SUPPLY CHAIN MANAGER COMPETENCIES AND THEIR IMPACT ON SUPPLY CHAIN INTEGRATION

Mr. Supachai Archiwaranguprok

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By	Mr. Supachai Archiwaranguprok
Field of Study	Logistics Management
Thesis Advisor	Professor Dr. Kamonchanok Suthiwartnarueput
Thesis Co-Advisor	Associate Professor Dr. Pongsa Pornchaiwiseskul

Accepted by the Graduate School, Chulalongkorn University in Partial Fulfillment of the Requirements for the Doctoral Degree

.....Dean of the Graduate School

(Assistant Professor Amorn Petsom)

THESIS COMMITTEE

.....Chairman

(Associate Professor Dr. Kanlaya Vanichbuncha)

.....Thesis Advisor

(Professor Dr. Kamonchanok Suthiwartnarueput)

.....Thesis Co-Advisor

(Associate Professor Dr. Pongsa Pornchaiwiseskul)

.....Examiner

(Associate Professor Dr. Ananchai Kongchan)

.....Examiner

(Assistant Professor Dr. Tartat Mokkhamakkul)

.....External Examiner

(Dr. Krizz Chantjiraporn)

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วัตถุประสงค์ของการศึกษางานวิจัยในครั้งนี้ คือเพื่อศึกษาความสัมพันธ์ระหว่างสมรรถนะของผู้จัดการซัพพลายเชน บทบาทและหน้าที่รับผิดชอบของผู้จัดการซัพพลายเชน และบูรณาการของซัพพลายเชนในด้านต่างๆ นอกจากนี้ ยังเพื่อระบุหาสมรรถนะของผู้จัดการซัพพลายเชนที่ส่งผลต่อต่อบูรณาการของซัพพลายเชน ตลอดจนเพื่อระบุช่องว่างระหว่างสมรรถนะของผู้จัดการซัพพลายเชนในปัจจุบันกับที่คาดหวัง คำถามหลักของงานวิจัยคือ สมรรถนะของผู้จัดการซัพพลายเชนมีความสัมพันธ์กับบูรณาการของซัพพลายเชนหรือไม่ และสมรรถนะดังกล่าวมีความเหมือนหรือแตกต่างกันสำหรับบูรณาการภายใน บูรณาการกับซัพพลายเออร์ และบูรณาการกับลูกค้า ตลอดจนเหมือนหรือแตกต่างกัน สำหรับผู้จัดการซัพพลายเชนที่มีบทบาทและหน้าที่รับผิดชอบที่ต่างกัน

ผลลัพธ์ของงานวิจัยพบว่าสมรรถนะของผู้จัดการซัพพลายเชน 2 กลุ่มจากการวิเคราะห์ปัจจัย ซึ่งได้แก่ ความรู้ด้านเทคนิคและการนำไปใช้ และ คุณลักษณะและทักษะการจัดการ ประกอบกับบทบาทและหน้าที่รับผิดชอบของผู้จัดการซัพพลายเชน มีการส่งผลที่แตกต่างกันต่อบูรณการของซัพพลายเชน ที่ระดับนัยสำคัญ 0.05 ในการวิเคราะห์ถดถอยพหุนาม พบว่าความรู้ด้านเทคนิคและการนำไปใช้ส่งผลต่อบูรณาการภายใน และบูรณาการกับลูกค้า คุณลักษณะและทักษะการจัดการส่งผลต่อบูรณาการกับซัพพลายเออร์ และบทบาทหน้าที่รับผิดชอบส่งผลต่อบูรณาการภายใน

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SUPACHAI ARCHIWARANGUPROK: SUPPLY CHAIN MANAGER COMPETENCIES AND THEIR IMPACT ON SUPPLY CHAIN INTEGRATION. ADVISOR: PROF. DR. KAMONCHANOK SUTHIWARTNARUEPUT, CO-ADVISOR: ASSOC. PROF. DR. PONGSA PORNCHAIWISESKUL, 111 pp.

The objectives of this research are to examine the relationship among supply chain manager competencies, a supply chain manager' roles and responsibilities, and supply chain integration in different dimension, as well as to identify which supply chain manager competencies having impacts on supply chain integration, and to identify the gap of current and required supply chain manager competencies. The key questions of this study are whether there are any relationships between supply chain manager competencies and supply chain integration, whether such competencies are the same among internal integration, supplier integration and customer integration, as well as whether they are the same between those having different roles and responsibilities.

The results of the study reveal that two groups of competencies after applying factor analysis; namely Technical knowledge and application and Traits and Managements Skills, as well as a supply chain manager's roles and responsibilities, impact differently supply chain integration in the multivariate regression analysis. At a significance level of 0.05, Technical knowledge and application impacts internal and customer integration while Traits and Management Skills impacts supplier integration. A supply chain manager's roles and responsibilities impacts only internal integration.

Field of Study: Logistics Management Student's Signature .....

Academic Year: 2013 Advisor's Signature .....

Co-Advisor's Signature .....

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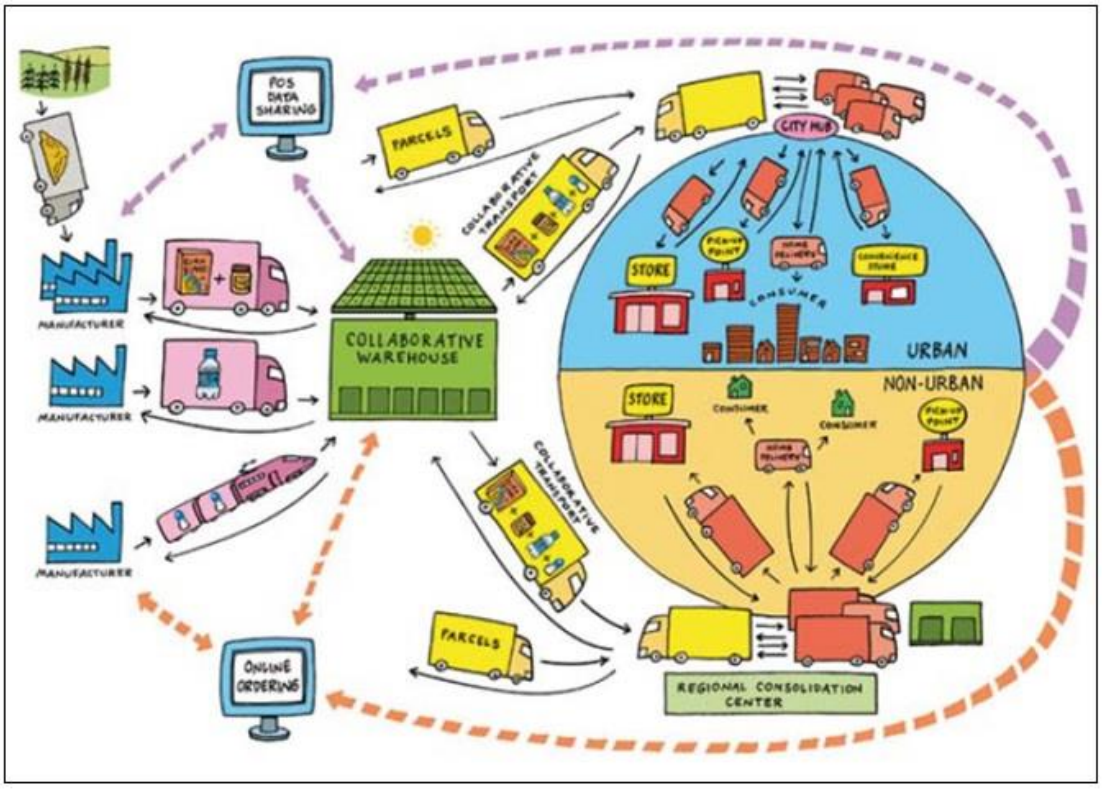
Introduction

1.1 Rationale

Supply chain excellence in the global marketplace can be achieved through excellence in skills and competencies of the people who manage it (Mangan and Christopher 2005). The level of supply chain professionals' competencies is a crucial factor to enhance a firm's competitiveness. As supply chain being a significant component of competitive strategy to support organizational productivity and profitability, it is important that supply chain managers equip themselves with appropriate skills, knowledge and competencies. Companies need to excel today key performance such as on-shelf availability improvement, cost reduction and sound financial figures support, as well as look ahead to give priorities to additional measures, which become key concerns to stakeholders such as CO2 emission reduction, reduced energy consumption, better traceability and reduced traffic congestion. Global Commerce Initiative (GCI) has released its report in 2008 on "2016 Future Supply Chain", describing that future supply chain is to provide clear benefits to the society, to the industry, to individual companies and finally to consumers (Initiative and Capgemini 2008). As shown in Figure 1.1, characteristics of future supply chain will be based on multi-partner information sharing among key stakeholders. This involves collaborative warehouse, collaborative transport, city hubs and regional centers, and requires synchronization of all supply chain activities. Lee (2004) summarizes that alignment by creating consistency in the interests of all these participants, in addition to agility and adaptability, is one of the three issues in managing ever-evolving supply chain complexity (Ketchen, Rebarick et al. 2008). Only with competent supply chain managers, companies can keep themselves abreast of all the latest development in this field.



Source: The Global Commerce Initiative

Figure 1. 1 The 2016 future supply chain: Serving consumers in a sustainable way

In the context of Southeast Asia where economic growth has become dramatically changing, especially with the combination of the 10 countries in forthcoming ASEAN Economic Community (AEC) in 2015, the market will rank the 9th largest economy in the world with its population swelling to more than 600 million people. The market is large enough for companies to capture more business gains through this promotion of a single market and manufacturing base. At a macro level, Table 1.1 reports the LPI ranking and score 2010 conducted by the World Bank's Connecting to Compete: Trade Logistics in the Global Economy (Arvis, Mustra et al. 2010), Thailand has gained its competitive advantage for being ranked 35th among 155 countries worldwide, and ranked 3rd in the ASEAN countries. It is critical that supply chain to be agile in acting rapidly in response to dramatic changes to demand and

supply, as well as be adaptable to reshape supply when necessary (Lau 2004, Whitten, Jr et al. 2012). Supply chain managers' job thus becomes more and more regional and global with complex, and multi-dimensions (Harvey and Richey 2001). The more we aim at sustaining competitive advantage of a firm's whole supply chain against other firms, the more crucial to recruit, develop and maintain the right supply chain managers. All supply chain initiatives cannot yield result if a firm does not have correct human resources to manage both internally and externally its counterparts. What skills and competencies contribute to supply chain integration, including internal integration, supplier integration and customer integration? While many supply chain researches focus considerably on pure supply chain principles, neglecting human part, the researcher would like to propose an interdisciplinary research on human resource management and supply chain by questioning what competencies are required for supply chain managers and their impact on supply chain integration.

Table 1. 1 Logistics Performance Index Ranking (LPI) and Score 2010 for ASEAN Countries

Economy	2010 LPI			
	Rank Worldwide	Rank ASEAN	Score	% of the highest performer
Singapore	2	1	4.09	99.2
Malaysia	29	2	3.44	78.4
Thailand	35	3	3.29	73.6
Philippines	44	4	3.14	68.8
Vietnam	53	5	2.96	63.1
Indonesia	75	6	2.76	56.5
Lao PR	118	7	2.46	47.0
Cambodia	129	8	2.37	44.0
Myanmar	133	9	2.33	42.7
Brunei	n/a	n/a	n/a	n/a

Remark: 2010 Logistics Performance Index (LPI) is a multidimensional assessment of logistics performance, rated on a scale from one (worst) to five (best). It uses more than 5,000 individual

countries assessments made by nearly 1,000 international freight forwarders to compare the trade logistics profile of 155 countries.

1.2 Research objectives

The objectives of this research are to examine the relationship among supply chain manager competencies, a supply chain manager' roles and responsibilities, and supply chain integration in different dimension; namely internal integration, supplier integration and customer integration; as well as to identify which supply chain manager competencies having impacts on supply chain integration, and to identify the gap of current and required supply chain manager competencies.

1.3 Scope of the study

This exploratory research focuses on Thailand industry in general. It will therefore cover different levels of companies from large scale to small and medium scale, and from different types of industry.

1.4 Research methodology

On-line questionnaire was sent to 598 target population with a personalized message starting from May-June 2013. After one month, a follow-up e-mail was sent to remind everyone about their participation in this survey. If we cannot obtain enough returns, countermeasure is to get members of department of primary industries and mines, who participate in supply chain symposium, to answer the questionnaire.

1.5 Expected contribution

This study applies multivariate regression analysis to identify relationship among supply chain manager competencies, a supply chain manager's roles and responsibilities and supply chain integration. The finding should establish an empirical basis for a framework leading to direction and content of supply chain managers'

development. In addition, the finding will confirm whether the pre-defined hypothesized model can be generalized and applicable for different groups of supply chain managers, or whether it requires different models. Practically, the result should aid all parties, including organizations, supply chain managers, and academics to identify important skills, knowledge and attributes to be attained so that supply chain managers can improve their efficiency, and subsequently that of the organizations.

1.6 Terminology and definition

Below is the terminology and definition used in this study.

1.6.1 Supply chain manager as those leading a team in at least one or more of the areas in logistics management (distribution, transportation, production planning), supplier-relations management (supply planning, sourcing, procurement), and customer-relations management (customer service, demand planning).

1.6.2 Supply chain manager competencies as skills, knowledge and attributes that a supply chain manager should possess in order to perform his roles and responsibilities in supply chain management field.

1.6.3 Supply chain integration as complex networks of relationship among firms within the supply chain to procure, manufacture, and deliver products or services to customers. The integration can be internal and external.

1.6.4 Internal integration as processes and management of both physical and information flows among different departments/functions within a firm to achieve optimization of its objectives.

1.6.5. Supplier integration as one of the two dimensions of external integration, involving synchronization between a firm and its suppliers. This integration enables both focal firm and suppliers to interact more efficiently in achieving their individual and global objectives in a supply chain network.

1.6.6 Customer integration as another dimension of external integration, which involves interaction between a firm and its customers. This integration helps focal firm to response to customers in the most possible efficiency through its adaptation, adjustment and agility to ever-changing requirement.

1.6.7 Roles and responsibilities as functions and activities that a supply chain manager needs to perform as an individual and within any teams he is a part of. A supply chain manager's roles and responsibilities can be operational on a day-to-day basis, tactical and strategic with the middle to long-term horizon.

Chapter II
Literature Review

The objective of this chapter is to study what has been covered in the areas of the researcher's interest. Comprehensive review of the literature brings about the understanding of contemporary discussion in the areas of skills and competencies of supply chain managers, which are important sources of qualitative and quantitative questions to be developed further. The researcher covers as well the review of supply chain integration.

2.1 Required Supply chain manager competencies

The review has shown that competencies required by supply chain managers are wider and more varied than those of other category managers. Supply chain managers need to possess "T-shape" skills profiles along with the evolvement of the seven major business transformations, as described in Table 2.1, namely from supplier to customer-centric, from push to pull, from inventory to information, from transactions to relationship, from "trucks and sheds" to end-to-end pipeline management, from functions to processes, and from stand-alone competition to network rivalry (Mangan and Christopher 2005).

Customers' requirement becomes a key driver to firms in developing their market strategy instead of pushing products out without evaluating the consequences, such as increase in inventory. Unlike previous transactional approach, firms have to build relationships with all key players (Barnes and Liao 2012) with a good understanding of the whole chain cost. For all these transactions, Mangan and Christopher (2005) has identified skills to perform the job (vertical bar) for supply chain managers. For example, they need to understand the market well with good customer insights. With their ability to manage complexity and change, firms can achieve a higher level of flexibility and agility. Supply chain managers should make adequate use of information technology to capture real demand from customers while sharing it to

their counterparts. If firms focus on customer retention, they need to ensure their supply chain managers capitalize the ability to define, to measure and to manage service requirements by market segments. Cost-wise, it is crucial to know wider definition of supply chain cost structure by implementing indicators to follow them as firms cannot render service to customers at any cost (Butner 2010). They also have to facilitate good teamwork cross-functionally and sustain a good relationship with all players (Kayakutlu and Büyüközkan 2010, Zhao, Huo et al. 2011) throughout the supply chain network with win-win orientation. On a horizontal bar, supply chain managers should possess a wide knowledge of such related areas as business process engineering, marketing understanding, information technology, cost-to-serve indicators, and relationship management for a more effective connection with other disciplines.

Mangan and Christopher (2005), through their triangulated research approach to capture the views of education and training providers, program participants, and corporate, identify key knowledge areas and competencies/skills comprising three board categories of general knowledge, logistics/supply chain management specific, and competencies/skills. Management skills, logistics skills and business skills are suggested by Murphy and Poist (1998) as required skills for senior-level logistics managers. The former emerges as the most important skills, followed respectively by the two latter. In addition to good communication skill in all interactions of supply chain managers, Gammelgaard and Larson (2011) has postulated interpersonal/managerial basic skills, quantitative/technology skills, and SCM core skills as a three-factor model of SCM skill areas for executive development. Razzaque and Sirat (2001) conclude that high rating on general business administration and information system in their research reflects the logistics executives' awareness of the need to be generalists rather than specialists. Ability of the firms to identify and maintain an adequate number of qualified global managers helps them to complete in the global marketplace. Multiple intelligences as specific competencies necessitate selection process of new managers, and development of existing ones (Wu and Lee 2007).

Table 2. 1 Seven major business transformations

Business Transformation	Leading to	Skills Required
From supplier to customer centric	The design of driven supply chain	Market understanding, customer insights
From push to pull	Higher level of flexibility and agility	Management of complexity and change
From inventory to information	Capturing and sharing information on real demand	Information system and information technology expertise
From transaction to relationship	Focus on service and responsiveness as the basis of customer retention	Ability to define, measure and manage service requirement by market segments
From "truck and sheds" to end-to-end pipeline management	A wider definition of supply chain cost	Understanding the "cost-to-served" and time-based performance indicators
From functions to processes	The creation of cross-function teams focused on value creation	Specific functional excellence with cross-functional understanding. Team work capability
From stand-alone competition to network rivalry	More collaborative working with supply chain partners	Relationship management and win-win orientation

How can firms be assured of no gap of their supply chain managers in term of current and required competencies? Defining required competencies for recruitment and selection process is as crucial as identifying the gap to improve training system, performance evaluation, development plan and career growth for each individual. Mangan and Christopher (2005) find that in many developing countries, a large proportion of relatively young and inexperienced supply chain managers require coaching and development. Competency model should be adopted to identify important skills and knowledge, both general and specific, to be attained so as to

improve the efficiency of their supply chain managers, and therefore support the excellence of the organization (Razzaque and Sirat 2001).

2.2 APICS Supply chain manager competencies

Competency is defined by the Competency Model Clearinghouse as “the capability to apply or use a set of related knowledge skills, and abilities required to successfully perform critical work functions or tasks in a defined work setting”. The structure of the APICS supply chain manager competencies model as shown in Figure 2.1 is adapted for the framework of this research. Additional key knowledge and competencies identified by different studies through literature review are included in the model in order to make the complete list of competencies to guide the survey and analysis, detailed in Table 2.2.

APICS has developed the model to guide individuals considering career in supply chain, managers seeking career advancement and human resource managers hiring those in this fast-growing supply chain field. Three categories of competencies and their entries are described as below.

2.2.1 Fundamental competency

Three components of fundamental competency consists (1) personal effectiveness, representing motives, traits, interpersonal & self-management styles (2) academic, what supply chain managers has learnt in the academic setting, including cognitive function and thinking styles, and (3) workplace & leadership, representing those skills and abilities that allow individuals to function in an organizational setting.

2.2.2 Professional-related competency

Three components of professional-related competency consists (1) operations management technical, representing the knowledge, skills, and abilities needed by all

occupations within operations management, including supply chain managers (2) supply chain managers knowledge areas, being broad knowledge areas used as a basis for specifying more detailed knowledge areas required for work as a supply chain manager, and (3) supply chain managers technical competencies, being specific to the role of supply chain manager.

2.2.3 Occupational-related competency

Occupational-related competency is specific requirements for supply chain managers, including such requirements as certification, licensure, and specialized educational degrees, or physical and training requirement.

2.3 A supply chain manager's roles and responsibilities

Supply chain managers play a tremendous impact on the success of an organization. They vary in groups and reflect different origins of the functional areas of their works. Some originally have backgrounds in real logistics and supply chain fields, while some used to hold responsibilities in transportation, procurement, information system or even in finance (Sutton 1993, Mangan and Christopher 2005). When it comes into business, supply chain managers engage in every aspect of the organization's activities from material planning to purchasing and storage, from production to distribution and customer services. Roles and responsibilities of supply chain manager differ by the level of strategic or operational dimension they have taken. Novicevic, Buckley et al. (2000) explain transforming roles of managers in supply chain networks composing of internal orientation and rate of environmental change. The former considers whether it is cross-functional or functional, and the latter whether it is stable or unstable. Findings of Sandberg and Abrahamsson (2010) categorize management's roles in the form of four archetypes. They are the supply chain thinker, the relationship manager, the controller and the organizer of the future. All of them are not exclusively independent from each other, but complementary.

