of the corporate strategy at the overall firm level, and should be present in various functional areas, such as marketing, transportation and social audit in accounting discipline along the supply chain. However, while sustainability dimensions integrated into the supply chain life cycle (i.e., sustainable production and supplier management) are well researched, there is marked paucity of studies on logistics management (Cooper, Frank & Kemp 2000). Logistics management refers to "the activities to obtain incoming materials and distribute finished products to the proper place, at the desired time, and in the optimal quantity"(Markley & Davis 2007,pp.767). In sum, sustainability dimensions should be studied in logistics management.

As evidences, Murphy and Poist (2002) studied attitudes of 40 firms towards sustainable supply chain and sustainable logistics. They concluded that firms were increasingly concerned with sustainability dimensions in logistics management. According to their findings, 85% of the participating firms perceived sustainable logistics as an important element of the sustainable supply chain.

According to McKinnon (2010), climate change and health issues are becoming major drivers of the redesignation and adaptation of organizational logistics and transportation structures. Due to the intention to reduce 50% of the current CO_2 levels by 2050, firms need to adapt or redesign the structure of supply chain and logistics activates in line with sustainability concepts, in order to cope with institutional pressures. Referring to Ciliberti, Pontrandolfo, and Scozzi (2008), corporate social responsibility in logistics management (also known as Logistics Social Responsibility or 'LSR') is becoming an important activity for achieving sustainable logistics and supply chain. Chapman (2007) stated that logistics activity is one of the most inefficient activities that emit large quantities of CO_2. This is because logistics activities account for approximately 5.5% of global GHG (greenhouse gas) emission (Ballou 2003). According to Dey, LaGuardia, and Srinivasan (2011), transportation in logistics operation consumes substantial fossil fuel and emits carbon dioxide (CO_2), sulphur dioxide (SO_2), nitrogen oxide (NO_x), particulate matter (PM), carbon monoxide (CO), and hydrocarbons (HC), all of which are harming communities and natural environment. Approximately 30% of CO_2 emissions in Europe are caused by transportation related to logistics processes. Moreover, global warming will lead to the declining of world GDP from the current level of 5% to 20% (Goel 2009). In Netherlands, transportation in logistics operations accounts for 21% of annual CO_2 emissions, of which 36% are contributed by freight transport. Thus, there is an urgent need to find new logistics strategies that can be implemented to reduce those harmful substances (Weijers, Glöckner & Pieters 2012).

Sustainable freight distribution can be achieved through purchasing social responsibility, sustainable packaging, sustainable warehousing, reverse logistics, and sustainable transportation (Banister & Button 1993; Feitelson 2002; Nijkamp 1994). Deakin (2001) defined sustainable transportation as transportation and distribution of material and products that meet mobility needs while sustaining and improving human living conditions, ecology systems and economic progress. As OECD (2002, pp.42) defined, transportation is sustainable when "transportation does not endanger public health or ecosystem and meets needs for access consistent with a) use of renewable resources below their rate of regeneration, and b) use of non-renewable resources below the rates of development of renewable substitutes." Moreover, Litman and Burwell (2006,pp.333) stated that sustainable transportation must "ensure that environmental, social and economic considerations are factored into decisions affecting transportation activities." Similarly, Carter and Jennings (2002a, pp.154) defined sustainable transportation as "a transportation management that contribute to environmental initiative by ensuring that vehicles are properly maintained in order to maximize fuel efficiency and minimize leak; properly transporting hazardous materials; and participating in the reverse, upstream movement of product for the purpose of reuse and recycle." The authors identified activities that can help achieve sustainable transportation, in particular fuel efficiency, reverse logistics, reuse of pallets, comply transportation management with regulations, and paying adequate wages to drivers. Moreover, they identified drivers and consequences of sustainable transportation. Drivers are organizational culture, top management support and commitment, individual values, regulation, liability and socially responsible marketing. The authors asserted that top management support and commitment is the most critical driver. Lieb and Lieb (2010) agreed with this view, and proposed additional drivers, such as desire to do the right thing, pressure from stakeholders, competitive pressure, desire to enhance market boundaries, and desire to enhance brand image. Consequences of sustainable transportation are total cost reducing, profitability improvement, employee job satisfaction, environmental sustainability improvement, increased community trust, and supply chain performance improvement (Carter & Jennings 2002b). Given the above, it is evident that sustainable transportation play important role in logistics social responsibility.

An area of sustainable transportation in the field of logistics social responsibility that is increasingly gaining popularity is sustainable freight distribution (Allen et al. 2004; Anderson, Allen & Browne 2005; Cruijssen, Cools & Dullaert 2007; Holweg & Miemczyk 2002; Lieb & Lieb 2010; McKinnon 2000; Potter, Mason & Lalwani 2002; Whiteing, Browne & Allen 2003; Wu & Dunn 1995). This is because SCM adopted by a firm is moving towards an energy-constrained and low-carbon era. Institutions, such as governments and communities, are demanding that the responsible parties must pay the costs of CO_2 and other harmful chemical emissions. Thus, carbon footprint from transportation and road freight distribution processes must be monitored and include both upstream and downstream activities along the supply chain (Pricewaterhousecoopers 2009). Wu and Dunn (1995) and McKinnon (2000) focused on sustainability in transportation and product distribution. They argued that sustainability in distribution and transportation sector is critical due to increasing social costs (i.e., illness from air pollution) and pollutant emission levels at every stage of the distribution process. Moreover, distribution cost is also increasing due to the higher price of fuel. Hence, the consideration of strategic alliance, network design, freight consolidation, and backhaul management is critical for achieving sustainable distribution.

Firms must assess negative impacts derived from inefficient freight distribution management (i.e., habitat loss, hydrologic impacts, global warming, air pollution, and depletion of non-renewable natural resources, such as gasoline) because they are adversely affecting organizational performance (Litman & Burwell 2006). Moreover, inefficient road freight distribution generates economic, environmental, and social impact. Economic impacts are including congestion, resource waste, and economic inefficiency. Environmental impacts comprise the loss of wildlife and wild species, waste of resources such as oil and tyres, and global warming. Social impacts pertain to public health issues (death, hazard, and illness) that are consequences of pollution emission from distributing vehicles, visual intrusion, noise pollution, and the reduction of available land (Anderson, Allen & Browne 2005).

Lenzen et al. (2007) stated that the management of carbon dioxide and other harmful chemical emissions related to freight distribution is critical for business management in this century. Top managers around the world agree that sustainable freight distribution are critical for sustaining business performance in this decade (Enkvist & Vanthournout 2008; Lee 2011). Litman and Burwell (2006) and Sundarakani et al. (2010) insisted that firms must reduce pollution emission in freight distribution process, as CO_2 and other harmful chemical emissions related to every stage of product movement. For example, delivery vehicles emit CO_2 when products are being distributed from distribution centres to customers. Thus, firms will place themselves at a disadvantage when they overlook sustainability dimensions in freight distribution process, as they have to gain legitimacy from institutions and fulfil social requirement to prevent future risks and uncertainty (Walker, Di Sisto & McBain 2008; Zhu, Sarkis & Lai 2007).

Given the importance of sustainable transportation in general, and in the context of this study in particular, prior to any further discussion, sustainable freight distribution must be defined. It refers to the product distribution management that considers sustainability dimensions, i.e., economic, and social and environmental issues (Belz & Peattie 2009; McKinnon 2000; Wu & Dunn 1995). In sum, in order to achieve sustainable freight distribution, firms must attempt to reduce emissions of toxics, energy use, waste, traffic accidences, noise pollution, operation costs and health consequences from transportation and distribution (Gilbert et al. 2002).

Hoffman (2007) insisted that firms must manage and measure carbon emissions in road freight distribution processes, as well as their effects on communities they operate in, by focusing on waste management, energy-efficient vehicles, emission control, and environmental management system. Moreover, firms must manage travel distances, mode of transportation, choice of fuel used and weight of vehicles, as well as CO_2 and N_2O (nitrous oxide) emitted during distribution process (Hui et al. 2007). Litman and Burwell (2006) proposed tactics for achieving sustainable freight distribution, which include creating policies aligned with sustainable freight distribution, reducing fuel consumption, reducing per capital vehicle mileage and reducing vehicle damage and injuries during distribution process. Litman (2005) stated that fuel efficiency and alternative fuels must be considered to achieve energy conservation and emission reduction. Steg and Gifford (2005) proposed additional strategies, including reducing travel distances, changing destination choices and combining trips and routes.

A 20% improvement in vehicle design and engine performance is critical for improving sustainable freight distribution development. A fuel management program can improve the efficiency of fuel usage by 15%-20%. Information technology and advanced communication methods, such as electronic load matching, electronic client validation, electronic monitoring of vehicle activity and in-cab mobile data communication can contribute additional 10% toward sustainable freight transport improvement. In addition, consideration of the location, number and capabilities of distribution facilities and improved vehicle utilization and vehicle loading are positively related to sustainable freight distribution (McKinnon 1999). Weijers, Glöckner, and Pieters (2012) concluded that firms can achieve sustainable freight distribution by monitoring driving speed, reducing empty haul, reducing travelling distances, and improving vehicle loading capacity.

McKinnon (2000) studied opportunities for improving vehicle loading capacity, indicating that an improvement of vehicle loading is necessary for achieving reductions in fuel consumption, minimizing harmful substance emissions, improving fuel efficiency, and enhancing organizational performance. To improve vehicle loading, vehicle fleet utilization must ensure that the capability and capacity of distributing vehicles is fully utilized. In other words, available vehicle space must not be wasted, empty running must be eliminated, and maximum weight capacity of the vehicle must be reached. These goals can be achieved by increasing the vehicle operational time within each 24-hour period, increasing payload weight, and minimizing the use of JIT practices. Another critical approach towards achieving vehicle fleet utilization is freight consolidation. That is, many small shipments must be consolidated into a single vehicle when distributing products to end customers in order to fulfil vehicle capacity. As a result, fuel consumption will be reduced, less harmful substances will be emitted, vehicle capacity will be fully utilized, and cost of distribution reduced as a result. Ülkü (2011) agreed that freight consolidation for outbound freight distribution is critical approach for achieving sustainable freight distribution since freight consolidation can improve customer satisfaction due to on-time delivery, reduced distribution costs due the reduction of fuel usage per vehicle-kilometre and reduced vehicles usage, as well as decrease in pollution emissions as a result of reduced fuel combustion from fewer delivery vehicles. Therefore, freight consolidation approach is considered by this study as a potential solution. More detailed discussion on freight consolidation will be given in the section below.

Another strategy that can achieve sustainable road freight distribution is the cooperation in road freight distribution with competing firms. Vehicle sharing with competitors is increasingly recognized as beneficial by many logistics firms. Those firms believe that the cooperation with competitors in freight distribution can improve delivery performance and reduce pollution emission of all involved parties (Weijers, Glöckner & Pieters 2012). Ruesch et al. (2012) studied sustainable freight distribution in urban area in Switzerland. They identified the functions firms must perform in order to achieve sustainable freight distribution, which consist of creating sustainable logistics strategies, optimizing mode of transport capacity, building sustainable transportation infrastructure, using environmental friendly vehicles, and cooperating with other firms and local communities. PriceWaterhouseCoopers (2009) insisted that cooperation between competing firms could reduce CO_2 emission levels and cost of road freight distribution, as well as generate competitive advantages. McKinnon (2010) agreed that sustainable freight distribution can be achieved through the sharing of vehicle capacity with competitors. For example, by sharing vehicle capacity, Kellogg's and Kimberly-Clark saved approximately 430,000 vehicle-kilometres per year. Anderson, Allen, and Browne (2005) agreed that sustainable freight distribution can be improved by freight consolidation with the cooperation with other organisations. Lindholm and Behrends (2010) concluded that an inefficient reduction of emission from road freight distribution derives from the lack of cooperation between competitors. In sum, cooperation with competitors in road freight distribution is another critical approach for achieving sustainable freight distribution.

Sustainable business practices in freight distribution could bring in potential benefits to economic, social and natural environment, otherwise known as profit, people and planet (3Ps) respectively, as listed in Table 3.3.

Table 3.3: Summary of literature regarding benefits of sustainability in freight distribution

Benefits	**Descriptions**	**Authors**
Economics		
Raw material	Raw materials are conserved by optimal utilization of resources and minimization of waste during production	(Alberti et al. 2000; Darnall & Edwards Jr 2006; Dyllick

conservation	and distribution activities. Those materials could be recycled and used for generating future value-added. For instance, worn out tyres could be recycled and used as fuel.	& Hockerts 2002; Klassen & McLaughlin 1996; Lieb & Lieb 2010; Porter & Van der Linde 1995; Rao 2002)
Reducing logistics costs	Costs of freight distribution and transportation could be reduced (e.g., fuel costs, maintenance costs and idle time).	(Alberti et al. 2000; BearingPoint 2008; Lieb & Lieb 2010; Porter & Van der Linde 1995)
Increase in resource usage efficiency	Sustainable business practices would improve resource usage efficiency in production and distribution processes. The ratio of raw material per final products units would decrease due to superior information and knowledge, and cleaner and more advanced technologies, so that resource wastage would be minimized. As a consequence, profitability would be improved due to lower cost of input resources.	(Alberti et al. 2000; BearingPoint 2008; Bowen 2002; Darnall & Edwards Jr 2006; Devinney 2009; Dutton 2009; Dyllick & Hockerts 2002; Klassen & McLaughlin 1996; Porter & Van der Linde 1995; Ranganathan 1998; Rao 2002; Rondinelli & Vastag 2000)
Improving customer perception of the product	Firm's reputation is positively related to customer purchasing behaviour. Thus, organizations could charge higher prices when customer loyalty is attained. For example, customers may prefer to purchase products from firms that emit low CO_2 in freight distribution process.	(Alberti et al. 2000; BearingPoint 2008; Bhattacharya 2004; Caroli & Tantalo 2012; Castaldo et al. 2009; Mahler 2007; Mohr, Webb & Harris 2001; Rao 2002; Smith 2003)
Improving market opportunities	Sustainable business practices could generate goodwill or improve firm's reputation. As a result, the firm would be perceived as qualified and trustworthy and customers would be likely to support the firm by purchasing its products. Consequently, market segment could be enhanced.	(Alberti et al. 2000; BearingPoint 2008; Klassen & McLaughlin 1996; Lieb & Lieb 2010; Rao 2002)

Lowering risk of business operation	Sustainable business practices would reduce risks, such as boycott from customers. In other words, consumers are likely not to purchase products from irresponsible firms whose products and services are yielding negative impact on environment and communities. Other risks stem from regulation, as the firm would suffer if environmental regulation was not appropriately adhered to.	(Alberti et al. 2000; Juš ius & Snieška 2008; McKinnon et al. 2010)
Stimulating the firm's innovation and creative work	Firms could identify new business strategies and tactics when working towards sustainable business practices. For example, they could adopt lean SCM to minimize waste of resources and reduce time allocated to logistics operations and assembly line processes.	(Juš ius & Snieška 2008; Porter & Van der Linde 1995; Turban & Greening 1997)
Helping to find easier ways to attract external sources of sponsorship	The firm could attract external sponsorship and gain grants from government agencies and non-government organizations.	(Alberti et al. 2000; Caroli & Tantalo 2012; Darnall & Edwards Jr 2006; Juš ius & Snieška 2008; Marsden & Andriof 1998)
Broadening markets and increasing sales opportunities	The firm could enhance its market position by attracting more customers that require responsible products and services (i.e., services that are not harmful to environment and communities.) In doing so, the firm could improve its profitability.	(Azapagic 2003; Juš ius & Snieška 2008; Rao 2002)
Lowering expenditure/cost saving	Sustainable business practices could mitigate hidden costs, costs of complying with regulation, and expenses related to disposing dangerous material/chemical in landfills. Savings could be achieved due to better use of resources and energy conservation. Innovative distribution and production methods could improve energy and material efficiency. Moreover, costs associated with health and safety of workers could also be reduced. In addition, savings can be achieved by lowering product and packaging costs.	(Alberti et al. 2000; Azapagic 2003; BearingPoint 2008; Carter & Jennings 2002a; Darnall & Edwards Jr 2006; IISD & WBCSD 2002; Juš ius & Snieška 2008; Klassen & McLaughlin 1996; Lieb & Lieb 2010; Porter & Van der Linde 1995; Rao 2002)
Improving firm's	Sustainable business practices could enhance firm's	(Alberti et al. 2000;

reputation	reputation when customer trust is increased. Thus, the firm could sustain its social license to operate and attract more customers.	Azapagic 2003; Bhattacharya 2004; IISD & WBCSD 2002; Juš ius & Snieška 2008; Klein & Dawar 2004; Marsden & Andriof 1998; Rao 2002; Stanaland, Lwin & Murphy 2011; Turban & Greening 1997)
Improving relationships with investors	As investors are increasingly aware of ethical business practices, they are more likely not to invest in firms exhibiting unacceptable environmental and social performance. In other words, sustainable business practices help firms attract more investors.	(Azapagic 2003; Caroli & Tantalo 2012; IISD & WBCSD 2002; Lieb & Lieb 2010)
Improving relationships with customers	The firm could improve business performance when its activities and products are accepted by customers. Customers are always looking for products that embody their attitude towards environmental and social problems. Therefore, the firm could improve its competitive advantage when customer complaints are minimized and its products and services meet customer expectations. Consequently, the firm could enhance the level of sales and increase profit margin.	(Auger et al. 2003; Azapagic 2003; Castaldo et al. 2009; Ellen, Mohr & Webb 2000; IISD & WBCSD 2002; Maignan & Ferrell 2004; Maignan, Ferrell & Hult 1999; Mohr, Webb & Harris 2001; Porter & Kramer 2006; Senge 2001; Stanaland, Lwin & Murphy 2011)

Improving financial performance	Customers are willing to pay higher price for goods produced in socially and environmentally sustainable way. Therefore, firms meeting these criteria could enhance their profitability by charging higher prices. As costs could be reduced as well, productivity and profitability would be improved.	(Azapagic 2003; Barnett 2007; Carter & Jennings 2002a; Castaldo et al. 2009; Klassen & McLaughlin 1996; Maignan, Ferrell & Hult 1999; Mohr, Webb & Harris 2001; Porter & Van der Linde 1995; Stanaland, Lwin & Murphy 2011; Stevens 2005; Swaen & Vanhamme 2004; Turban & Greening 1997; Waddock & Graves 1997)
Social		
Increasing staff motivation	Sustainable business practices could help the firm to motivate workers to improve performance, reduce worker absenteeism and lower incidences of disputes with labour unions. It could also motivate employees to support the business by making work tasks more enjoyable and increasing employees' self-value.	(Azapagic 2003; Caroli & Tantalo 2012; Carter & Jennings 2002a; Devinney 2009; IISD & WBCSD 2002; Koh & El'fred 2004; Kunes 2001; Lieb & Lieb 2010; Maignan, Ferrell & Hult 1999; Marsden & Andriof 1998; Rondinelli & Vastag 2000; Turban & Greening 1997)
Improving the ability to attract and retain good quality staff in the company through commitment to staff development	The firm could retain and attract quality workers through promoting a feeling of pride among employees, emphasizing top management commitment, providing staff development, and exemplifying social responsibility.	(Azapagic 2003; Caroli & Tantalo 2012; Devinney 2009; Koh & El'fred 2004; Lieb & Lieb 2010; Maignan, Ferrell & Hult 1999; Turban & Greening 1997; Wright et al. 1995)

Improving health and safety at the workplace	The firm could improve health and safety of its work environment and thus prevent complaints from labour union.	(Alberti et al. 2000; Azapagic 2003; Caroli & Tantalo 2012; Carter & Jennings 2002a; Koh & El'fred 2004; Porter & Van der Linde 1995; Ranganathan 1998; Steg & Gifford 2005)
Improving trust building with local community	The firm could improve relationships and trust with non-government organizations and local communities to reduce complaints through openness, transparency, partnership, and fair trading. As a consequence, the firm could maximize benefits to local communities and residents.	(Alberti et al. 2000; Azapagic 2003; Caroli & Tantalo 2012; Devinney 2009; IISD & WBCSD 2002; Juš ius & Snieška 2008; Ranganathan 1998)
Helping to attract positively motivated employees	As employees are the main internal core resource, sustainable business practices could improve workers' satisfaction and labour productivity. In order words, the firm could attract employees that are satisfied with working conditions, work tasks, and firm's social and environmental performance.	(Carter & Jennings 2002a; Juš ius & Snieška 2008; Koh & El'fred 2004; Maignan, Ferrell & Hult 1999; Marsden & Andriof 1998; Turban & Greening 1997; Wright et al. 1995)
Enhancing the value of human capital	The firm could enhance its commitment towards sustainability when workers have higher self-value, and can enhance their commitment and dedication through training and social programs. Therefore, by increasing the value of human capital, improvements in sustainability performance can be achieved.	(Alberti et al. 2000; Juš ius & Snieška 2008; Koh & El'fred 2004; Maignan, Ferrell & Hult 1999; Ranganathan 1998; Stevens 2005)
Improving the contribution of a firm to community development	Sustainable business practices could create jobs for residents, improve wages, increase philanthropy, minimize child labour, promote meeting basic human needs, and create employee volunteerism in the communities.	(Caroli & Tantalo 2012; Devinney 2009; Marsden & Andriof 1998; Ranganathan 1998; Rao 2002; Turban & Greening 1997)

Environment		
Reducing environmental risks	The firm would be able to prevent threats that may affect environment negatively. Threats are such as pollution incidents, emission, waste, effluents and resources depletion.	(Azapagic 2003; Darnall & Edwards Jr 2006; Klassen & McLaughlin 1996; McKinnon et al. 2010)
Improving conservation of natural resources	Sustainable business practices would allow the firm to conserve natural environment, such as water and clean air, for the next generation and ensure future usage through production and product distribution efficiency.	(Azapagic 2003; Klassen & McLaughlin 1996; McKinnon et al. 2010; Parry, Martha & Grenon 2007)
Enhancing adherence to ISO 14000 (*International organization for standardization 14000)*	Sustainable business practices would help firms to monitor and control their environmental impacts and improve its environmental management and performance.	(Alberti et al. 2000; Azapagic 2003; McKinnon et al. 2010)
Reducing congestion	Reduction of delivery vehicle requirements of the distribution process and distributing products during off-peak periods would reduce traffic congestion levels.	(Geurs & Wee 2000; Goel 2009; McKinnon et al. 2010; Murphy, Poist & Braunschweig 1996)
Reducing air pollution	Reduction in number of delivery vehicles in the distribution process would reduce engine combustion, thus decreasing CO_2 emission level.	(Chapman 2007; Cowper-Smith & de Grosbois 2011; Geurs & Wee 2000; Goel 2009; McKinnon et al. 2010; Murphy, Poist & Braunschweig 1996; Parry, Martha & Grenon 2007; Rao 2002; Steg & Gifford 2005; Stevens 2005)

Reducing water pollution	Incorporating advanced technology in business processes would reduce water pollution.	(Cowper-Smith & de Grosbois 2011; Cramer & Hirschland 2006; Lambooy 2011; McKinnon et al. 2010; Murphy, Poist & Braunschweig 1996; Stevens 2005)
Reducing visual pollution	Reducing pollution emitted from business processes would improve air quality and visibility.	(Joseph et al. 2010; McKinnon et al. 2010; Murphy, Poist & Braunschweig 1996)
Reducing odour pollution	Sustainable business processes would reduce odour from production and distribution processes, such as those from engine combustion.	(McKinnon et al. 2010; Murphy, Poist & Braunschweig 1996; Rondinelli 2007)
Reducing noise pollution	Sustainable business processes would reduce human psychological and physical issues caused by unwanted noise or sound. Similarly, incidences of annoyance, high level of stress, hearing loss, hypertension, and sleep disturbance could also be minimized.	(Cowper-Smith & de Grosbois 2011; Geurs & Wee 2000; Joseph et al. 2010; McKinnon et al. 2010; Murphy, Poist & Braunschweig 1996; Rao 2002)
Reducing solid waste	Sustainable business processes would reduce quantity of solid waste, such as dirt, debris, demolition waste, paper and electronic appliances.	(Cowper-Smith & de Grosbois 2011; Joseph et al. 2010; McKinnon et al. 2010; Rao 2002)
Reducing liquid waste	Sustainable business processes would reduce liquid waste levels, such as asbestos, oil, and lead-acid batteries.	(Cowper-Smith & de Grosbois 2011; McKinnon et al. 2010; Rao 2002)
Improving recycling	Sustainable business processes would improve resource recycling, such as paper and electronic appliances.	(Cowper-Smith & de Grosbois 2011; Lieb & Lieb 2010; McKinnon et al. 2010; Rao 2002)

Improve environmental compliance	Firms would be able to comply with environmental regulations more efficiency and effectively. Australian environmental regulations include water (resources management) act of 2005, national greenhouse and energy reporting act of 2007, and environment protection and biodiversity conservation act of 1999.	(Alberti et al. 2000; Delmas & Toffel 2004; Lyon & Maxwell 2008; McKinnon et al. 2010; Rao 2002)

In conclusion, firms are suggested to consider sustainability in freight distribution for enhancing economic performance through social care and environmental protection. Potential solutions proposed in extant literature for accomplishing sustainable freight distribution are co-opetition, freight consolidation, and collaborative freight distribution. These approaches will be discussed next.

3.4 Three concepts for achieving sustainable freight distribution

3.4.1 Co-opetition

Co-opetition is a recent concept in the business world since it helps firms to accelerate innovation, R&D, and performance. Firms pay much attention to this concept because it yields many benefits, such as reduced risks and uncertainty, reduced cost of operation, improved economies of scale and scope, increased complementary knowledge, and access to new markets (Bouncken & Fredrich 2011; Mention 2011; Miotti & Sachwald 2003). Many scholars confirmed that co-opetition gets more benefits to service sector than manufacturing sector (Cainelli, Evangelista & Savona 2006; Evangelista 2006).

As a consequence of increasing globalization, rapid technological innovation, rapidly changing customer requirements, more rapid product obsolescence, increasing competitiveness and regulations pertaining to sustainable development set by many governments, independent firms are forced to recognize the value of networks, alliances and joint operations in their effort to meet new market environment demands and challenges (Bigliardi, Dormio & Galati 2011; Lilien & Grewal 2012; McKinnon et al. 2010). Firms are suggested to change their organizational culture from win-lose to win-win competition by recognizing value of strategic alliances as a starting point for reducing non-value-adding activities and improving performance. Strategic alliances are critical because, alone, firms usually lack resources, such as knowledge and skills, personnel, and market access, needed to sustain a competitive advantage. Strategic alliance allows firms to improve performance because firm can gain complementary resources from alliance partners (Whipple & Frankel 2000). Thus, strategic alliance is defined as “a long-term relationship where participants cooperate and willingly modify their business practices to improve joint performance” (Whipple & Frankel 2000, pp. 22). The authors further identified factors needed for establishing successful strategic alliances, including trust, top management support, ability to meet performance expectations, clear objective, and partner compatibility.

A broader approach to this initiative is horizontal cooperation. According to Dagnino and Padula (2002) and Bigliardi, Dormio, and Galati (2011), a single firm cannot expand, grow, innovate, access new markets, develop new products and services, or optimize business operations without the consideration of alliance partners. Thus, the focal firm should cooperate with external parties, including suppliers, customers (vertical cooperation), competitors, and complementors (horizontal cooperation), for improving business performance (Barratt 2004). This is because independent firms are unable to optimise route planning, logistics capacity, vehicle capacity utilization, full truck load and transport process alone (Cruijssen, Cools & Dullaert 2007; Leitner et al. 2011).

A more specific term of horizontal cooperation used in this study is co-opetition. It derives from the combination of competition and cooperation (Bengtsson & Kock 2000; Cruijssen, Cools & Dullaert 2007; Osarenkhoe 2010). Co-opetition occurs when a firm cooperates and competes simultaneously with other firms to achieve its strategic goals (Luo 2004). As Ross and Robertson (2007) stated, co-opetition refers to the circumstance in which two or more rivals cooperate for enhance a piece of ‘pie’ in the marketplace and then compete for the greatest share of that ‘pie’. Thus, co-opetition allows each participating firm to enhance its benefits. Zineldin (2004) described co-opetition as “a business situation in which independent parties co-operate with one another and co-ordinate their activities, thereby collaborating to achieve mutual goals, but at the same time compete with each other as well as other firms” (Zineldin 2004, pp.780). Co-opetitive relationship allows firms to establish mutually beneficial relationships with other competitors. They might jointly work in one business function (i.e., R&D) and compete in another (i.e., sales and marketing) (Beckeman, Bourlakis & Olsson 2013). Firms could cooperate in activities that far from customers while compete in activities that closer to customers (Bengtsson & Kock 2000). There are many examples of successful coopetitions, such as the co-opetition in manufacturing function between Toyota and General Motors and between Japan's JVC and France's Thomson, as well as in product development between Phillips and Siemens, and in suppling activity between Canon and Kodak (Hamel, Doz & Prahalad 1989).

Individual firms cooperate with competitors because they have common strategic goals, but lack resources and capacity (i.e., funds, human resources, and technologies). Thus, they tend to cooperate to extend their capacity, enlarge market segment and achieve desired economies of scales and scope (i.e., new product development and R&D). They also cooperate to prevent high costs, enhance resource boundaries and prevent high-risk activities (Dhanarag & Parkhe 2006). As Dyer (2000) demonstrated, a supplier competes with another supplier in one product and cooperates in another product to fulfil customer requirements. Wu and Choi (2005) provided another case of co-opetition between suppliers in which suppliers are sometimes required by the buyers to cooperate in the manufacturing activity. In other words, the buyers coerce various suppliers to work together to take advantage of new technologies possessed by those suppliers. In sum, co-opetition emphasizes the importance of collaborating with competitors that possess unique knowledge, expertise and skills, new technologies, and other unique resources. Firms could pool unique resources from alliance partners to gain greater competitive advantage, expedite development of new products, reduce cost of operation, and maximize customer satisfaction (Ho & Ganesan 2012).

A firm's success in the adoption of co-opetitive relationship is affected by external and internal environments (Ho & Ganesan 2012). First, a multinational firm cooperates with local competitors because they have already established local market and have more knowledge of domestic market trends. By cooperating with local competitors, the multinational firm could access new knowledge and market segment at a lower cost and reduced risk (Luo 2004). Second, given the rapidly changing technologies at a high cost, rapid change of customer requirements, and shorter product lifecycle, firms may suffer if they do not adapt the organizational capacity accordingly. Customers always require the firm to invest in new technologies and regularly launch new products incorporating high technology. They are highly likely not to purchase products from firms that are not innovative. Thus, by cooperating with the competitors, firms could access new knowledge and new technologies at a lower cost. The cooperating firms could, therefore, launch new products to satisfy customer requirements and achieve economies of scale and scope, thus enhancing a firm's capacity (Ho & Ganesan 2012).

There are also internal factors that force the firms to recognize the need for co-opetition. First, firms that are experienced in working in alliance-dominated environments tend to adopt co-opetition strategy. This trend develops as they have existing knowledge and skills to manage the co-opetitive relationship, which is contingent on successful partner selection and conflict management. For example, firms could select partners that would yield minimal risk in the future. In short, experienced firms have higher capacity to maximize benefits from co-opetition strategy (Sivadas & Dwyer 2000). Second, firms with limited internal resources tend to cooperate with competitors to gain both supplementary and complementary resources in order to enhance their organizational capacity (Gulati & Kletter 2005). Third, organizations with high learning capacity are more likely to adopt the co-opetition strategy, as they recognize the co-opetition as a learning opportunity. They could integrate the exiting knowledge with new knowledge for creating organizational strategy, tactics, and operation. Thus, the firms with high learning capability are able to absorb their partners' skills and knowledge more effectively. Consequently, these firms could gain more benefits from co-opetitive relationship (Inkpen 2000).

There are different types and degrees of co-opetition. Verstrepten et al. (2009) proposed a four-stage approach towards cooperation between competitors, which includes strategic positioning, design, implementation, and moderation. Bengtsson and Kock (2000) proposed three degrees of co-opetition, namely cooperation-dominated, equal, and competition-dominated relationship. Similarly, Barringer and Harrison (2000) defined five types of co-opetition: joint venture, network, consortia, trade association, and alliance. Ehrenmann and Reiss (2012) added acquisitions and mergers to that list, while Verstrepen et al. (2009) identified strategic, tactical, and operational cooperation as three degrees of cooperation with competitor.

Specifically, Zinn and Parasuraman (1997) stated that the cooperative relationship depends on the degree of scope and intensity. The authors define four types of logistics-based strategic alliances, namely integrated, extensive, focused, and limited cooperation. Luo (2004) and Verstrepen et al. (2008) agreed on the following four types of co-opetition that are classified by degree of competition and cooperation: contender, adapter, monoplayer, and partner. The authors concluded that the consideration of different types of relationship could guide the strategies and determination of the final goal of the alliance partners. However, according to

Mentzer et al. (2000) and Golicic et al. (2003), collaboration is more critical than cooperation for enabling co-opetition because collaboration requires higher level of magnitude and closeness in terms of sharing risk, knowledge, information, and profit. Nonetheless, Chin, Chan, and Lam (2008) argued that the consideration of antecedent factors for establishing co-opetitive relationship is the most critical consideration.

Collaboration, as part of co-opetition, requires managerial input into relationship establishment. Min et al. (2005) proposed six antecedent elements for establishing collaborative relationships: strategic intent (i.e., aims and objectives), internal alignment (i.e., adapting the current operation towards the collaborative arrangement), relationship management (i.e., establishment of collaborative relationship), information sharing (i.e., sharing latest and specific information), resource sharing (i.e., sharing facilities and human resources), and formulization (i.e., implementation of collaborative plans, standardization of communication technology, sharing of specific information, and agreement on common objectives and goals). Kilger and Reuter (2005) added mutual interest to the above list. Reliability of supply, top management support (i.e., vision and mission), mutual interest (interest of all parties), and frequent meetings are additional factors proposed by Akintoye, McIntosh, and Fitzgerald (2000). However, Cheng, Yeh, and Tu (2008) strongly argued that collaboration must be established based on mutual trust to prevent competitive conflicts and occurrences of unexpected outcomes that may negatively impact the firms involved. The authors investigated factors affecting inter-organizational knowledge sharing and trust. Their findings suggest that participation, communication, learning capacity, minimum opportunistic behaviour, use of power to dominate others, and resource fitness of the firm and its partners are positively related the establishment of trust. On the other hand, the previous factors and trust are positively related to inter-organizational knowledge sharing.

Literature review also revealed the existence of antecedent managerial factors required for enabling co-opetitive relationship. Zineldin (2004) stated that firms must select appropriate partners to achieve better interaction process. Once the interaction process is agreed, all partners can then establish appropriate co-opetitive atmosphere and cooperative environment. Trust and commitment are the most critical factors for establishing co-opetitive relationship. Nonetheless, firms must also consider factors needed for sustaining co-opetitive relationships, including individual willingness, motivation and strategic fit, interdependence, cultural alignment, organizational arrangement, integration, and integrity. In sum, the firm and its partners must share business philosophy and recognize the mutual interdependency. As Nakano (2009) and Beamon (2008) stated, alliance partners should cooperate in their business processes through the establishment of trust and working relationships, information sharing (Nyaga, Whipple & Lynch 2010; Simatupang & Sridharan 2008), joint planning, and problem-solving.

Specifically, Chin, Chan, and Lam (2008) proposed three main driving forces of co-opetition including management commitment, relationship management, and communication management. Firstly, management commitment represents the degree of management support and attitude of top management towards the implementation of co-opetition approach. (Chin, Chan & Lam 2008). The authors asserted that co-opetition approach will never be successful if full management commitment is not present. Literature sources offer strong evidence indicating that management commitment is an antecedent factor for establishing co-opetitive business operations (Akintoye, McIntosh & Fitzgerald 2000; Bouncken & Fredrich 2011; Kilger & Reuter 2005; Min et al. 2005; Morris, Koçak & Özer 2007; Whipple & Frankel 2000; Zineldin 2004).

There are critical measurement items in management commitment, including missions and visions (Cheng, Yeh & Tu 2008), supportive manner (Morris, Koçak & Özer 2007), long-term contract (Cheng, Yeh & Tu 2008), creation or adaptation of the current organizational policy accordingly to the co-opetitive relationship (Cheng, Yeh & Tu 2008), creation of new strategy (Chin, Chan & Lam 2008), reconfiguration of internal business process (Chin, Chan & Lam 2008), the ability to extend existing capabilities to encompass new organizational structure (Cheng, Yeh & Tu 2008), the ability to apply new knowledge to accomplish goal of the relationship (Cheng, Yeh & Tu 2008), willingness to sharing core competencies (Das & Teng 2000), and willingness to sharing physical resources (Das & Teng 2000).

Secondly, relationship management is defined as the development of relationship among competitive organizations for creating, enhancing and sustaining long term co-opetitive business operation (Chin, Chan & Lam 2008; Zineldin 2004). It is often employed as a component for achieving and sustaining long term co-opetitive business operations, as well as preventing future conflicts, because business activities are linked and resources are tied together when several competitive firms have to jointly implement various business activities (Min et al. 2005; Morris, Koçak & Özer 2007; Osarenkhoe 2010; Whipple & Frankel 2000; Zineldin 2004). Many scholars agreed that relationship management is a critical consideration for achieving co-opetition approach (Klein, Rai & Straub 2007; Makhija & Ganesh 1997; Zineldin 2004).

The measurement items of relationship management are including an intension to arrange detailed standard operating procedures (Wallenburg & Raue 2011), mutual goals and objectives (Morris, Koçak & Özer 2007), honesty and reliability (Morris, Koçak & Özer 2007), weekly or monthly basis meeting (Cheng, Yeh & Tu 2008), an intending to share know-how from work experience (Cheng, Yeh & Tu 2008), an enthusiastic about accepting potential partner's organizational culture or working environment (Cheng, Yeh & Tu 2008), and willingness to accepting potential risks (Cheng, Yeh & Tu 2008).

Thirdly, communication management refers to "the systematic planning, implementing, monitoring, and revision of all channels of communication within an organization and between coopetitors" (Chin, Chan & Lam 2008, pp.444). It is often employed as the communication among competitive firms to sustaining their long-term success and prevents potential uncertainties. When information is correctly communicated and transferred, information systems allow effective and real time information sharing, which facilitates effective communication among parties, as well as minimizes potential for conflict (Chin, Chan & Lam 2008).

Measurement items of communication management are including an intension to arrange the written documents that spell out detailed tasks (Wallenburg & Raue 2011), activities and schedule for the cooperation (Morris, Koçak & Özer 2007), the prevention that internal information must not be used for any other purposes than for the partnership (Morris, Koçak & Özer 2007), an intension to monitor conflict intensity periodically (Morris, Koçak & Özer 2007), willingness to share internal and external information (Morris, Koçak & Özer 2007), an intension to exchange each other's opinion (Cheng, Yeh & Tu 2008), an intension to frequently keep informed of new development (Cheng, Yeh & Tu 2008), and an intension to implement information technology to exchange information (Cheng, Yeh & Tu 2008). Overall, as indicated by many scholars, communication management is critical for implementing co-opetition approach (Cheng, Yeh & Tu 2008; Chin, Chan & Lam 2008; Kilger & Reuter 2005; Min et al. 2005; Thorgren, Wincent & Örtqvist 2009; Zineldin 2004).

Firms can gain many benefits from co-opetition. Bigliardi et al. (2011) identified four advantages of co-opetition strategy, namely synergistic effect, specialization, advantages of scales, and risk reduction. Similarly, Bartlett and Ghoshal (2000) demonstrated three ways of sharing benefits among alliances. First, an independent firm can acquire non-core resources from alliance partners and concentrate on its core activities. Second, alliance partners can share and leverage each other's strengths and capabilities to improve their own operation. Last, firms can eliminate cost by acquiring complementary resources. Thus, they can share non-core resources to comply with relevant environmental regulations, such as environmental management system and other technologies. Hageback and Segerstedt (2004) studied joint transportation and collaborative freight distribution in Pajala in Northern Sweden and concluded that co-distribution among competitors could result in approximately 33% total cost reduction due to the reduction of vehicle and fuel usage. Moreover, as the reduction of fuel usage reduces emissions, it implicitly leads to environmental and health benefits. However, the authors noted that managers must have capability to form alliances and maintain long-term co-opetitive relationships. Similarly, Ehrenmann and Reiss (2012) found that co-opetition can increase quality and delivery reliability, reduce distribution costs, increase innovation, explore new business fields, as well as identify new business partners.

Co-opetition not only yields benefits, but also pitfalls and challenges. The most challenging issue is partner selection. An ineffective partner may diminish the firm's productivity, efficiency, and profitability (Zineldin 2004). Cummings and Holmberg (2012) suggested several categories when selecting appropriate partner, the four main ones being task-fit, learning-fit, partnering-fit and risk-fit. Task-fit includes compatible distribution channel, strong local brand, strong host government relations, and compatible SCM system. Learning-fit includes capability to share explicit and tacit knowledge and ability to leverage partner's knowledge network. Partnering-fit includes similarity of organizational culture, proven collaboration track record, importance of the proposed alliance to the partner, and senior management compatibility. Risk-fit includes negative reputation if alliance fails, spill over of proprietary knowledge, and likelihood of lock-out if relationship disintegrates. However, the authors concluded that task-fit is the most important of the aforementioned four. Therefore, partner selection is concerned in this study.

Second, it is difficult to assess the performance of co-opetition, as different firms use different key performance indicators and general goals. In addition, some cooperating activities could not be assessed in the short-term (i.e., R&D). Thus, firms that are joining in the co-opetitive relationship need to find a standard performance measurement and indicators (Child, Faulkner & Tallman 2005; Ho & Ganesan 2012).

Third, risks may arise from an unintended leakage of knowledge. The issue of leakage is difficult to address, since information exchange and communication between workers of alliance firms are critical for forming co-opetitive relationships. Thus, all firms need to specify both sharable and un-sharable knowledge and information before entering into the co-opetitive relationship (Hamel 1991; Makhija & Ganesh 1997).

Fourth, working with an inexperienced partner may yield hidden costs, as the firm may have to devote additional funds, resources, time, attention, effort, and energy, which may affect firm's core activities. Moreover, firms may also have to devote these resources for learning about each other. Fifth, co-opetition requires resource mobilization, as return of investment may not be certain. Sixth, co-opetition forces firms to give up some control over their resources and facilities. Thus, firms participating in the relationship may lose control of their own resources. As a consequence, those resources and facilities may be managed poorly, diminishing productivity. Seventh, independence and power are the potential sources of conflict. One firm may use its power, technologies, policy, and strategy to dominate other firms. Consequently, the co-opetitive relationship could only be maintained in the short-term. Lastly, too close co-opetitive relationships could create strong barriers for leaving the relationship. If one firm wishes to leave, another firm may feel betrayed due to the loss of investment (Zineldin 2004). Given the above, standardized system and operations, as well as partner selection, must be considered before entering into any relationship (Child, Faulkner & Tallman 2005; Cummings & Holmberg 2012; Zineldin 2004). Therefore, firms need to overcome these challenges to accomplish successful co-opetition practices. However, co-opetition is not the only approach that can be adopted for achieving sustainable freight distribution. Freight consolidation is another potential solution.

Extant literature shows that co-opetition is researched widely across various countries as summarised in Table 3.4. However, a very few studies have been documented in Thailand context. Moreover, literatures studied on management commitment, relationship management, and communication management for archiving co-opetition in sustainable freight distribution context is scare. Therefore, knowledge of co-opetition in sustainable supply chain and logistics in Thailand context needs to be extended.

Table 3.4: Summary of literatures in co-opetition context

Author	Country	Research Methods	Findings
Markendahl & Mölleryd (2012)	Sweden and India	- Qualitative - Interview	- Four types of co-opetition between competing mobile operators: co-operative spirit, infrastructure cooperation through a third party, infrastructure cooperation through a joint venture, and service and infrastructure cooperation through a joint venture.
Elisa & Leigh (2003)	United Kingdom	- Qualitative - Literature review	- Promoters and inhibitors for a successful co-opetitive relationship in food retailers and financial services sector.
Herbert & Christoph (2003)	Austrian	- Qualitative - Literature review and case study	- Co-opetition can be facilitated in Austrian grocery industry for improving efficient customer responses.
Adamik (2013)	Poland	- Quantitative - Postal questionnaire	- Factors for achieving co-opetitive activities of SMEs
Gnyawali & Park (2011)	United States	- Qualitative - Secondary data	- Proposed a model of co-opetition, which consisted of driver of co-opetition, dynamic of co-opetition, outcome of co-opetition, and co-opetition capability.
Gnyawali & He (2006)	United States, Europe, Asia, and Australia	- Quantitative - Secondary data and regression analysis	- Co-opetition could positively influence firm competitive behaviours.
Ehrenmann & Reiss (2012)	German	- Quantitative - Online survey	- Management infrastructures for co-opetition in manufacturing networks (i.e. information infrastructure, human resource infrastructure, culture infrastructure, structural infrastructure, and technocratic infrastructure)

Hsieh & Lo (2010)	Taiwan	- Qualitative - Case study	- Trust is a critical factor for interorganizational co-opetitive relationship in a mobile TV trial project
Peng et al.(2012)	Taiwan	- Qualitative - Interview	- Opportunities and threats on organizational performance when a co-opetitive relationship is implemented in supermarket industry.
Osarenkhoe (2010)	Sweden and Kosovo	- Qualitative - Case study, interview and secondary data sources	- Topology of inter-firm dynamics and relationships (i.e. competition, collaboration, cooperation, and co-opetition) - Inter-firm dynamics between competition and cooperation
Leitner et al.(2011)	Spain and Romania	- Qualitative - Case study and secondary data	- Model of horizontal- logistics cooperation of automotive supplier - Critical factors for enabling cooperative transportation - Horizontal logistics cooperation is critical to improve organizational performance and logistics operation.
Chin, Chan & Lam (2008)	Hong Kong	- Quantitative - Questionnaire survey	- Antecedent factors for enabling co-opetitive relationship (i.e. management commitment, relationship management and communication management)
Bengtsson & Kock (2000)	Sweden	- Qualitative - Case study and interview	- Types of cooperative relationships between competitors - Heterogeneity of resources as a main factor of co-opetitive relationship - The closeness of business activity to customer influences the pattern of co-opetitive relationship - Conflicts of co-opetition relationship
Morris, Koçak & Özer (2007)	Turkey	- Quantitative - Questionnaire survey	- Three key dimensions (i.e. mutual benefits, trust, and commitment) for the formation of co-opetitive relationships for improving organizational performance

Whipple & Frankel (2000)	North America	- Quantitative - Questionnaire survey	- Critical factor for achieving strategic alliance - Critical factors that may influence failure or success of alliance formation

3.4.2 Freight consolidation

Due to the increased cost of transportation, as well as pressure to decrease delivery lead time and increase customer satisfaction, firms have to improve efficiency. One of the main problems in logistics and transportation management derive from issues related to less-than-truck-load (LTL) (Anderson, Allen & Browne 2005; Bloos & Kopfer 2009; Charkhgard & Tabar 2011; Tyan, Wang & Du 2003b). Piercy (1977) stated that LTL is the main source of transportation cost because a small shipment requires number of drivers, vehicles, gallons of gasoline, more transit time, and delivery routes. The solution, therefore, is to combine two or more small shipments into one larger shipment (Gümüş & Bookbinder 2004).

Freight consolidation is defined as “a transportation option that combines a number of frequent, small shipment destined for a similar geographical region into a single large shipment in an effort to reduce per unit shipping cost” (Min 1996, pp.235). Hall (1987, pp.57) defined freight consolidation as “ the process of combining different items, produced and used at different locations and different times, into single vehicle loads.” According to Gümüş and Bookbinder (2004, pp.202), freight (or shipment) consolidation is an activity that “...combines small orders to enable dispatch of larger loads.” Definition given by Tyan, Wang, and Du (2003b, pp.56) describes it as “ the process of grouping different shipments from suppliers into a large shipment at the consolidation point. The motivation behind consolidation is to take advantage of lower transportation rates through better utilization of a vehicle’s capacity.” Many scholars confirmed that freight consolidation is one of the most promising strategies for improving logistics efficiency (Browne et al. 2005; Collins, Henchion & O’Reilly 1999; Gümüş & Bookbinder 2004; Lewis, Fell & Palmer 2010; Min 1996; Tyan, Wang & Du 2003b; Ülkü 2011; Zhou, Hui & Liang 2011).

The work conducted by Hall (1987) is important for the current study, as it serves as its fundamental background, given that the author studied inventory, vehicle, and terminal consolidation. The author proposed four freight consolidation policies, namely one-terminal-closest, two-terminal-closest, one-terminal-best-nearby, and two-terminal-best-nearby. One-terminal routing implies that each shipment must go through exactly one terminal before going to the destination. Two-terminal routing means that shipment must go through two terminals. The term ‘closest’ requires that the shipment is served by the terminal closest to the origin or the destination, and each origin and destination is served by exactly one terminal. The term ‘best-nearby’ means that the shipment is loaded from any terminal that is closest to the destination. The author suggested that one-terminal routing is suitable for cases involving low number of origins and destinations. This strategy is also suitable when travel time is an issue. For the two-terminal routing, both the number of origins and destinations should be large. The closest routing is appropriate when the shipment is small and the destination and the origin are close to each other. Finally, the best-nearby is appropriate when the shipment is large and the origin and the destination are far apart. Thus, the number of terminals will be increased when the shipment volume increases. In addition, the average distance will decline when the number of terminals increases. The average distance is lower when one-terminal routing strategy, rather than two-terminal routing is implemented. Finally, the average distance in best-nearby routing is shorter than in closest routing approach. Unfortunately, trade-offs are necessary when reducing travel time by adding terminals, changing from two-terminal routing to one-terminal routing, or shifting from closest routing to best-nearby routing. First, terminal ownership, cost of operation, and the number of vehicles and routes may increase when new terminals are added. Second, switching to one-terminal routing may require additional vehicle routes, decreased delivery frequency, and deceased load sizes. Lastly, changing to best-nearby routing may require additional delivery routes, decreased delivery frequency, and deceased load sizes. In short, appropriate freight consolidation policies are dependent on the business operation and policies of each firm.

Scholars often studying freight consolidation focus on the field of cross-docking, which Lee, Jung and Lee (2006, pp.248) defined as “the continuous process to the final destination through the cross-dock, without storing products and materials in a distribution centre. When cross-docking is implemented in the supply chain, products in various locations are collected in the cross-dock prior to transportation to their destination. After classification according to product destination in the cross-dock, products are moved from the cross-dock to their respective destination.” The authors stated that cross-docking system is suitable for short life products that incur low stock-out costs. They further proposed that the pickup from the suppliers and delivery to the destination must be carefully aligned. The vehicles from suppliers must arrive simultaneously at the cross-dock terminal and leave simultaneously in order to minimize time required for freight consolidation and distribution and cost of holding inventory at the terminal.

Tyan, Wang, and Du (2003b) studied freight consolidation of notebooks (personal computers) operated by third party logistics (3PL). Notebooks are packed and consolidated at the manufactures according to the cross-dock terminal of the 3PL provider. The packages are then reassigned at the 3PL terminal before being loaded into the vehicle according to their destinations. The authors concluded that freight consolidation approach can simultaneously benefit manufacturers, carriers, shippers and customers. As consequence, freight consolidation can improve truck utilization and reduce inventory costs.

Benefits of freight consolidation can lead to achievement of sustainable freight distribution. It can result in efficient fuel consumption arising from delivery vehicle usage, loading, and route scheduling, as well as congestion abatement, and the reduction of air and noise pollution when the vehicle is efficiently loaded (Cadotte & Robicheaux 1979; Gümüş & Bookbinder 2004; Merrick & Bookbinder 2010). In addition, it can eliminate less-than-truck-load (LTL) incidences and improve vehicle usage in terms of optimizing available space utilization (González-Ramírez & Askin 2009). According to Collins, Henchion, and O'Reilly (1999), freight consolidation can improve market penetration, improve on time delivery for each drop-off point, reduce travel time, reduce transportation cost, improve vehicle utilization, provide more cost-efficient full load deliveries, reduce number of delivery vehicles, and reduce number of drivers. Browne et al. (2005) stated that freight consolidation can improve customer services, sale quantity, and inbound and outbound freight, while reducing distribution costs, improving delivery flexibility, increasing frequency of delivery, improving reliable delivery time, improving flow of product return, reducing pollution from delivery vehicles, increasing number of drop-off points, expanding delivery zone, generating additional delivery routes, and reducing fuel consumption.

According to González-Ramírez and Askin (2009), freight consolidation can improve transport mode utilization. It can also reduce negative environmental impacts of business processes, as it can reduce harmful emissions affecting air quality, such as CO_2 and NO_X (a generic term for NO and NO_2) emitted from delivery vehicle exhausts. Moreover, freight consolidation could minimize cost of wages of store workers and truck drivers, reduce delivery cost and travel distance, accelerate corporate social responsibility performance, and increase delivery window, all of which can markedly improve distribution chain efficiency (Lewis, Fell & Palmer 2010).

As TTR (2010) stated, shipment consolidation can improve economic performance (i.e., maximize retail space by up to 20% expansion, reduce delivery cost, increase delivery window, improve distribution chain, and improve site congestion), social (i.e., improve CSR, reduce conflict between road users and minimize traffic congestion), and environment (i.e., reduce pollution by up to 55%) in the United Kingdom. In short, freight consolidation can reduce pollutant emissions from distribution process, improve delivery performance, and minimize distribution costs (Aronsson & Brodin 2006). Therefore, freight consolidation should be concerned in this study for achieving sustainable freight distribution.

Min (1996) identified three main types of freight consolidation, namely spatial, product, and temporal consolidation. The author suggested that managers need to consider the location of consolidation terminal, customers that are going to be aggregated and the consolidation centre at which they are located, and sequencing the customers served by the consolidated vehicle, before implementing their freight consolidation strategy. In addition, as Piercy (1977) suggested, managers have to consider average load-size, location, and number of consolidation centres, route configuration, holding time at the consolidation terminal, concentration of origins and the destinations. Thus, to achieve freight consolidation strategy objectives, the location of freight consolidation terminals must be concerned.

3.4.2.1 Location, geographical coverage and transport mode utilization

Many scholars considered location of freight consolidation centre when studying freight distribution methods (Avittathur, Shah & Gupta 2005; Barahona & Jensen 1998; Canel & Khumawala 1997; Chakravarty 2005; Chan, Carter & Burnes 2001; Daskin 2011; Drezner & Hamacher 2004; Fleischmann, Ferber & Henrich 2006; Jacobsen & Madsen 1980; Prodhon 2007; Sabri & Beamon 2000; Schwardt & Fischer 2009; Sterzik, Wang & Kopfer 2011; Tuzun & Burke 1999). Location plays an important role in the overall freight distribution success, since it influences delivery time, fuel usage, operating costs and revenue (De Ligt & Wever 1998; Huang, Menezes & Kim 2012). Nonetheless, the location of freight consolidation centre has also been extensively used as a predictor/factor for collaborative freight distribution (Krajewska et al. 2007) and business performance improvement (Ding, Benyoucef & Xie 2009; Van Thai & Grewal 2005).

As freight consolidation terminal is a critical component of any supply chain, allowing it to bridge the gap between producers and customers, facility location plays an important role in closing this gap (Van Thai & Grewal 2005). Since costs related to inbound and outbound freight comprise 50%-60% of the total distribution cost, firms need to consider freight consolidation centre location, as it affects customer allocation and freight distribution system design (Renshaw 2002). The ability to market and manufacture the products partially depends on the location of the facility. Moreover, inappropriate decision-making may affect customer satisfaction and, therefore, profitability (Klose & Drexl 2005).

There are factors that need to be concerned on location. As Jedd (2001) suggested, location of customers/suppliers is a critical factor for determining the location of a cross-dock terminal. Melo, Nickel, and Saldanha-Da-Gama (2009) argued that capacity, inventory, procurement, production, routing, and transportation modes are critical considerations when making decisions on the location of facility and the allocation of customers. Huang, Menezes, and Kim (2012) aimed to minimize the total cost of transportation from suppliers to the distribution centre and from the distribution centre to the customers. The decision-making in terms of whether to locate the cross-docking terminal near the producers' facility or customer facility is of particular concern. The authors concluded that cross-dock terminals should be located closer to supplier's or producer's facility when they offer lower mean price. On the other hand, the cross-dock terminal should be settled closer to the customer's facility when suppliers offer high price variability, as customers would be able to identify suppliers offering lower prices. In this case, the cross-docking terminal can be located near the customer's facility to reduce outbound costs.

There are steps-wise to consider appropriate location. Specifically, Jacobsen and Madsen (1980) studied the location-routing problem in newspaper distribution, suggesting that managers first need to consider the number of transfer node locations. Secondly, the route for each tour must be decided at the printing facility, to serve each transfer nodes. Finally, the route for each tour from the transfer nodes to the end users or retailers must be determined. According to Drezner and Hamacher (2004) and Daskin (2011), simple two-step approach can be used when choosing the location. First, a finite set of candidate locations must be established. Second, minimum distance between the cross-dock terminal and the customers must be calculated for each location. Schwardt and Fischer (2009) proposed three-step-wise approach for determining the location of the distribution centre by using a neural network method for solving a single-depot location-routing problem. First, the candidate location must be found by using the Weiszfeld procedure. Second, the route for delivery must be found by applying a capacited vehicle routing problem (CVRP) construction procedure. Lastly, the chosen location must be improved by using Weiszfeld procedure. Thus, appropriate location must be concerned.

De Ligt and Wever (1998) argued that the distribution centre should be located close to customers, as customers increasingly require products that exactly fit their needs. Thus, firms can react and serve customers' tastes more effectively. The authors further stated that this strategy can reduce inventory holding costs since less space is used and fewer products are stored. Moreover, the supply cost and transhipment cost (i.e., transportation costs) can also be reduced, since products can be consolidated at the terminal before being delivered to the end users, as fewer trucks are required. According to Van Thai and Grewal (2005), appropriate facility location can improve business performance, enhance linkage between downstream and upstream supply chain components, reduce transportation cost, improve profitability, increase competitiveness, improve efficiency and meeting strategic needs, promote production and consumption, and improve customer satisfaction (Ding, Benyoucef & Xie 2009).

Hence, measurement items of location of freight consolidation centre for this study are including the closeness of the freight consolidation centre to the firm's manufacturing unit/factory, the closeness of the freight consolidation centre to customer's facility/warehouse, customer service improvement, sale volume improvement, inbound and outbound flow of products improvement, reduction of distribution costs, improvement of delivery flexibility, frequency of delivery improvement, improvement of reliable delivery time, improvement of the flow of product returns and reduction of pollutant from delivery vehicle (Browne et al. 2005).

For improving freight distribution performance, Aghezzaf (2004) argued that location, as well as, geographical coverage and transport mode utilization are aspects that firms need to carefully consider since they are influencing freight distribution improvement. Cross-dock terminal location can influence the distance between the distribution terminal and the end users, as well as the number of required delivery trucks and vehicle space utilization.

Geographical coverage is aspect that considered by a number of scholars studying freight consolidation, since it often relates to the decision-making pertaining to the location of freight consolidation centre (Jedd 2001; McKnight 1998; Van Thai & Grewal 2005). Van Thai and Grewal (2005) studied geographical coverage of the cross-dock terminal and employed the theory of centre of gravity to explain geographical coverage of a chosen cross-dock terminal.

They stated that the terminal must cover the predetermined region. Oum and Park (2004) argued that the geographical coverage of the consolidation centre is empirically proven as a critical factor that influences improvement of freight distribution performance of all involved parties.

Measurement items of geographical coverage are including improvement on time delivery of each drop-off point (Collins, Henchion & O'Reilly 1999), increase of the number of drop-off point (Browne et al. 2005), increases of delivery vehicle zones (Browne et al. 2005), reduction of travel distance (Collins, Henchion & O'Reilly 1999), and reduction fuel consumption (Browne et al. 2005).

In terms of transport mode utilization, it usually links to freight distribution improvement and sustainable distribution, since it has been shown to yield improved truck capacity and space usage, economies of scale, and reduction in delivery costs and pollution (Forkenbrock 1999; McKinnon 2000). Moreover, empirical evidence suggests that the potential benefits of improved transport mode utilization can encourage firms to implement freight consolidation approach (Esper & Williams 2003; Sutherland 2006).

McKinnon (2000) stated that truck utilization is critical for freight consolidation approach in several ways. First, as fewer trucks are employed in freight consolidation approach, truck capacity and space is used more effectively. As a result, transportation cost is reduced, since the truck can benefit from economies of scale. In other words, the more products the truck carries per trip, the lower delivery cost per unit of product can be achieved. Second, in freight consolidation approach, trucks deliver products throughout the 24-hour period, which leads to less congestion and reduces noise. Third, the problem of trucks being filled with low-density products before the maximum weight is reached can be mitigated, since products would be re-packed at the cross-dock terminal according to the destination. Firms have incentive to maximize vehicle weight and capacity in order to minimize delivery costs. Thus, the consideration of transport utilization in freight consolidation approach can improve delivery operations, reduce transportation costs, and decrease pollution levels.

Moreover, Forkenbrock (1999) argued that trucking utilization is critical in mitigating proprietary and externals costs. Proprietary costs include economic expenditure that includes tax and licenses, utilities, depreciation, equipment rent, disposal of assets, fuel, maintenance, insurance, wages, fringes, salaries, user charge, and other operating costs. On the other hand, externalities comprise of social and environmental costs. Social costs include death, injuries, and property damage, while environmental costs are air pollution and greenhouse gases. The author concluded that the well-organized freight movement management would improve economic, social, and environmental sustainability.

Measurement items of utilization of transport modes are including reduction of transportation cost (Collins, Henchion & O'Reilly 1999), improvement of efficient use of vehicles (Collins, Henchion & O'Reilly 1999), improvement of the usage of vehicle capacity (González-Ramírez & Askin 2009), improvement of cost-efficient full load deliveries (Collins, Henchion & O'Reilly 1999), reduction of fuel consumption (González-Ramírez & Askin 2009), reduction of the number of delivery vehicles (Collins, Henchion & O'Reilly 1999), and reduction of the number of drivers (Collins, Henchion & O'Reilly 1999).

As evidence shows in Table 3.5, there are number of literatures conducted studied in different countries. However, a few studies have been documented in Thailand context. Moreover, a few literatures studied on location, geographical coverage, and transport modes utilization for archiving freight consolidation in sustainable freight distribution context. Thus, it would be valuable to extend the current knowledge of freight consolidation approach in sustainable freight distribution in Thailand context.

Table 3.5: Existing literatures surrounding freight consolidation approach

Author	**Country**	**Research Methods**	**Findings**
Browne et (2005)	United Kingdom	- Qualitative -Literature review and secondary data	- Framework of urban freight consolidation centre - Urban freight consolidation scheme - Key issues of urban freight consolidation
Lewis, Fell & Palmer (2010)	United Kingdom	- Qualitative -Literature review -Secondary Data	- Costs and benefits of freight consolidation centre - Implementation decision tree of freight consolidation centre - Freight consolidation of the wider toolkit
Merrick & Bookbinder (2010)	United States	- Quantitative - Simulation approach	- Freight consolidation can improve environmental management performance
González-Ramírez &	Mexico	- Quantitative - Algorithm	- Shipment consolidation module - Vehicle consolidation strategy

Askin (2009)			- Shipment consolidation can reduce distribution costs comparing with direct shipment
Tyan, Wang, and Du (2003b)	United States	- Quantitative - Algorithm	- Freight consolidation can improve cost saving and service level
Cadotte & Robicheaux (1979)	United States	- Qualitative - Workshop and interview	- Potential benefits, problems, and uncertainties of urban freight consolidation - Proposed eleven steps to implement consolidation terminal program
Collins, Henchion & O'Reilly (1999)	United Kingdom	- Qualitative - Case study	- A coupled-consolidation can improve freight distribution operation and customer services.

3.4.3 Collaborative freight distribution

As transportation accounts for approximately 30% of the total supply chain cost, consumes approximately 6% of the US GDP and accounts for approximately 16-50% of the air pollution in Sweden, firms need to implement new management approaches to mitigate transport inefficiencies, such as high transportation costs, poor time performance, high inventory costs, long cycle time, and empty deadhead miles in order to achieve sustainability (Sutherland 2006). Innovate transportation management methods must be able to reduce noise, increase social safety, reduce energy consumption, improve land use and air quality, and reduce climate change by limiting greenhouse gas emissions (Lindholm & Behrends 2012). In this context, collaborative transportation is recognized as a valid approach that can be used coincidently with the co-opetitive relationship and freight consolidation approach (Bloos & Kopfer 2009; Chen, Yeh & Chen 2010; Esper & Williams 2003; Graham 2011). As presented above, in co-opetition and freight consolidation section, freight consolidation approach is critical because it allows the firm to consider where to locate the consolidation centre between supply source and customer as well as analyse its potential benefits, such as reduction of distribution cost and delivery time (Cruijssen, Cools & Dullaert 2007). On the other hand, a successful strategic alliance and full collaboration could enable collaborative freight distribution. This is possible, as strong relationships among competitors can abate conflicts, generate more trust, improve quality of relationships, and achieve effective information sharing (Graham 2011). Thus, co-opetition and freight consolidation approach are considered as antecedent factors of collaborative transportation among competitive firms in this study since less researches have emerged.

The most recent practice that emerged in transport collaboration is collaborative transportation management (CTM), defined as “a holistic process that brings together supply chain partners and services providers to drive inefficiencies out of the transport planning and execution process. CTM start with the shipment forecast includes order generation and load tender and finally delivery execution and carrier payment” (Sutherland 2003pp. 1). According to Sutherland (2006), the objective of CTM is to eliminate inefficiencies in transportation processes related to, for example, inventory, time, distance, and space, by vertically and horizontally collaborating with other supply chain members. The author further stated that firms need to work with other firms by forming strategic alliances or partnerships, as a single firm cannot overcome the inefficiencies in transportation and freight distribution in isolation. Once two or more firms agree to participate in transport collaboration, they are able to share resources, facilities, explicit and tacit knowledge, as well as risks to improve their freight distribution performance. According to Song and Panayides (2002), the key objectives of strategic alliances in freight distribution are financial (i.e., maximized profitability), economic (i.e., economies of scale), strategic (i.e., wider delivery geographical area), marketing (i.e., improved customer satisfaction), and operational objectives (i.e., increased delivery frequency). CTM can be regarded as value-added because it can reduce dwell time waiting to load and unload, as well as optimize weight and volume of transportation assets. Moreover, it can reduce deadhead miles due to improved routing. Participating firms can combine their delivery routes and identify optimal routes that can serve all destinations of all participating firms while eliminating billing errors. The author noted that, by participating in the CTM, firms could reap greater benefits than can be achieved if operating in isolation.

Many authors define benefits and opportunities of collaboration in freight distribution among competitors for achieving sustainable freight distribution. For example, according to Krajewska et al. (2007), horizontal cooperation among freight carriers can improve space utilization, optimize truck capacity, reduce fuel and truck usage, as well as labour and driver costs, and minimize cost of freight movement. The authors concluded that collaborative freight operations are critical in achieving sustainable distribution. Sutherland (2006) observed benefits of collaborative transportation in various US companies and concluded that CTM can yield up to 35% improvement in on-time service, 75% reduction of lead time, 50% inventory, 23% sales increase, 20% freight cost reduction, 20% administrative cost reduction, 15% deadhead mile reduction, 15% dwell-time reduction, 33% fleet utilization improvement, and 15% driver turnover reduction.

Similarly, Esper and Williams (2003) summarized benefits of CTM into four main metrics, namely reduced transportation costs, improved asset utilization, improved on-time performance, and reduced administrative costs. Sutherland (2003) stated that CTM can increase sales, reduce costs, improve transportation asset utilization, reduce inventory, and improve outstanding sales. The author asserted that CTM requires effective freight consolidation, effective real-time information sharing, common objectives, leadership management, trust, and sharing benefits and risks amongst all collaborative partners. Moreover, in order to facilitate effective CTM, collaborative partners must consider formal contract terms, creating daily transportation plan, establishing continuous improvement programs and performing regular financial analysis pertaining to transportation. Cruijssen et al. (2007) demonstrated several opportunities of horizontal cooperation in transportation management, concluding that co-opetition can decrease empty hauling, optimize storage usage, reduce fuel usage, decrease purchasing costs of fuel, vehicles, and other equipment, achieve shorter and reliable delivery time, increase delivery frequency and geographical coverage, and, most importantly, decrease pollutant emissions from distribution process. This, in turn, reduces environmental and social impact of business operations, such as air quality reduction, threat to biodiversity, and ecosystem stress. Tyan, Wang, and Du (2003a) confirmed that benefits and risks must be shared equally among participating parties.

There are methods and practices for facilitating CTM. Sutherland (2006) proposed practices that can facilitate CTM, including increasing control and centralizing management, establishment of core programs, establishment of proper contracts, transportation plan optimization, implementation of electronic tendering, automating reporting, increasing visibility of inventory, shipment and orders, implementation of self-billing, introduction of payments on agreed milestones, implementation of key performance indicators, usage of trading partner reports, establishment of continuous improvement programs, implementation of freight cost allocation report, and regular financial analysis. Browning and White (2000) proposed key activities in CTM, including creation of joint organizational plans, order generation, order forecasting, freight delivery confirmation, and payment procedure. Mason, Lalwani, and Boughton (2007) identified key CTM methods, including factor gate pricing, skylark, and pallet network. Tyan, Wang, and Du (2003a) proposed three phases comprising of fourteen key steps for implementing CTM for either direct collaboration or via third party logistics. Those phases include planning, forecasting, and execution phase. In the planning phase, all parties jointly create and develop a collaborative business plan and determine facilities and resources requirements. In the forecasting phase, all participating parties forecast their order and shipment requirements and adjust equipment accordingly. In the last step, all parties must finalize the agreement and act upon shipment tenders, distribution process, payment method, and the review of collaborative business performance. The key enablers that are required in all phases are commitment, responsibility, collaborative initiative of participating parties, and trust. Moreover, the author confirmed that information technology is a most critical enabler of every single step because each step requires real-time, transparent, and accurate information to optimize collaborative business performance and prevent emergence of potential conflicts. According to Dutton (2009), all participating parties must agree on the location of cross-dock terminal, formalize information technology, freight terms, and types of shipment, as well as identify products to be consolidated, and business strategies to be adopted, before initiating the collaborative transportation. In sum, appropriate methods and practices must be considered in order to achieve effective CTM.

Sutherland (2006) proposed seven roadblocks for successful transport collaboration, including trust and control to share appropriate knowledge, sharing of proprietary information, integrating system and technology for accurate data/information sharing, addressing potential ethics issues, monitoring, controlling and measuring benefits being shared among participating firms, and implementation of standardized system and organizational structure. The author also proposed enablers of CTM, including common interest, transparent expectation, openness, leadership, trust, cooperation initiative, benefits and risks sharing and effective utilization of information technology. Thus, the key enablers of collaborative freight distribution can be categorized into adoption of advanced information technology, partner selection, and fare benefits and risks sharing.

3.4.3.1 Information Technology

Effective CTM is cost-effective, real-time, automated, and extendible. Thus, advanced information technology plays an important role in CTM (Esper & Williams 2003; Mentzer, Foggin & Golicic 2000). According to Mason and Lalwani (2006, pp.59), “developments in information communication technology (ICT) are creating a new operational landscape for collaborative logistics system.” Hence, ICT is critical for improving speed of information flow within the supply chain (Potter et al. 2003). Esper and Williams (2003) added that the Internet allows parties to communicate via email and other IT tools to automatically receive load tenders, load tender acceptance, inbound shipment, manage cross-dock labour and capacity, monitor status of shipment orders, diary capacity, and available shipment during the day. Moreover, an advanced ICT can accelerate supply chain collaboration and integration, as it can increase visibility, accuracy, and reliability, which in turn lead to reduced supply chain cost (Mason, Potter & Lalwani 2002). Browning and White (2000) insisted that ICT must be employed before implementing CTM because information needs to be shared among participating parties. Thus, ICT is critical for implementing CTM approach.

There are number of roles and benefits of ICT in CTM. Esper and Williams (2003) confirmed two import roles of ICT in CTM. First, ICT enables transport collaboration by allowing participating parties to share real-time data and automated communication. Second, ICT supports transport collaboration by reducing transaction costs and transaction risks. The authors further suggested using a wide range of ICT tools, such as message-based system (i.e., email, EDI, sms, and XML), market-based system (i.e., hubs and portals), and collaborative planning system (i.e., collaborative planning and forecasting based systems). In their work, the authors mainly focused on electronic data interchange (EDI)—an on-line computer-to-computer communication system between parties. Information that needs to be shared between parties is, firstly, material-specific information, including material identification number, projected volumes, and delivery requirements needed to support manufacturer's short- and long-term forecasts. Second, specific loading sequence information is needed for the receipt of the shipping order. Third, master production schedule is needed to manage supplier's shop floor. Lastly, delivery-specific information, including item identification number, units shipped, order ID, unit quantity, truck ID, and delivery time are needed to ensure on-time delivery. (Dilts 1989).

According to Lee (2000), firstly, information integration allows chain members to share information, knowledge, and schedules. They could share demand forecasts, promotion plans, inventory status, shipment schedules, production schedules, and capacity plans. It also allows chain members to collaborate when developing their forecasts and replenishment projections. Second, coordination allows chain members to coordinate their decision-marking, planning and control strategies and tactics, as well as improve decision delegation and outsourcing. Lastly, firm linkage allows chain members to exchange their gains, costs, risks, and accountabilities.

In contrast, number of authors identified limitations and failures of the integration. According to Mantzana and Themistocleous (2006), firms can face many barriers when attempting to achieve integration. First, barriers in the operational area include substantial cost of reengineering the business structure and processes, and high cost of program package. Second, a barrier can arise in managerial area, due to the lack of skilled workers. Third, barriers in strategic area include resistance of employees to the changes in the work structure, resistance of a firm to sharing information with its business partners, and potential breaches of information security. Fourth, barriers in information technology area can emerge, including the complexity and incompatibility of the existing system and the confusion pertaining to integration technology. Lastly, barriers in the organizational area include political and cultural issues, complexity of the existing business processes, and the time and cost associated with staff training. Furthermore, Momoh, Roy, and Shehab (2010) identified a number of failures resulting from integration, which they presented in terms of percentages, as follows: 13% derived from excessive customization, 12% derived from lack of change management, 9% attributed to poor data quality, 8% stemming from dilemmas of internal integration, 7% deriving from poor understanding of business requirements, 5% due to the lack of top management support, 4% deriving from limited training time, 3% stemming from the hidden cost, and 3% arising from the misalignment of information technology with business. According to Zhao, Zhao, and Hou (2010), the greatest barrier to integration in SCM is that different suppliers, customers, manufacturers and distributors are using different ICT systems. Thus, these barriers must be concerned when implementing ICT.

Hence, measurement items of advanced information technology for this study are including supply chain information sharing, implementation of message based system, implementation of market based system, implementation of collaborative planning and forecasting based systems, reduction of transportation costs, improvement of vehicle utilization, improvement of service level, improvement of visibility, improvement of customer satisfaction, and improvement of revenue (Esper & Williams 2003).

3.4.3.2 Partner selection and benefits and risks sharing

Partner selection is the next most critical factor for successful CTM implementation (Graham 2011; Sutherland 2006). According to Cruijssen, Cools, and Dullaert (2007), establishing strategic alliances must be first considered before starting working with the competitors. As Claycomb and Frankwick (2004) and Kwon and Suh (2004) asserted, firms not only rely on internal resources for competitive advantage, but also resources that can be acquired from alliance or competitive partners, including complementary resources, explicit and tacit knowledge. However, when forming a strategic alliance, firm must first address partner selection and consideration of partner's characteristics, such as knowledge, skills, complementary resources, structure, strategy, policy, and working environment (Child & Faulkner 1998). This is because the firm's performance will be influenced by the performance of the alliance partners (Ireland, Hitt & Vaidyanath 2002). Since strategic alliance is theoretically based on the development of resource based view and knowledge sharing theory, firms can utilize resources provided by the alliance partners to enhance their own competitive advantage. These theories can help explain why selecting an appropriate partner is critical for forming strategic alliances (Hitt et al. 2000). Unfortunately, as Koza and Lewin (2000) asserted, the most common reason behind strategic alliance failures is lack of understanding of interplay among the strategies of all partners in the relationship and differences in their characteristics and performance measures. Therefore, each firm must consider partners' criteria and evaluate them to find the most compatible partners. In other words, the partner characteristics must match the objectives, goals, and strategies of the firm, in order to obtain optimal benefits from the partnership (Lambe, Spekman & Hunt 2002).

Many scholars studied partner selection process and criteria to be used when making a selection. Wu, Shih, and Chan (2009) studied criteria for selecting partners, proposing four criteria. First, partner characteristics consist of unique competencies, compatible management style, compatible strategies objectives, and higher or equal level of technical capabilities. A second criterion is degree of fitness, which consists of compatible organization cultures, willingness to share experiences, equivalent mode of control, and willingness to be flexible. Third, an intangible assets criterion consists of license, trademark and patent knowledge, reputation, previous alliance experience, and technically skilled employees. The last criterion is complimentary capability, which consists of managerial capability, wider market coverage, diverse customer base, and quality and size of distribution system. The author also proposed eight steps for evaluating alliance partners, namely (1) decompose problem, (2) define criteria for selecting partners, (3) design the hierarchy, (4) perform pairwise comparison, (5) calculate the weight of each criterion, (6) rate the alternative partners, (7) calculate the overall score of each partner, and (8) choose the most qualified partner.

Lambe, Spekman, and Hunt (2002) employed nine criteria for selecting partners—partner attractiveness, trust criticality, commitment criticality, complementarity criticality, financial payoff criticality, trust perception, commitment perception, complement perception, and financial payoff perception. De Boer, Labro, and Morlacchi (2001) suggested that partner selection process should be conducted in four phases consisting of formulation of criteria, qualification, final selection, and application feedback phase. Lin, Chiu, and Chu (2006) proposed four criteria, including process integration, collaborative relationship, information integration, customer and marketing sensitivity. Kannan and Tan (2002) employed seven criteria for selecting a alliance partner, including quality, delivery, production capability, services, technical capability, price, and business structure. Van der Rhee, Verma, and Plaschka (2009) proposed five criteria—flexibility, delivery performance, cost, value-added services, and value-added support.

On the other hand, Xia and Wu (2007) employed eight criteria, namely technical level, price, defects, reliability, supply capacity, on-time delivery, warranty period, and repair turnaround. Dulmin and Mininno (2003) proposed six criteria, which consist of processing-time, prototyping time, make-up, quality system, co-design, and technological level. Lin and Chen (2004) proposed eight criteria, comprising finance, industry characteristics, knowledge management, organizational competitiveness, product development and logistics, and relationship building and coordination. Thus, although different authors suggested varying number of assessment criteria, strategic fit between partners seems to be the most critical factor, as it is included in all aforementioned partner selection criteria.

There are number of criteria for selecting the fittest partner. According to Cruijssen, Cools, and Dullaert (2007), firms need to find commensurable and reliable partners that can cooperate for core and non-core activities, make sure that all other participating alliance partners are satisfied, can agree on fare benefits and risks sharing without further conflict, ensure that workload is fairly allocated, and have incentive to share internal and external information. These criteria are also impediments for finding the fittest partner. Therefore, a successful strategic alliance formation can be achieved only by addressing each of these impediments.

Brouthers, Brouthers, and Wilkinson (1995) asserted that firms need to firstly find partners that possess complementary skills and human resources, as this would allow them to accelerate their performance and enhance competitive advantage. With complementary skills and resources, partners can share tacit and explicit knowledge through joint business activities. Firms can create new strategies or launch new products by employing skills and resources of their partners. As complementary financial resources are also important, partners must be able to financially support the firms when launching a new project. Second, a cooperative culture must also be ensured, as it indicates an optimal mix of organizational cultures between partners. Another organizational culture indicator is the working style and unique business operation. If culture prevailing in partner's firm is compatible, sharing knowledge and skills is more effective. Therefore, collaborators can combine their cultures in order to create new strategy and develop new products. Moreover, a good relationship between top management is critical for combining cultures. Top managements should exchange their personal philosophies, private histories and lifestyle choices, as this would allow top management of each company to learn more about each other and understand the source of each organizational culture, as organizational culture usually derives from top management. Third, compatible goals must the most critical consideration. Without goal compatibility, strategic alliances will mean nothing, because the fundamental principle of a strategic alliance is to work with other firms to achieve common goals and yield greater benefits. Therefore, firms need to select a partner that has the most compatible goals. Lastly, risks must be fairly allocated between partners to avoid potential conflict, which is a main source of strategic alliance failure. In sum, strategic fit is a critical factor for selecting appropriate partners. Overall, evidences shows that partner selection should be considered as antecedent factor since fewer researches have considered partner selection as an enabler of collaborative freight distribution.

Hence, measurement items of partner selection are categorized as a fair share of benefits to all partners, an intension to find commensurable partner with whom it is possible to cooperate for core activities, a fair allocation of the shared workload in advance (Cruijssen, Cools & Dullaert 2007), compatible goals and objectives, evaluation of partner's goals/objective, complementary skills of potential partners, compatible financial resources, compatible internal working environment, peer relationship between the top executive, willingness to learn a new working environment, and commensurable of the level of risks (Brouthers, Brouthers & Wilkinson 1995).

Fair benefits and risks sharing among partners also play an important role in collaborative freight distribution. As evidenced above, advantage and unique resources are being shared between alliance partners. Thus, they must be fairly distributed in order to sustain long-term relationship, ensure long-term commitment, optimize mutual benefits, abate conflict (Cruijssen, Cools & Dullaert 2007; Sutherland 2006). The evidence provided by extant studies confirmed that the sharing of fair benefits and risks is critical for the successful collaborative business operation.

Hence, measurement items of fair benefit and risks sharing are including reduction of the cost of non-core activities, reduction of purchasing costs, improvement of quality of services at lower costs, protection of market share (Cruijssen, Cools & Dullaert 2007), improvement of sale, improvement of fleet utilization, improvement of on-time delivery, reduction of delivery lead-time, reduction of administrative cost, and reduction of drivers turn-over (Sutherland 2006).

There are number of literatures studied collaborative freight distribution in different countries as presents in Table 3.6. However, a few literatures concerned collaborative freight distribution simultaneously with co-opetition and freight consolidation in sustainable supply chain and logistics in Thailand context. Thus, evidences support that the knowledge of collaborative freight distribution for achieving sustainable freight distribution context in Thailand should be extended. Nonetheless, evidences show that postal questionnaire was successfully employed. Therefore, postal questionnaire technique could ensure a successful study of the current research.

Table 3.6: Summary of literatures in collaborative freight distribution context

Author	**Country**	**Research Methods**	**Findings**
Zhou, Hui & Liang (2011)	China	- Quantitative -Simulation approach	- The optimal dispatching level for improving distribution performance through collaborative freight consolidation
Cruijssen, Cools & Dullaert (2007)	Belgium	- Quantitative -Pilot interview and questionnaire survey	- Impediments and benefits of horizontal cooperation in logistics
Krajewska et al.(2007)	Canada	- Quantitative - Algorithm	- Co-opetitive freight distribution can improve freight distribution efficiency and effectiveness
Hageback & Segerstedt (2004)	Sweden	- Quantitative -Interview and questionnaire survey	- Co-freight distribution in rural area can improve supply chain management and freight distribution performance (i.e. improved customer services and decreased distribution costs)
Sutherland (2006)	United States	- Qualitative - Secondary data	- Benefits and enablers of collaborative transportation

Esper and Williams (2003)	United States	- Qualitative - Interview and case study	- Benefits of collaborative transportation management and roles of information technology on collaborative transportation management

3.5 Conclusion

Many models and theories on sustainable supply chain management have proven that sustainability in freight distribution operation is vital for improving and sustaining economic performance, social, and natural resources and environment. Extensive literature review conducted as a part of this study revealed several potential solutions, including establishment of co-opetitive relationship among competitive organizations, freight consolidation and collaborative freight distribution among competitors. However, previous studies in this field failed to evaluate these three approaches simultaneously, as best practices for achieving sustainability in freight distribution. Therefore, this study aims to fill the existing research gap by examining co-opetition, freight consolidation and collaborative freight distribution simultaneously for accomplishing sustainable freight distribution. A conceptual framework based on literature review is presented in Chapter 4.

CHAPTER 4

CONCEPTUAL FRAMEWORK AND HYPOTHESES DEVELOPMENT

4.0 Introduction

Identification and development of appropriate conceptual framework is critical for a research study, allowing it to draw upon extant theories and models that can benefit the research process and help draw conclusions for the study findings. This chapter will discuss and explain the processes involved in generating a conceptual framework. Next, the chapter will identify the research hypotheses that describe the relationship among co-opetition, freight consolidation, collaborative freight distribution and sustainable distribution. This chapter will end by proposing the conceptual framework.

4.1 Conceptual framework

Conceptual framework is defined as a collection of models and theories presented in extant literatures that underpins the positivistic research. In other words, it represents the identified concepts and their relationships that determine the study. Development of a most appropriate conceptual framework for the study helps the researcher to hypothesise and examine the relationships between the study variables in order to improve the understanding of the dynamic situation the study aims to explore (Bryman & Bell 2007). There are four essential steps for developing the conceptual framework, namely identifying concepts, defining their characteristics, exploring relationship between those concepts, and operationalising concepts. First, identification of concepts is the starting point for modeling the conceptual framework and it aims to identify all concepts pertaining to the research objectives and questions. Second, those identified concepts must be defined in order to clarify the meaning of each concept in the context of the study. Third, the relationship between concepts, or cause and effect, must be identified in order to answer the research questions. Lastly, the operationalization of concepts refers to the decision-making in terms of the manner in which those concepts might be measured, if the research study is a quantitative in nature (Veal & Ticehurst 2005). After the hypotheses has been hypothesised, the conceptual framework can be formulated to test whether the proposed relationship among concepts is valid or not (Sekaran 2003).

4.2 Development of research hypotheses

The comprehensive identification and review of the theoretical background presented in Chapter 3 focused on four concepts (i.e., co-opetition, freight consolidation, collaborative freight distribution, and sustainable distribution), which are significant to the development of the conceptual framework of the present study. These concepts have been used and discussed by many authors in the area of modern supply chain management and logistics. Thus, research hypotheses will be next identified in order to answer research objectives.

4.2.1 Relationship between co-opetition and sustainable distribution

Owing to increasing competitiveness (Shee, VanGramberg & Foley 2011) and regulations pertaining to sustainable development, independent firms are forced to collaborate and recognize the value of networks, alliances and joint operations in their effort to successfully function in an increasingly dynamic and globalized market environment (Bigliardi, Dormio & Galati 2011; McKinnon et al. 2010). A single firm cannot grow without relying on alliance partners (Bigliardi, Dormio & Galati 2011; Dagnino & Padula 2002), and is unable to improve freight distribution activities (Cruijssen, Cools & Dullaert 2007; Leitner et al. 2011). Therefore, for improving business performance, the focal firm must cooperate with external parties, such as competitors and complementors (Barratt 2004).

The more specific term that describes the aforementioned initiatives, used in this study, is co-opetition. The majority of literature that addresses this topic asserts that sustainable logistics requires firms to work closely with and across supply chain partners towards sustainability by re-engineering internal and inter-organizational operations, as well as production, distribution processes, and prioritizing social and environmental responsibility (Bowen et al. 2001; Carter & Jennings 2002a; McKinnon 2010; Murphy & Poist 1992). Vachon and Klassen (2008) specifically study environmental collaboration encompassing joint environmental planning activities and solutions for solving social and environmental issues. On the other hand, Cheng, Yeh, and Tu (2008) focused on inter-organizational knowledge sharing in green supply chain management in the Hong Kong context, where collaboration and competition coexist. The authors concluded that inter-organizational business operation had the potential to enhance competitive advantages of all parties in the supply chain and improve their sustainability performance.

There are evidences that define benefits and opportunities of collaboration among competitors, regarding to economic, social and environmental sustainability. Bartlett and Ghoshal (2000) demonstrate three ways of sharing benefits among alliances. Firstly, an independent firm can acquire non-core resources from alliance partners and concentrate on its core activities. Secondly, alliance partner can share and leverage each other's strengths and capabilities to improve their own operation. Lastly, the firm can eliminate cost by acquiring complementary resources. Thus, they can share non-core resources to comply with relevant environmental regulations, such as environmental management systems and other technologies. Hageback and Segerstedt (2004) states that co-distribution among competitors could subside total cost due to the reduction of vehicle and fuel usage. Moreover, as the reduction of fuel usage could reduce emissions, it implicitly leads to environmental and health benefits. Similarly, Ehrenmann and Reiss (2012) find that co-opetition can increase quality and delivery reliability, reduce distribution costs, increase innovation, explore new business fields, as well as identify new business partners. More specifically, Cruijssen et al. (2007) demonstrate several opportunities of horizontal cooperation in transportation management. They conclude that co-opetition in the freight distribution process can decrease empty hauling, optimize storage usage, reduce fuel usage, decrease purchasing costs of fuel, vehicles, and other equipment, achieve shorter and reliable delivery time, increase delivery frequency and geographical coverage, and, most importantly, decrease pollutant emissions from distribution process. This, in turn, reduces environmental and social impact of business operations, such as air quality, biodiversity, and ecosystem stress.

Hence, a relationship between co-opetition and sustainable distribution can be developed in the form of a hypothesis as stated below.

H1: Co-opetitive relationship has a positive effect on sustainable distribution.

4.2.2 Relationship between freight consolidation and sustainable distribution

Freight consolidation is an essential activity in cross-dock terminals. It leads to an efficient fuel consumption arising from improved delivery vehicle usage, loading, and route scheduling, as well as congestion abatement, and the reduction of air and noise pollution when the vehicle is efficiently loaded (Merrick & Bookbinder 2010). In addition, freight consolidation can eliminate the less-than-truck-load (LTL) incidences and improve vehicle usage in terms of optimizing available space utilization (González-Ramírez & Askin 2009). According to Lewis et al. (2010), freight consolidation can reduce negative environmental effects of business processes, as it can reduce emissions emitted from delivery vehicle exhausts, which adversely affect air quality. Moreover, freight consolidation can minimize cost of wages of store workers and truck drivers, reduce delivery cost and travel distance, accelerate corporate social responsibility performance, and increase delivery window, all of which can markedly improve distribution chain efficiency. In short, freight consolidation can reduce pollutant emissions from distribution process, improve delivery performance, and minimize distribution costs (Aronsson & Brodin 2006).

From the above, a hypothesis can be formulated as:

H2: Freight consolidation has a positive effect on sustainable distribution.

4.2.3 Relationship between co-opetition, freight consolidation and collaborative freight distribution

The most recent approach for improving freight distribution process is collaborative transportation management (CTM) (Gonzalez-Feliu, Peris-Pla & Rakotonarivo 2010). According to Sutherland (2003), CTM can increase sales, reduce costs, improve transportation asset utilization, reduce inventory, and improve outstanding sales. The author asserted that CTM requires effective freight consolidation, effective real-time information sharing, common objective, leadership management, trust, and sharing benefits amongst all collaborative partners. Moreover, in order to facilitate effective CTM, collaborative partners must consider centralized transportation management, formal contract terms, daily transportation plan, continuous improvement programs and regular financial analysis of transportation processes.

Collaborative freight distribution can be enabled by the association of co-opetitive relationship and freight consolidation approach (Bloos & Kopfer 2009; Chen, Yeh & Chen 2010; Esper & Williams 2003; Graham 2011). On the one hand, freight consolidation approach is critical, as firms could choose the consolidation centre location, so that it can cover all suppliers and customers. Its potential benefits include reduction of distribution costs and delivery times (Cruijssen, Cools & Dullaert 2007). On the other hand, a successful strategic alliance and full collaboration could enable collaborative freight distribution, as a strong relationship between competitors can abate conflicts, generate more trust, improve performance, and achieve effective information sharing (Zhou, Hui & Liang 2011). According to Sutherland (2006), the key factors a firm and its collaborative partners need to consider for enabling the collaborative freight distribution are partner selection, benefits and risks sharing, and advanced information technology.

Therefore, the following hypotheses will be tested in this study:

H3: Co-opetitive relationship has a positive effect on collaborative freight distribution.

H4: Freight consolidation has a positive effect on collaborative freight distribution.

4.2.4 Relationship between collaborative freight distribution and sustainable distribution

Sustainability in freight distribution and transportation sector is becoming increasingly important, due to increased economic costs and pollutant emissions at every stage of distribution process. The consideration of sustainable distribution, strategic alliance, network design, freight consolidation, and backhaul management are critical for achieving sustainability (McKinnon 2000; Wu & Dunn 1995). According to Elkington (1998), firms must take organizational sustainability into consideration when aiming to achieve sustainability. According to the author, firms need to balance between economic, social and environmental sustainability.

McKinnon et al. (2010) and Wu and Dunn (1995) also agreed that sustainability can be achieved through characteristics of sustainable distribution, including improvement of freight distribution operations, accomplishment of environmentally friendly logistics structure and sustainable distribution, characterized by an improvement of truck space utilization (tonne-km), full-truck-loads, optimization of truck capacity, reduction of truck usage, and decreased vehicle travel distance and fuel usage, all of which help reduce emissions from vehicles and result in more efficient route scheduling. According to Krajewska et al. (2007), horizontal cooperation among freight carriers can improve space utilization, optimize truck capacity, reduce fuel and truck usage, as well as labour and driver costs, and minimize cost of freight movement. The authors concluded that collaborative freight operation is a critical component of sustainable distribution. Sutherland (2006) observed benefits of collaborative transportation in various US companies, concluding that CTM can result in on-time service improvement, reduction of lead time, improvement of sales volume, reduction of freight cost, reduction of administrative cost, reduction of deadhead mile, reduction of dwell-time, improvement of fleet utilization, and reduction of driver turnover. In addition, Vachon and Klassen (2008) and Mollenkopf et al. (2010) stated that autonomous firms can form an alliance that facilitates distribution and transport operations to reduce fuel usage by delivery vehicles, as well as improve delivery performance and fuel efficiency. Verstrepen et al. (2009) asserted that horizontal cooperation leads to freight sharing that, in turn, can substantially reduce costs and improve growth, resulting in sustainable development. According to Beamon (2008), inter-organizational relationships in freight management are essential when attempting to reduce the usage of fossil fuels, improve distribution efficiency and enhance transport performance, all of which are aimed at achieving sustainable distribution and improving sustainability performance.

Therefore, the following hypothesis will be tested in this work:

H5: Collaborative freight distribution has a positive effect on sustainable distribution.

4.3 Proposed conceptual framework

The section above identified relationship among concepts that arise from literatures. Thus, this study will reuse previous major concepts to model a more consistent framework. Next, the development of conceptual framework is provided (Figure 4.1), in order to clarify the reasons behind the inclusion of these major concepts and dimensions in the proposed conceptual framework. Thus, the conceptual framework to be adopted in this study comprises of four main concepts, with twelve sub-components (or measurement dimensions).

1) Co-opetition consists of three measurement dimensions—management commitment (MC), relationship management (RM), and communication management (CM)
2) Freight consolidation consists of location of freight consolidation centre (LO), geographical coverage (GC), and utilization of transport modes (UT).
3) Collaborative freight distribution consists of partner selection (PS), fair benefits and risks sharing (BR) and advanced information technology (IT).
4) Sustainable distribution consists of, economic factors (EC), social factors (SO), and environmental factors (EV)

4.3.1 Independent variables

Independent variable is the cause of the effects/dependent variables, also known as predictor variable or explanatory variable. It is a standalone variable and not influenced by other variables (Hair et al. 2010). For this study, co-opetition and freight consolidation are treated as independent variables, since they are expected to predict collaborative freight distribution and sustainable distribution, which are mediator and dependent variable respectively.

4.3.2 Dependent variable

Dependent variable is the variable that is affected/predicted/explained by independent variables. In other words, the dependent variable is influenced by independent variables (Hair et al. 2010). For this study, sustainable distribution is the only dependent variable and is expected to be explained by co-opetition concepts (independent variable), freight consolidation (independent variable), and collaborative freight distribution (mediator variable).

4.3.3 Mediator variable

Mediator is a variable that intervenes between independent and dependent variables. It is usually employed to examine indirect effects of independent variables on dependent variables. In other words, it helps examine whether the independent variables predict/influence the dependent variables when acting through the mediator variable (Hair et al. 2010). For this study, collaborative freight distribution is a mediator variable, since co-opetition concept and freight consolidation concept are expected to predict/influence sustainable distribution with an incorporation of collaborative freight distribution.

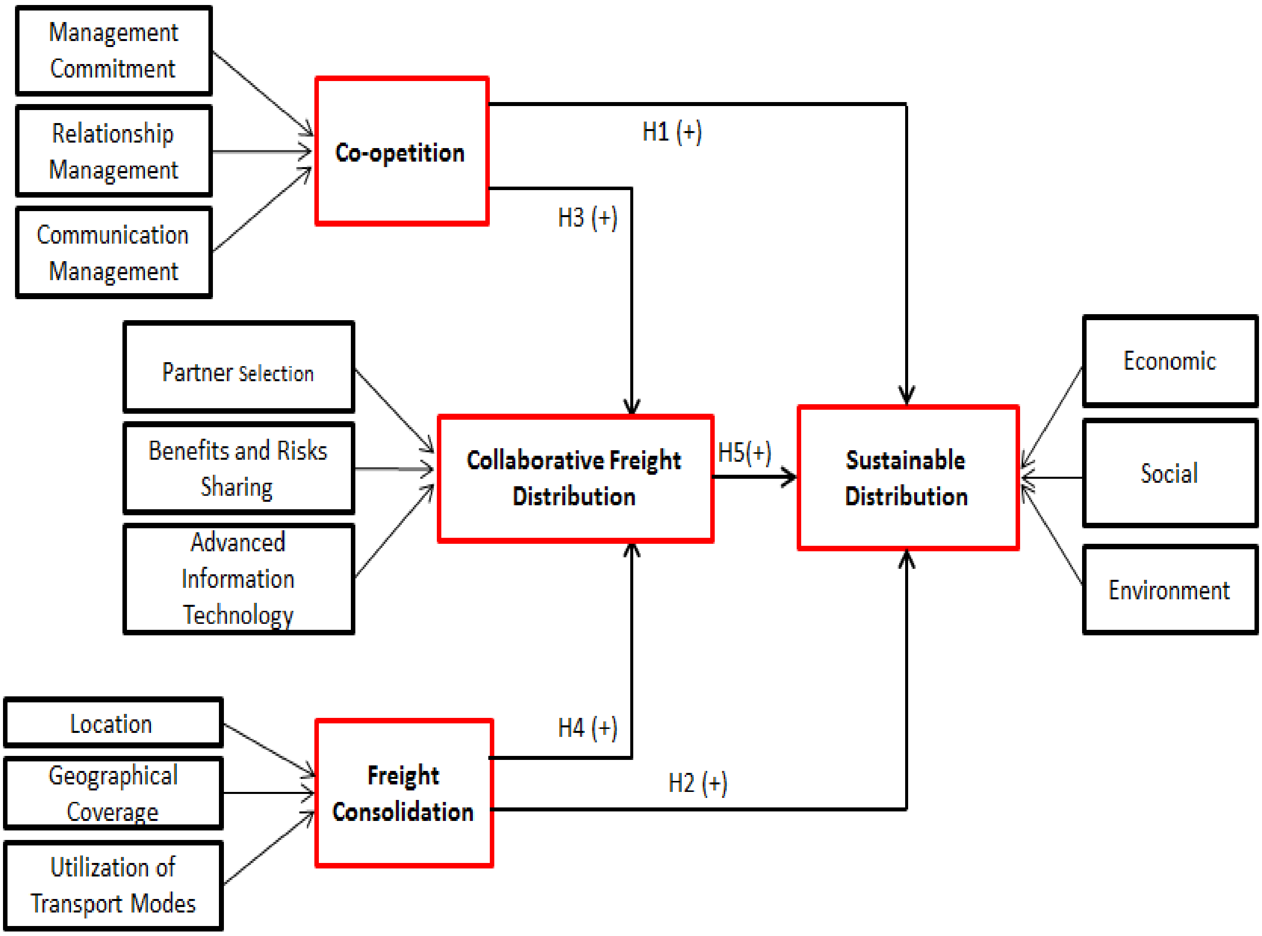


Figure 4.1: Conceptual framework

Based on the proposed conceptual framework (Figure 4.1), several hypotheses will be tested, aiming to answer:

1) Whether co-opetition is positively effect on sustainable distribution
2) Whether freight consolidation is positively effect on sustainable distribution
3) Whether co-opetition is positively effect on collaborative freight distribution
4) Whether freight consolidation is positively effect on collaborative freight distribution
5) Whether the collaborative freight distribution is positively effect on sustainable distribution

4.4 Conclusion

The purpose of this chapter was to propose the conceptual framework of this study, conceptualized from the relationship between co-opetition, freight consolidation, collaborative freight distribution, and sustainable distribution in the research context of Thailand newspaper industry sector. Hypotheses were developed based on evidence yielded by extant studies and will be tested by quantitative research methods presented in the next chapter.

CHAPTER 5

METHODOLOGY

5.0 Introduction

The purpose of this research is to identify factors influencing achievement of sustainable distribution in Thai newspaper industry. This empirical research intends to explore the relationship between several factors (e.g. co-opetition, freight consolidation, and collaborative freight distribution) as predictors affecting sustainable distribution. The quantitative research employed the mail survey as a data collection technique in order to gather information from cross-sectional sample of Thai newspaper companies, newsagents, and transporters operating in Thailand. This chapter presents details on research methodology, survey based research, sources of information, pilot study, population and sampling of the actual survey, mail survey procedure, development of final version of the questionnaire, validity and reliability, limitation of research methodology, and ethical issues. It concludes with the chapter summary.

5.1 Research methodology

Traditional quantitative research belongs to a positivist paradigm (Sachan & Datta 2005). The ontological position of the quantitative paradigm is that there is only one truth or one way mirror (Guba & Lincoln 1994), an objective reality that exists independent of human perception (Lincoln & Denzin 1994). Epistemologically, in quantitative research the investigator and investigated are independent entities. Veal and Ticehurst (2005) stated that statistical methods are suitable for positivist paradigm, which holds that the reality is external. In orther words, the researcher is independent from the external reality and, thus, needs to conduct a study to find out all facts and explain the reality through numerical measurments or quantitative research. Creswell (2009) explained positivism in terms of philosophy, inferring that it holds the basis for determining outcomes. The characteristics of the positivist paradigm (Ramanathan 2008) are presented in Table 5.1. This study uses appropriate statistical techniques as measures of high reliability and validity despite the low validity of positivist paradigm.

Table 5.1: Characteristics of positivist research paradigm (Ramanathan 2008)

Characteristics of research paradigm	
Factor	**Positivism**
Research procedures	Hypotheses and deduction
Observer	Must be independent
Concepts	Data must be measureable
Sample	Large and random
Data collection	Specific and precise
Human interests	Should be irrelevant
Data analysis	Simplified, fundamental
Reliability	High
Validity	Low
Explanations	Must demonstrate causality
Generalization	From sample to population

Veal and Ticehurst (2005) asserted that positivism usually emphasizes on deductive research processes (Figure 5.1). It is defined as a research process in which the researcher starts with the statements of predetermined facts, i.e., hypotheses formulation. Next, the researcher collects numerical data from individuals or firms, relevant to the phenomenon under investigation. Data are then analysed and the results used to either accept or reject the hypotheses.

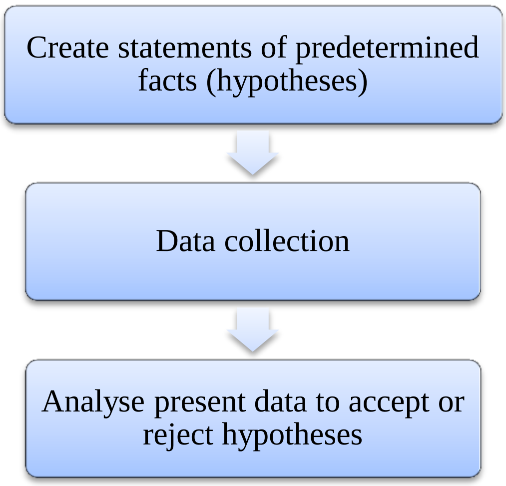


Figure 5.1: Flow of deductive research process

Creswell (2009) argued that numerical analyses are the most suitable tools for measuring potential causes of outcomes, as numerical results clearly show the relationship between causes and outcomes. Phillips and Burbules (2000) asserted that numerical measurement methods, or quantitative research, allow the researcher to identify and assess relevant causes and outcomes thereby accepting or rejecting the predetermined hypotheses. Referring to Veal and Ticehurst (2005), quantitative research involves the collection of data, analysis and presentation of numerical information. Thus, the acceptance or rejection of predetermined hypotheses is dependent on numerical evidence. However, large number of individuals or firms must be studied to assure the reliability of the results and findings. Therefore, this study is adopting the positivist approach and employing quantitative research method, through survey to test the hypotheses in order to answer the research questions.

5.2 Survey-based research

An empirical research method and survey-based research are common approaches in the field of marketing and management (Flynn et al. 1990). Boyer and Swink (2008) stated that researchers in the field of supply chain management often use empirical data to develop and validate business models. Survey-based research allows the researcher to elicit attitudes or perceptions of participants, which is known as perceptual measure. Therefore, survey technique was employed in this study to collect respondents' views pertaining to the study objectives. This research is using primary data collected through questionnaire responses provided by respondents from various firms. Primary data refers to new information that is collected for the primary use of a particular research project. According to Boyer and Swink (2008), primary data allows the researcher to test the current perceptions of participants toward a business circumstance under investigation. Data collected from firms is respondent-completed data, in that it represents individual beliefs or attitudes reported by the respondents. Veal and Ticehurst (2005) suggested this technique as cheaper, quicker and more anonymous than data obtained in face-to-face interviews or direct observations. However, there are some disadvantages of this approach including potential for patchy, frivolous, and incomplete responses. The data collection tool employed in this study is mail survey, conducted through a questionnaire specifically adapted for the purpose of this research. Thus, the primary data is yielded by questionnaire responses. The data collection procedure is separated into two phases, the pilot study phase and the full sample study, both of which will be presented later in this chapter.

A mail survey was chosen because this technique was cost-effective, required minimal interviewer involvement, was easier for participants who were not accessible in person, increased the survey population without increasing variable costs, and provided enough time for participants to think about questions. However, mail surveys generally result in low response (return) rates, especially unsolicited surveys. Thus, to mitigate this issue, questionnaire and individual items cannot be long or complex, as participants are more likely to be distracted (Cooper, Schindler & Sun 1998). The survey questionnaire utilized in this study was designed based on questionnaire design techniques suggested by Foddy (1994), Blumberg, Cooper, and Schindler (2008), Dillman (1978), Fowler (2008), Zikmund, Carr, and Griffin (2012), Bryman and Bell (2007), and Veal and Ticehurst (2005).

Veal and Ticehurst (2005) suggested specific methods that can increase the response rate when using a mail survey. First, according to the authors, questionnaires must be sent to the participants who are likely to have interest in the survey topic. Groves and Peytcheva (2008) argued that people who are more interested in the topic of the survey are more inclined to respond. Thus, in this study, the questionnaire was distributed to individuals that work in the area of supply chain management and logistics. Second, the length of questionnaire must be limited, as longer questionnaires often yield lower response rate. Third, questionnaire content must be easy to understand and the presentation must be simple. Fourth, the letter from the researcher that accompanies the questionnaire should be worded so that it helps increase the participants' interest in the study and thus improve the response rate. Fifth, a postage-paid pre-addressed return envelope should be attached with the questionnaire. Lastly, a reminder, such as a postcard, fax, email, or letter should be sent, as this strategy was shown to increase the response rate. After a predetermined timeframe, a reminder letter should be sent to participants to reiterate that their input is valued and state the significance of the study and the contribution they would make by completing the questionnaire. If participants have already retuned the questionnaires, they can ignore the reminder letter, but ideally a record should be kept and only those that have not responded should be issued the reminders. Kaplowitz, Hadlock, and Levine (2004) agreed that reminder letters are effective in increasing the survey response rate.

Oppenheim (2000) and Dillman (2000) suggested additional techniques that can be employed in order to increase the response rate. First, instructions related to, and purpose of, each section in the questionnaire must be well explained. Second, the researcher must certify that the given information will be treated confidentially. Third, questionnaire must be respondent-friendly and the questions must be easy and clear to interpret. In addition, questionnaire layout must be clear and simple, and colour should be used to enhance visual appeal. Fourth, a replacement questionnaire should be sent to all non-respondents, together with a letter explaining the significance of the study and value of their contribution. A final reminder should also be made via fax, telephone or mail a week or two after the replacement questionnaire was sent to non-respondents. Based on the above arguments, mail survey method is a sensitive technique but could be successfully implemented by following the suggestions from scholars.

Questions or measurement items employed in this study were adapted from the measures established in literature. In order to make responses uniform and facilitate subsequent analyses, questionnaire items were presented in a 5-point Likert-type scale, with 1 being "strongly disagree", 2 being "disagree", 3 as "neither agree nor disagree", 4 as "agree", and 5 being "strongly agree." The researcher chose the 5-point Likert-type scale format because the quantitative method was employed to measure qualitative factors. Allen and Seaman (2007) stated that a Likert scale allows data to be analysed more accurately, increases transparency, and can produce ordinal and interval data. Thus, by adopting this approach, data and results could be interpreted and presented more clearly and easier than other methods (Blumberg, Cooper & Schindler 2008; Dillman 1978). There are scholars in the field of SCM who have successfully employed Likert scale in their studies (i.e. Akintoye, McIntosh and Fitzgerald (2000); Chin, Chan and Lam (2008); Verstrepen et al. (2009); Rao (2002); Kotzab and Teller (2003); Murphy, Poist, and Braunschweig (1995); Nakano (2009); Alberti et al. (2000); Hageback and Segerstedt (2004); Vachon and Klassen (2008); Nyaga, Whipple, and Lynch (2010); Esper, Fugate, and Rapert (2008); Morris, Koçak, and Özer (2007); Azapagic (2003); Bowen et al. (2001); Mention (2011); Bouncken and Fredrich (2011); Whipple and Frankel (2000); Min et al. (2005); and Cruijssen, Cools, and Dullaert (2007)).

5.3 Sources of information

Sources that yielded useful information for this study's survey bases research were identified at official and government websites, including www.energy.go.th (Ministry of Energy of Thailand), www.industry.go.th (Ministry of Industry of Thailand), www.moph.go.th (Ministry of Public Health), www.mnre.go.th (Ministry of Natural resources and Environment), http://www.dmr.go.th (Department of Mineral Resources), www.doh.go.th, http://www.doh.go.th (Department of Highways), www.dlt.go.th (Department of Land transport), and www.sme.go.th (Office of Small and Medium Enterprises Promotion).

All of sources are official websites of the department of Thai government. Therefore, secondary data sources are valid in this research (Veal & Ticehurst 2005). These sources were useful for gathering information pertaining to currently relevant business, economic, social and public health, and environment and natural resources aspects. Not all these sources are cited in the literature review chapter, since they were used as guidance for the research.

5.4 Population and sampling frame for pilot and the full survey

The most important issue in survey method is sample representativeness of the population of respondents. In other words, the sample size must represent the target population. Since this research focuses on the supply chain and distribution of printed newspapers in Thailand, the sampling frame needs to include newspaper companies, newsagents and transport companies together they form a three echelon supply chain. Thus, firms from different regions of Thailand would allow the researcher to generalize the study findings for the whole nation.

These firms were identified from various sources, including Thai online Yellow Pages, Office of Small and Medium Enterprises Promotion (OSMEP) of Thailand, The Press Association of Thailand, Thailand Newspaper Industry Directory and National library. Target participant was restricted to large and medium size firms. Thai Government has defined medium enterprises as firms having annual turnover of less than THB200 million (or equivalent to approximately USD6 million) and employing less than 200 full time staff. Similarly, large firms' annual turnover should exceed THB200 million (or equivalent to approximately USD6 million) and number of employees should be greater than 200 (www.sme.go.th).

The selection of newspaper companies are limited to those producing printed newspapers. The newsagents are limited to those selling newspapers and other printed media. Finally, the transport companies are limited to large and medium size firms. Another sampling frame focuses on the job title of the participants. Chief executive officer, executive director, president, co-ordinator, director, chief distribution officer, chief logistics officer, chief marketing officer, distribution director, logistics director, and marketing director are the various positions related to the distribution activities and are held by individuals with high level of responsibility, and they are expected to answer the questions more accurately. These three industries deem appropriate target population for this research study.

5.5 Pilot Study

Prior to the actual data collection and data analysis, the researcher has undertaken a pilot study to test content validity of the questionnaire. In social research, a pilot study could yield two-fold benefits (Surrey 2001; Veal & Ticehurst 2005; Walker 2010). In one sense, it could be used as a feasibility test or a trial run for the actual data collection. In another sense, it could be used as a pre-testing phase for testing the research instruments. The above authors insisted that conducting a pilot study is a priori to the full sample data collection and analysis. This allows the researcher to test and ensure adequacy of the research instrument, assess the feasibility of the survey, estimate response rate, assess the likelihood of success of the proposed research methodology and instrument, assess the preliminary data analysis technique, check the appropriateness of wording, meaning and questions, and edit and develop research questions and measurement items. Thus, pilot study was undertaken in this research.

One week prior to commencing the pilot study, postcards were sent to the prospective participants, as mentioned in section 5.4, with a clear explanation of significance and objectives of the study. The pilot study started off on 19 November, 2012, whereby 150 questionnaires were distributed conveniently to the companies who took interest for this study: 50 questionnaires were posted to newspaper companies, 50 to newsagents and the remaining 50 to transport companies. Four weeks were allowed for the questionnaires to be returned. According to Roscoe (1969), the sample size between 30 and 500 is appropriate for most research purposes. By December 3rd, 2012, 19 questionnaires were returned by the respondents from newspaper companies, 12 by transporters, and 9 by newsagents, resulting in a response rate of 26.67%. The response rate appeared to be higher than anticipated of as postcards were sent to the targeted participants before distributing the questionnaires following the suggestion by Dillman (1978). Moreover, questionnaires were reviewed and commented on by four professionals prior to the start of the pilot. Two questionnaires were reviewed by two professionals from newspaper companies (a member from the board of directors and logistics manager), one professional from newsagents (logistics director), and one professional from transport company (Chief Executive Officer).

The researcher and supervisors went through the checklists provided by Litwin (1995), shown in Table 5.2, to confirm that the pilot test was appropriately administered.

Table 5.2: Checklist for Pilot Testing

Checklist for Pilot Testing
❖ Are there any typographical errors? ❖ Are there any misspelled words? ❖ Do the item numbers make sense? ❖ Is the type size big enough to be easily read? ❖ Is the vocabulary appropriate for the respondents? ❖ Is the survey too long? ❖ Is the style of the items too monotonous? ❖ Are there easy questions in with the difficult questions? ❖ Are the skip patterns too difficult? ❖ Does the survey format flow well? ❖ Are the items appropriate for the respondents? ❖ Are the items sensitive to possible cultural barriers? ❖ Is the survey in the best language for the respondents?

The pilot data was analysed for item-total correlation, normality check using QQ-test and exploratory factor analysis. This resulted in a number of items being dropped from 134 to 113, decreasing the length of the questionnaire from 18 to 14 pages, including the cover page. These questions were removed due to the issues of duplication, potential for unreliable responses, inconsistent meaning, and un-correlated items. Professionals also suggested to increasing the font size to make the questions and the questionnaire instructions easier to read and follow. They also suggested to adding questions eliciting demographic information, such as age and gender. Moreover, five questions were added at the end of Section B in the questionnaire for the purpose of testing Common Method Variance (CMV). According to Craighead et al. (2011, pp.578), CMV in supply chain management research is a “spurious correlation that arises from using the same method to measure the independent and dependent variables within a relationship.” Therefore, CMV must be considered to reduce likelihood of reaching erroneous findings and conclusions.

5.6 The full survey

The total target participants estimated for distributing the questionnaire was 1,000 firms operating nationwide. The target was to achieve 20% response rate. Moreover, the goal was to include adequate proportions of respondents from each sub-group. Details of the target population break up in different regions of Thailand are presented in Table 5.3.

Table 5.3: Details of target population

Regions	**Newsagent**	**Newspaper company**	**Transporter**	**Total**
	Population (N)	**Population (N)**	**Population (N)**	**Population (N)**
Central Thailand	59	109	64	232
Northern Thailand	38	53	52	143
Southern Thailand	47	61	59	167
Eastern Thailand	35	78	43	156
Western Thailand	41	51	58	150
North-eastern Thailand	48	49	55	152
Total	268	401	331	1000

The population of newspaper companies and newsagents appear to be small, thus the survey included all companies for participation in the survey. This led to an unbiased sampling (Veal & Ticehurst 2005). On the other hand, the transport companies were in larger proportion thereby half of the population was conveniently selected. Therefore, the study sample included 1,000 companies consisting of 268 newsagents, 401 newspaper companies and 331 transport companies nationwide.

5.7 Mail survey procedure

Three months were allocated for data collection which was conducted in two waves, each lasting six weeks. Employment of waves of data collection would allow the researcher to test the non-response bias and sample representativeness (Sheikh & Mattingly 1981). The first wave started on 11 March 2013 whereby 1,000 questionnaires (final version) were mailed out using Thai National Post. The questionnaire package included the questionnaire, consent form, letter providing the participants all relevant information about the study, and a stamped, self-addressed envelope for returning the questionnaire (see Appendix1). The participants who chose to complete the survey were asked to read and sign the consent form to certify that they were over 18 years old and free to participate or quit the survey if they choose to do so. The letter to the participant aimed to provide general information about the study. It was hoped that would increase the response rate as participants would understand the purpose and value of the study and would be more likely to take part in the research.

The first wave ended on 20 April 2013. At that time a total 58 completed questionnaires were returned by newsagents, 51 by transport companies, and 68 by newspaper companies. However, 74 incomplete questionnaires were returned, including 27 from newsagents, 23 from transport companies, and 24 from newspaper companies. The most common reason for not completing the questionnaire was closedown of the business the survey was mailed to, followed by change of address and incomplete address details.

A reminder letter was sent on 20 April 2013 to all participating companies reiterating the study significance and importance of the participation in the research. The second wave started on 22 April 2013 and ended on 31 May 2013. Additional 62 completed questionnaires were obtained, including 19 from newsagents, 16 from transport companies, and 27 from newspaper companies. However, 55 incomplete questionnaires were returned as well, of which 26 were addressed to newsagents, 20 to transport companies, and 7 to newspaper companies. So a total 368 questionnaires were received through two data collection phases. After detail scrutiny, 239 questionnaires were found usable that comprised of 77 newsagents, 67 transport companies, and 95 newspaper companies. This yielded the response rate of 23.9%. A summary of response rates pertaining to different regions and industries is presented in Table 5.4. The overall sample responses show about 20 per cent representation of the regions with a higher response of 32 per cent for central Thailand.

Table 5.4: Response rates pertaining to different industries and regions across Thailand.

Regions	Newsagent		Newspaper company		Transporter		Total	
	Response received	**Per cent**	**Response received**	**Per cent**	**Response received**	**Per Cent**	**Response received**	**Per cent**
Central Thailand	18	30.51	26	23.85	30	46.88	74	31.89
Northern Thailand	13	34.21	18	52.83	1	1.92	32	22.38
Southern Thailand	10	21.28	17	27.87	9	15.25	36	21.56
Eastern Thailand	11	31.43	6	7.69	16	37.21	33	21.15
Western Thailand	7	17.07	20	39.22	4	6.89	31	20.67
North-eastern Thailand	18	37.5	8	16.33	7	12.72	33	21.71
Total	77	28.73	95	17.06	67	20.24	**239**	**23.9**

5.8 Development of the Final version of the Questionnaire

As stated above, the questionnaire was revised based on the results of the pilot study and comments made by professionals who reviewed its content and evaluated its suitability. Moreover, the consent form and the letter conveying the study information to participants were revised according to the suggestions provided by Human Research Ethics Committee at Victoria University. The final version of the questionnaire followed the guidelines of Human Research Ethics Committee, to confirm that the research and data collection procedure ethically proceed.

The finalized questionnaire contained 113 questions, which are organized as follows: (the questionnaire is replicated in full in Appendix 1)

Section A - Driving factors for establishing co-opetitive relationship.

This section aims to seek participants' views/attitudes on factors that would be critical for the establishment of co-opetitive relationship. The factors being tested under this section are management commitment (ten questions), relationship management (seven questions), and communication management (seven questions).

Section B – Driving factors for enabling freight consolidation.

This section aims to seek participants' views/attitudes on factors that could enable freight consolidation. The factors being tested under this section are location of freight consolidation centre (eleven questions), geographical coverage (five questions), and utilization of transport mode (seven questions).

Additional section - Marker variables for Common Method Variance (CMV) test

This section was added in order to enable testing Common Method Variance. It consists of five questions about the top management team management practices. This set has nothing to do with the research objectives.

Section C – Driving factors for enabling collaborative freight distribution.

This section aims to seek participants' views on factors that enable collaborative freight distribution. The factors being tested under this section are partner selection (eleven questions), benefits and risks sharing (ten questions), and advanced information technologies (ten questions).

Section D – Sustainable distribution.

This section aims to seek participants' views on the potential benefits of improving freight management towards sustainable distribution. This section is separated into three sub-sections, respectively addressing environmental factor (thirteen questions), economic assets factor (fifteen questions), and social factor (seven questions).

Section E – Questions about participants' firm.

This section aims to elicit general information about participants' firm.

Section F – Questions about participants' demographics

This section aims to elicit general information about the participants.

Section G – Additional comments

This section allows participants to add additional comments, as well as to indicate whether they would like to receive a summary of the study findings, either directly or addressed to their firms.

5.9 Data analysis

The data set obtained from the survey is used in subsequent analyses, performed in two stages using the Statistical Package for Social Science (SPSS) and AMOS version 21. In the first stage, the data set was checked for data consistency via preliminary data analysis, consisting of missing value assessment, multivariate outliers, comparing respondents' characteristics, non-response bias assessment, multivariate normality assessment, multicollinearity test, unidimensionality test and common method variance assessment, for the purpose of data management and data cleaning. Moreover, EFA was also employed for the purpose of data exploration via SPSS. For the second stage, the data set from the first stage was analysed via AMOS, applying CFA and SEM. The aim of this analysis was finding the most appropriate observed variables (measurement items) pertaining to each latent variable (i.e. measurement dimensions), as well as testing the relationship between exogenous variables (independent variables) and endogenous variables (dependent variables). Each of the methodological techniques is explained below.

(a) Missing value assessment: This technique is used to identify any value that may be missing in the data set or any questions that were not completed by the respondents. Presence of missing values is not unusual for self-completed questionnaire surveys, as the researcher has little control over respondents answering the questionnaire (Veal & Ticehurst 2005). The problems of missing data in multivariate analysis stem from, firstly, the missing data potentially adversely affecting the adequate sample size because the questionnaire containing missing data has to be excluded from the data analysis if those missing data are not appropriately remedied. Secondly, the missing data may lead to erroneous research results (Hair et al. 2010). Finally, the missing data may negatively impact the fit measurement and saturated model in Structural Equation Modeling using AMOS (Arbuckle & Wothke 1999). Thus, any missing data must be carefully remedied to avoid unreliable research findings.

(b) Multivariate outliers assessment: This assessment technique is typically applied following the normality assessment. According to Hair et al. (2010), outliers refer to the distinctly different response values or observations pertaining to each measurement item. In other words, outliers are the observation values that are different to a unique combination of measurement items or the majority of the whole data set. The outliers may influence the data analysis if the proper action is not performed because extreme values may negatively influence the subsequent analysis. The outliers could be either retained or deleted, depending on how much they influence the data analysis results. Kripanont (2007) suggested that outliers could be assessed by SPSS, by calculating the Mahalanobis (D^2) distance. Mahalanobis distance refers to the distance of a particular observation value from the centre of the mean value of all observations (Tabachnick, Fidell & Osterlind 2001). According to Hair et al. (2010), the Mahalanobis measure should test each observation across a set of measurement items. The author suggested that the data value should be converted to a standard score with the mean of zero and a standard deviation of one. For small sample size, not exceeding 80 observations, the absolute standard score of the observation equal or above ±2.5 signifies presence of outliers. On the other hand, for a larger sample, exceeding 80 observations, outliers are identified by the absolute standard score of the observation in the ±3 range.

(c) Comparing respondents' characteristics: One-way analysis of variance (ANOVA) is employed to test whether the difference between respondents' demographic characteristics and their attitude towards measurement items is significantly different. If their attitudes are not statistically different, the data set can be used to represent population and the samples can be used as one element (Chen & Paulraj 2004; Li et al. 2006).

(d) Non-response bias assessment: Another method that can be applied to test sample representativeness of target population is non-response bias test (Armstrong & Overton 1977). The respondents in the first wave represent the respondents that are highly interested in the research topic and intended to devote their time to completing the questionnaire. The respondents in the second wave, however, reacted to the reminder notices and would have most likely been non-respondents otherwise. The respondents in the first wave are those who returned questionnaires between 13 March 2013 and 20 April 2013, and the respondents in the second wave are those who returned questionnaires between 21 April 2013 and 31 May 2013. The ANOVA was employed to test the difference in the attitudes of the two groups towards measurement items. A non-significant result would indicate no difference between respondents returning the completed questionnaires in different waves.

(e) Multivariate normality assessment: The basic requirement for SEM is that all data must follow a multivariate normal distribution (Hulland, Chow & Lam 1996). Multivariate normal distribution implies that individual measurement items, as well as combinations of measurement items, must be normally distributed (Hooley & Hussey 1994). Since SEM usually relies on the validity of multivariate normality assumption, non-normality of data will severely affect the standard error and goodness-of-fit indices (Baumgartner & Homburg 1996; Hulland, Chow & Lam 1996). Distributional properties of each measurement item were, therefore, reviewed to test the symmetry and ensure the data set normality. The normality of data is measured by assessing skewness and kurtosis of the measurement items. Skewness is used to indicate the symmetry of the distribution of the measurement items, whereby positive values indicate that data is clustered to the left (i.e. toward lower values). Similarly, negative skewness values indicate that data is clustered to the right (i.e., toward higher values).

On the other hand, kurtosis is used to indicate the peakedness of the data set distribution. Positive kurtosis values indicate that significant proportion of data is clustered in the centre and is peaked, whereas negative values indicate that data is more widely spread and the distribution is relatively flat (Pallant 2010). However, when the sample size is larger than 200, the skewness and kurtosis values were not expected to significantly influence the analysis (Tabachnick, Fidell & Osterlind 2001). As suggested by Chou and Bentler (1995), skewness exceeding 3.0 refers to a skewed data set. On the another hand, Hoyle (1995) and Kassim (2001) suggested that the value of kurtosis greater than 10.0 generates moderate non-normality and the value over 20.0 would generate severe non-normality. Referring to Appendix 2.4, in this research, the greatest value of skewness and kurtosis is .992 and 1.318, respectively. Therefore, the data set collected for this research is normally distributed and suitable for further analysis.

Pallant (2010) further advised testing whether the skewness and kurtosis values influence the mean value. Referring to the Appendix 2.5, the 5% Trimmed Mean means that the highest and lowest 5% of the values are removed from the sample and a new mean value was calculated. If the original mean value and the new one are not substantially different, the extreme values, as indicated from skewness and kurtosis values, do not influence the actual mean value.

There are other critical values that can be used to test the data set normality, namely Kolmogorov-Smirnov statistic and the normal probability plot (Normal Q-Q Plot). The Kolmogorov-Smirnov statistic is used to test the normality of the data set distribution. If the result is non-significant (the "Sig." value is greater than 0.05), then the data is normally distributed. However, all significance (sig.) values in this study were below 0.05. Fortunately, according to Pallant (2010), it is common for a large sample size to produce Sig. values below

0.05. Therefore, the Kolmogorov-Smirnov values less than 0.05 are assumed not to influence the analysis results substantially.

(f) Multicollinearity test: Multicollinearity refers to the situation when two or more variables or measurement items are highly correlated. A perfect lack of multicollinearity between variables occurs when their correlation coefficient value is 0.0, whereas a perfect multicollinearity occurs when their correlation coefficient value is 1.0 or -1.0, which means that one measurement item is predicted (correlation of 1.0) by another measurement item or a combination of several items (Var 1998). Since high correlation among variables may be harmful for multiple regression analysis and other multivariate data analyses, the value greater than 0.9 of any correlation between two or more variables must be remedied (Hair et al. 2010). However, Grewal, Cote, and Baumgartner (2004) and Hair et al. (2010) argue that the correlation coefficient between measurement items greater than 0.8 is considered as an extreme value. Clearly, using threshold of 0.8 would produce more reliable measurement items. Whenever correlation is noted, it can be remedied by either deleting one of the highly correlated variables, or combining those variables to form a new variable (Pallant 2010).

(g) Unidimensionality test: Unidimensionality suggests that the measurement item must belong to only one factor, i.e., it must load on only one factor. Cronbach's (1951) alpha coefficient and factor loading can assess unidimensionality of measurement items of each factor. Cronbach's alpha coefficient exceeding 0.7 indicates that the measurement items of a particular factor are reliable, since they are intending to measure the same factor (Carmines & Zeller 1979). Therefore, those measurement items exhibit unidimensionality (Nunnally 1978). On the other hand, factor loading exceeding 0.3 indicates that the measurement items are significant for the particular factor (Carmines & Zeller 1979; Kerlinger & Lee 1964; Pedhazur & Schmelkin 2013).

(h) Common method variance (CMV) assessment: Common method variance refers to the spurious covariance being shared among measurement items when a common method (i.e., questionnaire survey) is used to collect data (Buckley, Cote & Comstock 1990). As Podsakoff et al. (2003) state, common method variance refers to variance that is attributed to measurement method rather the measurement construct. It is thus seen as measurement error, since it could lead to a spurious correlation among measurement items. Therefore, the common method bias must be assessed and remedied. Common method variance can be assessed by Harman's single-factor test in EFA (EFA), and goodness-of-fit with marker-variable technique in CFA (Malhotra, Kim & Patil 2006). For Harman's single test, substantial common method bias occurs when (1) a single factor is unrotated and then extracted from the EFA, and (2) the first factor that was extracted explains the majority of the covariance among measurement items (Andersson & Bateman 1997; Aulakh & Gencturk 2000; Podsakoff et al. 2003).

For goodness-of-fit in CFA technique, common method bias can be assessed by modeling all measurement items as the indicators of a single factor. If the model fits the data well, common method biases are assumed to be substantial (Mossholder et al. 1998). On the other hand, Lindell and Whitney (2001) proposed a marker-variable technique to address common method bias. Marker variables are measurement items that are deliberately included into the data collection instrument, along with other measurement items, making sure that the marker variables are theoretically unrelated to other measurement items. Thus, common method variance can be assessed by the correlation between the marker variables and other measurement items or dimensions via CFA. For this study, such a correlation is denoted by r_m, which is an indicator of common method variance. The r_m can be derived by the average correlation between marker variable and other measurement items or dimensions. Once r_m is identified, it is used to calculate a CMV-adjusted correlation, which is the true correlation without common method variance, as proposed by Malhotra, Kim, and Patil (2006). The authors further claim that the common method bias can be identified by a chi-square difference test between the original correlation and the CMV-adjusted correlation of each measurement construct via CFA. If the difference of chi-square and degrees of freedom between the CFA without marker variables and the CFA with marker variables yields a non-significant result, it indicates that the effect of common method bias is not substantial.

(i) Exploratory factor analysis (EFA): The purpose of EFA is the data reduction or data summarization. The data set pertaining to each measurement item is calculated and clustered into a smaller group, based on their intercorrelations. EFA aims to meet three main objectives. First, it is used to identify the relationship or correlation between either respondents or variables. Second, it is used to identify representative variables from a large set of variables. Lastly, it is used to create a smaller new set of variables to replace the original set of variables (Hair et al. 2010).

Alongside with EFA, the suitability of the data set for EFA must be assessed. First, since factor analysis is based on the correlation among measurement items, at least some of the measurement items must have the correlation coefficient greater than 0.3 (Tabachnick, Fidell &

Osterlind 2001). As the author suggested, if fewer correlations exceeding 0.3 are found, EFA is inappropriate. In this research, the correlation matrix identified presence of many correlations between variables of each measurement construct that exceeded 0.3. Second, Pallant (2010) suggests that the value of Bartlett's test of sphericity of each variable set should be significant ($p < .05$), otherwise factor analysis is inappropriate (Bartlett 1954). Third, Pallant (2010) also suggests that the value of Kaiser-Meyer-Olkin (KMO) must greater than 0.6 for a good EFA (Kaiser 1970).

Regarding factor extraction by EFA, Kaiser's criterion was employed in this study, in order to consider the factor levels pertaining to each measurement construct. Kaiser's criterion is also known as the eigenvalue rule, whereby the eigenvalue indicates the loading of the sum of squared values for a particular factor. In other words, it represents the variance accounted for by the factors (Hair 2009). According to the rule, the factors with eigenvalue greater than 1.0 are considered significant and should be retained for the further analysis.

Once the factors are identified, the communalities and factor loading values are the next concerns. Communalities refer to the proportion of the variance in the original measurement items that are accounted for by the factor solution. Since measurement items should share some common variance with other measurement items, the communality values should be greater than 0.3, otherwise the items should be deleted (Neill 2008; Pallant 2010). Factor loading refers to the degree of correspondence between measurement items and the latent factor; hence, the high loading indicates that the measurement items are representative of the factor. In other words, the factor loading represents the role of each measurement item in defining the factor (Hair 2009). Hair et al. (2010) suggest that the factor loading of each measurement item should be above 0.5 in order to generate a more reliable factor. Therefore, measurement items with the factor loading less than 0.5 should be eliminated.

(j) Confirmatory factor analysis (CFA): CFA is employed to test how well the measurement items represent the constructs. It is also used to ensure that the measurement items (questions) are valid and reliable (unidimensional) for the constructs. Cronbach's alpha cannot ensure unidimensionality, though it is useful for identifying presence of unidimensionality (Hamid 2006). For this study, CFA is employed to confirm that the measurement items are in fact measuring the construct extracted by EFA. Thus, the measurement items and construct are tested based on the factors generated in EFA results.

(k) Structural equation modeling (SEM): SEM refers to a multivariate technique that allows the researcher to simultaneously examine series of relationships between exogenous and endogenous variables. It can be employed for theory development and theory testing. The goodness or fitness of structural model can be assessed by interpreting goodness-of-fit (GOF) index. The measurement of fitness of the model for CFA and structural model can be justified by three main types of indices, namely incremental fit indices, absolute fit indices and parsimony fit indices (Hair et al. 2010). These indices are summarized in Table 5.5.

Incremental fit measures

An incremental fit measures test GOF by comparing the standard hypothesized model with the hypothesized model (Byrne 2009). Hamid (2006) suggests that Tucker Lewis Fit Index (TLI) and Bentler's Comparative Fit Index (CFI) be reported for incremental fit measures, since the normed fit index (NFI) may yield unreliable results when the model is complex (Hair et al. 2010). These measures are used to indicate an improvement of the overall fit of the hypothesized model with respect to the null model.

CFI is employed to compare the hypothesized model with the null model and tests the complete covariance of the data set, whereby a value close to zero indicates a poor fit, whereas a value close to one indicates a good fit. The value equal to or above 0.9 indicates moderate fit, while value greater than 0.95 indicates a good fit (Byrne 2009; Hu & Bentler 1999). TLI is an alternative measurement used to compare the hypothesized model with the null model. Similarly to CFI, a value close to zero indicates a poor fit and the value greater than 0.95 indicates a good fit. However, the value greater than 1 indicates an overfit of the model (Weston & Gore 2006). NFI is an original incremental fit index. As the value ranges between 0 and 1, the value closer to 1 indicates a better fit (Hair et al. 2010).

Absolute fit measures

An absolute fit measures technique is employed to measure the overall fit of the measurement and the structural model (Hair et al. 2010). It comprises four indices—Chi-square probability level (χ^2), relative Chi-square (CMIN/df), goodness-of-fit index (GFI), root mean square error of approximation (RMSEA) and p of close fit (PCLOSE)

Chi-square probability level (χ^2) is the most fundamental absolute fit index. The purpose of χ^2 is to compare the observed (measurement items) covariance and the estimated covariance.

Thus, a significant value ($p < 0.05$) indicates a poor fit, whereas a non-significant value ($p > 0.05$) indicates a good fit which designate the indifference between observed and estimated covariance (Baumgartner & Homburg 1996). Relative Chi-square (CMIN/df) is employed to support χ^2, since χ^2 is sensitive to the sample size. As a sample size increases, χ^2 tends to increase. Thus, a large sample size is likely to produce a significant result when it is actually non-significant (Byrne 2009). To remedy this issue, Hamid (2006) suggests dividing χ^2 by the degrees of freedom in order to reduce the sensitivity of χ^2 statistics. According to Kline (2011), the value less than 3.0 indicates good overall fit.

Goodness-of-fit index (GFI) attempts to produce a fit statistics that is less sensitive to sample size. Here, a value close to zero indicates poor fit, while a value equal or greater than 0.9 indicates a good fit (Hair et al. 2010). Root mean square error of approximation (RMSEA) is used to measure GOF irrespective of the sample size. Thus, RMSEA can indicate how well the model fits the population, rather than the observed sample (Hair et al. 2010). A value equal or less than 0.08 indicates a good fit. In contrast, p of close fit (PCLOSE) is used to test whether RMSEA is good in the population. A value greater than 0.5 indicates a good fit (Byrne 2009).

<u>Parsimony Fit Indices</u>

Parsimony fit indices approach is used to identify the hypothesized model that represents the best fit, when compared to other competing hypothesized models. Typically, a more complex model would appear to be better fit (Hair et al. 2010). Thus, parsimony fit indices approach is not useful when attempting to measure GOF of a single model, but rather helps compare two or more models that are more complex (Byrne 2009).

Adjusted goodness of fit index (AGFI) is used to compare the difference between complexity degrees of different models. Its value ranges from zero to one, and the value closer to one indicates a better fit (Byrne 2009). Normed fit index (NFI) is used to compare competing models, whereby relatively higher value is associated with a model that represents a relatively better fit (Hair et al. 2010). Table 5.5 provides recommended threshold values of goodness-of-fit indices.

Table 5.5: Summary of fit measures' indications

Fit measures	**Fit measures' indications**
Bentler's Comparative Fit Index (CFI)	A value equal or above 0.9 indicates moderate fit, while a value greater than 0.95 indicates a good fit.
Tucker Lewis Fit Index (TLI)	A value greater than 0.95 indicates a good fit and a value greater than 1 indicates an overfit of the model
Chi-square probability level (χ^2)	Significant value ($p < 0.05$) indicates a poor fit, whereas a non-significant value ($p > 0.05$) indicates a good fit.
CMIN/df Relative Chi-square (CMIN/df)	The value less than 3.0 indicates overall fit.
Goodness-of-fit index (GFI)	A value close to 0 indicates poor fit, while the value equal to or greater than 0.9 indicates a good fit.
Root mean square error of approximation (RMSEA)	A value equal to or less than 0.08 indicates a good fit.
Adjusted goodness of fit index (AGFI)	A value closer to one indicates a better fit.
Normed fit index (NFI)	A value closer to 1 indicates a better fit.
P of close fit (PCLOSE)	A value greater than 0.5 indicates a good fit.

5.10 Reliability and validity

Reliability and validity tests are usually performed by researchers for the purpose of reducing measurement error. Reliability refers to the degree to which the measurement items are measuring the true value and are free from error, both across different situations and over time (Hair et al. 2010). Cronbach's alpha is the most widely used approach for testing internal consistency of the measurement (Churchill 1979). Cronbach's alpha exceeding 0.7 indicates that the measurement items share the common core of the constructs and are hence reliable (Nunnally 1978). However, Hair et al. (2010) argued that the threshold value of Cronbach's alpha can be decreased to 0.6 in exploratory research. Moreover, construct reliability is also considered in CFA and SEM. Construct reliability is employed to test the internal consistency of the set of measurement items, in order to ascertain that they are measuring what they are intending to measure, with respect to the constructs and latent variable. Further discussion on reliability calculation is available in Chapter 7.

In the context of this study, validity implies that the survey instruments must assess what they intend to assess. In other words, the instrument must be appropriately implemented to examine or assess the research questions and nothing else. Four measurement techniques can be applied to assess the validity, respectively measuring face, content, criterion, and construct validity. In this research, face, content, criterion and construct assessment were performed (Litwin 1995).

With respect to face assessment, the final version of the questionnaire was quickly read by peer researchers, which allowed the author to establish whether they were able to understand the content correctly, in line with the purpose of the study. This test confirmed that the questionnaire was easy to understand, free from ambiguity and thus suitable for use as data collection instrument. For the purpose of content assessment, the final version of the questionnaire was read by three professionals in the field of logistics, all of whom agreed that the content was appropriate and did not make any suggestions for modifications. With respect to criterion assessment, it was implicitly verified, as the questions were adapted from literature sources in the field of co-opetitive relationship (Cheng, Yeh & Tu 2008; Chin, Chan & Lam 2008; Das & Teng 2000; Morris, Koçak & Özer 2007), freight consolidation (Browne et al. 2005; Collins, Henchion & O'Reilly 1999; González-Ramírez & Askin 2009), collaborative transportation management (Cruijssen, Cools & Dullaert 2007; Sutherland 2006), and sustainability (Azapagic 2003; Juš ius & Snieška 2008; Murphy, Poist & Braunschweig 1996; Ranganathan 1998).

As the survey instrument was successfully utilized in many studies, it was deemed appropriate for the present research. Therefore, all the questions included in the final version of the questionnaire are valid and assess what they are intending to assess. Nonetheless, construct validity (i.e. convergent and discriminant validity) was also assessed in CFA and SEM. This helped assess the consistency of the measurement items under each measurement construct (Hair et al. 2010). Further discussion on validity calculation is available in Chapter 7.

5.11 Limitations of the chosen research methodology

As in any study, some limitations affect this research. First, the data was collected from newspaper companies, transport companies and newsagents operating in Thailand. Thus, it is likely that the questionnaire responses would vary and the analysis results would be different if the survey was conducted in a different country. Second, the main purpose of this study is to assess newspaper distribution sustainability in newspaper industry. Thus, the findings cannot be generalized to other industries. Moreover, uncontrollable effects and external factors that affect the attitudes and views of respondents with respect to the constructs measured in this study may change over time. As Carral and Kajanto (2008) argued, no industry is stable. Therefore, if the same study will be repeated in the future, it would possibly produce different findings.

5.12 Ethical issues

When conducting research that examines human activities and requires human participation, both the researcher and the supervisor must exhibit ethical behaviour (Veal & Ticehurst 2005). Thus, the research method, survey procedure, consent form, Ethical application, and information sheets to participants were proposed and approved by the Human Research Ethics Committee of the Victoria University before the survey was conducted. Moreover, the respondents were reassured that all data they provide will be guaranteed confidentiality and that their participation would be anonymous.

5.13 Conclusion

This research is an empirical research that employed cross sectional survey method. The mail survey, in the form of self-reported questionnaire, was used as the primary data collection instrument. This chapter undertakes discussion on data collection methods, various statistical tools and techniques that are employed for data cleaning, reliability & validity test, multivariate outliers assessment, respondents' characteristics comparison, non-response bias assessment, multivariate normality assessment, multicollinearity test, unidimensionality test, common method variance assessment, EFA, CFA, and structural equation modeling. The final version of questionnaire derived from the result of pilot study. The full survey yielded 239 usable questionnaires, corresponding to 23.9% response rate, which was adequate for preliminary data analysis as presented in Chapter 6 and SEM in Chapter 7.

CHAPTER 6

PRELIMINARY DATA ANALYSIS

6.0 Introduction

This chapter presents preliminary data analysis. The aim is to test and present results pertaining to sample size adequacy and demographic profile of respondents—conducted for the purpose of establishing representativeness of survey respondents. Missing value assessment, multivariate outlier assessment, comparing respondents' characteristics, non-response bias assessment, multivariate normality assessment, multicollinearity test, unidimensionality test and common method variance assessment were undertaken for the purpose of data management and data cleaning. Further, EFA was conducted for factor reduction resulting in fewer factors used in CFA.

6.1 Sample size

The sample size (n = 239) obtained in this study must be assessed for its representativeness of the population from which the sample was drawn. According to Sekaran (2006), sample size affects the representativeness of the sample and generalizability of the study findings to the wider population of interest. Roscoe (1969) recommended that the sample size between 30 and 500 is appropriate for most research purposes. Moreover, the minimum sample size, when the sample is divided into sub-groups, should be 30 samples for each group. According to Pallant (2010), ANOVA testing requires at least 30 members for each group. Hair et al. (2010) proposed that the sample size as small as 50 can produce valid results. However, structural equation modeling (SEM) requires larger sample size 150 to 400 and the minimum of 100 to150 to ensure valid Maximum Likelihood (ML) estimation results. Since the sample size obtained in the present study is 239, which consists of 77 newsagents, 95 newspaper companies, and 67 transport companies, the minimum sample size requirement is satisfied and representativeness of population is ensured.

Prior to the preliminary data analysis, a review of demographic characteristics of the respondents is presented to ensure sample representativeness.

6.2 Demographic profile of respondents

First, the researcher presented general information and statistics pertaining to the respondents' demographic profiles. Later in this chapter, the researcher used this information to compare the mean score of attitude/perception toward the measurement items, and to ensure sample representativeness through one-way analysis of variance (ANOVA).

The respondents were categorised in to eight demographic characteristics (i.e., type of industry, region in which their company was located, job title, company annual revenue, owned distribution facilities, education, gender, and age). Summaries of these demographic characteristics are presented in Tables 6.1 – 6.7.

Table 6.1: Summary of respondents demographic characteristics by type of industry and region (N = 239)

By region	**Newsagent**		**Newspaper company**		**Transporter**		**Total**	
	Frequency	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**
Central Thailand	18	24.32	26	35.13	30	40.54	74	30.96
Northern Thailand	13	40.62	18	56.25	1	3.13	32	13.39
Southern Thailand	10	27.78	17	47.22	9	25	36	15.06
Eastern Thailand	11	33.33	6	18.18	16	48.48	33	13.81
Western Thailand	7	22.58	20	64.52	4	12.9	31	12.97
North-eastern Thailand	18	54.54	8	24.24	7	21.21	33	13.81
Total	77	32.22	95	39.75	67	28.03	239	100

Industry: As shown in Table 6.1, 32.22% of respondents work in newsagent industry, with the remaining 39.75% and 28.03% employed by newspaper and transport companies, respectively.

Region: As shown in Table 6.1, respondents were located in six main regions of Thailand, and were geographically distributed as follows: 30.96% from Central Thailand, 13.39% from Northern Thailand, 15.06% from Southern Thailand, 13.81% from Eastern Thailand, 12.97% from Western Thailand, and 13.81% from North-Eastern Thailand. This indicates a good and wide coverage of the sample representing Thailand as whole.

Table 6.2: Summary of respondents demographic characteristics by type of industry and job title (N = 239)

By job title	Newsagent		Newspaper company		Transporter		Total	
	Frequency	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**
Chief executive officer	26	70.27	5	13.51	6	16.21	37	15.48
Executive director	5	35.71	2	14.29	7	50	14	5.86
President	2	18.18	4	36.36	5	45.45	11	4.6
Co-ordinator	3	21.43	4	28.84	7	50	14	5.86
Director	12	31.58	5	13.16	21	55.26	38	15.9
Chief distribution officer	7	33.33	6	28.57	8	38.1	21	8.79
Chief logistics officer	2	20	7	70	1	10	10	4.18
Chief marketing officer	2	66.67	1	33.33	0	0	3	1.26
Distribution director	2	8	17	68%	6	24	25	10.46
Logistics director	7	14	37	74	6	12	50	20.92
Marketing director	9	56.25	7	43.75	0	0	16	6.69
Total	77	32.22	95	39.75	67	28.03	239	100

Job title: As shown in Table 6.2, respondents were categorized into 11 job tiles. Of these titles, 15.48% held a position of CEO, 5.86% had a title of executive director, 4.6% were given a role of president. Nonetheless, 5.86% worked as a co-ordinator, 15.9% had a function of director, 8.79% were chief distribution officer, 4.18% were chief logistics officer, 1.26% was chief marketing officer, 10.46% were distribution director, 20.92% were logistics director, and 6.69% were marketing director.

Table 6.3: Summary of respondents demographic characteristics by type of industry and annual revenue (N = 239)

By annual revenue	Newsagent		Newspaper company		Transporter		Total	
	Frequency	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**
Below 50 Billion baht	58	48.33	31	25.83	31	25.53	120	50.21
Between 51 million and 200 million baht	15	19.74	43	56.58	18	23.68	76	31.8
Between 201 million and 500 baht	4	12.12	16	48.48	13	39.39	33	13.81
Between 501 and 1000 million baht	0	0	3	50	3	50	6	2.51
Above 1000 million baht	0	0	2	50	2	50	4	1.67
Total	77	32.22	95	39.75	67	28.03	239	100

Annual revenue: As shown in Table 6.3, respondents were categorized into 5 groups, based on their company's annual revenue. The responses revealed that 50.21% of companies earned below 50 million baht annually, 31.8% earned between 51 million and 200 million baht annually, 13.81% earned between 201 million and 500 million baht annually, 2.51% earned between 501 million and 1000 million baht annually, and 1.67% earned above 1000 million baht annually. The currency exchange is 1 USD = 32.59 THB as on 16 June 2014 (Bangkokbank 2014).

Table 6.4: Summary of respondents' demographic characteristics by type of industry and owned distribution facilities (N = 239)

By owned distribution facilities	**Newsagent**		**Newspaper company**		**Transporter**		**Total**	
	Frequency	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**
Yes	30	21.9	51	37.23	56	40.8	137	57.32
No	47	46.08	44	43.14	11	10.78	102	42.68
Total	77	32.22	95	39.75	67	28.03	239	100

Owned distribution facilities: As shown in Table 6.4, 57.32% of companies had their own distribution facilities, whereas 42.68% did not own any distribution facility.

Table 6.5: Summary of respondents' demographic characteristics by type of industry and education (N = 239)

By education	**Newsagent**		**Newspaper company**		**Transporter**		**Total**	
	Frequency	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**
Certificate	5	71.43	0	0	2	28.58	7	2.93
Diploma	8	30.77	10	38.46	8	30.77	26	10.88
Bachelor	49	36.5	55	41.04	30	22.39	134	56.07
Graduate diploma	8	22.22	21	58.33	7	19.44	36	15.06
Master	7	19.44	9	25	20	55.56	36	15.06
Total	77	32.22	95	39.75	67	28.03	239	100

Education: As shown in Table 6.5, most of the respondents held a Bachelor's degree (56.07%), followed by graduate diploma and master's degree (15.06%), 10.88% had only a high school diploma, and 2.93% held a certificate.

Table 6.6: Summary of respondents' demographic characteristics by type of industry and gender (N = 239)

By gender	**Newsagent**		**Newspaper company**		**Transporter**		**Total**	
	Frequency	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**
Male	39	26.53	67	45.27	42	28.57	148	61.92
Female	38	41.76	28	30.77	25	27.47	91	38.08
Total	77	32.22	95	39.75	67	28.03	239	100

Gender: As shown in Table 6.6, the study respondents were predominantly male (61.92%), versus 38.08% female.

Table 6.7: Summary of respondents' demographic characteristics by type of industry and age (N = 239)

By age (years)	**Newsagent**		**Newspaper company**		**Transporter**		**Total**	
	Frequency	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**
21-30	13	29.54	21	47.72	10	22.72	44	18.41
31-40	34	40.96	29	34.93	20	24.09	83	34.73
41-50	9	17.65	22	43.14	20	39.22	51	21.34
51-60	14	28.58	19	38.78	16	32.65	49	20.50
60+)	7	58.33	4	33.33	1	8.33	12	5.02
Total	77	32.22	95	39.75	67	28.03	239	100

Age: As shown in Table 6.7, the respondents were classified into five groups according to their age, indicating that 18.41% of respondents were between 21-30 years, 34.73% were 31-40 years, 21.34% 41-50 years, 20.50% were 51-60 years, and 5.02% were older than 60 years of age.

6.3 Missing values assessment

Missing value assessment is the technique used to assess any value that may be missing in the data set or identify measurement items that respondents failed to complete. In this survey, the respondents did not answer some questions. There were 11 respondents that did not complete few items in the questionnaire, leaving 20 questions unanswered. They were contacted immediately via email and phone number and were asked to answer the unanswered questions. This rapid reaction helped to ensure that the respondents would still remember the content and purpose of the questionnaire and would be more likely to provide responses relevant to the research topic. As a result, all missing data was remedied, resulting in a complete data set (Appendix 2.3).

6.4 Multivariate outliers

Multivariate outliers refer to the observation values that are different from a unique combination of measurement items or the majority of the whole data set. In this research study, the standard scores (Z-score) assessment technique was employed to assess outliers. None of the Z-score of measurement items less than -3 or exceeded 3 ($-2.62 \leq z \leq 2.41$) (Hair et al. 2010), (refer Appendix 2.6). Therefore, all observations were used in further analysis.

6.5 Comparing respondents' characteristics

One-way analysis of variance (ANOVA) was employed to compare the attitudes of respondents toward questionnaire (i.e. measurement items) whose demographic characteristics differed. If their perceptions are not affected by their demographic characteristics, the data set can be used to represent the wider population from which the sample was drawn and the entire sample can be used as one element in subsequent data analyses (Chen & Paulraj 2004; Li et al. 2006).

The ANOVA results of attitude versus measurement items are presented in Appendix 2.1.The attitude of respondents of newspaper companies, newsagents and transporters towards measurement items were nearly identical, since F-values of only 11 questions out of 113 questions were found significant ($p < 0.05$). These 11 questions included items MC_1.1, MC_1.9, RM_ 2.3, RM_2.6, CM_3.3, LO_4.3, LO_4.11, UT_6.3, PS_7.7, IT_9.2, and SO_10.3.5. In other words, respondents across the three industries have similar attitudes towards measurement items. The questions that yielded significant F-values were removed as a result of factor analysis, which would further reduce biasness. This process is shown in Figure

7.1 to Figure 7.4, indicating the effect of removal of these items, based on the CFA. Therefore, apart from above 11 items, the remaining measurement items can represent the attitude of all companies in newspaper, transporter and newsagent industry (Chen & Paulraj 2004; Handfield & Bechtel 2002; Moberg et al. 2002).

6.6 Non-response bias

Non-response bias test was employed to test whether data provided by respondents in the first wave differed from those obtained in the second wave (Armstrong & Overton 1977; Studer et al. 2013). Responses received in both waves are almost identical, since only two questions yielded significant difference ($p < 0.05$), namely questions 9.5 and X5 (refer Appendix 2.2). Thus, it can be concluded that respondents in both waves have similar attitudes towards the study topics and measurement items. Question 9.5 was removed as a result of CFA. Therefore, these results can certify that the sample can represent population (Li et al. 2006; Singh, Power & Chuong 2011).

6.7 Multivariate normality assessment

Multivariate normality of individual measurement items, as well as any combination of measurement items, must be normally distributed (Hooley & Hussey 1994). Result showed that data related to each measurement item was normally distributed as skewness value was below 3.0 (Chou & Bentler 1995) and the value of kurtosis was less than 10.0 (Hoyle 1995; Kassim 2001). (See Appendix 2.4) Moreover, when top and bottom 5% of the value set were excluded, the new mean was different from the original by only 0.06. Therefore, the extreme values did not influence the original mean value in this study (Pallant 2010). Nonetheless, Q-Q plot of each measurement items was generated, revealing that all data were scattered closely to a straight line. Thus, the data set is confirmed to be normally distributed (Hair et al. 2010).

6.8 Multicollinearity

Multicollinearity refers to the situation when two or more variables or measurement items are highly correlated which means that one measurement item is predicted by another measurement item, or more than one item (Var 1998). Result indicated that three pairs of measurement items were highly correlated that is correlation was greater than 0.8. These were measurement items UT_6.1 and UT_6.2 ($r = 0.85$), BR_8.1 and BR_8.2 ($r = 0.80$) and EC_10.2.11 and EC_10.2.12 ($r = 0.84$). In such cases, one of the items in the pair should be deleted (Grewal, Cote & Baumgartner 2004). As the results, items UT_6.2, BR_8.1, EC_10.2.12 were deleted, which justified by the lower factor loading in EFA (See Appendix 2.7). Therefore, all remaining measurement items are free from multicollinearity issue.

6.9 Common Method Variance (CMV)

Common method variance refers to the spurious covariance being shared among measurement items when common method (i.e. questionnaire survey) is used to collect data (Buckley, Cote & Comstock 1990). In a survey based study, the subjects respond to the questionnaire items at the same point in time, thereby the data are likely to be susceptible to CMV. It can be assessed by Harman's single-factor test in EFA (EFA), and goodness-of-fit indices with marker-variable technique in CFA (Malhotra, Kim & Patil 2006).

The results of Harman's single-factor test (Table 6.8) indicated that total 27 factors were extracted when all of the items were subject to EFA. The first factor accounted for 19.89% of variance explained, which did not explain the majority of the variance among variables. Therefore, Harman's single test findings confirmed that common method bias was not substantially exist in the data (Andersson & Bateman 1997). As an alternative to EFA, CFA can be used to test CVM as below.

Table 6.8: Total variance explained by Harman's single factor EFA test (selective screen shot)

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	23.475	19.894	19.894	23.475	19.894	19.894
2	8.888	7.532	27.427	8.888	7.532	27.427
3	7.053	5.977	33.403	7.053	5.977	33.403
4	5.561	4.713	38.116	5.561	4.713	38.116
5	4.397	3.726	41.842	4.397	3.726	41.842
6	2.801	2.374	44.216	2.801	2.374	44.216
7	2.707	2.294	46.510	2.707	2.294	46.510
8	2.585	2.191	48.701	2.585	2.191	48.701
9	2.281	1.933	50.634	2.281	1.933	50.634
10	2.112	1.790	52.424	2.112	1.790	52.424
11	2.045	1.733	54.157	2.045	1.733	54.157
12	1.895	1.606	55.762	1.895	1.606	55.762
13	1.695	1.437	57.199	1.695	1.437	57.199
14	1.656	1.403	58.602	1.656	1.403	58.602
15	1.576	1.335	59.938	1.576	1.335	59.938
16	1.520	1.288	61.226	1.520	1.288	61.226
17	1.453	1.231	62.457	1.453	1.231	62.457
18	1.305	1.106	63.563	1.305	1.106	63.563
19	1.264	1.072	64.635	1.264	1.072	64.635
20	1.219	1.033	65.668	1.219	1.033	65.668
21	1.217	1.031	66.699	1.217	1.031	66.699
22	1.178	.999	67.698	1.178	.999	67.698
23	1.129	.957	68.654	1.129	.957	68.654
24	1.123	.951	69.606	1.123	.951	69.606
25	1.105	.936	70.542	1.105	.936	70.542
26	1.091	.925	71.466	1.091	.925	71.466
27	1.013	.858	72.324	1.013	.858	72.324

In the CFA approach, all the manifested variables were modelled as an indicator of a single factor that assumed to have method effects. The goodness-of-fit of the single factor CFA model is depicted in Figure 6.1. The result shows high chi-square value with significant p-value (i.e. χ^2= 18122.70, p = .000, CMIN/DF = 2.92), and the fit indices are below the threshold values (GFI = .29, AGFI = .27, CFI = .31, TLI = .29, NFI = .23 and RMSEA = .09), and didn't fit the data. Therefore, common method bias is not an issue. However, EFA and CFA are subject to limitations, thus Marker variable technique was employed.