Figure 2. 1 APICS supply chain manager competencies model

Table 2. 2 Literature review of supply chain manager competencies

Competency categories	Competencies components	Competencies entries	Literature review*									
			A	B	C	D	E	F	G	H	I	J
Fundamental	Personal effectiveness	Awareness of needs of others	X								X	
		Integrity	X									X
		Continuous learning	X								X	
		Effective communication	X	X		X					X	X
		Interpersonal skills	X	X	X	X			X		X	X
		Creativity	X							X	X	
	Academic	Math, statistics, analytical thinking	X	X	X	X			X			X
		Reading and writing for comprehension	X									
		Foreign language/ language skills		X						X		
		Applied science and technology	X	X	X							
		Supply chain fundamental	X							X		

		Foundation of business management	X				X					
		Fundamental of technology	X	X		X						
		Operations and enterprises economics	X		X							
		Finance		X	X							
	Workplace & leadership	Problem solving, decision making	X		X					X		X
		Teamwork	X		X							
		Accountability/ Responsibility	X		X							
		Customer focus (internal/external)	X	X	X			X				X
		Planning and organization	X	X	X							
		Conflict management	X				X					
		Enabling technology	X		X					X		
Professional-related	Operations Management	Strategy development and application	X		X				X		X	X
	Technical	Supply chain management	X	X	X		X					X
		Process improvement/ six sigma	X		X		X					X

		Execution planning, Scheduling, control	X		X		X					X
		Project management	X		X		X					
		Lean management	X				X					
		Enabling technology application	X		X	X						
	Supply Chain Managers Knowledge area	Performance trade-offs	X									
		Warehouse management	X		X	X	X					X
		Transportation management	X	X	X	X	X					X
		Supply chain synchronization	X	X				X				
		Risk management	X		X		X					
		Sustainability	X									
	Supply Chain Managers Technical Competencies	Locating facilities	X	X	X	X	X					
		Distribution	X	X	X	X	X					
		Warehousing	X	X	X	X	X					X
		Logistics in emerging markets	X	X	X	X	X					X

		International regulations, Security & Trade	X	X	X						X
		Strategic sourcing/ supplier relationship	X	X	X	X	X		X			
		Management customer relationship	X	X	X		X		X			X
		Management applying lean/six sigma tools	X		X	X						
		Change management		X	X						X	X
Occupational-related	Supply Chain Managers Specific requirements	Bachelor or equivalent degree	X	X							X	
		Supply chain industry association membership	X									
		Supply chain-specific certification	X	X							X	

*Remarks: A = APICS supply chain manager competencies model (APICS 2009), B = Canadian Logistics Skills Committee (Committee 2005), C = Mangan and Christopher (2005), D = Gammelgaard and Larson (2011), E = Murphy and Poist (1998), F = Novicevic, Buckley et al. (2000), G = Sandberg and Abrahamsson (2010), H = Office of Industrial Economy (2011), I = Hoek, Chatham et al. (2002), J = Razzaque and Sirat (2001)

2.4 Supply chain integration

Lambert (2001) and Flynn, Huo et al. (2010) have defined supply chain management as the integration of key business processes from end users through original suppliers that provides effective and efficient flows of products, services, information, money and decisions to provide maximum value to the customers at low cost and high speed. This integration degree to which a manufacturer strategically collaborates with its supply chain partners and collaboratively manage intra- and inter-organization processes have been receiving in recent year greater attention from academics and managers. Supply chain integration is necessary step for business performance improvement in market competition (Braunscheidel, Suresh et al. 2010). Stevens (1989) defined four stages to achieve supply chain integration, namely (1) distinct departments (2) cross-functional integration primarily focus on inbound flow of goods disconnect from demand side (3) effective internal management of in and out flow (4) external integration with both supplier & customers

Many researchers have attempted to find what influences supply chain integration and relationship among internal integration, external integration, and business performance. A holistic view of supply chain has shifted paradigmatic role from initial focus of a single firm to include a broader scope of overall performance, to which requires an adaptation of a systematic approach (Shepherd and Günter 2006). Some researchers examine specifically the intensity of supply chain integration. Some identify factors that facilitate and inhibit integration. Some propose the linkage of integration and performance, testing antecedents at different points.

Rosenzweig, Roth et al. (2003) has discovered that supply chain integration intensity leads to increase in competitive capabilities and business performance improvement. Firms with the highest integration with suppliers and customers have the highest level of financial, non-financial and operational performance (Frohlich and Westbrook 2001), whereas the interaction of internal and external integration, related to time-based performance, is significantly related to both market share and financial performance after controlling for all other effects (Droge, Jayaram et al. 2004).

From a separate dimension, internal integration is directly related to both business and operational performance, while customer integration is directly related to operational performance. However, there is no direct relation of supplier integration to performance, yet its interaction with customer integration is related to operational performance (Flynn, Huo et al. 2010). Droge, Jayaram et al. (2004) postulate positive antecedents of both external and internal integration to time-based performance, namely time-to-market, time-to-product and responsiveness. They define external integration as an inclusive of supplier development, supplier partnerships, and closer customer relationship, whereas internal integration an inclusive of concurrent engineering (CE), designs for manufacturability (DFM), standardization, computer aided design (CAD) and computer-aided engineering (CAE).

Braunscheidel, Suresh et al. (2010) investigate organizational culture effect to determine cultural characteristics types that are associated with efforts to integrate supply chain and delivery performance. Their findings provide evidence that culture does influence firms to adopt internal and external integration practices. They describe the effects of organizational culture to determine the types of cultural characteristics (clan, adhocracy, market, hierarchy) that are strongly associated with efforts to integrate the supply chain and delivery performance. Wong and Boon-itt (2008) find an association of supply chain integration and the moderating roles of environmental uncertainty and institutional norm. The results of test model proposed by Zhao, Huo et al. (2008) show that internal integration and relationship commitment improve external integration independently, and their interactive effect on external integration is not significant. However, internal integration has a much greater impact on external integration than relationship commitment. This aligns with the study of Flynn, Huo et al. (2010) that internal and customer integration are more strongly related to improving performance than supplier integration.

2.4.1 Internal integration

As business environment becomes more complex than ever, effective integration of key functions within a firm leads to increased organization performance

by delivering values to customers. Narayanan, Jayaraman et al. (2011) analyze the antecedents of process integration and its impact on firm performance. Those antecedents include information technology, task security, task complexity, end customer orientation. Similarly, O'Leary-Kelly and Flores (2002) suggest that the integration impact of manufacturing and marketing/sales decision on organizational performance is moderated by a firm's business strategy and demand uncertainty. While each functional area such as sales, marketing, finance and operations may retain different incentives and orientation to maintain their stakeholders' needs, a firm is still capable of integration.

Oliva and Watson (2011) identify four key attributes – information quality, procedural quality, alignment quality, and constructive engagement – that influence supply chain planning performance. Information quality depicts the degrees to which a process enables the information used for decision making to be appropriate for the decision maker. This aligns with suggestion of Narayanan, Jayaraman et al. (2011) in that increased emphasis on information technology is critical to improve process integration, which mediates the impact of information technology capability on firm performance.

2.4.2 Supplier integration

Collaborative supplier-buyer relationship (Lockström, Schadel et al. 2010, Ha, Park et al. 2011) can be sources of competitive advantage for manufacturing firms. It fosters common identity, driving individual firms to exchange valuable knowledge, and explicit information to create products and services providing the most possible values to customers. Through their survey research by sampling 346 German automotive supplier companies, (Corsten, Gruen et al. 2011) posit that identification of supplier-to-buyer directly impacts supplier relationship-specific investments and information exchange. Both play different yet complimentary roles in effecting operational performance. Supplier relation-specific investments impact innovation and cost performance, while information exchange influences innovation and operational disturbances. This aligns with findings of Prajogo and Olhager (2011) that supplier

relationships in a long term can have both direct and indirect effects on performance. Indirectly, performance is achievable through the effects of information and logistics integration.

2.4.3 Customer integration

Integrating customers through customer centricity, alignment, and agility allow firms to generate different business model in maximizing values for customers. For example, it facilitates product design and development activities, which support firms to successfully response to customers' requirement in a competitive world of continual change. Practically, customers can play different roles in contributing to innovation projects. Some express their problems and provide new product ideas while some share their experiences in using existing products. Firms need to pay attention to all these details, and capture them for further improvement. Chow, Madu et al. (2008) aligned with the notion that ultimate success of any firms is to build around supply chain capability and capacity by responding to customers' voice through their supply chain integration processes.

Not only capturing new products' requirement, firms can also manage their inventory better while avoid losing sales through customer collaboration. With the business pressure to be more profitable growth (Butner 2010), intimacy with customers give visibility throughout supply chain network for faster actions. Together with fast-response of suppliers, firms can sustain their competitive advantage in this complex market environment.

Different types of customer power impact manufacturers' relationship commitment in different ways: expert power, referent power and reward power are important in improving manufacturers' normative relationship commitment, while reward power and coercive power enhance instrumental relationship commitment (Zhao, Huo et al. 2008). Spekman, Spear et al. (2002) find that learning appears to have a positive impact on performance measures relating to end-customer satisfaction and

being a more market-focused supply chain Pre-conditions for learning include integrative mechanism, shared culture, commitment, trust and communications.

Chapter III
Research Hypotheses and Methodology

This chapter develops a hypothesized model to explain the relationship among supply chain manager competencies, a supply chain manager's roles and responsibilities and supply chain integration. It also describes the process used in this study, including target population, data collection and questionnaire design. The study applies a multivariate regression analysis with the hypotheses tests on relationships among supply chain manager competencies, a supply chain manager's roles and responsibilities and supply chain integration.

From literature review, the researcher has not found any studies exploring the relationship between supply chain managers and supply chain integration with the link of competency. This interdisciplinary research becomes the researcher's interest for it connects supply chain and human resource, both of which are key functions of any firms. Therefore, this paper is organized in such way that we develop supply chain manager competencies constructs from relevant literature and explores their associations with different dimensions of supply chain integration. Different group of supply chain managers defined by their level of responsibilities are also compared and contrasted when the researcher analyzes competencies and their impacts.

3.1 Research questions

There might be potentially different in opinions regarding current and expected competencies amongst supply chain managers depending on their levels of roles and responsibilities. Some may base their answers on personal experiences of how they and their team have been handling all the day-to-day works, and how they perceive as important to develop their own competencies to cope with complexity challenges. Some may base on broader information of business aspects for a firm's strategic moves

in order to sustain their competitive advantage. Some may focus mainly on all technical knowledge and know-how in operating supply chain activities for higher efficiency and effectiveness. Of all the differences, we expect to answer whether

1. Are there any relationships between supply chain manager competencies and supply chain integration?
2. Are there any relationships between a supply chain manager's roles and responsibilities and supply chain integration?
3. Are supply chain manager competencies for internal integration, supplier integration and customer integration the same?
4. Are roles and responsibilities of a supply chain manager for internal integration, supplier integration and customer integration the same?
5. Are there any gaps of current and required competencies?

Therefore, this exploratory research will focus on the conceptual model as shown in figure 3.1.

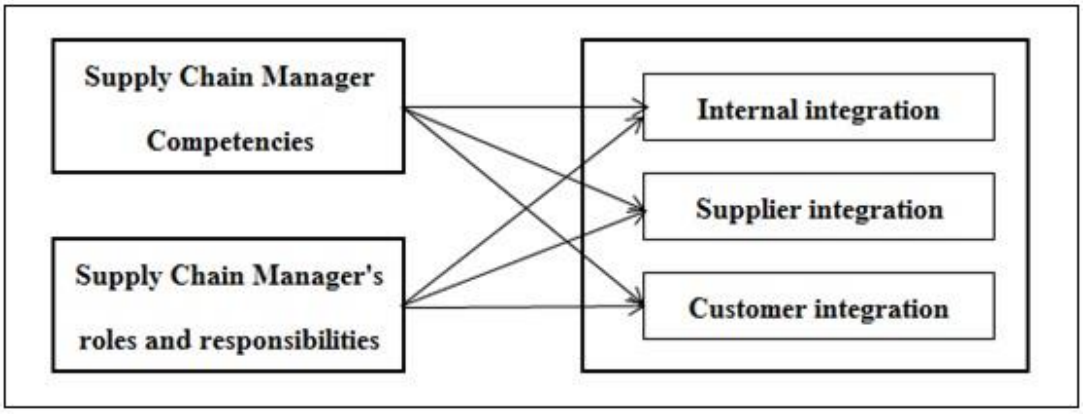


Figure 3. 1 Hypothesized model: relationship among a supply chain manager's roles and responsibilities, competencies and supply chain integration

3.2 Research hypotheses

We can draw four major hypotheses from the conceptual model to test the impact of supply chain manager competencies as well as that of a supply chain manager's roles and responsibilities on each dimension of supply chain integration.

3.2.1 Impact of supply chain manager competencies

Hypothesis 1a: Supply chain manager competencies have a positive impact on internal integration

Hypothesis 1b: Supply chain manager competencies have a positive impact on supplier integration

Hypothesis 1c: Supply chain manager competencies have a positive impact on customer integration

3.2.2 Significance test of independent variable – supply chain manager competencies

Hypothesis 2: Supply chain manager competencies for each supply chain integration dimension are the same

3.2.3 Impact of a supply chain manager's roles and responsibilities

Hypothesis 3a: A supply chain manager's roles and responsibilities have a positive impact on internal integration

Hypothesis 3b: A supply chain manager's roles and responsibilities have a positive impact on supplier integration

Hypothesis 3c: A supply chain manager's roles and responsibilities have a positive impact on customer integration

3.2.4 Significance test of independent variable – roles & responsibilities

Hypothesis 4: A supply chain manager's roles and responsibilities for each supply chain integration dimension are the same

3.3 Research methodology

3.3.1 Sample and data collection

The sample from this research was collected from two sources; (1) the Directory of the Logistics Office, the Department of Primary Industry and Mines, and (2) LinkedIn website by searching supply chain professionals in Thailand. An on-line questionnaire was sent to 598 target population with personalized message if they would like to obtain the result of this survey. Respondents profile cover various industries in Thailand as well as their roles range from specific supply chain activities to the full coverage.

After one month, 82 responses were received. As the researcher did not request respondents to identify their names in the questionnaire, a follow-up e-mail was sent to everyone to remind their participation in this survey. Consequently, 47 respondents have sent their answers. The researcher also collected additional 31 responses from participants of the supply chain seminar "Go Together: Win-Win Collaboration 2013" organized by the Department of Primary Industry and Mines in August 2013. This makes a total of 160 responses bringing a completion rate of 26.8%, which is a sizable number for empirical studies in operations management. Although a better conclusion is expected to be drawn from a higher response rate of surveyed data, the researcher has made analysis from different numbers of respondents and found that multivariate regression models enable statistically significant interpretation when response rate is higher than 25%.

3.3.2 Measures and questionnaire design

Self-administered questionnaire comprising three separate sections is an instrument for data collection. Key constructs are developed from the literature review. Section 1 focuses on the demographic aspects of the respondents. It also asks respondents' nature of work and their roles and responsibilities. Section 2 asks opinion about supply chain integration levels of the respondents' companies. Statements of integration are adapted from previous studies conducted by Zhao, Huo et al. (2011)

and Yew, Sakun et al. (2011). Section 3 shows a total of 20 items of supply chain manager competencies. The researcher uses continuous scale in the questionnaire as it allows interval-scaled data generation, and avoids singularity problem. Besides demographic questions, respondents were instructed to make assessment with the rating scale of 0-99 that best describes their roles and responsibilities, supply chain integration level, and current and required supply chain manager competencies. A higher value of the rating indicates a higher level of roles and responsibility, a higher supply chain integration, and a higher level of current or required competencies. With this wide range rating scale, it enables us to analyze data in different dimensions to obtain the best-fit model. This includes taking logarithmic scale of the response to reduce a wide-ranging quantity to a smaller scope.

3.3.3 Dependent variables

Three different dimensions of supply chain integration; namely internal integration, supplier integration and customer integration are used as dependent variables of the study. For each dimension of integration, respondents are asked to rate the integration level in their organizations from statements explaining them. Internal integration concerns cross-functional cooperation from incoming to outgoing activities of both operation and supporting teams to ensure smooth information and physical flow, as well as a joint effort of improvement. Supplier integration, one dimension of external integration, seeks for shared information between respondents' organization and their suppliers for strategic partnership, enabling both parties to address each other's requirements and constraints for better anticipation. Another dimension of external integration, customer integration, aims at responding not only timely but correctly markets' requirement through demand viability and operation flexibility consideration. While maturity of the three integrations is expected to contribute to the organizational performance sustainability, this study focuses their relationships with key independent variables on human resource dimensions. Giving an equal weight for different statements rating under the same integration, the researcher derives the mean values for analysis and draws three different models

exclusively for each type of integration to understand how much effect human resource dimensions have on them.

3.3.4 Independent variables

The researcher defines the independent variables from respondents' roles and responsibilities in addition to their competencies. The former describes how much involvement of the respondents' job functions within the organization from six statements both strategically and operationally to ensure not only that suppliers and customers concerns are addressed, but also the organization remains competitive in different period of times. An equal weight is given to each statement in order to obtain a mean value of roles and responsibilities independent variable in the model. The latter depicts 20 items of supply chain manager competencies derived from the literature review. Skills, knowledge and attributes that a supply chain manager should possess are well covered, and respondents are to rate their current competencies level as well as required level to perform their jobs. While the gap of current and required competencies level is analyzed, the researcher expects multi-collinearity among 20 entries and subsequently performs the factor analysis to reduce number of variables.

3.3.5 Multivariate regression analysis

Instead of running OLS regression, the researcher applies multivariate regression as it enables the tests of coefficients across different outcome variables. Different supply chain integration dimensions are dependent variables whereas supply chain manager competencies and a supply chain manager's roles and responsibilities are independent variables.

Different steps in managing survey data are summarized as below.

1. Add 0.5 points to all responses as to avoid having zero score in the respondents' rating

2. Take logarithmic scale of dependent variables – supply chain integration
3. Take logarithmic scale of independent variable – a supply chain manager's roles and responsibilities
4. Apply factor analysis of independent variable – supply chain manager competencies
5. Build a multivariate regression model

$$\ln\left(\frac{INTL_i}{100-INTL_i}\right) = \beta_0 + \beta_1 TKA_i + \beta_2 TMS_i + \beta_3 \ln\left(\frac{ROLES_i}{100-ROLES_i}\right) \quad \text{.....(1)}$$

$$\ln\left(\frac{SUPL_i}{100-SUPL_i}\right) = \beta_0 + \beta_1 TKA_i + \beta_2 TMS_i + \beta_3 \ln\left(\frac{ROLES_i}{100-ROLES_i}\right) \quad \text{.....(2)}$$

$$\ln\left(\frac{CUST_i}{100-CUST_i}\right) = \beta_0 + \beta_1 TKA_i + \beta_2 TMS_i + \beta_3 \ln\left(\frac{ROLES_i}{100-ROLES_i}\right) \quad \text{.....(3)}$$

where *i*= 1,2,3,...,n observation

INTL = Internal integration

SUPL = Supplier integration

CUST = Customer integration

TKA = Factor 1: Technical knowledge and application

TMS = Factor 2: Traits and management skills

ROLES = A supply chain manager's roles and responsibilities

Notice that two independent variables derived from factor analysis, TKA and TMS, are not in a logarithm form. This is because with such form the regression models do not report statistically significant result.

Chapter IV
Data Analysis and Results

In this chapter, the result of the data analysis is presented. In response to the questions posed in chapter 3 of this dissertation, the data is collected and subsequently possessed. Through different steps of analysis from descriptive statistics to application of factor analysis and multivariate regression analysis, all measures are used to test the hypothesis. The findings demonstrate how supply chain manager competencies and a supply chain manager's roles and responsibilities impact on different dimensions of supply chain integration.

4.1 Descriptive Statistics

4.1.1 Respondents' demographic characteristics

Table 4.1 shows that while sixty-one percent of 160 respondents work in only one of supply chain functions - be it in logistics management (covering distribution, transportation and production planning), customer relation management (covering customer service, demand planning), or supply relation management (covering supply management, sourcing, procurement), the rest is responsible for more than one functions. The majority of respondents work in logistics management functions (38.8%), followed by the respondents being in charge of all supply chain functions (17.5%). The least respondents cover both logistics management and customer relation management 5.6%).

As respondents are requested to fill the name of their companies and type of industry freely, we apply the Industry Classification Benchmark (ICB) launched by Dow Jones and FTSE in 2005 to segregate markets into sectors within the macro-economy. The type of industry of respondents is therefore considered from the list of 19 super-sectors of the ICB.

The respondents' profile can be categorized into 8 super-sectors of industry as illustrated in Table 4.2. The key industry of respondents is Industrial Goods & Services (31.3%), followed by Personal & Households Goods (25.6%). The least respondents are from Utilities, which is accounted for only 1.3%

Table 4. 1 Respondents' Work Nature

Work Nature	Response	Percentage of sample (%)
Logistics Management (LM)	62	38.8%
Customer Relation Management (CRM)	10	6.3%
Supplier Relation Management (SRM)	25	15.6%
LM + CRM	9	5.6%
LM + SRM	16	10.0%
CRM + SRM	10	6.3%
LM + CRM + SRM	28	17.5%

Table 4. 2 Respondents' Type of Industry

Type of Industry	Response	Percentage of sample (%)
Industrial goods & services	50	31.3%
Personal & Household Goods	41	25.6%
Automobile & Parts	22	13.8%
Health Care	20	12.5%
Food & Beverage	18	11.3%
Retail	4	2.5%
Chemicals	3	1.9%
Utilities	2	1.3%

Table 4.3 classifies the respondents' size of companies and number of employees working in the supply chain functions. We can consider half of them work in the company size of less than 500 employees, and the other half more than 500 employees. On a similar notion, half of them work in the companies which employ

less than 100 employees in supply chain functions, and the other half more than 100 employees. Cross-tabulation of the two dimensions, we find the majority of the respondents work in the companies of 100-500 employees in size, and employees working in supply chain functions are of 10-50 persons (15%). It is also noticeable that respondents whose companies employ more than 500 persons in supply chain areas are from the company size of 500 employees and above. For example, 6.3% of respondents are from the company of more than 5,000 employees in size, with more than 500 supply chain professionals.

Table 4. 3 Respondents' Size of the Companies & number of employees working in supply chain functions

	<10	10-50	50-100	100-300	300-500	>500	Total
<100	10.6%	4.4%	1.3%				16.3%
100-500	10.6%	15.0%	3.8%	1.9%			31.3%
500-1,000	0.6%	5.6%	6.9%	1.3%	1.3%	0.6%	16.3%
1,000-3,000		4.4%	3.1%	9.4%	0.6%	1.9%	19.4%
3,000-5,000		0.6%		1.9%	1.3%		3.8%
>5,000		1.3%	4.4%	1.3%		6.3%	13.1%
Total		31.3%	19.4%	15.6%	3.1%	8.8%	100%

Looking at the respondents' status, Table 4.4 describes that 43.1% works as supply chain manager themselves, whereas 26.3% considers themselves as superior of supply chain manager, and 30.6% as subordinate of supply chain managers. The positions of each respondents ranges largely from simply officer level to supervisor, chief, manager, director, managing director and executive. All of the job titles indicate their roles & responsibilities in the supply chain processes, as well as whether they perform functional-related or non-functional related activities in the companies. A cross-tabulation between respondents' status and the job titles shows that respondents' position titles are more functional-related. This includes job titles in such areas as warehouse, purchasing, customer service and operations. For non-functional

related position titles are those having generic names as logistics manager and supply chain managers.

Table 4. 4 Respondents' status and their job titles

Status	Functional-related title	Non-functional-related title	Total
Supply chain manager themselves	21 (13.1%)	48 (30.0%)	69 (43.1%)
Superior of supply chain manager	15 (9.4%)	27 (16.9%)	42 (26.3%)
Subordinate of supply chain manager	49 (30.6%)	0 (0%)	49 (30.6%)
Total	85 (53.1%)	75 (46.9%)	100 (100%)

Years of experience of respondents ranges from 1 to 47. As shown in Table 4.5, the majority of them have working experiences between 5-10 years (31.3%), followed by 10-20 years (30.6%), less than 3 years (19.4%), 3-5 years (12.5%) and more than 20 years (6.3%). An average age of working experience is 10.36 years, whereas the median is reported as 10 years.