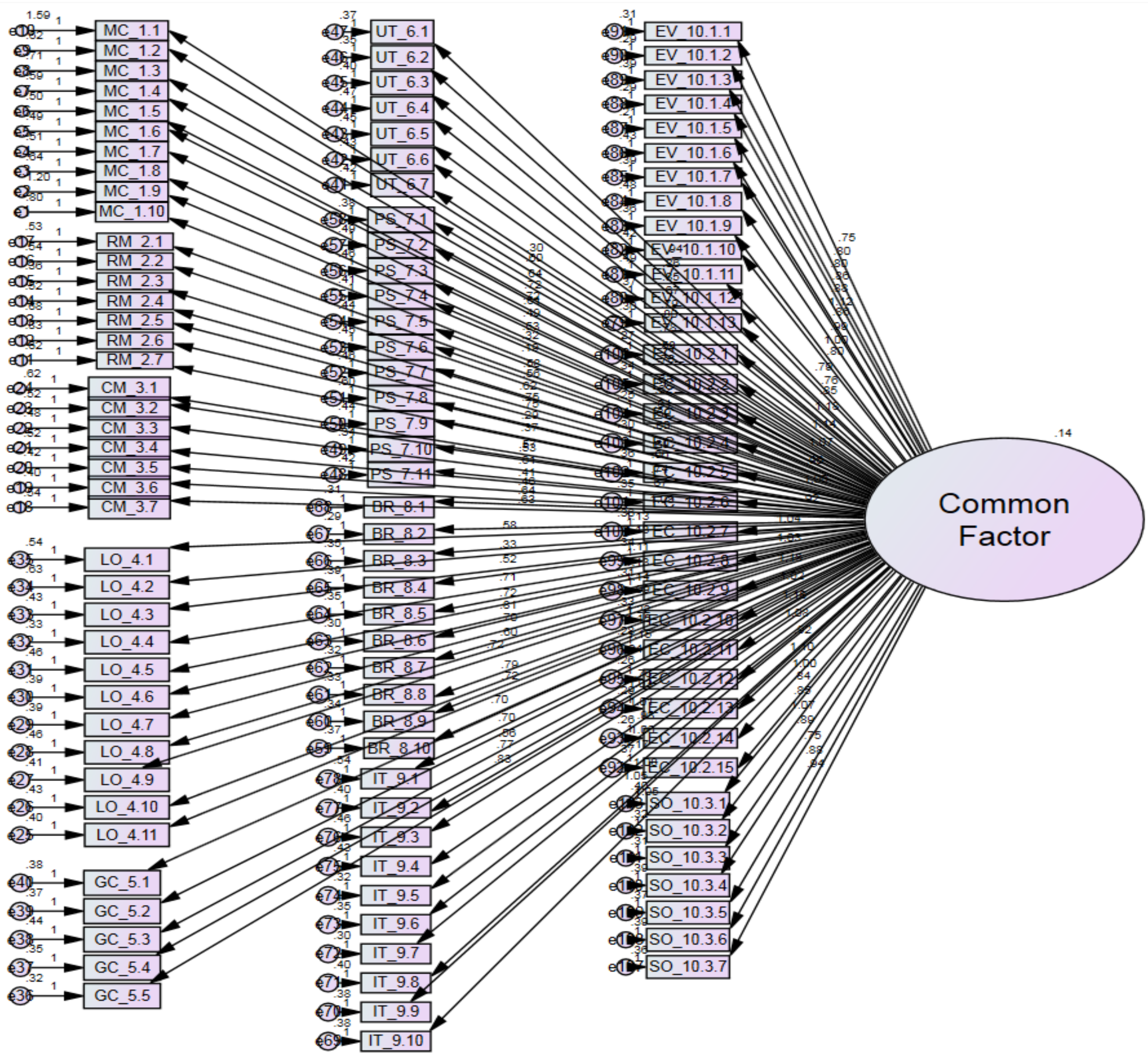


Figure 6.1: All-item CFA with common factor

CMV was also tested using marker-variable technique (Malhotra, Kim & Patil 2006). In this method, CFA of measurement model was conducted first with marker variable (MV), and again without marker variable. The covariance/correlation results are shown in Figures 6.2 to Figure 6.5. The covariance between measurement dimensions and marker variable under each construct is presented in Table 6.9. Note that marker variable comprises of measurement item X1 and X2 since these two items have the least correlation with other measurement items of study variables (Hair et al. 2010). For co-opetition construct, the correlation obtained between management commitment and marker variable was 0.04, between relationship management and marker variable was 0.15, and communication management and marker variable was 0.21. Thus, the average correlation was estimated as 0.13. For freight consolidation construct, the marker variable was correlated with location dimension (0.29), geographical coverage (0.21) and utilization of transport modes (0.19), yielding average correlation of 0.23. For collaborative freight distribution, the coefficients of partner selection, benefits and risks sharing, and advanced information technology were 0.14, 0.10, and 0.14, respectively, resulting in average correlation of 0.13. For sustainable distribution construct, the correlation of environmental factor, economic factor and social factor with the marker variable was 0.19, 0.18, and 0.10, respectively, which yielded the average correlation(r_M) of 0.16 (Table 6.9).

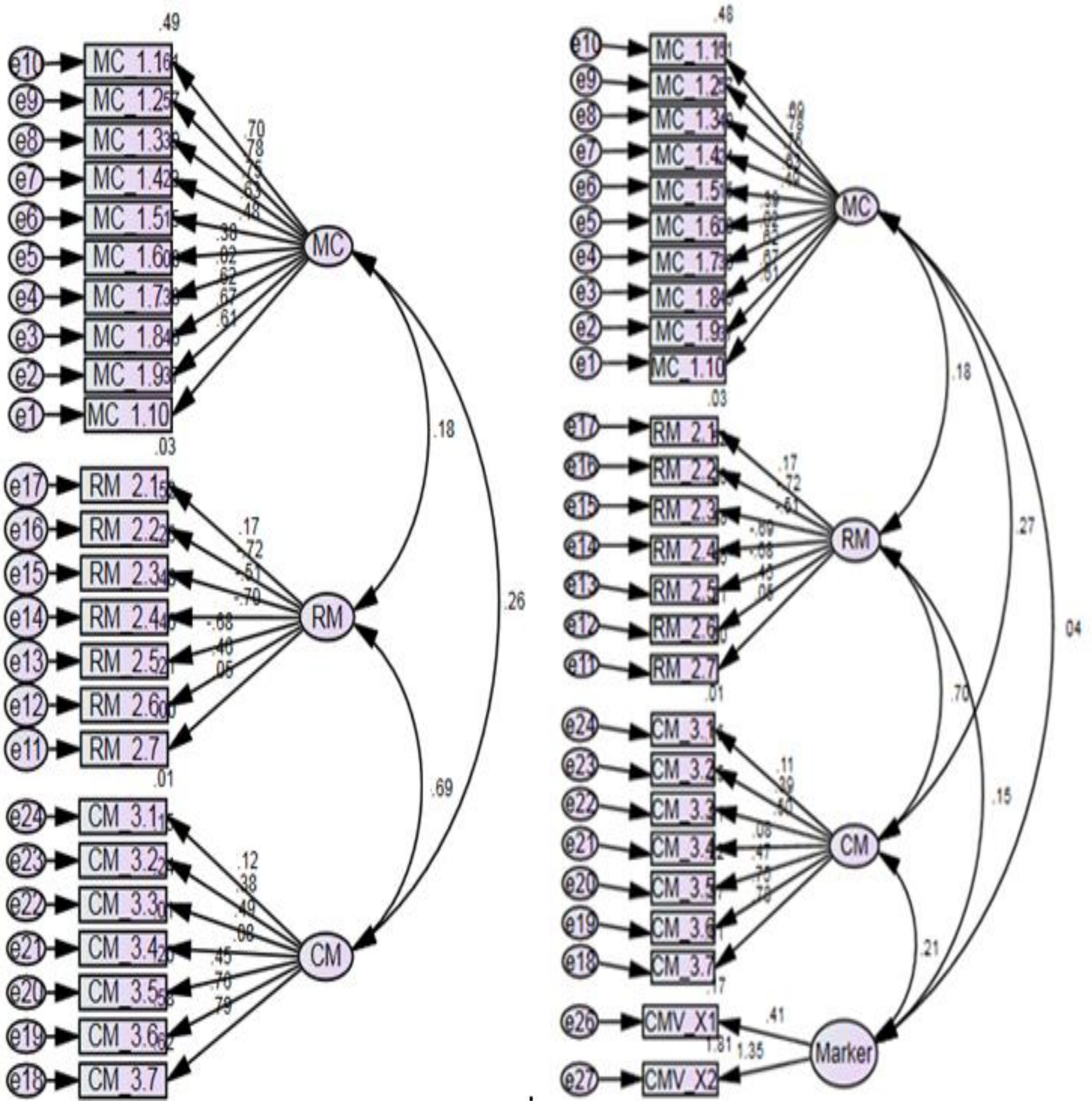


Figure 6.2: CFA without and with marker variable of co-opetition construct

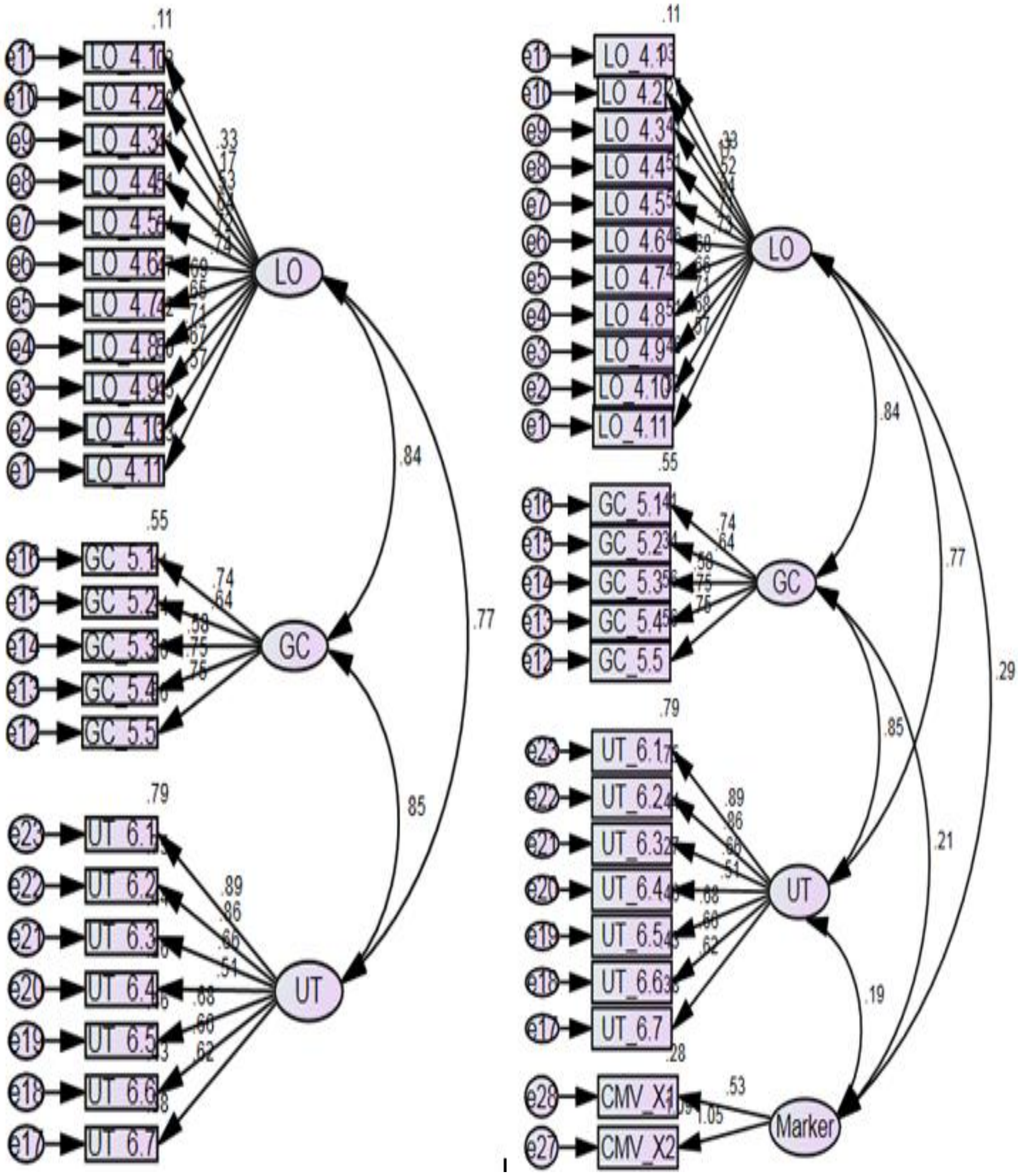


Figure 6.3: CFA without and with marker variable of freight consolidation construct

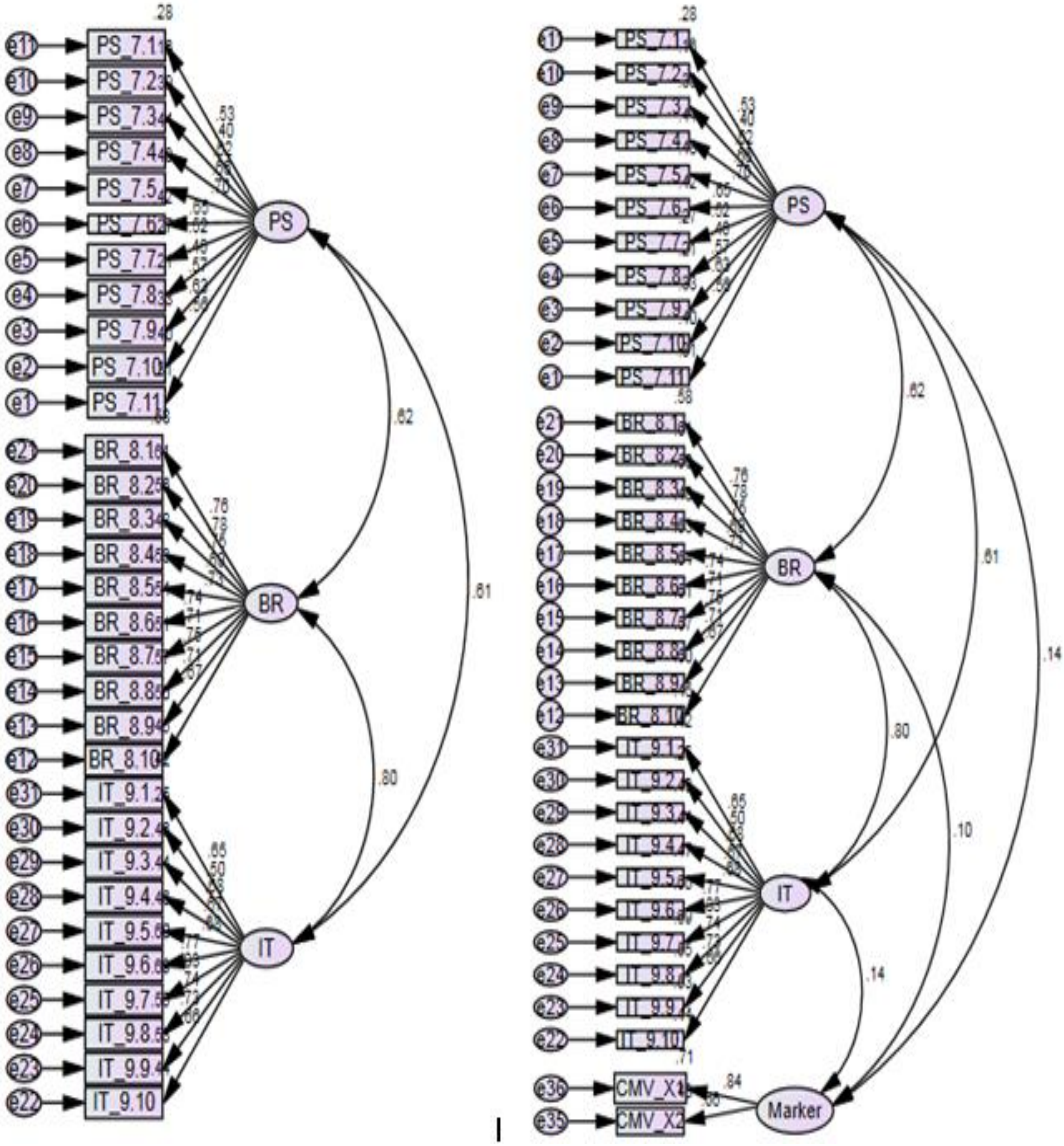


Figure 6.4: CFA without and with marker variable of collaborative freight distribution construct

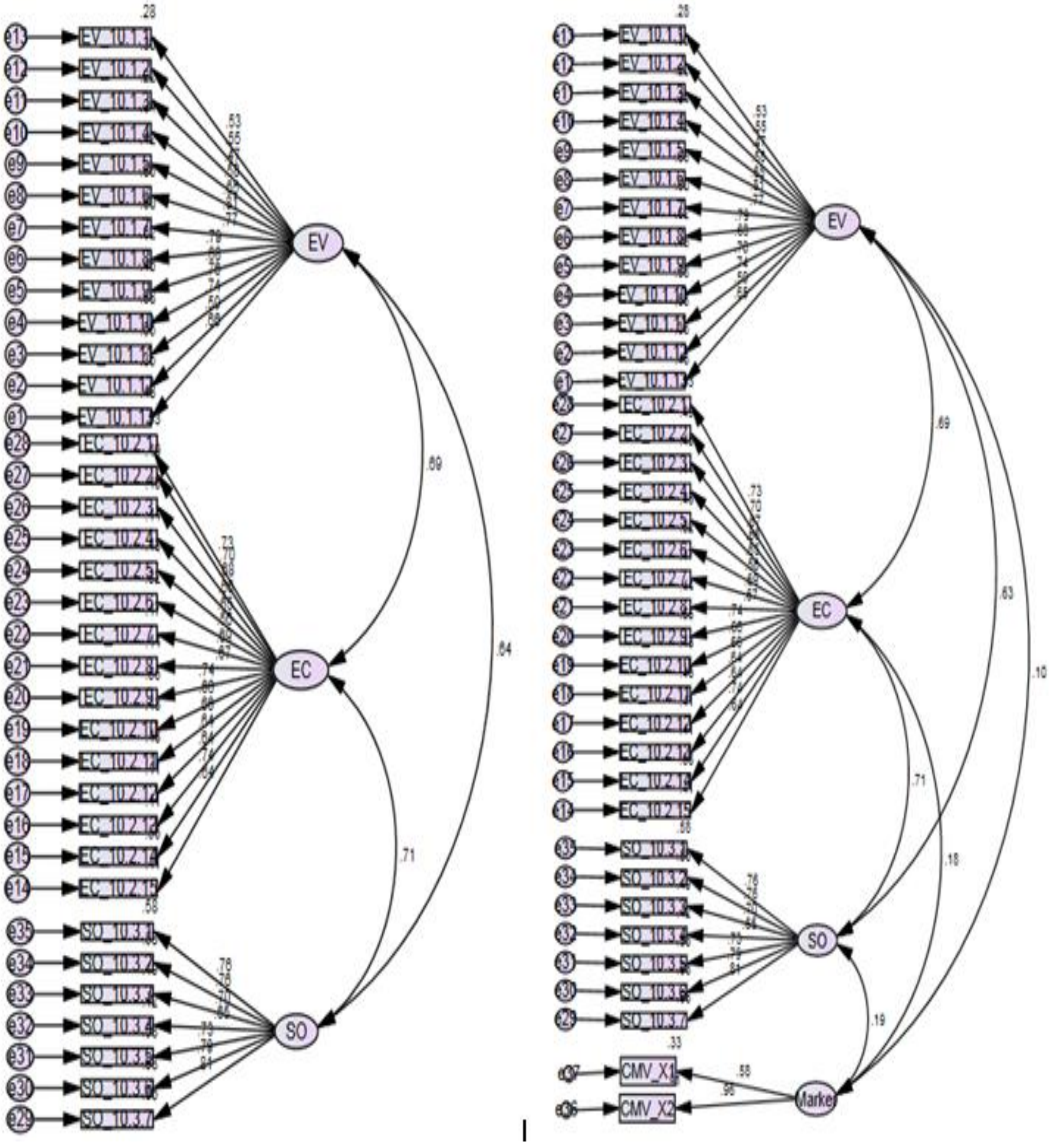


Figure 6.5: CFA without and with marker variable of sustainable distribution construct

Table 6.9: Correlation and average correlation between measurement dimension and the marker variable

Measurement dimensions and marker variable	Correlation (r)	Average correlation (r_m)
Co-opetition		
r(Management commitment, Marker variable)	0.04	0.13
r(Relationship management, Marker variable)	0.15	
r(Communication management, Marker variable)	0.21	
Freight consolidation		
r(Location of freight consolidation centre, Marker variable)	0.29	0.23
r(Geographical coverage, Marker variable)	0.21	
r(Utilization of transport modes, Marker variable)	0.19	
Collaborative freight distribution		
r(Partner selection , Marker variable)	0.14	0.13
r(Benefits and risks sharing , Marker variable)	0.10	
r(Advanced Information technologies, Marker variable)	0.14	
Sustainable distribution		
r(Environmental factor , Marker variable)	0.10	0.16
r(Economics factor, Marker variable)	0.18	
r(Social factor, Marker variable)	0.19	

Now the average correlation (r_M) and original correlation (r_U) will be used to calculate a new correlation r_A (i.e., CMV-adjusted correlation) using the following equation 6.1 proposed by Malhotra et al. (2006).

$$r_A = \frac{r_U - r_M}{1 - r_M}$$

Equation 6.1: Common method variance estimation

Where, $r_{M=}$ average correlation between marker variable and measurement dimensions, $r_{U\,=}$ the actual correlation, $r_{A\,=}$ adjusted correlation

As can be seen from the results presented in Table 6.10, the adjusted correlation (r_A) between management commitment and relationship management is reduced from 0.18 to 0.06, while r_A between management commitment and communication management is reduced from 0.26 to 0.15; and between relationship management and communication management is reduced from 0.69 to 0.65. The $r_A$between location and geographical coverage is reduced from 0.84 to 0.79; between location and utilization of transport modes is reduced from 0.77 to 0.70 and so on. The correlation between geographical coverage and utilization of transport modes dimension reduced from 0.85 to 0.81. The correlation between partner selection dimension and benefits and risks sharing dimension reduced from 0.62 to 0.57. The correlation between partner selection dimension and advanced information technology dimension reduced from 0.61 to 0.55. The correlation between benefits and risks sharing dimension and advanced information technology dimension reduced from 0.80 to 0.78. The correlation between environmental dimension and economic dimension reduced from 0.69 to 0.63. The correlation between environmental dimension and social dimension reduced from 0.64 to 0.57. Finally, the correlation between economic/organizational dimension and social dimension reduced from 0.71 to 0.66. Thus, these values indicate that the difference between the original correlation r_U and the CMV-adjusted correlation r_A , is relatively small (i.e., Δr < 0.12).

Table 6.10: Changes in correlation between measurement items

Measurement items	**Original Correlation** r_U	**CMV-adjusted correlation** r_A	**Δr**
Co-opetition			
r(Management commitment , Relationship management)	0.18	0.06	0.12
r(Management commitment , Communication management)	0.26	0.15	0.11
r(Relationship management , Communication management)	0.69	0.65	0.04
Freight consolidation			
r(Location of freight consolidation centre , Geographical coverage)	0.84	0.79	0.05
r(Location of freight consolidation centre ,	0.77	0.70	0.07

Utilization of transport)			
r(Geographical coverage , Utilization of transport)	0.85	0.80	0.04
Collaborative freight distribution			
r(Partner selection , Benefits and risks sharing)	0.62	0.57	0.05
r(Partner selection , Advanced Information technologies)	0.61	0.55	0.06
r((Benefits and risks sharing , Advanced Information technologies)	0.80	0.78	0.03
Sustainable distribution			
r(Environmental factor , Economics factor)	0.69	0.63	0.06
r(Environmental factor , Social factor)	0.64	0.57	0.07
r(Economics factor , Social factor)	0.71	0.66	0.05

The chi-square difference test was conducted to ensure that the difference between original and CMV-adjusted correlation was not substantial and the common method variance introduced small bias to the data set. Table 6.11 presents the chi-square and degrees of freedom (df) from CFA of each measurement construct, both with and without the marker variable. For co-opetition construct, introduction of the marker variable changed the chi-square value from 1749.69 to 1806.35, and increased the degrees of freedom from 249 to 293. Change of chi-square and degree of freedom values for other constructs are presented in Table 6.11. The chi-square difference test was conducted by subtracting the chi-square value without marker variable from the chi-square value with marker variable, as well as the differences in respective degrees of freedom (Bollen 1998). Results indicate that the changes in the chi-square values ($\Delta\chi2$) with associated changes in the degrees of freedom (Δdf) are non-significant at the 0.05 significance level ($p > 0.05$). In other words, the CFA with and without the marker variable of each measurement construct were not significantly different at the 0.05 level of significance. Therefore, it can be concluded that common method variance does not introduce substantial bias to the data set (Malhotra, Kim & Patil 2006).

Table 6.11: Chi-square difference test

Chi-square difference test	**$\chi2$**	**$\Delta\chi2$**	**df**	**Δdf**	**Chi-Square Critical Values; p =0.05**	**P value**
Co-opetition						
CFA without marker variable	1749.69	56.66	249	44	Non-significant	0.095

CFA with marker variable	1806.35		293			
Freight consolidation						
CFA without marker variable	784.07	62.99	220	49	Non-significant	0.086
CFA with marker variable	847.06		269			
Collaborative freight distribution						
CFA without marker variable	1201.26	67.23	431	58	Non-significant	0.190
CFA with marker variable	1268.49		489			
Sustainable distribution						
CFA without marker variable	2171.19	66.12	557	66	Non-significant	0.473
CFA with marker variable	2238.69		623			

6.10 Common method variance (CMV) for second level measurement model

CFA of second order measurement model describing the measurement constructs with and without the marker variable is presented in Figure 6.6. The value of each first order measurement dimension is derived from mean value of measurement items. For example, the mean value of management commitment dimension was derived from the mean value of items MC_1.1 to MC_1.10. As can be seen from the results of the second level analysis of CMV (Table 6.12), the correlation between the marker variable and co-opetition, freight consolidation, collaborative freight distribution and sustainable distribution was 0.11, 0.18, 0.03, and 0.10, respectively. The average correlation (r_m) between measurement constructs and the marker variable was estimated to be 0.10. The r_m was then used to calculate CMV-adjusted correlation (r_A) among the pairs of measurement constructs, using the equation proposed by Malhotra, Kim, and Patil (2006). It is evident that none of the changes (i.e., differences between the original correlation and the CMV-adjusted correlation) exceed 0.07 ($\Delta r < 0.07$), as presented in Table 6.13. Therefore, it indicates that common method variance does not introduce substantial bias in the data set (Malhotra, Kim & Patil 2006).

To confirm unbiasness of CMV, chi-square difference test was conducted (Bollen 1998). Results reveal that the change in the chi-square values ($\Delta\chi 2$) with associated changes in the degrees of freedom (Δdf) is non-significant at the 0.05 significance level ($p > 0.05$). In other words, the CFA with and without the marker variable of construct were not significantly different at the 0.05 level of significance. Therefore, the common method variance did not introduce substantial method bias in the data set (Table 6.14).

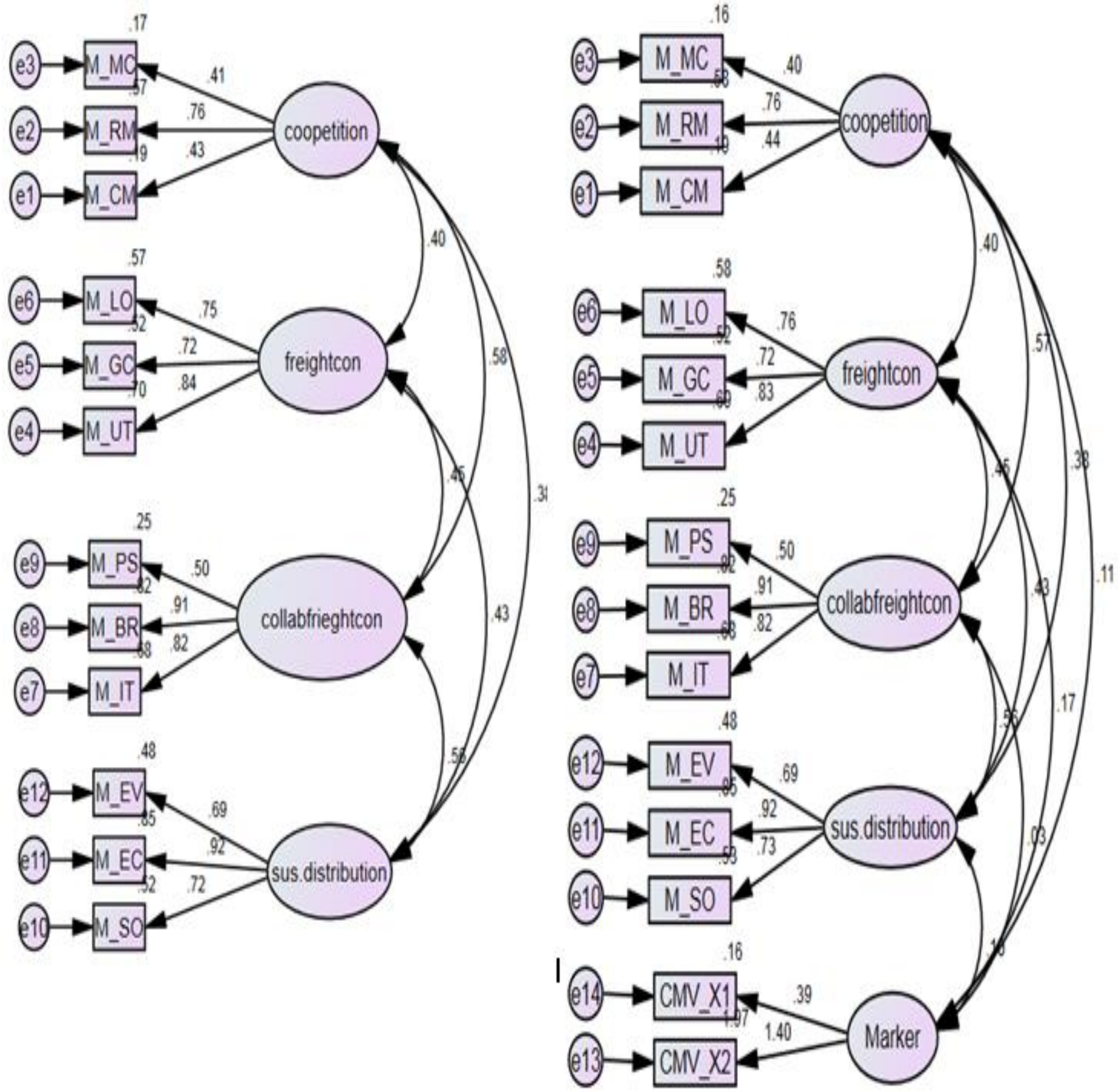


Figure 6.6: Second level CFA without and with marker variable at construct level

Table 6.12: Correlation and average correlation between the measurement constructs and the marker variable

Measurement constructs and marker variable	**Correlation (r)**	**Average correlation (r_m)**
r(co-opetition, MV)	0.11	0.10
r(freight consolidation, MV)	0.18	
r(collaborative freight distribution, MV)	0.03	
r(sustainable distribution, MV)	0.10	

Table 6.13: Changes in correlation between constructs

Measurement constructs	**Original Correlation**	**CMV-adjusted correlation**	**Δr**
r(co-opetition, freight consolidation)	0.39	0.33	0.07
r(co-opetition, collaborative freight distribution)	0.58	0.53	0.05
r(co-opetition, sustainable distribution)	0.39	0.32	0.07
r(freight consolidation, collaborative freight distribution)	0.45	0.39	0.06
r(freight consolidation, sustainable distribution)	0.43	0.36	0.07
r(collaborative freight distribution, sustainable distribution)	0.56	0.51	0.05

Table 6.14: Chi-square difference test at construct level

Chi-square difference test	**χ2**	**Δ χ2**	**df**	**Δdf**	**Chi-Square Critical Values; p =0.05**	**P value**
Measurement construct						
CFA without marker variable	84.23	21.11	48	19	Non-significant	0.331
CFA with marker variable	105.34		67			

6.11 Exploratory factor analysis (EFA)

6.11.1 Exploratory factor analysis: management commitment dimension under co-opetition construct

EFA for management commitment dimension under co-opetition construct was conducted in SPSS. The suitability of data for factor analysis of ten measurement items was firstly assessed. The result revealed that they were significant and suitable for factor analysis since KMO value was greater than the recommended value of 0.6 and the Bartlett's test of sphericity reached statistical significance ($p < 0.001$).

The results revealed that the presence of two factors with eigenvalue exceeding 1, explaining 35.24% and 63.76% of cumulative variance respectively. The first factor included measurement items MC_1.1, MC_1.2, MC_1.8, MC_1.9, and MC_1.10, whereas the second factor consisted of measurement items MC_1.3, MC_1.4, MC_1.5, MC_1.6 and MC_1.7. All factor loadings are above the cut off value 0.4 (Hair et al. 2010). Measurement items for both factors were unidimensional, since their individual corresponding Cronbach's alphas were 0.84 and 0.78 respectively (Table 6.15 and Figure 6.7).

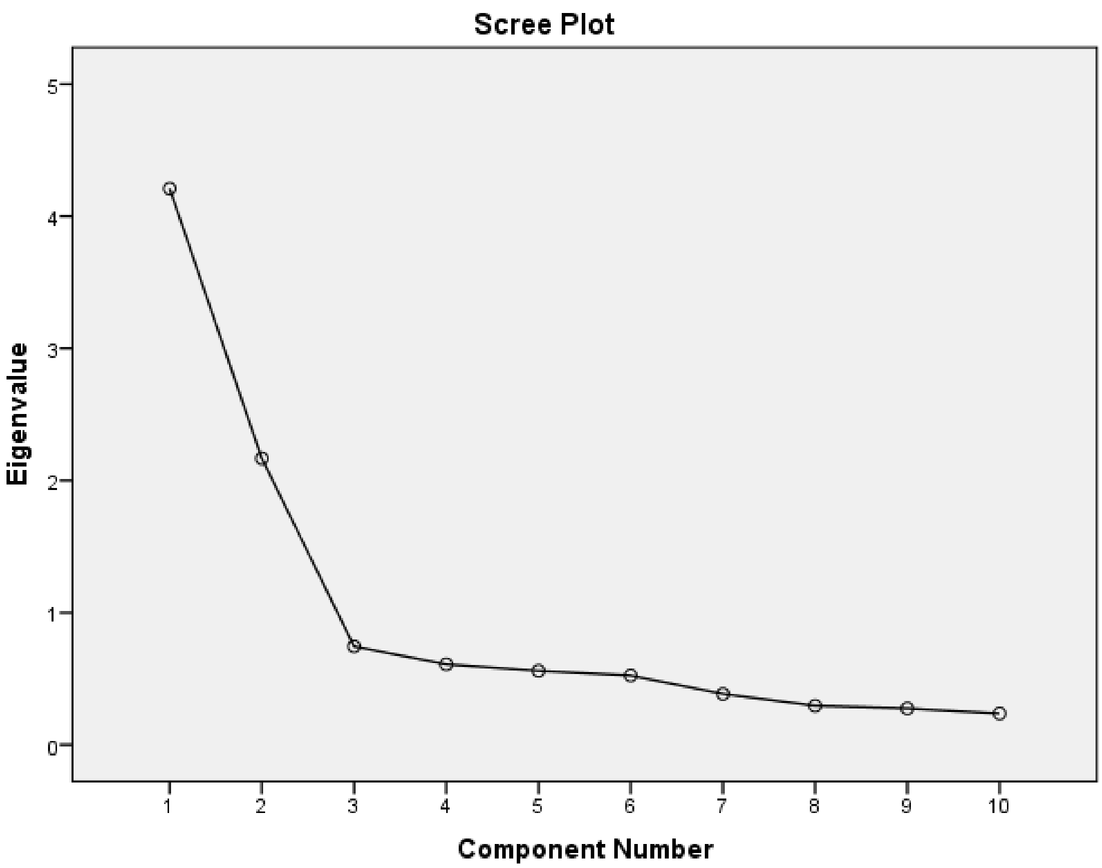


Figure 6.7: scree plot of management commitment dimension under co-opetition construct

Table 6.15: EFA for management commitment dimension under co-opetition construct

	Component	
	1	2
MC_1.9	0.87	
MC_1.1	0.87	
MC_1.10	0.75	
MC_1.8	0.65	
MC_1.2	0.64	
MC_1.4		0.79
MC_1.5		0.76
MC_1.6		0.75
MC_1.7		0.68
MC_1.3		0.57
Eigenvalue	4.21	2.17
Cumulative variance explained	35.24%	63.76%
Cronbach's alpha	0.84	0.78
Kaiser-Meyer-Olkin (KMO)	0.83	
Bartlett's test of sphericity	0.000	

6.11.2 Exploratory factor analysis: relationship management dimension under co-opetition construct

EFA for relationship management under co-opetition construct was conducted in SPSS. The suitability of data for factor analysis of seven measurement items was firstly assessed. The result revealed that they were significant and suitable for factor analysis since KMO value was greater than the recommended value of 0.6 and the Bartlett's test of sphericity reached statistical significance ($p < 0.001$).

The result revealed the presence of two factors with eigenvalue exceeding 1, explaining 34.29% and 60.76% of cumulative variance respectively. The first factor included measurement items RM_2.5, RM_2.4, RM_2.2, and RM_2.3 and the second consisted of measurement items RM_2.7, RM_2.6 and RM_2.1. All factor loadings are above the cut off value 0.4 (Hair et al. 2010). Measurement items of the first factor were unidimensional since the Cronbach alpha was 0.76. Nunnally (1978) stated that Cronbach alpha greater than 0.6 is acceptable. Second factor was also unidimensional, based on the Cronbach's alpha of 0.69 (Table 6.16 and Figure 6.8).

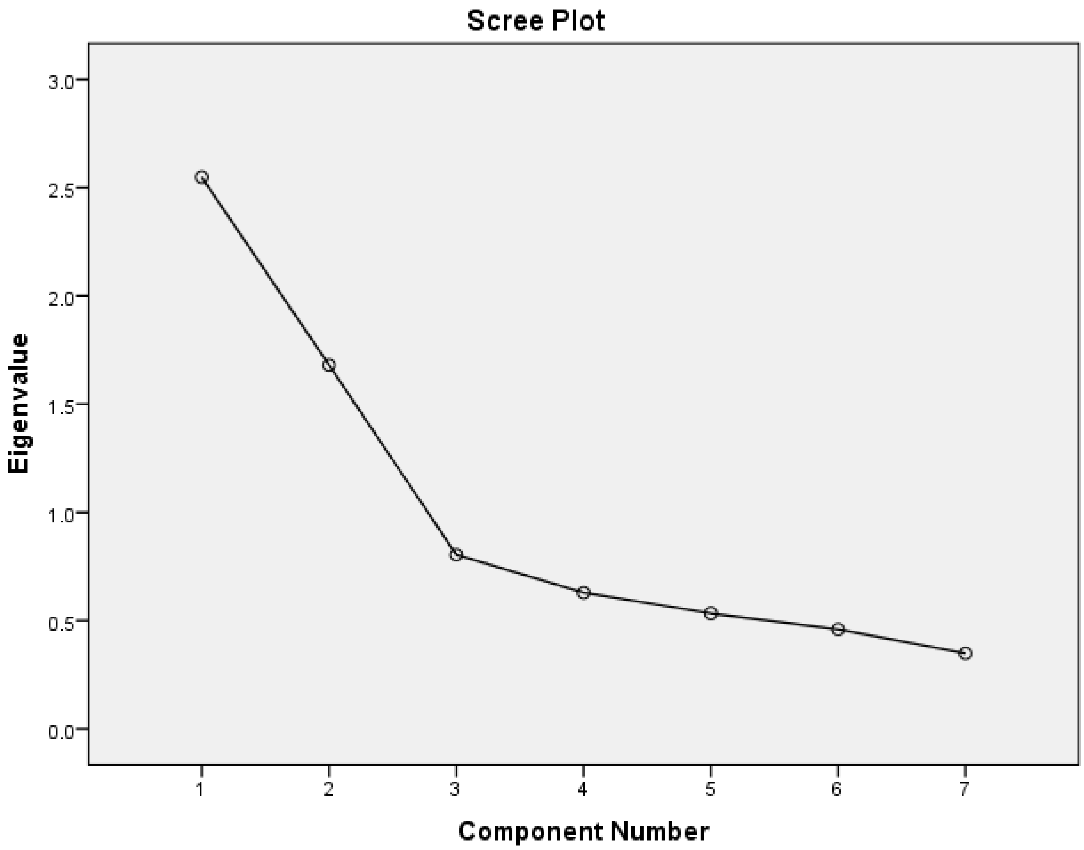


Figure 6.8: scree plot of relationship management dimension under co-opetition construct

Table 6.16: EFA for relationship management dimension under co-opetition construct

	Component	
	1	2
RM_2.5	0.80	
RM_2.4	0.78	
RM_2.2	0.78	
RM_2.3	0.64	
RM_2.7		0.79
RM_2.6		0.79
RM_2.1		0.76
Eigenvalue	2.59	1.63
Cumulative variance explained	34.29%	60.76%
Cronbach's alpha	0.76	0.69
Kaiser-Meyer-Olkin (KMO)		0.69
Bartlett's test of sphericity		0.000

6.11.3 EFA: Communication management dimension under co-opetition construct

EFA for communication management under co-opetition construct was conducted in SPSS. The suitability of data for factor analysis of seven measurement items was firstly assessed. The result revealed that they were significant and suitable for factor analysis since KMO value was greater than the recommended value of 0.6 and the Bartlett's test of sphericity reached statistical significance ($p < 0.001$).

The result revealed the presence of two factors with eigenvalue exceeding 1, explaining 32.78% and 56.45% of cumulative variance respectively. The first factor included measurement items CM_3.7, CM_3.6, CM_3.3, CM_3.5, and CM_3.2, and the second consisted of only two measurement items CM_3.4 and CM_3.1. Therefore, the second factor was excluded as Pallant (2010) and Costello & Osborne (2011) stated that one or two measurement items cannot explain a factor. All factor loadings are above the cut off value 0.4 (Hair et al. 2010). Measurement items of the first factor were unidimensional based on the Cronbach's alpha of 0.69 (Nunnally 1978) (Table 6.17 and Figure 6.9).

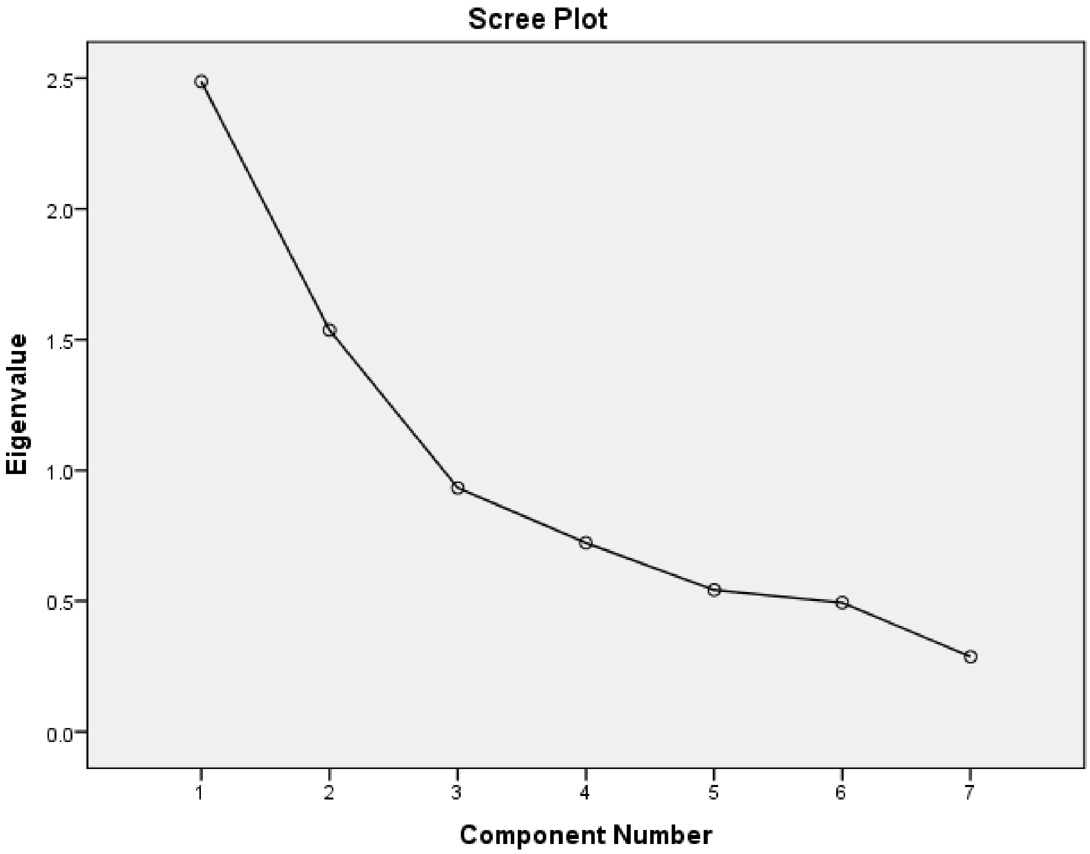


Figure 6.9: scree plot of communication management dimension under co-opetition construct

Table 6.17: EFA for communication management dimension under co-opetition construct

	Component	
	1	2
CM_3.7	0.83	
CM_3.6	0.77	
CM_3.3	0.61	
CM_3.5	0.58	
CM_3.2	0.54	
CM_3.4		0.84
CM_3.1		0.83
Eigenvalue	2.426	1.153
Cumulative variance explained	32.78%	56.45%
Cronbach's alpha	0.69	0.65
Kaiser-Meyer-Olkin (KMO)	0.65	
Bartlett's test of sphericity	0.000	

6.11.4 EFA: Location of freight consolidation centre under freight consolidation construct

EFA for location of freight consolidation centre under freight consolidation construct was conducted in SPSS. The suitability of data for factor analysis of eleven measurement items was firstly assessed. The result revealed that they were significant and suitable for factor analysis since KMO value was greater than the recommended value of 0.6 and the Bartlett's test of sphericity reached statistical significance ($p < 0.001$)

The result revealed the presence of two factors with eigenvalue exceeding 1, explaining 34.06% and 55.57% of cumulative variance respectively. The first factor included measurement items LO_4.8, LO_4.9, LO_4.10, LO_4.11, LO_4.5, LO_4.6, and LO_4.7, whereas the second factor consisted of measurement items LO_4.2, LO_4.1, LO_4.3, and LO_4.4. All factor loadings are above the cut off value 0.4 (Hair et al. 2010). Measurement items of both factors were unidimensional, based on their Cronbach's alphas exceeded 0.6 (Nunnally 1978) (Table 6.18 and Figure 6.10).

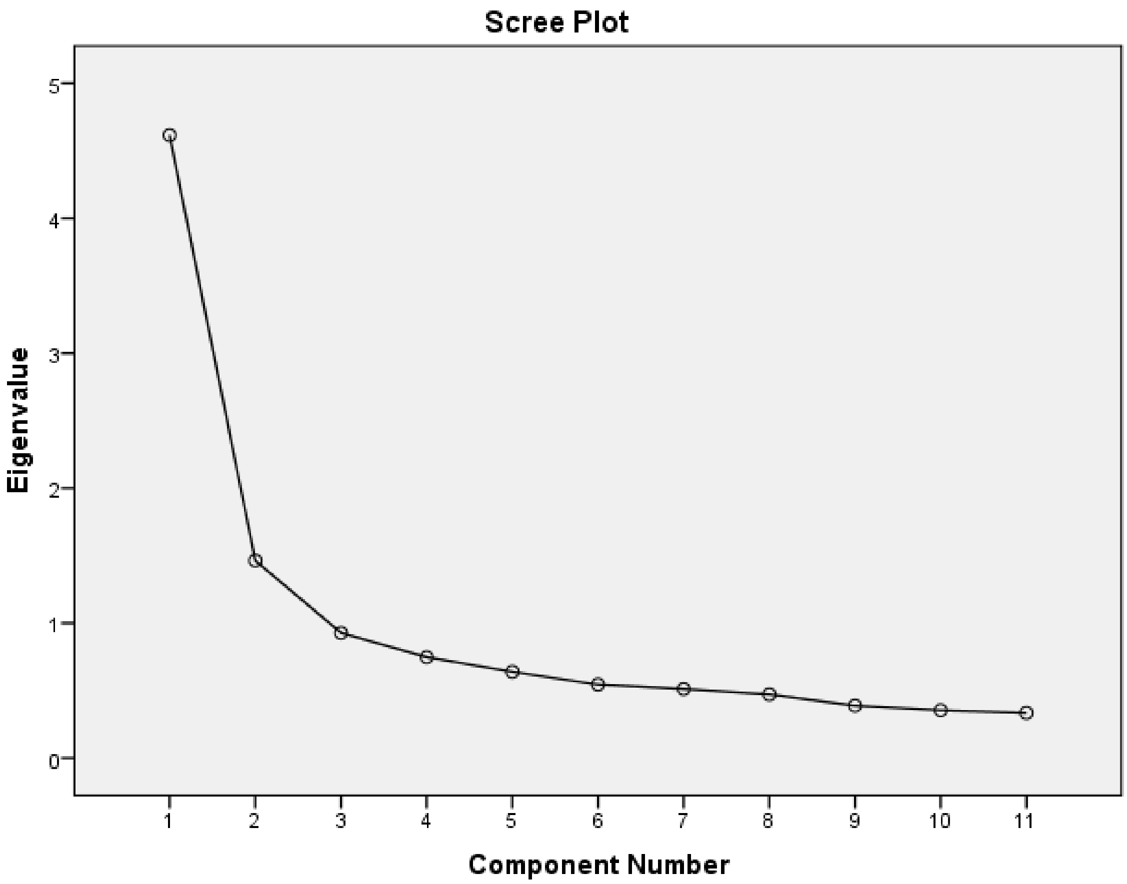


Figure 6.10: scree plot of location of freight consolidation centre under freight consolidation construct

Table 6.18: EFA for location of freight consolidation centre under freight consolidation construct

	Component	
	1	2
LO_4.8	0.79	
LO_4.9	0.79	
LO_4.10	0.75	
LO_4.11	0.73	
LO_4.5	0.59	
LO_4.6	0.58	
LO_4.7	0.56	
LO_4.2		0.76
LO_4.1		0.64
LO_4.3		0.59
LO_4.4		0.56
Eigenvalue	4.64	1.47
Cumulative variance explained	34.06%	55.57%
Cronbach's alpha	0.86	0.64
Kaiser-Meyer-Olkin (KMO)	0.88	
Bartlett's test of sphericity	0.000	

6.11.5 EFA: Geographical coverage under freight consolidation construct

EFA for geographical coverage under freight consolidation construct was conducted in SPSS. The result revealed that five measurement items were significant and suitable for factor analysis since KMO value was greater than the recommended value of 0.6 and the Bartlett's test of sphericity reached statistical significance ($p < 0.001$)

The result revealed the presence of one factor with eigenvalue exceeding 1, explaining 58.78% of the total cumulative variance. The factor included measurement items GC_5.1, GC_5.4, GC_5.5, GC_5.2, and GC_5.3, all of which were unidimensional, because the Cronbach's alpha was greater than 0.82. All factor loadings are above the cut off value 0.4 (Hair et al. 2010) (Table 6.19 and Figure 6.11).

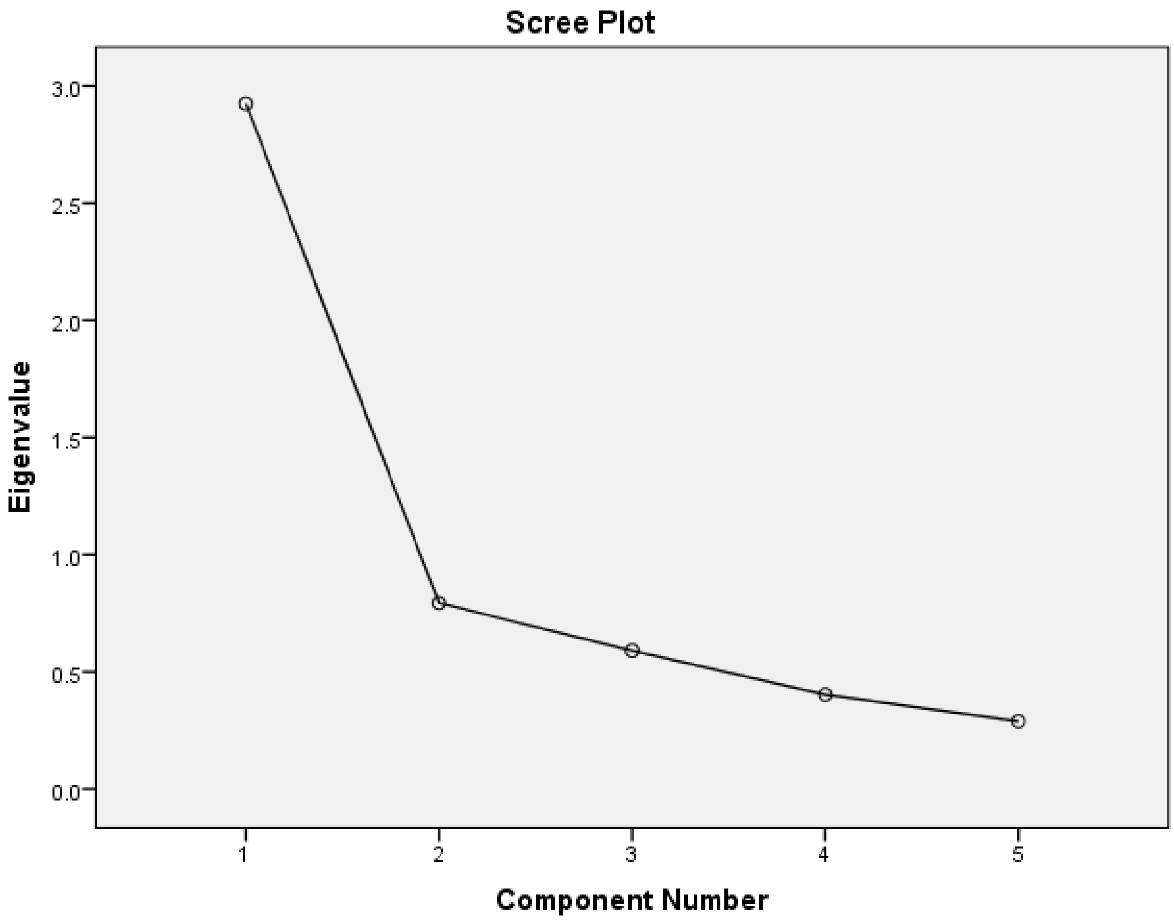


Figure 6.11: scree plot of geographical coverage under freight consolidation construct

Table 6.19: EFA for geographical coverage under freight consolidation construct

	Component
	1
GC_5.1	0.81
GC_5.4	0.79
GC_5.5	0.76
GC_5.2	0.75
GC_5.3	0.72
Eigenvalue	2.94
Cumulative variance explained	58.78%
Cronbach's alpha	0.82
Kaiser-Meyer-Olkin (KMO)	0.75
Bartlett's test of sphericity	0.000

6.11.6 EFA: Utilization of transport modes under freight consolidation construct

EFA for utilization of transport modes under freight consolidation construct was conducted in SPSS. The suitability of data for factor analysis of seven measurement items was assessed. The result revealed that they were significant and suitable for factor analysis since KMO value was greater than the recommended value of 0.6 and the Bartlett's test of sphericity reached statistical significance ($p < 0.001$). The EFA result then revealed the presence of one factor with eigenvalue exceeding 1, explaining 57.85% of the total cumulative variance. The factor included measurement items UT_6.1, UT_6.2, UT_6.3, UT_6.4, UT_6.5, UT_6.6, and UT_6.7. All factor loadings are above the cut off value 0.4 (Hair et al. 2010). The result is presented in Table 6.20 and Figure 6.12.

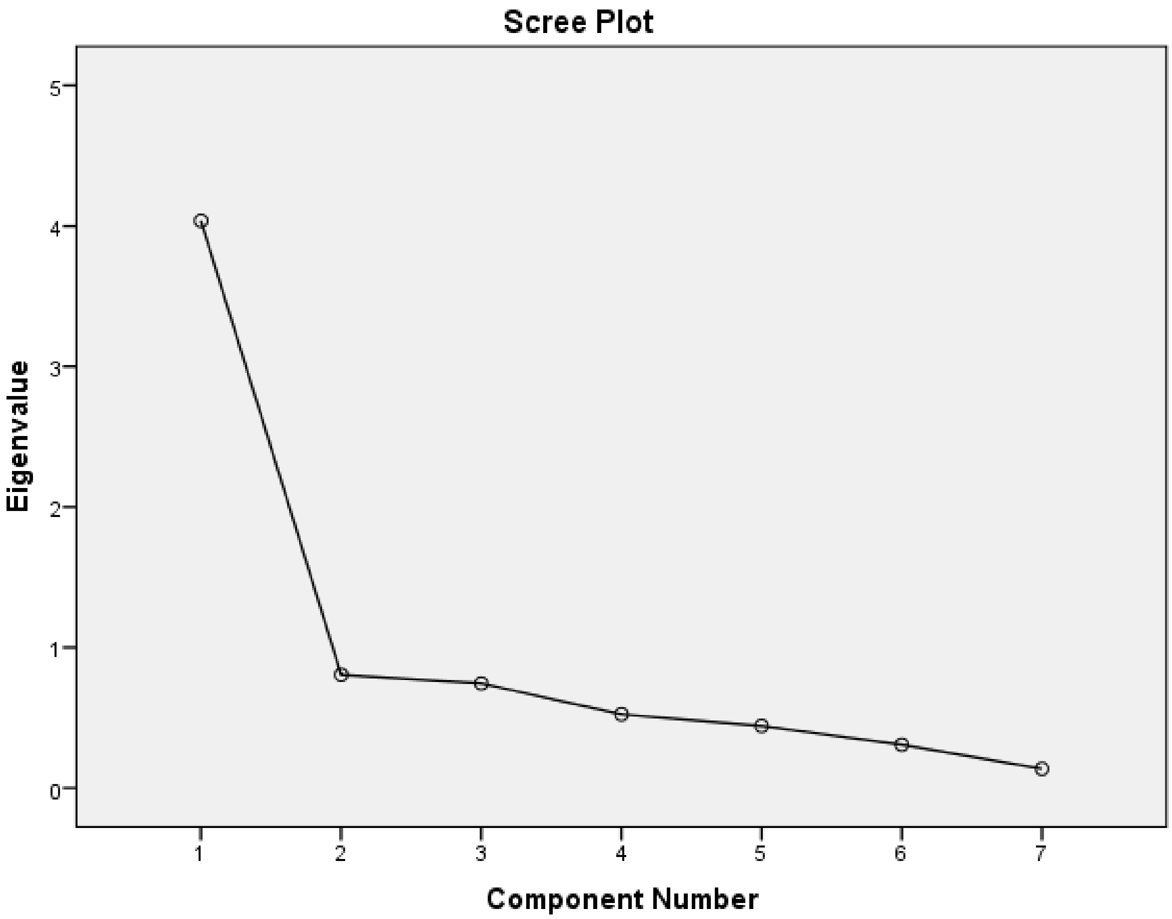


Figure 6.12: scree plot of utilization of transport modes under freight consolidation construct

Table 6.20: EFA for utilization of transport modes under freight consolidation construct

	Component
	1
UT_6.1	0.83
UT_6.2	0.82
UT_6.5	0.76
UT_6.6	0.75
UT_6.3	0.75
UT_6.7	0.73
UT_6.4	0.67
Eigenvalue	4.05
Cumulative variance explained	57.85%
Cronbach's alpha	0.88
Kaiser-Meyer-Olkin (KMO)	0.82
Bartlett's test of sphericity	0.000

However, referring section 6.9 on multicolinearity, item UT_6.2 was identified as contributing to multicolinearity. Therefore, it was decided to delete from further analysis of EFA in this section. As a result, the remaining measurement items were still suitable for factor analysis and loaded into one factor. The factor consists of all items except item UT_6.2. The total cumulative variance explained reduced to 57.41%. All factor loadings are above the cut off value 0.4 (Hair et al. 2010). The factor was unidimensional because the Cronbach's alpha was greater than 0.7. The revised EFA result is presented in Table 6.21 and Figure 6.13.

Figure 6.13: scree plot of utilization of transport modes under freight consolidation construct without measurement item UT_6.2

Table 6.21: EFA for utilization of transport modes under freight consolidation construct without measurement item UT_6.2

	Component
	1
UT_6.5	0.78
UT_6.1	0.78
UT_6.6	0.77
UT_6.7	0.75
UT_6.3	0.75
UT_6.4	0.71
Eigenvalue	3.44
Cumulative variance explained	57.41%
Cronbach's alpha	0.85
Kaiser-Meyer-Olkin (KMO)	0.82
Bartlett's test of sphericity	0.000

6.11.7 EFA: Partner selection under collaborative freight distribution construct

EFA for partner selection under collaborative freight distribution construct was conducted in SPSS. The EFA result revealed that eleven measurement items were significant and suitable for factor analysis since KMO value was greater than the recommended value of 0.6 and the Bartlett's test of sphericity reached statistical significance ($p < 0.001$)

The results revealed the presence of three factors with eigenvalue exceeding 1, explaining 27.18%, 46.09, and 58.67% of the cumulative variance respectively. The first factor included measurement items PS_7.5, PS_7.4, PS_7.6, PS_7.9, and PS_7.10. The second factor consisted of item PS_7.2, PS_7.7, PS_7.3, PS_7.1 and PS_7.8, while the third factor comprised of only item PS_7.11. Thus, factor three with only item PS_7.11 was excluded from further analysis, as one measurement item cannot be used to explain a factor (Costello & Osborne 2011). Measurement items of the first two factors were unidimensional because the Cronbach's alpha were greater than 0.6 (Nunnally 1978). All factor loadings are above the cut off value 0.4 (Hair et al. 2010) (Table 6.22 and Figure 6.14).

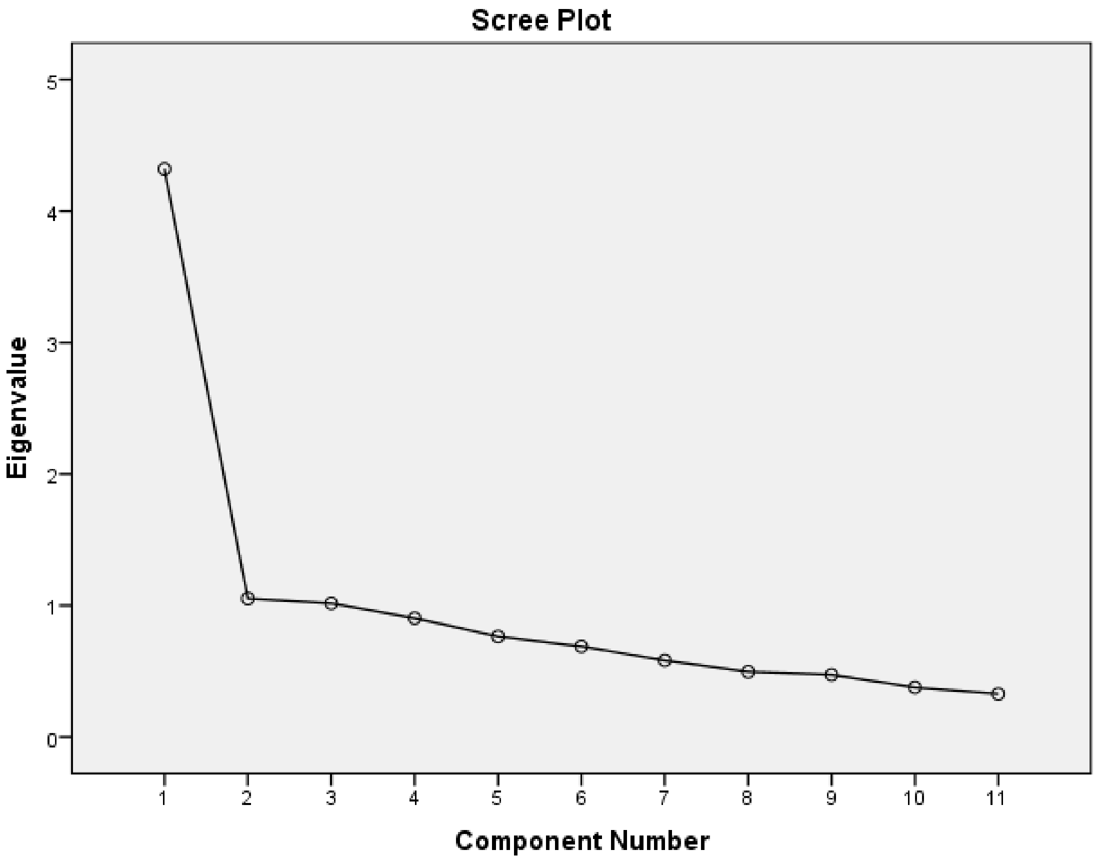


Figure 6.14: scree plot of partner selection under collaborative freight distribution construct

Table 6.22: EFA for partner selection under collaborative freight distribution construct

	Component		
	1	2	3
PS_7.5	0.79		
PS_7.4	0.74		
PS_7.6	0.69		
PS_7.9	0.62		
PS_7.10	0.58		
PS_7.2		0.75	
PS_7.7		0.63	
PS_7.3		0.57	
PS_7.1		0.55	
PS_7.8		0.53	
PS_7.11			0.68
Eigenvalue	4.32	1.10	1.03
Cumulative variance explained	27.18%	46.09%	58.67%
Cronbach's alpha	0.79	0.69	Cannot calculate
Kaiser-Meyer-Olkin (KMO)	0.85		
Bartlett's test of sphericity	0.000		

6.11.8 EFA: Benefits and risks sharing under collaborative freight distribution construct

EFA for benefits and risks sharing under collaborative freight distribution construct was conducted in SPSS. The EFA result revealed that ten measurement items were significant and suitable for factor analysis since KMO value was greater than the recommended value of 0.6 and the Bartlett's test of sphericity reached statistical significance ($p < 0.001$). The result revealed the presence of one factor with eigenvalue exceeding 1, explaining 57.89 of the total cumulative variance. It included measurement items BR_8.1, BR_8.2, BR_8.3, BR_8.4, BR_8.5, BR_8.6, BR_8.7, BR_8.8, BR_8.9, and BR_8.10. All factor loadings are above the cut off value 0.4 (Hair et al. 2010) (Table 6.23 and Figure 6.15).

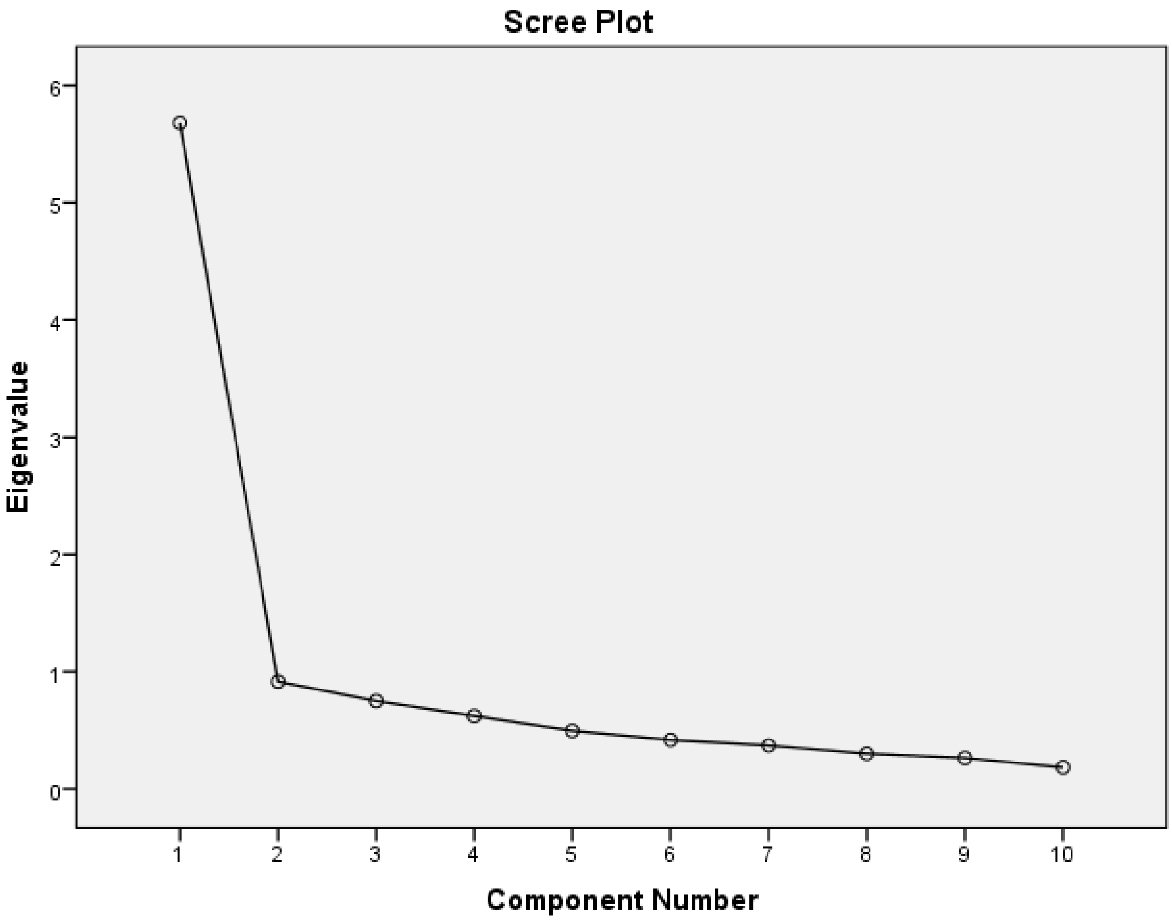


Figure 6.15: scree plot of benefits and risks sharing under collaborative freight distribution construct

Table 6.23: EFA for benefits and risks sharing under collaborative freight distribution construct

	Component
	1
BR_8.2	0.80
BR_8.8	0.79
BR_8.3	0.78
BR_8.1	0.77
BR_8.5	0.76
BR_8.6	0.76
BR_8.9	0.76
BR_8.7	0.74
BR_8.4	0.74
BR_8.10	0.71
Eigenvalue	5.79
Cumulative variance explained	57.89%
Cronbach’s alpha	0.92
Kaiser-Meyer-Olkin (KMO)	0.90
Bartlett’s test of sphericity	0.000

However, the item BR_8.1 was deleted, as it suffered from multicollinearity as presented above. Thus, all measurement items, except item BR_8.1, were used in the repeated factor analysis. As a result, the remaining measurement items (excluding BR_8.1) were still suitable for factor analysis and loaded into one factor, as presented in Table 6.24 and Figure 6.16. The total cumulative variance explained increased to 58.22%. All the remaining measurement items were unidimensional, based on the Cronbach's alpha exceeding 0.7. All factor loadings are above the cut off value 0.4 (Hair et al. 2010) (Table 6.24 and Figure 6.16).

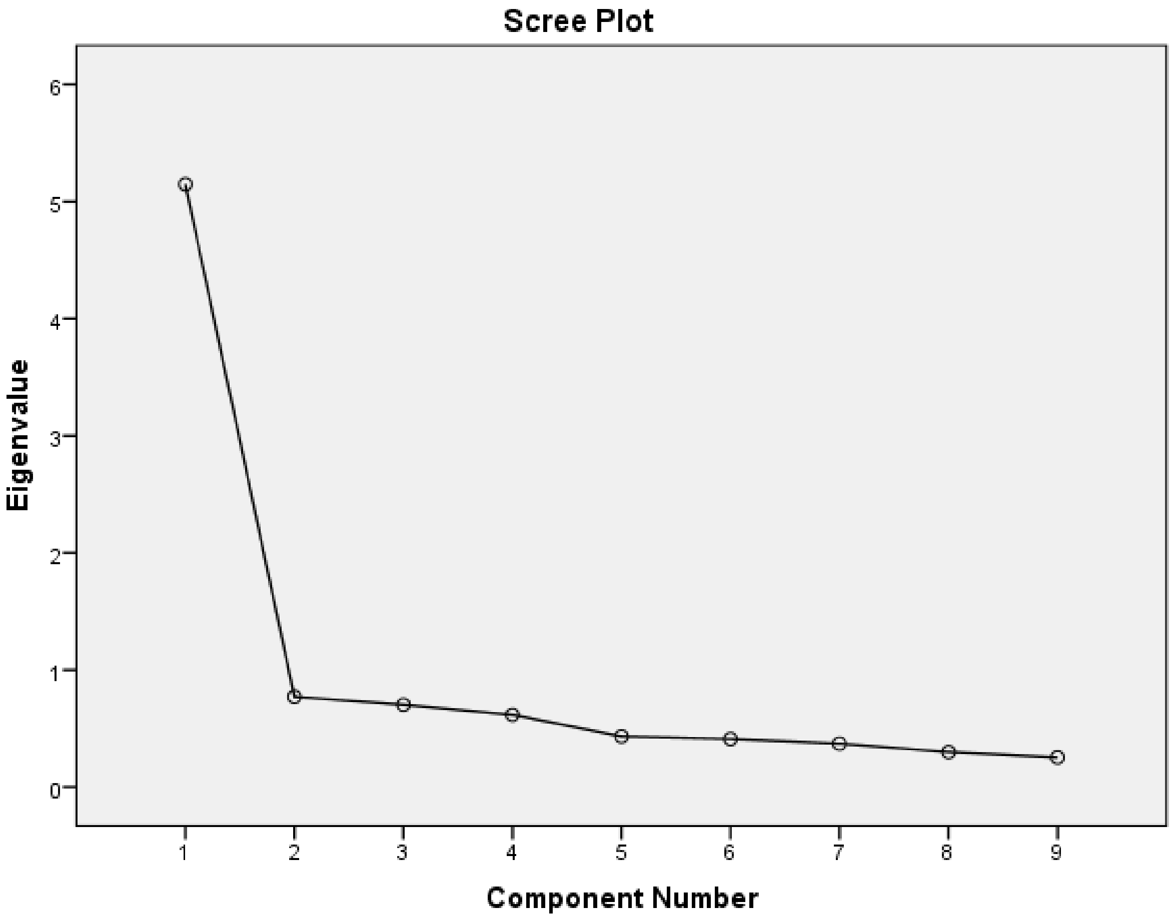


Figure 6.16: scree plot of benefits and risks sharing under collaborative freight distribution construct without measurement item BR_8.1

Table 6.24: EFA for benefits and risks sharing under collaborative freight distribution construct without measurement item BR_8.1

	Component
	1
BR_8.8	0.79
BR_8.5	0.77
BR_8.9	0.77
BR_8.3	0.77
BR_8.2	0.77
BR_8.6	0.76
BR_8.7	0.75
BR_8.4	0.75
BR_8.10	0.73
Eigenvalue	5.79
Cumulative variance explained	58.22%
Cronbach's alpha	0.91
Kaiser-Meyer-Olkin (KMO)	0.90
Bartlett's test of sphericity	0.000

6.11.9 EFA: Advanced information technologies under collaborative freight distribution construct

EFA for advanced information technologies under collaborative freight distribution construct was conducted in SPSS. The EFA result revealed that ten measurement items were significant and suitable for factor analysis since KMO value was greater than the recommended value of 0.6 and the Bartlett's test of sphericity reached statistical significance ($p < 0.001$). It also revealed the presence of two factors with eigenvalue exceeding 1, explaining 35.95% and 64.96% of the total cumulative variance respectively. The first factor included measurement items IT_9.9, IT_9.10, IT_9.8, IT_9.7, and IT_9.6, while the second consisted of items IT_9.2, IT_9.1, IT_9.3, IT_9.4, and IT_9.5. All factor loadings are above the cut off value 0.4 (Hair et al. 2010). Measurement items of both factors were unidimensional because the Cronbach's alpha were greater than 0.7 (Figure 6.17 and Table 6.25).