Table 4. 5 Respondents' years of experiences in supply chain functions

Years of experience	Response	Percentage of sample (%)
< 3 years	31	19.4%
3-5 years	20	12.5%
5-10 years	50	31.3%
10-20 years	49	30.6%
>20 years	10	6.3%
Minimum: 1 years, Maximum: 47 years, Median: 10 years, Average: 10.36 years		

4.1.2 Mean and correlation statistics of constructs

Table 4.6 – 4.13 report key statistics of each dependent and independent variable.

4.1.2.1 Mean statistics of supply chain integration

a. Internal integration

As illustrated in Table 4.6 and Figure 4.1, the mean of internal integration is 78.32 on a scale of 0-99 with a standard deviation of 16.07. The result of internal integration is the average of all three statements describing it. Out of the three statements, the highest mean statement rated by respondents is “Our organization emphasizes on cross-function team on process improvement and product development” (M = 78.84, S.D. = 18.72). It has also the highest Kurtosis at 5.93, explaining high probability for extreme value. The lowest mean statement is “Responsiveness between departments to meet each other requirement” (M = 77.91, S.D. = 17.40). We can see left skewed distribution as most values are concentrated on the right of the mean, with extreme values to the left.

b. Supplier integration

Likewise, the mean of supplier integration is 70.27 on a scale of 0-99 with a standard deviation of 21.28 as shown in Table 4.7 and Figure 4.2. Out of the four statements on supplier integration, the highest mean statement as rated by respondents is “Our organization has joint planning with our supplier to obtain rapid response ordering process , including new product development” (M = 71.41, S.D. = 23.16), and the lowest mean statement is “Our major suppliers share their capability of order flexibility” (M = 69.23, S.D. = 24.01). We can notice larger standard deviation of supplier integration than internal integration, both from each statement and overall result. This explains that respondents’ assessment has higher dispersion from the

mean. The most dispersion is from the statement “Our organization exchanges information with our major suppliers through information technologies”

c. Customer integration

Table 4.8 and Figure 4.3 shows the mean of customer integration is 68.31 on a scale of 0-99 with a standard deviation of 21.73. Out of the four statements on customer integration, the highest mean statement as rated by respondents is “Our organization exchanges market information with major customers” (M = 69.92, S.D. = 23.73), and the lowest mean statement is “Our customers are involved in our product development process” (M = 65.82, S.D. = 28.94). Its high standard deviation describes the largest dispersion from the mean as compared to all statements. It is the only statement having Kurtosis less than 3 which depicts a distribution flatter than a normal distribution with a wider peak and a wider spread around the mean.

We can remark that overall supply chain integration is rated an average of 71.75, with 17.38 S.D, as displayed in Table 4.9 and Figure 4.4. Considered separately, respondents give the lowest rating on customer integration as compared to internal integration and supplier integration. Internal integration shows higher maturity level as compared to the other two dimensions of supply chain integration. Their lower means and higher standard deviation explains high variation of respondents’ assessment on their firms. We therefore need to focus on improvement actions in supply chain integration of industry in Thailand, especially to ensure better supplier and customer integration dimensions.

4.1.2.2 Mean statistics of respondents’ roles & responsibility

Table 4.10 and Figure 4.5 reveal that the statement “I ensure operations flexibility to meet both current customer’s demand and future requirements” is rated with the highest level among all 6 statements. (M=81.34, S.D. = 17.40). It also has the least dispersion from the mean, showing the consistent assessment of respondents.

Kurtosis value at 5.41 explains high probability of extreme value. The statement “I am responsible for the company’s strategic move to sustain competitive advantage” is rated with the lowest level and rather high variation from the mean (M=73.14, S.D. = 22.32). The assessment in this section of questionnaire shows that respondents handle more on operational activities rather than focusing in strategic actions in supply chain. Overall roles and responsibilities of respondents have an average level of 77.63, and the standard deviation of 15.11. Taking into consideration all statements together, it depicts better dispersion from the mean in respondents’ opinion.

When comparing internal consistency of the measurement, this section has lower Cronbach’s alpha than those of supply chain integration section.

4.1.2.3 Mean statistics of respondents’ supply chain manager competencies level

Table 4.11-4.13 displays respondents’ opinion on their current and expected supply chain manager competencies level which is rated on a scale of 0-99, as well as how each of the competencies is required in the next 5 years, whether it will be less or more, rated on a Likert scale of 1-5.

a. Current Level of Supply Chain Manager Competencies

Of all 20 supply chain manager competencies, respondents have rated their current level with an average of 71.69, and a standard deviation of 14.34 as shown in Table 4.11 and Figure 4.6. Current competencies level ranges between a mean of 62.94 to 85.42, a standard deviation of 15.61 and 21.21. Dispersion of respondents’ assessment varies in each competency item, showing diverse opinions in their current levels. All variables have a negative skewness, while Integrity and Post-secondary education are substantially skewed. Likewise, Leptokurtic distribution can be observed from all competencies since their Kurtosis values are higher than 3, explaining high probability of extreme values, especially in Integrity and Post-secondary education.

Considering from the mean scores, the highest three-rated of current competencies level are Integrity (M = 85.42, S.D. = 15.93), Post-secondary education (M = 79.76, S.D. = 21.21), and Customer focus (internal/external) (M=75.78, S.D.17.18). In contrast, the lowest three-rated of current competencies level are International Business Rules and Regulations (M = 62.94, S.D. = 20.88), Technical logistics and supply chain functions (M=66.33, S.D. =20.13), and Supply chain synchronization (M=67.28, S.D. =19.59). Scale reliability coefficient has a value of 0.968, which provides high measure of internal consistency ensuring validity of the test.

b. Expected Level of Supply Chain Manager Competencies

While asked about expected level of the same supply chain manager competencies, the average level of all competencies is 89.28, and a standard deviation of 7.92, as shown in Table 4.12 and Figure 4.7. The low standard deviation describes small variation of respondents' opinions from the mean. It shows more consistent as compared to their opinions on current competencies level in previous paragraph. Expected competencies level ranges between a mean of 84.55 to 94.59, and a standard deviation of 7.31 to 15.01. This is considerably high in term of respondents' expectation. Considering from the mean scores of all the 20 competencies, the highest three-rated of expected competencies level are Integrity (M = 94.59, S.D. = 7.31), Building effective team (M = 91.68, S.D. = 8.35), and Customer focus (internal/external) (M=91.31, S.D. = 9.14). In contrast, the lowest three-rated of expected competencies level are International Business Rules and Regulations (M = 84.55, S.D. = 13.55), Math, statistics and analytical thinking (M=87.22, S.D. =11.89), and Technical logistics and supply chain functions (M=87.44, S.D. =11.63).

c. Requirement of Supply Chain Manager Competencies in the Next 5 Years

As illustrated in Table 4.13, on a scale from 1-5, an average result of overall supply chain manager competencies is 3.74 with a standard deviation of 0.97. Effective communication is the competency that supply chain manager would still require the

most in the next 5 years (M = 3.90, S.D. = 1.13), and Post-Secondary Education the least (M = 3.48, S.D. = 1.21). Considering each competencies, we can notice their mean scores are higher than half of the Likert scale 0-5. This confirms that respondents consider all competencies necessary in the next 5 years. From the 20 competencies items, there are three competencies; Effective communication, Technical logistics/supply chain functions, and Enabling technology having the Kurtosis values higher than 3, Leptokurtic, showing high probability of extreme values in respondents' opinion. The remaining 17 competencies with the Kurtosis values lower than 3, Platykurtic, indicates values are wider spread around the mean.

Table 4. 6 Mean statistics of dependent variable – Internal Integration

Variable	Description	Mean	Std. Dev.	Std. Err.	[95% Conf.	Interval]	Skewness	Kurtosis	Cronbach's Alpha
ina	Responsiveness between departments to meet each other requirement	77.913	17.403	1.376	75.195	80.630	(1.084)	3.895	0.889
inb	Integration and connections among all internal functions from raw material management through production, distribution and sales	78.188	19.764	1.562	75.102	81.273	(1.533)	5.404	0.904
inc	Our organization emphasizes on cross-function team on process improvement and product development	78.844	18.716	1.480	75.921	81.766	(1.506)	5.929	0.928
intl	**Internal Integration**	**78.315**	**16.068**	**1.270**	**75.806**	**80.823**	**(1.228)**	**4.732**	**0.826**

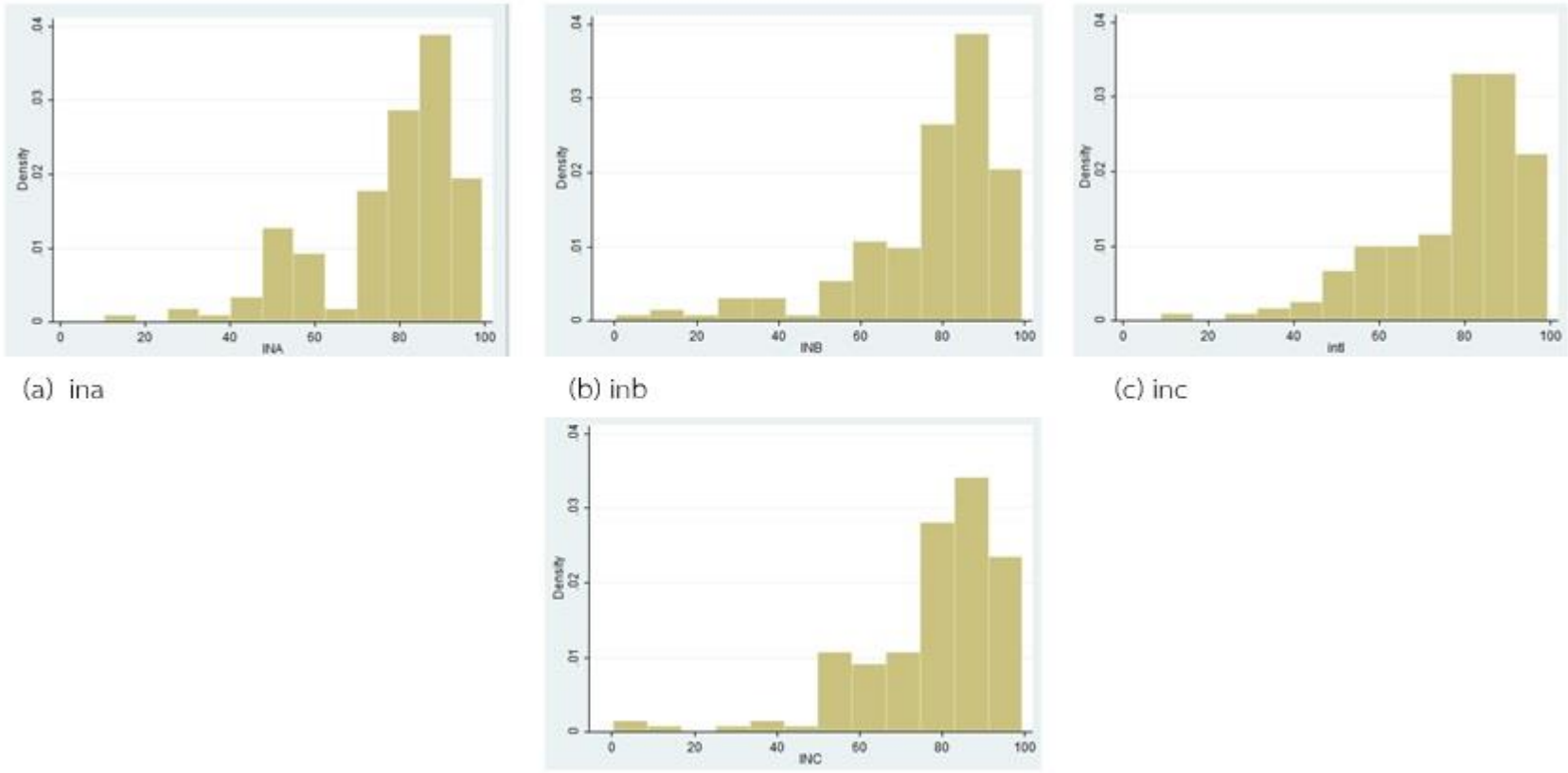


Figure 4. 1 Histogram of internal integration statements

Table 4. 7 Mean statistics of dependent variable – Supplier Integration

Variable	Description	Mean	Std. Dev.	Std. Err.	[95% Conf.	Interval]	Skewness	Kurtosis	Cronbach's Alpha
ind	Our organization exchanges information with our major suppliers through information technologies	70.019	24.687	1.952	66.164	73.873	(1.072)	3.453	0.947
ine	Our organization has a strategic partnership with our suppliers	70.419	24.237	1.916	66.634	74.203	(1.113)	3.629	0.938
inf	Our organization has joint planning with our suppliers to obtain rapid response ordering process, including new product development	71.413	23.163	1.831	67.796	75.029	(1.255)	4.198	0.925
ing	Our major suppliers share their capability of operations flexibility	69.225	24.010	1.898	65.476	72.974	(1.118)	3.586	0.942
supl	**Supplier integration**	**70.269**	**21.283**	**1.683**	**66.946**	**73.592**	**(1.015)**	**3.378**	**0.908**

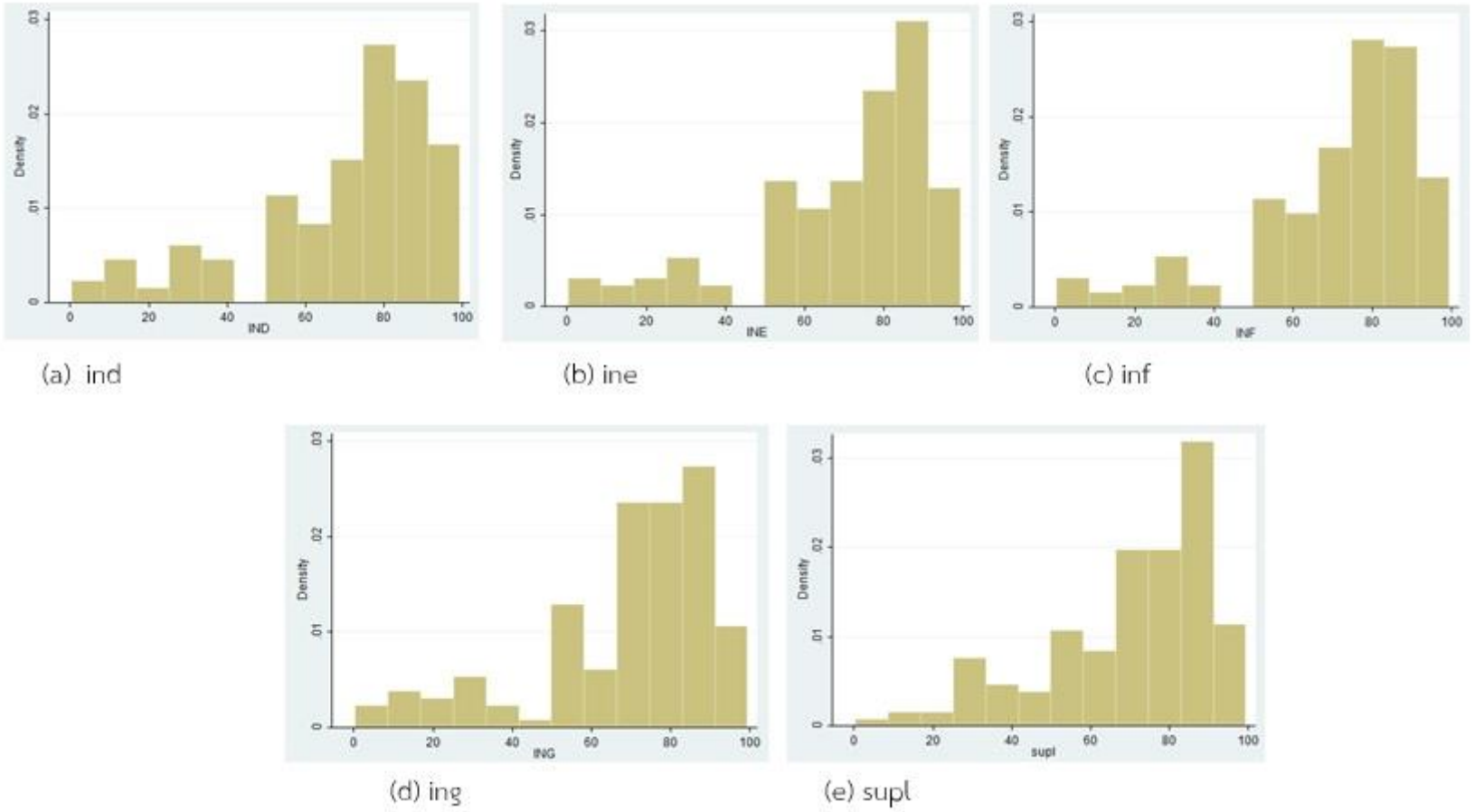


Figure 4. 2 Histogram of supplier integration statements

Table 4. 8 Mean statistics of dependent variable – Customer Integration

Variable	Description	Mean	Std. Dev.	Std. Err.	[95% Conf.	Interval]	Skewness	Kurtosis	Cronbach's Alpha
inh	Our organization exchanges market information with major customers	69.919	23.725	1.876	66.214	73.623	(1.267)	4.290	0.926
ini	Our organization shares information to major customers through information technologies on operations flexibility	67.656	24.131	1.908	63.888	71.424	(1.054)	3.517	0.916
inj	Our organization has joint planning and forecasting with major customers to anticipate demand visibility	69.831	24.148	1.909	66.061	73.602	(1.081)	3.808	0.911
ink	Our customers are involved in our product development process	65.819	28.938	2.288	61.300	70.337	(0.915)	2.714	0.927
cust	**Customer integration**	**68.306**	**21.733**	**1.718**	**64.913**	**71.700**	**(0.957)**	**3.656**	**0.881**

Table 4. 9 Comparative mean statistics of supply chain integration

Variable	Description	Mean	Std. Dev.	Std. Err.	[95% Conf.	Interval]	Skewness	Kurtosis	Cronbach's Alpha
intl	Internal Integration	78.31	16.07	1.27	75.81	80.82	(1.23)	4.73	0.93
supl	Supplier integration	70.27	21.28	1.68	66.95	73.59	(1.02)	3.38	0.88
cust	Customer integration	68.31	21.73	1.72	64.91	71.70	(0.96)	3.66	0.89
scint	**Overall supply chain integration**	**71.75**	**17.38**	**1.37**	**69.04**	**74.46**	**(0.754)**	**3.20**	**0.81**

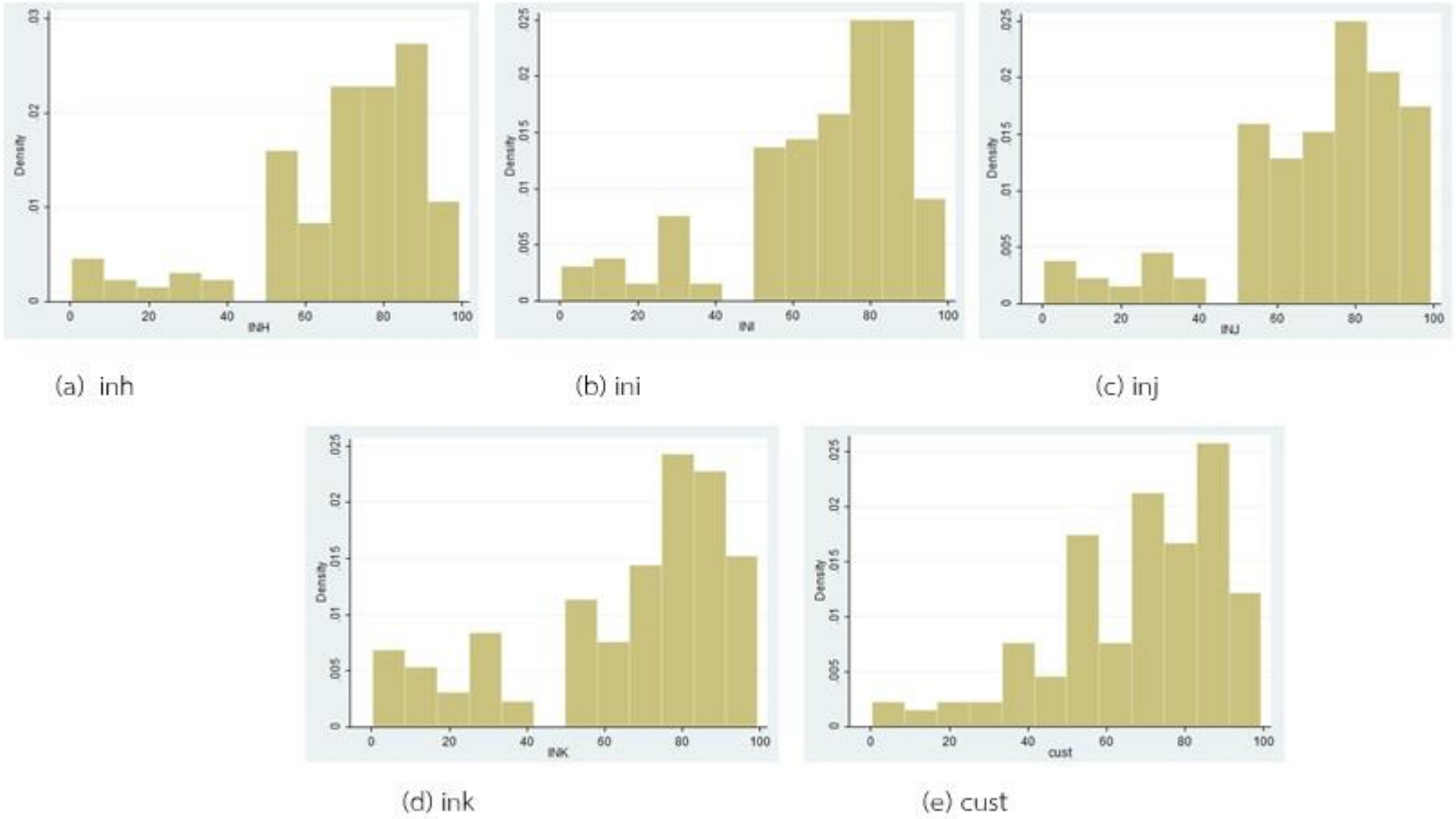


Figure 4. 3 Histogram of customer integration statements

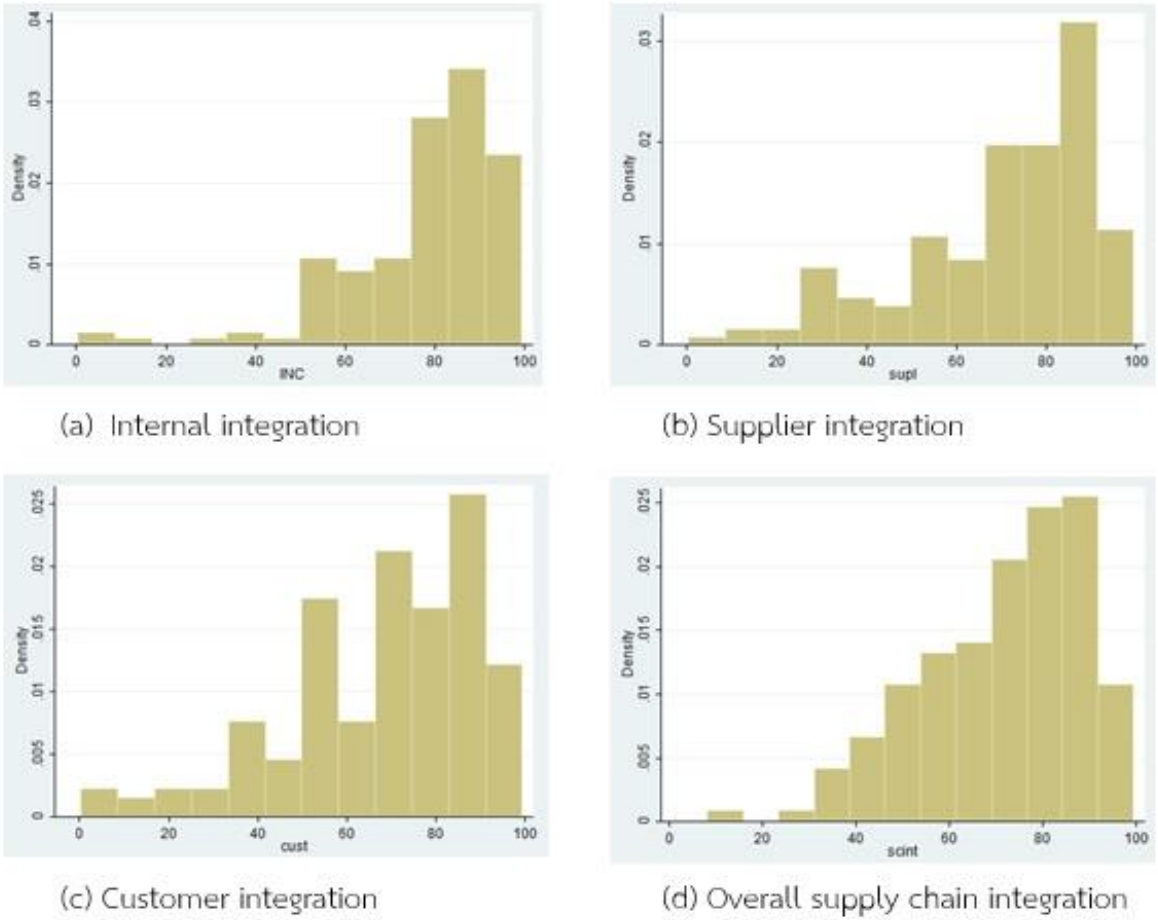


Figure 4. 4 Histogram of comparative supply chain integration dimensions

Table 4. 10 Mean statistics of respondents' roles and responsibilities

Variable	Description	Mean	Std. Dev.	Std. Err.	[95% Conf.	Interval]	Skewness	Kurtosis	Cronbach's Alpha
rr1	I ensure operations flexibility to meet both current customer's demand and future requirements.	81.344	17.399	1.376	78.627	84.060	(1.541)	5.406	0.855
rr2	I foster strategic relationship with suppliers and customers.	78.419	18.926	1.496	75.464	81.374	(1.474)	5.246	0.852
rr3	I am responsible for the company's strategic move to sustain competitive advantage.	73.144	22.319	1.764	69.659	76.629	(1.051)	3.822	0.877
rr4	I drive operational team to achieve daily and weekly targets.	77.681	23.127	1.828	74.070	81.292	(1.592)	5.351	0.870
rr5	I personally involve in corrective actions to most problems related to supply chain activities.	78.700	21.062	1.665	75.411	81.989	(1.505)	5.085	0.856
rr6	I deal with suppliers and/or customers to minimize all possible problems that will obstruct short-medium term supply chain operations	76.488	21.342	1.687	73.155	79.820	(1.545)	5.380	0.849
func	**Overall roles & resonsibilities**	**77.63**	**15.11**	**1.19**	**75.27**	**79.99**	**(1.221)**	**4.503**	**0.822**

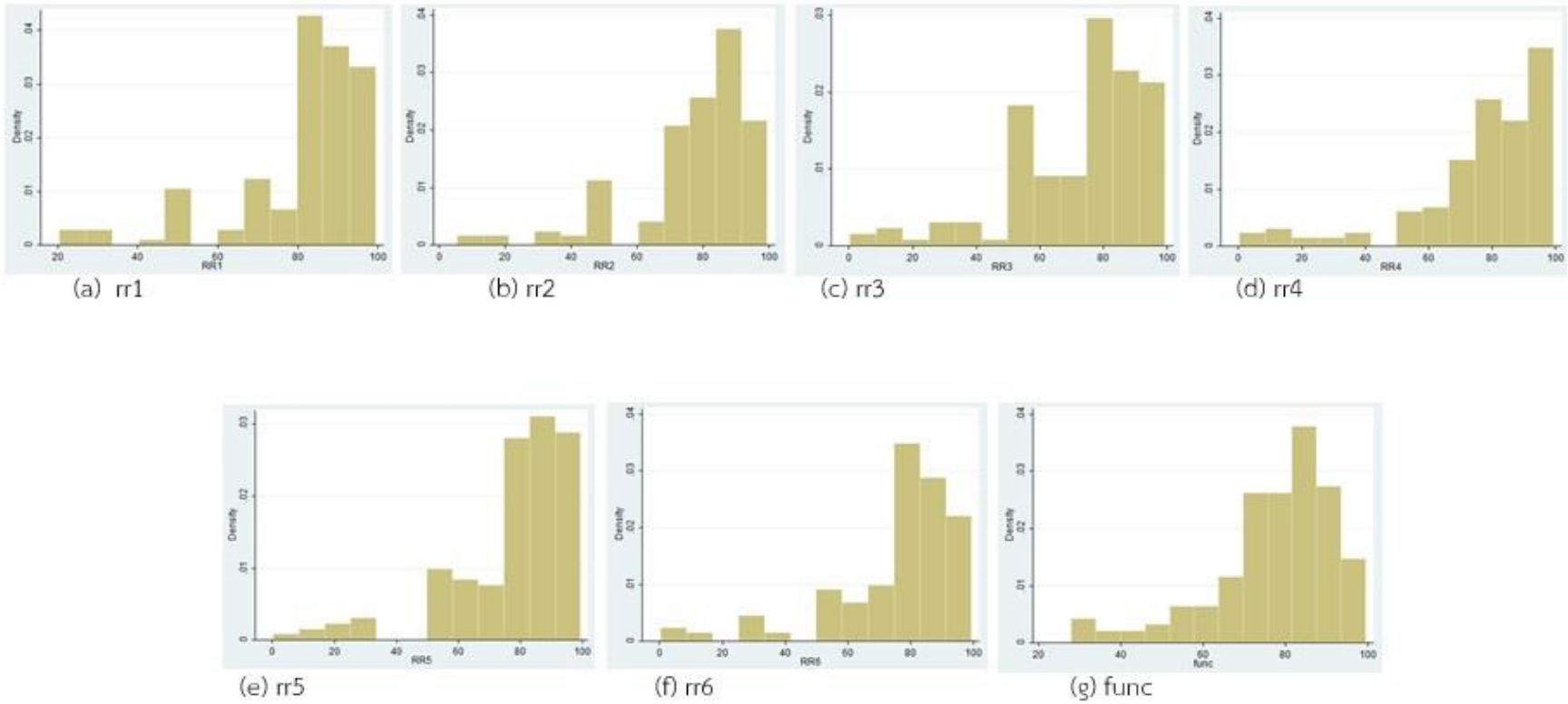
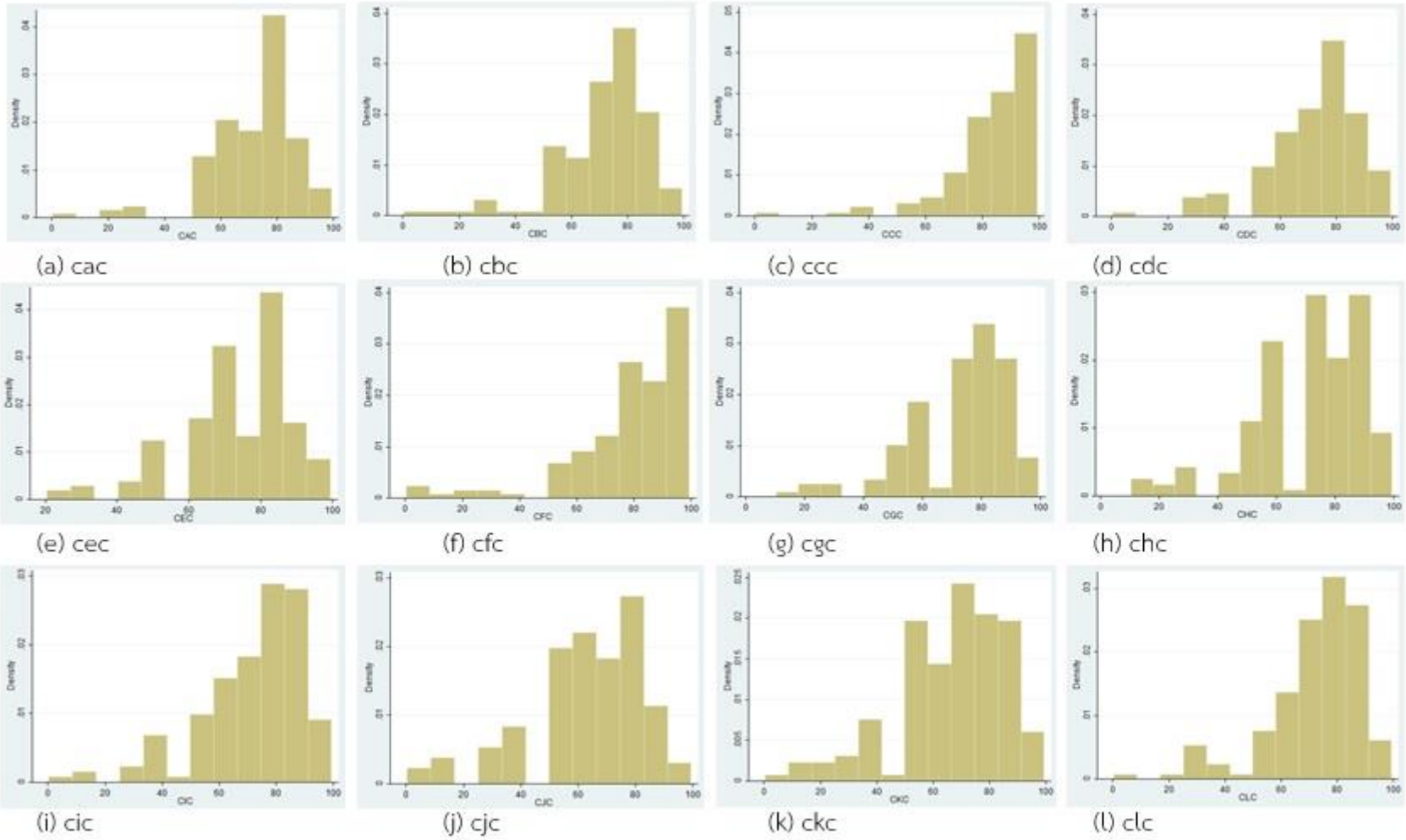


Figure 4. 5 Histogram of roles and responsibilities statements

Table 4. 11 Mean statistics of respondents' current supply chain manager competencies level

Variable	Description	Mean	Std. Dev.	Err.	[95% Conf.	Interval]	Skewness	Kurtosis	Cronbach's Alpha
cac	Interpersonal skills	71.93	16.14	1.28	69.41	74.45	(1.15)	5.48	0.967
cbc	Effective communication	71.86	17.05	1.35	69.20	74.52	(1.29)	5.42	0.966
ccc	Integrity	85.42	15.93	1.26	82.93	87.91	(1.87)	8.25	0.968
cdc	Building effective teams	72.23	17.13	1.35	69.56	74.91	(1.01)	4.45	0.965
cec	Personal learning & self-development	73.11	15.61	1.23	70.67	75.54	(0.97)	4.11	0.966
cfc	Post secondary education	79.76	21.21	1.68	76.45	83.07	(1.64)	6.12	0.969
cgc	Math, statistics and analytical thinking	72.64	17.42	1.38	69.92	75.36	(1.10)	4.28	0.967
chc	Supply chain fundamentals	71.31	19.29	1.52	68.29	74.32	(0.96)	3.88	0.966
cic	Business process knowledge	72.34	18.95	1.50	69.39	75.30	(1.07)	4.24	0.965
cjc	International business rules & regulations	62.94	20.88	1.65	59.68	66.20	(0.83)	3.62	0.966
ckc	Technical logistics/supply chain functions	66.33	20.13	1.59	63.19	69.47	(0.76)	3.42	0.966
clc	Work processes management	72.73	17.34	1.37	70.02	75.43	(1.22)	4.85	0.965
cmc	Supply chain synchronization	67.28	19.59	1.55	64.22	70.34	(1.11)	4.66	0.965
cnc	Customer focus (internal / external)	75.78	17.18	1.36	73.09	78.46	(1.32)	5.86	0.965
coc	Supplier management	70.03	18.20	1.44	67.18	72.87	(1.19)	4.94	0.966
cpc	Enabling technology	69.92	17.10	1.35	67.25	72.59	(0.88)	3.98	0.966
cqc	Conflict management	67.71	19.14	1.51	64.72	70.70	(0.99)	3.97	0.965
crc	Change & complexity management	68.58	18.63	1.47	65.67	71.49	(0.88)	4.06	0.965
csc	Focus on the bottom line (action oriented /results)	72.69	18.74	1.48	69.76	75.61	(1.06)	4.48	0.965
ctc	Strategy development & Application	69.21	17.56	1.39	66.47	71.95	(0.69)	3.62	0.966
OSCC	**Overall supply chain manager competencies**	**71.69**	**14.34**	**1.13**	**69.45**	**73.93**	**(0.947)**	**4.049**	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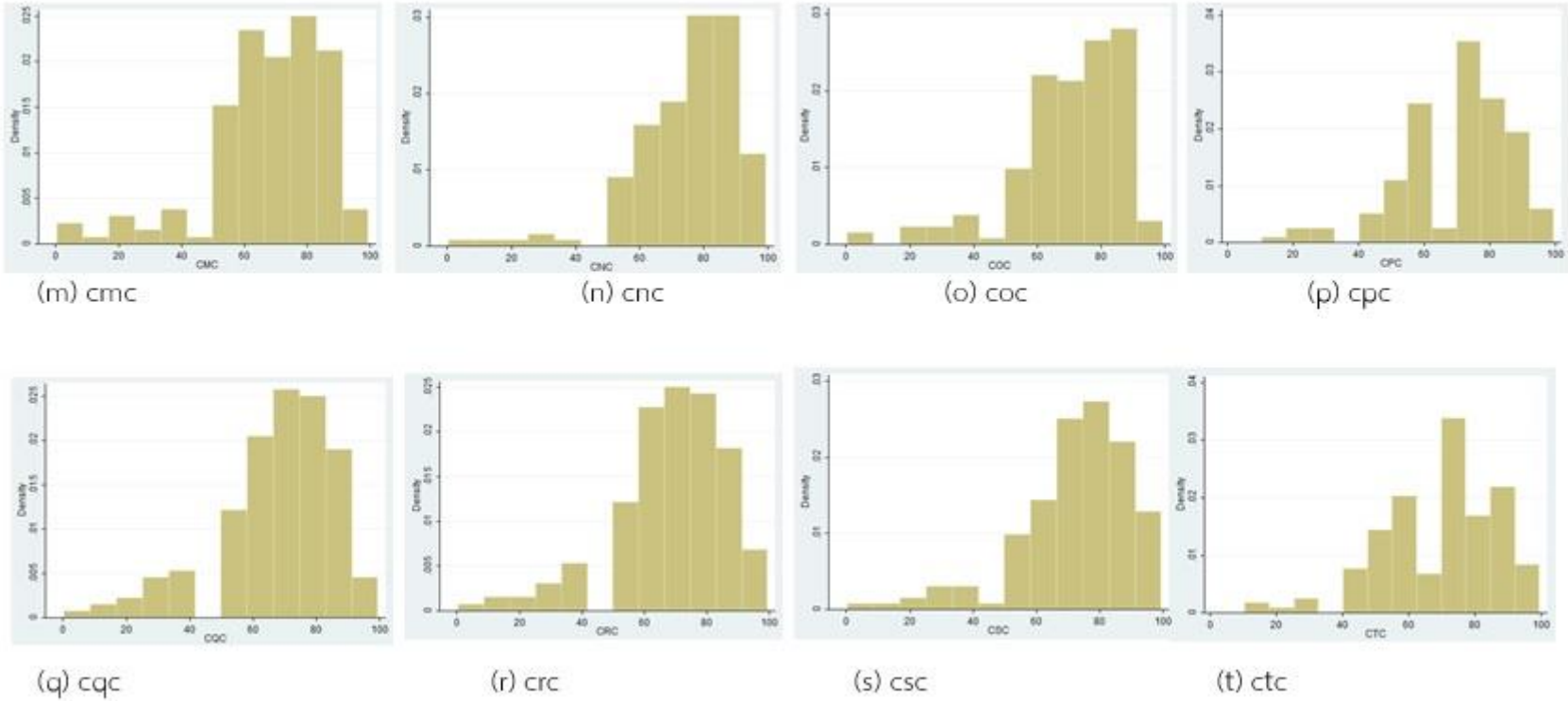
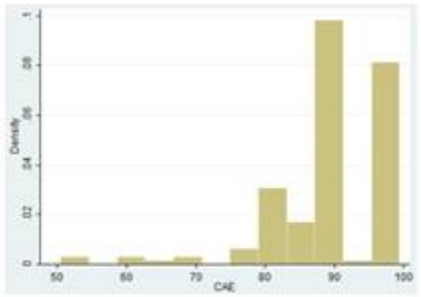


Figure 4. 6 Histogram of current level of supply chain manager competencies

Table 4. 12 Mean statistics of respondents' expected supply chain manager competencies level

Variable	Description	Mean	Std. Dev.	Err.	[95% Conf.	Interval]	Skewness	Kurtosis	Cronbach's Alpha
cae	Interpersonal skills	89.96	9.11	0.72	88.53	91.38	(1.63)	7.08	0.953
cbe	Effective communication	91.09	7.44	0.59	89.93	92.25	(1.09)	5.18	0.954
cce	Integrity	94.59	7.31	0.58	93.45	95.74	(2.00)	7.68	0.955
cde	Building effective teams	91.68	8.35	0.66	90.38	92.98	(1.68)	6.98	0.953
cee	Personal learning & self-development	90.26	8.86	0.70	88.88	91.65	(1.28)	5.53	0.952
cfe	Post secondary education	88.16	15.01	1.19	85.82	90.51	(2.47)	11.68	0.957
cge	Math, statistics and analytical thinking	87.22	11.89	0.94	85.36	89.08	(1.56)	6.48	0.953
che	Supply chain fundamentals	88.59	11.93	0.94	86.72	90.45	(1.52)	5.29	0.951
cie	Business process knowledge	90.03	10.24	0.81	88.43	91.62	(1.56)	5.78	0.951
cje	International business rules & regulations	84.55	13.55	1.07	82.43	86.67	(1.37)	5.76	0.952
cke	Technical logistics/supply chain functions	87.44	11.62	0.92	85.63	89.26	(1.48)	6.51	0.953
cle	Work processes management	90.41	9.00	0.71	89.01	91.82	(1.51)	6.80	0.953
cme	Supply chain synchronization	88.05	12.34	0.98	86.12	89.98	(2.83)	18.10	0.953
cne	Customer focus (internal / external)	91.31	9.14	0.72	89.88	92.73	(1.41)	5.41	0.953
coe	Supplier management	89.39	9.95	0.79	87.84	90.95	(1.41)	5.56	0.953
cpe	Enabling technology	88.59	9.57	0.76	87.09	90.08	(1.04)	4.36	0.953
cqe	Conflict management	88.15	12.73	1.01	86.16	90.14	(2.61)	14.30	0.955
cre	Change & complexity management	87.91	11.65	0.92	86.09	89.73	(1.67)	6.97	0.952
cse	Focus on the bottom line (action oriented /results)	89.76	11.24	0.89	88.01	91.52	(2.09)	9.04	0.952
cte	Strategy development & Application	88.45	10.94	0.87	86.74	90.16	(1.52)	5.66	0.952
OSCE	**Overall supply chain manager competencies**	**89.28**	**7.92**	**0.63**	**88.04**	**90.52**	**(1.20)**	**5.22**	



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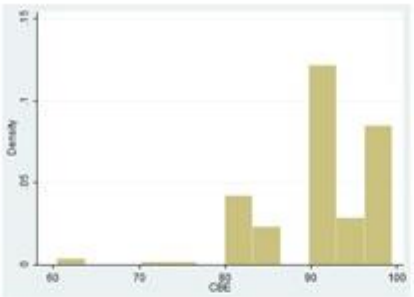

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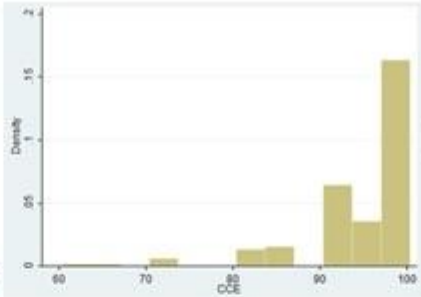

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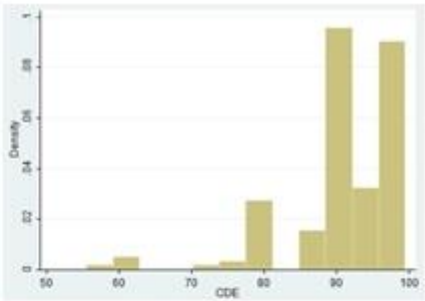

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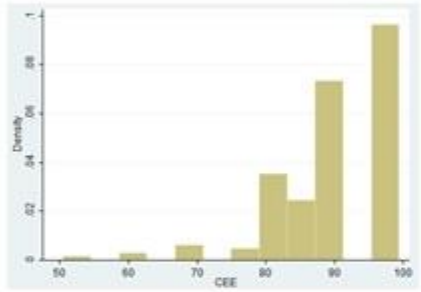