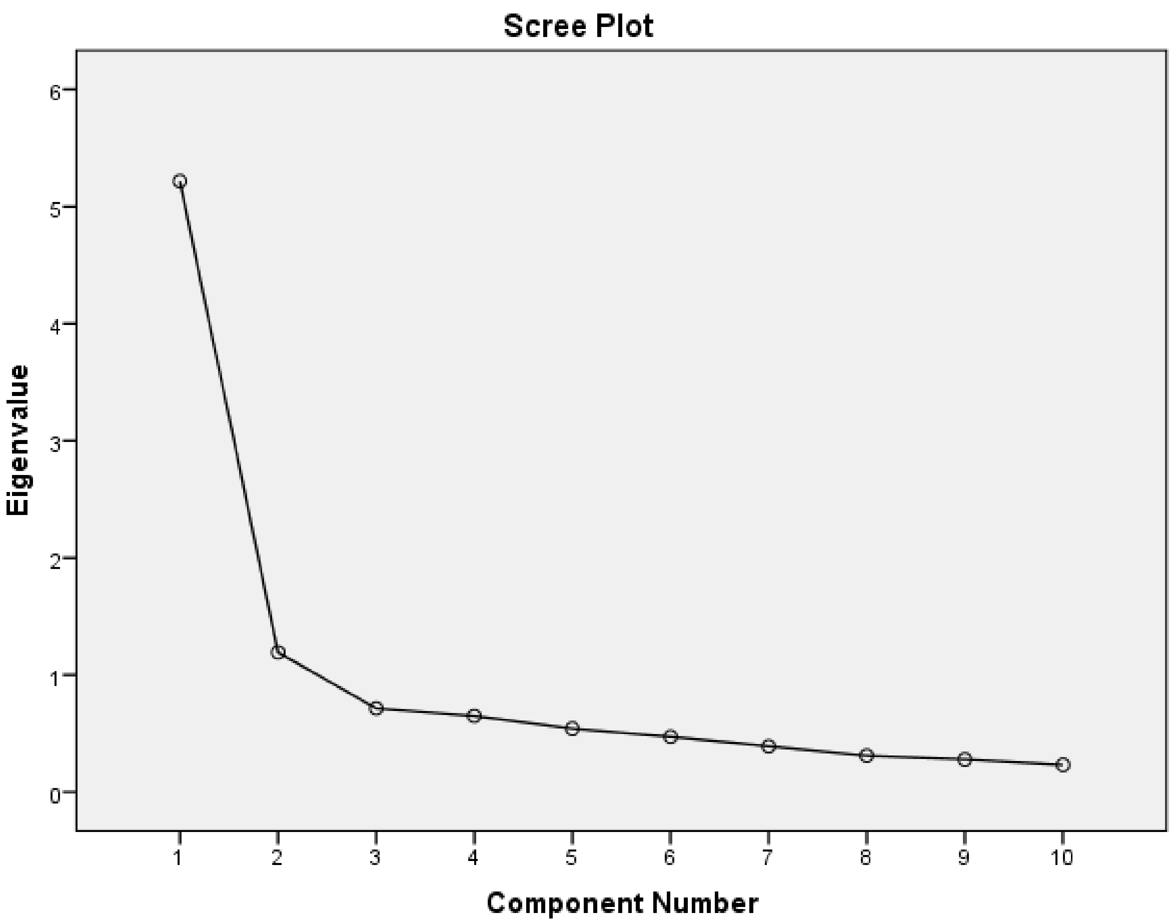


Figure 6.17: scree plot of advanced information technologies under collaborative freight distribution construct

Table 6.25: EFA for advanced information technologies under collaborative freight distribution construct

	Component	
	1	2
IT_9.9	0.82	
IT_9.10	0.81	
IT_9.8	0.81	
IT_9.7	0.73	
IT_9.6	0.65	
IT_9.2		0.82
IT_9.1		0.79
IT_9.3		0.67
IT_9.4		0.64
IT_9.5		0.52
Eigenvalue	5.34	1.162
Cumulative variance explained	35.95%	64.96%
Cronbach's alpha	0.88	0.83
Kaiser-Meyer-Olkin (KMO)		0.89
Bartlett's test of sphericity		0.000

6.11.10 EFA: Environmental sustainability under sustainable distribution construct

EFA for environmental sustainability under sustainable distribution construct was conducted in SPSS. The EFA result revealed that thirteen measurement items were significant and suitable for factor analysis since KMO value was greater than the recommended value of 0.6 and the Bartlett's test of sphericity reached statistical significance ($p < 0.001$). It revealed the presence of two factors with eigenvalue exceeding 1, explaining 35.56% and 60.17% of the total cumulative variance respectively. The first factor included measurement items EV_10.1.10, EV_10.1.8, EV_10.1.11, EV_10.1.7, EV_10.1.6, EV_10.1.9, EV_10.1.12, and EV_10.1.13. The second factor consisted of items EV_10.1.2, EV_10.1.1, EV_10.1.3, EV_10.1.5, and EV_10.1.4. All factor loadings are above the cut off value 0.4 (Hair et al. 2010). Measurement items of both factors were unidimensional because the Cronbach's alpha were greater than 0.7 (Figure 6.18 and Table 6.26).

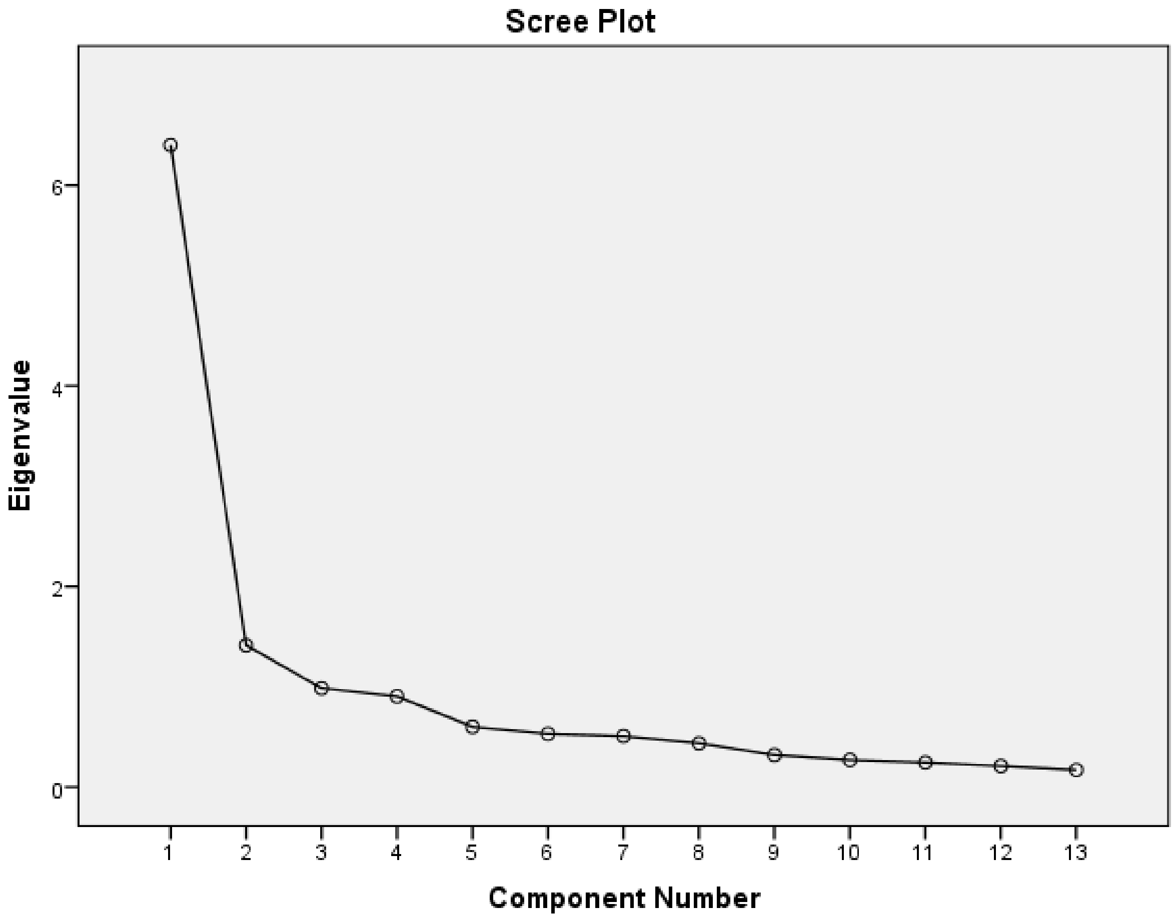


Figure 6.18: scree plot of environmental sustainability under sustainable distribution construct

Table 6.26: EFA for environmental sustainability under sustainable distribution construct

	Component	
	1	2
EV_10.1.10	0.84	
EV_10.1.8	0.84	
EV_10.1.11	0.83	
EV_10.1.7	0.77	
EV_10.1.6	0.76	
EV_10.1.9	0.61	
EV_10.1.12	0.57	
EV_10.1.13	0.54	
EV_10.1.2		0.83
EV_10.1.1		0.78
EV_10.1.3		0.72
EV_10.1.5		0.64
EV_10.1.4		0.57
Eigenvalue	6.35	1.48
Cumulative variance explained	35.56%	60.17%
Cronbach’s alpha	0.90	0.81
Kaiser-Meyer-Olkin (KMO)	0.88	
Bartlett’s test of sphericity	0.000	

6.11.11 EFA: Economic sustainability under sustainable distribution construct

EFA for economic sustainability under sustainable distribution construct was conducted in SPSS. The EFA result revealed that fifteen measurement items were significant and suitable for factor analysis since KMO value was greater than the recommended value of 0.6 and the Bartlett's test of sphericity reached statistical significance ($p < 0.001$). It revealed the presence of two factors with eigenvalue exceeding 1, explaining 31.89% and 57.36%, of the cumulative variance respectively. The first factor included measurement items EC_10.2.7, EC_10.2.5, EC_10.2.8, EC_10.2.6, EC_10.2.9, EC_10.2.10, EC_10.2.1, EC_10.2.15, EC_10.2.2, and EC_103.2.4. The second factor consisted of items EC_10.2.11, EC_10.2.12, EC_10.2.13, EC_10.2.3, and EC_10.2.14. All factor loadings are above the cut off value 0.4 (Hair et al. 2010) (Figure 6.19 and Table 6.27).

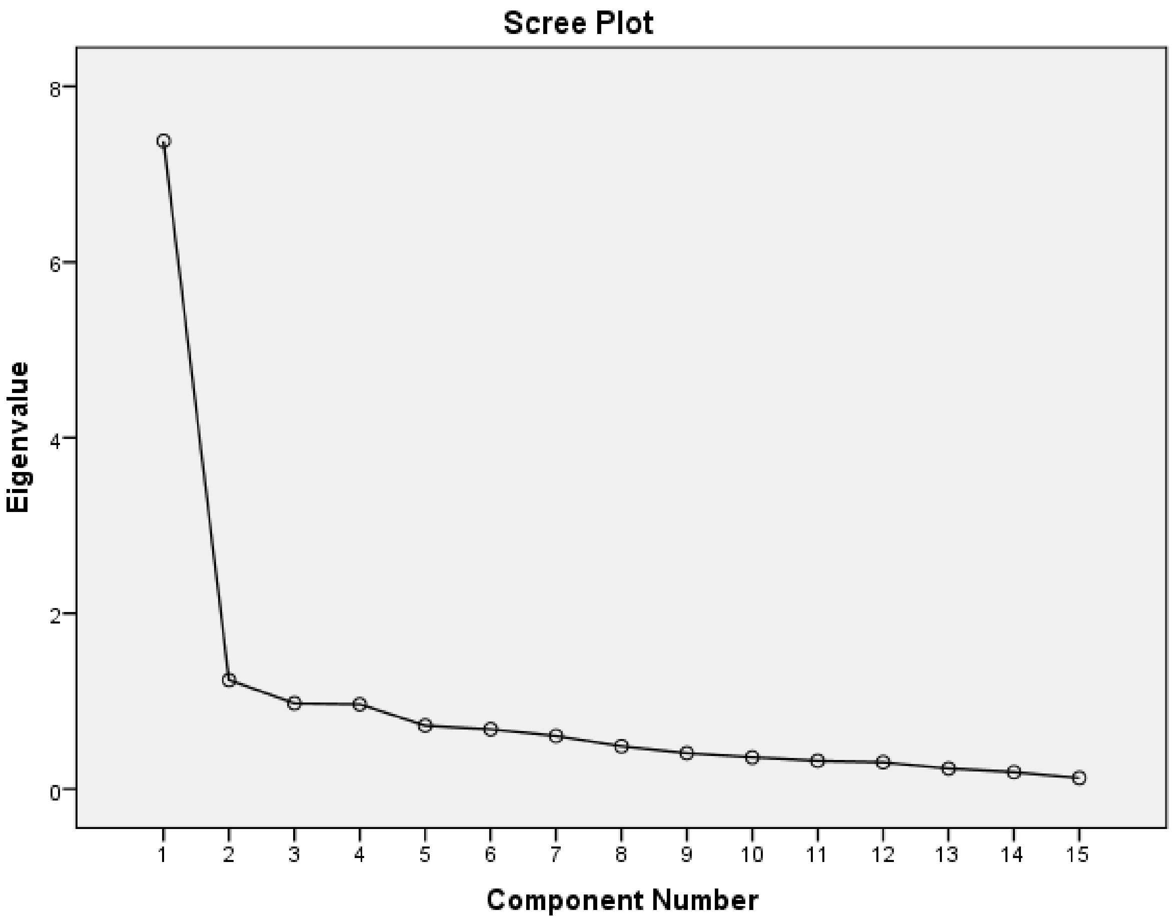


Figure 6.19: scree plot of economic sustainability under sustainable distribution construct

Table 6.27: EFA for economic sustainability under sustainable distribution construct

	Component	
	1	2
EC_10.2.7	0.79	
EC_10.2.5	0.72	
EC_10.2.8	0.68	
EC_10.2.6	0.67	
EC_10.2.9	0.65	
EC_10.2.10	0.63	
EC_10.2.1	0.61	
EC_10.2.15	0.59	
EC_10.2.2	0.56	
EC_10.2.4	0.52	
EC_10.2.11		0.89
EC_10.2.12		0.88
EC_10.2.13		0.63
EC_10.2.3		0.60
EC_10.2.14		0.59
Eigenvalue	7.313	1.29
Cumulative variance explained	31.89%	57.36%
Cronbach’s alpha	0.89	0.86
Kaiser-Meyer-Olkin (KMO)	0.89	
Bartlett’s test of sphericity	0.000	

However, item EC_10.2.12 was deleted, due to presence of multicollinearity. Thus, all measurement items, except item EC_10.2.12, were used again in factor analysis. As a result, the remaining measurement items were still suitable for factor analysis and loaded into two factors, as presented in Table 6.28 and Figure 6.20. The first factor consisted of items EC_10.2.1, EC_10.2.2, EC_10.2.3, EC_10.2.4, EC_10.2.11, EC_10.2.13, and EC_10.2.14, with the total cumulative variance explained of 29.30%. The second factor consisted of items EC_10.2.15, EC_10.2.5, EC_10.2.6, EC_10.2.7, EC_10.2.8, EC_10.2.9 and EC_10.2.10, with the total cumulative variance explained of 56.91%. All factor loadings are above the cut off value 0.4 (Hair et al. 2010). Measurement items of both factors were unidimensional, as the Cronbach's alpha were greater than 0.7. KMO value was greater than the recommended value of 0.6 and the Bartlett's test of sphericity reached statistical significance ($p < 0.001$) (Figure 6.20 and Table 6.28).

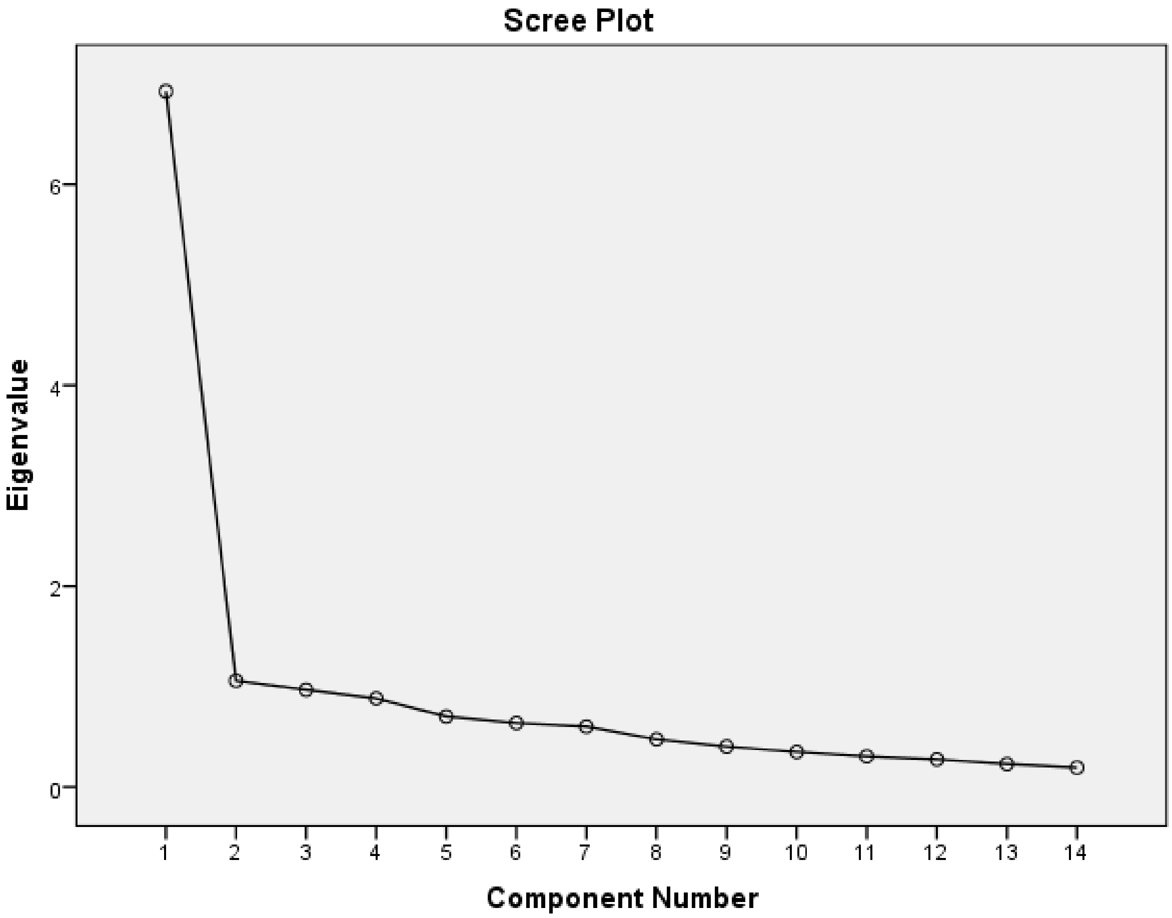


Figure 6.20: scree plot of economic sustainability under sustainable distribution construct without measurement item EC_10.2.12

Table 6.28: EFA for economic sustainability under sustainable distribution construct without measurement item EC_10.2.12

	Component	
	1	2
EC_10.2.3	0.79	
EC_10.2.11	0.74	
EC_10.2.2	0.74	
EC_10.2.1	0.70	
EC_10.2.14	0.63	
EC_10.2.13	0.62	
EC_10.2.4	0.53	
EC_10.2.5		0.78
EC_10.2.7		0.75
EC_10.2.6		0.72
EC_10.2.9		0.63
EC_10.2.8		0.62
EC_10.2.10		0.58
EC_10.2.15		0.52
Eigenvalue	6.89	1.08
Cumulative variance explained	29.30%	56.91%
Cronbach's alpha	0.87	0.86
Kaiser-Meyer-Olkin (KMO)	0.89	
Bartlett's test of sphericity	0.000	

6.11.12 EFA: Social sustainability under sustainable distribution construct

EFA for social sustainability under sustainable distribution construct was conducted in SPSS. The suitability of data for factor analysis of seven measurement items was firstly assessed. The result revealed that they were significant and suitable for factor analysis since KMO value was greater than the recommended value of 0.6 and the Bartlett's test of sphericity reached statistical significance ($p < 0.001$).

The result revealed the presence of one factor with eigenvalue exceeding 1, explaining 61.75% of the cumulative variance. The factor included measurement items SO_10.3.7, SO_10.3.6, SO_10.3.2, SO_10.3.1, SO_10.3.5, SO-10.3.3, and SO_10.3.4, all of which were unidimensional because the Cronbach's alpha was greater than 0.7. All factor loadings are above the cut off value 0.4 (Hair et al. 2010) (Table 6.29 and Figure 6.21).

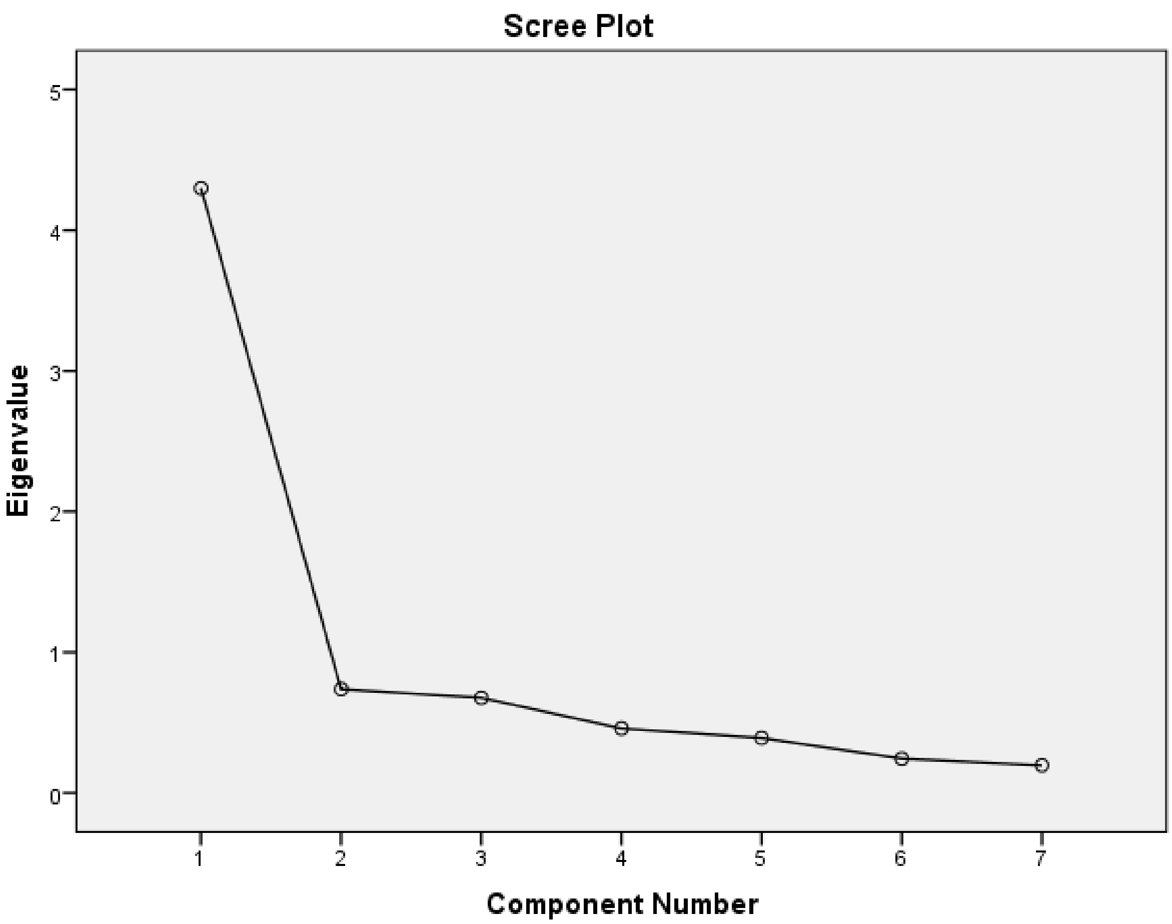


Figure 6.21: scree plot of social sustainability under sustainable distribution construct

Table 6.29: EFA for social sustainability under sustainable distribution construct

	Component
	1
SO_10.3.7	0.84
SO_10.3.6	0.82
SO_10.3.2	0.81
SO_10.3.1	0.79
SO_10.3.5	0.78
SO_10.3.3	0.75
SO_10.3.4	0.71
Eigenvalue	4.33
Cumulative variance explained	61.75%
Cronbach's alpha	0.89
Kaiser-Meyer-Olkin (KMO)	0.84
Bartlett's test of sphericity	0.000

Factors and measurement items of each construct are summarized in Table 6.30.

Table 6.30: Summary of factor analysis

Measurement dimension	**Number of Factor extracted**	**Question number**	
Co-opetition			
Management Commitment	2	Factor 1	MC_1.1, MC_1.2, MC_1.8, MC_1.9, MC_1.10
		Factor 2	MC_1.3, MC_1.4, MC_1.5, MC_1.6, MC_1.7
Relationship management	2	Factor 1	RM_2.2, RM_2.3, RM_2.4, RM_2.5
		Factor 2	RM_2.1, RM_2.6, RM_2.7
Communication Management	1	Factor 1	CM_3.2, CM_3.3, CM_3.5, CM_3.6, CM_3.7
Freight Consolidation Centre			
Location of Freight Consolidation Centre	2	Factor 1	LO_4.5, LO_4.6, LO_4.7, LO_4.8, LO_4.9, LO_4.10, LO_4.11
		Factor 2	LO_4.1, LO_4.2, LO_4.3, LO_4.4
Geographical Coverage	1	Factor 1	GC_5.1, GC_5.2, GC_5.3, GC_5.4, GC_5.5
Utilization of Transport Modes	1	Factor 1	UT_6.1, UT_6.3, UT_6.4, UT_6.5, UT_6.6, UT_6.7
Collaborative Freight distribution			
Partner Selection	2	Factor 1	PS_7.4, PS_7.5, PS_7.6, PS_7.9, PS_7.10

		Factor 2	PS_7.1, PS_7.2, PS_7.3, PS_7.7, PS_7.8
Benefits and Risks Sharing	1	Factor 1	BR_8.2, BR_8.3, BR_8.4, BR_8.5, BR_8.6, BR_8.7, BR_8.8, BR_8.9, BR_8.10
Advanced Information Technology	2	Factor 1	IT_9.6, IT_9.7, IT_9.8,IT_9.9, IT_9.10
		Factor 2	IT_9.1, IT_9.2, IT_9.3, IT_9.4, IT_9.5
Sustainability			
Environmental Factors	2	Factor 1	EV_10.1.6, EV_10.1.7, EV_10.1.8, EV_10.1.9, EV_10.1.10, EV_10.1.11, EV_10.1.12, EV_10.1.13
		Factor 2	EV_10.1.1, EV_10.1.2, EV_10.1.3, EV_10.1.4, EV_10.1.5
Economic Factors	2	Factor 1	EC_10.2.1, EC_10.2.2, EC_10.2.3, EC_10.2.4, EC_10.2.11, EC_10.2.13, EC_10.2.14
		Factor 2	EC_10.2.5, EC_10.2.6, EC_10.2.7, EC_10.2.8, EC_10.2.9 EC_10.2.10, EC_10.2.15
Social Factors	1	Factor 1	SO_10.3.1, SO_10.3.2, SO-10.3.3, SO_10.3.4, SO_10.3.5, SO_10.3.6, SO_10.3.7

6.12 Conclusion

In this chapter, the preliminary data analysis was presented. Sample size and demographic profiles of the respondents were initially presented to confirm sample size adequacy for multivariate data analysis. Missing value assessment, multivariate outlier assessment, comparison of respondents' characteristics, non-response bias assessment, multivariate normality assessment, multicollinearity test, unidimensionality test and common method variance were illustrated for the purpose of data management, data exploration, and data cleaning prior to further multivariate data analysis. EFA was finally illustrated for the purpose of data reduction and data exploration, which enabled summarizing data into smaller factor sets. Measurement items from EFA were then further tested by confirmatory factory analysis to satisfy the requirement of structural equation modeling, as presented in Chapter 7.

CHAPTER 7

STRUCTURAL EQUATION MODELING ANALYSIS

7.0 Introduction

This chapter aims to present the final measurement model of co-opetition, freight consolidation, collaborative freight distribution, and sustainable distribution construct through CFA technique using AMOS version 21. Final structural model was assessed in SEM in order to test hypothesised relationships among the study variables. Six competing structural models were proposed and compared with the hypothesised structural model in order to identify the most optimal structural model.

7.1 Confirmatory factor analysis (CFA)

CFA is employed to establish how well the measurement items represent the measurement dimensions and constructs. Though Cronbach Alpha provides an internal consistency and is quite useful for ensuring the unidimensionality (Hair et al. 2010), CFA is considered as a valid and reliable test of unidimensionality. CFA is employed to confirm validity and reliability of all measurement items (observed variables) measuring the constructs. The items that were extracted through EFA were used as a basis for further CFA analysis.

7.1.1 Reliability assessment

Reliability of scales (i.e. measurement items) and construct reliability assessments are employed to test the internal consistency of the set of measurement items and assess whether they are measuring what they are intending to measure with respect to the measurement dimensions and constructs. The aim is to reduce the measurement error and prevent further errors from occurring in data analysis. As stated in the methodology chapter (Chapter 5), all measurement items must be reliable and consistent in order to produce accurate results (Hair et al. 2010).

To test the reliability of measurement items, Cronbach's Alpha coefficient is usually used to assess the reliability of measurement items under the measurement dimensions and constructs (Cronbach 1951). The values range between 0 and 1, whereby higher value indicates better measurement item reliability (Hair et al. 2010). According to Pallant (2010), the Cronbach's Alpha value should be above 0.7 to be reliable. However, Nunnally (1978) stated that Cronbach's alpha of 0.6 is sufficient.

On the other hand, composite reliability (CR) is also an indicator of convergent validity. Its value ranges between 0 and 1 and, if greater than 0.7, it indicates that the internal consistency exists. It also means that the measurement items represent the same measurement construct. Composite reliability is calculated from the squared sum of factor loading (L_i) for each construct and the sum of the error variance terms for a construct (e_i) as shown in Equation 7.1 (Hair et al. 2010).

$$\mathrm{CR} = \frac{\left(\sum_{i=1}^{n} L_i\right)^2}{\left(\sum_{i=1}^{n} L_i\right)^2 + \sum_{i=1}^{n} e_i}$$

Equation 7.1: Composite reliability equation

Another technique that can be used to measure the construct reliability is the squared multiple correlations (SMC) pertaining to the measurement items. SMC refers to item reliability coefficients. In other words, it is used to assess the reliability of each measurement item under each measurement dimensions. The SMC is calculated from a square of the measurement items' standardized loading values. For instance, the standardised loading of 0.8 would yield a SMC of 0.64. The SMC greater than 0.5 is deemed acceptable, although a SMC of 0.3 is used by some authors as an indicator of acceptable measurement items (Cunningham, Holmes-Smith & Coote 2006)

7.1.2 Validity Assessment

Validity test is critical for testing the accuracy of a measure and ensuring that the measurement items are representing what they are intending to measure (Cunningham, Holmes-Smith & Coote 2006). CFA and structural equation modeling can be used for testing convergent validity and discriminant validity (Anderson & Gerbing 1988; Hair et al. 2010).

7.1.2.1 Convergent validity

Convergent validity aims to assess the consistency of the measurement items under each measurement construct. It intends to confirm that those measurement items are actually reflecting latent constructs that they are designed to measure. Factor loading is a critical consideration, as high factor loading on a latent factor indicates that the measurement items involved converge on a common latent factor. The standardised loading estimate could be used to consider the factor loading. The minimum requirement of standardised loading estimate is 0.5, and those factor loadings should be significant at this level. Another technique used for testing construct validity can be determined by the average variance extracted (AVE) value. The dimensions or constructs would have construct validity when the value of composite reliability (CR) is greater than the value of AVE (Cunningham, Holmes-Smith & Coote 2006; Kripanont 2007). AVE is calculated using standardized loading values and mean errors, using the expression presented in Equation 7.2 (Fornell & Larcker 1981). According to Nunnally and Bernstein (1994), the value of AVE should be greater than 0.4.

$$\rho_{vc(\eta)} = \frac{\sum_{i=1}^{P} \lambda^2}{\sum_{i=1}^{P} \lambda^2 + \sum_{i=1}^{P} \mathrm{Var}\,(\varepsilon_i)}$$

Equation 7.2: Average variance extracted equation

Where: $\rho_{vc(\eta)}$ corresponds the average variance extracted; λ corresponds the factor loading; ε represents error of measurement; η corresponds the construct.

7.1.2.2 Discriminant validity

Discriminant validity aims to confirm the uniqueness of measurement items, dimensions, or constructs in the model in which they should be truly distinct from others (Hair et al. 2010). Four distinct methods can be used for testing discriminant validity. The first method is Pearson's correlation between measurement items (or measurement dimensions) using AMOS. It indicates that the measurement items under the same measurement dimension should be highly correlated while having lower correlation with measurement items in other measurement dimensions. Similarly, the measurement dimensions under the same construct should be highly correlated while having lower correlation with measurement dimensions in other constructs. In other words, the measurement items (or measurement dimensions) must cluster into their respective dimension (or construct) (Cunningham, Holmes-Smith & Coote 2006; Kripanont 2007).

The second method is covariance, this time employed to inspect the correlation between measurement dimensions or constructs, rather than measurement items (observed variables). If the correlation between measurement dimensions or constructs in CFA is less than 0.9, then those constructs are unidimensional and are unlikely to have a problem with discriminant validity (Bagozzi, Yi & Phillips 1991; Cunningham, Holmes-Smith & Coote 2006; Kline 2011).

The third method is the square correlation (R^2) and average variance extracted (AVE) assessment. As suggested by Fornell and Larcker (1981), measurement dimensions or constructs meet discriminant validity criterion when AVE is greater than R^2. However, Anderson and Gerbing (1988) argued for a superior method for assessing discriminant validity. It is the examination of chi-square difference test between constructs through CFA. The test is to comparing the chi-square of the first model (i.e. model 1,) where the correlation between constructs is free to estimate, with the second model (i.e. model 2), in which the correlation is constrained to 1. If the chi-square difference test yields significant result, then the pair of construct is said to meet the discriminate validity criterion.

7.2 Measurement model of Fit

The measurement of fitness of CFA and structural models can be performed by calculating three main types of indices, namely incremental fit indices (e.g. NFI, CFI and TLI), absolute fit indices (e.g. χ^2, CMIN/df, GFI, RMSEA and PCLOSE), and parsimony fit indices (e.g. AGFI) (Hair et al. 2010), presented in Chapter 5 (Methodology Chapter). However, the measurement model may consist of the measurement dimensions that contain two measurement items. Fortunately, this incidence does not yield substantial effect because the measurement items will be aggregated for the second-order structural modeling. Kline (2005) posited that if a standard model with two or more factors has at least two indicators per factor, the model is identified. Moreover, the correlation of error terms may be employed when those measurement items are overlapped or correlated due to the common method of measurement. However, it does not technically affect the structural model because those measurement items will be aggregated before finding the best fit model (Byrne 2009).

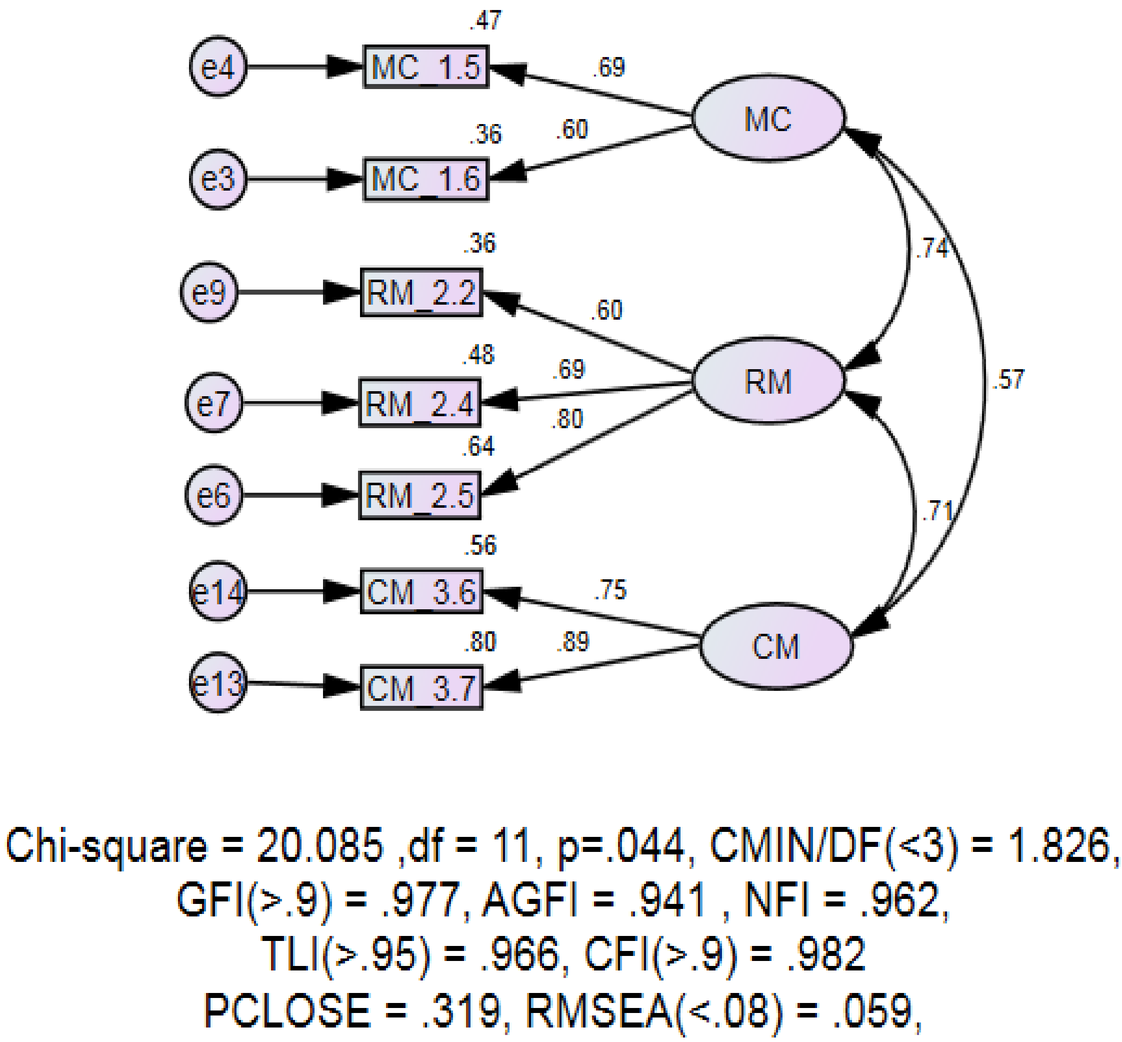
Bollen-Stine Bootstrap method was also employed in this study. AMOS version 21 provide the Bollen-Stine Bootstrapping analytical technique which is a useful method for estimating the sampling distribution of parameter estimates and testing model fit under non-normality conditions. The technique is used for modifying the model chi-square and adjusting for lack of multivariate normality. The Bollen-Stine Bootstrap method would calculate an adjusted chi-square and adjusted p-value for testing the model fit (Arbuckle 2010). Thus, in this study, the structural model fitness was tested based on the Bollen-Stine Bootstrap results to confirm the goodness-of-fit of measurement models and structural models.

7.3 Measurement model of Co-opetition

Figure 7.1 presents the final measurement model of the co-opetition construct. The standardised loading, composite reliability, Cronbach alpha and AVE results are presented in the Table 7.1-7.4 and the value of the figure is rounded up by AMOS version 21. The management commitment dimension consists of two observed variables MC_1.5 and MC_1.6 which ideally cannot explain the factor. However, Kline (2005) posited that if a standard CFA model with a single factor has at least three indicators, the model is identified. If a standard model with two or more factors has at least two indicators per factor, the model is identified. Therefore, two-item factor is not an issue. These observed variables are shown to exhibit convergent validity with standardised loadings exceed the threshold value of 0.5 ($0.60 < \beta < 0.69$) ($p<.01$), and construct validity with the value of CR (.60) greater than the value of AVE (.41) (see Table 7.1 and 7.3). Moreover, they are shown to exhibit discriminant validity, as clustered into their respective dimensions with covariance varies between 0.57 and 0.74 (see Table 7.2). Observed variables MC_1.5 and MC_1.6 are reliable, since their SMC is greater than the minimum threshold of 0.3 ($0.36 < SMC < 0.47$) (see Table 7.1). Moreover, these observed variables are reliable, because the Cronbach's alpha is .60, composite reliability is .60, and AVE is .41 (see Table 7.3).

The relationship management dimension consists of three observed variables RM_2.2, RM_2.4, and RM_2.5. These items exhibit convergent validity with standardised loadings greater than the threshold value of 0.5 ($0.6 < \beta < 0.8$) ($p<.01$) and construct validity with the value of CR (.74) greater than the value of AVE (.49) (see Table 7.1 and 7.3). Moreover, they demonstrate discriminant validity, as clustered into their respective dimensions with covariance varies between 0.71 and 0.74 (see Table 7.2). The items RM_2.2, RM_2.4, and RM_2.5 are reliable because their SMC is greater than the minimum threshold of 0.3 ($0.36 < SMC < 0.64$), as well as the Cronbach's alpha is 0.75, composite reliability is 0.74, and AVE is 0.49 (see Table 7.1 and 7.3).

The communication management dimension consists of observed variables CM_3.6 and CM_3.7. These observed variables are shown to exhibit convergent validity because the standardised loadings are greater than the threshold value of 0.5 ($0.75 < \beta < 0.89$) ($p<.01$) and construct validity with the value of CR (.81) greater than the value of AVE (.68) (see Table 7.1 and 7.3). Moreover, they are shown to exhibit discriminant validity, as clustered into their respective dimensions with covariance varies between 0.57 and 0.71 (see Table 7.2). Observed variables CM_3.6 and CM_3.7 are reliable because their SMC exceeds the minimum threshold of 0.3 (0.55 < SMC < 0.80), as well as the value of Cronbach's alpha (0.80), composite reliability (0.81), and AVE (0.68) are above threshold values (see Table 7.1 and 7.3).



Note: MC = management commitment, RM = relationship management, CM = communication management

Figure 7.1: Standardized estimates for co-opetition construct

Table 7.1: Standardized factor loading, squared multiple correlation and p value of co-opetition construct

Co-opetition				
Management commitment				
Question items	Item descriptions	Standardised Loading **	Squared Multiple Correlation	P-value
MC_1.5	You are willing to create a new strategy according to the goal of the relationship.	0.69	0.47	0.001
MC_1.6	You are intending to reconfigure your internal business processes according to new business structure.	0.60	0.36	0.001
Relationship management				
Question items	Item descriptions	Standardised Loading **	Squared Multiple Correlation	P-value
RM_2.2	To establish a relationship with your competitor, both companies must have mutual goals and objectives before the relationship establishment.	0.60	0.36	0.001
RM_2.4	Meeting on weekly or monthly basis with your competitor will be arranged.	0.69	0.48	0.001
RM_2.5	You are intending to share know-how from work experience with your competitor.	0.80	0.64	0.001
Communication management				
Question items	Item descriptions	Standardised Loading **	Squared Multiple Correlation	P-value
CM_3.6	You are intending to frequently keep informed of new developments with	0.75	0.55	0.001

	your competitor.			
CM_3.7	You are intending to implement information technology to exchange information with your competitor.	0.89	0.80	0.001
Achieved Fit Indices				
Chi-square = 20.08, Degrees of Freedom = 11, P = 0.04, Bollen-Stine p value = 0.19, CMIN/DF = 1.83, GFI = 0.98, AGFI = 0.94, NFI = 0.96, TLI = 0.97, CFI = 0.98, RMSEA = 0.06				

Note: ** Statistically significant at $p < 0.01$

Table 7.2: Correlations of measurement items and sub-constructs under co-opetition construct

	CM	RM	MC
CM	1.000		
RM	0.71	1.000	
MC	0.57	0.74	1.000
a3.6	**0.74**	0.53	0.42
a3.7	**0.89**	0.53	0.51
a2.2	0.42	**0.60**	0.44
a2.4	0.49	**0.69**	0.51
a2.5	0.56	**0.80**	0.59
a1.5	0.39	0.50	**0.68**
a1.6	0.34	0.44	**0.60**

Table 7.3: Validity and reliability test of co-opetition construct

	Cronbach's alpha (α)	Composite reliability (CR)	Average variance extracted (AVE)
Co-opetition	0.82	0.88	0.52
MC	0.60	0.60	0.41
RM	0.75	0.74	0.49
CM	0.80	0.81	0.68

Management commitment, relationship management and communication management dimensions are reliable and valid for co-opetition construct, since the composite reliability is .88, Cronbach's alpha is 0.82, and AVE value is 0.52. (see Table 7.3). Moreover, the Pearson's correlations between dimensions are below 0.9 ($0.57 < r < 0.74$), which satisfies discriminant validity and unidimensionality test (see Table 7.2). Nonetheless, all measurement dimensions meet discriminant validity criterion, since their chi-square differences are significant (see Table 7.4). The measurement model fit the data very well, since the Chi-square = 20.08, degrees of freedom = 11 and p value = 0.04 (Bollen-Stine p value = 0.19, which is not significant at the 0.05 level). Other fit measures also indicate the goodness of fit of the model to the data (GFI = 0.98, AGFI = 0.94, NFI = 0.96, TLI = 0.97, CFI = 0.98, RMSEA = 0.06) (Table 7.1).

Table 7.4: Chi-square difference test of co-opetition construct

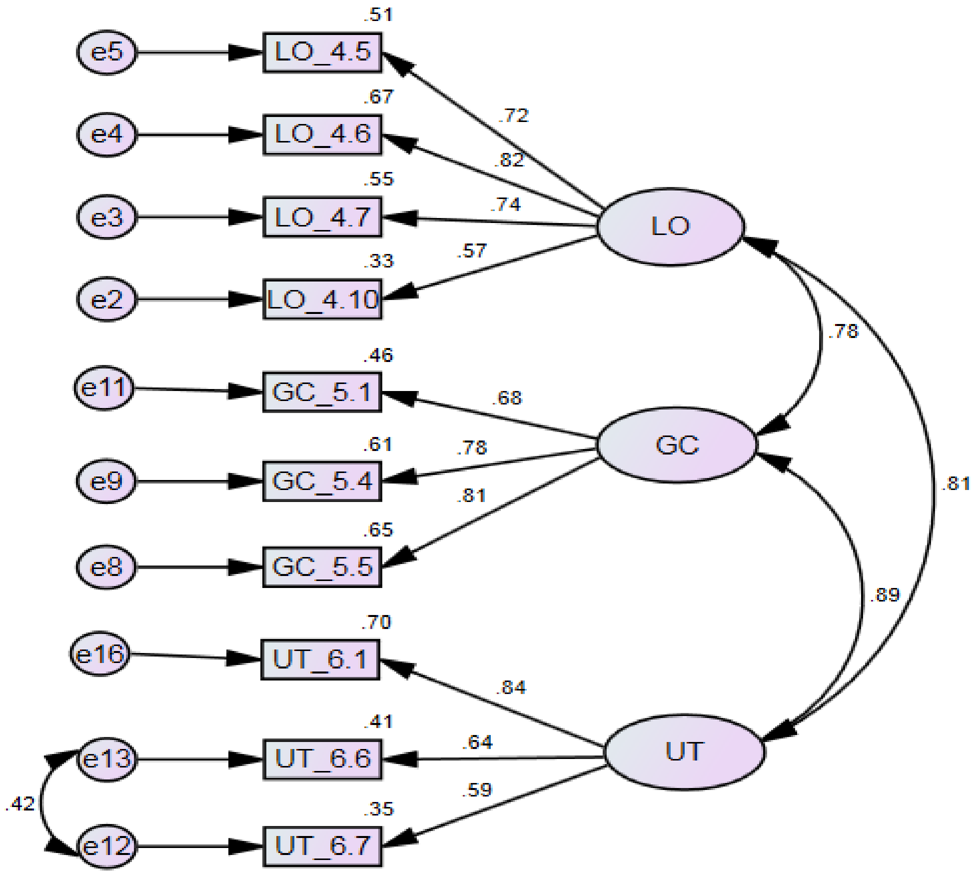
Pairs of Constructs	$\chi2$ of model 1 (correlation is unconstrained)	df of model 1	$\chi2$ of model 2 (correlation is constrained to 1)	df of model 2	Δ $\chi2$	Δdf	p-value	Chi-Square Critical Values; p =0.05
MC & RM	8.63	4	102.28	5	93.65	1	0.000	Significant
MC & CM	0.24	1	109.93	2	109.70	1	0.000	Significant
RM & CM	9.16	4	74.75	5	65.59	1	0.000	Significant

7.4 Measurement model of freight consolidation

Figure 7.2 presents the final measurement model of the freight consolidation construct. The standardised loading, composite reliability, Cronbach alpha and AVE results are presented in the Table 7.5-7.8 and the value of the figure is rounded up by AMOS version 21. Location of freight consolidation centre dimension consists of the observed variables LO_4.5, LO_4.6, LO_4.7, and LO_4.10. These observed variables meet convergent validity criterion with the standardised loadings greater than the threshold value of 0.5 ($0.57 < \beta < 0.82$) ($p<0.01$), and construct validity with the value of CR (.81) greater than the value of AVE (.51) (see Table 7.5 and 7.7). Moreover, they demonstrate discriminant validity, as they are highly correlated to the location of freight consolidation centre (LO) dimension while having lower correlation with other dimensions (covariance varies between 0.78 and 0.81) (Table 7.6). These observed variables are reliable, since their SMC exceeds the minimum threshold of 0.3 ($0.32 < SMC < 0.67$) (see Table 7.5). Moreover, these observed variables are reliable because the Cronbach's alpha is .80, composite reliability is .81, and AVE is .51 (see Table 7.7).

The geographical coverage dimension consists of three observed variables GC_5.1, GC_5.4 and GC_5.5. These observed variables are shown to exhibit convergent validity as the standardised loadings are greater than the threshold value of 0.5 ($0.68 < \beta < 0.81$) ($p<0.01$) and construct validity with the value of CR (.80) greater than the value of AVE (.57) (see Table 7.5 and 7.7). Moreover, they meet the discriminant validity criterion, as clearly clustered into their respective dimensions with covariance varies between 0.78 and 0.89 (see Table 7.6). These observed variables are reliable, as their SMC is greater than the minimum threshold of 0.3 ($0.46 < SMC < 0.65$), as well as because the Cronbach's alpha is .79, composite reliability is .80, and AVE is .57 (see Table 7.5 and 7.7).

The utilization of transport modes dimension consists of three observed variables UT_6.1, UT_6.6 and UT_6.7. The error term of variable UT_6.6 and 6.7 are correlated since they are sharing something in common to the latent variable (Byrne 2009). This is justified because the reduction of delivery vehicle would automatically lead to the reduction of driver. These observed variables are shown to exhibit convergent validity criterion since the standardised loadings exceed the threshold value of 0.5 ($0.59 < \beta < 0.83$) ($p<0.01$) and construct validity with the value of CR (.73) greater than the value of AVE (.50) (see Table 7.5 and 7.7). Moreover, they demonstrate discriminant validity, as clustered into their respective dimensions with covariance varies between 0.81 and 0.89 (see Table 7.6). These observed variables are reliable, as their SMC is greater than the minimum threshold of 0.3 (0.35 < SMC < 0.70), as well as because the Cronbach's alpha is .79, composite reliability is .73, and AVE is .50 (see Table 7.5 and 7.7).



Chi-square = 49.347 ,df = 31, p=.019, CMIN/DF(<3) = 1.592,
GFI(>.9) = .963, AGFI = .934 , NFI = .956, PCLOSE = .474
RMSEA(<.08) = .050, TLI(>.95) = .975, CFI(>.9) = .983

Note: LO = location of freight consolidation centre,
GC = geographical coverage, UT = utilization of transport modes.

Figure 7.2: Standardized estimates for freight consolidation construct

Table 7.5: Standardized factor loading, squared multiple correlation and p value of freight consolidation construct

Freight consolidation				
Location of freight consolidation centre				
Question items	Item descriptions	Standardised Loading **	Squared Multiple Correlation	P-value
LO_4.5	You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve inbound and outbound flow of products.	0.72	0.51	0.001
LO_4.6	You are going to implement freight consolidation, if the proper location of freight consolidation centre can reduce distribution costs.	0.82	0.67	0.001
LO_4.7	You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve delivery flexibility.	0.74	0.55	0.001
LO_4.10	You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve the flow of product returns.	0.57	0.33	0.001
Geographical coverage				
Question items	Item descriptions	Standardised Loading **	Squared Multiple Correlation	P-value
GC_5.1	You are going to implement freight consolidation, if it can improve on time delivery of each drop-off point.	0.68	0.46	0.001
GC_5.4	You are going to implement freight	0.78	0.61	0.001

	consolidation, if it can reduce travel distance.			
GC_5.5	You are going to implement freight consolidation, if it can reduce fuel consumption.	0.81	0.65	0.001
Utilization of transport mode				
Question items	Item descriptions	Standardised Loading **	Squared Multiple Correlation	P-value
UT_6.1	You are going to implement freight consolidation centre, if it can reduce transportation costs.	0.84	0.70	0.001
UT_6.6	You are going to implement freight consolidation centre, if it can reduce the number of delivery vehicles.	0.64	0.41	0.001
UT_6.7	You are going to implement freight consolidation centre, if it can reduce the number of drivers.	0.59	0.35	0.001
Achieved Fit Indices				
Chi-square =49.35, Degrees of Freedom = 31, P = 0.02, Bollen-Stine p value = 0.21, CMIN/DF = 1.59, GFI = 0.96, AGFI = 0.93, NFI = 0.96, TLI = 0.97, CFI = 0.98, RMSEA = 0.05				

Note: ** Statistically significant at $p < 0.01$ (two-tailed)

Table 7.6: Correlations of measurement items and sub-constructs under freight consolidation construct

	UT	GC	LO
UT	1.000		
GC	0.89	1.000	
LO	0.81	0.78	1.000
b6.1	**0.83**	0.64	0.57
b6.6	**0.64**	0.57	0.52
b6.7	**0.59**	0.52	0.48
b5.1	0.50	**0.68**	0.53
b5.4	0.51	**0.78**	0.51
b5.5	0.48	**0.81**	0.53
b4.5	0.58	0.56	**0.72**
b4.6	0.57	0.64	**0.82**
b4.7	0.40	0.58	**0.74**
b4.10	0.46	0.45	**0.57**

Table 7.7: Validity and reliability test of freight consolidation construct

	Cronbach's alpha (α)	Composite reliability (CR)	Average variance extracted (AVE)
Freight consolidation	0.90	0.92	0.52
LO	0.80	0.81	0.51
GC	0.79	0.80	0.57
UT	0.79	0.73	0.50

Location of freight consolidation centre dimension, geographical coverage dimension and utilization of transport modes dimension are, therefore, reliable and valid for freight consolidation construct because the composite reliability of .92, Cronbach alpha of 0.90, and AVE of 0.52 is greater than the threshold value (Table 7.7). Moreover, the Pearson's correlations between dimensions are below 0.9 (.79 < r < .89), which indicates discriminant validity and unidimensionality (Table 7.6). Nonetheless, all measurement dimensions demonstrate discriminate validity, as their chi-square differences are significant (Table 7.8). The measurement model fits the data very well with parameter like Chi-square = 49.347, Degrees of freedom = 31, p value = 0.019 (Bollen-Stine p value = 0.209, which is not significant at the 0.05 level). Other fit measures also indicate the goodness of fit of the model (CMIN/DF = 1.592, GFI = 0.963, AGFI = 0.934, NFI = 0.956, TLI = 0.975, CFI = 0.983, RMSEA = 0.050) (Table 7.5).

Table 7.8: Chi-square difference test of freight consolidation construct

Pairs of Constructs	$\chi 2$ of model 1 (correlation is unconstrained)	df of model 1	$\chi 2$ of model 2 (correlation is constrained to 1)	df of model 2	Δ $\chi 2$	Δdf	p-value	Chi-Square Critical Values; p =0.05
LO & GC	10.48	13	686.41	14	675.93	1	0.000	Significant
LO & UT	21.32	12	760.21	13	738.89	1	0.000	Significant
GC & UT	11.57	7	614.10	8	602.53	1	0.000	Significant

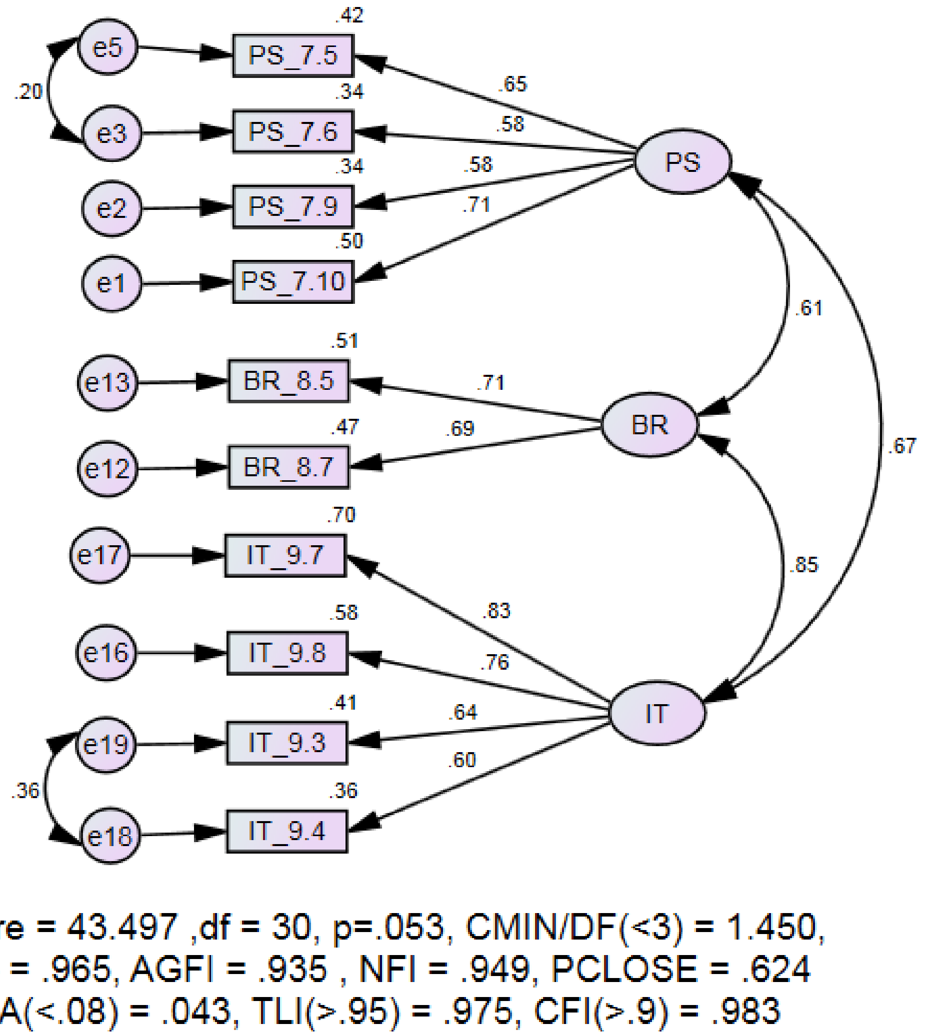
7.5 Measurement model of collaborative freight distribution

Figure 7.3 presents the final measurement model of collaborative freight distribution construct. The standardised loading, composite reliability, Cronbach alpha and AVE results are presented in the Table 7.9-7.12 and the value of the figure is rounded up by AMOS version 21. Partner selection dimension consists of observed variables PS_7.5, PS_7.6, PS_7.9, PS_7.10. These observed variables are shown to exhibit convergent validity criterion since the standardised loadings are greater than the threshold value of 0.5 ($0.58 < \beta < 0.71$) ($p<0.01$), and construct validity with the value of CR (.73) greater than the value of AVE (.45) (see Table 7.9 and 7.11). Moreover, they demonstrate discriminant validity, since they are strongly correlated with the partner selection (PS) dimension while having weaker correlation with other dimensions (see Table 7.10), with covariance ranging between 0.61 and 0.67. These observed variables are reliable, since their SMC is greater than the minimum threshold of 0.3 (0.34 < SMC < 0.5) (see Table 7.9). Moreover, they are reliable because the Cronbach's alpha is .74, composite reliability is .73, and AVE is .45 (see Table 7.11).

The benefits and risks sharing dimension consists of two observed variables BR_8.5 and BR_8.7, which ideally cannot explain the factor. However, Kline (2005) posits that if a standard CFA model with a single factor has at least three indicators, the model is identified. If a standard model with two or more factors has at least two indicators per factor, the model is identified. Therefore, two-item factor is not an issue. These observed variables are shown to exhibit convergent validity, since the standardised loadings exceed the threshold value of 0.5 ($0.69 < \beta < 0.71$) ($p<0.01$), and construct validity with the value of CR (.66) greater than the value of AVE (.51) (see Table 7.9 and 7.11). Moreover, they meet the discriminant validity criterion, since they are clearly clustered into their respective dimensions (see Table 7.10) with covariance varies between 0.61 and 0.85. These observed variables are reliable, since their SMC is greater than the minimum threshold of 0.3 (0.47 < SMC < 0.51), as well as because the Cronbach's alpha is .66, composite reliability is .66, and AVE is .51 (see Table 7.9 and 7.11).

The advanced information technology dimension consists of four observed variables IT_9.3, IT_9.4, IT_9.7 and IT_9.8. These observed variables exhibit convergent validity as their respective standardised loadings are greater than the threshold value of 0.5 ($0.60 < \beta < 0.83$) ($p<0.01$), and construct validity with the value of CR (.81) greater than the value of AVE (.52) (see Table 7.9 and 7.11). Moreover, they meet the discriminant validity criterion, since they are clearly clustered into their respective dimensions with covariance varies between 0.67 and 0.85

(see Table 7.10). These observed variables are reliable, as their SMC is greater than the minimum threshold of 0.3 (0.36 < SMC < 0.70), as well as because the Cronbach’s alpha is .83, composite reliability is .81, and AVE is .52 (see Table 7.9 and 7.11).



Note: PS= partner selection, BR = benefits and risks sharing, IT = advanced information technology

Figure 7.3: Standardized estimates for collaborative freight distribution construct

Table 7.9: Standardized factor loading, squared multiple correlation and p value of collaborative freight distribution construct

Collaborative Freight Distribution				
Partner selection				
Question items	Item descriptions	Standardised Loading**	Squared Multiple Correlation	P-value
PS_7.5	You are willing to assess and evaluate your partner's goals/objectives before choosing the partner.	0.65	0.42	0.001
PS_7.6	You consider complementary skills of your partner, e.g., partner's experience, capabilities, and potential for making real contribution, when choosing an alliance partner.	0.58	0.34	0.001
PS_7.9	Peer relationship between the top executives of you and your partner's firm must be established.	0.58	0.34	0.001
PS_7.10	You are willing to learn a new working environment.	0.71	0.50	0.001
Benefits and risks sharing				
Question items	Item descriptions	Standardised Loading**	Squared Multiple Correlation	P-value
BR_8.5	You will implement collaborative freight distribution, if it is going to improve sales of you and your partner's firm.	0.71	0.51	0.001
BR_8.7	You will implement collaborative freight distribution, if it is going to improve on-time delivery of you and your partner's firm.	0.69	0.47	0.001
Advanced Information Technology				
Question items	Item descriptions	Standardised	Squared	P-value

		Loading **	Multiple Correlation	
IT_9.3	You are going to implement market-based system (i.e., hubs, portals)	0.64	0.41	0.001
IT_9.4	You are going to implement collaborative planning and forecasting-based systems (i.e., CPFR)	0.60	0.36	0.001
IT_9.7	You will implement information technology, if it is going to improve service levels, e.g., higher on-time performance, of you and your partner's firm.	0.83	0.70	0.001
IT_9.8	You will implement information technology, if it is going to increase visibility, e.g., identifying location of freight in the supply chain, of you and your partner's firm.	0.76	0.58	0.001
Achieved Fit Indices				
Chi-square =43.50, Degrees of Freedom = 30, P = 0.05, Bollen-Stine p value = 0.16, CMIN/DF = 1.45, GFI = 0.96, AGFI = 0.93, NFI = 0.95, TLI = 0.97, CFI = 0.98, RMSEA = 0.04				

Note: ** Statistically significant at $p < 0.01$ (two-tailed)

Table 7.10: Correlations of measurement items and sub-constructs under collaborative freight distribution construct

	IT	BR	PS
IT	1.000		
BR	0.85	1.000	
PS	0.67	0.61	1.000
c9.3	**0.64**	0.55	0.43
c9.4	**0.60**	0.51	0.41
c9.7	**0.83**	0.61	0.56
c9.8	**0.76**	0.65	0.51
c8.5	0.60	**0.71**	0.44
c8.7	0.59	**0.69**	0.42
c7.5	0.44	0.40	**0.65**
c7.6	0.39	0.36	**0.58**
c7.9	0.39	0.36	**0.58**
c7.10	0.48	0.43	**0.71**

Table 7.11: Validity and reliability test of collaborative freight distribution construct

	Cronbach's alpha (α)	Composite reliability (CR)	Average variance extracted (AVE)
Collaborative Freight Distribution	0.85	0.89	0.50
PS	0.74	0.73	0.45
BR	0.66	0.66	0.51
IT	0.83	0.81	0.52

Based on the above findings, it is evident that partner selection, benefits and risks sharing, and advanced information technology dimensions are reliable and valid for collaborative freight distribution construct, since the composite reliability is .89, Cronbach's alpha is 0.85, and AVE is 0.50 (see Table 7.11). Moreover, the Pearson's correlations between dimensions are less than 0.9 ($0.61 < r < 0.85$) which indicates discriminant validity and unidimensionality (Table 7.10). Referring to Table 7.12, all measurement dimensions also demonstrate discriminant validity, since their chi-square differences are significant. The measurement model fits the data very well, since the Chi-square =43.50, degrees of freedom = 30, p value = 0.05 (Bollen-Stine p value = 0.16, which is not significant at the 0.05 level). Other fit measures also indicate the goodness of fit of the model (CMIN/DF = 1.45, GFI = 0.96, AGFI = 0.93, NFI = 0.95, TLI = 0.97, CFI = 0.98, RMSEA = 0.04) (Table 7.9).

Table 7.12: Chi-square difference test of collaborative freight distribution construct

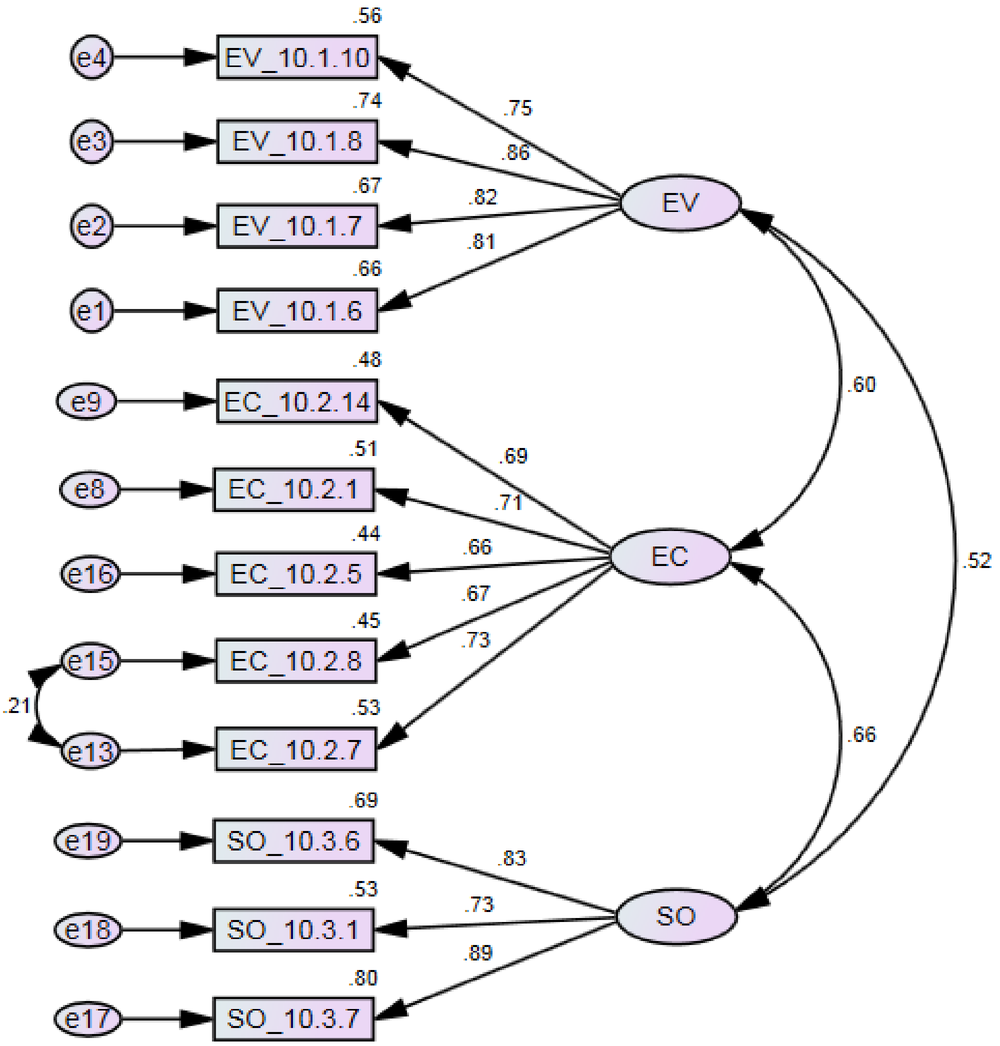
Pairs of Constructs	$\chi 2$ of model 1 (correlation is unconstrained)	df of model 1	$\chi 2$ of model 2 (correlation is constrained to 1)	df of model 2	$\Delta\ \chi 2$	Δdf	p-value	Chi-Square Critical Values; p =0.05
PS & BR	7.89	7	839.74	8	831.85	1	0.000	Significant
PS & IT	21.00	17	667.47	18	646.50	1	0.000	Significant
BR & IT	15.44	7	544.86	8	529.42	1	0.000	Significant

7.6 Measurement model of sustainable distribution

Figure 7.4 presents the final measurement model of sustainable distribution construct. The standardised loading, composite reliability, Cronbach alpha and AVE results are presented in the Table 7.13-7.16 and the value of the figure is rounded up by AMOS version 21. Environmental dimension consists of observed variables EV_10.1.6, EV_10.1.7, EV_10.1.8 and EV_10.1.10. These observed variables are shown to exhibit convergent validity, since their standardised loadings are greater than the threshold value of 0.5 ($0.75 < \beta < 0.86$) ($p<0.01$), and construct validity with the value of CR (.88) greater than the value of AVE (.66) (see Table 7.13 and 7.15). Moreover, they meet the discriminant validity criterion, as clustered into their respective dimensions with covariance varies between 0.52 and 0.60 (see Table 7.14). These observed variables are reliable, since their SMC exceeds the minimum threshold of 0.3 ($0.56 < SMC < 0.74$) (see Table 7.13). Moreover, they are reliable, as the Cronbach's alpha is 0.88, composite reliability is 0.88, and AVE is 0.66 (see Table 7.15).

The economic dimension consists of five observed variables EC_10.2.1, EC_10.2.5, EC_10.2.7, EC_10.2.8 and EC_10.2.14. These observed variables are shown to exhibit convergent validity since their standardised loadings are greater than the threshold value of 0.5 ($0.66 < \beta < 0.73$) ($p<0.01$), and construct validity with the value of CR (.82) greater than the value of AVE (.50) (see Table 7.13 and 7.15). Moreover, they demonstrate discriminant validity, as they are clearly clustered into their respective dimensions (see Table 7.14) with covariance varies between 0.60 and 0.66. These observed variables are reliable, since their SMC is greater than the minimum threshold of 0.3 ($0.44 < SMC < 0.53$), as well as because the Cronbach's alpha is .83, composite reliability is .82, and AVE is .50 (see Table 7.13 and 7.15).

The social dimension consists of three observed variables SO_10.3.1, SO_10.3.6 and SO_10.3.7. These observed variables exhibit convergent validity, since the standardised loadings are greater than the threshold value of 0.5 ($0.72 < \beta < 0.89$) ($p<0.01$), and construct validity with the value of CR (.86) greater than the value of AVE (.67) (see Table 7.13 and 7.15). Moreover, they meet the discriminant validity criterion, as clustered into their respective dimensions with covariance varies between 0.52 and 0.66 (see Table 7.14). They are reliable since their SMC is greater than the minimum threshold of 0.3 ($0.53 < SMC < 0.80$) and because the Cronbach's alpha is .85, composite reliability is .86, and AVE is .67 (see Table 7.13 and 7.15).



Chi-square = 64.069 ,df = 50, p=.087, CMIN/DF(<3) = 1.281,
GFI(>.9) = .959, AGFI = .935 , NFI = .957,
TLI(>.95) = .987, CFI(>.9) = .990
PCLOSE = .858, RMSEA(<.08) = .034,

Note: EV = environmental factor, EC = economic factor, SO = social factor

Figure 7.4: Standardized estimates for sustainable distribution construct

Table 7.13: Standardized factor loading, squared multiple correlation and p value of sustainable distribution construct

Sustainable distribution				
Environmental factor				
Question items	Item descriptions	Standardised Loading **	Squared Multiple Correlation	P-value
EV_10.1.6	Reduce water pollution	0.81	0.66	0.001
EV_10.1.7	Reduce visual pollution	0.82	0.67	0.001
EV_10.1.8	Reduce odour pollution	0.86	0.74	0.001
EV_10.1.10	Reduce solid waste	0.75	0.56	0.001
Economic factor				
Question items	Item descriptions	Standardised Loading **	Squared Multiple Correlation	P-value
EC_10.2.1	Improve company's reputation	0.71	0.51	0.001
EC_10.2.5	lower the risk of business operation	0.66	0.44	0.001
EC_10.2.7	Help identify easier ways to attract external sources of sponsorship	0.73	0.53	0.001
EC_10.2.8	Broaden markets and improve conditions for sales increase	0.67	0.45	0.001
EC_10.2.14	Improve market opportunities	0.69	0.48	0.001
Social factor				
Question items	Item descriptions	Standardised Loading **	Squared Multiple Correlation	P-value
SO_10.3.1	Increase staff motivation	0.73	0.53	0.001
SO_10.3.6	Enhance human capital value	0.83	0.69	0.001
SO_10.3.7	Improve the contribution of a firm to community development (i.e., job creation and tax breaks received)	0.89	0.80	0.001

Achieved Fit Indices
Chi-square = 64.07, Degrees of Freedom = 50, P = 0.09, Bollen-Stine p value = 0.29, CMIN/DF = 1.28, GFI = 0.96, AGFI = 0.93, NFI = 0.96, TLI = 0.99, CFI = 0.99, RMSEA = 0.03

Note: ** Statistically significant at $p < 0.01$ (two-tailed)

Table 7.14: Correlations of measurement items and sub-constructs under sustainable distribution construct

	SO	EC	EV
SO	1.000		
EC	0.66	1.000	
EV	0.52	0.60	1.000
d10.3.6	**0.83**	0.55	0.43
d10.3.1	**0.72**	0.49	0.38
d10.3.7	**0.89**	0.59	0.47
d10.2.5	0.44	**0.66**	0.40
d10.2.8	0.44	**0.67**	0.40
d10.2.7	0.48	**0.73**	0.44
d10.2.14	0.46	**0.69**	0.42
d10.2.1	0.47	**0.71**	0.43
d10.1.10	0.39	0.45	**0.75**
d10.1.8	0.45	0.52	**0.86**
d10.1.7	0.43	0.50	**0.82**
d10.1.6	0.42	0.49	**0.81**

Table 7.15: Validity and reliability test of sustainable distribution construct

	Cronbach's alpha (α)	Composite reliability (CR)	Average variance extracted (AVE)
Sustainable distribution	0.90	0.94	0.59
EV	0.88	0.88	0.66
EC	0.83	0.82	0.50
SO	0.85	0.86	0.67

Based on the evidence presented above, environmental, economic, and social dimension are reliable and valid for sustainable distribution construct, since the composite reliability is .94, Cronbach's alpha is 0.90 and AVE is 0.59 (see Table 7.15). The Pearson's correlations between dimensions are less than 0.9 ($0.52 < r < 0.66$), which indicate discriminant validity and unidimensionality (Table 7.14). Referring to Table 7.16, all measurement dimensions meet the discriminant validity criterion, since their chi-square differences are significant. The measurement model fits the data very well, as the Chi-square = 64.07, degrees of freedom = 50, p value = 0.09 (Bollen-Stine p value = 0.29, which is not significant at the level of 0.05). Other fit measures also indicate the goodness of fit of the model to the data (CMIN/DF = 1.28, GFI = 0.96, AGFI = 0.93, NFI = 0.96, TLI = 0.99, CFI = 0.99, RMSEA = 0.03) (Table 7.13).

Table 7.16: Chi-square difference test of sustainable distribution construct

Pairs of Constructs	χ2 of model 1 (correlation is unconstrained)	df of model 1	χ2 of model 2 (correlation is constrained to 1)	df of model 2	Δ χ2	Δdf	p-value	Chi-Square Critical Values; p =0.05
EV & EC	25.06	25	149.79	26	124.73	1	0.000	Significant
EV & SO	17.01	13	130.71	14	113.69	1	0.000	Significant
EC & SO	26.55	18	598.14	19	571.59	1	0.000	Significant

7.7 Measurement model of research construct

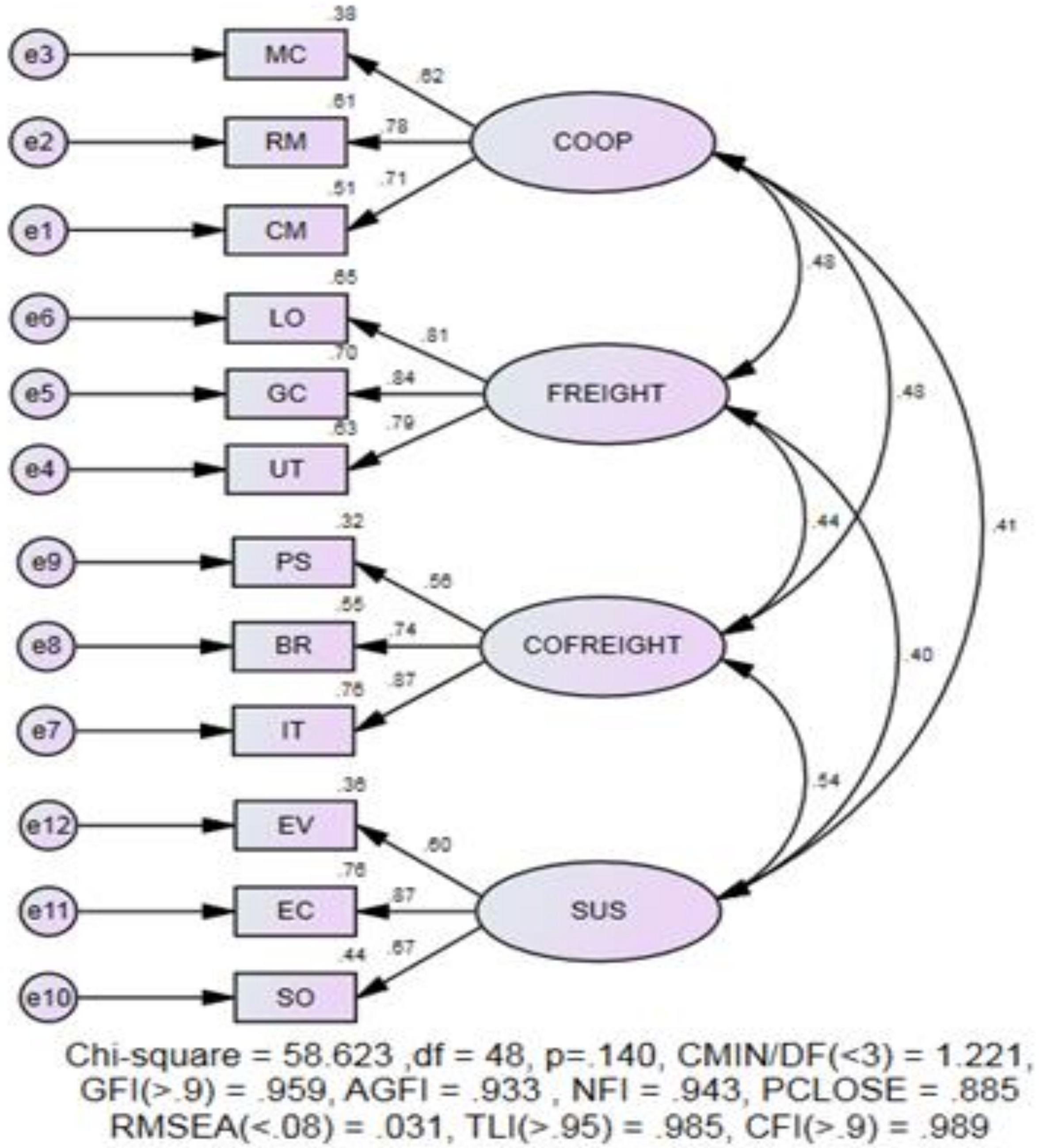
Figure 7.5 presents the final measurement model of all research constructs including co-opetition (COOP), freight consolidation (FREIGHT), collaborative freight distribution (COFREIGHT), and sustainable distribution (SUS). The model was produced to test validity and reliability of measurement dimensions and research constructs prior to use for structural modeling. In the model, the observe variables from previous analysis were aggregated to the measurement dimension level (Byrne, 2009). For example, management commitment (MC) dimension is derived from an aggregation of observed variables MC_1.5 and MC_1.6. The standardised loading, composite reliability, Cronbach alpha and AVE results are presented in the Table 7.17-7.20 and the value of the figure is rounded up by AMOS version 21.