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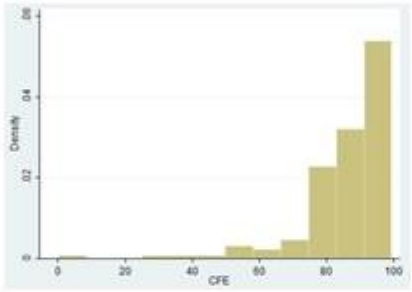

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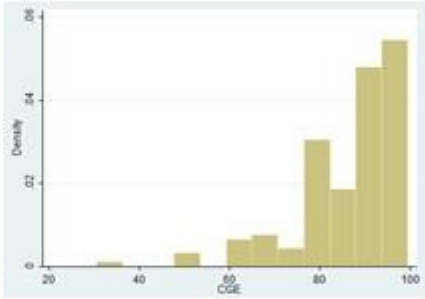
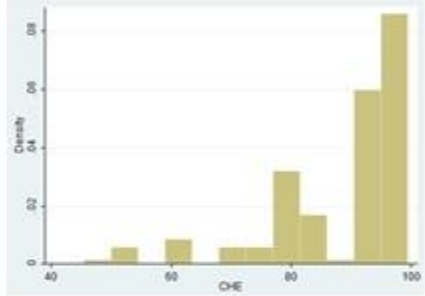
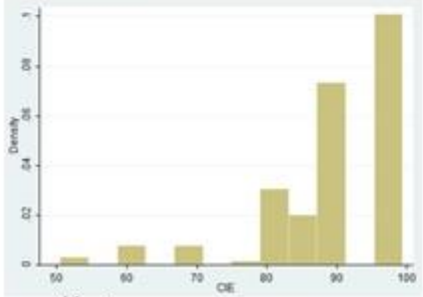


(g) cge



(h) che



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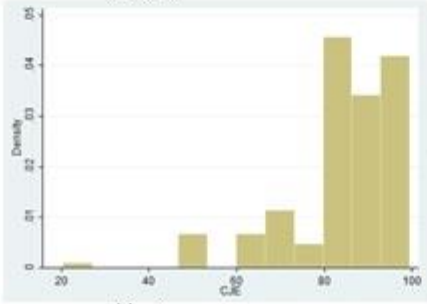

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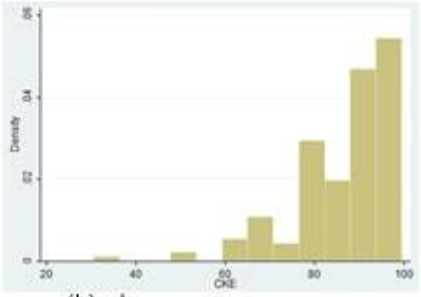

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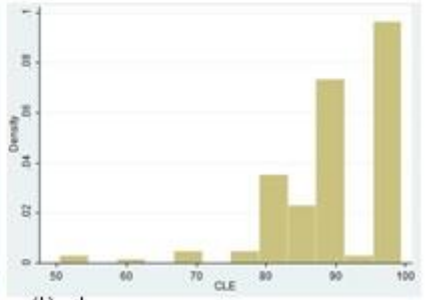

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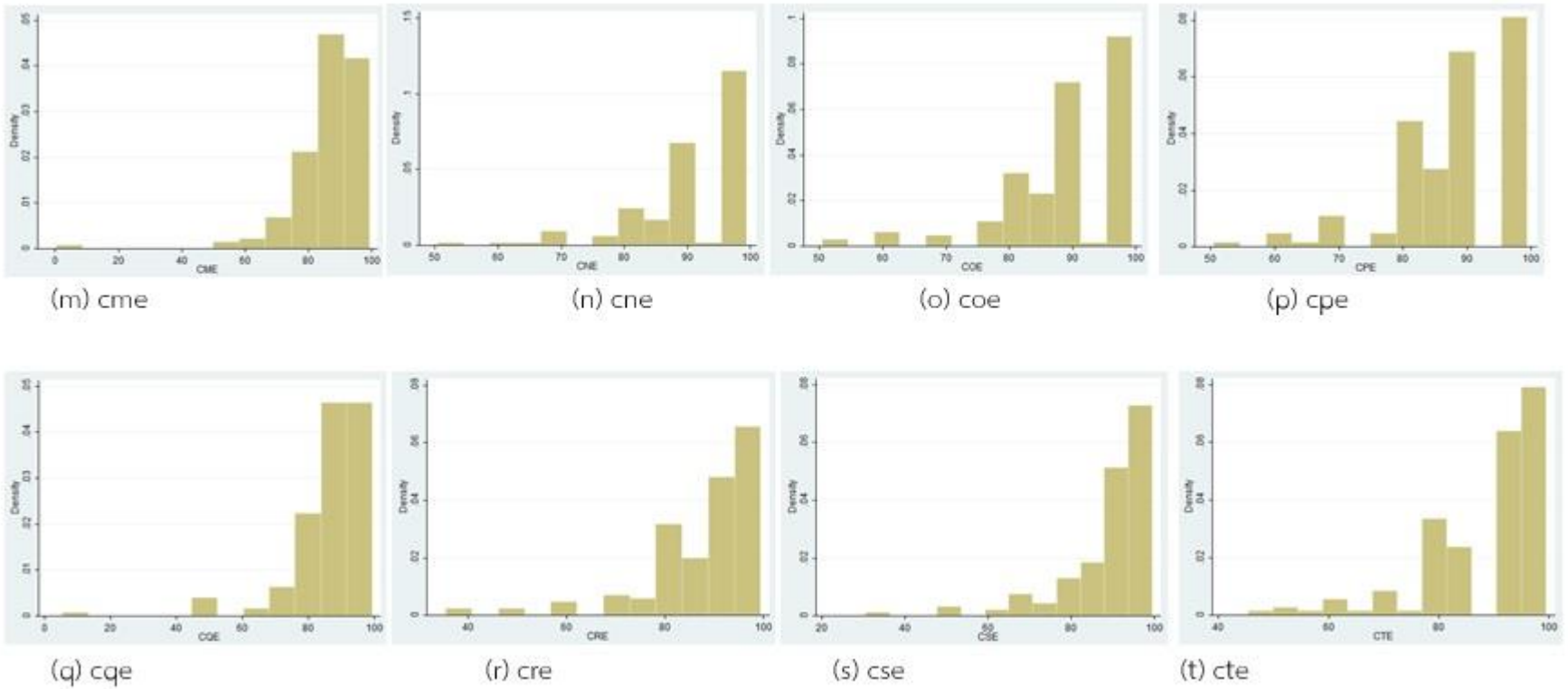

Figure 4. 7 Histogram of expected level of supply chain manager competencies

Table 4. 13 Mean statistics of respondents' opinion on supply chain competency requirement in the next 5 years (on a Likert scale of 1-5, where 1 is the least and 5 is the most)

Variabln	Description	Mean	Std. Dev.	Err.	[95% Conf.	Interval]	Skewness	Kurtosis	Cronbach's Alpha
can	Interpersonal skills	3.83	1.08	0.09	3.66	4.00	(0.62)	2.56	0.979
cbn	Effective communication	3.90	1.13	0.09	3.72	4.08	(0.94)	3.28	0.979
ccn	Integrity	3.69	1.34	0.11	3.48	3.90	(0.72)	2.42	0.979
cdn	Building effective teams	3.88	1.21	0.10	3.69	4.07	(0.95)	2.99	0.978
cen	Personal learning & self-development	3.82	1.12	0.09	3.64	3.99	(0.68)	2.68	0.978
cfn	Post secondary education	3.48	1.21	0.10	3.29	3.67	(0.32)	2.29	0.980
cgn	Math, statistics and analytical thinking	3.56	1.17	0.09	3.37	3.74	(0.48)	2.51	0.979
chn	Supply chain fundamentals	3.75	1.06	0.08	3.58	3.92	(0.62)	2.74	0.978
cin	Business process knowledge	3.65	1.14	0.09	3.47	3.83	(0.51)	2.52	0.978
cjn	International business rules & regulations	3.70	1.07	0.08	3.53	3.87	(0.51)	2.57	0.978
ckn	Technical logistics/supply chain functions	3.69	1.04	0.08	3.52	3.85	(0.62)	3.07	0.978
cln	Work processes management	3.76	1.09	0.09	3.59	3.93	(0.63)	2.75	0.978
cmn	Supply chain synchronization	3.87	1.06	0.08	3.70	4.03	(0.73)	2.94	0.979
cnn	Customer focus (internal / external)	3.79	1.20	0.09	3.60	3.97	(0.75)	2.68	0.978
con	Supplier management	3.79	1.08	0.09	3.62	3.96	(0.72)	3.00	0.978
cpn	Enabling technology	3.83	1.15	0.09	3.65	4.00	(0.86)	3.10	0.978
cqn	Conflict management	3.73	1.21	0.10	3.54	3.92	(0.70)	2.63	0.978
crn	Change & complexity management	3.68	1.17	0.09	3.49	3.86	(0.61)	2.60	0.978
csn	Focus on the bottom line (action oriented /results)	3.69	1.25	0.10	3.49	3.88	(0.72)	2.62	0.978
ctn	Strategy development & Application	3.74	1.11	0.09	3.57	3.92	(0.66)	2.87	0.978
OSCN	**Overall supply chain manager competencies**	**3.74**	**0.97**	**0.08**	**3.59**	**3.89**	**(0.71)**	**2.93**	

4.1.3 Supply Chain Manager Competencies Ranking

Taking into account the status of respondents whether they are a supply chain manager themselves, or a superior of supply chain manager, or a subordinate of supply chain manager, Table 4.14 shows that all recognized Integration as the competencies they are currently processing the most (M= 85.42). APICS defines integrity as demonstrating trustworthiness and responding in a consistent manner to situations that require honesty and candor, which is a crucial trait in supply chain professionalism. Integrity in supply chain encompasses both operational and reputational dimensions. While operational integrity is to meet objectives for quality, productivity and financial performance, reputational integrity is to protect and enhance the brand, response to customer and investor concerns, and comply with the growing burden of legislation (PricewaterhouseCoopers 2008). Post-secondary education comes as the second rank only to those considering themselves as a supply chain manager (M=79.84), or a subordinate of supply chain manager (M=81.83), whereas a superior of supply chain manager scores Customer focus (Internal/External) in the second place for the competencies they are currently processing (M=77.24).

From the other end, all respondents agree that International business rules & regulations (M=62.94) is the competency they are currently processing the less. With the borderless context in supply chain, knowing international business rules & regulations has a key advantage to succeed in this filed. We cannot rely only on domestic suppliers or customers anymore. To grow continuously the business with expansion to regional and international markets by moving raw materials from one country to add more values in another countries before selling to anywhere else in the world is what supply chain manager at present and the future has to integrate in their business model.

In addition, it is also confirmed in the study with another six supply chain manager competencies having the mean score lower than 70. Technical logistics & supply chain function (M=66.33) competency refers to the capability to perform well in such functions as transportation, warehousing, inventory management and reverse logistics. Supply chain synchronization (M=67.28) is operational integration across

multiple firms to facilitate logistics operations in the manner that is mutually supportive and seamless. While collaboration is vital in supply chain management, conflicts usually arise due to disagreement on thoughts, business process and objectives which are not aligned within the organization (Faridi and Alam 2011). It is the Conflict management (M=67.71) competency which supply chain manager of today needs to master. Change & complexity Management (M=68.58) competency is the ability of supply chain manager to handle different complexity drivers such as number/variety of suppliers, number/variety of customers, number/variety of interactions, conflicting policies, demand amplification, differing/conflicting/non-synchronized decisions and actions, and incompatible IT system (Serdar-Asan 2011). Supply chain manager should be able to identify the risks and opportunities associated with both regulatory pressures and expectation of stakeholders in order to define appropriate sustainable strategy for further implementation. This competency, Strategy development and application, shows low mean score of 69.21 from all respondents. Enabling technology (M=69.92) explains the managerial skills enabling adaptations of supply chain processes and corporate strategy to accommodate the use of IT play the strong rule in IT value creation.

It is important to note that supply chain mangers describes their current level of supply chain managers competencies in relation to technical and application of supply chain activities lower than those in relation to their attributes. Technically, it is vital to possess appropriate level of knowledge and skills in supply chain in order to execute all activities more effectively and efficiently.

Table 4. 14 Rank and mean score of perceived supply chain manager competencies by supply chain manager, subordinate of supply chain manager, and superior of supply chain manager

Rank	Supply Chain Manager (n = 61)		Subordiate of Supply Chain Manager (n=57)		Superior of Supply Chain Manager (n=42)	
1	Integrity	(M=87.24)	Integrity	(M=85.08)	Integrity	(M=83.24)
2	Post secondary education	(M=79.84)	Post secondary education	(M=81.83)	Customer focus (internal / external)	(M=77.24)
3	Customer focus (internal / external)	(M=77.29)	Customer focus (internal / external)	(M=73.08)	Post secondary education	(M=76.81)
4	Math, statistics and analytical thinking	(M=77.17)	Personal learning & self-development	(M=72.68)	Business process knowledge	(M=74)
5	Supply chain fundamentals	(M=76.19)	Work processes management	(M=72.1)	Building effective teams	(M=72.07)
6	Interpersonal skills	(M=75.29)	Focus on the bottom line (action oriented /results)	(M=71.87)	Personal learning & self-development	(M=71.64)
7	Personal learning & self-development	(M=74.52)	Building effective teams	(M=71.52)	Focus on the bottom line (action oriented /results)	(M=71.48)
8	Effective communication	(M=74.5)	Interpersonal skills	(M=70.46)	Work processes management	(M=71.45)
9	Focus on the bottom line (action oriented /results)	(M=74.29)	Effective communication	(M=70.2)	Supplier management	(M=70.98)
10	Work processes management	(M=74.19)	Business process knowledge	(M=70.03)	Effective communication	(M=70.29)
11	Business process knowledge	(M=73.37)	Math, statistics and analytical thinking	(M=69.73)	Supply chain fundamentals	(M=70.12)
12	Enabling technology	(M=73.2)	Supplier management	(M=67.68)	Math, statistics and analytical thinking	(M=70)
13	Building effective teams	(M=73.01)	Enabling technology	(M=67.24)	Strategy development & Application	(M=69.26)
14	Strategy development & Application	(M=71.98)	Supply chain fundamentals	(M=66.96)	Interpersonal skills	(M=69.05)
15	Supplier management	(M=71.57)	Change & complexity management	(M=66.73)	Enabling technology	(M=68.79)
16	Technical logistics/supply chain functions	(M=70.57)	Conflict management	(M=66.2)	Change & complexity management	(M=68.45)
17	Change & complexity management	(M=70.4)	Strategy development & Application	(M=66.2)	Supply chain synchronization	(M=67.6)
18	Conflict management	(M=69.2)	Supply chain synchronization	(M=65.06)	Conflict management	(M=67.6)
19	Supply chain synchronization	(M=69.14)	Technical logistics/supply chain functions	(M=62.39)	Technical logistics/supply chain functions	(M=65.52)
20	International business rules & regulations	(M=65.55)	International business rules & regulations	(M=59.17)	International business rules & regulations	(M=64.29)

4.1.4 Supply Chain Manager Competencies Gap

Table 4.15 reveals that International business rules & regulations has the largest gap between current and expected level (M=21.61, S.D. =16.46), and Postsecondary education the smallest (M=8.41, S.D. = 14.77). The former remains its 20th rank for both current and expected level, whereas the latter changes its ranking position from the 2nd in the current level to 14th in the expected level. Integrity continues to be the 1st rank in both current and expected level with a small gap mean of 9.14.

We could depict that 4 supply chain manager competencies have the gap higher than 20 points, or one fifth of the survey scale ranged between 0-99. They are International business rules & regulations, Technical logistics and supply chain functions (M=21.1, S.D. =15.9), Supply chain synchronization (M=20.8, S.D. =16.2) and Conflict management (M=20.4, S.D.15.9). All these 4 competencies are discussed in the previous section.

Graphically, Figure 4.8 shows rank change of current and expected supply chain manager competencies. Five competencies report negative rank change, lower ranking in expected level as compared to current level. These includes Change and complexity management (-1), Personal learning and self-development (-2), Focus on the bottom line (action oriented, results) (-3), Postsecondary education (-12), and Math, statistics and analytical thinking (-12). In principle, respondents view these competencies with less expectation as compared to the remaining competencies. In contrast, there are four competencies with no rank change; namely Integrity (1st rank), Customer focus (internal/external) (3rd rank), Work process management (5th rank), and International business rules and regulations (20th rank).

Table 4. 15 Rank change of current and expected supply chain manager competencies

Description	Current Level			Expected Level			GAP			Rank
	Rank	Mean	Std. Dev.	Rank	Mean	Std. Dev.	Rank	Mean	Std. Dev.	Change
Interpersonal skills	10	71.93	16.14	8	89.96	9.11	11	18.03	14.58	2.00
Effective communication	11	71.86	17.05	4	91.09	7.44	9	19.23	15.19	7.00
Integrity	1	85.42	15.93	1	94.59	7.31	19	9.18	13.41	0.00
Building effective teams	9	72.23	17.13	2	91.68	8.35	5	19.45	14.51	7.00
Personal learning & self-development	4	73.11	15.61	6	90.26	8.86	15	17.16	12.20	(2.00)
Post secondary education	2	79.76	21.21	14	88.16	15.01	20	8.41	14.77	(12.00)
Math, statistics and analytical thinking	7	72.64	17.42	19	87.22	11.89	18	14.58	11.28	(12.00)
Supply chain fundamentals	12	71.31	19.29	11	88.59	11.93	14	17.28	13.95	1.00
Business process knowledge	8	72.34	18.95	7	90.03	10.24	13	17.68	14.43	1.00
International business rules & regulations	20	62.94	20.88	20	84.55	13.55	1	21.61	16.46	0.00
Technical logistics/supply chain functions	19	66.33	20.13	18	87.44	11.62	2	21.11	15.88	1.00
Work processes management	5	72.73	17.34	5	90.41	9.00	12	17.69	14.53	0.00
Supply chain synchronization	18	67.28	19.59	16	88.05	12.34	3	20.77	16.16	2.00
Customer focus (internal / external)	3	75.78	17.18	3	91.31	9.14	17	15.53	14.61	0.00
Supplier management	13	70.03	18.20	10	89.39	9.95	6	19.37	15.83	3.00
Enabling technology	14	69.92	17.10	12	88.59	9.57	10	18.67	15.14	2.00
Conflict management	17	67.71	19.14	15	88.15	12.73	4	20.44	15.92	2.00
Change & complexity management	16	68.58	18.63	17	87.91	11.65	7	19.33	15.35	(1.00)
Focus on the bottom line (action oriented /results)	6	72.69	18.74	9	89.76	11.24	16	17.08	15.01	(3.00)
Strategy development & Application	15	69.21	17.56	13	88.45	10.94	8	19.24	14.04	2.00
Overall supply chain manager competencies		**71.69**	**14.34**		**89.28**	**7.92**		**17.59**	**11.22**	

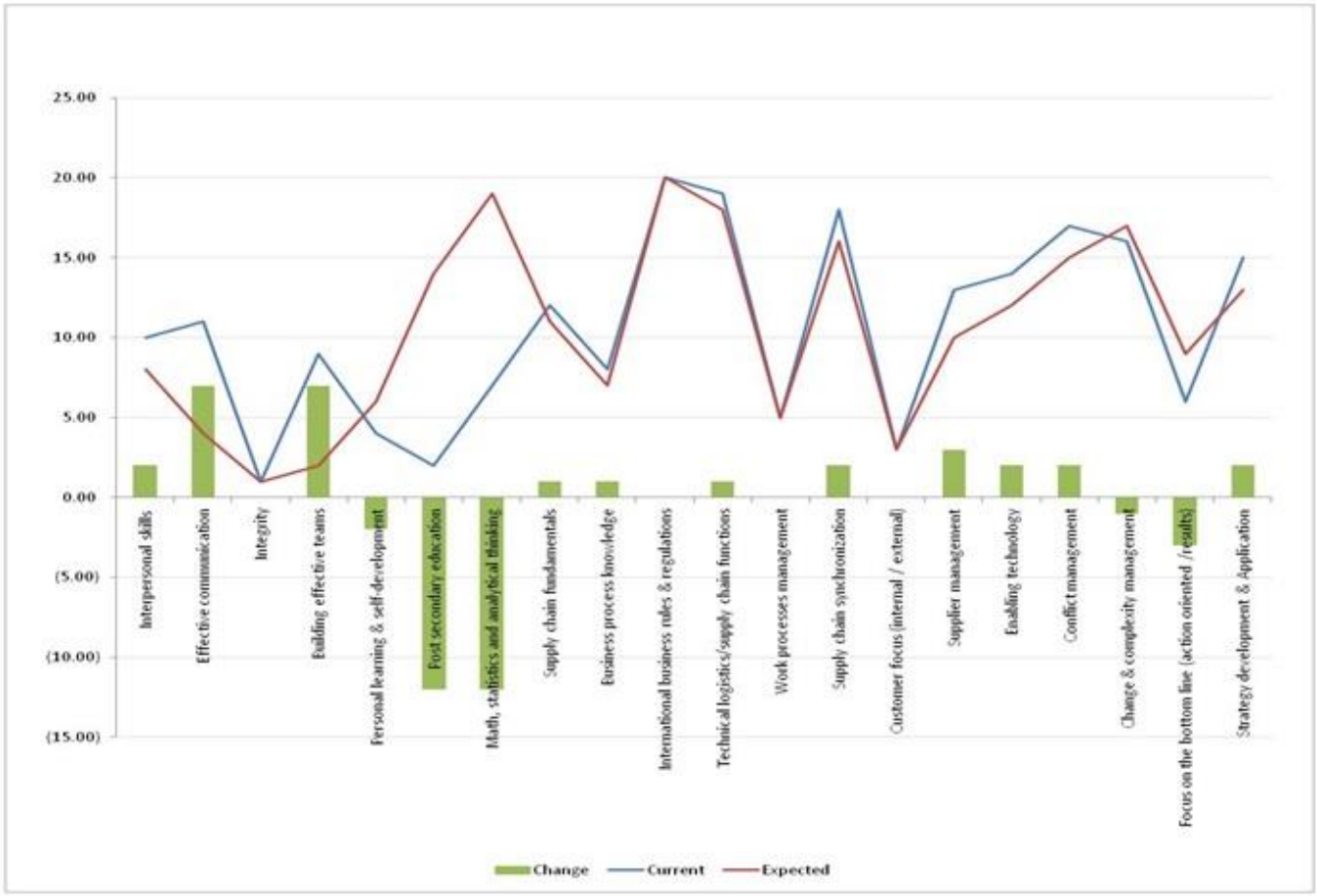

Figure 4. 8 Rank change of current and expected supply chain manager competencies

4.2 Paired t-test

4.2.1 Paired t-test of current and expected level of competencies

As the researcher expects there is a relationship between respondents' assessment on their current and expected level of supply chain manager competencies, the paired t-test is applied for this analysis. For each respondent, the researcher looks at the differences in the values of the two variables, namely current level of competencies and expected level of competencies, and then test if the mean of these differences is equal to zero. Table 4.16 provides the paired t-test statistics for each competency.