Co-opetition construct consists of management commitment (MC), relationship management (RM), and communication management (CM). These measurement dimensions are shown to exhibit convergent validity since their standardised loadings are greater than the threshold value of 0.5 ($0.61 < \beta < 0.78$) ($p<0.01$), and construct validity with the value of CR (.75) greater than the value of AVE (.50) (see Table 7.17 and 7.19). Moreover, they meet the discriminant validity criterion, as clustered into their respective construct (see Table 7.18) with covariance varies from .41 to .48 and within the threshold values 0.80. These measurement dimensions are reliable, since their SMC exceeds the minimum threshold of 0.3 ($0.38 < SMC < 0.61$) (see Table 7.17). Moreover, they are reliable, as the Cronbach's alpha is 0.74, composite reliability is 0.75, and AVE is 0.50 (see Table 7.19).

Freight consolidation construct consists of location of freight consolidation centre (LO), geographical coverage (GC), and utilization of transport modes (UT). These measurement dimensions are shown to exhibit convergent validity since their standardised loadings are greater than the threshold value of 0.5 ($0.79 < \beta < 0.84$) ($p<0.01$), and construct validity with the value of CR (.85) greater than the value of AVE (.66) (see Table 7.17 and 7.19). Moreover, they meet the discriminant validity criterion, as clustered into their respective construct (see Table 7.18) with covariance varies between 0.40 and 0.48. These measurement dimensions are reliable, since their SMC exceeds the minimum threshold of 0.3 ($0.63 < SMC < 0.70$) (see Table 7.17). Moreover, they are reliable, as the Cronbach's alpha is 0.85, composite reliability is 0.85, and AVE is 0.66 (see Table 7.19).

Collaborative freight distribution construct consists of partner selection (PS), benefits and risks sharing (BR), and advanced information technology (IT). These measurement dimensions are shown to exhibit convergent validity, since their standardised loadings are greater than the threshold value of 0.5 ($0.56 < \beta < 0.87$) ($p<0.01$), and construct validity with the value of CR (.78) greater than the value of AVE (.54) (see Table 7.17 and 7.19). Moreover, they meet the discriminant validity criterion, as clustered into their respective construct (see Table 7.18) with covariance varies between 0.44 and 0.54. These measurement dimensions are reliable, since their SMC exceeds the minimum threshold of 0.3 (0.31 < SMC < 0.76) (see Table 7.17). Moreover, they are reliable, as the Cronbach's alpha is 0.77, composite reliability is 0.78, and AVE is 0.54 (see Table 7.19).

Sustainable distribution construct consists of economics (EC), social (SO), and environmental (EV) factor. These measurement dimensions are shown to exhibit convergent validity, since their standardised loadings are greater than the threshold value of 0.5 ($0.60 < \beta < 0.87$) ($p<0.01$), and construct validity with the value of CR (.76) greater than the value of AVE (.52) (see Table 7.17 and 7.19). Moreover, they meet the discriminant validity criterion, as clustered into their respective construct (see Table 7.18) with covariance varies between 0.40 and 0.54. These measurement dimensions are reliable, since their SMC exceeds the minimum threshold of 0.3 (0.36 < SMC < 0.76) (see Table 7.17). Moreover, they are reliable, as the Cronbach's alpha is 0.76, composite reliability is 0.76, and AVE is 0.52 (see Table 7.19).



Note: COOP = co-opetition, FREIGHT = freight consolidation, COFREIGHT = collaborative freight consolidation, SUS = sustainable distribution

Figure 7.5: Standardized estimates for research constructs

Table 7.17: Standardized factor loading, squared multiple correlation and p value of research constructs

Co-opetition				
Measurement dimension	Item descriptions	Standardised Loading **	Squared Multiple Correlation	P-value
MC	Management Commitment	0.62	0.38	0.001
RM	Relationship management	0.78	0.61	0.001
CM	Communication management	0.71	0.51	0.001
Freight consolidation				
Measurement dimension	Item descriptions	Standardised Loading **	Squared Multiple Correlation	P-value
LO	Location of freight consolidation centre	0.81	0.65	0.001
GC	Geographical coverage	0.84	0.70	0.001
UT	Utilization of transport modes	0.79	0.63	0.001
Collaborative freight consolidation				
Measurement dimension	Item descriptions	Standardised Loading **	Squared Multiple Correlation	P-value
PS	Partner selection	0.56	0.31	0.001
BR	Benefits and risks sharing	0.74	0.55	0.001
IT	Advanced information technology	0.87	0.76	0.001
Sustainable distribution				
Measurement dimension	Item descriptions	Standardised Loading **	Squared Multiple Correlation	P-value
EV	Environmental factor	0.60	0.36	0.001
EC	Economic factor	0.87	0.76	0.001
SO	Social factor	0.67	0.44	0.001

Achieved Fit Indices
Chi-square = 58.62, Degrees of Freedom = 48, P = 0.14, CMIN/DF = 1.22, GFI = 0.96, AGFI = 0.93, NFI = 0.94, TLI = 0.98, CFI = 0.99, RMSEA = 0.03

Note: ** Statistically significant at $p < 0.01$

Table 7.18: Correlations of sub-constructs of research constructs

	COOP	FREIGHT	COFREIGHT	SUS
COOP	1.000			
FREIGHT	0.48	1.000		
COFREIGHT	0.48	0.44	1.000	
SUS	0.41	0.40	0.54	1.000
MC	**0.61**	0.29	0.30	0.21
RM	**0.78**	0.37	0.37	0.27
CM	**0.71**	0.34	0.34	0.24
LO	0.39	**0.81**	0.35	0.33
GC	0.40	**0.84**	0.37	0.34
UT	0.38	**0.79**	0.35	0.32
PS	0.27	0.25	**0.56**	0.30
BR	0.36	0.33	**0.74**	0.40
IT	0.42	0.38	**0.87**	0.47
EV	0.20	0.24	0.32	**0.60**
EC	0.30	0.35	0.47	**0.87**
SO	0.23	0.27	0.36	**0.67**

Table 7.19: Validity and reliability test of research construct

	Cronbach's alpha (α)	Composite reliability (CR)	Average variance extracted (AVE)
COOP	0.74	0.75	0.50
FREIGHT	0.85	0.85	0.66
COFREIGHT	0.77	0.78	0.54
SUS	0.76	0.76	0.52

Based on the above result, COOP, FREIGHT, COFREIGHT, and SUS are reliable and valid to be used in structural equation modeling. The Pearson's correlations between constructs are less than 0.9 (0.40 < r < 0.54), which indicates discriminant validity and unidimensionality (Table 7.18). Referring to Table 7.20, all constructs also demonstrate discriminant validity, since their chi-square differences are significant. The measurement model fits the data very well, since the Chi-square =58.62, degrees of freedom = 48, p value = 0.14. Other fit measures also indicate the goodness of fit of the model (CMIN/DF = 1.22, GFI = 0.96, AGFI = 0.93, NFI = 0.94, TLI = 0.98, CFI = 0.99, RMSEA = 0.03) (Table 7.17).

Table 7.20: Chi-square difference test of research construct

Pairs of Constructs	$\chi 2$ of model 1 (correlation is unconstrained)	df of model 1	$\chi 2$ of model 2 (correlation is constrained to 1)	df of model 2	$\Delta \chi 2$	Δdf	p-value	Chi-Square Critical Values; p =0.05
COOP &FREIGHT	4.73	8	237.71	9	232.98	1	0.000	Significant
COOP & COFREIGHT	5.28	8	392.64	9	387.36	1	0.000	Significant
COOP & SUS	9.92	8	307.03	9	297.38	1	0.000	Significant
FREIGHT & COFREIGHT	8.23	8	506.78	9	498.55	1	0.000	Significant
FREGITH & SUS	13.44	8	611.80	9	598.36	1	0.000	Significant
COFREIGHT & SUS	13.91	8	572.03	9	558.12	1	0.000	Significant

In summary, CFA confirmed that all measurement dimensions of each latent factor (constructs) are valid and reliable, and are thus ready to be employed for path analysis using AMOS 21.

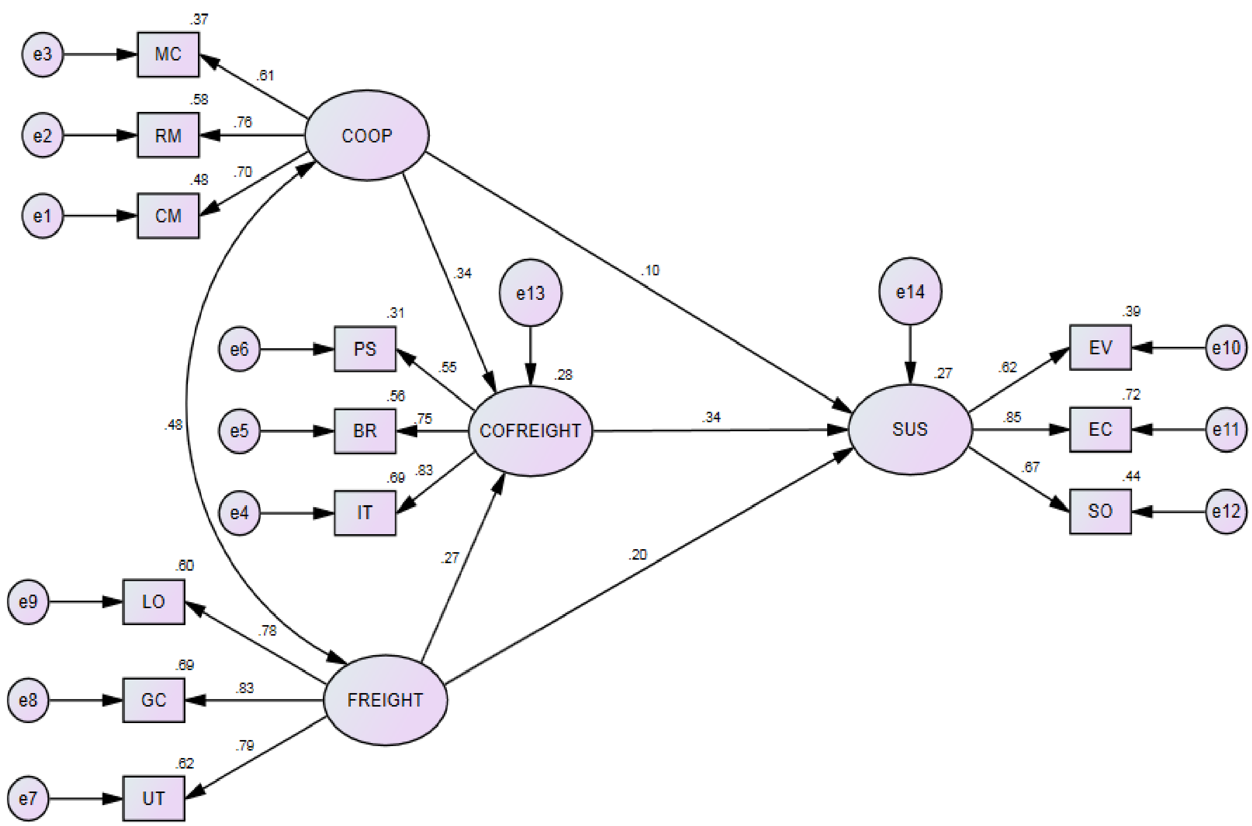
7.8 Structural model of sustainable distribution

The final measurement models of co-opetition (COOP), freight consolidation (FREIGHT), collaborative freight distribution (COFREIGHT), and sustainable distribution (SUS) were employed to generate the structural model. Byrne (2009) suggested that mean values of measurement items (observed variables) yielded by CFA could be used to develop the structural model. Thus, the management commitment dimension was derived from the mean value of measurement items MC_1.5 and MC_1.6, and relationship management dimension was derived from the mean value of measurement items RM_2.2, RM_2.4, and RM_2.5. Similarly, communication management dimension was derived from the mean value of measurement items CM_3.6 and CM_3.7, and location of freight consolidation dimension was derived from the mean value of measurement items LO_4.5, LO_4.6, LO_4.7, and LO_4.10. Geographical coverage dimension was derived from the mean value of measurement items GC_5.1, GC_5.4, and GC_5.5, whereas utilization of transport modes dimension was derived from the mean value of measurement items UT_6.1, UT_6.6, and UT_6.7. Partner selection dimension was derived from the mean value of measurement items PS_7.5, PS_7.6, PS_7.9, PS_7.10. Benefits and risks sharing dimension was derived from the mean value of measurement items BR_8.5 and BR_8.7. Advanced information technology dimension was derived from the mean value of measurement items IT_9.7, IT_9.8, IT_9.3, and IT_9.4. Environmental dimension was derived from the mean value of measurement items EV_10.1.10, EV_10.1.8, EV_10.1.7, and EV_10.1.6. Economic dimension was derived from the mean value of measurement items EC_10.2.14, EC_10.2.1, EC_10.2.5, EC_10.2.8, and EC_10.2.7. Finally, social dimension was derived from the mean value of measurement items SO_10.3.6, SO_10.3.1, and SO_10.3.7.

The hypothesized model in the form of a structural path model is presented in Figure 7.6. AMOS version 21 was used to analyse model fit. To determine whether the hypothesized model yields the best fit to the data, alternative models were also evaluated by excluding one of the paths at a time (Li et al. 2006). This approach resulted in six competing models, labelled ‘competing model 1’ to ‘competing model 6’ (Figure 7.7 to Figure 7.12).

7.8.1 The hypothesized model

Figure 7.6 presents the hypothesized model and the value of the figure is rounded up by AMOS version 21. All measurements had standardized loading significant at 0.01 and 0.05. However, relationship between COOP and SUS is found to be non-significant (p = .34, p> 0.05) (Table 7.21). The data fitted the model very well, with Chi-square = 52.55, degrees of freedom = 48, p value = .30, CMIN/DF = 1.09, GFI = .96, AGFI = .94, NFI = .95, TLI = .99, CFI = .99, PCLOSE = .96, and RMSEA = 0.02. Based on the goodness-of-fit indices, it can be concluded that the hypothesized model had an adequate level of fit. To determine whether the proposed model in Figure 7.6 was the best fit or any other alternate ones would result in better parsimony, alternative models were assessed by dropping one of the links between the constructs at a time (Li et al., 2006).



Chi-square = 52.549 ,df = 48, p=.302, CMIN/DF(<3) = 1.095,
GFI(>.9) = .965, AGFI = .943 , NFI = .947, TLI(>.95) = .993, CFI(>.9) = .995
PCLOSE = .963, RMSEA(<.08) = .020, PNFI = .688

Figure 7.6: Hypothesized model

Table 7.21: Standardized loading and p value of the hypothesized model

			Standardized loading	P value
COFREIGHT	<---	COOP	0.34	0.001**
COFREIGHT	<---	FREIGHT	0.27	0.003**
SUS	<---	COOP	0.10	0.339
SUS	<---	FREIGHT	0.19	0.036*
SUS	<---	COFREIGHT	0.34	0.001**
CM	<---	COOP	0.70	0.001**
RM	<---	COOP	0.76	0.001**
MC	<---	COOP	0.61	0.001**
IT	<---	COFREIGHT	0.83	0.001**
BR	<---	COFREIGHT	0.75	0.001**
PS	<---	COFREIGHT	0.55	0.001**
UT	<---	FREIGHT	0.79	0.001**
GC	<---	FREIGHT	0.83	0.001**
LO	<---	FREIGHT	0.78	0.001**
EV	<---	SUS	0.62	0.001**
EC	<---	SUS	0.85	0.001**
SO	<---	SUS	0.67	0.001**

** Statistically significant at $p < 0.01$
*   Statistically significant at $p < 0.05$

7.8.2 Competing model 1 (excluding path between COOP and SUS)

Figure 7.7 presents the competing model 1 and the value of the figure is rounded up by AMOS version 21. The non-significant path between COOP and SUS was removed. As can be seen in Table 7.22, all path coefficients were statistically significant at the 0.01 level. Comparing with the hypothesised model, the path coefficient between COFREIGHT and COOP, SUS and FREIGHT, and SUS and COFREIGHT became stronger except the path coefficient between COFREIGHT and FREIGHT. The data set fitted the model very well, with Chi-square = 53.42, degrees of freedom = 49, p value = .31, CMIN/DF = 1.09, GFI = .96, AGFI = .94, NFI = .95, TLI = .99, CFI = .99, PCLOSE = .97, and RMSEA = 0.02. These indices confirmed that the competing model 1 had an adequate level of empirical support.

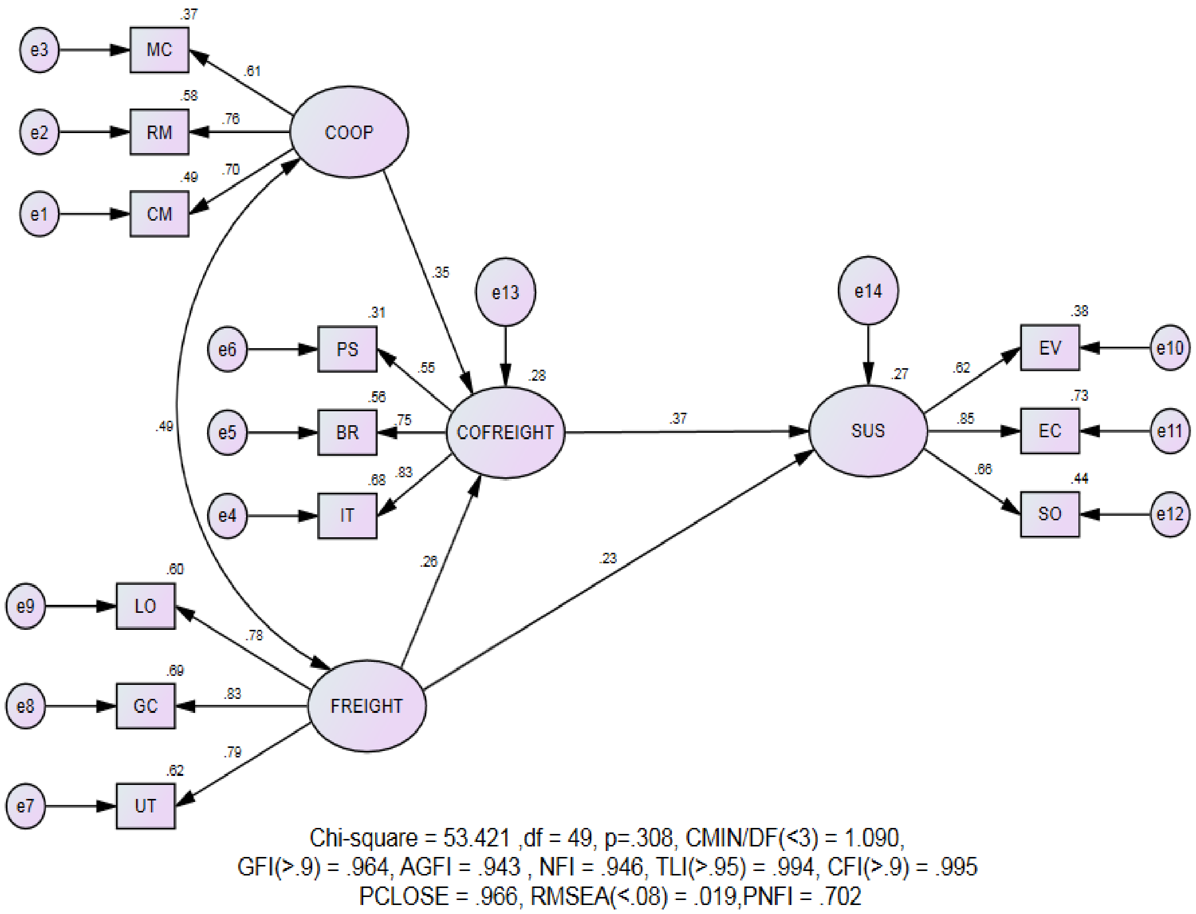


Figure 7.7: Competing model 1

Table 7.22: Standardized loading estimate and p value of competing model 1

			Standardised loading	P value
COFREIGHT	<---	COOP	0.35	0.001**
COFREIGHT	<---	FREIGHT	0.26	0.003**
SUS	<---	FREIGHT	0.23	0.008**
SUS	<---	COFREIGHT	0.37	0.001**
CM	<---	COOP	0.70	0.001**
RM	<---	COOP	0.76	0.001**
MC	<---	COOP	0.61	0.001**
IT	<---	COFREIGHT	0.83	0.001**
BR	<---	COFREIGHT	0.75	0.001**
PS	<---	COFREIGHT	0.55	0.001**
UT	<---	FREIGHT	0.79	0.001**
GC	<---	FREIGHT	0.83	0.001**
LO	<---	FREIGHT	0.78	0.001**
EV	<---	SUS	0.62	0.001**
EC	<---	SUS	0.85	0.001**
SO	<---	SUS	0.66	0.001**

** Statistically significant at $p < 0.01$
* Statistically significant at $p < 0.05$

7.8.3 Competing model 2 (excluding path between FREIGHT and SUS)

Figure 7.8 presents the competing model 2 and the value of the figure is rounded up by AMOS version 21. The path between FREIGHT and SUS was removed. The results presented in Table 7.23 revealed that all path coefficients were significant at both 0.01 and 0.05 significance levels. Comparing with the hypothesised model, the path coefficient between COFREIGHT and FREIGHT, SUS and COOP, and SUS and COFREIGHT became stronger except the path coefficient between COFREIGHT and COOP. Overall, the data fitted the model very well, with Chi-square = 56.89, degrees of freedom = 49, p value = .20, CMIN/DF = 1.16, GFI = .96, AGFI = .94, NFI = .94, TLI = .99, CFI = .99, PCLOSE = .94, and RMSEA = 0.03. These indices demonstrated adequate level of empirical support for the competing model 2.

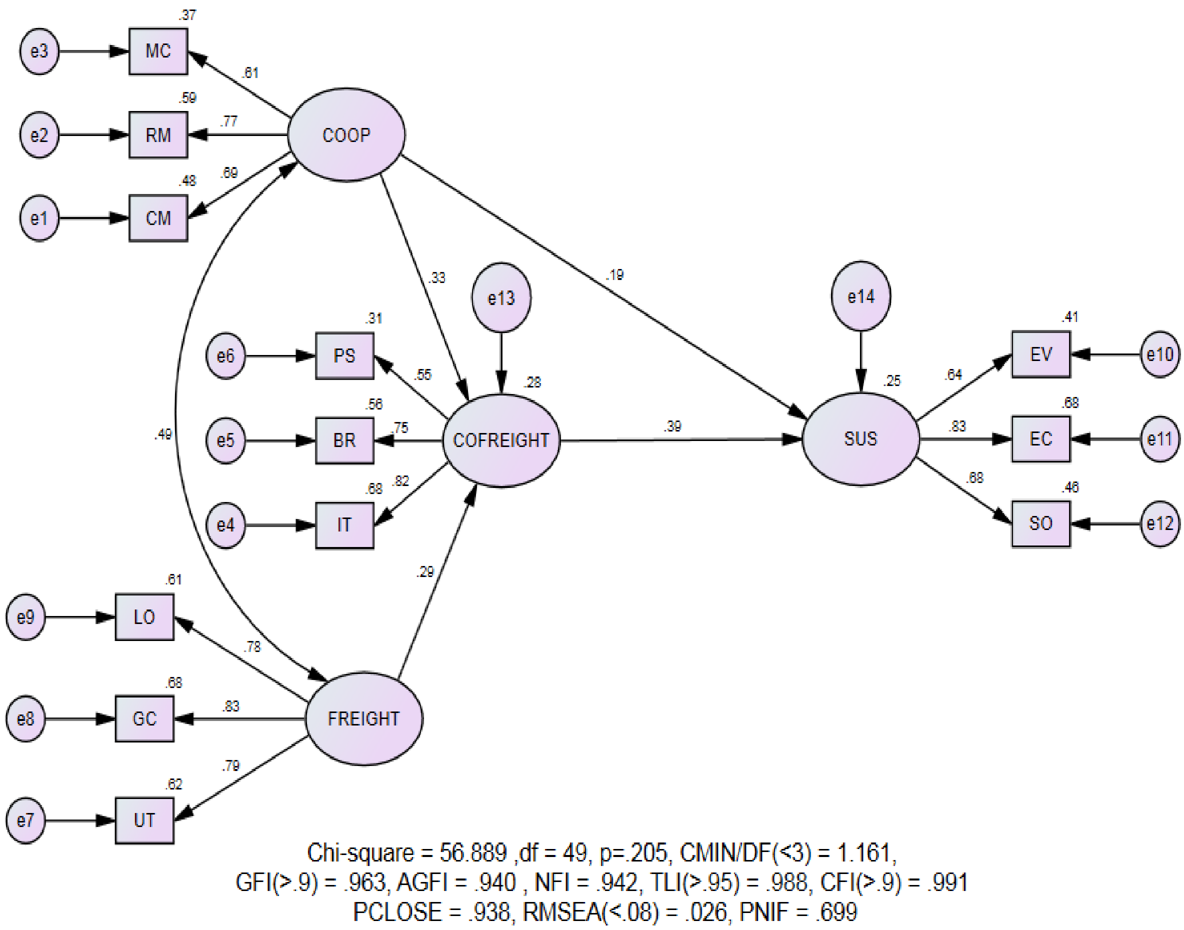


Figure 7.8: Competing model 2

Table 7.23: Standardized loading estimate and p value of competing model 2

			Standardised loading	P value
COFREIGHT	<---	COOP	0.33	0.001**
COFREIGHT	<---	FREIGHT	0.29	0.002**
SUS	<---	COFREIGHT	0.39	0.001**
SUS	<---	COOP	0.19	0.050*
CM	<---	COOP	0.69	0.001**
RM	<---	COOP	0.76	0.001**
MC	<---	COOP	0.61	0.001**
IT	<---	COFREIGHT	0.82	0.001**
BR	<---	COFREIGHT	0.75	0.001**
PS	<---	COFREIGHT	0.55	0.001**
UT	<---	FREIGHT	0.79	0.001**
GC	<---	FREIGHT	0.83	0.001**
LO	<---	FREIGHT	0.78	0.001**
EV	<---	SUS	0.64	0.001**
EC	<---	SUS	0.83	0.001**
SO	<---	SUS	0.68	0.001**

** Statistically significant at $p < 0.01$
* Statistically significant at $p < 0.05$

7.8.4 Competing model 3 (excluding path between COOP and COFREIGHT)

Figure 7.9 presents the competing model 3 and the value of the figure is rounded up by AMOS version 21. The path between COOP and COFREIGHT was removed. As demonstrated in Table 7.24, most of the path coefficients were significant at the 0.01 level, except the path coefficient between SUS and COOP (p = 0.202), and SUS and FREIGHT (p = 0.079). Comparing with the hypothesised model, the path coefficient between COFREIGHT and FREIGHT, and SUS and COFREIGHT became stronger. Overall, the data fitted the model very well, with Chi-square = 65.73, degrees of freedom = 49, p value = .05, CMIN/DF = 1., GFI = .6 , AGFI = .93, NFI = .93, TLI = .97, CFI = .98, PCLOSE = .80, and RMSEA = 0.04. These indices confirmed that the competing model 3 had adequate level of empirical support.

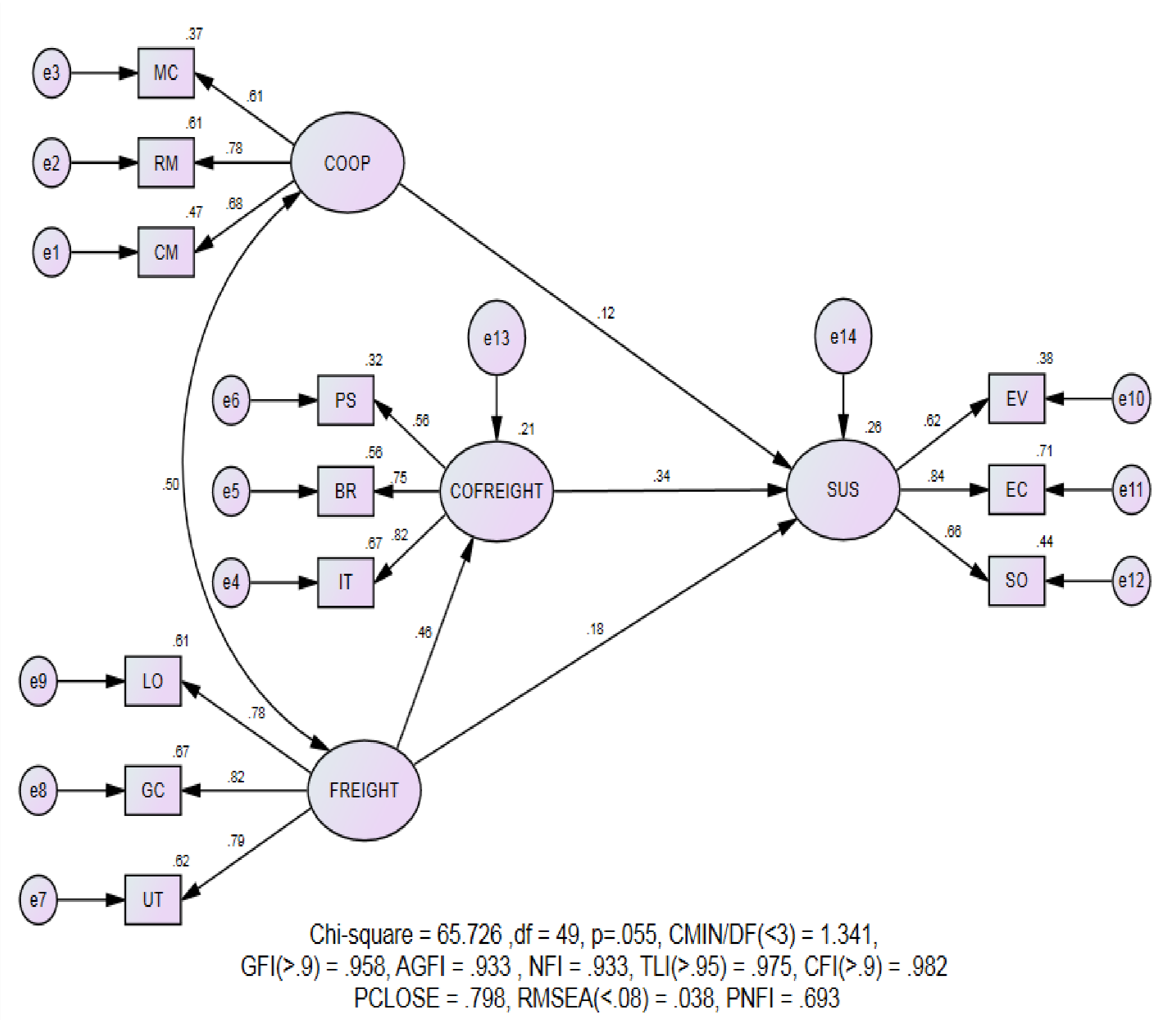


Figure 7.9: Competing model 3

Table 7.24: Standardized loading estimate and p value of competing model 3

			Standardised loading	P value
COFREIGHT	<---	FREIGHT	0.46	0.001**
SUS	<---	COFREIGHT	0.34	0.001**
SUS	<---	COOP	0.12	0.202
SUS	<---	FREIGHT	0.18	0.079
CM	<---	COOP	0.68	0.001**
RM	<---	COOP	0.78	0.001**
MC	<---	COOP	0.60	0.001**
IT	<---	COFREIGHT	0.82	0.001**
BR	<---	COFREIGHT	0.75	0.001**
PS	<---	COFREIGHT	0.56	0.001**
UT	<---	FREIGHT	0.79	0.001**
GC	<---	FREIGHT	0.82	0.001**
LO	<---	FREIGHT	0.78	0.001**
EV	<---	SUS	0.62	0.001**
EC	<---	SUS	0.84	0.001**
SO	<---	SUS	0.66	0.001**

** Statistically significant at $p < 0.01$
* Statistically significant at $p < 0.05$

7.8.5 Competing model 4 (excluding path between FREIGHT and COFREIGHT)

Figure 7.10 presents the competing model 4 and the value of the figure is rounded up by AMOS version 21. The path between FREIGHT and COFREIGHT was removed. As the results presented in Table 7.25 revealed, most of the path coefficients were significant at both 0.01 and 0.05 significance levels, except the path coefficient between COOP and SUS (p = 0.469). Comparing with the hypothesised model, the path coefficient between COFREIGHT and COOP, SUS and FREIGHT, and SUS and COFREIGHT became stronger. Overall, the data fitted the model very well, with Chi-square = 61.50, degrees of freedom = 49, p value = .11, CMIN/DF = 1.25, GFI = .96, AGFI = .93, NFI = .94, TLI = .98, CFI = .99, PCLOSE = .88, and RMSEA = 0.03. Based on these indices, it can be concluded that the competing model 4 had an adequate level of empirical support.

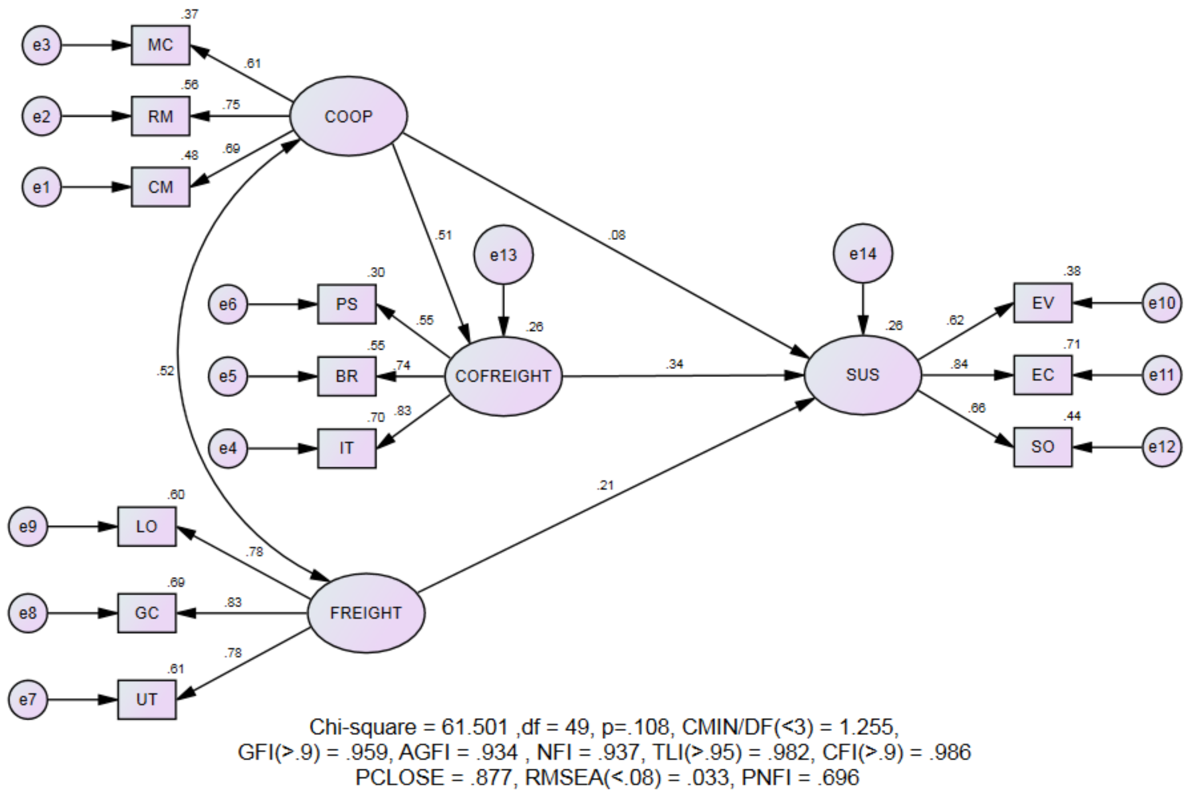


Figure 7.10: Competing model 4

Table 7.25: Standardized loading estimate and P value of competing model 4

			Standardised loading	p value
COFREIGHT	<---	COOP	0.51	0.001**
SUS	<---	COFREIGHT	0.34	0.001**
SUS	<---	COOP	0.08	0.469
SUS	<---	FREIGHT	0.21	0.023*
CM	<---	COOP	0.69	0.001**
RM	<---	COOP	0.75	0.001**
MC	<---	COOP	0.61	0.001**
IT	<---	COFREIGHT	0.83	0.001**
BR	<---	COFREIGHT	0.74	0.001**
PS	<---	COFREIGHT	0.55	0.001**
UT	<---	FREIGHT	0.78	0.001**
GC	<---	FREIGHT	0.83	0.001**
LO	<---	FREIGHT	0.78	0.001**
EV	<---	SUS	0.62	0.001**
EC	<---	SUS	0.84	0.001**
SO	<---	SUS	0.66	0.001**

** Statistically significant at $p < 0.01$
*   Statistically significant at $p < 0.05$

7.8.6 Competing model 5 (excluding path between COFREIGHT and SUS)

Figure 7.11 presents the competing model 5 and the value of the figure is rounded up by AMOS version 21. The path between COFREIGHT and SUS was removed in the competing model 5. As can be seen from Table 7.26, all path coefficients are significant at 0.01 and 0.05 significance levels. Comparing with the hypothesised model, the path coefficient between COFREIGHT and COOP, SUS and COOP, and SUS and FREIGHT became stronger except the path coefficient between COFREIGHT and FREIGHT. Overall, the data fitted the model very well, with Chi-square = 64.71, degrees of freedom = 49, p value = .07, CMIN/DF = 1.31, GFI = .96, AGFI = .93, NFI = .93, TLI = .98, CFI = .98, PCLOSE = .82, and RMSEA = 0.04. These indices confirmed that the competing model 5 had an adequate level of empirical support.

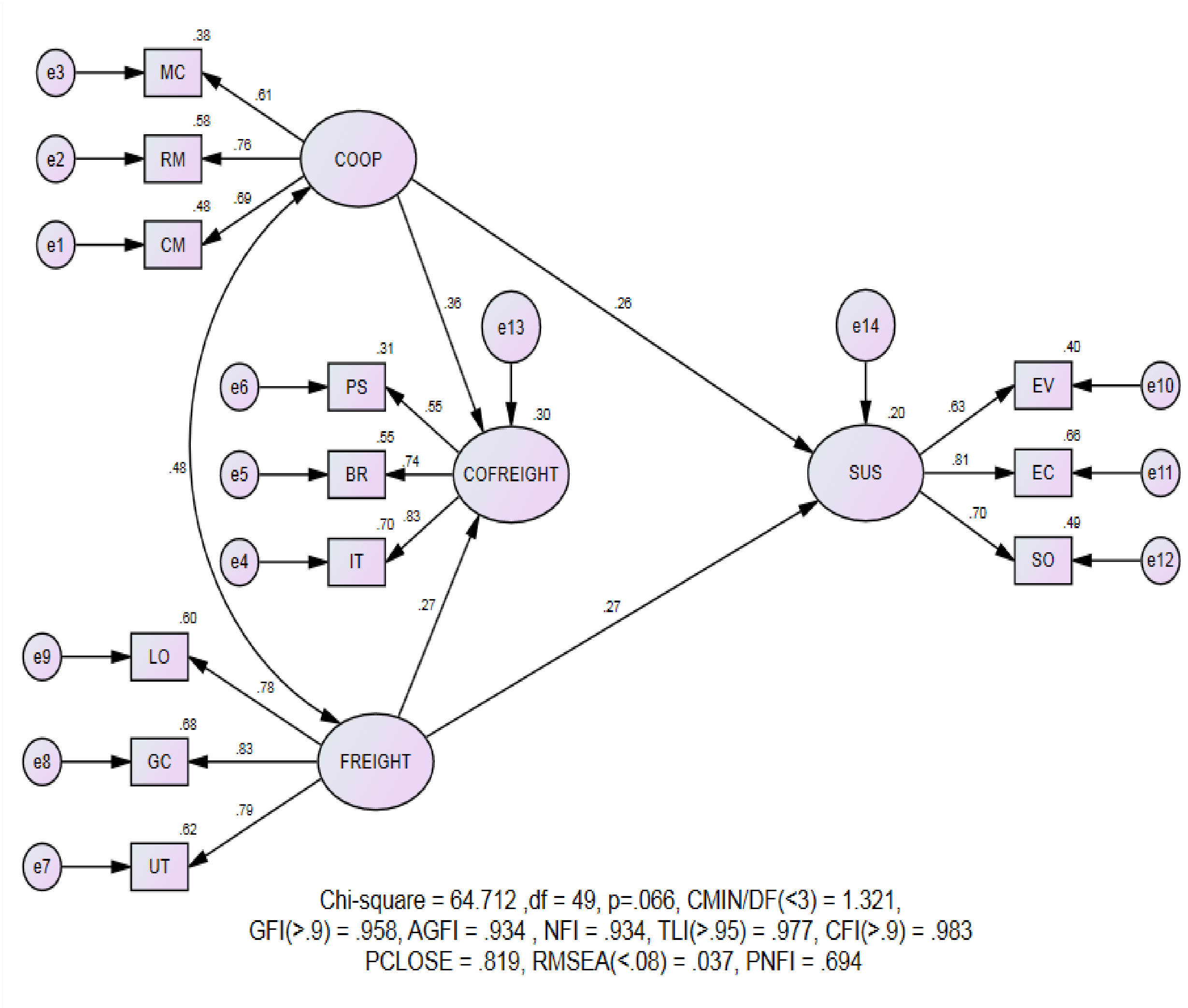


Figure 7.11: Competing model 5

Table 7.26: Standardized loading estimate and p value of competing model 5

			Standardised loading	P value
SUS	<---	COOP	0.26	0.011*
SUS	<---	FREIGHT	0.27	0.005**
COFREIGHT	<---	COOP	0.36	0.001**
COFREIGHT	<---	FREIGHT	0.27	0.002**
CM	<---	COOP	0.69	0.001**
RM	<---	COOP	0.76	0.001**
MC	<---	COOP	0.61	0.001**
IT	<---	COFREIGHT	0.83	0.001**
BR	<---	COFREIGHT	0.74	0.001**
PS	<---	COFREIGHT	0.55	0.001**
UT	<---	FREIGHT	0.79	0.001**
GC	<---	FREIGHT	0.83	0.001**
LO	<---	FREIGHT	0.78	0.001**
EV	<---	SUS	0.63	0.001**
EC	<---	SUS	0.81	0.001**
SO	<---	SUS	0.70	0.001**

** Statistically significant at $p < 0.01$
* Statistically significant at $p < 0.05$

7.8.7 Competing model 6 (excluding path between COOP and FREIGHT and SUS)

Figure 7.12 presents the competing model 6 and the value of the figure is rounded up by AMOS version 21. The path between COOP and SUS and the path between FREIHGT and SUS were removed. As the results presented in Table 7.27, all path coefficients were significant at the 0.01 significance level. Comparing with the hypothesised model, the path coefficient between COFREIGHT and COOP, SUS and COFREIGHT, and FREIGHT and COFREIGHT became stronger. Overall, the data fitted the model very well, with Chi-square = 60.71, degrees of freedom = 50, p value = .14, CMIN/DF = 1.21, GFI = .96, AGFI = .94, NFI = .94, TLI = .98, CFI = .99, PCLOSE = .91, and RMSEA = 0.03. These indices confirmed that the competing model 4 had an adequate level of empirical support.

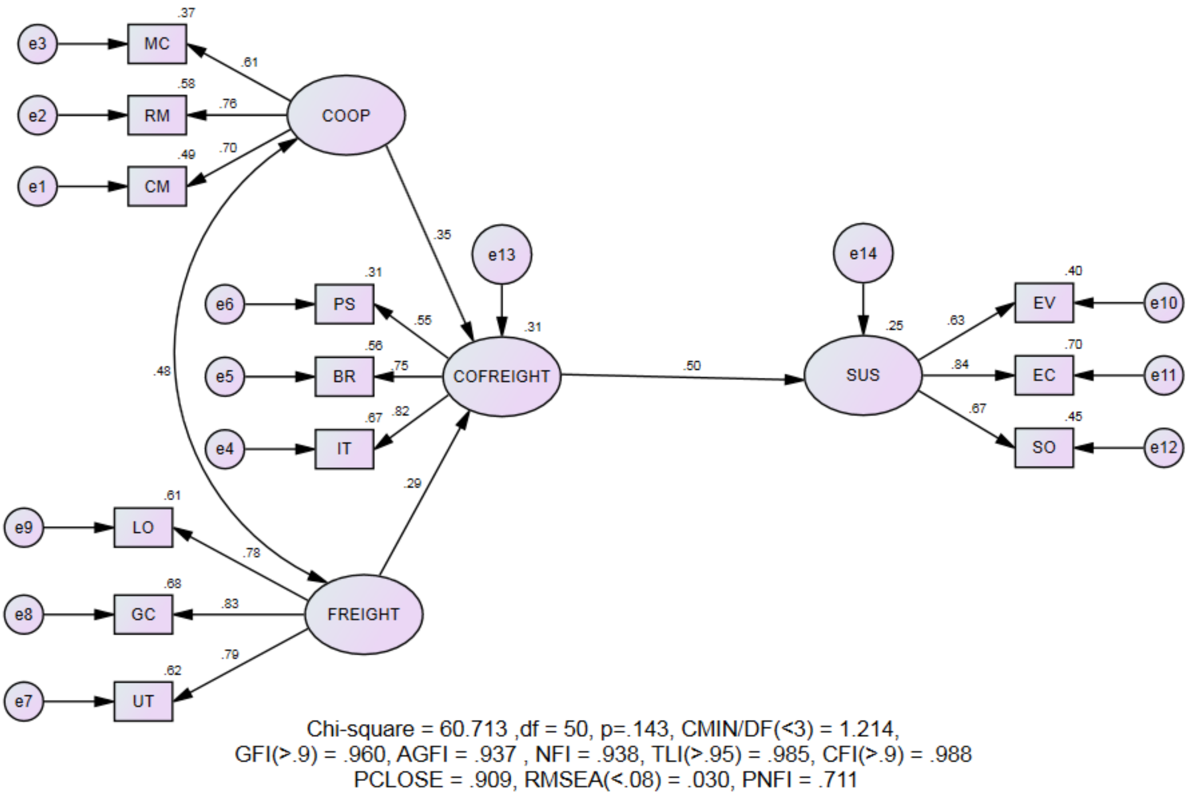


Figure 7.12: Competing model 6

Table 7.27: Standardized loading estimate and p value of competing model 6

			Standardised loading	P value
COFREIGHT	<---	COOP	0.35	0.001**
COFREIGHT	<---	FREIGHT	0.29	0.001**
SUS	<---	COFREIGHT	0.50	0.001**
CM	<---	COOP	0.70	0.001**
RM	<---	COOP	0.76	0.001**
MC	<---	COOP	0.61	0.001**
IT	<---	COFREIGHT	0.82	0.001**
BR	<---	COFREIGHT	0.75	0.001**
PS	<---	COFREIGHT	0.55	0.001**
UT	<---	FREIGHT	0.79	0.001**
GC	<---	FREIGHT	0.83	0.001**
LO	<---	FREIGHT	0.78	0.001**
EV	<---	SUS	0.63	0.001**
EC	<---	SUS	0.84	0.001**
SO	<---	SUS	0.67	0.001**

** Statistically significant at $p < 0.01$
* Statistically significant at $p < 0.05$

For formally comparing the hypothesized model with other competing models, Li et al. (2006) suggest using Chi-square difference test, which allows comparing the difference between chi-square statistics values and the degrees of freedom of the hypothesized model and each of the competing models. To compare the models, the chi-square value of the competing model is subtracted from the chi-square value of the hypothesized model, and the degree of freedom of the competing model is subtracted from the degree of freedom of the hypothesized model. The chi-square statistics table is then used to assess whether the chi-square difference is significant, that is the calculated p-value should be less than .05 ($|t| > 1.96$), which should indicate that the hypothesized model is preferred. Alternatively, one can use MS Excel formula to calculate p-values. The formula is CHISQ.DIST.RT available under statistical category in MS Excel formula. However, if the difference is non-significant, that is calculated p-value is more than .05 ($|t| <$ 1:96), the competing model is preferred (Werner & Schermelleh-Enge 2010).

The results of the chi-square difference test are shown in Table 7.28 indicating that the competing model-1 is the most optimal because the chi-square difference between the hypothesized model and the competing model-1 is non-significant (p = 0.350). Therefore, the competing model-1 is selected as the final structural model of this study.

Table 7.28: Chi-Square difference test for comparison of alternative models

Model	**$\chi2$**	**$\Delta\chi2$**	**df**	**Δdf**	**Chi-Square Critical Values; p =0.05**	**P value**
Figure 7.6 : Hypothesized model	52.55	48				
Figure 7.7 : Competing model 1	53.42	49	0.87	1	Non-significant	0.350
Figure 7.8 : Competing model 2	56.89	49	4.34	1	Significant	0.037
Figure 7.9 : Competing model 3	65.73	49	13.18	1	Significant	0.000
Figure 7.10 : Competing model 4	61.50	49	8.95	1	Significant	0.003
Figure 7.11 : Competing model 5	64.71	49	12.16	1	Significant	0.000
Figure 7.12 : Competing model 6	60.71	49	8.16	1	Significant	0.004

7.9 Research hypotheses testing

The researcher employed CFA and SEM to test the research hypotheses. The hypotheses reflected the research objectives and were directly related to the questions the researcher aimed to answer. As presented in Chapter 4, the research hypotheses were;

H1: Co-opetitive relationship has a positive effect on sustainable distribution.
H2: Freight consolidation has a positive effect on sustainable distribution.
H3: Co-opetitive relationship has a positive effect on collaborative freight distribution.
H4: Freight consolidation has a positive effect on collaborative freight distribution.
H5: Collaborative freight distribution has a positive effect on sustainable distribution.

7.9.1 Results of hypotheses testing

The hypothesized relationships among constructs were tested by SEM using AMOS (Cunningham, Holmes-Smith & Coote 2006; Hair et al. 2010; Kripanont 2007). The hypothesized model was compared with six alternative models by excluding one of the paths between constructs at a time. This resulted in competing model 1 as the best fit structural model. The model fit indices of the competing model 1 are Chi-square = 53.42, degrees of freedom = 49, p value = .31, CMIN/DF = 1.09, GFI = 0.96, AGFI = 0.94, NFI = 0.95, TLI = 0.99, CFI = 0.99, PCLOSE = 0.97, and RMSEA = 0.02. The indices confirmed that the model had adequate level of empirical support.

The final structural equation model results are presented in Table 7.29. It can be seen that hypothesis 1 linked co-opetition to sustainable distribution. Unfortunately, the direct path between co-opetition and sustainable distribution was not significant and was thus removed from the hypothesized model because the competing model 1 yielded a better model fit. The indirect relationship was, therefore, estimated and found to have positive effect on sustainable distribution through collaborative freight distribution (β =0.13; $p < 0.05$). Therefore, hypothesis 1 was not supported, due to the lack of a direct relationship.

Hypothesis 2 verified the relationship of freight consolidation with sustainable distribution. The results indicate that freight consolidation was significantly and positively effect on sustainable distribution ($\beta = 0.23$; $p < 0.01$). Furthermore, freight consolidation was indirectly effect on sustainable distribution through collaborative freight distribution ($\beta = 0.99$; $p < 0.01$). Thus, the total effect of freight consolidation on sustainable distribution was significant ($\beta = 0.33$; $p < 0.01$) Therefore, hypothesis 2 was supported.

Hypothesis 3 tested the influence of co-opetition on collaborative freight distribution. Based on the results, co-opetition was positively effect on collaborative freight distribution ($\beta = 0.35$; $p < 0.05$). Therefore, hypothesis 3 was supported.

Hypothesis 4 tested the effect of freight consolidation on collaborative freight distribution. The result showed that freight consolidation was significantly and positively affect to collaborative freight distribution ($\beta = 0.26$; $p < 0.01$). Therefore, hypothesis 4 was supported.

Hypothesis 5 linked collaborative freight distribution with sustainable distribution. The results indicated that collaborative freight distribution was significantly and positively affect to sustainable distribution ($\beta = 0.37$; $p < 0.05$). Therefore, hypothesis 5 was supported.

A summary of all hypotheses testing is presented in Table 7.29.

Table 7.29: Results of competing model 1 for hypotheses testing

Hypothesis Number	**Exogenous Latent Construct**	**Endogenous Latent Construct**	**Total effect (sig)**	**Direct effects (sig)**	**Indirect effects (sig)**	**Hypothesis result**
H1	Co-opetition (COOP)	Sustainable distribution (SUS)	0.13* (0.012)	0	0.13* (0.012)	Not supported (lack of direct relationship)
H2	Freight consolidation (FREIGHT)	Sustainable distribution (SUS)	0.33** (0.002)	0.23** (0.007)	0.99** (0.002)	Supported
H3	Co-opetition (COOP)	Collaborative freight distribution (COFREIGHT)	0.35* (0.015)	0.35* (0.015)	0	Supported
H4	Freight consolidation (FREIGHT)	Collaborative freight distribution (COFREIGHT)	0.26** (0.007)	0.26** (0.007)	0	Supported

H5	Collaborative freight distribution (COFREIGHT)	Sustainable distribution (SUS)	0.37* (0.020)	0.37* (0.020)	0	Supported

** Statistically significant at $p < 0.01$

* Statistically significant at $p < 0.05$

7.10 Conclusion

In this chapter, the researcher presented CFA, which was employed to confirm measurement items (observed variables) of each construct using AMOS. The measurement models pertaining to each construct were finalized by considering model fit indices and performing construct validity assessment and construct reliability assessment. The final measurement models were then used to generate structural path models. The modeling procedure was finalized by comparing the hypothesized model with the other six competing models. As a result, the competing model 1 was the best fit model.

The competing model 1, as final path model, was used to test the hypothesised relationship among the study constructs. Hypotheses H2, H3, H4, and H5 were supported while H1 was not supported. The findings confirmed that co-opetition can indirectly enable sustainable distribution, while freight consolidation and collaborative freight distribution can directly enable sustainability. In addition, co-opetition and freight consolidation can directly enable collaborative freight distribution. Lastly, collaborative freight distribution can directly enable sustainable distribution in Thailand’s newspaper industry.

CHAPTER 8

DISCUSSION

8.0 Introduction

The purpose of this chapter is to discuss the research results found in Chapters 6 and 7, with respect to the research questions and research hypotheses. The researcher gave particular focus to the structural model for achieving sustainable distribution in Thailand newspaper industry.

8.1 Answering research questions

The purpose of this study was to investigate the significant relationship between co-opetition, freight consolidation, collaborative freight distribution, and sustainable distribution. The researcher examined whether co-opetition, freight consolidation, and collaborative freight distribution approaches taken by firms would have any significant implications on the logistics distribution leading to sustainability. Using cross-sectional sample of medium and large Thai newspaper companies, transporters, and newsagents, the results of path analysis suggested that co-opetition and freight consolidation have significant positive effect on collaborative freight distribution. Moreover, the study results showed that freight consolidation and collaborative freight distribution had significant positive effect on sustainable distribution, whereas co-opetition had indirect positive effect through collaborative freight distribution.

8.1.1 Co-opetition

Co-opetition was significantly explained by management commitment ($\beta = 0.61$; $p < 0.01$), relationship management ($\beta = 0.76$; $p < 0.05$), and communication management ($\beta = 0.70$; $p < 0.01$). Respondents perceived these dimensions as significant factors for achieving co-opetition that directly and indirectly influenced collaborative freight distribution and sustainable distribution respectively.

For management commitment, respondents are more likely to create new business strategies of the relationship and reconfigure internal business processes to align with the new business structure. That is, firms are likely to reconfigure and develop new freight distribution strategies to align with the overall strategy of their partner firms. This confirms the findings of Chin, Chan, and Lam (2008), who claimed that the management team needs to create new stategies in order to align the business mission, policy, and resources allocation accordingly, to the joint business operation. The firm must evaluate its practices and identify capabilities, resources, and skills they possess. This would assist in identifying complementary resources required from the alliance partners for creating new strategies in order to maximize partnership benefits. On the other hand, Min et al. (2005) asserted that current internal business processes and organizational functions must be reconfigured toward a new business environment. For example, communication process may need to be reconfigured to facilitate inter-organizational information sharing. The current working environment and culture may also need to align with those of the alliance partners. Chin, Chan, and Lam (2008) concluded that a co-opetition approach would never be successful if full management commitment was not demonstrated.

The results also indicated that respondents perceived relationship management as an antecedent for achieving a co-opetitive relationship. Respondents agreed that mutual goals and objectives, frequent meetings, and the sharing of expertise from work experience are critical for establishing the co-opetitive relationship. Regarding mutuality, these findings showed that sample newspaper companies and other firms involved in the relationship must ensure that they are mutual (i.e., not conflicting or serving only interests of individual firms). For example, all involving firms must have mutual objectives toward freight distribution improvement and sustainability. Morris et al. (2007) asserted that mutual goals and objectives must be identified in order to achieve a better joint business operation. Zineldin (2004) further asserted that all parties in the relationship need to adapt their current business process, vision, mission, and strategy in line with the mutual goal, in order to achieve a better coincident business operation, information sharing, and uncertainty minimization. Further, the findings also showed that expertise and experience must be shared frequently, on a weekly or monthly basis. The results of this study are consistent with Cheng et al. (2008). The newspaper company that has collaboration experiences with transporters can share the collaborating process knowledge and strategies with other partners in order to enable collaborative freight distribution. However, frequent meetings must be arranged for the continuous information and experience sharing, in order to avoid discontinuity of the joint business project.

The third factor that enforces co-opetition is communication management. The respondents are more likely to partner with competitors who perceive new information sharing and stress on implementation of information and communication technology (ICT). ICT, such as electronic data interchange (EDI), is suggested as vital for sharing real-time information and to increase communication effectively (Zhao, Zhao, and Hou 2010). ICT would allow all involving firms to share real-time information without any interruptions. Thus, participating firms would be able to retrieve the latest information continually and very quickly. For instance, new orders could be shared as soon as the customers place them. All firms in the relationship could respond to the order more effectively as a result and, hence, improve distribution efficiency. Respondents from sample firms perceived that successful co-opetitive relationships can be established with the consideration of management commitment, relationship management, and communication management.

8.1.2 Freight consolidation

Freight consolidation is significantly explained by location of freight consolidation centre (β = 0.78 $p < 0.05$), geographical coverage ($\beta = 0.83$; $p < 0.05$), and utilization of transport modes ($\beta = 0.79$; $p < 0.01$). Respondents perceived these dimensions as critical factors for achieving freight consolidation, thus directly influenced collaborative freight distribution, then sustainable distribution.

Regarding the location of the freight consolidation centre, the respondents perceived that appropriate location must be carefully selected before initiating freight consolidation practice. Authors have suggested steps in selecting the most appropriate location (Jacobsen and Madsen 1980; Drezner and Hamacher 2004; Daskin 2011). First, the area or the region to be serviced by the consolidation terminal must be decided. Second, the possible candidate locations must be selected with respect to the location requirements. Based on the results obtained in this study, respondents perceive that the location must be able to improve inbound and outbound flow of products, reduce distribution costs, improve delivery flexibility, and improve flow of product returns. Third, several candidate locations must be compared and selected, based on to the aforementioned criteria. Thus, the study findings indicated that respondents give precedence to distribution efficiency, on-time delivery, and cost reduction when initiating freight consolidation approach.

Regarding geographical coverage, Van Thai and Grewal (2005) state that freight consolidation operation must cover the predetermined region. The study found improvement of delivery time to each drop-off point, reduction of travel distance, and reduction of fuel consumptions as key determinants of a terminal to cover the desired geographical area. In other words, respondents perceive distribution efficiency and cost saving as critical considerations to optimising geographical coverage. De Ligt and Wever (1998) further suggested that if the objective of establishing the consolidation terminal was to improve time delivery to each drop-off point, the terminal should be located near customer receiving docks. As a result, the delivery time, travel distance and fuel consumption will be reduced due to the shorter distance between the terminal and the customers. Thus, the consideration of geographical coverage plays an important role for enabling freight consolidation.

Moreover, respondents perceived that delivery vehicle utilization also played important role for initiating freight consolidation operation. As Wang and Du (2003) stated, the motivation behind freight consolidation is to take advantage of lower transportation cost through better utilization of vehicle capacity. As the study findings demonstrated, respondents agreed on the initiatives for implementing freight consolidation operations that included the potential for reducing transport costs, number of delivery vehicles, and drivers. For example, number of delivery vehicles could be reduced when small shipments are consolidated into a single truck. As a result, fewer trucks and drivers would be employed to deliver the same freight quantity. Hence, this study found that utilization of transport modes must be considered before implementing freight consolidation approach.

8.1.3 Collaborative freight distribution

Collaborative freight distribution is significantly explained by partner selection ($\beta = 0.55$; $p < 0.01$), fair benefits and risks sharing ($\beta = 0.75$; $p < 0.01$) and advanced information technologies ($\beta = 0.83$; $p < 0.01$). Respondents perceived these dimensions as critical for achieving collaborative freight distribution that in turn directly influences sustainable distribution.

As the research findings show, sample respondents perceived that partner selection routinely plays an important role in the collaborative business activity. Firms need to continually seek new resources for improving business operation (Bierly III & Gallagher 2007). These new resources could derive from acquired assets, internal development, or the development of relationships with other firms. Since alliance partners can improve resource acquisition potential, careful selection of appropriate partners is essential. The study found that, prior to selecting potential partners, respondents are more likely consider partners' goals and objectives, as well as complementary skills, in addition to peer relationships among top executives and the willingness of the firm to learn a new working environment. First, sample firms believe that goals and objectives of potential partners should be aligned with their goals and objectives, in order to improve the strategic fit of the firm. This is consistent with Lambe, Spekman & Hunt (2002). Moreover, the coherent goals and objectives would lead to the coherent business operations. Newspaper companies would be able to support each other to achieve the same goals, since they would have similar business philosophy and strategies. Consequently, the firm and its partners could achieve their respective goals faster, at a lower cost, since resources are being shared. Second, respondents from sample firms perceived that the consideration of complementary skills of potential partners is important. Appropriate evaluation of partners' goals and objectives would allow the firm to assess the availability of complementary resources that are not available within the firm. Resources can take various forms, such as capital, firms-specific assets, technology, knowledge and skills, and capabilities (Claycomb & Frankwick, 2004). Newspaper companies may be able to gain new geographic markets from capitalizing on its partners' routine delivery routes. As a result, the firm could improve its sales by selling newspapers to new customers. Third, respondents from sample firms perceived that the relationship between top executives should be established in order to gain long-term relationship and achieve collaborative freight distribution. Top executives should share personal philosophy, experience, background, corporate culture, and vision to align business strategies and practises according to the goals and objectives of the alliance. Carmeli et al. (2012) stated that an alignment among top executives can lead to a better management team and an improvement in collaborative business operations. Lastly, respondents from sample firms are likely to select partners that have willingness to learn new working environment. When this is presented, the collaborative business operations could commence faster, as the alignment between top executives would lead to a more rapid reconfiguration of internal business cultures and environments of their respective companies. Thus, employees as well as management teams could rapidly adjust their prevalent behaviours and attitudes to align with the new business environment. According to Hoffmann (2007), all firms would improve their competences when they adapt their internal business operations according to the new business environment. Thus, partner selection must be performed before commencing collaborative freight distribution.

On the other hand, respondents from sample firms believed that fair benefits and risks sharing must be considered when the working environment changes toward collaborative business operation. The study findings indicated that firms are likely to join in collaborative freight distribution if sales and on-time delivery benefits were fairly allocated to all firms in the relationship. This is in line with Luo's (2002) findings, which revealed that the sharing of benefits, resources, costs and risks would help firms to sustain and improve joint business operations. Moreover, sharing of benefits and risks would help all firms to stabilize the market demand and operating costs fluctuations. Nonetheless, Cruijssen et al. (2007) asserted that fair benefits and risks sharing can prevent future conflict that may lead to the collapsing of a horizontal relationship. Thus, benefits and risks sharing must be concerned for initiating collaborative freight distribution.

Advanced information technology is given precedence by respondents as a critical factor for initiating collaborative freight distribution. The study findings demonstrated that respondents from sample firms are willing to implement market-based system (i.e., hubs and portal) and collaborative planning and forecasting-based system (i.e., CPFR) when working in collaborative freight distribution. The respondents believed that advanced information technology would help them to improve services level (i.e., better on-time performance) and increase visibility (i.e., identifying location of freight in the supply chain). As, for example, real-time demands could be shared among firms through information technology, the delivery vehicle schedule could be arranged accordingly to improve space utilization. Thus, advanced information technology must be considered to implementing collaborative freight distribution.

8.1.4 Sustainable distribution

Sustainable distribution is significantly explained by environmental ($\beta = 0.62$; $p < 0.05$), economic performance ($\beta = 0.85$; $p < 0.01$) and social factors ($\beta = 0.66$; $p < 0.05$). Respondents perceived these dimensions as critical factor for achieving sustainable distribution.

Regarding environmental sustainability, respondents believed that improvement of freight distribution management toward a sustainability framework could reduce water pollution, visual pollution, odour pollution, and solid waste. McKinnon (2010) stated that effective management of logistics operations can reduce their environmental impacts. For example, improvement in vehicle factor loading could improve vehicle's space utilization. Thus, fewer delivery vehicles could be employed, which would result in reduction of fuel usage and pollutant emissions. As a result, visual and odour pollution from fuel combustion would be reduced. Moreover, with fewer vehicles in operation, vehicle maintenance requirements, such as engine oil renewal or vehicle cleaning would be reduced. This would reduce water pollution resulting from chemical and oil leakage into the water sources. Regarding solid waste, implementation of information technology such as CPFR would allow firms to accurately plan and forecast the demand of newspapers. Additionally, quantity of unsold newspapers could be minimized if parties working together join hands for collaborative planning and forecasting resulting in an appropriate estimate of newspapers. Thus, an improvement of freight distribution management through environmental sustainability would lead to successful sustainable distribution.

The study findings also identified that sustainable distribution can be achieved through improvement of economic performance. Respondents perceived the improvement that can be achieved by company's reputation, lowering risks of business operations, broadening market boundaries, increasing sales opportunities, and improving market position. With improved reputation, firms could claim that the product is environmentally friendly when less fuel is used in newspaper distribution process. As customers are increasingly aware of environmental protection issues, firms showing positive attitude towards this initiative would attract more sales (Ellen et al., 2006). Moreover, respondents from sample firms perceived that improvement of freight distribution operation could also lower risks associated with business operations. As customers are increasingly demanding environmentally friendly products (Bhaskaran et al. 2006), firms should develop and deliver products accordingly to improve customer satisfaction. As a result, respondents believed that demand could be improved by broadening market opportunities through environmentally friendly products and services. Thus the environmentally friendly processes, products and delivery could acquire subsidies or sponsorships from the government. Sustainable distribution, therefore, can be achieved by economic/organizational sustainability.

Respondents believe that social sustainability is another important factor which is very likely to influence sustainable distribution. Improvement of freight distribution process towards sustainability framework could lead to increased staff motivation, enhanced value of human capital, and greater firm's contribution to community development. This is in line with Adams and Frost (2008), who stated that the sustainability paradigm can motivate employees to promote sustainability, both in the workplace and within their community. Moreover, respondents perceived that improvement of freight distribution processes could enhance the value of human capital. Since sustainable freight distribution would reduce negative effect on natural environment, local population would experience less stress, have better life expectancy, and better health due to reduction of pollution in the society (Dietz, Rosa & York 2009). In addition, respondents from sample firms believed that improvement of freight distribution management would contribute to community development. More proactive contribution of the firm to the community development could be achieved by, for example, creating additional jobs that can support the reconfiguration of freight distribution process. This would further improve local economy, as residents would have more disposable income. As a result, the welfare of the local residents would be improved. Thus, social sustainability is another critical factor positively influences sustainable distribution.

Overall, improvement of newspaper distribution management towards economic, social and environmental sustainability is critical for achieving sustainable distribution.

8.1.5 The relationship between co-opetition, collaborative freight distribution and sustainable distribution

Hypothesis H1 states that co-opetition is positively affected to sustainable distribution. However, the parameter estimate for the path between co-opetition and sustainable distribution was not statistically significant even though it was in the expected direction. One explanation for this non-finding might be that the measures used to tapping this construct might be insufficient. A more plausible explanation might be that merely having co-opetition among the supply chain partners may not be sufficient to create a value that would drive sustainable distribution. Instead, the respondents perceived that co-opetition has a significant positive influence on collaborative freight distribution. However, co-opetition strategy is a significant but indirect predictor ($\beta = 0.35*0.37 = 0.13$, $p < .05$) of sustainable distribution via collaborative freight distribution.

Regarding to the direct relationship between co-opetition and collaborative freight distribution, Sutherland (2006) and Zhou, Hui & Liang (2011) stated that collaborative business activity among competitors would require co-opetitive relationship. Thus, co-opetitive relationship between competing firms are critical considerations for selecting potential partners, managing fair benefits and risks sharing, and implementing appropriate advanced information technology for enabling collaborative freight distribution.

As the research results of the present study shown, respondents perceived that co-opetition approach is critical for considering criteria for selecting alliance partners, including goals and objectives, complementary skills (i.e., partner’s experience, capabilities, and potential for making real contribution), peer relationship between the top executives, and capability to learn a new working environment. The research findings contributes to the work of Lambe, Spekman, and Hunt (2002) that the firm has to consider its goals and objectives and evaluate them against those of the potential partners in order to establish relationships, as well as assess the complementary business strategies and objectives of the potential partners. However, if the goals and objectives of the parties planning to enter into an alliance are similar, but their business strategies are different, all parties must reconfigure their strategy and internal business processes according to the mutual goals and objectives. The study revealed that relationship management is another critical consideration, as for an alliance to be successful, relationship between top management should be established. Moreover, information should be shared between parties and frequent meetings held, in order to exchange information, opinions, and report on business progress, which is supported by the work of Morris, Koçak & Özer (2007). Firms must also consider communication management by implementing information technologies to communicate and exchange real time information with their potential partners in order to reduce potential for future conflict, as Chin, Chan & Lam (2008) supported. In conclusion, the results of this study indicated that co-opetitive relationship is critical for partner selection.

The research results also showed that an establishment of co-opetitive relationship can influence fair benefits and risks sharing, regarding to sale and on-time delivery improvement. The study contributed to the work of Cruijssen, Cools, and Dullaert (2007), who asserted that benefits and risks sharing must be managed fairly in order to sustain long-term relationships and avoid potential conflicts from emerging. Based on the results obtained in this study, respondents perceived that one of the important considerations is obtaining an agreement on the mutual goals and objectives. If the firm and its partners have different goals and objectives, this disparity may lead to unequal expectations with respect to the benefits that would be derived from the co-opetitive relationship. Thus, the firm and its partners must have aligned or similar goals and objectives in order to agree on fair benefits and risks sharing. For example, alignment in the objectives aimed at improving on-time delivery of all partners (i.e., benefits sharing) in the co-opetitive relationship would require a solid agreement on strategies, tactics and operations of freight movement management. All partners must create new strategy or reconfigure both current strategy and internal processes according to the mutual goals and objectives. Once this is achieved, all partners would have an equal expectation of the benefits that could be derived from the alliance. Thus, respondents perceived that a co-opetitive relationship management is critical for fair benefits and risks sharing.

Moreover, as shown by the study results, respondents perceived that advanced information technology must be implemented by all firms in the co-opetitive relationship for improving service levels (i.e. better on-time performance) and increasing visibility (i.e. identifying location of freight in the supply chain). Effective real time information sharing is one of the most critical considerations for collaborative freight distribution (Esper & Williams, 2003). Thus, respondents believed that advanced information technologies must be implemented, including market-based system and collaborative planning and forecasting-based system. Information technologies would allow firms to frequently exchange information on the new developments and potential issues. For example, the firm could share real time de-tour route during the delivery with its partners. Thus, all partners could change their delivery routes accordingly, in order to avoid late delivery. Therefore, co-opetitive relationship would influence involving firms to implement advanced information technologies. All in all, the study indicated that co-opetition could influence collaborative freight distribution.

Regarding to the relationship between co-opetition and sustainable distribution with incorporation of collaborative freight distribution, Sutherland (2006) and McKinnon (2000) stated that achievement of sustainable distribution requires a formation of strategic alliance or co-opetitive working environment. That is, all involving parties need to form co-opetitive relationship prior an arrangement of collaborative transportation and joint operation towards sustainability for achieving sustainable distribution. Bengtsson and Kock (2000) asserted that firms should consider co-opetitive relationship when common goal is homogenous. This allows firms to share information, resources, facilities, and knowledge. However, firms are suggested to cooperate in activities far from customers and compete in activities close to customers. Transporters could cooperate and join hands together to carrying newspapers to a regional hub that will save everyone’s resources while achieving the goal of cost saving through less fuel consumption and vehicular emission. However, they are free to compete among themselves from the regional hub to the newsagents to deliver the newspapers as soon as possible to reach the end customers. The parties are seen not to observe the practice at the moment. Overall, the results showed that respondents perceive co-opetition is vital for achieving collaborative freight distribution. This will influence sustainable distribution.

Many scholars also agreed that co-opetition could enable sustainable distribution through collaborative freight distribution approach. Leitner et al. (2011) and Cruijssen et al. (2007) asserted that independent firms are unable to optimise route planning, logistics capacity, vehicle capacity utilization, full truck load, and transport process when they operate in isolation. The co-opetitive relationship would allow participating firms to combine their delivery route and identify optimal route. Thus, sustainable freight distribution cannot be achieved without the consideration of strategic alliances. McKinnon et al. (2010) stated that participating in horizontal collaboration is critical for enabling any collaborative business activities in logistics and supply chain management. The authors further stated that the collaborative freight distribution could reduce tonne-kilometers per delivery vehicle per year and improve vehicle capacity utilization, as well as reduce empty running. Consequently, firms in the co-opetitive relationship could reduce costs of logistics operation, reduce toxic and waste from distribution activity, and improve atmosphere quality, thus improving living conditions of their community. Thus, co-opetition can indirectly enable sustainable distribution through collaborative freight distribution.

On economic sustainability, respondents perceived that co-opetition approach with incorporation of collaborative freight distribution is likely to boost firm's reputation, lower risk of business operations, identify easier ways to attract external sources of sponsorship, broaden market and improve condition for sale increase, and improve market opportunity. Results indicated that firms are likely to create new strategy and reconfigure internal business operations according to the common goal of the co-opetitive relationship. Under cooperative arrangement, firms would reconfigure to sharing unique resources, such as distribution network and facilities. Newspaper companies could share distribution routes encouraging transporters to minimise the travel frequency, fuel consumption and emission. As a result, economic performance would be influenced by lower risk of business operations, broader market, improve market opportunity and sale volume of newspapers in wider geographical area. Moreover, firms could gain grants from the government when performing towards sustainability. For example, the government provides financial support for businesses to save energy and water and reduce other emissions (NSW_Government 2014). Thus, co-opetitive relationship would indirectly influence sustainable distribution.

Social sustainability is very likely to be achieved by co-opetition via collaborative freight distribution. Results indicated that respondents believed in mutual goals and objectives that must be identified in establishing the relationship. That is, all participating firms must be mutually interested in joint business operation leading to a sustainability paradigm change within and between firms. Respondents are of the opinion that co-opetition through collaborative freight distribution would help them to increase staff motivation, enhance human capital value, and improve the contribution of a firm to community development. For instance, establishment of collaborative freight distribution terminal would require workers to operate the terminal. Thus, local community employment rate would be increased. Moreover, human capital value and community development would be improved since employees would have more knowledge and skills from new work experience. Nonetheless, Hanna, Newman, and Johnson (2000) stated that employee involvement is positively related to the achievement of sustainable supply chain. A sustainability and joint business operation initiative implemented by the firm would motivate employees to act accordingly, thus contributing to the effectiveness of the sustainability framework. Nevertheless, those employees would be motivated by the sustainability initiative and share their environmentally-friendly outlook with the community. As a consequence, the entire community would benefit from the sustainability initiative. Therefore, co-opetition together with collaborative freight distribution is critical for achieving social sustainability.

Environmental sustainability, the research findings showed that respondents perceived potential benefits of reduced water pollution, visual pollution, odour pollution and solid waste from co-opetition with an incorporation of collaborative freight distribution approach. For example, implementation of information technology would reduce solid waste from waste paper when all transactions are communicated via market-based system or collaborative planning and forecasting-based system. Similarly, newspapers could be distributed via a shared vehicle, which would improve truck space utilization. As the consequence, less number of delivery vehicles would be employed to distributing the same quantity of newspaper, which would reduce visual and odour pollution from engine combustion. This is supported by Krajewska et al. (2007) who stated that horizontal cooperation among freight carriers could improve space utilization, optimize truck capacity, and reduce fuel and truck usage. Thus, co-opetition could influence sustainable distribution through an incorporation of collaborative freight distribution.

8.1.6 The relationship between freight consolidation, collaborative freight distribution and sustainable distribution

Respondents from medium and large firms believed that freight consolidation approach could directly influence collaborative freight distribution. The findings of the study extend the existing knowledge of Sutherland (2003) and showed that partner selection in collaborative freight distribution is influenced by freight consolidation approach. The results revealed that sample firms are likely to evaluate partner's goals and objectives regarding to an intention to improve inbound and outbound of product flow, reduce distribution costs, improve delivery flexibility, and improve the flow of product returns through optimizing the location of the freight consolidation terminal. Respondents also perceived that potential partners are required to be intended to improve delivery time at each drop-off point, reduce travel distance, and decrease fuel consumption by considering an appropriate geographical coverage of the consolidation terminal. Moreover, firms are likely to investigate partners' capabilities and complementary skills regarding to vehicle sharing for the purpose of reducing transportation costs, as well as decreasing the number of delivery vehicles and drivers for improving transport mode utilization. Nonetheless, respondents perceived that peer relationship between top management is critical. It would allow firms in the relationship to accelerate joint distribution operation and make decision regrading to location of freight consolidation terminal, geographical coverage, and transport modes utilization. This is supported by Faisal and Akhtar (2011) who asserted that top managements have power to redesign and reform firms' organization structure, vision, mission and policy. Moreover, they are able to persuade employees to act accordingly. Hence, employees would be encouraged to learn new working environment. Overall, freight consolidation approach could influence partner selection in collaborative freight distribution.

With respect to fair benefits and risks sharing that would be influenced by freight consolidation approach, respondents perceived that it is essential to consider location, geographical coverage of the terminal and vehicle utilization, in order to improve sales and on-time delivery of all firms in the relationship. For example, firms in the relationship could improve on-time delivery and sale when the freight consolidation terminal is located at the most appropriate location. This would also allow newspaper companies to cover geographical region more effectively. As the result, all newspaper companies in the relationship could reduce delivery time fairly.

In the aforementioned process, information technology would play an important role (Esper & Williams 2003; Mentzer, Foggin & Golicic 2000). Respondents believed that effective information sharing with respect to location of newspapers that need to be delivered would allow all firms in the relationship to manage product flow more effectively. For example, newspaper companies could improve services level by assigning newspapers from the closest alliance freight consolidation terminal to a particular destination via market-based system or collaborative planning and forecasting-based systems. Similarly, a requirement to improving vehicle utilization would lead to an implementation of advanced information technology. For instance, the delivery truck could optimize space usage when real time information about the location of freight (i.e. newspaper) is visibility and effectively shared among consolidation terminal. Thus, the required quantity of newspaper would be more accurately loaded and space would not be wasted. Overall, freight consolidation approach is critical to influencing collaborative freight distribution.

Regarding to research objective of achieving sustainable distribution through freight consolidation, the findings indicated that freight consolidation could directly influence sustainable distribution in Thai context. Respondents believed that freight consolidation approach would help them to achieve environmental sustainability in their distribution processes through the reduction of water pollution, visual pollution, odour pollution and solid waste. The present study makes noteworthy contribution to the study of Lewis et al. (2010) and Merrick & Bookbinder (2010) that freight consolidation can reduce negative environmental effects of business processes, as it can reduce pollution from freight distribution activities. This is because freight consolidation would allow firms to reduce visual and odour pollution from the fuel combustion by consolidating many small shipments for each delivery round. As a result, pollutant emissions from each delivery vehicle would be reduced, due to fewer delivery rounds and number of vehicle employed.

In term of economic sustainability, respondents perceived that freight consolidation could boost firm’s reputation, lower risk of business operations, identify easier ways to attract external sources of sponsorship, broaden market and improve condition for sale increase, and improve market opportunity. The present study contribute to the current knowledge of González-Ramírez & Askin (2009) that freight consolidation can improve freight distribution performance and cost saving, and reduce risk of business operation when the vehicle is efficiently loaded and eliminate the less-than-truck-load (LTL) incidences. In Thai newspaper industry context, freight consolidation approach would allow more small shipments of newspapers to be loaded on the single delivery vehicle. Thus, less gasoline would be used due to the reduced delivery vehicle usage. As a result, risk of high operation costs that derive from price of gasoline would be reduced. Another possible competitive advantage would stem from delivery time efficiency. As stated in Chapter 2, time management is one of the greatest concerns for improving business performance and reduce risk of business operation in the newspaper industry, since newspaper is a time-sensitive product and would lead to economic loss if distributed late. Freight consolidation would allow each newspaper edition to reach the destination faster, since more delivery vehicles would be available when more newspapers are loaded onto the single vehicle. Thus, more available delivery vehicles with a better truck load can deliver newspapers to a greater number of routes within the specified time limit. Overall, freight consolidation could lower the risk of business operation, improve reputation, improve market opportunity and sustain sale volume.

Regarding to social sustainability, respondents perceived that freight consolidation could not only subside social costs as assert by Forkenbrock (1999), but it could also enhance human capital value, increase employees' motivation and enhance the contribution to community development. For example, more staff would be required, in order to load the newspapers onto the delivery vehicle faster. As a result, freight consolidation operation would create new jobs, directly benefitting the community. Moreover, freight consolidation would enhance value of human capital when more training is required for improving distribution procedures, such as loading and driving skills. Thus, employees would be more skilled and have better job opportunities in the same industry, as well as elsewhere. Therefore, freight consolidation could influence companies to enhance social sustainability.

Moreover, the results extend the existing knowledge of González-Ramírez and Askin (2009), Lewis, Fell, and Palmer (2010), and Aronsson and Brodin (2006), who asserted that a freight consolidation approach could directly reduce pollutant emissions from distribution process, improve delivery performance, and minimize distribution costs. This study demonstrated that freight consolidation can also indirectly influence sustainable distribution via collaborative freight distribution approach. The results presented in this study demonstrate that freight consolidation approach must be considered by every firm in order to effectively implement collaborative freight distribution practice, which in turn facilitate sustainable distribution. In Thai newspaper industry context, all newspaper companies, transporter and newsagents in the relationship should reconfigure their freight distribution operations structure in line with the freight consolidation and collaborative freight distribution approach. Once all parties agree on location of the consolidation centre, geographical coverage, utilization of transport modes, appropriate partners, fair benefits and risks sharing, and optimal implementation of information technology, they would have capabilities to cooperate in newspaper distribution operations to achieving sustainable distribution.

8.2 Conclusion

In this chapter, the researcher summarized the key findings of the study with respect to the research aims and research hypotheses. The significant relationships between co-opetition, freight consolidation, collaborative freight distribution, and sustainable distribution were discussed.

The results reveal that co-opetition strategy affects collaborative freight distribution that in turn can significantly influence sustainable freight distribution indirectly through a collaborative freight distribution approach. Moreover, freight consolidation has a significant effect on collaborative freight distribution and can influence sustainable freight distribution, both directly and indirectly.

The next section is organised with an overview of the present study, theoretical and practical implications and study limitations.

CHAPTER 9

CONCLUSIONS AND IMPLICATIONS

9.0 Introduction

This chapter concludes the research with an overview of the study and the research questions. The summaries of research findings from CFA and SEM are also presented. Implications and significant of the research and its contribution to knowledge are also discussed. At the end, the researcher also outlines recommendation for future research and limitations of this current research.

9.1 Overview of research

The Thai newspaper industry is facing the pressure of declining sales and demands, due to the emergence of advanced telecommunication technologies, such as the Internet and personal communication devices. Moreover, social and environmental issues also have negative impact on its performance. Logisticians and academic researchers in the field of freight movement and transportation have argued for ‘sustainable freight distribution’ through triple bottom line approach. Potential solutions identified are co-opetition, freight consolidation and collaborative freight distribution which appear to be overlooked in previous studies. Thus, this study aimed to develop a model of sustainable freight distribution to guide and assist Thai newspaper industry to secure its economic assets while caring social capitals and environment assets by exploring whether co-opetition, freight consolidation, and collaborative freight distribution have a positive effect on sustainable freight distribution.

The following research questions were posed within the context of Thai newspaper industry:

- Would the co-opetition influence sustainable distribution?
- Would freight consolidation influence sustainable distribution?
- Would co-opetition influence collaborative freight distribution?
- Would freight consolidation influence collaborative freight distribution?
- Would collaborative freight distribution influence sustainable distribution?

9.2 Research investigation phase and results

This research is an empirical research and exploratory study that intended to explore the relationship between co-opetition, freight consolidation, and collaborative freight distribution influencing sustainable distribution. The quantitative research method was employed and the mail questionnaire survey was used as a data collection technique. The pilot test was conducted prior to full sample data collection to test the research instruments. The mailed survey resulted in 40 questionnaires representing 27 per cent response rate. Nonetheless, the questionnaire was reviewed by professionals in the field to assure its consistency. The data from pilot was analysed for item-total correlation, normality test and EFA for the purpose of data cleaning and dropping inconsistency questions. The final version of questionnaires was then mailed to participants. The survey resulted in a final sample of 239 with a response rate of 23.9%, consisted of newspaper companies, transporters, and newsagents in Thailand.

The data set obtained from the survey was analysed in two stages using SPSS and AMOS version 21. In the first stage, the data set was checked for its data consistency via missing value assessment, multivariate outliers, comparing respondents' characteristics, non-response bias assessment, multivariate normality assessment, multicollinearity test, unidimensionality test and common method variance assessment, for the purpose of data management and data cleaning. Nonetheless, EFA was also performed for the purpose of data exploration. In the second stage, the data set was analysed by CFA and SEM. These analyses were employed for the purpose of finding the observed variables of each latent variable as well as the relationship between co-opetition, freight consolidation, collaborative freight distribution, and sustainable distribution construct.

9.2.1 Results of confirmatory factor analysis

The study identified critical factors for achieving co-opetition, freight consolidation, collaborative freight distribution, and sustainable distribution in Thai newspaper industry context. Management commitment, relationship management, and communication management were identified as critical factors of co-opetition as perceived by respondents. For freight consolidation, location of freight consolidation centre, geographical coverage, and utilization of transport modes should be concerned. For collaborative freight distribution, partner selection, fair benefits and risks sharing, and advanced information technologies should be considered. Lastly, economic, social capital, and environmental assets were identified as critical factor for achieving sustainable distribution.

The results of this investigation also found elements that explained each critical factor as perceived by sample medium and large firms. Under co-opetition, creation of a new strategy as the goal of the co-opetitive relationship and reconfiguration of internal business process should be considered in the management commitment. For relationship management, all participating firms should have mutual goals and objective before the start of the relationship establishment. Moreover, they should be intended to share know-how from work experience. Nonetheless, frequent meeting should be arranged for continually information sharing and relationship establishment. For communication management, the results suggested that firms should intend to frequently inform new development to other members in the relationship and intend to implement information technology to exchange information.

Under freight consolidation, the results suggested that an improvement of inbound and outbound flow of product, the reduction of distribution costs, an improvement of delivery flexibility, and an improvement of flow of product return should be concerned when considering location of freight consolidation centre. The study suggested that firms should consider an improvement of on-time delivery of each drop-off point, the reduction of travel distance, and the reduction of fuel consumption when considering an implementation of freight consolidation practice. Moreover, the utilization of transport mode should also be concerned, including the reduction of transportation costs, the reduction of the number of delivery vehicles, and the reduction of the number of drivers.

Partner selection is critical for collaborative freight consolidation. Firms are suggested to assess and evaluate partner’s goals, objectives, and complementary skills prior to partner selection. Moreover, a peer relationship between top executives should be established. Nonetheless, firms should be willing to learn a new working environment in order to align its working process with partners. Under benefits and risks sharing, an improvement of sales and on-time delivery should be fairly shared between members in order to sustain long-term relationship and prevent future conflict. Nonetheless, advanced information technology should be implemented to initiate collaborative freight consolidation, including an implementation of market-based system (i.e., portals, and hub) and collaborative planning and forecasting-based systems (CPFR). The study found that firms are likely to implement these advanced information technology if they could improve services level and increase visibility of all participating firms.

Under sustainable distribution, the study found that an improvement of sustainable freight distribution process could improve environmental assets through the reduction of water pollution, visual pollution, odour pollution, and solid waste. Economic sustainability could be improved through an improvement of company's reputation, the lower risk of business operation, improvement of external sources of sponsorship attraction, enhancement of market and sales, and market opportunities. The social capitals would be improved through an increase of staff motivation, enhancement of human capital value, and improvement of the contribution of a firm to community development. Thus, the study suggests that firms should consider these critical factors when aiming to achieve co-opetition, freight consolidation, and collaborative freight consolidation and sustainable distribution.

9.2.2 Results of the structural equation modeling

The SEM was employed to generate the best-fit structural model. As presented in Chapter 8, the final structural model (competing model 1) indicates that co-opetition does not appear to have a direct effect on sustainable distribution in Thai newspaper industry. Thus, H1 is not supported. Nonetheless, freight consolidation has a positive effect on sustainable distribution (H2). Co-opetition also has a positive effect on collaborative freight distribution (H3). Moreover, freight consolidation has a positive effect on collaborative freight distribution (H4). Also, collaborative freight distribution has a positive effect on sustainable distribution (H5). Thus, H2, H3, H4, and H5 are supported.

The results indicate that a co-opetition approach can positively influence sustainable distribution indirectly through a collaborative freight distribution strategy. Moreover, freight consolidation is a critical enabler of collaborative freight distribution, and can directly and indirectly enable sustainable distribution. Thus, the results conclude that co-opetition, freight consolidation and collaborative freight distribution could either directly or indirectly influence sustainable freight distribution in Thai newspaper industry context.

9.3 Implication for theory

The findings have some important implications for the theory of sustainable supply chain and logistics management. The most significant implication of this research is the provision of an empirical model of sustainable freight distribution. The sustainability issues have increasingly drawn attention from academics and practitioners in the field of sustainability development. Previous studies in this field have discussed potential solutions for improving sustainability in supply chain and logistics. These discussions, however, lack empirical support in achieving sustainable freight distribution with incorporation of collaboration in freight distribution among competitors (i.e. coopetition), together with freight consolidation management. Thus, the model developed in this study could be used as a reference guide for understanding collaborative logistics activities aimed at achieving a sustainable supply chain.

The results reported here extend the discussion of previous authors in various aspects. For example, this work is an extension of that performed by Cheng, Yeh, and Tu (2008) in a sense that inter-organizational business operations in resources-based view framework have the potential to enhance competitive advantages of all parties in the supply chain and improve their sustainability performance. Firms could acquire complementary resources through an engagement in inter-firm relationships (Hitt et al. 2000). The results of this research suggest that establishment of strategic alliance or inter-organizational relationship among competitors within an industry can lead to an agreement on freight collaboration. Strategic alliances in freight distribution result in financial (i.e., maximized profitability), economic (i.e., economies of scale), strategic (i.e., wider delivery geographical area), marketing (i.e., improved customer satisfaction) and operational objectives (i.e., increased delivery frequency) (Song & Panayides 2002). Once two or more firms agree to participate in transport collaboration, they are able to share valuable resources—including rare, imperfectly imitable and non-substitutable resources—as well as facilities, explicit and tacit knowledge. They can also minimize the risks and ultimately improve their freight distribution performance (Hitt et al. 2000; Sutherland 2006).

The present study also supports the idea that redesigning the logistics activity towards collaborative transportation and improvement of freight distribution process towards population ecology framework could lead to an achievement of sustainable distribution (i.e., reducing waste, emission levels and negative social and environmental impacts), as discussed by Shrivastava (1995) and Fenwick (2007). The results of this study also extend the previous work of Krajewska et al. (2007) in relation to horizontal cooperation among competing firms. In game theory framework, it can generate value by improving space utilization, optimizing truck capacity, reducing fuel and truck usage, as well as labour and driver costs, along with minimizing cost of freight movement, improving employee satisfaction and enhancing fuel efficiency. Individual firms cooperate with competitors in freight distribution because they have common strategic goals, but lack resources and capacity (i.e., funds, vehicles and technologies). Thus, they tend to cooperate in order to extend their capacity and achieve desired economies of scale and scope. They also cooperate to prevent high costs, enhance resource boundaries and prevent high-risk activities (Dhanarag & Parkhe 2006). Hence, this research claims that collaborative freight operation among competitors is a critical component of sustainable distribution.

The empirical model of sustainable freight distribution also reveals the relationship among freight consolidation, collaborative freight distribution and sustainable freight distribution. These results extend those reported by Lewis et al. (2010) and Merrick and Bookbinder (2010), as they demonstrate that freight consolidation is critical for achieving sustainable distribution. This study found that collaborative freight distribution requires effective freight consolidation management, effective real-time information sharing, sharing benefits amongst all collaborative partners, centralized transportation management, location management and a daily transportation plan, in order to decrease empty hauling (Sutherland 2003). Hence, it can be posited that, in order to achieve sustainable freight distribution, firms need to consider freight consolidation management and collaborative freight transportation simultaneously.

9.4 Implication for practice

This research proposes a model of sustainable freight distribution that could be used to redesign logistics and freight movement by newspaper companies, transporters and newsagents in newspaper supply chain in Thailand context. The model suggests that the consideration of co-opetition, freight consolidation and collaborative freight distribution could be adopted to improve logistics performance and reduce costs of operation, while caring for the natural environment and social capital.

This study provides evidence of the positive relationship among co-opetitive relationship, collaborative freight distribution and sustainable freight distribution. Although co-opetitive relationship cannot directly influence sustainable freight distribution, as argued by Hageback and Segerstedt (2004), Ehrenmann and Reiss (2012), and Cruijssen et al. (2007), the results indicate that co-opetitive relationship could influence sustainable distribution via collaborative freight distribution. As previously noted, independent firms are unable to optimise route planning, logistics capacity, vehicle capacity utilization, full truck load and transport process without the consideration of co-opetitive relationship among competing firms. This advantage arises because firms in co-opetitive relationships could share and gain supplementary and complementary resources. For example, they may have a mutual goal to improve distribution efficiency and agree on joint-distribution centre, whereby small loads of newspapers from various firms are combined to enable dispatching larger loads. They could also share trucks and delivery routes when newspapers are being distributed to the same or nearby destination. This research revealed that collaborative freight distribution among competing newspaper companies would improve sales, increase the on-time delivery rates, enhance the service level and increase visibility.

The results further suggest that collaborative freight distribution among competing firms would lead to sustainable freight distribution because resource sharing would improve their usage. For instance, when trucks are being shared, firms could reduce cost of operation as well as pollution, while improving their logistics performance. For example, typically, three trucks are employed by three firms to distribute a small load of newspaper each, while these shipments could be combined into a single truck in collaborative freight distribution. As a result, less pollution is emitted, and the cost of operating a single truck allows all three companies to generate savings. In addition, firms could share costs of petrol and improve vehicle utilization. Hence, this research suggests that co-opetitive relationship could indirectly influence sustainable freight distribution via collaborative freight distribution in the Thai newspaper supply chain.

Firms could also consider the model as a guideline for implementing freight consolidation in order to achieve sustainable freight distribution. This study provides evidence of a direct positive relationship between freight consolidation and sustainable freight distribution. This result is consistent with the findings reported by González-Ramírez and Askin (2009), Lewis et al. (2010), and Aronsson and Brodin (2006), as it shows that freight consolidation is critical for achieving sustainable distribution. It is vital as it can reduce delivery cost and travel distance, accelerate corporate social responsibility performance and increase delivery window, all of which could markedly improve distribution chain efficiency. In the case of newspaper distribution in Thailand, firms partaking in the newspaper supply chain should be aware that the selection of the location of freight consolidation centre is critical and should thus identify the most appropriate location. For example, having a distribution centre located close to the main drop-off points would reduce the cost of petrol and minimize the delivery time, thus helping serve the customers more efficiently.

In addition to the location selection, the geographical coverage of the freight consolidation centre is also important. For example, the freight consolidation centre that covers the main drop-off points in both central and northern Thailand would improve on-time delivery, while reducing travel distance and fuel consumption during the distribution process. These improvements can be achieved because the truck could deliver a full-truck load to the single freight consolidation centre, rather than having to service the designated consolidation centres of each part of Thailand. As a result, this practice would improve sustainability by reducing pollution arising from the distribution process.

When considering the aforementioned strategies, it is vital to do so in conjunction with the delivery vehicle utilization, as this is another aspect of sustainable distribution. As the researcher stated earlier, less-than-truck-load is the main source of transportation inefficiency because a small shipment requires a greater number of drivers, vehicles, and gallons of gasoline, and creates more transit time and delivery routes. The results yielded by this study suggest that freight consolidation could improve utilization of transport modes and lead to lower transportation costs, as well as smaller number of delivery trucks and drivers, which would in turn lead to sustainable distribution. For example, delivery routes should be rerouted to allow consolidation of small loads into a single truck. As a result, less gasoline would be used due to the reduced delivery vehicle usage. Consequently, risk of high operation costs derived from price of gasoline would be reduced. Hence, this research suggests that firms along the newspaper supply chain should consider freight consolidation for achieving sustainable freight distribution.

The results yielded by this research also indicate that freight consolidation could indirectly influence sustainable distribution via collaborative freight distribution approach. In the Thai newspaper industry context, firms along the newspaper supply chain should reconfigure their freight distribution operations structure in line with the freight consolidation and collaborative freight distribution approach. Once all firms agree on the most optimal location of the consolidation centre, geographical coverage, utilization of transport modes, appropriate partners, fair benefits and risk sharing, as well as optimal implementation of information technology, they would have capabilities to cooperate in newspaper distribution operations and thus achieve sustainable distribution.

The model of sustainable freight distribution further suggests that firms could successfully implement collaborative freight distribution by considering co-opetition and freight consolidation approach simultaneously. Firms and their partners could discuss the key freight consolidation activities, such as location of the consolidation centre, the geographical coverage and the utilization of delivery vehicle. Once they agree on these essential elements, they can reconfigure their own business operations according to the joint business strategy. These findings are in line with those reported by Chen, Yeh, and Chen (2010), Esper and Williams

(2003), and Graham (2011), as they suggest that freight consolidation approach is critical. More specifically, firms should aim to find the most appropriate consolidation centre location, so that it can cover all suppliers and customers. The potential benefits of this strategy include reduction of distribution costs and delivery times. On the other hand, a successful strategic alliance and full collaboration could enable collaborative freight distribution, as a strong relationship between competitors can abate conflicts, generate more trust, improve performance and achieve effective information sharing. Hence, this research suggests that newspaper companies, transporters and newsagents should consider co-opetitive relationship and freight consolidation for enabling effective collaborative freight distribution.

9.5 Significance of the research and its contribution to the extant knowledge

9.5.1 Theoretical contributions

The most significant contribution of this research is the provision of an empirical model of sustainable freight distribution in the context of Thailand newspaper industry. The past studies conducted in this field have failed to approach co-opetition, freight consolidation and collaborative freight distribution simultaneously, as antecedents of sustainable freight distribution. Previous research on co-opetition (i.e., Min et al. (2005), Cheng et al. (2008), Nakano (2009), Beamon (2008)), and freight consolidation (Browne et al. 2005; Cruijssen, Cools & Dullaert 2007; Sutherland 2003; Zhou, Hui & Liang 2011) mostly focused on other industries. Thus, very little work on the newspaper supply chain has been conducted to date. Further, studies focusing on newspaper logistics (i.e., Van Buer et al. (1999), Bohnlein et al. (2009), Boonkleaw et al. (2009) and Eraslan and Derya (2010)) tended to overlook the influence of co-opetition, freight consolidation and collaborative freight distribution on sustainable distribution. Hence, in an attempt to bridge this gap, this study extends the current knowledge of the relationship between co-opetition, freight consolidation, collaborative freight distribution and sustainable distribution in supply chain management in the context of Thai newspaper industry.

The findings of this study benefit academic communities, logisticians, related industries, economists, socialists and environmentalists, as they provide additional information on how sustainability in the Thailand newspaper industry context can be improved. Moreover, the study also expanded the current knowledge on the capacity of alternative logistics and supply chain models to improve logistics applications towards sustainable distribution and sustainability. This will very likely contribute to improving the economic, social and natural environment dimensions in Thailand.

9.5.2 Practical contributions

This study also provides practical contributions, as the findings it yielded are highly relevant for improving newspaper distribution and related freight consolidation. They can also assist Thailand's newspaper industry participants in making their logistics and supply chain operations more efficient and cost effective. The successful establishment of co-opetitive relationship would allow newspaper firms, transporters and newsagents and their competitors to work together towards improving customer satisfaction, all achieved through joint distribution. The successful joint newspaper distribution agreement among competitors can lead to the successful implementation of collaborative freight distribution (by, for example, sharing a delivery truck). Therefore, successful collaborative freight distribution would allow the participating firms to improve organizational performance while caring for the society and natural environment (i.e., reducing fuel consumption). Thus, the study will likely improve freight distribution practices in the Thailand's newspaper industry. It is also envisaged that they can assist firms wishing to enhance the capacity of logistics, transport management, and freight consolidation activities for improving freight distribution operations. All these efforts ultimately promote sustainability in Thailand.

This study also contributes to practical fields. Sustainable freight distribution has been practiced in United Kingdom for some time. For example, UK's largest competing food and drink companies, including Coca Cola, Coors, Northern Foods, Heinz and Asda, have agreed to participate in a sustainable distribution initiative that will result in the removal of 800 trucks from UK roads. Similarly, Tesco and Unilever agreed on transport collaboration by sharing delivery vehicles between the Tesco Goole and the Unilever Doncaster distribution centre. In the same vein, this study provides an empirical model of sustainable freight distribution and explores academic evidence suggesting that relationship establishment among competing companies, freight consolidation and collaboration in freight transport could be adopted for achieving sustainable freight distribution.

9.6 Limitations and opportunities for future research

The present study is valuable because it provides an empirical model of sustainable freight distribution in the Thailand newspaper industry. However, this research suffers from some limitations that could be addressed in future studies in this field. On the methodological side, the research setting and survey undertaken among the stakeholders in one country could limit the generalizability of the findings presented here. Thus, the current results could be validated through a future study in another country or industry context, since all constructs and sub-constructs in this study have good theoretical support. Moreover, future research using longitudinal data of the effect of co-opetition strategy, freight consolidation and collaborative freight distribution on sustainable distribution is recommended for improving our understanding of these phenomena. Nonetheless, other supply chain members included in the newspaper distribution process, such as newsboys or provincial agents, could be included in the future research, thus providing further information on the newspaper distribution. An aggregation of small firms in the survey population should also be considered in future studies, as they may reveal significant relationship between co-opetition and sustainable distribution. It must also be noted that the sample size in this study was small, as fewer than 100 respondents were included in each sub-group (e.g., newspaper companies generated 95 responses, transporters 67 and newsagents 77). Clearly, a larger sub-sample in future research would be desirable, as it would increase the potential for generalizing the findings and increase the statistical power.

On the theoretical side, as logistics and transportation sustainability is increasingly taking centre stage among researchers and practitioners, management of co-opetition strategy, freight consolidation and collaborative freight distribution needs a follow-up action over time. It is thus advised to investigate and include the changes occurring in the industry and further examine the changes in the above stated relationships. Hence, future research could build on this work and the constructs presented in this study to more fully understand the dynamics of these constructs within firms and their competitive environment.

To enhance the knowledge yielded by this study, the relationship between co-opetition and sustainable distribution could be further examined, since the direct path between these constructs was found to be non-significant. However, empirical evidence (McKinnon, 2010) indicates that co-opetition has a direct effect on sustainable distribution. Thus, future studies in this field could identify additional co-opetitive factors or additional data that would help identify a direct effect on sustianable disitrubution. Authors of several extant studies (Barringer and Harrison 2000; Ehrenmann and Reiss 2012) posited a positive relationship between different types and degree of co-opetitive relationship and joint business performance. Thus, future studies could extend the boundary of the current study by examining the most appropriate types of co-opetitive relationship (i.e., joint venture, network and mergers) for achieving long-term collaborative freight distribution operations and sustainable distribution in the Thai newspaper industry context.

On the methodology side, there are also further opportunities for studies in this field. For example, a mixed method design could be employed to confirm and enhance the results yielded by this study. This could be achieved by interviewing participants from newspaper companies, transporters and newsagents. On the theoretical side, there are different types of freight consolidation practices, such as manufacturing, distribution and terminal cross-docking approach (Schultz 2000; Gümüş & Bookbinder 2004). These practices differ in terms of the manner and timing of the freight shipment to the assigned destination. For example, freight should be moved directly from the production line to the waiting truck before reaching the destination when implementing manufacturing cross-docking practices. On the other hand, when following terminal cross-docking practice, freight should be moved from various distribution centres to the cross-dock terminal before reaching the destination. Thus, future studies in this field could examine the type of freight consolidation that is most suitable for the newspaper industry. Such initiatives could also enhance the current knowledge by identifying the most appropriate location of the consolidation centre, optimal geographical coverage and transport mode utilization, in order to optimize collaborative freight distribution operation and sustainability.

9.7 Conclusion

This chapter presents an overview of the study findings. The implications for theories of sustainable supply chain and practical implications for newspaper industry are discussed. Finally, it concludes with research contributions, limitations and opportunities for future research.

Reference List

Adamik, A. 2013, 'A partnering approach to extending the business base through cooperation with competitors (coopetition)–is it an option for SMEs?', *Recent advances in management, marketing and finances* Cambridge.

Adams, C.A. & Frost, G.R. 2008, 'Integrating sustainability reporting into management practices', *Accounting Forum*, vol. 32, Elsevier, pp. 288-302.

AECnews 2013, *Newagency industry in the growing digital era*, AECnews, Bangkok, viewed 10 October 2013, <http://aecnews.co.th/>.

Aghezzaf, E. 2004, 'Capacity planning and warehouse location in supply chains with uncertain demands', *Journal of the Operational Research Society*, vol. 56, no. 4, pp. 453-62.

Akintoye, A., McIntosh, G. & Fitzgerald, E. 2000, 'A survey of supply chain collaboration and management in the UK construction industry', *European Journal of Purchasing & Supply Management*, vol. 6, no. 3-4, pp. 159-68.

Aktas, E. & Ulengin, F. 2005, 'Outsourcing logistics activities in Turkey', *Journal of Enterprise Information Management*, vol. 18, no. 3, pp. 316-29.

Akyelken, N. 2011, 'Green Logistics: Improving the Environmental Sustainability of Logistics', *Transport Reviews*, vol. 31, no. 4, pp. 547-8.

Alberti, M., Caini, L., Calabrese, A. & Rossi, D. 2000, 'Evaluation of the costs and benefits of an environmental management system', *International Journal of Production Research*, vol. 38, no. 17, pp. 4455-66.

Allen, I.E. & Seaman, C.A. 2007, 'Likert scales and data analyses', *Quality Progress*, vol. 40, no. 7, pp. 64-5.

Allen, J., Browne, M., Tanner, G., Anderson, S., Christodoulou, G. & Jones, P. 2004, 'Analyzing the Potential Impacts of Sustainable Distribution Measures in UK Urban Areas', *The 3rd International Conference on City Logistics*

Andersen, M. & Skjoett-Larsen, T. 2009, 'Corporate social responsibility in global supply chains', *Supply Chain Management: an international journal*, vol. 14, no. 2, pp. 75-86.

Anderson, J.C. & Gerbing, D.W. 1988, 'Structural equation modeling in practice: A review and recommended two-step approach', *Psychological bulletin*, vol. 103, no. 3, p. 411.

Anderson, S., Allen, J. & Browne, M. 2005, 'Urban logistics—how can it meet policy makers' sustainability objectives?', *Journal of Transport Geography*, vol. 13, no. 1, pp. 71-81.

Andersson, L.M. & Bateman, T.S. 1997, 'Cynicism in the workplace: Some causes and effects', *Journal of Organizational Behavior*, vol. 18, no. 5, pp. 449-69.

ANF 2011, *Australian government productivity commission issues paper: Economic structure and performance of the Australian retail industry* Asutralian newsagents' federation

Apte, U.M. & Viswanathan, S. 2000, 'Effective cross docking for improving distribution efficiencies', *International Journal of Logistics*, vol. 3, no. 3, pp. 291-302.

Arbuckle, J.L. 2010, 'IBM SPSS® Amos™ 19 user's guide', *Crawfordville, FL: Amos Development Corporation*.

Arbuckle, J.L. & Wothke, W. 1999, *Amos 4.0 user's guide*, Marketing Department, SPSS Incorporated.

Armstrong, J.S. & Overton, T.S. 1977, 'Estimating nonresponse bias in mail surveys', *Journal of Marketing Research (JMR)*, vol. 14, no. 3, pp. 396-402.

Aronsson, H. & Brodin, M.H. 2006, 'The environmental impact of changing logistics structures', *International Journal of Logistics Management, The*, vol. 17, no. 3, pp. 394-415.

Auger, P., Burke, P., Devinney, T.M. & Louviere, J.J. 2003, 'What will consumers pay for social product features?', *Journal of Business Ethics*, vol. 42, no. 3, pp. 281-304.

Aulakh, P.S. & Gencturk, E.F. 2000, 'International principal–agent relationships: Control, governance and performance', *Industrial Marketing Management*, vol. 29, no. 6, pp. 521-38.
Avittathur, B., Shah, J. & Gupta, O.K. 2005, 'Distribution centre location modelling for differential sales tax structure', *European Journal of Operational Research*, vol. 162, no. 1, pp. 191-205.
Azapagic, A. 2003, 'Systems Approach to Corporate Sustainability:: A General Management Framework', *Process Safety and Environmental Protection*, vol. 81, no. 5, pp. 303-16.
Bagozzi, R.P., Yi, Y. & Phillips, L.W. 1991, 'Assessing construct validity in organizational research', *Administrative Science Quarterly*, pp. 421-58.
Ballou, R. 2003, 'Business logistics management,(international edition)', *Recherche*, vol. 67, pp. 49-59.
Bangkokbank 2014, *Foreign exchange rates* Bangkok Bank, Bangkok, viewed 16 June 2014 <http://w ww.bangkokbank.com/bangkokbank/webservices/rates/pages/fx_rates.aspx>.
Banister, D. & Button, K. 1993, *Transport, the environment and sustainable development*, Routledge.
Banomyong, R. & Supatn, N. 2011, 'Selecting logistics providers in Thailand: a shippers' perspective', *European Journal of Marketing*, vol. 45, no. 3, pp. 419-37.
Bansal, P. 2005, 'Evolving sustainably: a longitudinal study of corporate sustainable development', *Strategic Management Journal*, vol. 26, no. 3, pp. 197-218.
Barahona, F. & Jensen, D. 1998, 'Plant location with minimum inventory', *Mathematical Programming*, vol. 83, no. 1-3, pp. 101-11.
Barnett, M.L. 2007, 'Stakeholder influence capacity and the variability of financial returns to corporate social responsibility', *Academy of Management Review*, vol. 32, no. 3, pp. 794-816.
Barney, J. 1991, 'Firm resources and sustained competitive advantage', *Journal of management*, vol. 17, no. 1, pp. 99-120.
Barney, J.B., Ketchen, D.J. & Wright, M. 2011, 'The Future of Resource-Based Theory', *Journal of management*, vol. 37, no. 5, pp. 1299-315.
Barratt, M. 2004, 'Understanding the meaning of collaboration in the supply chain', *Supply Chain Management: an international journal*, vol. 9, no. 1, pp. 30-42.
Barringer, B.R. & Harrison, J.S. 2000, 'Walking a tightrope: Creating value through interorganizational relationships', *Journal of Management*, vol. 26, no. 3, pp. 367-403.
Bartlett, C. & Ghoshal, S. 2000, 'Managing across boundaries: the collaborative challenge', *Text, cases and readings in cross-border management*, pp. 403-502.
Bartlett, M.S. 1954, 'A note on the multiplying factors for various χ 2 approximations', *Journal of the Royal Statistical Society. Series B (Methodological)*, pp. 296-8.
Baum, J.A.C. 1999, 'Organizational ecology', *Studying Organization: Theory and Method*, pp. 71-108.
Baumgartner, H. & Homburg, C. 1996, 'Applications of structural equation modeling in marketing and consumer research: a review', *International Journal of research in Marketing*, vol. 13, no. 2, pp. 139-61.
Beamon, B.M. 2008, 'Sustainability and the Future of Supply Chain Management', *Operations and Supply Chain Management*, vol. 1, no. 1, pp. 4-18.
BearingPoint 2008, '2008 Supply chain monitor: How mature is the green supply chain', New York: Bearing Point Publishing.
Beckeman, M., Bourlakis, M. & Olsson, A. 2013, 'The role of manufacturers in food innovations in Sweden', *British food journal*, vol. 115, no. 7, pp. 953-74.
Belz, F. & Peattie, K. 2009, *Sustainability marketing: a global perspective*, John Wiley & Sons.

Bengtsson, M. & Kock, S. 2000, '"Coopetition" in Business Networks—to Cooperate and Compete Simultaneously', *Industrial Marketing Management*, vol. 29, no. 5, pp. 411-26.
Bhaskaran, S., Polonsky, M., Cary, J. & Fernandez, S. 2006, 'Environmentally sustainable food production and marketing: opportunity or hype?', *British food journal*, vol. 108, no. 8, pp. 677-90.
Bhattacharya, C. & Sen, S. 2007, 'Doing Better at Doing Good: When, Why, and How Consumers Respond to Corporate Social Initiatives CB Bhattacharya and Sankar Sen Source: California Management Review, 47 (1)(2004): 9-24', *Corporate Social Responsibility: Managing and implementing corporate social responsibility*, vol. 2, no. 1, p. 149.
Bhattacharya, C.B.S.S. 2004, 'Doing better at doing good: When, why, and how consumer respond to corporate social initiatives', *California Management Review*, vol. 47, no. 1, pp. 9-24.
Bierly III, P.E. & Gallagher, S. 2007, 'Explaining alliance partner selection: fit, trust and strategic expediency', *Long Range Planning*, vol. 40, no. 2, pp. 134-53.
Bigliardi, B., Dormio, A.I. & Galati, F. 2011, 'Successful co-opetition strategy: evidence from an Italian consortium', *International Journal of Business, Management and Social Sciences*, vol. 2, no. 4, pp. 1-8.
Blomqvist, K., Hurmelinna, P. & Seppänen, R. 2005, 'Playing the collaboration game right—balancing trust and contracting', *Technovation*, vol. 25, no. 5, pp. 497-504.
Bloos, M. & Kopfer, H. 2009, 'Efficiency of transport collaboration mechanisms', *Communications of SIWN*, vol. 6, pp. 23-8.
Blumberg, B., Cooper, D.R. & Schindler, P.S. 2008, *Business research methods*, vol. 2, McGraw-Hill Higher Education New York.
Bohnlein, D., Gahm, C. & Tuma, A. 2009, 'A hybrid meta-heuristic for the VRPTW with cluster-dependent tour starts in the newspaper industry', IEEE, pp. 1-10.
Böhnlein, D., Schweiger, K. & Tuma, A. 2011, 'Multi-agent-based transport planning in the newspaper industry', *International Journal of Production Economics*, vol. 131, no. 1, pp. 146-57.
Bollen, K.A. 1998, *Structural equation models*, Wiley Online Library.
Boog, J. 2011, *7 survival secrets for independent bookstores*, Mediabistro, New York, viewed 2 October 2013, <http://www.mediabistro.com/>.
Boonkleaw, A., Suthikarnnarunai, N. & Srinon, R. 2009, 'Strategic planning and vehicle routing algorithm for newspaper delivery problem: Case study of morning newspaper, Bangkok, Thailand', *World Congress on Engineering and Computer Science*, vol. 2, pp. 1-5.
Boonkleaw, A., Suthikarnnarunai, N. & Srinon, R. 2010, 'Strategic Planning for Newspaper Delivery Problem Using Vehicle Routing Algorithm with Time Window (VRPTW)', *Engineering Letters*, vol. 18, no. 2, pp. 1-10.
Bouncken, R.B. & Fredrich, V. 2011, 'Coopetition: Its successful management in the nexus of dependency and trust', IEEE, pp. 1-12.
Bowen, F.E. 2002, 'Does size matter? Organizational slack and visibility as alternative explanations for environmental responsiveness', *Business & society*, vol. 41, no. 1, pp. 118-24.
Bowen, F.E., Cousins, P.D., Lamming, R.C. & Farukt, A.C. 2001, 'The role of supply management capabilities in green supply', *Production and operations management*, vol. 10, no. 2, pp. 174-89.

Boyer, K.K. & Swink, M.L. 2008, 'Empirical elephants—why multiple methods are essential to quality research in operations and supply chain management', *Journal of Operations Management*, vol. 26, no. 3, pp. 338-44.
Braber, P. 2012, *A brief history of newspaper*, Historicpages, viewed 18 June 2012, <http://www.historicpages.com/nprhist.htm>.
Brandenburger, A.M. & Nalebuff, B. 1998, *Co-opetition*, Doubleday, New York.
Brandenburger, A.M. & Nalebuff, B.J. 2002, 'Use game theory to shape strategy', *Strategy: critical perspectives on business and management*, vol. 4, pp. 57-73.
Brouthers, K.D., Brouthers, L.E. & Wilkinson, T.J. 1995, 'Strategic alliances: choose your partners', *Long Range Planning*, vol. 28, no. 3, pp. 2-25.
Browne, M., Sweet, M., Woodburn, A. & Allen, J. 2005, 'Urban Freight Consolidation Centres Final Report', *Transport Studies Group, University of Westminster*.
Browning, B. & White, A. 2000, 'Collaborative transportation management–a proposal', *Logility Inc., http://www. vics. org*.
BRS 2006, *Issue brifs: Business ethics, economic development and community investment, environment, governance and accountability, human rights, marketplace, workplace.*, Business of Social Responsibility, viewed 09 August 2012, <www. bsr.org.>.
Brundtland, G.H. 1987, 'Global change and our common future', *Oxford paperbacks*, vol. 31, no. 5, pp. 16-43.
Bryman, A. & Bell, E. 2007, *Business research methods*, Oxford University Press, USA.
Buckley, M.R., Cote, J.A. & Comstock, S.M. 1990, 'Measurement errors in the behavioral sciences: The case of personality/attitude research', *Educational and Psychological Measurement*, vol. 50, no. 3, pp. 447-74.
Byrne, B.M. 2009, *Structural equation modeling with AMOS: Basic concepts, applications, and programming*, CRC Press.
Cadotte, E.R. & Robicheaux, R.A. 1979, 'Institutional Issues in Urban Freight Consolidation', *International Journal of Physical Distribution & Logistics Management*, vol. 9, no. 4, pp. 158-68.
Cainelli, G., Evangelista, R. & Savona, M. 2006, 'Innovation and economic performance in services: a firm-level analysis', *Cambridge Journal of Economics*, vol. 30, no. 3, pp. 435-58.
Cambridgedictionary 2013, *Newsagent* Cambridge University Press, Cambridge viewed 25 September 2013, <http://dictionary.cambridge.org/dictionary/british/newsagent?q=newsagent>.
Canel, C. & Khumawala, B.M. 1997, 'Multi-period international facilities location: an algorithm and application', *International Journal of Production Research*, vol. 35, no. 7, pp. 1891-910.
Carmeli, A., Tishler, A. & Edmondson, A.C. 2012, 'CEO relational leadership and strategic decision quality in top management teams: The role of team trust and learning from failure', *Strategic Organization*, vol. 10, no. 1, pp. 31-54.
Carmines, E.G. & Zeller, R.A. 1979, *Reliability and validity assessment*, vol. 17, Sage Publications, Incorporated.
Caroli, M.G. & Tantalo, C. 2012, 'Corporate Social Responsibility and SME's Competitiveness', *International Journal of Technology Management*, vol. 58, no. 1, pp. 129-51.
Carral, R. & Kajanto, M. 2008, 'Nokia: a case study in managing industry downturn', *Journal of Business Strategy*, vol. 29, no. 1, pp. 25-33.
Carroll, A.B. 1999, 'Corporate social responsibility evolution of a definitional construct', *Business & society*, vol. 38, no. 3, pp. 268-95.

Carter, C. & Dresner, M. 2001, 'Environmental purchasing and supply management: cross-functional development of grounded theory', *The Journal of Supply Chain Management*, vol. 37, no. 3, pp. 12-27.
Carter, C., Ellram, L. & Tate, W. 2007, 'Structure and influence: a logistics management application of social network analysis', *Journal of Business logistics*, vol. 28, no. 1, pp. 137-68.
Carter, C.R. & Jennings, M.M. 2002a, 'Logistics social responsibility: an integrative framework', *Journal of Business logistics*, vol. 23, no. 1, pp. 145-80.
Carter, C.R. & Jennings, M.M. 2002b, 'Social responsibility and supply chain relationships', *Transportation Research Part E: Logistics and Transportation Review*, vol. 38, no. 1, pp. 37-52.
Carter, C.R. & Rogers, D.S. 2008, 'A framework of sustainable supply chain management: moving toward new theory', *International Journal of Physical Distribution & Logistics Management*, vol. 38, no. 5, pp. 360-87.
Castaldo, S., Perrini, F., Misani, N. & Tencati, A. 2009, 'The missing link between corporate social responsibility and consumer trust: the case of fair trade products', *Journal of business ethics*, vol. 84, no. 1, pp. 1-15.
Chaabane, A., Ramudhin, A. & Paquet, M. 2010, *Optimization and evaluation of sustainable supply chains*, Citeseer.
Chakravarty, A.K. 2005, 'Global plant capacity and product allocation with pricing decisions', *European Journal of Operational Research*, vol. 165, no. 1, pp. 157-81.
Chan, Y., Carter, W.B. & Burnes, M.D. 2001, 'A multiple-depot, multiple-vehicle, location-routing problem with stochastically processed demands', *Computers & Operations Research*, vol. 28, no. 8, pp. 803-26.
Chapman, L. 2007, 'Transport and climate change: a review', *Journal of Transport Geography*, vol. 15, no. 5, pp. 354-67.
Charkhgard, H. & Tabar, A.A.Y. 2011, 'Transportation problem of cross-docking network with three-dimensional trucks', *African Journal of Business Management*, vol. 5, no. 22, pp. 9297-303.
Chen, I.J. & Paulraj, A. 2004, 'Towards a theory of supply chain management: the constructs and measurements', *Journal of Operations Management*, vol. 22, no. 2, pp. 119-50.
Chen, M.C., Yeh, C.T. & Chen, K.Y. 2010, 'Development of collaborative transportation management framework with Web Services for TFT–LCD supply chains', *International Journal of Computer Integrated Manufacturing*, vol. 23, no. 1, pp. 1-19.
Cheng, J.H., Yeh, C.H. & Tu, C.W. 2008, 'Trust and knowledge sharing in green supply chains', *Supply Chain Management: an international journal*, vol. 13, no. 4, pp. 283-95.
Chiang, W.C., Russell, R., Xu, X. & Zepeda, D. 2009, 'A simulation/metaheuristic approach to newspaper production and distribution supply chain problems', *International Journal of Production Economics*, vol. 121, no. 2, pp. 752-67.
Child, J. & Faulkner, D. 1998, *Strategies of cooperation: Managing alliances, networks, and joint ventures*, Oxford University.
Child, J., Faulkner, D. & Tallman, S. 2005, *Cooperative strategy: Managing alliances, networks, and joint ventures*, Oxford University Press, Oxford.
Chin, K.S., Chan, B.L. & Lam, P.K. 2008, 'Identifying and prioritizing critical success factors for coopetition strategy', *Industrial Management & Data Systems*, vol. 108, no. 4, pp. 437-54.
Chou, C.-P. & Bentler, P.M. 1995, 'Estimates and tests in structural equation modeling'.
Churchill, J.G.A. 1979, 'A paradigm for developing better measures of marketing constructs', *Journal of marketing research*, pp. 64-73.

Ciliberti, F., Pontrandolfo, P. & Scozzi, B. 2008, 'Logistics social responsibility: Standard adoption and practices in Italian companies', *International Journal of Production Economics*, vol. 113, no. 1, pp. 88-106.
Claycomb, C. & Frankwick, G.L. 2004, 'A Contingency Perspective of Communication, Conflict Resolution and Buyer Search Effort in Buyer-Supplier Relationships', *Journal of Supply Chain Management*, vol. 40, no. 1, pp. 18-34.
Collins, A., Henchion, M. & O'Reilly, P. 1999, 'The impact of coupled-consolidation: experiences from the Irish food industry', *Supply Chain Management: an international journal*, vol. 4, no. 2, pp. 102-11.
Cooper, D.R., Schindler, P.S. & Sun, J. 1998, *Business research methods*, Irwin/McGraw-Hill Burr Ridge, IL.
Cooper, R.W., Frank, G.L. & Kemp, R.A. 2000, 'A multinational comparison of key ethical issues, helps and challenges in the purchasing and supply management profession: the key implications for business and the professions', *Journal of Business Ethics*, pp. 83-100.
Costello, A. & Osborne, J. 2011, 'Best practices in exploratory factor analysis: four recommendations for getting the most from your analysis. Pract Assess Res Eval 2005; 10', *pareonline. net/getvn. asp*, vol. 10, p. 7.
Cowper-Smith, A. & de Grosbois, D. 2011, 'The adoption of corporate social responsibility practices in the airline industry', *Journal of Sustainable Tourism*, vol. 19, no. 1, pp. 59-77.
Craighead, C.W., Ketchen, D., Dunn, K.S. & Hult, G. 2011, 'Addressing common method variance: guidelines for survey research on information technology, operations, and supply chain management', *Engineering Management, IEEE Transactions on*, vol. 58, no. 3, pp. 578-88.
Cramer, A. & Hirschland, M. 2006, 'The socially responsible board', *The Corporate Board*, vol. 161, pp. 20-4.
Creswell, J.W. 2009, *Research design: Qualitative, quantitative, and mixed methods approaches*, Sage Publications, Incorporated.
Cronbach, L.J. 1951, 'Coefficient alpha and the internal structure of tests', *Psychometrika*, vol. 16, no. 3, pp. 297-334.
Croom, S., Barani, S., Belanger, D., Lyons, T. & Murakami, J. 2009, 'Sustainable supply chain management–an exploration of current practice', *Proceedings of the European Operation Management Association Conference*.
Cruijssen, F., Cools, M. & Dullaert, W. 2007, 'Horizontal cooperation in logistics: opportunities and impediments', *Transportation Research Part E: Logistics and Transportation Review*, vol. 43, no. 2, pp. 129-42.
Cummings, J.L. & Holmberg, S.R. 2012, 'Best-fit alliance partners: the use of critical success factors in a comprehensive partner selection process', *Long Range Planning*, vol. 45, no. 2, pp. 136-59.
Cunningham, E., Holmes-Smith, P. & Coote, L. 2006, 'Structural equation modelling: From the fundamentals to advanced topics', *Streams Statsline, Melbourne*.
Dagnino, G.B. & Padula, G. 2002, 'Coopetition strategy: a new kind of interfirm dynamics for value creation', *Innovative Research in Management, European Academy of Management (EURAM), Second Annual Conference, Stockholm, May*, vol. 9.
Dahlsrud, A. 2008, 'How corporate social responsibility is defined: an analysis of 37 definitions', *Corporate Social Responsibility and Environmental Management*, vol. 15, no. 1, pp. 1-13.
Dailynews 2013, *Thai newagency industry in ditigal era*, Dailynews, Bangkok, viewed 17 October 2013, <http://www.dailynews.co.th/>.

Darnall, N. & Edwards Jr, D. 2006, 'Predicting the cost of environmental management system adoption: the role of capabilities, resources and ownership structure', *Strategic Management Journal*, vol. 27, no. 4, pp. 301-20.

Darnall, N., Jolley, G.J. & Handfield, R. 2008, 'Environmental management systems and green supply chain management: complements for sustainability?', *Business strategy and the environment*, vol. 17, no. 1, pp. 30-45.

Das, T.K. & Teng, B.S. 2000, 'A resource-based theory of strategic alliances', *Journal of Management*, vol. 26, no. 1, pp. 31-61.

Daskin, M.S. 2011, *Network and discrete location: models, algorithms, and applications*, Wiley-Interscience.

De Boer, L., Labro, E. & Morlacchi, P. 2001, 'A review of methods supporting supplier selection', *European Journal of Purchasing & Supply Management*, vol. 7, no. 2, pp. 75-89.

De Ligt, T. & Wever, E. 1998, 'European distribution centres: location patterns', *Tijdschrift voor economische en sociale geografie*, vol. 89, no. 2, pp. 217-23.

Deakin, E. 2001, 'Sustainable development and sustainable transportation: strategies for economic prosperity, environmental quality, and equity', *Institute of Urban & Regional Development*

Delmas, M. & Toffel, M.W. 2004, 'Stakeholders and environmental management practices: an institutional framework', *Business strategy and the Environment*, vol. 13, no. 4, pp. 209-22.

Devinney, T.M. 2009, 'Is the socially responsible corporation a myth? The good, the bad, and the ugly of corporate social responsibility', *The Academy of Management Perspectives (formerly The Academy of Management Executive)(AMP)*, vol. 23, no. 2, pp. 44-56.

Dey, A., LaGuardia, P. & Srinivasan, M. 2011, 'Building sustainability in logistics operations: a research agenda', *Management Research Review*, vol. 34, no. 11, pp. 1237-59.

Dhanarag, C. & Parkhe, A. 2006, 'Orchestrating innovation networks', *Academy of Management Review*, vol. 31, no. 3, pp. 659-69.

Dietz, T., Rosa, E.A. & York, R. 2009, 'Environmentally efficient well-being: Rethinking sustainability as the relationship between human well-being and environmental impacts', *Human Ecology Review*, vol. 16, no. 1, pp. 114-23.

Dillman, D.A. 1978, *Mail and telephone surveys*, Wiley New York.

Dillman, D.A. 2000, *Mail and internet surveys: The tailored design method*, vol. 2, Wiley New York.

Dilts, D.M. 1989, 'JIT needs an information system', *Logistics Information Management*, vol. 2, no. 3, pp. 157-60.

Ding, H., Benyoucef, L. & Xie, X. 2009, 'Stochastic multi-objective production-distribution network design using simulation-based optimization', *International Journal of Production Research*, vol. 47, no. 2, pp. 479-505.

Drezner, Z. & Hamacher, H.W. 2004, *Facility location: applications and theory*, Springer Verlag.

Dulmin, R. & Mininno, V. 2003, 'Supplier selection using a multi-criteria decision aid method', *Journal of Purchasing and Supply Management*, vol. 9, no. 4, pp. 177-87.

Dutton, G. 2009, 'Managing Fleets in Turbulent Times-Striking the balance between cost volatility and customer service', *World Trade*, vol. 22, no. 2, p. 28.

Dyer, J.H. 2000, *Collaborative advantage: Winning through extended enterprise supplier networks*, Oxford University Press, USA.

Dyllick, T. & Hockerts, K. 2002, 'Beyond the business case for corporate sustainability', *Business strategy and the environment*, vol. 11, no. 2, pp. 130-41.

Ehrenmann, F. & Reiss, M. 2012, 'Co-opetition as a facilitator of manufacturing competitiveness: opportunities and threats', *Enabling Manufacturing Competitiveness and Economic Sustainability*, pp. 403-8.
Elisa, M. & Leigh, S. 2003, 'Food retailers and financial services in the UK: a co-opetitive perspective', *British food journal*, vol. 105, no. 9, pp. 577-90.
Elkington, J. 1998, 'Partnerships from cannibals with forks: The triple bottom line of 21st-century business', *Environmental Quality Management*, vol. 8, no. 1, pp. 37-51.
Ellen, P.S., Mohr, L.A. & Webb, D.J. 2000, 'Charitable programs and the retailer: do they mix?', *Journal of Retailing*, vol. 76, no. 3, pp. 393-406.
Ellen, P.S., Webb, D.J. & Mohr, L.A. 2006, 'Building corporate associations: consumer attributions for corporate socially responsible programs', *Journal of the Academy of Marketing Science*, vol. 34, no. 2, pp. 147-57.
Enkvist, P. & Vanthournout, H. 2008, 'How Companies think about climate change', *McKinsey Quarterly*, vol. 2, p. 46.
Eraslan, E. & Derya, T. 2010, 'Daily newspaper distribution planning with integer programming: an application in Turkey', *Transportation Planning and Technology*, vol. 33, no. 5, pp. 423-33.
Esper, T., Fugate, B. & Rapert, M.I. 2008, 'Enhancing Relationships Within Groups: The Impact of Role Perceptions Within Logistics Teams', *Journal of Relationship Marketing*, vol. 7, no. 2, pp. 121-50.
Esper, T.L. & Williams, L.R. 2003, 'The value of collaborative transportation management (CTM): its relationship to CPFR and information technology', *Transportation journal*, vol. 42, no. 4, pp. 55-65.
Evangelista, R. 2006, 'Innovation in the European service industries', *Science and Public Policy*, vol. 33, no. 9, pp. 653-68.
Faisal, M.N. & Akhtar, A. 2011, 'Sustainable Supply Chains', *Skimming & Scanning*, p. 31.
Feitelson, E. 2002, 'Introducing environmental equity dimensions into the sustainable transport discourse: issues and pitfalls', *Transportation Research Part D: Transport and Environment*, vol. 7, no. 2, pp. 99-118.
Fenwick, T. 2007, 'Developing organizational practices of ecological sustainability: A learning perspective', *Leadership & Organization Development Journal*, vol. 28, no. 7, pp. 632-45.
Fleischmann, B., Ferber, S. & Henrich, P. 2006, 'Strategic planning of BMW’s global production network', *Interfaces*, vol. 36, no. 3, pp. 194-208.
Fletcher, M. 2008, *How newsagents defy the retail downturn*, viewed 25 September 2013, <http://www.newsagencyblog.com.au/wp-content/uploads/2008/12/report_benchmark_nov08.pdf>.
Flint, D.J., Larsson, E., Gammelgaard, B. & Mentzer, J.T. 2005, 'Logistics innovation : A customer value-oriented social process', *Journal of Business Logistics*, vol. 26, no. 1, pp. 113-47.
Flynn, B.B., Sakakibara, S., Schroeder, R.G., Bates, K.A. & Flynn, E.J. 1990, 'Empirical research methods in operations management', *Journal of Operations Management*, vol. 9, no. 2, pp. 250-84.
Foddy, W. 1994, *Constructing questions for interviews and questionnaires: theory and practice in social research*, Cambridge university press.
Forkenbrock, D.J. 1999, 'External costs of intercity truck freight transportation', *Transportation Research Part A: Policy and Practice*, vol. 33, no. 7, pp. 505-26.
Fornell, C. & Larcker, D.F. 1981, 'Evaluating structural equation models with unobservable variables and measurement error', *Journal of marketing research*, pp. 39-50.
Fowler J.R., F.J. 2008, *Survey research methods*, vol. 1, SAGE Publications, Incorporated.

French, M.L. 2008, 'Improving sustainability through effective reuse of product returns: minimizing waste in a batch blending process environment', *Journal of Cleaner Production*, vol. 16, no. 15, pp. 1679-87.

Frota Neto, J.Q., Bloemhof-Ruwaard, J.M., Van Nunen, J. & Van Heck, E. 2008, 'Designing and evaluating sustainable logistics networks', *International Journal of Production Economics*, vol. 111, no. 2, pp. 195-208.

Garcia, M.L., Centeno, M.A. & Penaloza, G. 1999, 'A simulation of the product distribution in the newspaper industry', vol. 2, IEEE, pp. 1268-71 vol. 2.

Geurs, K. & Wee, G.P. 2000, *Environmentally sustainable transport: Implementation and impacts for the Netherlands for 2030*.

Gilbert, R., Irwin, N., Hollingworth, B. & Blais, P. 2002, 'Sustainable transportation performance indicators', *STPI) Projects, reports on phase*, vol. 3.

Gnyawali, D.R. & He, J. 2006, 'Impact of co-opetition on firm competitive behavior: An empirical examination', *Journal of management*, vol. 32, no. 4, pp. 507-30.

Gnyawali, D.R. & Park, B.-J.R. 2011, 'Co-opetition between giants: Collaboration with competitors for technological innovation', *Research Policy*, vol. 40, no. 5, pp. 650-63.

Godelnik, R. 2010, *The future of bookstores :Business as unusual, local solutions and positioning for success*, Eco-Libris Blog, viewed 15 October 2013, <http://ecolibris.blogspot.com/>.

Godelnik, R. 2011, *Why a Green Strategy Will Help Barnes & Noble Avoid Bankruptcy*, Triple Pundit, viewed 19 October 2013, <http://www.triplepundit.com/>.

Goel, A. 2009, 'A roadmap for sustainable freight transport', *Methods of Multicriteria Decision Theory and Applications, edited by F. Heyde, A. Löhne, and C. Tammer (Shaker)*, pp. 47-56.

Gold, S., Seuring, S. & Beske, P. 2010, 'Sustainable supply chain management and inter-organizational resources: a literature review', *Corporate Social Responsibility and Environmental Management*, vol. 17, no. 4, pp. 230-45.

Golicic, S.L., Foggin, J.H. & Mentzer, J.T. 2003, 'Relationship magnitude and its role in interorganizational relationship structure', *Journal of Business Logistics*, vol. 24, no. 1, pp. 57-75.

González-Benito, J. & Gonzalez-Benito, O. 2006, 'The role of stakeholder pressure and managerial values in the implementation of environmental logistics practices', *International Journal of Production Research*, vol. 44, no. 7, pp. 1353-73.

Gonzalez-Feliu, J., Peris-Pla, C. & Rakotonarivo, D. 2010, 'Simulation and optimization for logistics pooling in the outbound supply chain', *Proceeding of the Third International Conference on Value Chain Sustainability.'Towards a Sustainable Development and Corporate Social Responsibility Strategies in the 21st Century Global Market'*, pp. 394-401.

González-Ramírez, R.G. & Askin, R.G. 2009, 'Shipment consolidation by terminals and vehicles', *Revista de Matemática: Teoría y Aplicaciones*, vol. 16, no. 1, pp. 178-87.

Graham, L. 2011, *Transport collaboration in Europe*, Prologis Research Report Paris.

Greenfield, J. 2011, *Research: E-Books at $10 billion, bookstores under pressure in 2016*, Digital Book World, Blue Ash, Ohio, viewed 17 october 2013, <http://www.digitalbookworld.com/>.

Grewal, R., Cote, J.A. & Baumgartner, H. 2004, 'Multicollinearity and measurement error in structural equation models: Implications for theory testing', *Marketing Science*, vol. 23, no. 4, pp. 519-29.

Groves, R.M. & Peytcheva, E. 2008, 'The Impact of Nonresponse Rates on Nonresponse Bias A Meta-Analysis', *Public opinion quarterly*, vol. 72, no. 2, pp. 167-89.

Guardian 2011, *World carbon dioxide emissions data by country: China speeds ahead of the rest*, <http://www.guardian.co.uk/news/datablog/2011/jan/31/world-carbon-dioxide-emissions-country-data-co2>.
Guba, E.G. & Lincoln, Y.S. 1994, 'Competing paradigms in qualitative research', *Handbook of qualitative research*, vol. 2, pp. 163-94.
Gulati, R. & Kletter, D. 2005, 'Shrinking core, expanding periphery: The relational architecture of high-performing organizations', *California Management Review*, vol. 47, no. 3, pp. 77-104.
Gümüş, M. & Bookbinder, J.H. 2004, 'Cross-docking and its implications in location-distribution systems', *Journal of Business logistics*, vol. 25, no. 2, pp. 199-228.
Hageback, C. & Segerstedt, A. 2004, 'The need for co-distribution in rural areas—a study of Pajala in Sweden', *International Journal of Production Economics*, vol. 89, no. 2, pp. 153-63.
Hair, J.F. 2009, *Multivariate data analysis*, Upper Saddle River, NJ: Pearson Prentice Hall.
Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E. & Tatham, R.L. 2010, *Multivariate data analysis*, vol. 7, Prentice Hall Upper Saddle River, NJ.
Hall, J. 2000, 'Environmental supply chain dynamics', *Journal of Cleaner Production*, vol. 8, no. 6, pp. 455-71.
Hall, J. 2006, 'Environmental supply-chain innovation', *Greener management international*, pp. 105-19.
Hall, R.W. 1987, 'Consolidation strategy: inventory, vehicles and terminals', *Journal of Business logistics*, vol. 8, no. 2, pp. 57-73.
Hamel, G. 1991, 'Competition for competence and interpartner learning within international strategic alliances', *Strategic Management Journal*, vol. 12, no. S1, pp. 83-103.
Hamel, G., Doz, Y.L. & Prahalad, C.K. 1989, 'Collaborate with your competitors and win', *Harvard Business Review*, vol. 67, no. 1, pp. 133-9.
Hamid, N.R.A. 2006, 'An assessment of the Internet's potential in enhancing consumer relationships', Victoria University Melborune.
Handfield, R.B. & Bechtel, C. 2002, 'The role of trust and relationship structure in improving supply chain responsiveness', *Industrial Marketing Management*, vol. 31, no. 4, pp. 367-82.
Hanna, M.D., Newman, W.R. & Johnson, P. 2000, 'Linking operational and environmental improvement through employee involvement', *International Journal of Operations & Production Management*, vol. 20, no. 2, pp. 148-65.
Hannan, M.T. & Freeman, J. 1993, *Organizational ecology*, Harvard Univ Pr.
Hansen, S. 2004, 'Resilience and sustainability', *Chartered Accountants Journal os New Zealand*, vol. 83, no. 9, pp. 66-7.
Hanson, J.D., Melnyk, S.A. & Calantone, R.J. 2010, 'Core values and environmental management: a strong inference approach', *Greener management international*, vol. 2004, no. 46, pp. 29-40.
Hautanen, K., Jacobs, E., Meade, E., Ranson-Walsh, K. & Studio, S. 2009, *Publishing is a problem*, Sustainability Studio, viewed 16 July 2014, <http://www.ericameade.com/publishing_is_a_problem_DMBA.pdf>.
Herbert, K. & Christoph, T. 2003, 'Value-adding partnerships and co-opetition models in the grocery industry', *International Journal of Physical Distribution & Logistics Management*, vol. 33, no. 3, pp. 268-81.
Hitt, M.A., Dacin, M.T., Levitas, E., Arregle, J.-L. & Borza, A. 2000, 'Partner Selection in Emerging and Developed Market Contexts: Resource-Based and Organizational Learning Perspectives', *Academy of Management Journal*, vol. 43, no. 3, pp. 449-67.

Ho, H.D. & Ganesan, S. 2012, 'Learning in coopetitive relationships', *Handbook of Business-to-Business Marketing*, pp. 368-85.
Hoffman, W. 2007, 'Who's carbon-free? Wal-Mart takes on supply chains of products as expansive carbon measuring plan eyes distribution', *Traffic World*, vol. 271, no. 42, pp. 1-2.
Hoffmann, W. 2007, 'Strategies for managing a portfolio of alliances', *Strategic Management Journal*, vol. 28, no. 8, pp. 827-56.
Holmes, S.M., Power, M.L. & Walter, C.K. 1996, 'A motor carrier wellness program: development and testing', *Transportation journal*, vol. 35, no. 3, pp. 33-48.
Holweg, M. & Miemczyk, J. 2002, 'Logistics in the "three-day car" age: Assessing the responsiveness of vehicle distribution logistics in the UK', *International Journal of Physical Distribution & Logistics Management*, vol. 32, no. 10, pp. 829-50.
Hooley, G.J. & Hussey, M.K. 1994, 'Quantitative methods in marketing: The multivariate jungle revisited introduction and overview to special edition', *Journal of Marketing Management*, vol. 10, no. 1-3, pp. 3-12.
Horwitz, S. 2011, *When bookstore bullies are brought low*, StarTribune, Minneapolis, viewed 10 October 2013, <http://www.mediabistro.com/>.
Hoyle, R.H. 1995, *Structural equation modeling: Concepts, issues, and applications*, Sage Publications, Incorporated.
Hsieh, C.C. & Lo, C.H. 2010, 'Trust in cross boundary co-opetition: an explorative case study', ACM, pp. 229-36.
Hu, L.t. & Bentler, P.M. 1999, 'Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives', *Structural Equation Modeling: A Multidisciplinary Journal*, vol. 6, no. 1, pp. 1-55.
Huang, R., Menezes, M.B.C. & Kim, S. 2012, 'The impact of cost uncertainty on the location of a distribution center', *European Journal of Operational Research*, vol. 218, no. 2, pp. 401-7.
Hugo, A. & Pistikopoulos, E. 2005, 'Environmentally conscious long-range planning and design of supply chain networks', *Journal of Cleaner Production*, vol. 13, no. 15, pp. 1471-91.
Hui, K.H., Spedding, T.A., Bainbridge, I. & Taplin, D.M.R. 2007, 'Creating a green supply chain: a simulation and modeling approach', *Greening the Supply Chain, Springer, New York, NY*, pp. 341-61.
Hulland, J., Chow, Y.H. & Lam, S. 1996, 'Use of causal models in marketing research: A review', *International Journal of research in Marketing*, vol. 13, no. 2, pp. 181-97.
Hum, S.H. 2000, 'A Hayes-Wheelwright framework approach for strategic management of third party logistics services', *Integrated Manufacturing Systems*, vol. 11, no. 2, pp. 132-7.
Hurter, A.P. & Van Buer, M.G. 1996, 'The newspaper production/distribution problem', *Journal of Business Logistics*, vol. 17, pp. 85-108.
IISD & WBCSD 2002, *Mining, minerals and sustainable development project*, viewed 16 Octorber 2012, <www.iied.org/mmsd>.
Inkpen, A.C. 2000, 'Learning through joint ventures: a framework of knowledge acquisition', *Journal of Management Studies*, vol. 37, no. 7, pp. 1019-44.
Ireland, R.D., Hitt, M.A. & Vaidyanath, D. 2002, 'Alliance management as a source of competitive advantage', *Journal of management*, vol. 28, no. 3, pp. 413-46.
Jacobsen, S.K. & Madsen, O.B. 1980, 'A comparative study of heuristics for a two-level routing-location problem', *European Journal of Operational Research*, vol. 5, no. 6, pp. 378-87.

Jedd, M. 2001, *Trends in selecting distribution centres are all over the map*, viewed 25 July 2014, <http://www.glscs.com/archives/3.01.sites.htm?adcode=40>.
Jenkins, M., Ambrosini, V. & Collier, N. 2007, *Advanced strategic management: A multi-perspective approach* Palgrave Macmillan, New York.
Joseph, P., Prasad, V., Janarthanan, A. & Chandrasekar, V. 2010, 'Environmental management in beach sand mining and processing—a role model', *Proceedings of the XI International Seminar on Mineral Processing Technology (MPT-2010)*, vol. 2, Allied Publisher, pp. 1129-36.
Juš ius, V. & Snieška, V. 2008, 'Influence of corporate social responsibility on competitive abilities of corporations', *Engineering Economics*, vol. 3, no. 58, pp. 34-44.
Kaiser, H.F. 1970, 'A second generation little jiffy', *Psychometrika*, vol. 35, no. 4, pp. 401-15.
Kannan, V.R. & Tan, K.C. 2002, 'Supplier selection and assessment: Their impact on business performance', *Journal of Supply Chain Management*, vol. 38, no. 4, pp. 11-21.
Kantabutra, S. & Siebenhuner, T. 2011, 'Predicting corporate sustainability: a Thai approach', *Journal of Applied Business Research (JABR)*, vol. 27, no. 6, pp. 123-34.
Kaplowitz, M.D., Hadlock, T.D. & Levine, R. 2004, 'A comparison of web and mail survey response rates', *Public opinion quarterly*, vol. 68, no. 1, pp. 94-101.
Kassim, N.M. 2001, 'Determinants of customer satisfaction and retention in the cellular phone market of Malaysia', Southern Cross University.
Kerlinger, F.N. & Lee, H.B. 1964, *Foundations of behavioral research: Educational and psychological inquiry*, John Wiley, New York
Khamkaew, R. & Somhom, S. 2009, 'Survey of metaheuristic methodology for solving container loading problem', paper presented to the *ThaiVCML2009*, Thailand, <http://bal.buu.ac.th/vcml2009/paper/P016.pdf>.
Kilger, C. & Reuter, B. 2005, 'Collaborative planning', *Supply Chain Management and Advanced Planning*, pp. 259-78.
King'scollege 2014, *Systematic Reviews*, King's College, Longdon, viewed 24 December 2014, <www.kcl.ac.uk>.
Klassen, R.D. & McLaughlin, C.P. 1996, 'The impact of environmental management on firm performance', *Management science*, vol. 42, no. 8, pp. 1199-214.
Klein, J. & Dawar, N. 2004, 'Corporate social responsibility and consumers' attributions and brand evaluations in a product–harm crisis', *International Journal of research in Marketing*, vol. 21, no. 3, pp. 203-17.
Klein, R., Rai, A. & Straub, D.W. 2007, 'Competitive and Cooperative Positioning in Supply Chain Logistics Relationships*', *Decision Sciences*, vol. 38, no. 4, pp. 611-46.
Kline, R.B. 2005, *Principles and Practice of Structural Equation Modeling. 2005*, Guilford Press, New York.
Kline, R.B. 2011, *Principles and practice of structural equation modeling*, Guilford press, New York
Klose, A. & Drexl, A. 2005, 'Facility location models for distribution system design', *European Journal of Operational Research*, vol. 162, no. 1, pp. 4-29.
Koh, H.C. & El'fred, H. 2004, 'Organisational ethics and employee satisfaction and commitment', *Management Decision*, vol. 42, no. 5, pp. 677-93.
Kotzab, H. & Teller, C. 2003, 'Value-adding partnerships and co-opetition models in the grocery industry', *International Journal of Physical Distribution & Logistics Management*, vol. 33, no. 3, pp. 268-81.
Kovacs, G. 2008, 'Corporate environmental responsibility in the supply chain', *Journal of Cleaner Production*, vol. 16, no. 15, pp. 1571-8.
Koza, M. & Lewin, A. 2000, 'Managing partnerships and strategic alliances: raising the odds of success', *European Management Journal*, vol. 18, no. 2, pp. 146-51.

Krajewska, M.A., Kopfer, H., Laporte, G., Ropke, S. & Zaccour, G. 2007, 'Horizontal cooperation among freight carriers: request allocation and profit sharing', *Journal of the Operational Research Society*, vol. 59, no. 11, pp. 1483-91.

Kripanont, N. 2007, 'Examining a technology acceptance model of internet usage by academics within Thai business schools ', Victoria University, Melbourne.

Kunes, T.P. 2001, 'A green and lean workplace?', *Strategic finance*, pp. 70-80.

Kwon, I.W.G. & Suh, T. 2004, 'Factors affecting the level of trust and commitment in supply chain relationships', *Journal of Supply Chain Management*, vol. 40, no. 2, pp. 4-14.

Kytle, B. & Ruggie, J.G. 2005, 'Corporate social responsibility as risk management: A model for multinationals', *Journal of Corporate Citizenship*, vol. 22, pp. 39-51.

Lambe, C.J., Spekman, R.E. & Hunt, S.D. 2002, 'Alliance competence, resources, and alliance success: conceptualization, measurement, and initial test', *Journal of the Academy of Marketing Science*, vol. 30, no. 2, pp. 141-58.

Lambooy, T. 2011, 'Corporate social responsibility: sustainable water use', *Journal of Cleaner Production*, vol. 19, no. 8, pp. 852-66.

Lange, E.A. 2003, 'Living transformation: Beyond midlife crisis to restoring ethical space', University of Alberta.

Lee, H.L. 2000, 'Creating value through supply chain integration', *Supply Chain Management Review*, vol. 4, no. 4, pp. 30-6.

Lee, K.H. 2011, 'Integrating carbon footprint into supply chain management: the case of Hyundai Motor Company (HMC) in the automobile industry', *Journal of Cleaner Production*, vol. 19, no. 11, pp. 1216-23.

Lee, Y.H., Jung, J.W. & Lee, K.M. 2006, 'Vehicle routing scheduling for cross-docking in the supply chain', *Computers & Industrial Engineering*, vol. 51, no. 2, pp. 247-56.

Leitner, R., Meizer, F., Prochazka, M. & Sihn, W. 2011, 'Structural concepts for horizontal cooperation to increase efficiency in logistics', *CIRP Journal of Manufacturing Science and Technology*, vol. 4, no. 3, pp. 332-7.

Lenzen, M., Murray, J., Sack, F. & Wiedmann, T. 2007, 'Shared producer and consumer responsibility—Theory and practice', *Ecological Economics*, vol. 61, no. 1, pp. 27-42.

Lewis, A., Fell, M. & Palmer, D. 2010, *Freight consolidation centre study*, Transport and Travel Research London.

Li, S., Ragu-Nathan, B., Ragu-Nathan, T. & Subba Rao, S. 2006, 'The impact of supply chain management practices on competitive advantage and organizational performance', *Omega*, vol. 34, no. 2, pp. 107-24.

Liao, C.J., Lin, Y. & Shih, S.C. 2010, 'Vehicle routing with cross-docking in the supply chain', *Expert Systems with Applications*, vol. 37, no. 10, pp. 6868-73.

Lieb, K.J. & Lieb, R.C. 2010, 'Environmental sustainability in the third-party logistics (3PL) industry', *International Journal of Physical Distribution & Logistics Management*, vol. 40, no. 7, pp. 524-33.

Lieb, R.C., Millen, R.A. & Van Wassenhove, L.N. 1993, 'Third party logistics services: a comparison of experienced American and European manufacturers', *International Journal of Physical Distribution & Logistics Management*, vol. 23, no. 6, pp. 35-44.

Lilien, G. & Grewal, R. 2012, *Handbook of Business-to-Business Marketing*, Edward Elgar Pub.

Lin, C.-T., Chiu, H. & Chu, P.-Y. 2006, 'Agility index in the supply chain', *International Journal of Production Economics*, vol. 100, no. 2, pp. 285-99.

Lin, C.-W.R. & Chen, H.-Y.S. 2004, 'A fuzzy strategic alliance selection framework for supply chain partnering under limited evaluation resources', *Computers in Industry*, vol. 55, no. 2, pp. 159-79.

Lincoln, Y.S. & Denzin, N.K. 1994, 'The fifth moment', *Handbook of qualitative research*, vol. 1, pp. 575-86.
Lindell, M.K. & Whitney, D.J. 2001, 'Accounting for common method variance in cross-sectional research designs', *Journal of applied psychology*, vol. 86, no. 1, pp. 114-21.
Lindholm, M. & Behrends, S. 2010, 'A holistic approach to challenges in urban freight transport planning', *General Proceedings of the 12th World Conference on Transport Research Society*.
Lindholm, M. & Behrends, S. 2012, 'Challenges in urban freight transport planning–a review in the Baltic Sea Region', *Journal of Transport Geography*, vol. 22, pp. 129-36.
Linton, J.D., Klassen, R. & Jayaraman, V. 2007, 'Sustainable supply chains: An introduction', *Journal of Operations Management*, vol. 25, no. 6, pp. 1075-82.
Litman, T. 2005, 'Efficient vehicles versus efficient transportation. Comparing transportation energy conservation strategies', *Transport Policy*, vol. 12, no. 2, pp. 121-9.
Litman, T. & Burwell, D. 2006, 'Issues in sustainable transportation', *International Journal of Global Environmental Issues*, vol. 6, no. 4, pp. 331-47.
Litwin, M.S. 1995, *How to measure survey reliability and validity*, vol. 7, SAGE Publications, Incorporated.
Luo, Y. 2002, 'Partnering with foreign businesses: perspectives from Chinese firms', *Journal of Business Research*, vol. 55, pp. 481-93.
Luo, Y. 2004, 'A coopetition perspective of MNC–host government relations', *Journal of International Management*, vol. 10, no. 4, pp. 431-51.
Lyon, T.P. & Maxwell, J.W. 2008, 'Corporate social responsibility and the environment: A theoretical perspective', *Review of environmental economics and policy*, vol. 2, no. 2, pp. 240-60.
Mahlburg, D. 2012, *Steep drop in newsprint continues*, viewed 23 November 2013, <http://www.risiinfo.com/techchannels/papermaking/A-steep-drop-continues.html>.
Mahler, D. 2007, 'The sustainable supply chain', *Supply Chain Management Review*, vol. 11, no. 8, pp. 59-60.
Maignan, I. & Ferrell, O. 2004, 'Corporate social responsibility and marketing: an integrative framework', *Journal of the Academy of Marketing Science*, vol. 32, no. 1, pp. 3-19.
Maignan, I., Ferrell, O.C. & Hult, G.T.M. 1999, 'Corporate citizenship: cultural antecedents and business benefits', *Journal of the Academy of Marketing Science*, vol. 27, no. 4, pp. 455-69.
Makhija, M.V. & Ganesh, U. 1997, 'The relationship between control and partner learning in learning-related joint ventures', *Organization science*, vol. 8, no. 5, pp. 508-27.
Malhotra, N.K., Kim, S.S. & Patil, A. 2006, 'Common method variance in IS research: A comparison of alternative approaches and a reanalysis of past research', *Management science*, vol. 52, no. 12, pp. 1865-83.
Maloni, M.J. & Brown, M.E. 2006, 'Corporate social responsibility in the supply chain: an application in the food industry', *Journal of Business Ethics*, vol. 68, no. 1, pp. 35-52.
Maniwan, S., KUmbunreang, D., MitSomwang, S. & KhupTaBut, Y. 2005, 'Assessment of CO2 reduction in the participative energy conservation project', Narasoun University, Tummasath University Bangkok.
Mantel, R. & Fontein, M. 1993, 'A practical solution to a newspaper distribution problem', *International Journal of Production Economics*, vol. 30, pp. 591-9.
Mantzana, V. & Themistocleous, M. 2006, 'Benefits and barriers related to eai adoption: the case of a healthcare organisation', *ECIS*, pp. 2017-29.
Markendahl, J. & Mölleryd, B.G. 2012, 'On co-opetition between mobile network operators: Why and how competitors cooperate', paper presented to the *19th Biennal ITS Conference*, Bangkok.