From the table, the t-statistics is the ratio of the mean of the difference between current and expected level to the standard error of the difference between current and expected level. Negative value of t-statistics explains that the respondents rate all supply chain manager competencies at higher level of expectation as compared to current one. Pr(|T| > |t|) is the two-tailed p-value describing the probability of observing a greater absolute value of t under the null hypothesis. From all competencies, the corresponding two-tailed p-values are lower than 0.05. Therefore, it can be concluded that the mean difference of current and expected level of all competencies are statistically significantly different from zero. Furthermore, interpretation can be drawn from the alternatives Pr(T < t) where the mean < H0 value, and Pr(T > t) where the mean > H0 value. At the pre-specified alpha level of 0.05, the conclusion is that the mean difference of current and expected level of all competencies is statistically significantly greater than zero, and not statistically significantly less than zero. Current competency level is not enough, respondents expect to have higher competency level.

4.2.2 Independent group t-test of current level of competencies

Since we have categorized respondents' positions title to be functional-related and non-functional related as earlier described in Table 4.4, it is interesting to compare means of current level of competencies between those two groups. The t-test assumes that variances of the two groups are the same. Table 4.17 shows the t-statistics of and corresponding p-values for the null and alternative hypotheses.

Table 4. 16 Paired t-test of current and expected level of competencies

Competency	Df	t-statistics	Pr(T < t)[a]	Pr(|T| > |t|)[b]	Pr(T > t)[c]
Interpersonal skills	159	-15.64	0.000	0.000	1.000
Effective communication	159	-16.02	0.000	0.000	1.000
Integrity	159	-8.66	0.000	0.000	1.000
Building effective team	159	-16.96	0.000	0.000	1.000
Personal learning & self-development	159	-17.78	0.000	0.000	1.000
Post-secondary education	159	-7.20	0.000	0.000	1.000
Math, statistics and analytical thinking	159	-16.35	0.000	0.000	1.000
Supply chain fundamentals	159	-15.67	0.000	0.000	1.000
Business process knowledge	159	-15.50	0.000	0.000	1.000
International business rules and regulations	159	-16.60	0.000	0.000	1.000
Technical knowledge and supply chain functions	159	-16.82	0.000	0.000	1.000
Work processes management	159	-15.39	0.000	0.000	1.000
Supply chain synchronization	159	-16.26	0.000	0.000	1.000
Customer focus (internal/external)	159	-13.44	0.000	0.000	1.000
Supplier management	159	-15.48	0.000	0.000	1.000
Enabling technology	159	-15.60	0.000	0.000	1.000
Conflict management	159	-16.24	0.000	0.000	1.000

Change & complexity management	159	-15.92	0.000	0.000	1.000
Focus on bottom line (action oriented/results)	159	-14.38	0.000	0.000	1.000
Strategy development & application	159	-17.33	0.000	0.000	1.000

Remarks: [a] = Ha: mean(diff)<0, [b] = Ha: mean(diff)!=0, [c] = Ha: mean(diff)>0

Table 4. 17 Independent group t-test of current level of competencies

Competency	Df	t-statistics	Pr(T < t)[a]	Pr(|T| > |t|)[b]	Pr(T > t)[c]
Interpersonal skills	158	-0.97	0.167	0.335	0.833
Effective communication	158	-0.35	0.363	0.727	0.637
Integrity	158	-0.16	0.437	0.873	0.563
Building effective team	158	-0.03	0.488	0.977	0.512
Personal learning & self-development	158	-1.46	0.073	0.146	0.927
Post-secondary education	158	0.30	0.618	0.765	0.382
Math, statistics and analytical thinking	158	-1.80	0.037	0.074	0.963
Supply chain fundamentals	158	-1.63	0.053	0.105	0.948
Business process knowledge	158	-0.96	0.170	0.339	0.831
International business rules and regulations	158	-1.72	0.044	0.088	0.956
Technical knowledge and supply chain functions	158	-3.290	0.001	0.001	0.999
Work processes management	158	-0.69	0.244	0.488	0.756
Supply chain synchronization	158	-1.28	0.101	0.201	0.899
Customer focus (internal/external)	158	-0.85	0.198	0.396	0.802
Supplier management	158	-0.83	0.203	0.407	0.797
Enabling technology	158	-1.05	0.147	0.294	0.853
Conflict management	158	-0.17	0.431	0.862	0.569

Change & complexity management	158	-1.05	0.149	0.297	0.851
Focus on bottom line (action oriented/results)	158	-0.21	0.417	0.834	0.583
Strategy development & application	158	-0.92	0.179	0.359	0.821

Remarks: [a] = Ha: mean(diff)<0, [b] = Ha: mean(diff)!=0, [c] = Ha: mean(diff)>0

Similarly to previous section, the t-statistics is the ratio of the mean of the difference between functional-related and non-functional related groups to the standard error of the difference between functional-related and non-functional related groups. Interpretation of all competencies, except three of them, namely Math, statistics and analytical thinking, International business rules and regulations, and Technical knowledge and supply chain functions, is the same. The conclusion is that at the significance level of 0.05, the means of the 17 competencies are not statistically different from zero between the two groups. For example, the p-value for the difference between functional-related job title of the respondents and non-functional-related job title of the respondents for Interpersonal skills is greater than 0.05, so it can be concluded that the difference in means is not statistically significantly different from zero.

Below three competencies show statistically significant in the independent group t-test.

(1) Math, statistics and analytical skills: At the significance level of 0.05, the one-tailed p-value for the alternative hypotheses (mean difference < 0) at 0.037 enables a conclusion that the mean is statistically greater than zero.
(2) International business rules and regulations: The one-tailed p-value for the alternative hypotheses (mean difference < 0) at 0.044 which is less than the pre-specified alpha level of 0.05 gives a conclusion that the mean is statistically greater than zero.
(3) Technical knowledge and supply chain functions: The two-tailed p-value for the difference between functional-related job title and non-functional-

related job title is less than 0.05, so it can be concluded that the difference in means is statistically significantly different from zero. As for the one-tailed p-value for the alternative hypotheses (mean difference < 0), it is also less than the pre-specified alpha level of 0.05, so it is concluded that the mean is statistically greater than zero.

4.3 Reliability and validity of independent variables

4.3.1 Reliability test

Cronbach's alpha is estimated to assess the reliability of the constructs for independent variables in the questionnaire. As shown in Table 4.18, twenty items of supply chain manager competencies has a coefficient alpha of 0.968 The item-test correlation shows how highly correlated each item with the overall scale. It is noticeable that cfc Post-secondary education has the lowest value of interim test correlation at 0.579. As for the interim-rest correlation, it shows how the item is correlated with a scale computed from only the other 19 items. Similarly, cfc also shows the lowest value at 0.526. Nevertheless, cfc's Cronbach alpha reports high value of 0.969, meaning the scale does not change much if we drop this item.

Table 4. 18 Reliability test of the supply chain manager competencies constructs

Item	Obs	Sign	Interim-test correlation	Interim-rest correlation	Average interim covariance	alpha
cac	160	+	0.739	0.711	202.594	0.967
cbc	160	+	0.828	0.808	199.085	0.966
ccc	160	+	0.609	0.572	206.283	0.968
cdc	160	+	0.844	0.826	198.533	0.965
cec	160	+	0.788	0.766	201.859	0.966
cfc	160	+	0.579	0.526	203.126	0.969
cgc	160	+	0.716	0.684	201.932	0.967
chc	160	+	0.786	0.758	197.823	0.966

cic	160	+	0.863	0.845	195.746	0.965
cjc	160	+	0.793	0.764	195.840	0.966
ckc	160	+	0.782	0.753	197.028	0.966
clc	160	+	0.866	0.850	197.648	0.965
cmc	160	+	0.836	0.814	195.841	0.965
cnc	160	+	0.841	0.822	198.558	0.965
coc	160	+	0.777	0.750	199.284	0.966
cpc	160	+	0.767	0.741	200.776	0.966
cqc	160	+	0.850	0.830	195.937	0.965
crc	160	+	0.892	0.878	195.227	0.965
csc	160	+	0.853	0.834	196.304	0.965
ctc	160	+	0.782	0.757	199.835	0.966
Test scale					198.963	0.968

Table 4.19 displays six items of a supply chain manager's roles and responsibilities with a coefficient alpha of 0.822. The lowest interim-test correlation is rr3 statement "I am responsible for the company's strategic move to sustain competitive advantage" at 0.646. However, Cronbach's alpha does not improve much if we remove this item.

Table 4. 19 Reliability test of a supply chain manager's roles and responsibilities constructs

Item	Obs	Sign	Interim-test correlation	Interim-rest correlation	Average interim covariance	alpha
rr1	160	+	0.746	0.640	194.115	0.786
rr2	160	+	0.766	0.655	185.937	0.781
rr3	160	+	0.646	0.464	200.594	0.821
rr4	160	+	0.697	0.524	188.923	0.809
rr5	160	+	0.751	0.617	182.561	0.787
rr6	160	+	0.790	0.671	174.196	0.775
Test scale					187.721	0.822

Nunally (19878) suggests that a Cronbach's alpha greater than 0.70 indicates an exceptional internal consistency of the measurement scale. Therefore, we conclude reliability of both twenty items of supply chain manager competencies and six statements of a supply chain manager's roles and responsibilities constructs.

4.3.2 Validity test

The validity of questionnaire is assessed by factor analysis. The process starts with confirming whether the twenty items of supply chain manager competencies in this study can be reduced to fewer competency components that are relatively independents of one another, and describe the underlying phenomenon. The result in Table 4.23 shows a two-factor solution with 70.1% of the variance explained. This percentage is acceptable in social science (Hair et al, 1998). The Eigenvalue for the first factor is 12.61, which explains 63% of the variance whereas the second factor is 1.416 explaining 7.1% of the variance. Therefore, we confirm validity of the supply chain manager competencies constructs.

4.4 Factor analysis

As part of a model building, the researcher applies Kaiser-Meyer-Olkin (KMO) and Bartlett's Test to measure the strength of the relationship among twenty variables of supply chain manager competencies. Test results meeting the criteria allow a procedure of principle component analysis (PCA) from those variables in order to express data in such a way to highlight their similarities and differences, as well as to get a small set of variables, so-called factors (Smith, 2002).

4.4.1 Kaiser-Meyer-Olkin (KMO) measure

If a common factor is shared among variables, their partial correlation will be small, which indicate a unique variance they share. Table 4.20 indicates degree of common variance following KMO value. The researcher discovers the KMO measure of

sampling adequacy in the study at 0.95 indicating that the degree of common variance is marvelous (Kaiser, 1974) for factor analysis.

Table 4. 20 KMO value classification

KMO value	Degree of common variance
0.90 to 1.00	Marvelous
0.80 to 0.89	Meritorious
0.70 to 0.79	Middling
0.60 to 0.69	Mediocre
0.50 to 0.59	Miserable
0.00 to 0.49	Don't factor

4.4.2 Barlett's test of sphericity

Table 4.21 displays the approximate chi-square value obtained from Barlett's test of sphericity, which is used to test the null hypothesis that variables are not inter-correlated. The value reports 3183.22 with its associated p-value less than 0.01. This significance level is small enough to reject the null hypothesis that the correlation matrix of supply chain manager competencies is an identity matrix.

Table 4. 21 Barlett's test of sphericity

Chi-square	Degree of freedom	Prob
3183.22	190	0.000

4.4.3 Principle component analysis

Performing a principle component analysis procedure, twenty factors (components) are extracted, the same as the number of variables factors as shown in Table 4.22. The Keiser test, as a criterion, says that only factors with an Eigenvalue of 1 or greater than 1 are meaningful.

The first factor has an Eigenvalue of 12.61. Since this is greater than 1.0, it explains more variance than one single variable, in fact 12.61 times as much. The percent explained variance is 63.0% (12.61 divided by 20 units of variance and multiplied by 100) which has the largest explanatory power of supply chain manager competencies.

Table 4. 22 Total variance explained

Component	Eigenvalue	Difference	Proportion	Cumulative
1	12.606	11.190	0.630	0.630
2	1.416	0.524	0.071	0.701
3	0.891	0.165	0.045	0.746
4	0.727	0.074	0.036	0.782
5	0.652	0.140	0.033	0.815
6	0.512	0.037	0.026	0.840
7	0.475	0.092	0.024	0.864
8	0.383	0.034	0.019	0.883
9	0.349	0.037	0.017	0.901
10	0.312	0.051	0.016	0.916
11	0.261	0.021	0.013	0.929
12	0.240	0.035	0.012	0.941
13	0.204	0.009	0.010	0.951
14	0.196	0.018	0.010	0.961
15	0.178	0.032	0.009	0.970
16	0.146	0.008	0.007	0.977
17	0.138	0.010	0.007	0.984
18	0.127	0.020	0.006	0.991
19	0.107	0.027	0.005	0.996
20	0.080	-	0.004	1.000

The second factor has an Eigenvalue of 1.416 which is also greater than 1, thus can explain more variance than one single variable. Its percent explained variance is 7.1% (1.42 divided by 20 units of variance and multiplied by 100). Cumulatively, the 2

factors have a variance of 70.1%. The remaining factors 3 to 20 have Eigenvalues of less than 1, and therefore explain less variance than a single variable.

This initial analysis procedure suggests that supply chain manager competencies should not have more than 2 factors.

4.4.4 The Scree plot graph

Figure 4.9 displays graph of the Scree test, which is a graphic presentation of Eigenvalues. It guides to determine the number of the essential factorial axes. The graph presents a distinguished break-up to the second factor, whereas after the second factor the plot begins to level off. Therefore, we can consider the Eigenvalues which are over 1 for the two factors (12.606 and 1.416 for the 1st and 2nd factor respectively) since the additional factors explain less variance than a single variable.

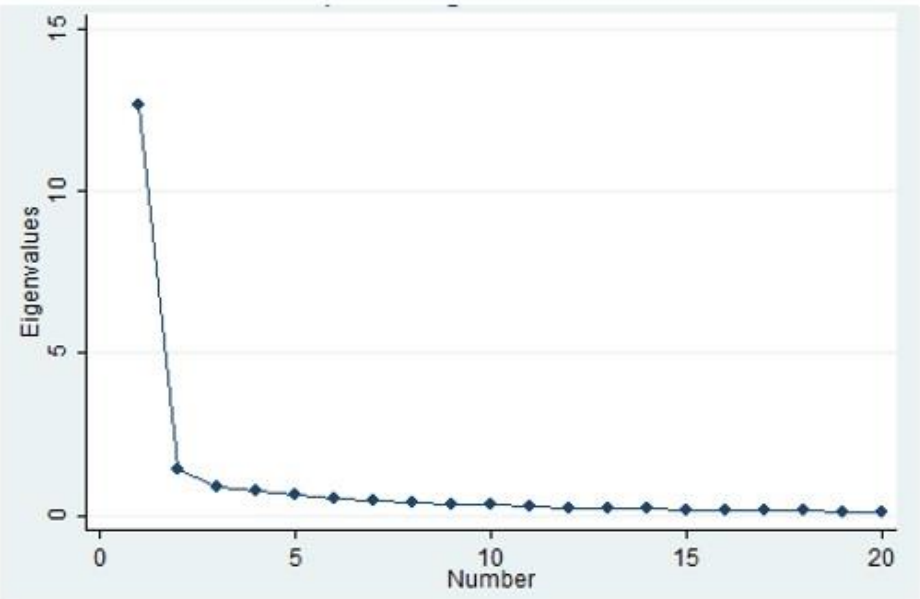

Figure 4. 9 Scree plot of Eigenvalues

4.4.5 The two topic factors

The researcher later performs Varimax rotation to produce orthogonal factors, not correlating to each other. Table 4.23 displays two factors we obtain with detailed loading value of each supply chain manager competencies.

Table 4. 23 Factor analysis

	Factor 1	Factor 2
Factor 1: Technical knowledge and application (TKA)		
Technical logistics/supply chain functions	0.868	
Supply chain fundamentals	0.846	
Strategy development & Application	0.796	
Enabling technology	0.776	
Personal learning & self-development	0.716	
Math, statistics and analytical thinking	0.696	
International business rules & regulations	0.630	
Supply chain synchronization	0.628	
Business process knowledge	0.607	
Factor 2: Traits and Management Skills (TMS)		
Integrity		0.810
Effective communication		0.796
Interpersonal skills		0.769
Building effective teams		0.749
Work processes management		0.703
Conflict management		0.653
Change & complexity management		0.645
Focus on the bottom line (action oriented /results)		0.641
Post-secondary education		0.638
Customer focus (internal / external)		0.635
Supplier management		0.574
Eigenvalues	12.606	1.416
Explained variance (%)	0.630	0.071
Total explained variance (%)	0.630	0.701

Nine items loaded on Factor 1. It is obvious that these nine items relate mainly to technical knowledge in supply chain which supply chain managers need to apply in their jobs. This factor loads onto the following competencies; Technical knowledge and supply chain functions; Supply chain fundamentals; Strategy development and application; Enabling technology; Personal learning and development; Math, statistics and analytical thinking; International business and regulations; Supply chain synchronization; and Business process knowledge. This factor was labeled "Technical knowledge and application"

Eleven items load onto a second factor related to a supply chain manager's characteristic and his skill in management. This includes Integrity, Effective communication, Interpersonal skills, Building effective teams, Work process management, Conflict management, Change and complexity management, Focus on the bottom line, Post-secondary education and Customer focus. This factor is labeled "Traits and management skills"

For Technical knowledge and application competencies, Technical logistics/supply chain functions, Supply chain fundamentals and Strategy development and application are the top three competencies with high loading at 0.868, 0.846 and 0.796 respectively. Likewise, Integrity, Effective communication and Interpersonal skills with respective loading of 0.810, 0.796 and 0.769 are the top three competencies loading in Traits and management skills.

4.5 Multivariate regression analysis

4.5.1 Without interaction terms

The researcher uses multivariate regression for supply chain integration outcomes (internal, supplier and customer) in term of a set of predictor variables (Technical knowledge and application, Traits and management skills, and a supply chain manager's roles and responsibilities). We apply multivariate regression as it enables us to conduct tests of coefficients across different outcome variables as

required by the hypothesis 2 and 4. Prior to analysis, we take logarithm of dependent variables and independent variables of roles and responsibilities of a supply chain manager.

Table 4. 24 Manova result

Source	Statistics		df	F(df1,	df2) =	F	Prob>F	
Model	W	0.5833	3	9.0	374.9	10.33	0.0000	a
	P	0.4554		9.0	468.0	9.31	0.0000	a
	L	0.6493		9.0	458.0	11.01	0.0000	a
	R	0.5352		3.0	156.0	27.83	0.0000	u
Residual	156							
TKA	W	0.9285	1	3.0	154.0	3.95	0.0095	e
	P	0.0715		3.0	154.0	3.95	0.0095	e
	L	0.0770		3.0	154.0	3.95	0.0095	e
	R	0.0770		3.0	154.0	3.95	0.0095	e
TMS	W	0.9027	1	3.0	154.0	5.53	0.0012	e
	P	0.0973		3.0	154.0	5.53	0.0012	e
	L	0.1078		3.0	154.0	5.53	0.0012	e
	R	0.1078		3.0	154.0	5.53	0.0012	e
ROLES	W	0.8828	1	3.0	154.0	6.81	0.0002	e
	P	0.1172		3.0	154.0	6.81	0.0002	e
	L	0.1327		3.0	154.0	6.81	0.0002	e
	R	0.1327		3.0	154.0	6.81	0.0002	e
Residual	156							
Total	159							

Remarks: W = Wilks' lambda, L = Lawley-Hotelling trace, P = Pillai's trace, R = Roy's largest root, e = exact, a = approximate, u = upper bound on F

STATA statistical software version 11.0 is applied through *manova* and *mvreg* procedures. The *manova* command will indicate whether all the equations are statistically significant if taken together. The F-ratio and p-values for four multivariate criteria, including Wilks' lambda, Lawley-Hotelling trace, Pillai's trace, and Roy's largest

roots, are given. Table 4.24 shows the result of *manova* procedure. It provides test for overall model as well as the multivariate tests for each predictor variables. The former indicates that the model is statistically significant, regardless of the type of multivariate criteria, as the p-values are less than 0.0001. Likewise, the latter depicts that each of the predictors is statistically significant overall, regardless of which test is used. Since overall model is statistically significant, we continue the second procedure of *mvreg* command.

As summarized in Table 4.25 of *mvreg* command, it shows that each of the three univariate models is statistically significant at the alpha level of 0.01. Three predictor variables explain 33%, 22% and 13% of the variance in the equations internal integration, supplier integration, and customer integration respectively.

Table 4. 25 Univariate models

Equation	RMSE	R-square	F	P
Internal integration	0.485	0.332	25.809	0.000
Supplier integration	0.604	0.220	14.626	0.000
Customer integration	0.674	0.134	8.037	0.000

Table 4.26 reports correlation matrix of residuals. It can be observed that residuals of supplier integration and those of customer integration is the most highly correlated at 0.6271. The Breusch-Pagan test is significant with a chi-square of 122.631 and $p < 0.001$, so conclusion is that the residuals of supply chain integration variables are not independent of each other.

Table 4. 26 Correlation matrix of residuals

	Internal	Supplier	Customer
Internal	1.000		
Supplier	0.4412	1.000	
Customer	0.4225	0.6271	1.000

Breusch-Pagan test of independent

Chi-square	df	Prob
122.631	3	0.000

As we build the estimated regressions with logged dependent variable, non-logged independent variables (supply chain manager competencies), and logged independent variables (a supply chain manager's roles and responsibility), the outcomes can be interpreted differently. For competencies variables, the interpretation is that a unit-change in competency level changes integration level by 100 x β hat percent, keeping other variables constant. For variable on roles and responsibility, the interpretation is that one percent change in roles and responsibility level changes integration level by β hat percent. Figure 4.10 depicts coefficients of the three independent variables for each supply chain integration dimension. With the significance level of 0.05, it can be remarked that Technical knowledge and application competencies shows a relationship with internal integration and customer integration. Traits and management skills competencies has a relationship with supplier integration. A supply chain manager's roles and responsibilities has a relationshiop with internal integration.

Let's first look at the coefficient for Technical knowledge and application competencies in the internal integration. This says that as the level of Technical knowledge and application competencies increases by one unit, holding other variables constant, a level of internal integration increases by 1%. A similar notion can be applied for customer integration which says an increase level of Technical knowledge and application competencies by one unit leads to an increase of customer integration level by 1.5%%, holding other variables constant. Similarly, coefficients for Traits and management skills can be interpreted. Holding other variables constant, a change of Traits and management skills by one unit can increase a level of supplier integration by 2%.