Markley, M.J. & Davis, L. 2007, 'Exploring future competitive advantage through sustainable supply chains', *International Journal of Physical Distribution & Logistics Management*, vol. 37, no. 9, pp. 763-74.
Marsden, C. & Andriof, J. 1998, 'Towards an understanding of corporate citizenship and how to influence it', *Citizenship Studies*, vol. 2, no. 2, pp. 329-52.
Mason, R. & Lalwani, C. 2006, 'Transport integration tools for supply chain management', *International Journal of Logistics: Research and Applications*, vol. 9, no. 1, pp. 57-74.
Mason, R., Lalwani, C. & Boughton, R. 2007, 'Combining vertical and horizontal collaboration for transport optimisation', *Supply Chain Management: An International Journal*, vol. 12, no. 3, pp. 187-99.
Mason, R., Potter, A. & Lalwani, C. 2002, 'Trends in ICT and their impact on grocery supply chains', *Proceedings of the 7th International Symposium on Logistics and 2nd International Symposium on Operations Strategy*, pp. 255-62.
Matichon 2013, *What is the trend of newsagency industry* Matichon Bangkok, <www.matichon.co.th. >.
Matten, D. & Moon, J. 2007, 'Pan-European Approach. A Conceptual Framework for Understanding CSR', *Corporate Ethics and Corporate Governance*, pp. 179-99.
McKinnon, A. 2000, 'Sustainable distribution: opportunities to improve vehicle loading', *Industry and Environment*, vol. 23, no. 4, pp. 26-7.
McKinnon, A. 2010, 'Green logistics: the carbon agenda', *LogForum*, vol. 6, no. 3, pp. 1-9.
McKinnon, A., Cullinane, S., Browne, M. & Whiteing, A. 2010, *Green Logistics: Improving the Environmental Sustainability of Logistics*, Kogan Page Ltd.
McKinnon, A.C. 1999, 'A logistical perspective on the fuel efficiency of road freight transport', *Transport*, vol. 24.
McKnight, D. 1998, 'Site selection: you need a plan', *Warehousing Management*, vol. 5, no. 6, pp. 54-7.
McWilliams, A. & Siegel, D. 2001, 'Corporate social responsibility: A theory of the firm perspective', *Academy of management review*, pp. 117-27.
Melnyk, S.A., Davis, E.W., Spekman, R.E. & Sandor, J. 2010, 'Outcome driven supply chains', *Sloan Management Review*, vol. 52, no. 2, pp. 32-8.
Melo, M.T., Nickel, S. & Saldanha-Da-Gama, F. 2009, 'Facility location and supply chain management–A review', *European Journal of Operational Research*, vol. 196, no. 2, pp. 401-12.
Mention, A.L. 2011, 'Co-operation and co-opetition as open innovation practices in the service sector: Which influence on innovation novelty?', *Technovation*, vol. 31, no. 1, pp. 44-53.
Mentzer, J.T., DeWitt, W., Keebler, J.S., Min, S., Nix, N.W., Smith, C.D. & Zacharia, Z.G. 2001, 'Defining supply chain management', *Journal of Business logistics*, vol. 22, no. 2, pp. 1-25.
Mentzer, J.T., Flint, D.J. & Kent, J.L. 1999, 'Developing a logistics service quality scale', *Journal of Business*, vol. 20, no. 1, pp. 9-32.
Mentzer, J.T., Foggin, J.H. & Golicic, S.L. 2000, 'Collaboration: the enablers, impediments, and benefits', *Supply chain management review*, vol. 4, no. 4, pp. 52-8.
Merrick, R.J. & Bookbinder, J.H. 2010, 'Environmental assessment of shipment release policies', *International Journal of Physical Distribution & Logistics Management*, vol. 40, no. 10, pp. 748-62.
Miao, Z., Cai, S. & Xu, D. 2011, 'Exploring the antecedents of logistics social responsibility: A focus on Chinese firms', *International Journal of Production Economics*, vol. 140, no. 1, pp. 18-27.

Millen, R., Sohal, A., Dapiran, P., Lieb, R. & Van Wassenhove, L.N. 1997, 'Benchmarking Australian firms' usage of contract logistics services: a comparison with American and Western European practice', *Benchmarking for Quality Management & Technology*, vol. 4, no. 1, pp. 34-46.

Min, H. 1996, 'Consolidation terminal location-allocation and consolidated routing problems', *Journal of Business Logistics*, vol. 17, no. 2, pp. 235-63.

Min, S., Roath, A.S., Daugherty, P.J., Genchev, S.E., Chen, H., Arndt, A.D. & Richey, R.G. 2005, 'Supply chain collaboration: what's happening?', *International Journal of Logistics Management, The*, vol. 16, no. 2, pp. 237-56.

Miotti, L. & Sachwald, F. 2003, 'Co-operative R&D: why and with whom?: An integrated framework of analysis', *Research Policy*, vol. 32, no. 8, pp. 1481-99.

Moberg, A., Johansson, M., Finnveden, G. & Jonsson, A. 2010, 'Printed and tablet e-paper newspaper from an environmental perspective--A screening life cycle assessment', *Environmental impact assessment review*, vol. 30, no. 3, pp. 177-91.

Moberg, C.R., Cutler, B.D., Gross, A. & Speh, T.W. 2002, 'Identifying antecedents of information exchange within supply chains', *International Journal of Physical Distribution & Logistics Management*, vol. 32, no. 9, pp. 755-70.

Mohr, L.A., Webb, D.J. & Harris, K.E. 2001, 'Do consumers expect companies to be socially responsible? The impact of corporate social responsibility on buying behavior', *Journal of Consumer Affairs*, vol. 35, no. 1, pp. 45-72.

Mollenkopf, D., Closs, D., Twede, D., Lee, S. & Burgess, G. 2005, 'Assessing the viability of reusable packaging: a relative cost approach', *Journal of Business logistics*, vol. 26, no. 1, pp. 169-97.

Mollenkopf, D., Stolze, H., Tate, W.L. & Ueltschy, M. 2010, 'Green, lean, and global supply chains', *International Journal of Physical Distribution & Logistics Management*, vol. 40, no. 1/2, pp. 14-41.

Momoh, A., Roy, R. & Shehab, E. 2010, 'Challenges in enterprise resource planning implementation: state-of-the-art', *Business Process Management Journal*, vol. 16, no. 4, pp. 537-65.

Montiel, I. 2008, 'Corporate social responsibility and corporate sustainability', *Organization & Environment*, vol. 21, no. 3, p. 245.

Morris, M.H., Koçak, A. & Özer, A. 2007, 'Coopetition as a small business strategy: Implications for performance', *Journal of Small Business Strategy Vol*, vol. 18, no. 1, pp. 35-55.

Mossholder, K.W., Bennett, N., Kemery, E.R. & Wesolowski, M.A. 1998, 'Relationships between bases of power and work reactions: The mediational role of procedural justice', *Journal of management*, vol. 24, no. 4, pp. 533-52.

Murphy, P.R. & Poist, R.F. 1992, 'The logistics-marketing interface: techniques for enhancing cooperation', *Transportation journal*, vol. 32, no. 2, pp. 14-23.

Murphy, P.R. & Poist, R.F. 2002, 'Socially responsible logistics: an exploratory study', *Transportation journal*, pp. 23-35.

Murphy, P.R., Poist, R.F. & Braunschweig, C.D. 1995, 'Role and relevance of logistics to corporate environmentalism: an empirical assessment', *International Journal of Physical Distribution & Logistics Management*, vol. 25, no. 2, pp. 5-19.

Murphy, P.R., Poist, R.F. & Braunschweig, C.D. 1996, 'Green logistics: Comparative views of environmental progressive, moderates and conservatives ', *Journal of Business Logistics*, vol. 17, no. 1, pp. 191-211.

Nakano, M. 2009, 'Collaborative forecasting and planning in supply chains: The impact on performance in Japanese manufacturers', *International Journal of Physical Distribution & Logistics Management*, vol. 39, no. 2, pp. 84-105.

Nalebuff, B.J. & Brandenburger, A.M. 1996, *Co-opetition*, Doubleday, New York.
Nasa 2011, *Nasa research finds 2010 tied for warmest year on record*, viewed 26/06 2012, <http://www.nasa.gov/topics/earth/features/2010-warmest-year.html>.
Neary, L. 2010, *End of days for bookstores?: Not if they can help it*, National Public Radio, Washington, viewed 17 October 2013, <http://www.npr.org/>.
Neill, J. 2008, 'Writing up a factor analysis', *Retrieved September*, vol. 7, p. 2008.
Nijkamp, P. 1994, 'Roads toward environmentally sustainable transport', *Transportation Research Part A: Policy and Practice*, vol. 28, no. 4, pp. 261-71.
Nisbet, M.C. 2010, *Some doubts about the future of independent bookstores* Big Think Edge New York, viewed 1 October 2013, <http://edge.bigthink.com/>.
NSW_Government 2014, *Sustainability funding* New South Wales Government, New South Wales, viewed 25 May 2014, <http://www.environment.nsw.gov.au/grants/>.
Nunnally, J. & Bernstein, I. 1994, *Psychometric theory*, McGraw-Hill, New York
Nunnally, J.C. 1978, *Psychometric Theory, 2nd end*, Tata McGraw-Hill Education.
Nyaga, G.N., Whipple, J.M. & Lynch, D.F. 2010, 'Examining supply chain relationships: Do buyer and supplier perspectives on collaborative relationships differ?', *Journal of Operations Management*, vol. 28, no. 2, pp. 101-14.
OECD 2002, *OECD guidelines towards environmentally sustainable transport* Paris
Oppenheim, A.N. 2000, *Questionnaire design, interviewing and attitude measurement*, Pinter Publishers, New York.
Osarenkhoe, A. 2010, 'A coopetition strategy–a study of inter-firm dynamics between competition and cooperation', *Business Strategy Series*, vol. 11, no. 6, pp. 343-62.
Oum, T.H. & Park, J.-H. 2004, 'Multinational firms' location preference for regional distribution centers: focus on the Northeast Asian region', *Transportation Research Part E: Logistics and Transportation Review*, vol. 40, no. 2, pp. 101-21.
Pallant, J. 2010, *SPSS survival manual: A step by step guide to data analysis using SPSS*, Open University Press.
Parr, B. 2010, *The dire state of the newspaper industry* Mashable, viewed 19 June 2012, <http://mashable.com/2010/03/26/the-dire-state-of-the-newspaper-industry-stats/>.
Parry, P., Martha, J. & Grenon, G. 2007, 'The energy-efficient supply chain', *Strategy+ Business*, vol. 47, no. 10.
Pedersen, E.R. 2009, 'The many and the few: rounding up the SMEs that manage CSR in the supply chain', *Supply Chain Management: an international journal*, vol. 14, no. 2, pp. 109-16.
Pedhazur, E.J. & Schmelkin, L.P. 2013, *Measurement, design, and analysis: An integrated approach*, Psychology Press.
Péli, G., Bruggeman, J., Masuch, M. & Nualláin, B.O. 1994, 'A logical approach to formalizing organizational ecology', *American Sociological Review*, pp. 571-93.
Peng, T.J.A., Pike, S., Yang, J.C.H. & Roos, G. 2012, 'Is Cooperation with Competitors a Good Idea? An Example in Practice', *British Journal of Management*, vol. 24, no. 4, pp. 532-60.
Phillips, D.C. & Burbules, N.C. 2000, *Postpositivism and educational research*, Rowman & Littlefield Pub Inc.
Piercy, J.E. 1977, 'A performance profile of several transportation freight services', Case Western Reserve University.
Podsakoff, P.M., MacKenzie, S.B., Lee, J.-Y. & Podsakoff, N.P. 2003, 'Common method biases in behavioral research: a critical review of the literature and recommended remedies', *Journal of applied psychology*, vol. 88, no. 5, pp. 879-903.
Porter, M.E. & Kramer, M.R. 2006, 'The link between competitive advantage and corporate social responsibility', *Harvard business review*, vol. 84, no. 12, pp. 78-92.

Porter, M.E. & Van der Linde, C. 1995, 'Green and competitive: ending the stalemate', *Harvard business review*, vol. 73, no. 5, pp. 120-34.

Potter, A., Lalwani, C., Disney, S. & Velho, H. 2003, 'Modelling the impact of factory gate pricing on transport and logistics', *Proceedings of the 8 th International Symposium on Logistics*, pp. 625-30.

Potter, A., Mason, R. & Lalwani, C. 2002, 'Performance measurement in the supply chain for sustainable distribution', *Proceedings of the 7th Logistics Research Network Conference*, Birmingham, UK.

Pricewaterhousecoopers 2009, *Transportation & Logistics 2030*, European Business School, Supply Chain Management Institute.

Prodhon, C. 2007, 'Solving the capacitated location-routing problem', *4OR*, vol. 5, no. 4, pp. 339-42.

PUBAT 2013, *Trend of newsprint industry from 2004 to 2010* PUBAT, Bangkok, viewed 25 September 2013, <http://www.pubat.or.th/upload/pubat_industries/pubat_industries2553_forcast2554_tenor2555.pdf>.

QLD 2013, *Getting into the newsagency industry* Queensland, viewed 25 September 2013, <http://www.business.qld.gov.au/industry/retail-and-wholesale/starting-a-newsagency>.

Rafele, C. 2004, 'Logistic service measurement: a reference framework', *Journal of Manufacturing Technology Management*, vol. 15, no. 3, pp. 280-90.

Ramanathan, R. 2008, *The Role of Organisational Change Management in Offshore Outsourcing of Information Technology Services*, Universal Publishers.

Ranganathan, J. 1998, 'Sustainability rulers: Measuring corporate environmental and social performance', *World Resources Institute, Sustainable Enterprise Initiative* pp. 1-11.

Rao, P. 2002, 'Greening the supply chain: a new initiative in South East Asia', *International Journal of Operations & Production Management*, vol. 22, no. 6, pp. 632-55.

Rao, P. & Holt, D. 2005, 'Do green supply chains lead to competitiveness and economic performance?', *International Journal of Operations & Production Management*, vol. 25, no. 9, pp. 898-916.

Redorbit 2011, *EBooks threaten brick-and-mortar book stores*, Redorbit, Texas, viewed 16 october 2013, <http://www.redorbit.com/>.

Renshaw, F.W. 2002, *Natural selection*, viewed 25 July 2014, <http://multichannelmerchant.com/opsandfulfillment_warehouse/natural-selection-01122002/#_>.

Ribeiro, K., Kobayashi, S., Beuthe, M., Gasca, J., Greene, D., Lee, D., Muromachi, Y., Newton, P., Plotkin, S. & Sperling, D. 2007, 'Transport and its infrastructure, Climate Change 2007: Mitigation, Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change', *Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA*.

Roberts, S. 2003, 'Supply chain specific? Understanding the patchy success of ethical sourcing initiatives', *Journal of Business Ethics*, vol. 44, no. 2, pp. 159-70.

Rondinelli, D. & Vastag, G. 2000, 'Panacea, common sense, or just a label?: The value of ISO 14001 environmental management systems', *European Management Journal*, vol. 18, no. 5, pp. 499-510.

Rondinelli, D.A. 2007, 'Globalization of sustainable development: Principles and practices in transnational corporations', *Multinational Business Review*, vol. 15, no. 1, pp. 1-24.

Roscoe, J.T. 1969, *Fundamental research statistics for the behavioral sciences*, Holt, Rinehart and Winston New York.

Ross Jr, W.T. & Robertson, D.C. 2007, 'Compound relationships between firms', *Journal of Marketing*, vol. 71, no. 3, pp. 108-23.
Ruesch, M., Hegi, P., Haefeli, U., Matti, D., Schultz, B. & Rütsche, P. 2012, 'Sustainable Goods Supply and Transport in Conurbations: Freight Strategies and Guidelines', *Procedia-Social and Behavioral Sciences*, vol. 39, pp. 116-33.
Runhaar, H. & van der Heijden, R. 2003, 'Transport costs: the dark continent of the logistics world? The impact of transport costs on book and newspaper logistics'.
Russell, R., Chiang, W.C. & Zepeda, D. 2008, 'Integrating multi-product production and distribution in newspaper logistics', *Computers & Operations Research*, vol. 35, no. 5, pp. 1576-88.
Sabri, E.H. & Beamon, B.M. 2000, 'A multi-objective approach to simultaneous strategic and operational planning in supply chain design', *Omega*, vol. 28, no. 5, pp. 581-98.
Sachan, A. & Datta, S. 2005, 'Review of supply chain management and logistics research', *International Journal of Physical Distribution & Logistics Management*, vol. 35, no. 9, pp. 664-705.
Sakulsuttawong, S. 2013, *How to avoid bankruptcy in newagency industry* Praphansarn, Bangkok, viewed 17 October 2013, <http://www.praphansarn.com/>.
Schultz, B. 2000, 'Implementing a successful cross-docking operations', *Plant Engineering* vol. 29, no. 10, pp. 128-34.
Schwardt, M. & Fischer, K. 2009, 'Combined location-routing problems—a neural network approach', *Annals of Operations Research*, vol. 167, no. 1, pp. 253-69.
Sekaran, U. 2003, *Research methods for business: a skill-building approach*, John Wiley & Sons, Inc.
Sekaran, U. 2006, *Research methods for business: A skill building approach*, Wiley. com.
Senge, P.M.C.G. 2001, 'Innovating Our Way to the Next Industrial Revolution', *MIT Sloan Management Review*, vol. 42, no. 2, pp. 24-38.
Setthasakko, W. 2007, 'Determinants of corporate sustainability: Thai frozen seafood processors', *British food journal*, vol. 109, no. 2, pp. 155-68.
Setthasakko, W. 2009, 'Barriers to implementing corporate environmental responsibility in Thailand: a qualitative approach', *International journal of organizational analysis*, vol. 17, no. 3, pp. 169-83.
Seuring, S. & Müller, M. 2008, 'From a literature review to a conceptual framework for sustainable supply chain management', *Journal of Cleaner Production*, vol. 16, no. 15, pp. 1699-710.
Seuring, S., Sarkis, J., Müller, M. & Rao, P. 2008, 'Sustainability and supply chain management-An introduction to the special issue', *Journal of Cleaner Production*, vol. 16, no. 15, pp. 1545-51.
Shee, H., VanGramberg, B. & Foley, P. 2011, 'Capability and practices to enhance firm competitiveness under competitive intensity: A SEM approach', *International Journal of Global Business and Competitiveness*, vol. 6, no. 1, pp. 1-13.
Sheikh, K. & Mattingly, S. 1981, 'Investigating non-response bias in mail surveys', *Journal of epidemiology and community health*, vol. 35, no. 4, pp. 293-6.
Shrivastava, P. 1995, 'The role of corporations in achieving ecological sustainability', *Academy of Management Review*, pp. 936-60.
Simatupang, T.M. & Sridharan, R. 2008, 'Design for supply chain collaboration', *Business Process Management Journal*, vol. 14, no. 3, pp. 401-18.
Singh, P.J., Power, D. & Chuong, S.C. 2011, 'A resource dependence theory perspective of ISO 9000 in managing organizational environment', *Journal of Operations Management*, vol. 29, no. 1, pp. 49-64.

Sisaye, S. 2011, 'Ecological systems approaches to sustainability and organizational development: Emerging trends in environmental and social accounting reporting systems', *Leadership & Organization Development Journal*, vol. 32, no. 4, pp. 379-98.
Sivadas, E. & Dwyer, F.R. 2000, 'An examination of organizational factors influencing new product success in internal and alliance-based processes', *The Journal of Marketing*, pp. 31-49.
Skjoett-Larsen, T. 2000, 'Third party logistics–from an interorganizational point of view', *International Journal of Physical Distribution & Logistics Management*, vol. 30, no. 2, pp. 112-27.
Smith, N.C. 2003, 'Corporate Social Responsibility: not whether, but how', *Center for Marketing Working Paper*, no. 03-701.
Sohail, M.S. & Sohal, A. 2003, 'The use of third party logistics services: a Malaysian perspective', *Technovation*, vol. 23, no. 5, pp. 401-8.
Song, D.W. & Panayides, P.M. 2002, 'A conceptual application of cooperative game theory to liner shipping strategic alliances', *Maritime Policy & Management*, vol. 29, no. 3, pp. 285-301.
Soni, G. & Kodali, R. 2011, 'A critical analysis of supply chain management content in empirical research', *Business Process Management Journal*, vol. 17, no. 2, pp. 238-66.
Stanaland, A.J.S., Lwin, M.O. & Murphy, P.E. 2011, 'Consumer Perceptions of the Antecedents and Consequences of Corporate Social Responsibility', *Journal of business ethics*, pp. 1-9.
Steg, L. & Gifford, R. 2005, 'Sustainable transportation and quality of life', *Journal of Transport Geography*, vol. 13, no. 1, pp. 59-69.
Sterzik, S., Wang, X. & Kopfer, H. 2011, 'A Case Study for a Location-Routing Problem', *Operations Research Proceedings 2010*, Springer, pp. 275-80.
Stevens, C. 2005, 'Measuring sustainable development', *Statistics Brief*, no. 10.
Studer, J., Baggio, S., Mohler-Kuo, M., Dermota, P., Gaume, J., Bertholet, N., Daeppen, J.-B. & Gmel, G. 2013, 'Examining non-response bias in substance use research—Are late respondents proxies for non-respondents?', *Drug and Alcohol Dependence*, vol. 132, no. 1–2, pp. 316-23.
Sundarakani, B., Souza, R.D., Goh, M., Wagner, S.M. & Manikandan, S. 2010, 'Modeling carbon footprints across the supply chain', *International Journal of Production Economics*, vol. 128, no. 1, pp. 43-50.
Sung, C. & Song, S. 2003, 'Integrated service network design for a cross-docking supply chain network', *Journal of the Operational Research Society*, pp. 1283-95.
Surrey, U.o. 2001, *The importance of pilot study*, vol. 35, University of Surrey.
Sutherland 2003, 'Collaborative transportation management–creating value through increased transportation efficiencies', *Business Briefing: Pharmagenerics*, pp. 1-4.
Sutherland, J.L. 2006, 'Collaborative transportation management: A solution to the current transportation crisis', *CVCR white paper*, vol. 602.
Svensson, G. 2007, 'Aspects of sustainable supply chain management (SSCM): conceptual framework and empirical example', *Supply Chain Management: an international journal*, vol. 12, no. 4, pp. 262-6.
Swaen, V. & Vanhamme, J. 2004, 'See how ‘good’we are: the dangers of using corporate social activities in communication campaigns', *Advances in Consumer Research*, vol. 31, no. 1, pp. 302-3.
Tabachnick, B.G., Fidell, L.S. & Osterlind, S.J. 2001, 'Using multivariate statistics'.
Teuteberg, F. & Wittstruck, D. 2010, 'A systematic review of sustainable supply chain management', *Multikonferenz Wirtschaftsinformatik 2010*, p. 203.

Thomas, R. 2011, *Top 10 reasons the newspaper is dying*, Listverse, viewed 18 June 2012, <http://listverse.com/2011/07/03/top-10-reasons-the-newspaper-is-dying/>.

Thorgren, S., Wincent, J. & Örtqvist, D. 2009, 'A cause–effect study of inter-firm networking and corporate entrepreneurship: initial evidence of self-enforcing spirals', *Journal of Developmental Entrepreneurship*, vol. 14, no. 4, pp. 1-18.

TTLA 2012, *Summary of the fundamental of trasportation industry* Bangkok, viewed 25 September 2013, <http://www.ttla.or.th/ttla/index.php?option=com_content&view=article&id=126%3A2012-04-10-09-51-03&catid=39%3A2011-03-04-09-56-35&Itemid=57&lang=th>.

TTR 2010, *New freight consolidation study - Results released*, Transport & Travel Research Ltd, viewed 22 April 2010, <http://www.ttr-ltd.com/downloads/pdf/FCCNov2010.pdf>.

Turban, D.B. & Greening, D.W. 1997, 'Corporate social performance and organizational attractiveness to prospective employees', *Academy of Management Journal*, vol. 40, no. 3, pp. 658-72.

Tuzun, D. & Burke, L.I. 1999, 'A two-phase tabu search approach to the location routing problem', *European Journal of Operational Research*, vol. 116, no. 1, pp. 87-99.

Tyan, J., Wang, F. & Du, T. 2003a, 'Applying collaborative transportation management models in global third-party logistics', *International Journal of Computer Integrated Manufacturing*, vol. 16, no. 4-5, pp. 283-91.

Tyan, J.C., Wang, F.K. & Du, T.C. 2003b, 'An evaluation of freight consolidation policies in global third party logistics', *Omega*, vol. 31, no. 1, pp. 55-62.

Ülkü, M.A. 2011, 'Dare to care: Shipment consolidation reduces not only costs, but also environmental damage', *International Journal of Production Economics*, vol. 139, pp. 438-46.

UN 2011, *Carbon dioxide emissions (CO2), thousand metric tons of CO2 (CDIAC)*, <http://mdgs.un.org/unsd/mdg/SeriesDetail.aspx?srid=749&crid=>.

Vachon, S. & Klassen, R.D. 2006, 'Extending green practices across the supply chain: the impact of upstream and downstream integration', *International Journal of Operations & Production Management*, vol. 26, no. 7, pp. 795-821.

Vachon, S. & Klassen, R.D. 2008, 'Environmental management and manufacturing performance: The role of collaboration in the supply chain', *International Journal of Production Economics*, vol. 111, no. 2, pp. 299-315.

Van Buer, M.G., Woodruff, D.L. & Olson, R.T. 1999, 'Solving the medium newspaper production/distribution problem', *European Journal of Operational Research*, vol. 115, no. 2, pp. 237-53.

Van der Rhee, B., Verma, R. & Plaschka, G. 2009, 'Understanding trade-offs in the supplier selection process: The role of flexibility, delivery, and value-added services/support', *International Journal of Production Economics*, vol. 120, no. 1, pp. 30-41.

Van Laarhoven, P., Berglund, M. & Peters, M. 2000, 'Third-party logistics in Europe–five years later', *International Journal of Physical Distribution & Logistics Management*, vol. 30, no. 5, pp. 425-42.

Van Thai, V. & Grewal, D. 2005, 'Selecting the location of distribution centre in logistics operations: a conceptual framework and case study', *Asia Pacific Journal of Marketing and Logistics*, vol. 17, no. 3, pp. 3-24.

Var, I. 1998, 'Multivariate data analysis', *vectors*, vol. 8, p. 6.

Veal, A.J. & Ticehurst, G.W. 2005, *Business research methods: A managerial approach*, Longman.

Veerudh 2011, *history of newspaper*, Weechakarn, Bangkok, viewed 18 June 2012, <http://www.vcharkarn.com/varticle/38234>.

Verstrepen, S., Cools, M., Cruijssen, F. & Dullaert, W. 2009, 'A dynamic framework for managing horizontal cooperation in logistics', *International Journal of Logistics Systems and Management*, vol. 5, no. 3, pp. 228-48.

VTPI 2011, *Transport cost and benefit analysis II-Air pollution costs*, Victoria, <http://www.vtpi.org/tca/tca0510.pdf>.

Waddock, S.A. & Graves, S.B. 1997, 'The corporate social performance', *Strategic Management Journal*, vol. 8, no. 4, pp. 303-19.

Walker, H., Di Sisto, L. & McBain, D. 2008, 'Drivers and barriers to environmental supply chain management practices: Lessons from the public and private sectors', *Journal of Purchasing and Supply Management*, vol. 14, no. 1, pp. 69-85.

Walker, I. 2010, *Research methods and statistics*, Palgrave Macmillian, Hampshire.

Walton, S.V., Handfield, R.B. & Melnyk, S.A. 1998, 'The green supply chain: integrating suppliers into environmental management processes', *Journal of Supply Chain Management*, vol. 34, no. 2, pp. 2-11.

Watts, T. 1999, ''Social auditing': the KPMG UK experience: The pressure for companies to report on non-financial measures is growing', *AUSTRALIAN CPA*, vol. 69, pp. 46-7.

Weijers, S., Glöckner, H.H. & Pieters, R. 2012, 'Logistic service providers and sustainable physical distribution', *Log Forum*, vol. 8, pp. 157-65.

Werner, C. & Schermelleh-Enge, K. 2010, *Deciding between competing models: Chi-square difference tests*, Goethe University, Frankfurt, viewed 11 January 2014, <http://www.psychologie.uzh.ch/fachrichtungen/methoden/team/christinawerner/sem/chisquare_diff_en.pdf>.

Weston, R. & Gore, P.A. 2006, 'A brief guide to structural equation modeling', *The Counseling Psychologist*, vol. 34, no. 5, pp. 719-51.

Whipple, J.M. & Frankel, R. 2000, 'Strategic alliance success factors', *Journal of Supply Chain Management*, vol. 36, no. 3, pp. 21-8.

Whiteing, T., Browne, M. & Allen, J. 2003, 'City logistics: the continuing search for sustainable solutions', *Global Logistics and Distribution Planning: Strategies for Management.: London: Kogan Page*, pp. 308-20.

Wilding, R., Wagner, B., Gligor, D.M. & Holcomb, M.C. 2012, 'Understanding the role of logistics capabilities in achieving supply chain agility: a systematic literature review', *Supply Chain Management: An International Journal*, vol. 17, no. 4, pp. 438-53.

Wright, P., Ferris, S.P., Hiller, J.S. & Kroll, M. 1995, 'Competitiveness through management of diversity: Effects on stock price valuation', *Academy of Management Journal*, pp. 272-87.

Wu, H.J. & Dunn, S.C. 1995, 'Environmentally responsible logistics systems', *International Journal of Physical Distribution & Logistics Management*, vol. 25, no. 2, pp. 20-38.

Wu, W.Y., Shih, H.-A. & Chan, H.-C. 2009, 'The analytic network process for partner selection criteria in strategic alliances', *Expert Systems with Applications*, vol. 36, no. 3, pp. 4646-53.

Wu, Z. & Choi, T.Y. 2005, 'Supplier–supplier relationships in the buyer–supplier triad: Building theories from eight case studies', *Journal of Operations Management*, vol. 24, no. 1, pp. 27-52.

Xia, W. & Wu, Z. 2007, 'Supplier selection with multiple criteria in volume discount environments', *Omega*, vol. 35, no. 5, pp. 494-504.

Zhao, X., Zhao, H. & Hou, J. 2010, 'B2B e-hubs and information integration in supply chain operations', *Management Research Review*, vol. 33, no. 10, pp. 961-79.

Zhou, G., Hui, Y.V. & Liang, L. 2011, 'Strategic alliance in freight consolidation', *Transportation Research Part E: Logistics and Transportation Review*, vol. 47, no. 1, pp. 18-29.

Zhu, Q., Sarkis, J. & Lai, K. 2007, 'Initiatives and outcomes of green supply chain management implementation by Chinese manufacturers', *Journal of Environmental Management*, vol. 85, no. 1, pp. 179-89.

Zikmund, W.G., Carr, J.C. & Griffin, M. 2012, *Business Research Methods (with Qualtrics Printed Access Card)*, South-Western Pub.

Zineldin, M. 2004, 'Co-opetition: the organisation of the future', *Marketing Intelligence & Planning*, vol. 22, no. 7, pp. 780-90.

Zinn, W. & Parasuraman, A. 1997, 'Scope and intensity of logistics-based strategic alliances: a conceptual classification and managerial implications', *Industrial Marketing Management*, vol. 26, no. 2, pp. 137-47.

Appendix 1

Questionnaire Survey

CONSENT FORM FOR PARTICIPANTS INVOLVED IN THE RESEARCH

INFORMATION FOR THE POTENTIAL PARTICIPANTS:

The purpose of this research is to identify factors that can contribute to achieving sustainable freight distribution in the context of Thai economic, social and environmental sustainability. For achieving sustainable distribution, co-opetition, freight consolidation and collaborative freight distribution are proposed as potential logistics management strategies. Co-opetition is a business strategy that implies that the firm should collaborate as well as compete with its competitors to achieve common goals and objectives. On the other hand, freight consolidation is a distribution strategy that allows products from different origins to be re-loaded, re-scheduled and consolidated into a single truck when products are dispatched to the same or nearby destinations. Thus, collaborative freight distribution is an integration of distribution process between competitors for improving distribution efficiency and effectiveness.

As a member of a leading firm, you are invited to participate in a research study entitled "Factors Influencing Sustainable Distribution: A Framework of Co-opetition, Freight Consolidation, and Collaborative Freight Distribution in the Thailand Newspaper Industry". Participation in the study will involve approximately 30 minutes of your time, whereby you will be asked to complete a questionnaire. All the information you provide will be kept confidential and will not identify you personally in any way. The completed questionnaire will be destroyed 5 years after the completion of the project. Please note that you can refuse to answer any question in the questionnaire or even choose not to participate in the study. Essentially, your participation poses no risk to you and withdrawing from the study will not result in any negative consequences.

In short, as a part of this research project, I am examining critical factors that can help achieve sustainable distribution within a distribution process and would appreciate your participation in this study. I would like you to consider the factors underpinning effective co-opetitive relationship establishment, freight consolidation, and collaborative freight distribution practice.

CERTIFICATION BY SUBJECT:

I,
of
certify that I am at least 18 years old* and that I am voluntarily giving my consent to participate in the study entitled
"Factor Influencing Collaborative freight distribution: A Framework of Sustainable Distribution" being conducted at Victoria University by: Dr. Himanshu K. Shee.
I certify that the objectives of the study, together with any risks and safeguards associated with the procedures listed hereunder to be carried out in the research, have been fully explained to me by
Chattharn Limoubpratum
and that I freely consent to participation involving the following procedures:

- For each question in Section A, B, C, and D, please choose a position on the scale that best describes you evaluation of the factor being judged. For items included in Section E, F and G, please fill the gap and circle the choice that best describes you and your firm. If possible, please answer all the questions. Please note that the questionnaire is structured in seven sections, as outlined below.
- Section A seeks your views on factors that are influencing the establishment of relationship between your firm and competitor(s).
- Section B examines factors that are critical for enabling freight consolidation operation.
- Section C seeks your views on factors that are critical for enabling freight consolidation operation with competitors.
- Section D includes questions pertaining to your views on the potential benefits of collaborative freight distribution towards sustainable distribution.
- Section E includes questions related to general information about your firm.
- Section F pertains to general information about you.
- Section G allows you to express any additional comments.

I certify that I have had the opportunity to have any questions answered and that I understand that I can withdraw from this study at any time and that this withdrawal will not jeopardise me in any way.

I have also been informed that the information I provide will be kept confidential.

Signed:

Date:

Any queries about your participation in this project may be directed to the researcher

Principal Investigator: Dr. Himanshu K Shee

School of Management and Information Systems, Victoria University of Technology, Melbourne, Australia.

Phone: +613-9919-4077

Email: Himanshu.shee@vu.edu.au

If you have any queries or complaints about the way you have been treated, you may contact the Research Ethics and Biosafety Manager, Victoria University Human Research Ethics Committee, Victoria University, PO Box 14428, Melbourne, VIC, 8001 or phone (03) 9919 4148.

[*please note: Where the participant/s are aged under 18, separate parental consent is required. Similarly, if the participant/s are unable to answer for themselves due to mental illness or disability, parental or guardian consent may be required.]

INFORMATION FOR THE POTENTIAL STUDY PARTICIPANTS

You are invited to participate

You are invited to participate in a research project entitled "Factors Influencing Sustainable Distribution: A Framework of Co-opetition, Freight Consolidation, and Collaborative Freight Distribution in the Thailand's Newspaper Industry".

This project is being conducted by a student researcher, Chattharn Limoubpratum, as part of a Doctor of Business Administration (DBA) study at Victoria University under the supervision of Dr. Himanshu Shee and Dr. Kamrul Ahsan from the faculty of business and law/ School of Management and Information Systems, Victoria University, Melbourne, Australia.

Project explanation

Issues of sustainability have become increasingly important due to excessive global warming, substantial emissions of greenhouse gases (GHG), growing social problems and rising cost of business operations. Logisticians have been increasingly concerned with logistics activities that yield a negative effect on the natural environment and societies, such as air pollution and health problems, as well as economic performance. The logistics activities mostly affected by those issues are transportation and production distribution. These processes must be improved, as the issues, such as half-loaded vehicles, suboptimal routing problems, and substantial fuel consumption, are having increasing economic, social and environmental impact. To keep the impact of their distribution operations at minimum, firms must consider the concept of sustainable distribution. Sustainable distribution refers to the distribution process management that considers sustainability dimensions, i.e. economics, as well as social and environmental issues. In the context of SCM, sustainability is generally defined as ‘meeting the needs of a firm’s direct and indirect stakeholders (such as shareholders, employees, clients, pressure groups, communities etc.), without compromising its ability to meet the need of future stakeholders’. At present, there are three potential strategic solutions, namely horizontal cooperation among competitors (or co-opetition), freight consolidation and collaborative freight distribution. Co-opetition as a business strategy implies that the firm should collaborate as well as compete with its competitors to achieve common goals and objectives through joint business activities. On the other hand, freight consolidation is a distribution strategy that allows products from different origins to be re-loaded, re-scheduled, and consolidated into a single truck for delivery to the same or nearby destinations. Thus, once co-opetitive relationship is successfully established, collaborative freight distribution could potentially be initiated, as it allows for vertical and horizontal integration of distribution processes, thus improving distribution efficiency and effectiveness of all supply chain partners. However, scholars are yet to investigate managerial factors for establishing collaborative freight distribution in Thailand. Moreover, the issues of environmental and social impact of product distribution, as well as its improved performance through collaborative freight distribution management and co-opetition, are less researched and scarcely documented. Therefore, the research in these contexts is the objective of this study.

Focusing on the Thai product distribution system, this study will aim to answer the following research questions: Would the co-opetitive relationship influence sustainable distribution? Would freight consolidation influence sustainable distribution? Would co-opetitive relationship influence collaborative freight distribution? Would freight consolidation influence collaborative freight distribution? and Would collaborative freight distribution influence sustainable distribution?

Therefore, the aim of this research is to examine:

- -the co-opetition strategy and the extent to which it can help with sustainable distribution,
- -the freight consolidation process that can be applied to achieving sustainable distribution,
- -the collaborative freight distribution process and its impact on sustainable distribution.

What will study participation entail?

The questionnaire you will be given should only take approximately 30 minutes to complete. Please also answer the general question at the end of this questionnaire. You could also express your views or provide additional comments on the last page.

The questionnaire responses follow the 5-point Likert scale format, with 1 corresponding to ‘strongly disagree’ and 5 to ‘strongly agree’.

The survey questionnaire consists of 7 sections. Section A seeks your views on factors that are influencing the establishment of relationship between participants’ firm and competitor(s). Section B focuses on factors that are critical for enabling freight consolidation. Section C includes questions pertaining to your views on factors that are critical for enabling collaborative freight distribution operation with competitors. Section D seeks your views on the potential benefits of collaborative freight distribution towards sustainable distribution. Section E consists of questions aimed at gathering general information about your firm. In Section F, general information about you is collected. Lastly, section G allows you to express any additional comments.

For Section A, B, C, and D, please choose only one response by indicating the position on the scale that best describes you evaluation of the factor being judged. For Section E, F and G, please fill the gap and circle the choice that best describes you and your firm. If possible, please do not omit answering any question.

Once the questionnaire is completed, please return it to the researcher by posting it in the envelope provided.

How will the information I give be used?

Data from the completed questionnaires will be used to analyse factors that are critical for establishing co-opetitive relationship, freight consolidation, collaborative freight distribution and achieving sustainable distribution in product distribution process.

The collected data will be subjected to several screening tests (i.e. data cleaning), such as Q-Q test (Quartile-Quartile plots) and histogram for normality check, Mahalanobis D2 test for presence of outliers, variance inflation factor (VIF) test for multicollinearity and KMO measures for sample adequacy, as well as principal component factor analysis, and confirmation factor analysis (CFA), before progressing to other zero-order correlation and multivariate tests. These techniques will eliminate infeasible factors. Moreover, SEM (structure equation modeling) will be employed, provided that the sample size is adequate. SEM would bring in the predictive power of the antecedent variables on the outcome variable, i.e. sustainable distribution, considering all effects occurring concurrently in the stated framework. SEM refers to the matrix of variances and covariances used to explore the causal relationship among the variables. The analysis will, however, focus on testing all the hypotheses for their acceptability.

What are the potential risks of participating in this project?

There are no known physical, social, psychological or legal risks associated with the participation in this research project. We assure you that the completed questionnaire will be kept confidential and you will not be personally identified in any results or publications. The questionnaire will be destroyed 5 years after the completion of the project. Essentially, your participation poses no risk to you and withdrawing from the study will not result in any negative consequences.

Who is conducting the study?

Principal Investigator: Dr. Himanshu K Shee

School of Management and Information Systems, Victoria University of Technology, Melbourne, Australia.
Phone: +613-9919-4077
Email: Himanshu.shee@vu.edu.au

Co-investigator: Dr. Kamrul Ahsan
School of Management and Information Systems, Victoria University of Technology, Melbourne, Australia.
Phone: +613-9919-1174
Email: Kamrul.ahsan@vu.edu.au

Student: Chattharn Limoubpratum
Address: 3/4 Unakan Road, Wnagburapapirom, Pranakorn, Bangkok, 10200, Thailand
Phone: +662-222-7537
Mobile Phone: +6689-206-5011

Sustainable distribution in Thailand

Any queries about your participation in this project may be directed to the Chief Investigator using the contact information listed above.

If you have any queries or complaints about the way you have been treated, you may contact the Research Ethics and Biosafety Manager, Victoria University Human Research Ethics Committee, Victoria University, PO Box 14428, Melbourne, VIC, 8001 or phone (03) 9919 4148.

Mr. Chattharn Limoubpratum

Research Doctorate Student

Victoria University

Melbourne

Australia

Factors Influencing Sustainable Distribution: A Framework of Co-opetition, Freight Consolidation, and Collaborative Freight Distribution in the Thailand's Newspaper Industry

How to achieve sustainable distribution?

Sustainable distribution is the management of freight distribution towards an improvement of economic performance, society and natural environment. In other words, it is an improvement of freight distribution process by reducing negative impact that affects economy, society and natural environment.

There are three potential strategies to achieve sustainable freight distribution including co-opetitive relationship, freight consolidation and collaborative freight distribution. Co-opetition is a business strategy that implies that the firm should collaborate as well as compete with its competitors to achieve common goals and objectives. On the other hand, freight consolidation is a distribution strategy that allows products from different origins to be re-loaded, re-scheduled and consolidated into a single truck when products are dispatched to the same or nearby destinations. Finally, collaborative freight distribution is an integration of distribution process between competitors for improving distribution efficiency and effectiveness.

For the purpose of this study, I am examining critical factors to achieve sustainable distribution in distribution process and would appreciate your participation in this study. I would like you to consider the factors underpinning effective co-opetitive relationship establishment, freight consolidation centre, and collaborative freight distribution practice.

START HERE

Section A - Driving factors for establishing co-opetitive relationship

This section seeks your view on factors that would be critical for the establishment of co-opetitive relationship.

Please tick the box to indicate the extent to which you AGREE or DISAGREE with the following statements.

1. Management Commitment

Management commitment concerns the degree of attitude of top management to developing relationship with competitor(s).

	Strongly Disagree	Disagree	Neither agree and disagree	Agree	Strongly Agree
MC_1.1 You are enthusiastic about pursuing the mission of your competitor.	☐	☐	☐	☐	☐
MC_1.2 For the success of a relationship with your competitor, you will be completely supportive.	☐	☐	☐	☐	☐
MC_1.3 You are intending to arrange a long-term contract (either formal or informal) with your competitor.	☐	☐	☐	☐	☐
MC_1.4 You are intending to create or adapt the current policy according to the relationship.	☐	☐	☐	☐	☐
MC_1.5 You are willing to create a new strategy according to the goal of the relationship.	☐	☐	☐	☐	☐
MC_1.6 You are intending to reconfigure your internal business processes according to new business structure.	☐	☐	☐	☐	☐
MC_1.7 You have the ability to extend existing capabilities to encompass new organizational	☐	☐	☐	☐	☐

structure.					
MC_1.8 You have the ability to apply new knowledge to accomplish goal of the relationship.	☐	☐	☐	☐	☐
MC_1.9 You are willing to share core competencies (i.e. core resources) with your competitor.	☐	☐	☐	☐	☐
MC_1.10 You are willing to share physical resources, such as delivery vehicle etc., with your competitor.	☐	☐	☐	☐	☐

2. Relationship management

Relationship management refer to the development of relationship between the firm and competitors. The strong relationship between firms could lead to the higher potential to accomplish goals of all firms participating in the relationship.

	Strongly Disagree	Disagree	Neither Agree And Disagree	Agree	Strongly Agree
RM_2.1 In the relationship with your competitor, you are intending to arrange detailed standard operating procedures (e.g. rules, policies, forms, etc.) for the process of the operation consistency.	☐	☐	☐	☐	☐
RM_2.2 To establish a relationship with your competitor, both companies must have mutual goals and objectives before the relationship establishment.	☐	☐	☐	☐	☐
RM_2.3 In a relationship you establish with your competitor, your partner must be honest and reliable.	☐	☐	☐	☐	☐
RM_2.4 Meeting on weekly or monthly basis with your competitor will be arranged.	☐	☐	☐	☐	☐
RM_2.5 You are intending to share know-how from work experience with your competitor.	☐	☐	☐	☐	☐
RM_2.6 You are enthusiastic about accepting your competitor's organizational culture or working environment.	☐	☐	☐	☐	☐
RM_2.7 You are willing to accept risk, i.e. unforseen	☐	☐	☐	☐	☐

events, cost and uncertainties, which are being shared by your competitors.					

3. Communication management

Communication management refers to the revision, implementation, monitoring, and planning of communication channels between competitors to ensure effective communication and reduce conflict between parties.

	Strongly Disagree	Disagree	Neither agree and disagree	Agree	Strongly Agree
CM_3.1 In the relationship with your competitor, you are intending to arrange the written documents (e.g. handbooks) that spell out detailed tasks, activities and schedule for the cooperation.	☐	☐	☐	☐	☐
CM_3.2 In a relationship, you establish with your competitor, internal information must not be used for any other purposes than for the partnership.	☐	☐	☐	☐	☐
CM_3.3 In a relationship, you establish with your competitor, you are intending to monitor conflict intensity periodically.	☐	☐	☐	☐	☐
CM_3.4 In a relationship, you establish with your competitor, participants must be willing to share internal and external information.	☐	☐	☐	☐	☐
CM_3.5 You are intending to exchange each other's opinion with your competitor.	☐	☐	☐	☐	☐
CM_3.6 You are intending to frequently keep informed of new development with your competitor.	☐	☐	☐	☐	☐
CM_3.7 You are intending to implement information technology to exchange information with your competitor.	☐	☐	☐	☐	☐

Section B - Driving factors for enabling freight consolidation

This section seeks your view on factors that could enable freight consolidation.

Please tick the box to indicate the extent to which you AGREE or DSIAGREE with the following statements.

4. Location of freight consolidation center

Location is very critical for locating the freight consolidation center. The proper location yields benefits towards freight distribution activities.

	Strongly Disagree	Disagree	Neither agree and disagree	Agree	Strongly Agree
LO_4.1 You are going to implement freight consolidation, if the location of the freight consolidation centre is close to your manufacturing unit/factory. **(Browne et al. 2005) (Browne et al. 2005) (Browne et al. 2005) (Browne et al. 2005) (Browne et al. 2005) (Browne et al. 2005) (Browne et al. 2005) (Browne et al. 2005) (Browne et al. 2005) (Browne et al. 2005) (Browne et al. 2005) (Browne et al. 2005) (Browne et al. 2005) (Browne et al. 2005)**	☐	☐	☐	☐	☐
LO_4.2 You are going to implement freight consolidation, if the location of the freight consolidation centre is close to your customer's facility/warehouse.	☐	☐	☐	☐	☐
LO_4.3 You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve customer service.	☐	☐	☐	☐	☐
LO_4.4 You are going to implement freight consolidation, if the proper location of freight consolidation can improve sales volume.	☐	☐	☐	☐	☐

LO_4.5 You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve inbound and outbound flow of products.	☐	☐	☐	☐	☐
LO_4.6 You are going to implement freight consolidation, if the proper location of freight consolidation centre can reduce distribution cost.	☐	☐	☐	☐	☐
LO_4.7 You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve delivery flexibility.	☐	☐	☐	☐	☐
LO_4.8 You are going to implement freight consolidation, if the freight consolidation centre can increase the frequency of delivery.	☐	☐	☐	☐	☐
LO_4.9 You are going to implement freight consolidation, if the proper location of freight consolidation can improve reliable delivery time.	☐	☐	☐	☐	☐
LO_4.10 You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve the flow of product returns.	☐	☐	☐	☐	☐
LO_4.11 You are going to implement freight consolidation, if it can reduce pollutant from vehicle.	☐	☐	☐	☐	☐

5 Geographical Coverage

Geographical coverage concerns an increasing of distribution area or zone that covered by the freight consolidation centre.

	Strongly Disagree	**Disagree**	**Neither agree and disagree**	**Agree**	**Strongly Agree**
GC_5.1 You are going to implement freight consolidation, if it can improve on time delivery of each	☐	☐	☐	☐	☐

drop-off point.					
GC_5.2 You are going to implement freight consolidation, if it can increase the number of drop-off point.	☐	☐	☐	☐	☐
GC_5.3 You are going to implement freight consolidation, if it increases delivery vehicle zones (i.e. number of cities).	☐	☐	☐	☐	☐
GC_5.4 You are going to implement freight consolidation, if it can reduce travel distance.	☐	☐	☐	☐	☐
GC_5.5 You are going to implement freight consolidation, if it can reduce fuel consumption.	☐	☐	☐	☐	☐

6 Utilization of transport mode

Transport mode utilization concerns the effectiveness and efficiency of the usage of mode of transportation (i.e. delivery truck and van)

	Strongly Disagree	Disagree	Neither agree and disagree	Agree	Strongly Agree
UT_6.1 You are going to implement freight consolidation centre, if it can reduce transportation cost.	☐	☐	☐	☐	☐
UT_6.2 You are going to implement freight consolidation centre, if it can improve more efficient use of vehicles.	☐	☐	☐	☐	☐
UT_6.3 You are going to implement freight consolidation centre, if it can improve the usage of vehicle capacity.	☐	☐	☐	☐	☐
UT_6.4 You are going to implement freight consolidation, if it can provide for more cost-efficient full load deliveries.	☐	☐	☐	☐	☐
UT_6.5 You are going to implement freight consolidation, if it can reduce fuel consumption.	☐	☐	☐	☐	☐

UT_6.6 You are going to implement freight consolidation centre, if it can reduce the number of delivery vehicles.	☐	☐	☐	☐	☐
UT_6.7 You are going to implement freight consolidation centre, if it can reduce the number of drivers.	☐	☐	☐	☐	☐

Collaborative Practices (marker variable)

In general, how much do you disagree or agree as a member of your organisation's top management team that the following statements accurately describe the management practices within your top management team.

	Strongly Disagree	Disagree	Neither agree and disagree	Agree	Strongly Agree
X1. We frequently communicate with our suppliers, distributors and partner companies.	☐	☐	☐	☐	☐
X2. We frequently discuss common problems with our suppliers, distributors and partner companies.	☐	☐	☐	☐	☐
X3. Marketing personnel share close ties with people who work for our suppliers, distributors and partner companies.	☐	☐	☐	☐	☐
X4. Our relationship with our suppliers, distributors and partner companies is mutually gratifying and highly cohesive.	☐	☐	☐	☐	☐
X5. We expect that our strong social relationship will exist far into the future with our suppliers, distributors and partner companies.	☐	☐	☐	☐	☐

Section C - Driving factor for enabling collaborative freight distribution

This section seeks your view on factors that are enabling collaborative freight distribution.

Please tick the box to indicate the extent to which you AGREE or DISAGREE with the following statements.

7 Partner selection

Partner selection concerns the process of monitoring, revising, and selecting partners (i.e. competitors)

	Strongly Disagree	Disagree	Neither agree and disagree	Agree	Strongly Agree
PS_7.1 A fair share of benefits to all the partners is essential for a successful cooperation.	☐	☐	☐	☐	☐
PS_7.2 You intend to find commensurable partner with whom it is possible to cooperate for core activities.	☐	☐	☐	☐	☐
PS_7.3 Partners find it easy to ensure a fair allocation of the shared workload in advance.	☐	☐	☐	☐	☐
PS_7.4 Goals/objectives of you and your partner's firm must be compatible.	☐	☐	☐	☐	☐
PS_7.5 You are willing to assess and evaluate your partner's goals/objective before choosing the partner.	☐	☐	☐	☐	☐
PS_7.6 You concern complementary skills of your partner, e.g. partner's experience, capabilities, and potential for making real contribution, when you are choosing an alliance partner.	☐	☐	☐	☐	☐
PS_7.7 financial resources of you and your partner must be compatible.	☐	☐	☐	☐	☐
PS_7.8 Internal working environment of you and your partner must be compatible.	☐	☐	☐	☐	☐

PS_7.9 Peer relationship between the top executive of you and your partner's firm must be established.	☐	☐	☐	☐	☐
PS_7.10 You are willing to learn a new working environment.	☐	☐	☐	☐	☐
PS_7.11 Commensurate levels of risk must be involved among you and your potential partner.	☐	☐	☐	☐	☐

8 Benefits and risks sharing

Benefits and risks sharing between partners (competitors) is critical for sustaining long term relationship between parties. Benefits are such as profits, market share, and cost reduction. On the other hand, risks are such as potential cost, unforeseen events, and uncertainty.

	Strongly Disagree	**Disagree**	**Neither agree and disagree**	**Agree**	**Strongly Agree**
BR_8.1 Collaborative freight distribution would reduce the cost of non-core activities, e.g. decrease in empty hauling, of you and your partner's firm.	☐	☐	☐	☐	☐
BR_8.2 Collaborative freight distribution will reduce purchasing costs, e.g. truck, on-board computer, fuel etc., of you and your partner's firm.	☐	☐	☐	☐	☐
BR_8.3 Collaborative freight distribution will offer better quality of service at lower costs, e.g. in term of speed, frequency of deliveries, geographical coverage, reliability of delivery time etc., of you and your partner's firm.	☐	☐	☐	☐	☐
BR_8.4 Collaborative freight distribution will help to protect market share of you and your partner's firm.	☐	☐	☐	☐	☐
BR_8.5 You will implement collaborative freight distribution, if it is going to improve sales of you and your partner's firm.	☐	☐	☐	☐	☐
BR_8.6 You will implement collaborative freight	☐	☐	☐	☐	☐

distribution, if it is going to improve fleet utilization of you and your partner's firm.					
BR_8.7 You will implement collaborative freight distribution, if it is going to improve on-time delivery of you and your partner's firm.	☐	☐	☐	☐	☐
BR_8.8 You will implement collaborative freight distribution, if it is going reduce delivery lead-time of you and your partner's firm.	☐	☐	☐	☐	☐
BR_8.9 You will implement collaborative freight distribution, if it is going to reduce administrative cost of you and your partner's firm.	☐	☐	☐	☐	☐
BR_8.10 You will implement collaborative freight distribution, if it is going to reduce driver turn-over of you and your partner's firm.	☐	☐	☐	☐	☐

9 Advance information technologies

Advance information technologies refer to communication technology that can be used to communicate and share information more effectively and efficiency between firms.

	Strongly Disagree	Disagree	Neither agree and disagree	Agree	Strongly Agree
IT_9.1 You are going to implement information technology to share supply chain information such as point of sale, forecasts, purchase order, shipment schedules and status, performance reporting.	☐	☐	☐	☐	☐
IT_9.2 You are going to implement message based system (i.e. fax, email, sms, EDI).	☐	☐	☐	☐	☐
IT_9.3 You are going to implement market based system (i.e. hubs, portals)	☐	☐	☐	☐	☐
IT_9.4 You are going to implement collaborative planning and forecasting based systems (i.e. CPFR)	☐	☐	☐	☐	☐

IT_9.5 You will implement information technology, if it is going to reduce transportation costs, e.g. eliminate excessive empty backhauls and dwell time, of you and your partner's firm.	☐	☐	☐	☐	☐
IT_9.6 You will implement information technology, if it is going to increase vehicle utilization of you and your partner's firm.	☐	☐	☐	☐	☐
IT_9.7 You will implement information technology, if it is going to improve services levels, e.g. higher on-time performance, of you and your partner's firm.	☐	☐	☐	☐	☐
IT_9.8 You will implement information technology, if it is going to fairly increase visibility, e.g. identifying location of freight in the supply chain, of you and your partner's firm.	☐	☐	☐	☐	☐
IT_9.9 You will implement information technology, if it is going to improve end-customer satisfaction, e.g. increase number of perfect order, of you and your partner's firm.	☐	☐	☐	☐	☐
IT_9.10 You will implement information technology, if it is going to increase revenues, e.g. improve fully load miles, better on shelf performance, and increase order quantity, of you and your partner's firm.	☐	☐	☐	☐	☐

SECTION D - Sustainable Distribution

This section seeks your view on the potential benefits from improving freight movement management towards sustainability framework.

Please tick a box to indicate the extent to which you AGREE or DISAGREE with the following statements.

10) An improvement of freight movement management towards sustainability framework would….					
10.1 Environmental Factor	Strongly Disagree	Disagree	Neither agree and disagree	Agree	Strongly Agree
EV_10.1.1 reduce environmental risk (including reduced risk of pollution incidents)	☐	☐	☐	☐	☐
EV_10.1.2 improve conservation of resources	☐	☐	☐	☐	☐
EV_10.1.3 enhance ISO 14000 *(International organization for standardization 14000 provides tools for organization to monitor and control their environmental impacts and improve their environmental performance)*	☐	☐	☐	☐	☐
EV_10.1.4 reduce congestion	☐	☐	☐	☐	☐
EV_10.1.5 reduce air pollution	☐	☐	☐	☐	☐
EV_10.1.6 reduce water pollution	☐	☐	☐	☐	☐
EV_10.1.7 reduce visual pollution	☐	☐	☐	☐	☐
EV_10.1.8 reduce odour pollution	☐	☐	☐	☐	☐

EV_10.1.9 reduce noise pollution	☐	☐	☐	☐	☐
EV_10.1.10 reduce solid waste	☐	☐	☐	☐	☐
EV_10.1.11 reduce liquid waste	☐	☐	☐	☐	☐
EV_10.1.12 improve recycling	☐	☐	☐	☐	☐
EV_10.1.13 improve environmental compliance	☐	☐	☐	☐	☐
10.2 Economic performance	Strongly Disagree	Disagree	Neither agree and disagree	Agree	Strongly Agree
EC_10.2.1 improve company’s reputation	☐	☐	☐	☐	☐
EC_10.2.2 improve relationship with investor	☐	☐	☐	☐	☐
EC_10.2.3 improve relationship with customer	☐	☐	☐	☐	☐
EC_10.2.4 improve financial performance	☐	☐	☐	☐	☐
EC_10.2.5 lower the risk of business operation	☐	☐	☐	☐	☐
EC_10.2.6 stimulate the firm’s innovation and creative work	☐	☐	☐	☐	☐
EC_10.2.7 help to find easier ways to attract external sources of sponsorship	☐	☐	☐	☐	☐
EC_10.2.8 broaden markets and improves situations for sales increase	☐	☐	☐	☐	☐
EC_10.2.9 lower expenditure	☐	☐	☐	☐	☐
EC_10.2.10 improve raw material conservation	☐	☐	☐	☐	☐
EC_10.2.11 reduce transportation cost (i.e. fuel cost)	☐	☐	☐	☐	☐
EC_10.2.12 increase in resources usage efficiency	☐	☐	☐	☐	☐
EC_10.2.13 improve product image towards customer	☐	☐	☐	☐	☐
EC_10.2.14 improve market opportunities.	☐	☐	☐	☐	☐
EC_10.2.15 reduce cost of insurance	☐	☐	☐	☐	☐

10.3 Social Factors	Strongly Disagree	Disagree	Neither agree and disagree	Agree	Strongly Agree
SO_10.3.1 increase staff motivation	☐	☐	☐	☐	☐
SO_10.3.2 improve health and safety of workers at the workplace.	☐	☐	☐	☐	☐
SO_10.3.3 Improve trust building with local community through openness, transparency and partnership	☐	☐	☐	☐	☐
SO_10.3.4 reduce complaints from local community	☐	☐	☐	☐	☐
SO_10.3.5 help to attract positively motivated employees	☐	☐	☐	☐	☐
SO_10.3.6 enhance human capital value	☐	☐	☐	☐	☐
SO_10.3.7 improve the contribution of a firm to community development	☐	☐	☐	☐	☐

Section E –About your firm

This section seeks general information about your firm.

Please ensure you complete each question.

(se1) Please indicate your industry.

Newspaper industry

Transport industry

Newsagent industry

Other Please specify___________________________ (se2) Which part of Thailand your firm is located in?

Central Thailand

Northern Thailand

Eastern Thailand

Western Thailand

Southern Thailand

North-eastern Thailand

(se3) Do you have your own distribution facility (i.e. delivery vehicle)?

Yes *(please go to question (se4)*

No *(please go to question (se9)*

(se4) Which part of Thailand is your distribution center located in?

Central Thailand

Northern Thailand

Eastern Thailand

Western Thailand

Southern Thailand

North-eastern Thailand

(se5) How many delivery vehicles does your firm own? ________________________

(se6) How many drivers have your firm employed? ____________________

(se7) How many litters of fuel for distribution operations do you use per month in average? _________

(se8) What is the approximate total value of fuel expense in the distribution process per month? ______________

(se9) How many employees at your firm? _________________

(se10) please indicate the total sales revenue per year

Below 50 million baht

Between 51 million and 200 million baht

Between 201 million and 500 million baht

Between 501 and 1000 million baht

Above 1000 million baht

Section F –About yourself

This section seeks general information about you.

Please ensure you complete each question.

(sf1) Your position or your current job title.

Chief executive officer

Executive Director

Chairperson / President

Co-ordinator

Director

Chief Distribution Officer

Chief Logistics Officer

Chief Marketing Officer

Distribution Director

Logistics Director

Marketing Director

Other Please specify________________________________

(sf2) How many years have you worked for this firm? _____________

(sf3) Total number of years in the industry _____________

(sf4) What is the highest level of education you have completed?

Certificate

Diploma

Bachelor Degree

Graduate Diploma

Master Degree

Doctorate Degree

(sf5) Please indicate your gender

Male

Female

(Sf6) Please specify your age range (in years)

18-20

21-30

31-40

41-50

51-60

60+

Section G –Additional comments

Thank you very much for your participation.
(sh1) If you wish to add any comments or further observation, please use the space below.
Comments:

(so1) Would you like a summary of the result from this study for yourself or firm?
Yes
No

If yes, please provide contact person and mailing address in the above space or include your business card when you return this survey.

Thank you very much for your assistance.

Appendix 2

Preliminary Data Analysis

Appendix 2.1: ANOVA of different industry

Measurement Items	Newspaper industry	Transport industry	Newsagent industry	F-value	Sig.
Management Commitment					
1.1. You are enthusiastic about pursuing mission of your competitor.	2.75	2.84	2.19	5.953	.003
1.2. For the success of a relationship you establish with your competitor, you will be completely supportive.	3.36	3.45	3.18	2.011	.136
1.3. You are intending to arrange long-term contract (either formal or informal) with your competitor.	3.41	3.45	3.31	.477	.621
1.4. You are intending to create or adapt current policy according to the relationship.	3.77	3.61	3.73	.749	.474
1.5. You are willing to create new strategy accordingly to the goal of the relationship.	3.75	3.76	3.96	1.979	.140
1.6. You are intending to reconfigure your internal business process accordingly to new business structure.	4.15	3.88	4.04	2.622	.075
1.7. You have the ability to extend existing capabilities to encompass new organizational structure.	4.22	4.28	4.42	1.503	.225
1.8. You have the ability to apply new knowledge to accomplish goal of the relationship.	3.65	3.76	3.51	1.736	.178
1.9. You are willing to share core competencies (i.e., core resources) with your competitor.	2.44	2.58	2.00	5.913	.003
1.10. You are willing to share physical resources, such as delivery vehicle, with your competitor.	2.72	2.67	2.51	1.222	.297
Relationship Management					
2.1. In the relationship with your competitor, you are intending to arrange detailed standard operating procedures (e.g. rules, policies, forms, etc.) for the processes of the operation consistency.	3.55	3.57	3.38	1.463	.234
2.2. To establish a relationship with your competitor, both companies must have mutual goals and objectives before the relationship establishment.	4.06	4.07	4.31	2.681	.071
2.3. In a relationship you establish with your competitor, your partner must be honest and	4.35	4.57	4.68	6.009	.003

reliable.					
2.4. Meeting on weekly or monthly basis with your competitor will be arranged.	4.17	3.91	4.29	4.525	.098
2.5. You are intending to share know-how from work experience with your competitor.	3.79	3.84	4.23	6.576	.115
2.6. You are enthusiastic about accepting your competitor's organizational culture or working environment.	3.21	3.39	2.97	3.770	.024
2.7. You are willing to accept risk, i.e. unforseen events, cost and uncertainties, which are being shared by your competitors.	3.36	3.31	3.09	2.623	.075
Communication Management					
3.1. In the relationship with your competitor, you are intending to arrange the written documents (e.g. handbooks) that spell out detailed tasks, activities and schedule for the cooperation.	3.72	3.67	3.49	1.687	.187
3.2. In a relationship, you establish with your competitor, internal information must not be used for any other purposes than for the partnership.	4.21	4.25	4.36	.917	.401
3.3. In a relationship, you establish with your competitor, you are intending to monitor conflict intensity periodically.	3.74	3.75	4.01	3.682	.027
3.4. In a relationship, you establish with your competitor, participants must be willing to share internal and external information.	3.57	3.76	3.48	2.726	.068
3.5. You are intending to exchange each other's opinion with your competitor.	3.87	3.96	3.95	.383	.682
3.6. You are intending to frequently keep inform of new development (e.g. technological application) with your competitor.	3.82	3.69	3.81	.863	.423
3.7. You are intending to implement information technology to exchange information with your competitor.	4.18	3.94	4.29	3.813	.197
Location of Freight Consolidation Centre					
4.1 You are going to implement freight consolidation, if the location of the freight consolidation centre is close to your manufacture/factory.	3.76	3.78	3.95	1.490	.227
4.2 You are going to implement freight consolidation, if the location of the freight consolidation centre is close to your customer's facility/warehouse.	3.58	3.60	3.70	.540	.584
4.3 You are going to implement freight	3.95	4.27	4.06	4.421	.013

consolidation, if the proper location of freight consolidation centre can improve customer service.					
4.4 You are going to implement freight consolidation, if the proper location of freight consolidation can improve quantity of sale.	4.11	4.18	4.25	1.063	.347
4.5 You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve inbound and outbound of product.	4.18	4.30	4.27	.626	.536
4.6 You are going to implement freight consolidation, if the proper location of freight consolidation centre can reduce distribution cost.	4.11	4.27	4.30	1.937	.146
4.7 You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve delivery flexibility	4.16	4.21	4.18	.111	.895
4.8 You are going to implement freight consolidation, if the freight consolidation centre can increase the frequency of delivery.	4.17	4.25	4.35	1.395	.250
4.9 You are going to implement freight consolidation, if the proper location of freight consolidation can improve reliable delivery time.	4.23	4.24	4.32	.441	.644
4.10 You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve the flow of product returns.	4.05	4.22	4.29	2.482	.086
4.11 You are going to implement freight consolidation, if it can reduce pollutant from vehicle.	4.03	4.18	4.32	3.946	.021
Geographical Coverage				2.482	.086
5.1. You are going to implement freight consolidation, if it can improve on time delivery of each drop-off point.	4.14	4.21	4.31	1.466	.233
5.2. You are going to implement freight consolidation, if it can increase the number of drop-off point.	4.04	4.06	4.16	.687	.504
5.3. You are going to implement freight consolidation, if it increases delivery vehicle zone.	4.07	4.07	4.14	.250	.779
5.4. You are going to implement freight consolidation, if it can reduce travel distance.	4.20	4.28	4.36	1.315	.270
5.5. You are going to implement freight consolidation, if it can reduce fuel consumption.	4.27	4.33	4.34	.247	.782

Utilization of Transport Mode					
6.1. You are going to implement freight consolidation centre, if it can reduce transportation cost.	4.21	4.40	4.44	2.724	.068
6.2. You are going to implement freight consolidation centre, if it can improve more efficient use of vehicles	4.21	4.37	4.43	2.470	.087
6.3. You are going to implement freight consolidation centre, if it can improve the usage of vehicle space.	3.98	4.15	4.27	3.816	.023
6.4. You are going to implement freight consolidation, if it can provide for more cost-efficient full load deliveries.	4.06	4.12	4.14	.268	.765
6.5. You are going to implement freight consolidation, if it can utilize appropriate mode of transport to reduce fuel consumption.	4.24	4.36	4.35	.673	.511
6.6. You are going to implement freight consolidation centre, if it can reduce the number of delivery vehicle.	4.23	4.30	4.30	.247	.782
6.7. You are going to implement freight consolidation centre, if it can reduce the number of driver.	4.18	4.18	4.25	.235	.791
Partner Selection					
7.1. A fair share of benefits to all the partners is essential for a successful cooperation.	4.06	4.24	4.10	1.479	.230
7.2. You intend to find commensurable partner with whom it is possible to cooperate for core activities.	3.73	3.61	3.70	.472	.624
7.3. Partners find it easy to ensure a fair allocation of the shared workload in advance.	3.88	4.10	4.05	2.180	.115
7.4. Goals/objectives of you and your partner’s firm must be compatible.	4.12	4.16	4.00	1.142	.321
7.5. You are willing to assess and evaluate your partner’s goals/objective before choosing the partner.	3.99	4.21	4.00	2.120	.122
7.6. You concern complementary skills of your partner, e.g. partner’s experience, capabilities, and potential for making real contribution, when you are choosing an alliance partner.	4.07	4.15	4.16	.345	.709
7.7. Financial resources of you and your partner must be compatible.	3.83	3.99	4.17	4.875	.008
7.8. Internal working environment of you and your partner must be compatible.	3.82	3.88	3.88	.158	.854

7.9. Peer relationship between the top executive of you and your partner's firm must be established.	4.08	4.37	4.16	3.425	.258
7.10. You are willing to learn a new working environment.	4.00	4.24	4.13	2.791	.063
7.11. Commensurate levels of risk must be involved among you and your potential partner.	4.07	4.21	4.16	.783	.458
Benefits and Risks Sharing					
8.1. Collaborative freight distribution would reduce the cost of non-core activities, e.g. decrease in empty hauling, of you and your partner's firm.	4.08	4.12	4.17	.324	.724
8.2. Collaborative freight distribution will reduce purchasing costs (e.g., truck, on-board computer, fuel etc., of you and your partner's firm.	4.05	4.03	4.03	.038	.963
8.3. Collaborative freight distribution will offer better quality of service at lower costs, e.g. in term of speed, frequency of deliveries, geographical coverage, reliability of delivery time etc., of you and your partner's firm.	4.09	4.15	4.16	.184	.832
8.4. Collaborative freight distribution will help to protect market share of you and your partner's firm.	3.94	3.96	3.97	.052	.950
8.5. You will implement collaborative freight distribution, if it is going to improve sales of you and your partner's firm.	4.00	4.06	4.06	.210	.811
8.6. You will implement collaborative freight distribution, if it is going to improve fleet utilization of you and your partner's firm.	3.96	4.07	4.14	1.565	.211
8.7. You will implement collaborative freight distribution, if it is going to improve on-time delivery of you and your partner's firm.	4.01	4.10	4.12	.643	.526
8.8. You will implement collaborative freight distribution, if it is going reduce delivery lead-time of you and your partner's firm.	4.07	3.97	3.95	.728	.484
8.9. You will implement collaborative freight distribution, if it is going to reduce administrative cost of you and your partner's firm.	4.02	3.99	3.92	.398	.672
8.10. You will implement collaborative freight distribution, if it is going to reduce driver turn-over of you and your partner's firm.	3.87	3.94	3.87	.200	.819
Advanced Information Technology					
9.1. You are going to implement information	3.59	3.72	3.86	2.044	.132

technology to share supply chain information such as point of sale, forecasts, purchase order, shipment schedules and status, performance reporting.					
9.2. You are going to implement message based system (i.e., fax, email, sms, EDI).	3.88	4.19	4.12	4.651	.010
9.3. You are going to implement market based system (i.e. hubs, portals)	3.81	3.99	4.00	1.574	.209
9.4.You are going to implement collaborative planning and forecasting based systems (i.e. CPFR)	3.84	3.79	3.86	.147	.864
9.5. You will implement information technology, if it is going to reduce transportation costs, e.g. eliminate excessive empty backhauls and dwell time, of you and your partner's firm.	4.07	4.10	4.08	.045	.956
9.6. You will implement information technology, if it is going to increase vehicle utilization of you and your partner's firm.	4.02	4.04	4.22	1.903	.151
9.7. You will implement information technology, if it is going to improve services levels, e.g. higher on-time performance, of you and your partner's firm.	4.05	4.12	4.23	1.435	.240
9.8. You will implement information technology, if it is going to fairly increase visibility, e.g. identifying location of freight in the supply chain, of you and your partner's firm.	4.08	4.24	4.26	1.417	.244
9.9. You will implement information technology, if it is going to improve end-customer satisfaction, e.g. increase number of perfect order, of you and your partner's firm.	4.17	4.25	4.16	.379	.685
9.10. You will implement information technology, if it is going to increase revenues, e.g. improve fully load miles, better on shelf performance, and increase order quantity, of you and your partner's firm.	4.14	4.07	4.08	.194	.824
Environmental Factors					
10.1.1 reduce environmental risk (including reduced risk of pollution incidents)	4.12	4.13	4.12	.020	.980
10.1.2 improve conservation of resources	4.15	4.22	4.14	.395	.674
10.1.3 enhance ISO 14000 (International organization for standardization 14000 provides tools for organization to monitor and control their environmental impacts and improve their environmental performance)	4.09	4.12	4.23	.930	.396

10.1.4 reduce congestion	4.14	4.34	4.31	2.718	.068
10.1.5 reduce air pollution	4.17	4.30	4.19	1.102	.334
10.1.6 reduce water pollution	3.83	3.96	4.10	2.633	.074
10.1.7 reduce visual pollution	3.96	4.13	4.08	1.372	.256
10.1.8 reduce odour pollution	3.88	3.96	4.01	.571	.566
10.1.9 reduce noise pollution	4.08	4.24	4.23	1.330	.267
10.1.10 reduce solid waste	3.92	4.06	4.03	.924	.398
10.1.11 reduce liquid waste	3.86	3.96	4.01	.848	.430
10.1.12 improve recycling	4.15	4.16	4.14	.020	.980
10.1.13 improve environmental compliance	4.20	4.36	4.34	1.579	.208
Economics Factor					
10.2.1 improve company's reputation	4.14	4.18	4.16	.075	.928
10.2.2 improve relationship with investor	4.17	4.22	4.17	.140	.869
10.2.3 improve relationship with customer	4.28	4.36	4.25	.556	.574
10.2.4 improve financial performance	4.36	4.40	4.29	.592	.554
10.2.5 lower the risk of business operation	4.25	4.28	4.14	.815	.444
10.2.6 stimulate the firm's innovation and creative work	4.17	4.22	4.21	.143	.867
10.2.7 help to find easier ways to attract external sources of sponsorship	4.17	4.10	4.26	.867	.422
10.2.8 broaden markets and makes situations for sales increase	4.22	4.30	4.29	.296	.744
10.2.9 lower expenditure	4.26	4.34	4.32	.288	.750
10.2.10 improve raw material conservation	4.13	4.19	4.36	2.628	.074
10.2.11 reduce transportation cost (i.e. fuel cost)	4.34	4.43	4.44	.610	.544
10.2.12 increase in resources usage efficiency (i.e. fuel consumption)	4.31	4.40	4.43	.856	.426
10.2.13 improve product image towards customer	4.18	4.34	4.32	1.693	.186
10.2.14 improve market opportunities	4.28	4.33	4.31	.093	.911
10.2.15 reduce cost of insurance	4.32	4.10	4.12	2.388	.094
Social Factors					
10.3.1 increase motivation of staff	3.92	4.09	4.19	3.519	.167
10.3.2 Improve health and safety of workers at the workplace.	4.07	4.21	4.23	1.526	.220
10.3.3 Improve trust building with local community through openness, transparency and partnership	4.17	4.27	4.19	.434	.648
10.3.4 reduce complaints from local community	4.13	4.07	4.08	.140	.869
10.3.5 help to attract positively motivated employees	4.01	4.12	4.27	3.344	.037
10.3.6 enhance the value of human capital	4.09	4.10	4.29	1.826	.163
10.3.7 improve the contribution of a firm to community development (i.e. job creation and tax	4.03	4.07	4.22	1.651	.194

breaks received)					
Common Method Bias					
X1. We frequently communicate with our suppliers, distributors and partner companies.	4.00	3.85	3.96	.753	.472
X2. We frequently discuss common problems with our suppliers, distributors and partner companies.	3.96	4.07	4.14	1.372	.256
X3. Marketing personnel share close ties with people who work for our suppliers, distributors and partner companies.	3.88	3.94	4.13	2.155	.118
X4. Our relationship with our suppliers, distributors and partner companies is mutually gratifying and highly cohesive.	3.96	3.94	4.16	2.254	.107
X5. We expect that our strong social relationship will exist far into the future with our suppliers, distributors and partner companies.	4.06	4.24	4.25	1.952	.144

Appendix 2.2: Non-response Bias test

Measurement Items	First Wave (N=177) (Mean)	Second Wave (N=62) (Mean)	t-value	Sig. (2 tailed)
Management Commitment				
1.1. You are enthusiastic about pursuing mission of your competitor.	2.57	2.66	-.483	.629
1.2. For the success of a relationship you establish with your competitor, you will be completely supportive.	3.34	3.27	.580	.562
1.3. You are intending to arrange long-term contract (either formal or informal) with your competitor.	3.40	3.35	.357	.721
1.4. You are intending to create or adapt current policy according to the relationship.	3.76	3.56	1.659	.098
1.5. You are willing to create new strategy accordingly to the goal of the relationship.	3.81	3.85	-.418	.676
1.6. You are intending to reconfigure your internal business process accordingly to new business structure.	4.08	3.90	1.679	.094
1.7. You have the ability to extend existing capabilities to encompass new organizational structure.	4.34	4.18	1.536	.126
1.8. You have the ability to apply new knowledge to accomplish goal of the relationship.	3.66	3.58	.610	.542
1.9. You are willing to share core competencies (i.e., core resources) with your competitor.	2.35	2.31	.269	.788
1.10. You are willing to share physical resources, such as delivery vehicle, with your competitor.	2.62	2.68	-.420	.675
Relationship Management				
2.1. In the relationship with your competitor, you are intending to arrange detailed standard operating procedures (e.g. rules, policies, forms, etc.) for the processes of the operation consistency.	3.50	3.50	-.025	.980
2.2. To establish a relationship with your competitor, both companies must have mutual goals and objectives before the relationship establishment.	4.18	4.06	.978	.329
2.3. In a relationship you establish with your competitor, your partner must be honest and reliable.	4.52	4.50	.207	.836
2.4. Meeting on weekly or monthly basis with your competitor will be arranged.	4.16	4.05	1.014	.312
2.5. You are intending to share know-how from work experience with your competitor.	3.98	3.85	.954	.341
2.6. You are enthusiastic about accepting your competitor's organizational culture or working environment.	3.18	3.21	-.254	.800
2.7. You are willing to accept risk, i.e. unforseen events, cost and	3.28	3.21	.569	.570

uncertainties, which are being shared by your competitors.				
Communication Management				
3.1. In the relationship with your competitor, you are intending to arrange the written documents (e.g. handbooks) that spell out detailed tasks, activities and schedule for the cooperation.	3.64	3.60	.391	.696
3.2. In a relationship, you establish with your competitor, internal information must not be used for any other purposes than for the partnership.	4.28	4.26	.170	.865
3.3. In a relationship, you establish with your competitor, you are intending to monitor conflict intensity periodically.	3.82	3.85	-.329	.743
3.4. In a relationship, you establish with your competitor, participants must be willing to share internal and external information.	3.59	3.60	-.033	.974
3.5. You are intending to exchange each other's opinion with your competitor.	3.92	3.92	.016	.988
3.6. You are intending to frequently keep inform of new development (e.g. technological application) with your competitor.	3.79	3.74	.490	.625
3.7. You are intending to implement information technology to exchange information with your competitor.	4.18	4.06	.971	.333
Location of Freight Consolidation Centre				
4.1 You are going to implement freight consolidation, if the location of the freight consolidation centre is close to your manufacture/factory.	3.82	3.84	-.172	.864
4.2 You are going to implement freight consolidation, if the location of the freight consolidation center is close to your customer's facility/warehouse.	3.57	3.77	-1.721	.086
4.3 You are going to implement freight consolidation, if the proper location of freight consolidation center can improve customer service.	4.06	4.11	-.499	.618
4.4 You are going to implement freight consolidation, if the proper location of freight consolidation can improve quantity of sale.	4.13	4.29	-1.718	.087
4.5 You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve inbound and outbound of product.	4.24	4.26	-.193	.847
4.6 You are going to implement freight consolidation, if the proper location of freight consolidation centre can reduce distribution cost.	4.18	4.31	-1.220	.224
4.7 You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve delivery flexibility	4.18	4.19	-.184	.854
4.8 You are going to implement freight consolidation, if the freight consolidation centre can increase the frequency of delivery.	4.26	4.23	.323	.747
4.9 You are going to implement freight consolidation, if the proper location of freight consolidation can improve reliable delivery time.	4.28	4.23	.498	.619
4.10 You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve the flow of product returns.	4.18	4.18	-.021	.983
4.11 You are going to implement freight consolidation, if it can	4.18	4.13	.508	.612

reduce pollutant from vehicle.				
Geographical Coverage				
5.1. You are going to implement freight consolidation, if it can improve on time delivery of each drop-off point.	4.23	4.18	.492	.623
5.2. You are going to implement freight consolidation, if it can increase the number of drop-off point.	4.08	4.08	.042	.967
5.3. You are going to implement freight consolidation, if it increases delivery vehicle zone.	4.07	4.16	-.849	.397
5.4. You are going to implement freight consolidation, if it can reduce travel distance.	4.25	4.35	-1.091	.276
5.5. You are going to implement freight consolidation, if it can reduce fuel consumption.	4.32	4.27	.502	.616
Utilization of Transport Mode				
6.1. You are going to implement freight consolidation centre, if it can reduce transportation cost.	4.39	4.19	1.903	.058
6.2. You are going to implement freight consolidation centre, if it can improve more efficient use of vehicles	4.36	4.23	1.365	.174
6.3. You are going to implement freight consolidation centre, if it can improve the usage of vehicle space.	4.16	4.00	1.572	.117
6.4. You are going to implement freight consolidation, if it can provide for more cost-efficient full load deliveries.	4.12	4.06	.499	.619
6.5. You are going to implement freight consolidation, if it can utilize appropriate mode of transport to reduce fuel consumption.	4.29	4.35	-.565	.572
6.6. You are going to implement freight consolidation centre, if it can reduce the number of delivery vehicle.	4.25	4.32	-.643	.521
6.7. You are going to implement freight consolidation centre, if it can reduce the number of driver.	4.21	4.18	.301	.764
Partner Selection				
7.1. A fair share of benefits to all the partners is essential for a successful cooperation.	4.10	4.21	-1.176	.241
7.2. You intend to find commensurable partner with whom it is possible to cooperate for core activities.	3.66	3.76	-.871	.385
7.3. Partners find it easy to ensure a fair allocation of the shared workload in advance.	3.97	4.10	-1.238	.217
7.4. Goals/objectives of you and your partner’s firm must be compatible.	4.07	4.15	-.714	.476
7.5. You are willing to assess and evaluate your partner’s goals/objective before choosing the partner.	4.03	4.13	-.937	.350
7.6. You concern complementary skills of your partner, e.g. partner’s experience, capabilities, and potential for making real contribution, when you are choosing an alliance partner.	4.13	4.10	.311	.756
7.7. Financial resources of you and your partner must be compatible.	3.97	4.03	-.625	.532
7.8. Internal working environment of you and your partner must be	3.81	3.98	-1.414	.159

compatible.				
7.9. Peer relationship between the top executive of you and your partner's firm must be established.	4.20	4.15	.554	.580
7.10. You are willing to learn a new working environment.	4.08	4.18	-.973	.332
7.11. Commensurate levels of risk must be involved among you and your potential partner.	4.14	4.13	.119	.905
Benefits and Risks Sharing				
8.1. Collaborative freight distribution would reduce the cost of non-core activities, e.g. decrease in empty hauling, of you and your partner's firm.	4.12	4.11	.113	.910
8.2. Collaborative freight distribution will reduce purchasing costs (e.g., truck, on-board computer, fuel etc.) of you and your partner's firm.	4.03	4.05	-.142	.887
8.3. Collaborative freight distribution will offer better quality of service at lower costs, e.g. in term of speed, frequency of deliveries, geographical coverage, reliability of delivery time etc., of you and your partner's firm.	4.14	4.11	.212	.832
8.4. Collaborative freight distribution will help to protect market share of you and your partner's firm.	4.01	3.81	1.804	.072
8.5. You will implement collaborative freight distribution, if it is going to improve sales of you and your partner's firm.	4.05	4.00	.472	.638
8.6. You will implement collaborative freight distribution, if it is going to improve fleet utilization of you and your partner's firm.	4.06	4.03	.235	.814
8.7. You will implement collaborative freight distribution, if it is going to improve on-time delivery of you and your partner's firm.	4.07	4.08	-.129	.897
8.8. You will implement collaborative freight distribution, if it is going reduce delivery lead-time of you and your partner's firm.	4.01	4.00	.052	.958
8.9. You will implement collaborative freight distribution, if it is going to reduce administrative cost of you and your partner's firm.	3.99	3.95	.346	.729
8.10. You will implement collaborative freight distribution, if it is going to reduce driver turn-over of you and your partner's firm.	3.88	3.92	-.344	.731
Advanced Information Technology				
9.1. You are going to implement information technology to share supply chain information such as point of sale, forecasts, purchase order, shipment schedules and status, performance reporting.	3.68	3.81	-1.004	.317
9.2. You are going to implement message based system (i.e. fax, email, sms, EDI).	4.06	4.02	.394	.694
9.3. You are going to implement market based system (i.e. hubs, portals)	3.89	4.00	-.930	.353
9.4.You are going to implement collaborative planning and forecasting based systems (i.e. CPFR)	3.79	3.95	-1.436	.152
9.5. You will implement information technology, if it is going to reduce transportation costs, e.g. eliminate excessive empty backhauls and dwell time, of you and your partner's firm.	4.02	4.26	-2.388	.018
9.6. You will implement information technology, if it is going to	4.06	4.19	-1.310	.191

increase vehicle utilization of you and your partner's firm.				
9.7. You will implement information technology, if it is going to improve services levels, e.g. higher on-time performance, of you and your partner's firm.	4.09	4.24	-1.468	.143
9.8. You will implement information technology, if it is going to fairly increase visibility, e.g. identifying location of freight in the supply chain, of you and your partner's firm.	4.18	4.21	-.311	.756
9.9. You will implement information technology, if it is going to improve end-customer satisfaction, e.g. increase number of perfect order, of you and your partner's firm.	4.14	4.34	-1.898	.059
9.10. You will implement information technology, if it is going to increase revenues, e.g. improve fully load miles, better on shelf performance, and increase order quantity, of you and your partner's firm.	4.08	4.16	-.760	.448
Environmental Factors				
10.1.1 reduce environmental risk (including reduced risk of pollution incidents)	4.15	4.05	1.077	.283
10.1.2 improve conservation of resources	4.18	4.13	.572	.568
10.1.3 enhance ISO 14000 (International organization for standardization 14000 provides tools for organization to monitor and control their environmental impacts and improve their environmental performance)	4.18	4.06	1.084	.279
10.1.4 reduce congestion	4.26	4.23	.369	.713
10.1.5 reduce air pollution	4.24	4.15	1.104	.271
10.1.6 reduce water pollution	3.98	3.89	785	.658
10.1.7 reduce visual pollution	4.07	3.98	.812	.163
10.1.8 reduce odour pollution	3.99	3.81	.443	.427
10.1.9 reduce noise pollution	4.21	4.08	1.401	.259
10.1.10 reduce solid waste	4.02	3.90	.796	.219
10.1.11 reduce liquid waste	3.96	3.87	1.131	.107
10.1.12 improve recycling	4.19	4.05	1.234	.417
10.1.13 improve environmental compliance	4.30	4.26	1.618	.433
Economics Factor				
10.2.1 improve company's reputation	4.15	4.18	-.302	.763
10.2.2 improve relationship with investor	4.17	4.23	-.528	.598
10.2.3 improve relationship with customer	4.33	4.18	1.657	.099
10.2.4 improve financial performance	4.37	4.29	.795	.428
10.2.5 lower the risk of business operation	4.22	4.24	-.206	.837
10.2.6 stimulate the firm's innovation and creative work	4.19	4.21	-.174	.862
10.2.7 help to find easier ways to attract external sources of sponsorship	4.16	4.24	-.794	.428
10.2.8 broaden markets and makes situations for sales increase	4.25	4.29	-.349	.220
10.2.9 lower expenditure	4.33	4.23	1.023	.378
10.2.10 improve raw material conservation	4.23	4.19	.373	.668
10.2.11 reduce transportation cost (i.e. fuel cost)	4.40	4.40	-.076	.837
10.2.12 increase in resources usage efficiency (i.e. fuel consumption)	4.37	4.39	-.205	.940

10.2.13 improve product image towards customer	4.28	4.24	.429	.709
10.2.14 improve market opportunities	4.33	4.24	.884	.307
10.2.15 reduce cost of insurance	4.23	4.10	1.229	.727
Social Factors				
10.3.1 increase motivation of staff	4.08	3.97	1.125	.262
10.3.2 Improve health and safety of workers at the workplace.	4.17	4.15	.253	.800
10.3.3 Improve trust building with local community through openness, transparency and partnership	4.20	4.23	-.278	.781
10.3.4 reduce complaints from local community	4.12	4.03	.821	.412
10.3.5 help to attract positively motivated employees	4.14	4.08	.614	.540
10.3.6 enhance the value of human capital	4.15	4.19	-.445	.657
10.3.7 improve the contribution of a firm to community development (i.e. job creation and tax breaks received)	4.12	4.06	.524	.601
Common Method Bias				
X1. We frequently communicate with our suppliers, distributors and partner companies.	3.95	3.92	.310	.757
X2. We frequently discuss common problems with our suppliers, distributors and partner companies.	4.02	4.13	-.971	.333
X3. Marketing personnel share close ties with people who work for our suppliers, distributors and partner companies.	3.93	4.11	-1.542	.124
X4. Our relationship with our suppliers, distributors and partner companies is mutually gratifying and highly cohesive.	4.00	4.06	-.620	.536
X5. We expect that our strong social relationship will exist far into the future with our suppliers, distributors and partner companies.	4.11	4.34	-2.229	.027

Appendix 2.3: Missing value assessment

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
1.1. You are enthusiastic about pursuing mission of your competitor.	239	100.0%	0	0.0%	239	100.0%
1.2. For the success of a relationship you establish with your competitor, you will be completely supportive.	239	100.0%	0	0.0%	239	100.0%
1.3. You are intending to arrange long-term contract (either formal or informal) with your competitor.	239	100.0%	0	0.0%	239	100.0%
1.4. You are intending to create or adapt current policy according to the relationship.	239	100.0%	0	0.0%	239	100.0%
1.5. You are willing to create new strategy accordingly to the goal of the relationship.	239	100.0%	0	0.0%	239	100.0%
1.6. You are intending to reconfigure your internal business process accordingly to new business structure.	239	100.0%	0	0.0%	239	100.0%
1.7. You have the ability to extend existing capabilities to encompass new organizational structure.	239	100.0%	0	0.0%	239	100.0%
1.8. You have the ability to apply new knowledge to accomplish goal of the relationship.	239	100.0%	0	0.0%	239	100.0%

1.9. You are willing to share core competencies (i.e. core resources) with your competitor.	239	100.0%	0	0.0%	239	100.0%
1.10. You are willing to share physical resources, such as delivery vehicle, with your competitor.	239	100.0%	0	0.0%	239	100.0%
2.1. In the relationship with your competitor, you are intending to arrange detailed standard operating procedures (e.g. rules, policies, forms, etc.) for the processes of the operation consistency.	239	100.0%	0	0.0%	239	100.0%
2.2. To establish a relationship with your competitor, both companies must have mutual goals and objectives before the relationship establishment.	239	100.0%	0	0.0%	239	100.0%
2.3. In a relationship you establish with your competitor, your partner must be honest and reliable.	239	100.0%	0	0.0%	239	100.0%
2.4. Meeting on weekly or monthly basis with your competitor will be arranged.	239	100.0%	0	0.0%	239	100.0%
2.5. You are intending to share know-how from work experience with your competitor.	239	100.0%	0	0.0%	239	100.0%
2.6. You are enthusiastic about accepting your competitor's organizational culture or working environment.	239	100.0%	0	0.0%	239	100.0%

2.7. You are willing to accept risk, i.e. unforseen events, cost and uncertainties, which are being shared by your competitors.	239	100.0%	0	0.0%	239	100.0%
3.1. In the relationship with your competitor, you are intending to arrange the written documents (e.g. handbooks) that spell out detailed tasks, activities and schedule for the cooperation.	239	100.0%	0	0.0%	239	100.0%
3.2. In a relationship, you establish with your competitor, internal information must not be used for any other purposes than for the partnership.	239	100.0%	0	0.0%	239	100.0%
3.3. In a relationship, you establish with your competitor, you are intending to monitor conflict intensity periodically.	239	100.0%	0	0.0%	239	100.0%
3.4. In a relationship, you establish with your competitor, participants must be willing to share internal and external information.	239	100.0%	0	0.0%	239	100.0%
3.5. You are intending to exchange each other's opinion with your competitor.	239	100.0%	0	0.0%	239	100.0%
3.6. You are intending to frequently keep inform of new development (e.g. technological application) with your competitor.	239	100.0%	0	0.0%	239	100.0%
3.7. You are intending to implement information technology to exchange information with your competitor.	239	100.0%	0	0.0%	239	100.0%

4.1 You are going to implement freight consolidation, if the location of the freight consolidation centre is close to your manufacture/factory.	239	100.0%	0	0.0%	239	100.0%
4.2 You are going to implement freight consolidation, if the location of the freight consolidation centre is close to your customer's facility/warehouse.	239	100.0%	0	0.0%	239	100.0%
4.3 You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve customer service.	239	100.0%	0	0.0%	239	100.0%
4.4 You are going to implement freight consolidation, if the proper location of freight consolidation can improve quantity of sale.	239	100.0%	0	0.0%	239	100.0%
4.5 You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve inbound and outbound of product.	239	100.0%	0	0.0%	239	100.0%
4.6 You are going to implement freight consolidation, if the proper location of freight consolidation centre can reduce distribution cost.	239	100.0%	0	0.0%	239	100.0%
4.7 You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve delivery flexibility.	239	100.0%	0	0.0%	239	100.0%

4.8 You are going to implement freight consolidation, if the freight consolidation centre can increase the frequency of delivery.	239	100.0%	0	0.0%	239	100.0%
4.9 You are going to implement freight consolidation, if the proper location of freight consolidation can improve reliable delivery time.	239	100.0%	0	0.0%	239	100.0%
4.10 You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve the flow of product returns.	239	100.0%	0	0.0%	239	100.0%
4.11 You are going to implement freight consolidation, if it can reduce pollutant from vehicle.	239	100.0%	0	0.0%	239	100.0%
5.1. You are going to implement freight consolidation, if it can improve on time delivery of each drop-off point.	239	100.0%	0	0.0%	239	100.0%
5.2. You are going to implement freight consolidation, if it can increase the number of drop-off point.	239	100.0%	0	0.0%	239	100.0%
5.3. You are going to implement freight consolidation, if it increases delivery vehicle zone.	239	100.0%	0	0.0%	239	100.0%
5.4. You are going to implement freight consolidation, if it can reduce travel distance.	239	100.0%	0	0.0%	239	100.0%
5.5. You are going to implement freight consolidation, if it can reduce fuel consumption.	239	100.0%	0	0.0%	239	100.0%

6.1. You are going to implement freight consolidation centre, if it can reduce transportation cost.	239	100.0%	0	0.0%	239	100.0%
6.2. You are going to implement freight consolidation centre, if it can improve more efficient use of vehicles	239	100.0%	0	0.0%	239	100.0%
6.3. You are going to implement freight consolidation centre, if it can improve the usage of vehicle space.	239	100.0%	0	0.0%	239	100.0%
6.4. You are going to implement freight consolidation, if it can provide for more cost-efficient full load deliveries.	239	100.0%	0	0.0%	239	100.0%
6.5. You are going to implement freight consolidation, if it can utilize appropriate mode of transport to reduce fuel consumption.	239	100.0%	0	0.0%	239	100.0%
6.6. You are going to implement freight consolidation centre, if it can reduce the number of delivery vehicle.	239	100.0%	0	0.0%	239	100.0%
6.7. You are going to implement freight consolidation centre, if it can reduce the number of driver.	239	100.0%	0	0.0%	239	100.0%
X1. We frequently communicate with our suppliers, distributors and partner companies.	239	100.0%	0	0.0%	239	100.0%
X2. We frequently discuss common problems with our suppliers, distributors and partner companies.	239	100.0%	0	0.0%	239	100.0%

X3. Marketing personnel share close ties with people who work for our suppliers, distributors and partner companies.	239	100.0%	0	0.0%	239	100.0%
X4. Our relationship with our suppliers, distributors and partner companies is mutually gratifying and highly cohesive.	239	100.0%	0	0.0%	239	100.0%
X5. We expect that our strong social relationship will exist far into the future with our suppliers, distributors and partner companies.	239	100.0%	0	0.0%	239	100.0%
7.1. A fair share of benefits to all the partners is essential for a successful cooperation.	239	100.0%	0	0.0%	239	100.0%
7.2. You intend to find commensurable partner with whom it is possible to cooperate for core activities.	239	100.0%	0	0.0%	239	100.0%
7.3. Partners find it easy to ensure a fair allocation of the shared workload in advance.	239	100.0%	0	0.0%	239	100.0%
7.4. Goals/objectives of you and your partner's firm must be compatible.	239	100.0%	0	0.0%	239	100.0%
7.5. You are willing to assess and evaluate your partner's goals/objective before choosing the partner.	239	100.0%	0	0.0%	239	100.0%
7.6. You concern complementary skills of your partner, e.g. partner's experience, capabilities, and potential for making real contribution, when you are choosing an alliance partner.	239	100.0%	0	0.0%	239	100.0%

7.7. Financial resources of you and your partner must be compatible.	239	100.0%	0	0.0%	239	100.0%
7.8. Internal working environment of you and your partner must be compatible.	239	100.0%	0	0.0%	239	100.0%
7.9. Peer relationship between the top executive of you and your partner's firm must be established.	239	100.0%	0	0.0%	239	100.0%
7.10. You are willing to learn a new working environment.	239	100.0%	0	0.0%	239	100.0%
7.11. Commensurate levels of risk must be involved among you and your potential partner.	239	100.0%	0	0.0%	239	100.0%
8.1. Collaborative freight distribution would reduce the cost of non-core activities, e.g. decrease in empty hauling, of you and your partner's firm.	239	100.0%	0	0.0%	239	100.0%
8.2. Collaborative freight distribution will reduce purchasing costs (e.g., truck, on-board computer, fuel etc.) of you and your partner's firm.	239	100.0%	0	0.0%	239	100.0%
8.3. Collaborative freight distribution will offer better quality of service at lower costs, e.g. in term of speed, frequency of deliveries, geographical coverage, reliability of delivery time etc., of you and your partner's firm.	239	100.0%	0	0.0%	239	100.0%
8.4. Collaborative freight distribution will help to protect market share of you and your partner's firm.	239	100.0%	0	0.0%	239	100.0%

8.5. You will implement collaborative freight distribution, if it is going to improve sales of you and your partner's firm.	239	100.0%	0	0.0%	239	100.0%
8.6. You will implement collaborative freight distribution, if it is going to improve fleet utilization of you and your partner's firm.	239	100.0%	0	0.0%	239	100.0%
8.7. You will implement collaborative freight distribution, if it is going to improve on-time delivery of you and your partner's firm.	239	100.0%	0	0.0%	239	100.0%
8.8. You will implement collaborative freight distribution, if it is going reduce delivery lead-time of you and your partner's firm.	239	100.0%	0	0.0%	239	100.0%
8.9. You will implement collaborative freight distribution, if it is going to reduce administrative cost of you and your partner's firm.	239	100.0%	0	0.0%	239	100.0%
8.10. You will implement collaborative freight distribution, if it is going to reduce driver turn-over of you and your partner's firm.	239	100.0%	0	0.0%	239	100.0%
9.1. You are going to implement information technology to share supply chain information such as point of sale, forecasts, purchase order, shipment schedules and status, performance reporting.	239	100.0%	0	0.0%	239	100.0%

9.2. You are going to implement message based system (i.e. fax, email, sms, EDI).	239	100.0%	0	0.0%	239	100.0%
9.3. You are going to implement market based system (i.e. hubs, portals)	239	100.0%	0	0.0%	239	100.0%
9.4. You are going to implement collaborative planning and forecasting based systems (i.e. CPFR)	239	100.0%	0	0.0%	239	100.0%
9.5. You will implement information technology, if it is going to reduce transportation costs, e.g. eliminate excessive empty backhauls and dwell time, of you and your partner's firm.	239	100.0%	0	0.0%	239	100.0%
9.6. You will implement information technology, if it is going to increase vehicle utilization of you and your partner's firm.	239	100.0%	0	0.0%	239	100.0%
9.7. You will implement information technology, if it is going to improve services levels, e.g. higher on-time performance, of you and your partner's firm.	239	100.0%	0	0.0%	239	100.0%
9.8. You will implement information technology, if it is going to fairly increase visibility, e.g. identifying location of freight in the supply chain, of you and your partner's firm.	239	100.0%	0	0.0%	239	100.0%

9.9. You will implement information technology, if it is going to improve end-customer satisfaction, e.g. increase number of perfect order, of you and your partner's firm.	239	100.0%	0	0.0%	239	100.0%
9.10. You will implement information technology, if it is going to increase revenues, e.g. improve fully load miles, better on shelf performance, and increase order quantity, of you and your partner's firm.	239	100.0%	0	0.0%	239	100.0%
10.1.1 reduce environmental risk (including reduced risk of pollution incidents)	239	100.0%	0	0.0%	239	100.0%
10.1.2 improve conservation of resources	239	100.0%	0	0.0%	239	100.0%
10.1.3 enhance ISO 14000 (International organization for standardization 14000 provides tools for organization to monitor and control their environmental impacts and improve their environmental performance)	239	100.0%	0	0.0%	239	100.0%
10.1.4 reduce congestion	239	100.0%	0	0.0%	239	100.0%
10.1.5 reduce air pollution	239	100.0%	0	0.0%	239	100.0%
10.1.6 reduce water pollution	239	100.0%	0	0.0%	239	100.0%
10.1.7 reduce visual pollution	239	100.0%	0	0.0%	239	100.0%
10.1.8 reduce odor pollution	239	100.0%	0	0.0%	239	100.0%
10.1.9 reduce noise pollution	239	100.0%	0	0.0%	239	100.0%
10.1.10 reduce solid waste	239	100.0%	0	0.0%	239	100.0%
10.1.11 reduce liquid waste	239	100.0%	0	0.0%	239	100.0%
10.1.12 improve recycling	239	100.0%	0	0.0%	239	100.0%

10.1.13 improve environmental compliance	239	100.0%	0	0.0%	239	100.0%
10.2.1 improve company's reputation	239	100.0%	0	0.0%	239	100.0%
10.2.2 improve relationship with investor	239	100.0%	0	0.0%	239	100.0%
10.2.3 improve relationship with customer	239	100.0%	0	0.0%	239	100.0%
10.2.4 improve financial performance	239	100.0%	0	0.0%	239	100.0%
10.2.5 lower the risk of business operation	239	100.0%	0	0.0%	239	100.0%
10.2.6 stimulate the firm's innovation and creative work	239	100.0%	0	0.0%	239	100.0%
10.2.7 help to find easier ways to attract external sources of sponsorship	239	100.0%	0	0.0%	239	100.0%
10.2.8 broaden markets and makes situations for sales increase	239	100.0%	0	0.0%	239	100.0%
10.2.9 lower expenditure	239	100.0%	0	0.0%	239	100.0%
10.2.10 improve raw material conservation	239	100.0%	0	0.0%	239	100.0%
10.2.11 reduce transportation cost (i.e. fuel cost)	239	100.0%	0	0.0%	239	100.0%
10.2.12 increase in resources usage efficiency (i.e. fuel consumption)	239	100.0%	0	0.0%	239	100.0%
10.2.13 improve product image towards customer	239	100.0%	0	0.0%	239	100.0%
10.2.14 improve market opportunities	239	100.0%	0	0.0%	239	100.0%
10.2.15 reduce cost of insurance	239	100.0%	0	0.0%	239	100.0%

10.3.1 increase motivation of staff	239	100.0%	0	0.0%	239	100.0%
10.3.2 Improve health and safety of workers at the workplace.	239	100.0%	0	0.0%	239	100.0%
10.3.3 Improve trust building with local community through openness, transparency and partnership	239	100.0%	0	0.0%	239	100.0%
10.3.4 reduce complaints from local community	239	100.0%	0	0.0%	239	100.0%
10.3.5 help to attract positively motivated employees	239	100.0%	0	0.0%	239	100.0%
10.3.6 enhance the value of human capital	239	100.0%	0	0.0%	239	100.0%
10.3.7 improve the contribution of a firm to community development (i.e. job creation and tax breaks received)	239	100.0%	0	0.0%	239	100.0%

Appendix 2.4: Descriptive Statistics for Multivariate normality assessment (skewness and kurtosis)

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
1.1. You are enthusiastic about pursuing mission of your competitor.	239	2.59	1.270	.116	.157	-1.134	.314
1.2. For the success of a relationship you establish with your competitor, you will be completely supportive.	239	3.33	.821	.295	.157	-.364	.314
1.3. You are intending to arrange long-term contract (either formal or informal) with your competitor.	239	3.39	.876	.438	.157	-.502	.314
1.4. You are intending to create or adapt current policy according to the relationship.	239	3.71	.812	-.515	.157	-.095	.314
1.5. You are willing to create new strategy accordingly to the goal of the relationship.	239	3.82	.759	-.440	.157	.088	.314
1.6. You are intending to reconfigure your internal business process accordingly to new business structure.	239	4.04	.735	-.059	.157	-1.140	.314
1.7. You have the ability to extend existing capabilities to encompass new organizational structure.	239	4.30	.740	-.547	.157	-.996	.314
1.8. You have the ability to apply new knowledge to accomplish goal of the relationship.	239	3.64	.828	.275	.157	-.781	.314
1.9. You are willing to share core competencies (i.e. core resources) with your competitor.	239	2.34	1.103	.339	.157	-.788	.314

1.10. You are willing to share physical resources, such as delivery vehicle, with your competitor.	239	2.64	.901	.125	.157	-.905	.314
2.1. In the relationship with your competitor, you are intending to arrange detailed standard operating procedures (e.g. rules, policies, forms, etc.) for the processes of the operation consistency.	239	3.50	.761	.151	.157	-.336	.314
2.2. To establish a relationship with your competitor, both companies must have mutual goals and objectives before the relationship establishment.	239	4.15	.767	-.256	.157	-1.256	.314
2.3. In a relationship you establish with your competitor, your partner must be honest and reliable.	239	4.51	.647	-.992	.157	-.128	.314
2.4. Meeting on weekly or monthly basis with your competitor will be arranged.	239	4.13	.772	-.235	.157	-1.284	.314
2.5. You are intending to share know-how from work experience with your competitor.	239	3.95	.870	-.434	.157	-.372	.314
2.6. You are enthusiastic about accepting your competitor's organizational culture or working environment.	239	3.18	.921	.114	.157	-.899	.314
2.7. You are willing to accept risk, i.e. unforseen events, cost and uncertainties, which are being shared by your competitors.	239	3.26	.799	.196	.157	-.404	.314
3.1. In the relationship with your competitor, you are intending to arrange the written documents (e.g. handbooks) that spell out detailed tasks, activities and schedule for the cooperation.	239	3.63	.819	.125	.157	-.646	.314

3.2. In a relationship, you establish with your competitor, internal information must not be used for any other purposes than for the partnership.	239	4.27	.748	-.491	.157	-1.069	.314
3.3. In a relationship, you establish with your competitor, you are intending to monitor conflict intensity periodically.	239	3.83	.733	-.300	.157	-.042	.314
3.4. In a relationship, you establish with your competitor, participants must be willing to share internal and external information.	239	3.59	.738	.240	.157	-.432	.314
3.5. You are intending to exchange each other's opinion with your competitor.	239	3.92	.672	.094	.157	-.777	.314
3.6. You are intending to frequently keep inform of new development (e.g. technological application) with your competitor.	239	3.78	.678	-.432	.157	.399	.314
3.7. You are intending to implement information technology to exchange information with your competitor.	239	4.15	.772	-.259	.157	-1.279	.314
4.1 You are going to implement freight consolidation, if the location of the freight consolidation centre is close to your manufacture/factory.	239	3.82	.769	-.080	.157	-.573	.314
4.2 You are going to implement freight consolidation, if the location of the freight consolidation centre is close to your customer's facility/warehouse.	239	3.62	.805	-.237	.157	-.364	.314
4.3 You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve customer	239	4.08	.688	-.098	.157	-.875	.314

service.							
4.4 You are going to implement freight consolidation, if the proper location of freight consolidation can improve quantity of sale.	239	4.17	.635	-.159	.157	-.589	.314
4.5 You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve inbound and outbound of product.	239	4.24	.727	-.408	.157	-1.027	.314
4.6 You are going to implement freight consolidation, if the proper location of freight consolidation centre can reduce distribution cost.	239	4.21	.698	-.319	.157	-.926	.314
4.7 You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve delivery flexibility.	239	4.18	.678	-.237	.157	-.830	.314
4.8 You are going to implement freight consolidation, if the freight consolidation centre can increase the frequency of delivery.	239	4.25	.713	-.408	.157	-.963	.314
4.9 You are going to implement freight consolidation, if the proper location of freight consolidation can improve reliable delivery time.	239	4.26	.693	-.405	.157	-.880	.314
4.10 You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve the flow of product returns.	239	4.18	.718	-.274	.157	-1.027	.314
4.11 You are going to implement freight consolidation, if it can reduce pollutant from vehicle.	239	4.17	.690	-.232	.157	-.893	.314

5.1. You are going to implement freight consolidation, if it can improve on time delivery of each drop-off point.	239	4.21	.668	-.274	.157	-.785	.314
5.2. You are going to implement freight consolidation, if it can increase the number of drop-off point.	239	4.08	.662	-.092	.157	-.712	.314
5.3. You are going to implement freight consolidation, if it increases delivery vehicle zone.	239	4.10	.700	-.135	.157	-.950	.314
5.4. You are going to implement freight consolidation, if it can reduce travel distance.	239	4.28	.660	-.368	.157	-.755	.314
5.5. You are going to implement freight consolidation, if it can reduce fuel consumption.	239	4.31	.645	-.396	.157	-.703	.314
6.1. You are going to implement freight consolidation centre, if it can reduce transportation cost.	239	4.34	.703	-.584	.157	-.818	.314
6.2. You are going to implement freight consolidation centre, if it can improve more efficient use of vehicles	239	4.33	.675	-.503	.157	-.766	.314
6.3. You are going to implement freight consolidation centre, if it can improve the usage of vehicle space.	239	4.12	.709	-.178	.157	-.993	.314
6.4. You are going to implement freight consolidation, if it can provide for more cost-efficient full load deliveries.	239	4.10	.734	-.166	.157	-1.127	.314
6.5. You are going to implement freight consolidation, if it can utilize appropriate mode of transport to reduce fuel consumption.	239	4.31	.731	-.555	.157	-.952	.314

6.6. You are going to implement freight consolidation centre, if it can reduce the number of delivery vehicle.	239	4.27	.720	-.459	.157	-.969	.314
6.7. You are going to implement freight consolidation centre, if it can reduce the number of driver.	239	4.20	.711	-.312	.157	-.987	.314
X1. We frequently communicate with our suppliers, distributors and partner companies.	239	3.95	.773	.094	.157	-1.318	.314
X2. We frequently discuss common problems with our suppliers, distributors and partner companies.	239	4.05	.743	-.081	.157	-1.178	.314
X3. Marketing personnel share close ties with people who work for our suppliers, distributors and partner companies.	239	3.98	.796	-.416	.157	-.311	.314
X4. Our relationship with our suppliers, distributors and partner companies is mutually gratifying and highly cohesive.	239	4.02	.704	-.023	.157	-.969	.314
X5. We expect that our strong social relationship will exist far into the future with our suppliers, distributors and partner companies.	239	4.17	.692	-.241	.157	-.903	.314
7.1. A fair share of benefits to all the partners is essential for a successful cooperation.	239	4.13	.655	-.135	.157	-.685	.314
7.2. You intend to find commensurable partner with whom it is possible to cooperate for core activities.	239	3.69	.754	-.356	.157	-.068	.314
7.3. Partners find it easy to ensure a fair allocation of the shared workload in advance.	239	4.00	.716	.000	.157	-1.038	.314
7.4. Goals/objectives of you and your partner’s firm must be	239	4.09	.680	-.115	.157	-.828	.314

compatible.							
7.5. You are willing to assess and evaluate your partner's goals/objective before choosing the partner.	239	4.05	.728	-.084	.157	-1.104	.314
7.6. You concern complementary skills of your partner, e.g. partner's experience, capabilities, and potential for making real contribution, when you are choosing an alliance partner.	239	4.12	.720	-.186	.157	-1.053	.314
7.7. Financial resources of you and your partner must be compatible.	239	3.98	.716	.025	.157	-1.036	.314
7.8. Internal working environment of you and your partner must be compatible.	239	3.86	.818	-.290	.157	-.463	.314
7.9. Peer relationship between the top executive of you and your partner's firm must be established.	239	4.19	.712	-.290	.157	-.994	.314
7.10. You are willing to learn a new working environment.	239	4.11	.646	-.105	.157	-.610	.314
7.11. Commensurate levels of risk must be involved among you and your potential partner.	239	4.14	.693	-.191	.157	-.911	.314
8.1. Collaborative freight distribution would reduce the cost of non-core activities, e.g. decrease in empty hauling, of you and your partner's firm.	239	4.12	.684	-.159	.157	-.860	.314
8.2. Collaborative freight distribution will reduce purchasing costs (e.g., truck, on-board computer, fuel etc.) of you and your partner's firm.	239	4.04	.688	-.049	.157	-.873	.314

8.3. Collaborative freight distribution will offer better quality of service at lower costs, e.g. in term of speed, frequency of deliveries, geographical coverage, reliability of delivery time etc., of you and your partner's firm.	239	4.13	.725	-.202	.157	-1.073	.314
8.4. Collaborative freight distribution will help to protect market share of you and your partner's firm.	239	3.95	.752	-.104	.157	-.780	.314
8.5. You will implement collaborative freight distribution, if it is going to improve sales of you and your partner's firm.	239	4.04	.730	-.058	.157	-1.110	.314
8.6. You will implement collaborative freight distribution, if it is going to improve fleet utilization of you and your partner's firm.	239	4.05	.696	-.068	.157	-.924	.314
8.7. You will implement collaborative freight distribution, if it is going to improve on-time delivery of you and your partner's firm.	239	4.07	.673	-.085	.157	-.781	.314
8.8. You will implement collaborative freight distribution, if it is going reduce delivery lead-time of you and your partner's firm.	239	4.00	.730	-.006	.157	-1.116	.314
8.9. You will implement collaborative freight distribution, if it is going to reduce administrative cost of you and your partner's firm.	239	3.98	.724	.032	.157	-1.084	.314
8.10. You will implement collaborative freight distribution, if it is going to reduce driver turn-over of you and your partner's	239	3.89	.748	-.063	.157	-.674	.314

firm.							
9.1. You are going to implement information technology to share supply chain information such as point of sale, forecasts, purchase order, shipment schedules and status, performance reporting.	239	3.71	.867	-.416	.157	-.407	.314
9.2. You are going to implement message based system (i.e. fax, email, sms, EDI).	239	4.05	.694	-.061	.157	-.908	.314
9.3. You are going to implement market based system (i.e. hubs, portals)	239	3.92	.782	-.232	.157	-.534	.314
9.4. You are going to implement collaborative planning and forecasting based systems (i.e. CPFR)	239	3.83	.760	-.231	.157	-.284	.314
9.5. You will implement information technology, if it is going to reduce transportation costs, e.g. eliminate excessive empty backhauls and dwell time, of you and your partner's firm.	239	4.08	.675	-.101	.157	-.794	.314
9.6. You will implement information technology, if it is going to increase vehicle utilization of you and your partner's firm.	239	4.09	.710	-.134	.157	-1.003	.314
9.7. You will implement information technology, if it is going to improve services levels, e.g. higher on-time performance, of you and your partner's firm.	239	4.13	.701	-.185	.157	-.953	.314

9.8. You will implement information technology, if it is going to fairly increase visibility, e.g. identifying location of freight in the supply chain, of you and your partner's firm.	239	4.18	.750	-.316	.157	-1.164	.314
9.9. You will implement information technology, if it is going to improve end-customer satisfaction, e.g. increase number of perfect order, of you and your partner's firm.	239	4.19	.729	-.307	.157	-1.073	.314
9.10. You will implement information technology, if it is going to increase revenues, e.g. improve fully load miles, better on shelf performance, and increase order quantity, of you and your partner's firm.	239	4.10	.732	-.158	.157	-1.117	.314
10.1.1 reduce environmental risk (including reduced risk of pollution incidents)	239	4.12	.620	-.084	.157	-.438	.314
10.1.2 improve conservation of resources	239	4.17	.613	-.110	.157	-.443	.314
10.1.3 enhance ISO 14000 (International organization for standardization 14000 provides tools for organization to monitor and control their environmental impacts and improve their environmental performance)	239	4.15	.692	-.202	.157	-.902	.314
10.1.4 reduce congestion	239	4.25	.625	-.239	.157	-.615	.314
10.1.5 reduce air pollution	239	4.21	.566	-.001	.157	-.268	.314
10.1.6 reduce water pollution	239	3.95	.779	-.242	.157	-.581	.314
10.1.7 reduce visual pollution	239	4.05	.700	-.063	.157	-.944	.314
10.1.8 reduce odour pollution	239	3.95	.789	-.368	.157	-.318	.314
10.1.9 reduce noise pollution	239	4.18	.706	-.263	.157	-.972	.314

10.1.10 reduce solid waste	239	3.99	.716	.012	.157	-1.037	.314
10.1.11 reduce liquid waste	239	3.94	.762	-.239	.157	-.458	.314
10.1.12 improve recycling	239	4.15	.669	-.183	.157	-.778	.314
10.1.13 improve environmental compliance	239	4.29	.632	-.321	.157	-.666	.314
10.2.1 improve company's reputation	239	4.15	.684	-.206	.157	-.860	.314
10.2.2 improve relationship with investor	239	4.18	.722	-.292	.157	-1.041	.314
10.2.3 improve relationship with customer	239	4.29	.640	-.350	.157	-.690	.314
10.2.4 improve financial performance	239	4.35	.655	-.504	.157	-.699	.314
10.2.5 lower the risk of business operation	239	4.23	.709	-.355	.157	-.967	.314
10.2.6 stimulate the firm's innovation and creative work	239	4.20	.685	-.273	.157	-.868	.314
10.2.7 help to find easier ways to attract external sources of sponsorship	239	4.18	.714	-.278	.157	-1.007	.314
10.2.8 broaden markets and makes situations for sales increase	239	4.26	.699	-.414	.157	-.902	.314
10.2.9 lower expenditure	239	4.31	.712	-.521	.157	-.900	.314
10.2.10 improve raw material conservation	239	4.22	.690	-.322	.157	-.885	.314
10.2.11 reduce transportation cost (i.e. fuel cost)	239	4.40	.690	-.711	.157	-.655	.314
10.2.12 increase in resources usage efficiency (i.e. fuel consumption)	239	4.37	.654	-.562	.157	-.663	.314
10.2.13 improve product image towards customer	239	4.27	.639	-.311	.157	-.683	.314
10.2.14 improve market opportunities	239	4.31	.657	-.417	.157	-.735	.314

10.2.15 reduce cost of insurance	239	4.19	.713	-.299	.157	-1.001	.314
10.3.1 increase motivation of staff	239	4.05	.705	-.077	.157	-.975	.314
10.3.2 Improve health and safety of workers at the workplace.	239	4.16	.650	-.174	.157	-.673	.314
10.3.3 Improve trust building with local community through openness, transparency and partnership	239	4.21	.683	-.284	.157	-.856	.314
10.3.4 reduce complaints from local community	239	4.10	.712	-.142	.157	-1.015	.314
10.3.5 help to attract positively motivated employees	239	4.13	.668	-.149	.157	-.764	.314
10.3.6 enhance the value of human capital	239	4.16	.710	-.239	.157	-.995	.314
10.3.7 improve the contribution of a firm to community development (i.e. job creation and tax breaks received)	239	4.10	.699	-.146	.157	-.943	.314
Valid N (listwise)	239						

Appendix 2.5: 5% Trimmed Mean table

Measurement Items	Mean	5% Trimmed Mean	Difference between Mean and 5% Trimmed Mean
Management Commitment			
You are enthusiastic about pursuing mission of your competitor.	2.59	2.55	0.04
1.2. For the success of a relationship you establish with your competitor, you will be completely supportive.	3.33	3.31	0.02
1.3. You are intending to arrange long-term contract (either formal or informal) with your competitor.	3.39	3.38	0.01
1.4. You are intending to create or adapt current policy according to the relationship.	3.71	3.73	-0.02
1.5. You are willing to create new strategy accordingly to the goal of the relationship.	3.82	3.86	-0.04
1.6. You are intending to reconfigure your internal business process accordingly to new business structure.	4.04	4.04	0
1.7. You have the ability to extend existing capabilities to encompass new organizational structure.	4.30	4.33	-0.03
1.8. You have the ability to apply new knowledge to accomplish goal of the relationship.	3.64	3.65	-0.01
1.9. You are willing to share core competencies (i.e. core resources) with your competitor.	2.34	2.29	0.05
1.10. You are willing to share physical resources, such as delivery vehicle, with your competitor.	2.64	2.65	-0.01
Relationship Management			0
2.1. In the relationship with your competitor, you are intending to arrange detailed standard operating procedures (e.g. rules, policies, forms, etc.) for the processes of the operation consistency.	3.50	3.50	0
2.2. To establish a relationship with your competitor, both companies must have mutual goals and objectives before the relationship establishment.	4.15	4.05	0.1
2.3. In a relationship you establish with your competitor, your partner must be honest and reliable.	4.51	4.57	-0.06
2.4. Meeting on weekly or monthly basis with your competitor will be arranged.	4.13	4.15	-0.02
2.5. You are intending to share know-how from work experience with your competitor.	3.95	4.00	-0.05
2.6. You are enthusiastic about accepting your competitor's organizational culture or working environment.	3.18	3.15	0.03

2.7. You are willing to accept risk, i.e. unforseen events, cost and uncertainties, which are being shared by your competitors.	3.26	3.23	0.03
Communication Management			0
3.1. In the relationship with your competitor, you are intending to arrange the written documents (e.g. handbooks) that spell out detailed tasks, activities and schedule for the cooperation.	3.63	3.65	-0.02
3.2. In a relationship, you establish with your competitor, internal information must not be used for any other purposes than for the partnership.	4.27	4.30	-0.03
3.3. In a relationship, you establish with your competitor, you are intending to monitor conflict intensity periodically.	3.83	3.85	-0.02
3.4. In a relationship, you establish with your competitor, participants must be willing to share internal and external information.	3.59	3.59	0
3.5. You are intending to exchange each other's opinion with your competitor.	3.92	3.91	0.01
3.6. You are intending to frequently keep inform of new development (e.g. technological application) with your competitor.	3.78	3.80	-0.02
3.7. You are intending to implement information technology to exchange information with your competitor.	4.15	4.16	-0.01
Location of Freight Consolidation Centre			0
4.1 You are going to implement freight consolidation, if the location of the freight consolidation centre is close to your manufacture/factory.	3.82	3.84	-0.02
4.2 You are going to implement freight consolidation, if the location of the freight consolidation centre is close to your customer's facility/warehouse.	3.62	3.64	-0.02
4.3 You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve customer service.	4.08	4.08	0
4.4 You are going to implement freight consolidation, if the proper location of freight consolidation can improve quantity of sale.	4.17	4.19	-0.02
4.5 You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve inbound and outbound of product.	4.24	4.27	-0.03
4.6 You are going to implement freight consolidation, if the proper location of freight consolidation centre can reduce distribution cost.	4.21	4.24	-0.03
4.7 You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve delivery flexibility	4.18	4.20	-0.02
4.8 You are going to implement freight consolidation, if the freight consolidation centre can increase the frequency of delivery.	4.25	4.28	-0.03
4.9 You are going to implement freight consolidation, if the proper location of freight consolidation can improve reliable delivery time.	4.26	4.29	-0.03
4.10 You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve the flow of product returns.	4.18	4.20	-0.02
4.11 You are going to implement freight consolidation, if it can reduce pollutant from vehicle.	4.17	4.19	-0.02
Geographical Coverage			0
5.1. You are going to implement freight consolidation, if it can improve on	4.21	4.24	-0.03

time delivery of each drop-off point.			
5.2. You are going to implement freight consolidation, if it can increase the number of drop-off point.	4.08	4.09	-0.01
5.3. You are going to implement freight consolidation, if it increases delivery vehicle zone.	4.10	4.11	-0.01
5.4. You are going to implement freight consolidation, if it can reduce travel distance.	4.28	4.31	-0.03
5.5. You are going to implement freight consolidation, if it can reduce fuel consumption.	4.31	4.34	-0.03
Utilization of Transport Mode			0
6.1. You are going to implement freight consolidation centre, if it can reduce transportation cost.	4.34	4.38	-0.04
6.2. You are going to implement freight consolidation centre, if it can improve more efficient use of vehicles	4.33	4.36	-0.03
6.3. You are going to implement freight consolidation centre, if it can improve the usage of vehicle space.	4.12	4.13	-0.01
6.4. You are going to implement freight consolidation, if it can provide for more cost-efficient full load deliveries.	4.10	4.12	-0.02
6.5. You are going to implement freight consolidation, if it can utilize appropriate mode of transport to reduce fuel consumption.	4.31	4.34	-0.03
6.6. You are going to implement freight consolidation centre, if it can reduce the number of delivery vehicle.	4.27	4.30	-0.03
6.7. You are going to implement freight consolidation centre, if it can reduce the number of driver.	4.20	4.22	-0.02
Partner Selection			0
7.1. A fair share of benefits to all the partners is essential for a successful cooperation.	4.13	4.14	-0.01
7.2. You intend to find commensurable partner with whom it is possible to cooperate for core activities.	3.69	3.71	-0.02
7.3. Partners find it easy to ensure a fair allocation of the shared workload in advance.	4.00	4.00	0
7.4. Goals/objectives of you and your partner’s firm must be compatible.	4.09	4.10	-0.01
7.5. You are willing to assess and evaluate your partner’s goals/objective before choosing the partner.	4.05	4.06	-0.01
7.6. You concern complementary skills of your partner, e.g. partner’s experience, capabilities, and potential for making real contribution, when you are choosing an alliance partner.	4.12	4.13	-0.01
7.7. Financial resources of you and your partner must be compatible.	3.98	3.98	0
7.8. Internal working environment of you and your partner must be compatible.	3.86	3.90	-0.04
7.9. Peer relationship between the top executive of you and your partner’s firm must be established.	4.19	4.21	-0.02
7.10. You are willing to learn a new working environment.	4.11	4.12	-0.01
7.11. Commensurate levels of risk must be involved among you and your	4.14	4.15	-0.01

potential partner.			
Benefits and Risks Sharing			0
8.1. Collaborative freight distribution would reduce the cost of non-core activities, e.g. decrease in empty hauling, of you and your partner's firm.	4.12	4.13	-0.01
8.2. Collaborative freight distribution will reduce purchasing costs (e.g., truck, on-board computer, fuel, etc.) of you and your partner's firm.	4.04	4.04	0
8.3. Collaborative freight distribution will offer better quality of service at lower costs, e.g. in term of speed, frequency of deliveries, geographical coverage, reliability of delivery time etc., of you and your partner's firm.	4.13	4.14	-0.01
8.4. Collaborative freight distribution will help to protect market share of you and your partner's firm.	3.95	3.96	-0.01
8.5. You will implement collaborative freight distribution, if it is going to improve sales of you and your partner's firm.	4.04	4.04	0
8.6. You will implement collaborative freight distribution, if it is going to improve fleet utilization of you and your partner's firm.	4.05	4.06	-0.01
8.7. You will implement collaborative freight distribution, if it is going to improve on-time delivery of you and your partner's firm.	4.07	4.08	-0.01
8.8. You will implement collaborative freight distribution, if it is going reduce delivery lead-time of you and your partner's firm.	4.00	4.00	0
8.9. You will implement collaborative freight distribution, if it is going to reduce administrative cost of you and your partner's firm.	3.98	3.98	0
8.10. You will implement collaborative freight distribution, if it is going to reduce driver turn-over of you and your partner's firm.	3.89	3.90	-0.01
Advanced Information Technology			0
9.1. You are going to implement information technology to share supply chain information such as point of sale, forecasts, purchase order, shipment schedules and status, performance reporting.	3.71	3.73	-0.02
9.2. You are going to implement message based system (i.e. fax, email, sms, EDI).	4.05	4.05	0
9.3. You are going to implement market based system (i.e. hubs, portals)	3.92	3.94	-0.02
9.4.You are going to implement collaborative planning and forecasting based systems (i.e. CPFR)	3.83	3.86	-0.03
9.5. You will implement information technology, if it is going to reduce transportation costs, e.g. eliminate excessive empty backhauls and dwell time, of you and your partner's firm.	4.08	4.09	-0.01
9.6. You will implement information technology, if it is going to increase vehicle utilization of you and your partner's firm.	4.09	4.10	-0.01
9.7. You will implement information technology, if it is going to improve services levels, e.g. higher on-time performance, of you and your partner's firm.	4.13	4.14	-0.01
9.8. You will implement information technology, if it is going to fairly increase visibility, e.g. identifying location of freight in the supply chain, of you and your partner's firm.	4.18	4.20	-0.02
9.9. You will implement information technology, if it is going to improve end-customer satisfaction, e.g. increase number of perfect order, of you and your	4.19	4.21	-0.02

partner's firm.			
9.10. You will implement information technology, if it is going to increase revenues, e.g. improve fully load miles, better on shelf performance, and increase order quantity, of you and your partner's firm.	4.10	4.11	-0.01
Environmental Factors			0
10.1.1 reduce environmental risk (including reduced risk of pollution incidents)	4.12	4.13	-0.01
10.1.2 improve conservation of resources	4.17	4.19	-0.02
10.1.3 enhance ISO 14000 (International organization for standardization 14000 provides tools for organization to monitor and control their environmental impacts and improve their environmental performance)	4.15	4.16	-0.01
10.1.4 reduce congestion	4.25	4.28	-0.03
10.1.5 reduce air pollution	4.21	4.24	-0.03
10.1.6 reduce water pollution	3.95	3.98	-0.03
10.1.7 reduce visual pollution	4.05	4.05	0
10.1.8 reduce odour pollution	3.95	3.98	-0.03
10.1.9 reduce noise pollution	4.18	4.20	-0.02
10.1.10 reduce solid waste	3.99	3.99	0
10.1.11 reduce liquid waste	3.94	3.96	-0.02
10.1.12 improve recycling	4.15	4.17	-0.02
10.1.13 improve environmental compliance	4.29	4.32	-0.03
Economics Factor			0
10.2.1 improve company's reputation	4.15	4.17	-0.02
10.2.2 improve relationship with investor	4.18	4.20	-0.02
10.2.3 improve relationship with customer	4.29	4.33	-0.04
10.2.4 improve financial performance	4.35	4.39	-0.04
10.2.5 lower the risk of business operation	4.23	4.25	-0.02
10.2.6 stimulate the firm's innovation and creative work	4.20	4.22	-0.02
10.2.7 help to find easier ways to attract external sources of sponsorship	4.18	4.20	-0.02
10.2.8 broaden markets and makes situations for sales increase	4.26	4.29	-0.03
10.2.9 lower expenditure	4.31	4.34	-0.03
10.2.10 improve raw material conservation	4.22	4.25	-0.03
10.2.11 reduce transportation cost (i.e. fuel cost)	4.40	4.44	-0.04
10.2.12 increase in resources usage efficiency (i.e. fuel consumption)	4.37	4.41	-0.04
10.2.13 improve product image towards customer	4.27	4.30	-0.03
10.2.14 improve market opportunities	4.31	4.34	-0.03
10.2.15 reduce cost of insurance	4.19	4.21	-0.02
Social Factors			0
10.3.1 increase motivation of staff	4.05	4.06	-0.01
10.3.2 Improve health and safety of workers at the workplace.	4.16	4.18	-0.02
10.3.3 Improve trust building with local community through openness, transparency and partnership	4.21	4.23	-0.02
10.3.4 reduce complaints from local community	4.10	4.11	-0.01

10.3.5 help to attract positively motivated employees	4.13	4.14	-0.01
10.3.6 enhance the value of human capital	4.16	4.18	-0.02
10.3.7 improve the contribution of a firm to community development (i.e. job creation and tax breaks received)	4.10	4.12	-0.02
Common Method Bias			0
X1. We frequently communicate with our suppliers, distributors and partner companies.	3.95	3.94	0.01
X2. We frequently discuss common problems with our suppliers, distributors and partner companies.	4.05	4.06	-0.01
X3. Marketing personnel share close ties with people who work for our suppliers, distributors and partner companies.	3.98	4.02	-0.04
X4. Our relationship with our suppliers, distributors and partner companies is mutually gratifying and highly cohesive.	4.02	4.02	0
X5. We expect that our strong social relationship will exist far into the future with our suppliers, distributors and partner companies.	4.17	4.19	-0.02

Appendix 2.6: Standard score for testing multivariate outliers

Descriptive Statistics				
	N	Minimum	Maximum	Mean
Z score: 1.1. You are enthusiastic about pursuing mission of your competitor.	239	-1.25562	1.89496	.0000000
Z score: 1.2.For the success of a relationship you establish with your competitor, you will be completely supportive.	239	-1.61493	2.03776	.0000000
Z score: 1.3.You are intending to arrange long-term contract (either formal or informal) with your competitor.	239	-1.58499	1.83802	.0000000
Z score: 1.4.You are intending to create or adapt current policy according to the relationship.	239	-2.10646	1.58629	.0000000
Z score: 1.5.You are willing to create new strategy accordingly to the goal of the relationship.	239	-2.39664	1.55368	.0000000
Z score: 1.6.You are intending to reconfigure your internal business process accordingly to new business structure.	239	-1.41130	1.30886	.0000000
Z score: 1.7.You have the ability to extend existing capabilities to encompass new organizational structure.	239	-1.75858	.94432	.0000000
Z score: 1.8. You have the ability to apply new knowledge to accomplish goal of the relationship.	239	-1.97485	1.64655	.0000000
Z score: 1.9. You are willing to share core competencies (i.e. core resources) with your competitor.	239	-1.21389	2.41261	.0000000
Z score: 1.10. You are willing to share physical resources, such as delivery vehicle, with your competitor.	239	-1.81517	1.51341	.0000000
Z score: 2.1. In the relationship with your competitor, you are intending to arrange detailed standard operating procedures (e.g. rules, policies, forms, etc.) for the processes of the operation consistency.	239	-1.96893	1.97443	.0000000
Z score: 2.2. To establish a relationship with your competitor, both companies must have mutual goals and objectives before the relationship establishment.	239	-1.49545	1.11340	.0000000
Z score: 2.3. In a relationship you establish with your competitor, your partner must be honest and reliable.	239	-2.34021	.74990	.0000000
Z score: 2.4. Meeting on weekly or monthly basis with your competitor will be arranged.	239	-1.46944	1.12241	.0000000
Z score: 2.5. You are intending to share know-how from work experience with your competitor.	239	-2.38434	1.21144	.0000000
Z score: 2.6. You are enthusiastic about accepting your competitor’s organizational culture or working environment.	239	-2.37134	1.97157	.0000000
Z score: 2.7. You are willing to accept risk, i.e. unforseen events, cost and uncertainties, which are being shared by your competitors.	239	-1.57636	2.17862	.0000000
Z score: 3.1. In the relationship with your competitor, you are intending to arrange the written documents (e.g. handbooks) that spell out detailed tasks, activities and schedule for the cooperation.	239	-1.99270	1.67080	.0000000

Z score: 3.2. In a relationship, you establish with your competitor, internal information must not be used for any other purposes than for the partnership.	239	-1.69947	.97272	.0000000
Z score: 3.3. In a relationship, you establish with your competitor, you are intending to monitor conflict intensity periodically.	239	-2.49358	1.59772	.0000000
Z score: 3.4. In a relationship, you establish with your competitor, participants must be willing to share internal and external information.	239	-2.16003	1.90491	.0000000
Z score: 3.5. You are intending to exchange each other’s opinion with your competitor.	239	-1.36971	1.60630	.0000000
Z score: 3.6. You are intending to frequently keep inform of new development (e.g. technological application) with your competitor.	239	-2.62467	1.80330	.0000000
Z score: 3.7. You are intending to implement information technology to exchange information with your competitor.	239	-1.48487	1.10553	.0000000
Z score: 4.1 You are going to implement freight consolidation, if the location of the freight consolidation centre is close to your manufacture/factory.	239	-2.37331	1.52959	.0000000
Z score: 4.2 You are going to implement freight consolidation, if the location of the freight consolidation centre is close to your customer’s facility/warehouse.	239	-2.01748	1.71070	.0000000
Z score: 4.3 You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve customer service.	239	-1.56304	1.34409	.0000000
Z score: 4.4 You are going to implement freight consolidation, if the proper location of freight consolidation can improve quantity of sale.	239	-1.84497	1.30466	.0000000
Z score: 4.5 You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve inbound and outbound of product.	239	-1.70841	1.04115	.0000000
Z score: 4.6 You are going to implement freight consolidation, if the proper location of freight consolidation centre can reduce distribution cost.	239	-1.73716	1.12616	.0000000
Z score: 4.7 You are going to implement freight consolidation, if the proper location of freight consolidation centre can improve delivery flexibility.	239	-1.74141	1.21034	.0000000
Z score: 4.8 You are going to implement freight consolidation, if the freight consolidation centre can increase the frequency of delivery.	239	-1.75502	1.05066	.0000000
Z score: 4.9 You are going to implement freight consolidation, if the proper location of freight consolidation can improve reliable delivery time.	239	-1.82262	1.06219	.0000000
Z score: 4.10 You are going to implement freight consolidation,	239	-1.63801	1.14836	.0000000

if the proper location of freight consolidation centre can improve the flow of product returns.				
Z score: 4.11 You are going to implement freight consolidation, if it can reduce pollutant from vehicle.	239	-1.69188	1.20675	.0000000
Z score: 5.1. You are going to implement freight consolidation, if it can improve on time delivery of each drop-off point.	239	-1.81717	1.17803	.0000000
Z score: 5.2. You are going to implement freight consolidation, if it can increase the number of drop-off point.	239	-1.63679	1.38401	.0000000
Z score: 5.3. You are going to implement freight consolidation, if it increases delivery vehicle zone.	239	-1.56493	1.29017	.0000000
Z score: 5.4. You are going to implement freight consolidation, if it can reduce travel distance.	239	-1.93262	1.09621	.0000000
Z score: 5.5. You are going to implement freight consolidation, if it can reduce fuel consumption.	239	-2.02967	1.06995	.0000000
Z score: 6.1. You are going to implement freight consolidation centre, if it can reduce transportation cost.	239	-1.90517	.94068	.0000000
Z score: 6.2. You are going to implement freight consolidation centre, if it can improve more efficient use of vehicles	239	-1.96403	.99750	.0000000
Z score: 6.3. You are going to implement freight consolidation centre, if it can improve the usage of vehicle space.	239	-1.58262	1.24011	.0000000
Z score: 6.4. You are going to implement freight consolidation, if it can provide for more cost-efficient full load deliveries.	239	-1.50396	1.21912	.0000000
Z score: 6.5. You are going to implement freight consolidation, if it can utilize appropriate mode of transport to reduce fuel consumption.	239	-1.79219	.94476	.0000000
Z score: 6.6. You are going to implement freight consolidation centre, if it can reduce the number of delivery vehicle.	239	-1.76703	1.01139	.0000000
Z score: 6.7. You are going to implement freight consolidation centre, if it can reduce the number of driver.	239	-1.68862	1.12378	.0000000
Z score: X1. We frequently communicate with our suppliers, distributors and partner companies.	239	-1.22295	1.36364	.0000000
Z score: X2. We frequently discuss common problems with our suppliers, distributors and partner companies.	239	-1.41342	1.27827	.0000000
Z score: X3. Marketing personnel share close ties with people who work for our suppliers, distributors and partner companies.	239	-2.48550	1.28216	.0000000
Z score: X4. Our relationship with our suppliers, distributors and partner companies is mutually gratifying and highly cohesive.	239	-1.44437	1.39682	.0000000
Z score: X5. We expect that our strong social relationship will exist far into the future with our suppliers, distributors and partner companies.	239	-1.69301	1.19720	.0000000
Z score: 7.1. A fair share of benefits to all the partners is essential for a successful cooperation.	239	-1.71729	1.33425	.0000000
Z score: 7.2. You intend to find commensurable partner with whom it is possible to cooperate for core activities.	239	-2.23503	1.74144	.0000000

Z score: 7.3. Partners find it easy to ensure a fair allocation of the shared workload in advance.	239	-1.39672	1.39672	.0000000
Z score: 7.4. Goals/objectives of you and your partner's firm must be compatible.	239	-1.60651	1.33568	.0000000
Z score: 7.5. You are willing to assess and evaluate your partner's goals/objective before choosing the partner.	239	-1.44744	1.29810	.0000000
Z score: 7.6. You concern complementary skills of your partner, e.g. partner's experience, capabilities, and potential for making real contribution, when you are choosing an alliance partner.	239	-1.55677	1.21986	.0000000
Z score: 7.7. Financial resources of you and your partner must be compatible.	239	-1.37372	1.42048	.0000000
Z score: 7.8. Internal working environment of you and your partner must be compatible.	239	-2.27171	1.39679	.0000000
Z score: 7.9. Peer relationship between the top executive of you and your partner's firm must be established.	239	-1.66981	1.14064	.0000000
Z score: 7.10. You are willing to learn a new working environment.	239	-1.71768	1.38063	.0000000
Z score: 7.11. Commensurate levels of risk must be involved among you and your potential partner.	239	-1.64121	1.24297	.0000000
Z score: 8.1. Collaborative freight distribution would reduce the cost of non-core activities, e.g. decrease in empty hauling, of you and your partner's firm.	239	-1.63842	1.28383	.0000000
Z score: 8.2. Collaborative freight distribution will reduce purchasing costs (e.g., truck, on-board computer, fuel, etc.) of you and your partner's firm.	239	-1.50819	1.39872	.0000000
Z score: 8.3. Collaborative freight distribution will offer better quality of service at lower costs, e.g. in term of speed, frequency of deliveries, geographical coverage, reliability of delivery time etc., of you and your partner's firm.	239	-1.55896	1.20098	.0000000
Z score: 8.4. Collaborative freight distribution will help to protect market share of you and your partner's firm.	239	-2.59930	1.39149	.0000000
Z score: 8.5. You will implement collaborative freight distribution, if it is going to improve sales of you and your partner's firm.	239	-1.42240	1.31916	.0000000
Z score: 8.6. You will implement collaborative freight distribution, if it is going to improve fleet utilization of you and your partner's firm.	239	-1.50822	1.36401	.0000000
Z score: 8.7. You will implement collaborative freight distribution, if it is going to improve on-time delivery of you and your partner's firm.	239	-1.59162	1.38023	.0000000
Z score: 8.8. You will implement collaborative freight distribution, if it is going reduce delivery lead-time of you and your partner's firm.	239	-1.37470	1.36324	.0000000
Z score: 8.9. You will implement collaborative freight	239	-1.35155	1.40931	.0000000

distribution, if it is going to reduce administrative cost of you and your partner's firm.				
Z score: 8.10. You will implement collaborative freight distribution, if it is going to reduce driver turn-over of you and your partner's firm.	239	-2.52827	1.48228	.0000000
Z score: 9.1. You are going to implement information technology to share supply chain information such as point of sale, forecasts, purchase order, shipment schedules and status, performance reporting.	239	-1.97284	1.48566	.0000000
Z score: 9.2. You are going to implement message based system (i.e. fax, email, sms, EDI).	239	-1.50813	1.37542	.0000000
Z score: 9.3. You are going to implement market based system (i.e. hubs, portals)	239	-2.45633	1.38068	.0000000
Z score: 9.4. You are going to implement collaborative planning and forecasting based systems (i.e. CPFR)	239	-2.41280	1.53692	.0000000
Z score: 9.5. You will implement information technology, if it is going to reduce transportation costs, e.g. eliminate excessive empty backhauls and dwell time, of you and your partner's firm.	239	-1.60629	1.35821	.0000000
Z score: 9.6. You will implement information technology, if it is going to increase vehicle utilization of you and your partner's firm.	239	-1.53810	1.27881	.0000000
Z score: 9.7. You will implement information technology, if it is going to improve services levels, e.g. higher on-time performance, of you and your partner's firm.	239	-1.61139	1.24137	.0000000
Z score: 9.8. You will implement information technology, if it is going to fairly increase visibility, e.g. identifying location of freight in the supply chain, of you and your partner's firm.	239	-1.57866	1.08777	.0000000
Z score: 9.9. You will implement information technology, if it is going to improve end-customer satisfaction, e.g. increase number of perfect order, of you and your partner's firm.	239	-1.62973	1.11327	.0000000
Z score: 9.10. You will implement information technology, if it is going to increase revenues, e.g. improve fully load miles, better on shelf performance, and increase order quantity, of you and your partner's firm.	239	-1.50293	1.22863	.0000000
Z score: 10.1.1 reduce environmental risk (including reduced risk of pollution incidents)	239	-1.80867	1.41724	.0000000
Z score: 10.1.2 improve conservation of resources	239	-1.90571	1.35927	.0000000
Z score: 10.1.3 enhance ISO 14000 (International organization for standardization 14000 provides tools for organization to monitor and control their environmental impacts and improve their environmental performance)	239	-1.65740	1.23398	.0000000
Z score: 10.1.4 reduce congestion	239	-2.00201	1.19853	.0000000
Z score: 10.1.5 reduce air pollution	239	-2.14559	1.39094	.0000000
Z score: 10.1.6 reduce water pollution	239	-2.50774	1.34247	.0000000
Z score: 10.1.7 reduce visual pollution	239	-1.49513	1.36356	.0000000

Z score: 10.1.8 reduce odour pollution	239	-2.46481	1.33577	.0000000
Z score: 10.1.9 reduce noise pollution	239	-1.66540	1.16756	.0000000
Z score: 10.1.10 reduce solid waste	239	-1.38512	1.40850	.0000000
Z score: 10.1.11 reduce liquid waste	239	-2.54355	1.39538	.0000000
Z score: 10.1.12 improve recycling	239	-1.71945	1.26927	.0000000
Z score: 10.1.13 improve environmental compliance	239	-2.03891	1.12537	.0000000
Z score: 10.2.1 improve company's reputation	239	-1.68891	1.23609	.0000000
Z score: 10.2.2 improve relationship with investor	239	-1.64113	1.13081	.0000000
Z score: 10.2.3 improve relationship with customer	239	-2.02000	1.10479	.0000000
Z score: 10.2.4 improve financial performance	239	-2.05623	.99619	.0000000
Z score: 10.2.5 lower the risk of business operation	239	-1.72795	1.09103	.0000000
Z score: 10.2.6 stimulate the firm's innovation and creative work	239	-1.74630	1.17234	.0000000
Z score: 10.2.7 help to find easier ways to attract external sources of sponsorship	239	-1.65301	1.14890	.0000000
Z score: 10.2.8 broaden markets and makes situations for sales increase	239	-1.80690	1.05303	.0000000
Z score: 10.2.9 lower expenditure	239	-1.83310	.97530	.0000000
Z score: 10.2.10 improve raw material conservation	239	-1.77117	1.12821	.0000000
Z score: 10.2.11 reduce transportation cost (i.e. fuel cost)	239	-2.02600	.87349	.0000000
Z score: 10.2.12 increase in resources usage efficiency (i.e. fuel consumption)	239	-2.09782	.95937	.0000000
Z score: 10.2.13 improve product image towards customer	239	-1.98911	1.13850	.0000000
Z score: 10.2.14 improve market opportunities	239	-1.98726	1.05732	.0000000
Z score: 10.2.15 reduce cost of insurance	239	-1.67140	1.13186	.0000000
Z score: 10.3.1 increase motivation of staff	239	-1.49559	1.34128	.0000000
Z score: 10.3.2 improve health and safety of workers at the workplace.	239	-1.78879	1.28690	.0000000
Z score: 10.3.3 Improve trust building with local community through openness, transparency and partnership	239	-1.76487	1.16432	.0000000
Z score: 10.3.4 reduce complaints from local community	239	-1.53880	1.26863	.0000000
Z score: 10.3.5 help to attract positively motivated employees	239	-1.68465	1.30889	.0000000
Z score: 10.3.6 enhance the value of human capital	239	-1.63251	1.18460	.0000000
Z score: 10.3.7 improve the contribution of a firm to community development (i.e. job creation and tax breaks received)	239	-1.57960	1.28043	.0000000
Valid N (listwise)	239			

Appendix 2.7: Correlation coefficient matrix for assessing multicollinearity

Management Commitment Construct

	1.1	1.2	1.3	1.4	1.8	1.9	1.10
1.1	1						
1.2	.555	1					
1.3	.471	.611	1				
1.4	.269	.545	.583	1			
1.8	.514	.429	.410	.268	1		
1.9	.711	.480	.415	.246	.545	1	
1.10	.520	.434	.377	.326	.413	.615	1

Relationship Management Construct

	2.2	2.4	2.5
2.2	1		
2.4	.555	1	
2.5	.471	.611	1

Communication Management Construct

	3.3	3.5	3.6	3.7
3.3	1			
3.5	.305	1		
3.6	.312	.349	1	
3.7	.327	.330	.665	1

Location of Freight Consolidation Construct

	4.3	4.4	4.5	4.6	4.7	4.8	4.9	4.10	4.11
4.3	1								
4.4	.499	1							
4.5	.434	.528	1						
4.6	.404	.476	.601	1					
4.7	.431	.426	.542	.661	1				

4.8	.270	.341	.449	.432	.358	1			
4.9	.381	.384	.448	.421	.408	.588	1		
4.10	.305	.450	.409	.428	.419	.505	.557	1	
4.11	.230	.299	.354	.335	.322	.469	.487	.568	1

Geographical Coverage Construct

	5.1	5.2	5.3	5.4	5.5
5.1	1				
5.2	.577	1			
5.3	.477	.517	1		
5.4	.514	.370	.478	1	
5.5	.519	.421	.306	.656	1

Utilization of Transport Mode Construct

	6.1	6.2	6.3	6.4	6.5	6.6	6.7
6.1	1						
6.2	.846	1					
6.3	.533	.575	1				
6.4	.354	.371	.516	1			
6.5	.597	.501	.520	.511	1		
6.6	.531	.517	.396	.478	.462	1	
6.7	.494	.484	.452	.402	.438	.640	1

Partner Selection Construct

	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	7.10	7.11
7.1	1										
7.2	.369	1									
7.3	.412	.296	1								
7.4	.389	.196	.440	1							
7.5	.329	.169	.371	.635	1						
7.6	.252	.210	.350	.449	.500	1					

7.7	.318	.247	.426	.254	.276	.428	1				
7.8	.135	.247	.359	.266	.281	.372	.355	1			
7.9	.318	.197	.338	.416	.377	.381	.229	.335	1		
7.10	.246	.183	.355	.370	.479	.378	.286	.205	.394	1	
7.11	.350	.244	.364	.231	.359	.362	.318	.131	.271	.520	1

Benefits and Risks Sharing Construct

	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	8.10
8.1	1									
8.2	.802	1								
8.3	.612	.673	1							
8.4	.468	.450	.543	1						
8.5	.504	.474	.539	.670	1					
8.6	.569	.584	.520	.518	.575	1				
8.7	.492	.521	.515	.463	.491	.611	1			
8.8	.570	.560	.467	.528	.544	.503	.589	1		
8.9	.454	.533	.565	.469	.534	.452	.512	.612	1	
8.10	.379	.457	.476	.499	.485	.446	.466	.593	.632	1

Advance Information Technology Construct

	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	9.10
9.1	1									
9.2	.532	1								
9.3	.486	.503	1							
9.4	.513	.374	.607	1						
9.5	.523	.315	.483	.528	1					
9.6	.500	.401	.452	.465	.501	1				
9.7	.504	.377	.494	.483	.528	.744	1			
9.8	.308	.299	.541	.482	.501	.560	.642	1		
9.9	.385	.257	.483	.497	.446	.551	.585	.682	1	
9.10	.350	.181	.396	.333	.434	.483	.572	.563	.618	1

Environmental Factor Construct

	10.1.1	10.1.2	10.1.3	10.1.4	10.1.5	10.1.6	10.1.7	10.1.8	10.1.9	10.1.10	10.1.11	10.1.12	10.1.13
10.1.1	1												
10.1.2	.710	1											
10.1.3	.438	.547	1										
10.1.4	.290	.351	.401	1									
10.1.5	.465	.479	.360	.632	1								
10.1.6	.351	.395	.348	.524	.556	1							
10.1.7	.326	.374	.325	.396	.485	.667	1						
10.1.8	.323	.340	.338	.309	.365	.679	.720	1					
10.1.9	.354	.398	.369	.376	.463	.511	.511	.658	1				
10.1.10	.353	.367	.232	.333	.388	.609	.605	.646	.560	1			
10.1.11	.337	.302	.265	.325	.392	.611	.573	.651	.443	.770	1		
10.1.12	.361	.256	.234	.381	.381	.448	.416	.405	.299	.467	.505	1	
10.1.13	.403	.385	.326	.486	.415	.488	.502	.419	.366	.479	.457	.572	1

Economics Factor Construct

	10.2.1	10.2.2	10.2.3	10.2.4	10.2.5	10.2.6	10.2.7	10.2.8	10.2.9	10.2.10	10.2.11	10.2.12	10.2.13	10.2.14	10.2.15
10.2.1	1														
10.2.2	.768	1													
10.2.3	.578	.620	1												
10.2.4	.405	.406	.588	1											
10.2.5	.421	.362	.344	.536	1										
10.2.6	.410	.394	.309	.240	.530	1									
10.2.7	.511	.449	.408	.432	.508	.503	1								
10.2.8	.485	.445	.446	.533	.506	.347	.595	1							
10.2.9	.524	.438	.467	.627	.528	.410	.520	.572	1						
10.2.10	.435	.433	.395	.405	.412	.396	.473	.410	.606	1					
10.2.11	.457	.435	.506	.446	.357	.296	.264	.348	.522	.406	1				
10.2.12	.397	.397	.471	.462	.370	.323	.324	.363	.485	.328	.844	1			
10.2.13	.432	.410	.462	.345	.392	.309	.463	.422	.370	.348	.497	.560	1		
10.2.14	.502	.466	.466	.455	.455	.379	.492	.464	.491	.471	.565	.516	.622	1	
10.2.15	.447	.461	.336	.396	.453	.378	.451	.336	.438	.451	.348	.341	.437	.627	1

Social Factor Construct

	10.3.1	10.3.2	10.3.3	10.3.4	10.3.5	10.3.6	10.3.7
10.3.1	1						
10.3.2	.714	1					
10.3.3	.448	.634	1				
10.3.4	.383	.537	.590	1			
10.3.5	.565	.475	.459	.504	1		
10.3.6	.579	.517	.513	443	.675	1	
10.3.7	.645	.554	.500	.503	.601	.753	1

Common Method Variance Construct

	X1	X2	X3	X4	X5
X1	1				
X2	.553	1			
X3	.326	.357	1		
X4	.341	.424	.413	1	
X5	.230	.441	.266	.486	1

Correlation matrix of research constructs and measurement dimensions

	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
FREIGHT	4.23	.48	-															
COOP	3.98	.49	.484	-														
COFREIGHT	4.03	.46	.435	.473	-													
SUS	4.12	.46	.388	.350	.468	-												
SO	4.12	.60	.259	.233	.312	.667	-											
EC	4.23	.53	.329	.296	.396	.746	.564	-										
EV	3.98	.64	.242	.218	.291	.622	.415	.526	-									
LO	4.21	.55	.778	.376	.339	.302	.201	.256	.188	-								
GC	4.25	.55	.829	.401	.361	.322	.215	.273	.200	.645	-							
UT	4.27	.59	.786	.380	.342	.305	.203	.258	.190	.611	.652	-						

PS	4.12	.52	.241	.262	.554	.259	.173	.219	.161	.188	.200	.190	-					
BR	4.05	.59	.325	.353	.747	.349	.233	.296	.217	.253	.270	.256	.414	-				
IT	4.03	.59	.361	.392	.728	.387	.258	.328	.241	.280	.299	.283	.459	.619	-			
MC	3.93	.62	.296	.611	.289	.214	.143	.181	.133	.230	.245	.232	.160	.216	.239	-		
RM	4.09	.66	.370	.765	.362	.268	.178	.226	.166	.288	.307	.291	.200	.270	.300	.467	-	
CM	3.97	.66	.337	.696	.329	.244	.162	.206	.152	.262	.279	.265	.182	.246	.273	.426	.533	-

Appendix 2.8: Skewness and ketosis for mean value.

	N	Mean	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
M_MC	239	3.38	.387	.157	-.169	.314
M_RM	239	3.81	-.710	.157	.299	.314
M_CM	239	3.92	-.128	.157	.414	.314
M_LO	239	4.11	-.361	.157	-.278	.314
M_GC	239	4.25	.027	.157	-.743	.314
M_UT	239	4.24	-.520	.157	-.588	.314
M_PS	239	4.06	-.055	.157	-.282	.314
M_BR	239	4.03	-.304	.157	-.752	.314
M_IT	239	4.03	-.378	.157	-.573	.314
M_EV	239	4.12	.039	.157	-.560	.314
M_EC	239	4.26	-.572	.157	-.180	.314
M_SO	239	4.13	-.259	.157	-.643	.314
M_COOP	239	3.66	-.483	.157	-.360	.314
M_FREIGHT	239	4.16	-.548	.157	-.379	.314
M_COFREIGHT	239	4.03	-.472	.157	-.307	.314
M_SUS	239	4.17	-.207	.157	-.416	.314
Valid N (listwise)	239					