As for a logged independent variable, a supply chain manager's roles & responsibilities, its impact only on the internal integration model can be remarked.

One percent increase of a supply chain manager's roles and responsibilities, keeping constant other variables, internal integration level increases by 0.3%.

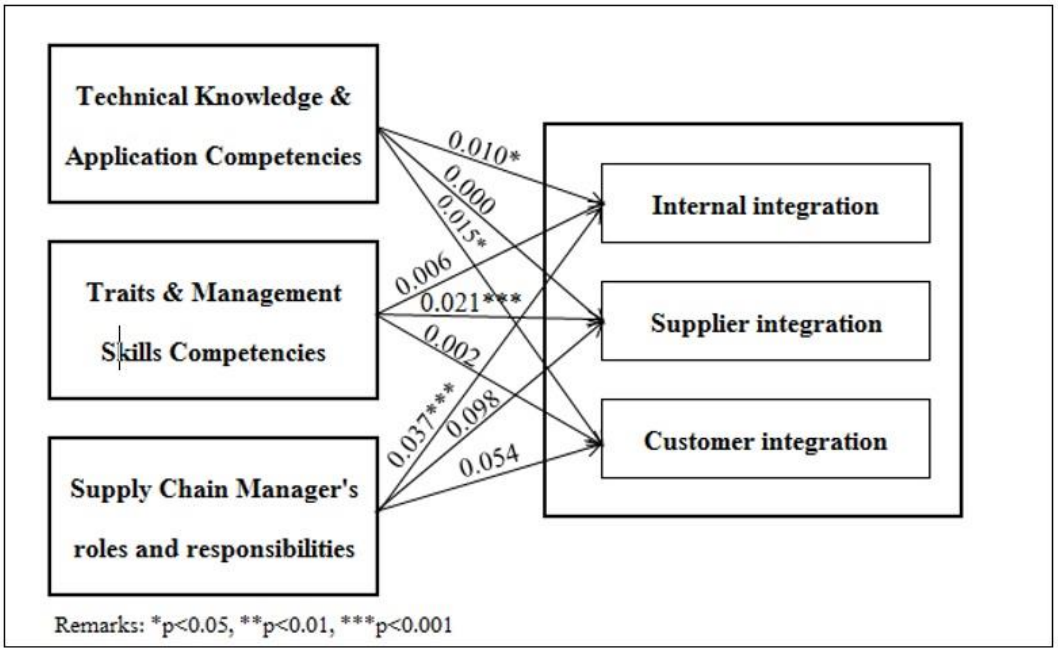

Figure 4. 10 Result of hypothesized model without interaction terms: relationship among supply chain manager competencies, a supply chain manager's roles and responsibilities and supply chain integration

4.5.2 With interaction terms

Further to previous findings, the researcher is interested in questioning whether there is an interaction between supply chain manager competencies and their roles and responsibilities. Does higher level of roles, responsibilities, and competencies have greater impacts to supply chain integration than lower level of roles, responsibilities, and competencies? To examine this possibility, we extend a multivariate regression by interacting a supply chain manager's roles and responsibilities with competencies.

Three different models can be written as below.

$$\ln\left(\frac{INTL_i}{100-INTL_i}\right)=\beta_0+\beta_1 TKA_i+\beta_2 TMS_i+\beta_3\ln\left(\frac{ROLES_i}{100-ROLES_i}\right)+\beta_4 TKA_i*\ln\left(\frac{ROLES_i}{100-ROLES_i}\right)+\beta_5 TMS_i*\ln\left(\frac{ROLES_i}{100-ROLES_i}\right) \quad \text{.....(4)}$$

$$\ln\left(\frac{SUPL_i}{100-SUPL_i}\right)=\beta_0+\beta_1 TKA_i+\beta_2 TMS_i+\beta_3\ln\left(\frac{ROLES_i}{100-ROLES_i}\right)+\beta_4 TKA_i*\ln\left(\frac{ROLES_i}{100-ROLES_i}\right)+\beta_5 TMS_i*\ln\left(\frac{ROLES_i}{100-ROLES_i}\right) \quad \text{.....(5)}$$

$$\ln\left(\frac{CUST_i}{100-CUST_i}\right)=\beta_0+\beta_1 TKA_i+\beta_2 TMS_i+\beta_3\ln\left(\frac{ROLES_i}{100-ROLES_i}\right)+\beta_4 TKA_i*\ln\left(\frac{ROLES_i}{100-ROLES_i}\right)+\beta_5 TMS_i*\ln\left(\frac{ROLES_i}{100-ROLES_i}\right) \quad \text{.....(6)}$$

where *i*= 1,2,3,...,n observation

INTL = Internal integration

SUPL = Supplier integration

CUST = Customer integration

TKA = Factor 1: Technical knowledge and application

TMS = Factor 2: Traits & management skills

ROLES = A supply chain manager's roles and responsibilities

From the STATA output simplified in Figure 4.11, it can be noticed that all coefficients are not statistically significant at the p-value of 0.05. In principle, there is no effect of one independent variable on the value of other independent variables. The multivariate regression models without interaction terms seems fit our data better than the ones with interaction terms.

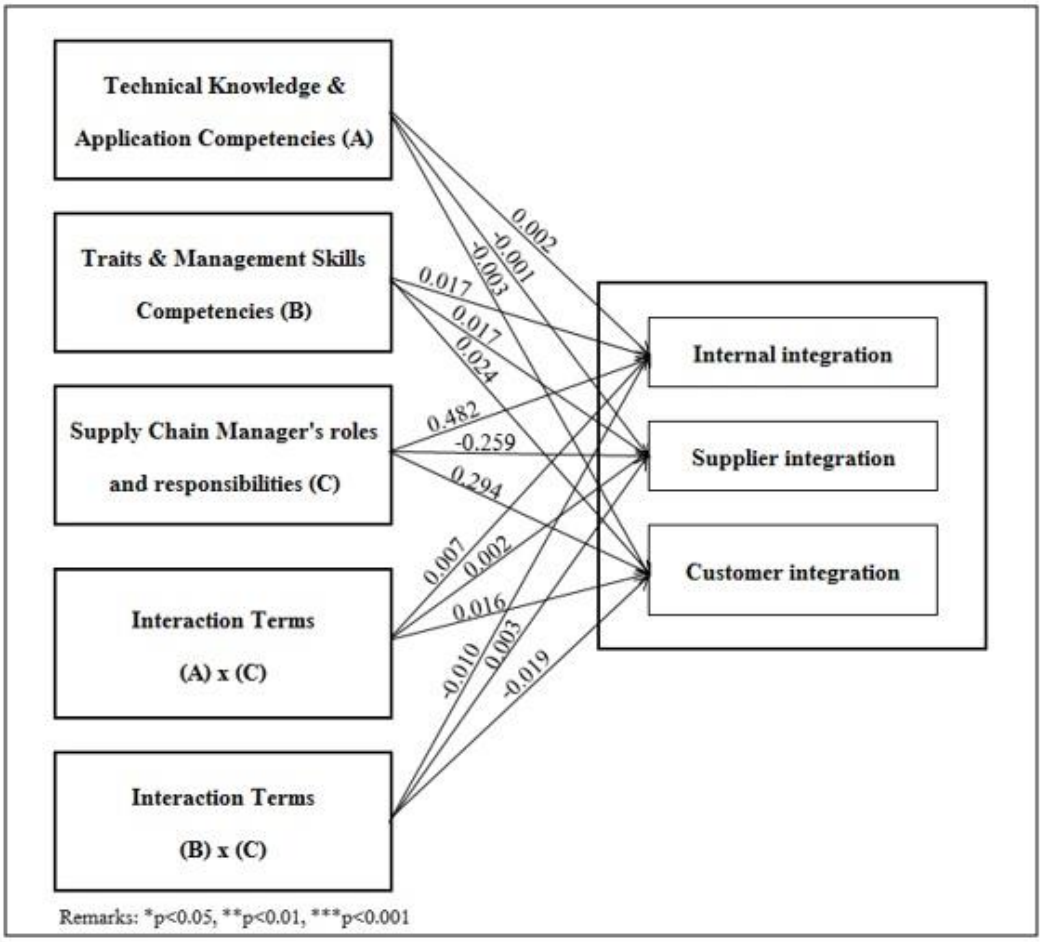

Figure 4. 11 Result of hypothesized model with interaction terms: relationship among supply chain manager competencies, a supply chain manager's roles and responsibilities and supply chain integration

4.5.3 Without interaction terms for different group of respondents

The respondents' profile allows us to categorize them into 2 groups following their job titles, namely functional-related job titles which include warehouse, distribution, purchasing, and customer service, and non-functional-related job tiles which may involve more strategically than operationally. The researcher is interested to know if multivariate regression analysis for functional-related job title yields the similar result as that for non-functional-related job title. If the result is different, it is possible to provide a separate interpretation for those two groups of people. Figure

4.12 shows the result of hypothesis model for respondents with functional-related job titles, whereas Figure 4.13 for respondents with non-functional-related job title.

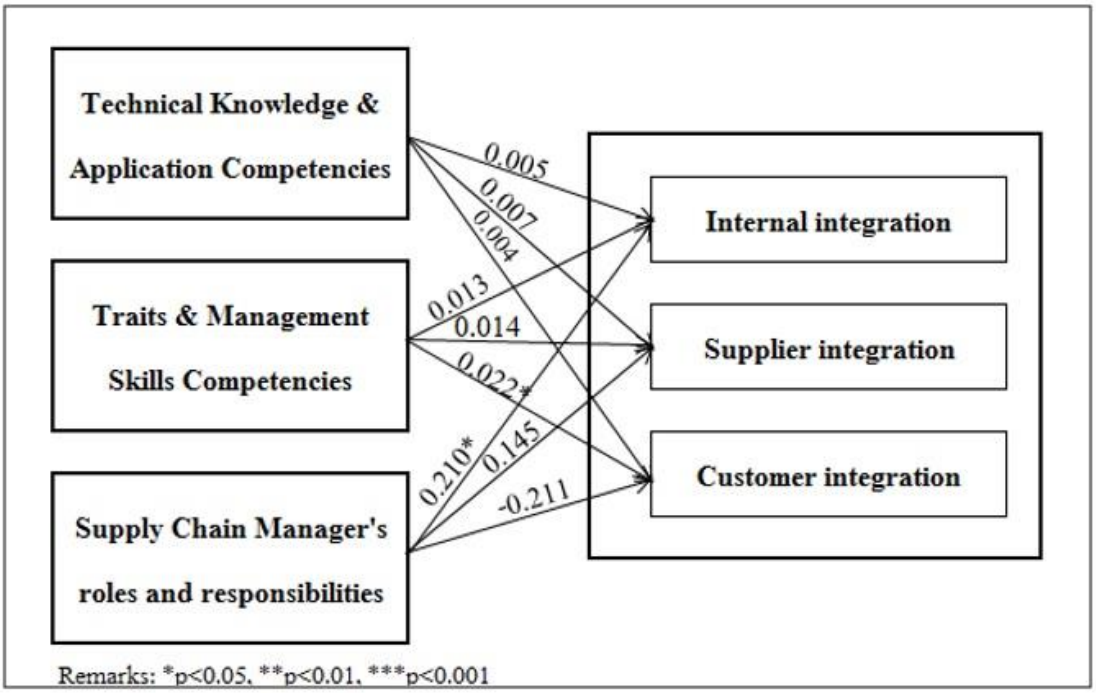

Figure 4. 12 Result of hypothesized model for functional-related job title respondents: relationship among supply chain manager competencies, a supply chain manager's roles and responsibilities and supply chain integration

From the STATA output in Figure 4.12, it can be remarked that only two coefficients are statistically significant at the p-value of 0.05. These are the coefficient of Traits and management skills in supplier integration model, and that of a supply chain manager's roles and responsibilities in internal integration model. Therefore, it can be interpreted that at the significance level of 0.05 and for the group of functional-related job title respondents, Traits and management skills impact supplier integration and a supply chain manager's roles and responsibility impact internal integration.

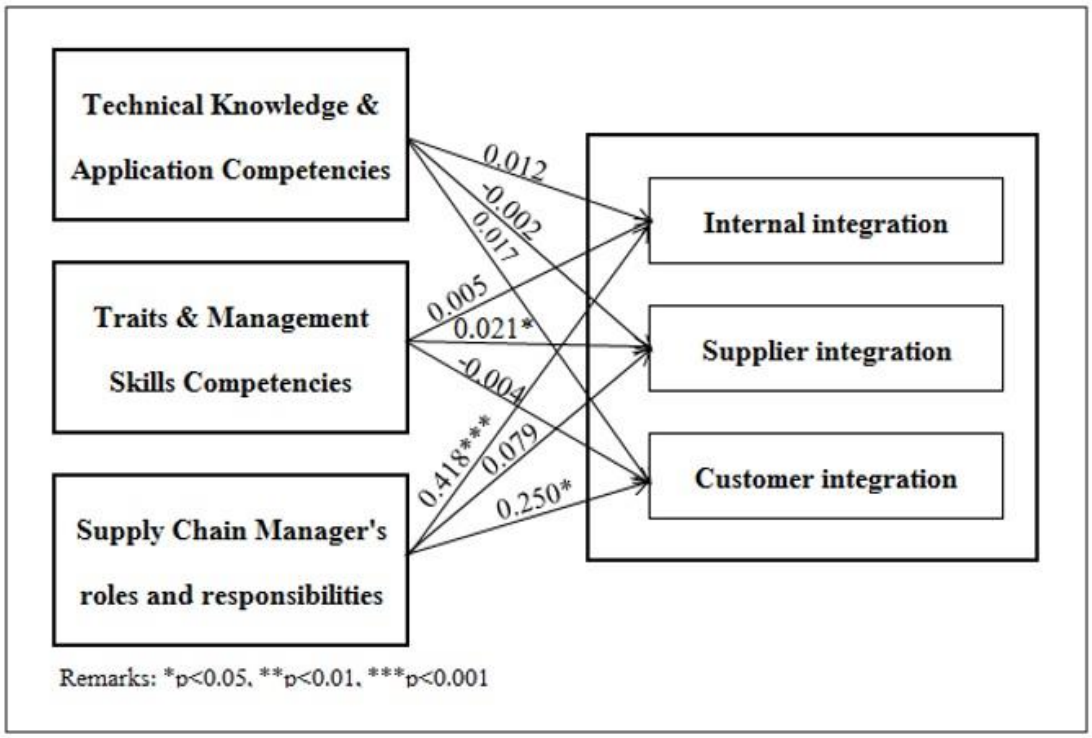

Figure 4. 13 Result of hypothesized model for non-functional-related job title respondents: relationship among supply chain manager competencies, a supply chain manager's roles and responsibilities and supply chain integration

It can be noticed from the STATA output in Figure 4.13 that Traits and management skills coefficient is statistically significant only in supplier integration model, and a supply chain manager's roles and responsibilities coefficients are significant in both internal and customer integration models. In conclusion, at the significance level of 0.05 and for the group of non- functional-related job title respondents, Traits and management skills impact supplier integration and a supply chain manager's roles and responsibility impact both internal and customer integration.

Table 4.27 provides an overview of coefficients and their significance level for three different hypothesized models (1) with overall respondents (2) with only functional-related job title respondents and (3) with only non-functional-related job title respondents. In summary, Technical knowledge and application has impact on

internal and customer integration when taking into account all respondents. However it does not show any relations in the two different group models. Traits and management skills has impact on supplier integration when taking into account both all respondents, and with only non-functional related job title respondents. It also has impact on customer integration when taking into account only functional-related job title respondents. A supply chain manager's roles and responsibilities has impact on internal integration in all three models, and it has specifically impact on customer integration when taking into account only non-functional related job title respondents.

Table 4. 27 Comparative hypothesized models

Independent variables	Model	Internal integration	Supplier integration	Customer integration
Technical knowledge and application competencies	1	0.010*	0.000	0.015*
	2	0.005	0.007	0.004
	3	0.012	-0.002	0.017
Traits and management skills competencies	1	0.006	0.021***	0.002
	2	0.013	0.014	0.022*
	3	0.005	0.021*	-0.004
A supply chain manager's roles and responsibilities	1	0.037***	0.098	0.054
	2	0.210*	0.145	-0.211
	3	0.418***	0.079	0.250*

Remarks: (1) with overall respondents (2) with only functional-related job title respondents (3) with only non-functional related job title respondents

4.6 Hypotheses testing

In order to validate the hypothesized model (Figure 4.10) on the relationship among supply chain manager competencies, a supply chain manager's roles and responsibility, and supply chain integration, we work through both collective variables and individual variables using a test procedure. As shown in Table 4.28, the result of three independent variables as a group in all equations reports a significant level of an

F-statistic of 11.26 and $p < 0.001$. It thus confirms fitness of the proposed models with observation data.

Table 4. 28 Test of fitness of proposed model

F-statistics	Degree of freedom	Significance
11.26	(3, 156)	0.0000

For each hypothesis, findings can be analyzed. Since we obtain two factors of supply chain manager competencies from factor analysis, hypothesis for each factor on supply chain integration dimensions can be redefined as below.

4.6.1 Impact of supply chain manager competencies

4.6.1.1 Technical knowledge and application competencies

Hypothesis 1a.1: Technical knowledge and application competencies have a positive impact on internal integration

Hypothesis 1b.1: Technical knowledge and application competencies have a positive impact on supplier integration

Hypothesis 1c.1: Technical knowledge and application competencies have a positive impact on internal integration

Table 4.29 shows the impact of Technical knowledge and application competencies on both overall models and individual integration model. An F-statistics on the overall models at 4.01 with its associated p-value less than 0.01 explains that Technical knowledge and application competencies impact supply chain integration. However, with individual integration model, significant statistics are observed in internal integration and customer integration models, but not in supplier integration model. F-statistics in internal integration model reads 4.68 with its associated p-value less than

0.05 whereas F-statistics in customer integration model is 5.14 with its p-value less than 0.05. In conclusion, at the significance level of 0.05, we accept the null hypothesis 1a.1 that Technical knowledge and application competencies have a positive impact on internal integration, and the null hypothesis 1c.1 that Technical knowledge and application competencies have a positive impact on internal integration. However, we reject the null hypothesis 1b.1 that Technical knowledge and application competencies have a positive impact on supplier integration.

Table 4. 29 Impact test of Technical knowledge and application competencies

Model	F-statistics	Degree of Freedom	Prob>F
Overall models	4.01	(3, 156)	0.0088
Internal integration model	4.68	(1, 156)	0.0321
Supplier integration model	0.00	(1, 156)	0.9791
Customer integration model	5.14	(1, 156)	0.0248

4.6.1.2 Traits and management skills competencies

Hypothesis 1a.2: Traits and management skills competencies have a positive impact on internal integration

Hypothesis 1b.2: Traits and management skills competencies have a positive impact on supplier integration

Hypothesis 1c.2: Traits and management skills competencies have a positive impact on internal integration

Similarly, the researcher tests the impact of Traits and management skills competencies on both overall models and individual integration model. The result is shown in Table 4.30. An F-statistics on the overall model reads 5.60 with its associated p-value less than 0.01. It shows statistically significance in the supplier integration

model only at 11.2 with its associated p-value less than 0.01, while insignificance in the internal and customer integration models. Therefore, it can be concluded that at the significance level of 0.05, we accept only the null hypothesis 1b.2 that Traits and management skills competencies have a positive impact on supplier integration. We also reject the null hypothesis 1a.2 that Traits and management skills competencies have a positive impact on internal integration, and the null hypothesis 1c.2 that Traits and management skills competencies have a positive impact on internal integration

Table 4. 30 Impact test of Traits and management skills competencies

Model	F-statistics	Degree of Freedom	Prob>F
Overall models	5.60	(3, 156)	0.0011
Internal integration model	1.67	(1, 156)	0.1983
Supplier integration model	11.20	(1, 156)	0.0010
Customer integration model	0.07	(1, 156)	0.7904

4.6.2 Significance test of independent variable – supply chain manager competencies

4.6.2.1 Technical knowledge and application competencies

Hypothesis 2.1: Technical knowledge and application competencies for each supply chain integration dimension are the same

The researcher tests whether simultaneously coefficients for Technical knowledge and application competencies are equal, and later conducts a pair-test of each equation. Table 4.31 shows that the first test yields an F-statistics of 4.24 with its associated p-value less than 0.05. By pair, an F-statistics for internal and supplier integration equations is 3.32 with its associated p-value higher than 0.05, for internal and customer integration equations is 0.55 with its p-value higher than 0.05, and for supplier and customer integration equations is 7.72 with its p-value less than 0.01. At

the significance level of 0.05, we conclude that coefficients for Technical knowledge and application are simultaneously not equal. We thus reject the null hypothesis that Technical knowledge and application competencies for each supply chain integration dimension are not the same. However pair-wise, we cannot reject the null hypothesis that coefficients for internal and supplier integration equations, as well as for internal and customer integration equations are the same due to their associated p-value is insignificant.

Table 4. 31 Significance test of Technical knowledge and application competencies

Model	F-statistics	Degree of Freedom	Prob>F
Simultaneously all models	4.24	(2, 156)	0.0161
Pair-wise: Internal and supplier integration models	3.32	(1, 156)	0.0703
Pair-wise: Internal and customer integration models	0.55	(1, 156)	0.4579
Pair-wise: Supplier and customer integration models	7.72	(1, 156)	0.0061

4.6.2.2 Traits and management skills

Hypothesis 2.2: Traits and management skills competencies for each supply chain integration dimension are the same

As for Traits and management skills competencies, an F-statistics of collective supply chain integrations in Table 4.32 reports a value of 6.29 with its associated p-value less than 0.01. By pair, an F-statistics for internal and supplier integration equations is 5.69 with its p-value less than < 0.05, for internal and customer integration equations is 0.48 with its p-value higher than 0.05, and for supplier and customer integration equations is 10.99 with its p-value less than 0.01. Therefore, with the

significance level of 0.05, we conclude that coefficients of Traits and management skills competencies in each equation are simultaneously not equal. Thus, we reject the null hypothesis that Traits and management skills competencies for each supply chain integration dimension are the same. Nevertheless, a test by pair shows significant p-values only in internal and supplier integration equations, and supplier and customer integration equations.

Table 4. 32 Significance test of Traits and management skills competencies

Model	F-statistics	Degree of Freedom	Prob>F
Simultaneously all models	6.29	(2, 156)	0.0024
Pair-wise: Internal and supplier integration models	5.69	(1, 156)	0.0183
Pair-wise: Internal and customer integration models	0.48	(1, 156)	0.4876
Pair-wise: Supplier and customer integration models	10.99	(1, 156)	0.0011

4.6.3 Impact of a supply chain manager's roles and responsibilities

Hypothesis 3a: A supply chain manager's roles and responsibilities have a positive impact on internal integration

Hypothesis 3b: A supply chain manager's roles and responsibilities have a positive impact on supplier integration

Hypothesis 3c: A supply chain manager's roles and responsibilities have a positive impact on customer integration

As shown in Table 4.33, a test result indicates that this variable is significant in the overall models with an F-statistics of 6.90 and its associated p-value less than 0.001. After reviewing each equation, we find significant statistics in only the internal integration model, with an F-statistics of 18.7 and its p-value less than 0.001. However, insignificant statistics are observed in supplier and customer integration models. In conclusion, with the significance level of 0.05, we accept the null hypothesis 3a that a supply chain manager's roles and responsibilities have a positive impact on internal integration. We also reject the null hypothesis 3b that a supply chain manager's roles and responsibilities have a positive impact on supplier integration, and the null hypothesis 3c that a supply chain manager's roles and responsibilities have a positive impact on customer integration.

Table 4. 33 Impact test of a supply chain manager's roles and responsibilities

Model	F-statistics	Degree of Freedom	Prob>F
Overall models	6.90	(3, 156)	0.0002
Internal integration model	18.70	(1, 156)	0.0000
Supplier integration model	1.23	(1, 156)	0.2684
Customer integration model	0.30	(1, 156)	0.5827

4.6.4 Significance test of independent variable – roles & responsibilities

Hypothesis 4: A supply chain manager's roles and responsibilities for each supply chain integration dimension are the same

With the same procedure conducted in the hypothesis 2.1 and 2.2, we test whether simultaneously coefficients for a supply chain manager's roles and responsibilities are equal, then we conduct a pair-test of each equation. Table 4.34 shows that the first test reports an F-statistics of 4.16 with its associated p-value less than 0.05. By pair, an F-statistics for internal and supplier integration equations is 5.96 with its associated p-value less than 0.05, for internal and customer integration equations is 7.21 with its p-value less than 0.05, and for supplier and customer

integration equations is 0.29 with its p-value higher than 0.05. At the significance level of 0.05, we conclude that coefficients for a supply chain manager's roles and responsibilities are simultaneously not equal. Thus, we reject the null hypothesis that a supply chain manager's roles and responsibilities for each supply chain integration dimension are the same. Nevertheless, a test by pair shows significant p-values only in internal and supplier integration equations, and in internal and customer integration equations.

Table 4. 34 Significance test of a supply chain manager's roles and responsibilities

Model	F-statistics	Degree of Freedom	Prob>F
Simultaneously all models	4.16	(2, 156)	0.0174
Pair-wise: Internal and supplier integration models	5.96	(1, 156)	0.0158
Pair-wise: Internal and customer integration models	7.21	(1, 156)	0.0080
Pair-wise: Supplier and customer integration models	0.29	(1, 156)	0.5903

Chapter V
Discussion and Conclusion

5.1 Managerial Implication and Conclusion

This research shows how multivariate regression can be applied to an assessment of supply chain integration level which is impacted by competencies and a supply chain manager's roles and responsibilities. As far as the researcher's knowledge, this is the only study to link how attitudes, knowledge and skills of supply chain managers can predict supply chain integration of any firms. The developed models provide to firms a way for identifying improvement actions of their supply chain professionals on both technical and soft skills. Such identification will guide concerned parties to take appropriate measures in order that required competencies can be achieved and sustained.

The results reveal that competencies listed in Technical knowledge and application, and Traits and management skills, as well as a supply chain manager's roles and responsibilities are obviously complimentary in driving higher level of supply chain integration. They do not, however, render the same impacts. If we consider that overall integration comprises of three dimensions, including internal integration, supplier integration and customer integration, firms have to evaluate in which dimension they need to emphasize to sustain their competitive advantage. For example, firms in a manufacturing environment may have to focus more on supplier and internal integration, while logistics service providers have to ensure customer integration is well managed. As indicating in the results, Technical knowledge and application competencies are significant factors in all supply chain integration dimensions, yet they play more important contribution to internal and customer integrations than supplier integration. Traits and management skills competencies, in contrast, are considered crucial in driving only supplier integration and do not support similar impacts on internal and customer integration. When we take into account a supply chain manager's roles and responsibilities as an individual factor, the result shows their influences only on internal integration. This may raise some concerns if we

make an interpretation by only regression result as they seem not impact supplier and customer integration. However, when we analyze in parallel simply with mean score of the statements describing a supply chain manager's roles and responsibilities, all statements show the level of higher than 75%. As a result, we cannot inevitably consider them important.

When comparing the two groups of supply chain manager competencies, Technical knowledge and application is found to be of higher contribution to supply chain integration. Loading factors show that the top three competencies, among nine of them, are Technical logistics/supply chain function, Supply chain fundamentals, and Strategy development and application. Technical logistics/supply chain function shows as well the second highest gap when compared current and expected level.

5.1.1 Application for firms

In applying our model, firms can conduct self-assessment to understand the level of each dimension of supply chain integration, as well as evaluating their supply chain professionals against the list of supply chain manager competencies. Should firms' activities focus mainly on internal and customer integration , they should be able to identify that Technical knowledge and application competencies are keys for their supply chain professionals to master. While the companies focusing on supplier integration requires that their supply chain managers need to possess Traits and management skills competencies. In practice, for each competency item, a 5-continuum level of maturity, can be established together with described detailed behaviors and related processes to achieve expected outcome, where the upper most level (5^{th} level) as the ideal state. For example, from level 1 fundamental awareness, level 2 sufficient understanding of competency concept and requirement of some guidance, level 3 proficient level with detailed knowledge/understanding and minimum supervision, level 4 advanced level with highly developed knowledge and long-term perspective, and level 5 an expert level recognized by others.

From the 5-level, the companies should set a target for each supply chain professionals to achieve with development actions in defined timeframe. Periodic review is to put in place so that the companies can assure its progress in improving supply chain integration level through their supply chain managers' competencies. This self-assessment requires active involvement of management team, who is responsible for gathering data and showing progress to concerned persons.

5.1.2 Application for human resources

Human resource department can establish criteria when they need to recruit, to train and to develop supply chain managers to meet business requirements of the companies. In other word, competency-based approach can be developed and applied.

5.1.2.1 Competency-based recruitment and selection

To start with, recruitment personnel need to familiarize themselves with supply chain manager's job description. They have to prepare in advance questions related to competencies described in the study. For instance, in order to learn about candidate's Technical logistics/supply chain functions competency, recruitment personnel can ask candidate to describe how he manages the inventory, and what are actions to ensure service level is achieve consistently. To learn about Strategy development and application competency, recruitment personnel can request candidate to explain an occasion when he has to develop strategies to implement for critical changes in his organization.

5.1.2.2 Competency-based training and development

This training identifies what are competencies and their levels that the companies require their supply chain manager to possess. In application, trainer needs to work with supply chain manager to collect evidence of competencies in comparison

with the 5-level maturity as guidelines in Table 5.1. For the competencies with lower level than expectation, a training plan can be developed to focuses on areas of improvement for supply chain manager. Assessment and follow-up needs to be identified in order to track progress.

5.1.3 Other applications

Similarly, supply chain professionals can refer to our model to identify competencies gap for their personal improvement, consequently increasing their employability level as when compared to those being less competent. Lastly, academic institutes might align the curriculum to foster required technical knowledge on supply chain (Hoek, Chatham et al. 2002, Lutz and Birou 2013, Wu, Huang et al. 2013) and help students to grow in their career advancement. On a macro level, we might be able to identify opportunities for partnerships between academic institutions and the corporate sectors in developing and delivering knowledge and learning as to equip current and future supply chain managers with appropriate skills and competencies.

5.2 Limitations and areas for further works

Similar to any research, this study may have some shortcomings. There are major areas which can be addresses for further works as below.

5.2.1 Coverage of supply chain manager competencies

The models, despite validity test, may not accurately reflect required skills, knowledge and competencies of supply chain managers in all types of industries. Some may consider a group of competencies more important than the others. For small and newly-established companies in any type of industries, supply chain managers are required to possess strong technical knowledge and skills in logistics and supply chain functions. Functional activities are critical for the companies to maintain their positions

among competitors in the field. When the companies become larger in size, exposed to an international environment and business gets more complex, supply chain managers must not be only familiar with international rules and regulations, but also to drive team towards the same goals with high adaptability to changes. Therefore, further study may focus on specific industries, as well as the size of companies. Future researchers can start filter from an exhaustive list of competencies related to the industries of their interest, taking into account business complexity.

5.2.2 Perception of respondents

Years of experiences and hierarchical level within the companies of supply chain managers may play an important role in their perceptions of each questionnaire item. Young graduates with less working experiences tend to perceive work environment in a more operational way than strategic. They act as members in performing functional activities within the companies, following the companies' direction. Their perception might be limited to achieving short-term goal, instead of medium and longer term to sustain its competitive advantage in supply chain networks. In contrast, managers with more working experiences can distinguish the level of supply chain integration from normal cooperation to a more bounded one. Through their experiences, they understand what work well to achieve higher supplier integration, and what are required to obtain customers' insights. On a similar notion, supply chain managers at a higher hierarchical level within the companies, for example top executive, usually expect to gain both operational and strategic supply chain integration. They may regard operational cooperation among different members within supply chain networks as critical as strategic collaboration. All these lead to requirement of supply chain manager competencies in a practical rather than theoretical approach. Further study taking into account yeas of experiences as well as hierarchical level of supply chain managers within the companies might provide an in-depth understanding of practical supply chain manager competencies, leading to clear guidance in implementing competency-based human resource management within the companies.

5.2.3 Additional variables

Apart from shortcomings in previous sections, there are potential areas for further works by adding other variables to verify their impacts on supply chain integration. The model can also be diversified on the basis of supply chain manager characteristics in order to verify how competencies change according to their functions. For instance, supply chain managers focusing on logistics management (distribution, transportation, production planning) may require different set of competencies than those focusing on supplier management (supply planning, sourcing, procurement) and customer management (customer service, demand planning). The researcher has realized that the number of observations is not large enough to allow this type of analysis. Suggestions for further works include identifying larger population which covers different work nature of respondents and planning more resources both times and manpower to collect data for a higher completion rate.

5.2.4 Different integration weight

Three dimensions of supply chain integration may have different important weight in overall integration. Instead of only analyzing each dimension, an aggregate integration may be interesting as it allows additional aspects of comparisons among firms' and businesses' competencies level. In the questionnaire, future researchers may request respondents to rank supply chain integration dimensions by its importance to their companies. Weighted average can be introduced in the analysis process. Companies giving higher attention to internal integration may require specific types of supply chain managers with corresponding competencies. For example, supply chain managers should possess higher level of effective communication skills, as well as business process knowledge, in order to coordinate effectively with different departments in the companies. Likewise, companies relying on supplier integration may expect supply chain managers being expert in supplier management in addition to having supply chain synchronization competencies.

5.2.5 In-depth and comparative study

Furthermore, in-depth case studies on best practice of firms' approach to coach and develop supply chain professionals at all levels, from junior to top management as to sustain their competitive edges can be explored. Future research could cover more countries to compare and contrast required competencies. For example, researchers may want to gain more insights by benchmarking supply chain professional development roadmap of each country, especially through cooperation of national firms as to validate its alignment with increasing supply chain complexity in the region.

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APPENDICES

Appendix A Questionnaire (Thai version)

Chulalongkorn University
จุฬาลงกรณ์มหาวิทยาลัย
Pillar of the Kingdom

แบบสอบถามเพื่อการศึกษาวิจัยเรื่อง
"สมรรถนะของผู้จัดการซัพพลายเชนและการส่งผลต่อบูรณาการของซัพพลายเชน"

ขอขอบพระคุณท่านเป็นอย่างสูงที่ร่วมตอบแบบสอบถามเพื่อการวิจัยเรื่อง "สมรรถนะของผู้จัดการซัพพลายเชนและการส่งผลต่อบูรณาการของซัพพลายเชน" ซึ่งเป็นส่วนหนึ่งของวิทยานิพนธ์ หลักสูตรวิทยาศาสตรดุษฎีบัณฑิต สาขาวิชาการจัดการด้านโลจิสติกส์ บัณฑิตวิทยาลัย จุฬาลงกรณ์มหาวิทยาลัย

โปรดมั่นใจได้ว่าข้อมูลที่ได้จากแบบสอบถามครั้งนี้จะถือเป็นความลับ เนื่องจากผู้วิจัยจะนำเสนอผลการประเมินในภาพรวมเท่านั้น แบบสอบถามนี้ถูกออกแบบขึ้นมาเพื่อศึกษามุมมองของบริษัทต่างๆ ในเรื่องสมรรถนะของผู้จัดการซัพพลายเชน ว่ามีสมรรถนะใดบ้างที่มีผลกระทบต่อผลการดำเนินงานของบริษัท ผู้วิจัยหวังว่าผลที่ได้จากการวิจัยจะช่วยให้บริษัทต่างๆ ตลอดจนองค์กร หน่วยงานของรัฐ และบุคลากรในแวดวงซัพพลายเชนร่วมกันพัฒนาสมรรถนะที่เป็นปัจจัยความสำเร็จในการดำเนินงาน

แบบสอบถามนี้มีทั้งหมด 5 หน้าประกอบด้วย 3 ส่วนคำถาม และจะใช้เวลาทั้งสิ้นประมาณ 15-20 นาที

ส่วนที่ 1 เป็นคำถามเกี่ยวกับข้อมูลทั่วไป
ส่วนที่ 2 เป็นการประเมินความสัมพันธ์ของกิจกรรมซัพพลายเชนในภาพกว้าง
ส่วนที่ 3 เป็นการประเมินสมรรถนะของผู้จัดการซัพพลายเชน

ผู้วิจัยยินดีน้อมรับทุกความคิดเห็นของท่านเพื่อพัฒนาแบบสอบถามนี้ให้ดียิ่งขึ้นในโอกาสต่อไป ตลอดจนเพื่อประโยชน์ของผู้ที่สนใจผลลัพธ์งานวิจัยนี้ ผู้วิจัยขอขอบคุณท่านอีกครั้งที่เสียสละเวลาและความคิดเห็นอันมีค่าของท่านต่อการตอบแบบสอบถามนี้

ขอแสดงความนับถือ

นายศุภชัย อาชีวระงับโรค
Email: supachai.archiw@gmail.com
มิถุนายน 2556

ส่วนที่ 1: ข้อมูลทั่วไป

ข้อมูลผู้ตอบแบบสอบถาม

1. ตำแหน่งงานของท่าน .....
2. ท่านทำงานทางด้านซัพพลายเชนมาเป็นเวลากี่ปี.....
3. ลักษณะงานที่ท่านทำอยู่ในปัจจุบันเป็นอย่างไร
   - ☐ การจัดการความสัมพันธ์กับซัพพลายเออร์ (การวางแผนอุปทาน การจัดหา การจัดซื้อ)
   - ☐ การจัดการโลจิสติกส์ (การกระจายสินค้า การขนส่ง การวางแผนการผลิต)
   - ☐ การจัดการความสัมพันธ์กับลูกค้า (การบริการลูกค้า การวางแผนอุปสงค์)
   - ☐ อื่นๆ โปรดระบุ .....

4. หากกำหนดระดับหน้าที่ที่ท่านรับผิดชอบ ระหว่าง 0-99 (โดย 0 หมายถึงระดับต่ำที่สุด และ 99 หมายถึงระดับสูงที่สุด) ท่านประเมินหน้าที่ที่ท่านรับผิดชอบในระดับใด สำหรับข้อความต่อไปนี้

บทบาทและหน้าที่รับผิดชอบ	ระดับความรับผิดชอบ (0-99)
ฉันจะทำให้มั่นใจได้ว่าการดำเนินงานของบริษัทมีความยืดหยุ่นเพียงพอที่จะสามารถสนองความต้องการของลูกค้าทั้งในอดีตและปัจจุบันได้เป็นอย่างดี	
ฉันสร้าง/รักษาความสัมพันธ์ที่ดีในเชิงกลยุทธ์กับลูกค้าและซัพพลายเออร์	
ฉันรับผิดชอบการดำเนินการเชิงกลยุทธ์เพื่อสร้างความได้เปรียบในการแข่งขัน	
ฉันผลักดันทีมปฏิบัติการให้บรรลุเป้าหมายทั้งรายวันและรายสัปดาห์	
ฉันมีส่วนร่วมในการแก้ปัญหาส่วนใหญ่ในกิจกรรมซัพพลายเชนของบริษัท	
ฉันประสานงานกับซัพพลายเออร์และ/หรือลูกค้าเพื่อลดปัญหาต่างๆ ที่อาจเกิดขึ้นและเป็นอุปสรรคต่อการปฏิบัติงานในซัพพลายเชนทั้งในระยะสั้นและระยะปานกลาง	

ข้อมูลบริษัท

1. ชื่อบริษัท.....
2. บริษัทของท่านอยู่ในอุตสาหกรรมประเภทใด.....
3. ผู้ถือหุ้นส่วนใหญ่ของบริษัทท่าน นับถือสัญชาติอะไร.....
4. จำนวนพนักงานในบริษัท ทั้งในโรงงานและสำนักงาน
   - ☐ น้อยกว่า 100 คน ☐ 100 – 500 คน ☐ 500-1,000 คน
   - ☐ 1,000-3,000 คน ☐ 3,000-5,000 คน ☐ มากกว่า 5,000 คน
5. จำนวนพนักงานในบริษัท ที่ทำงานทางด้านซัพพลายเชน ทั้งในโรงงานและสำนักงาน
   - ☐ น้อยกว่า 10 คน ☐ 10 – 50 คน ☐ 50-100 คน
   - ☐ 100-300 คน ☐ 300-500 คน ☐ More than 500 คน

ส่วนที่ 2: การประเมินด้านบูรณาการของซัพพลายเชน

หากกำหนดระดับบูรณาการของซัพพลายเชนในด้านต่างๆ ระหว่าง 0-99 (โดย 0 หมายถึงระดับต่ำที่สุด และ 99 หมายถึงระดับสูงที่สุด) ท่านประเมินบูรณาการของบริษัทท่านในระดับใด สำหรับข้อความต่อไปนี้

บูรณาการของซัพพลายเชน	ระดับบูรณาการ
บูรณาการภายในบริษัท	0 - 99
การตอบสนองความต้องการระหว่างแผนก	
บูรณาการและการเชื่อมโยงทุกกิจกรรม ตั้งแต่การจัดการวัตถุดิบจนกระทั่งการผลิต การการกระจายสินค้า และการขาย	
บริษัทของเรามุ่งเน้นการทำงานเป็นทีมแบบประสานกันระหว่างหน่วยงาน (cross-function team) เพื่อการปรับปรุงกระบวนการและการพัฒนาผลิตภัณฑ์	
บูรณาการกับซัพพลายเออร์	0-99
บริษัทของเรามีการแลกเปลี่ยนข้อมูลกับซัพพลายเออร์/ผู้จัดส่งสินค้าและวัตถุดิบ รายสำคัญผ่านทางเทคโนโลยีสารสนเทศ	
บริษัทของเราร่วมเป็นคู่ค้าเชิงกลยุทธ์กับซัพพลายเออร์/ผู้จัดส่งสินค้าและวัตถุดิบ	
บริษัทของเรามีการวางแผนร่วมกับซัพพลายเออร์/ผู้จัดส่งสินค้าและวัตถุดิบ เพื่อการตอบสนองอย่างรวดเร็วในการสั่งซื้อสินค้าและการพัฒนาผลิตภัณฑ์ใหม่ๆ	
ซัพพลายเออร์/ผู้จัดส่งสินค้าและวัตถุดิบ รายสำคัญของเราแบ่งปันข้อมูลด้านศักยภาพความยืดหยุ่นในการผลิต	
บูรณาการกับลูกค้า	0-99
บริษัทของเราแลกเปลี่ยนข้อมูลทางการตลาดกับลูกค้ารายสำคัญ	
บริษัทของเราแลกเปลี่ยนข้อมูลกับลูกค้ารายสำคัญในเรื่องความยืดหยุ่นในการผลิตผ่านทางเทคโนโลยีสารสนเทศ	
บริษัทของเรามีการวางแผนและพยากรณ์ตลาดร่วมกับลูกค้ารายสำคัญ เพื่อจะได้จัดการกับอุปสงค์ล่วงหน้า	
ลูกค้าของบริษัทมีส่วนร่วมในกระบวนการพัฒนาผลิตภัณฑ์ของบริษัท	

Section 3: การประเมินสมรรถนะของผู้จัดการซัพพลายเชน

หากกำหนดระดับสมรรถนะของผู้จัดการซัพพลายเชน ระหว่าง 0-99 (โดย 0 หมายถึงระดับต่ำที่สุด และ 99 หมายถึงระดับสูงที่สุด) ท่านประเมินสมรรถนะของผู้จัดการซัพพลายเชนในปัจจุบัน และที่คาดหวังในระดับใด และภายในอีก 5 ปีข้างหน้า ท่านคิดว่ามีความจำเป็นต้องใช้สมรรถนะดังกล่าวมากขึ้นหรือลดลงหรือไม่

3.1 ท่านประเมินสมรรถนะของผู้จัดการซัพพลายเชน ในฐานะใด

- ☐ ท่านเป็นผู้จัดการซัพพลายเชน
- ☐ ท่านเป็นผู้บังคับบัญชาของผู้จัดการซัพพลายเชน
- ☐ ท่านเป็นผู้ใต้บังคับบัญชาของผู้จัดการซัพพลายเชน

3.2 รายการสมรรถนะ	ระดับสมรรถนะ (0-99)		ความต้องการอีก 5 ปีข้างหน้า น้อยลง ◄——► มากขึ้น				
	ปัจจุบัน	ที่คาดหวัง	1	2	3	4	5
ตัวอย่าง: การควบคุมอารมณ์	50	85			x		
ทักษะด้านสัมพันธภาพระหว่างบุคคล							
การสื่อสารอย่างมีประสิทธิผล							
ความซื่อสัตย์							
การสร้างทีมงานที่มีประสิทธิผล							
การเรียนรู้และการพัฒนาส่วนบุคคล							
การศึกษาสูงกว่าระดับมัธยมศึกษา							
คณิตศาสตร์ สถิติและการคิดเชิงวิเคราะห์							
ความรู้พื้นฐานซัพพลายเชน							
ความรู้กระบวนการธุรกิจ							
กฎหมายและระเบียบบังคับการดำเนินธุรกิจสากล							
ฟังก์ชั่นของซัพพลายเชนและโลจิสติกส์ในเชิงเทคนิค							
การจัดการกระบวนการทำงาน							
ความสอดคล้องกันของซัพพลายเชน (Supply chain synchronization)							
การมุ่งเน้นลูกค้า (ภายใน/ภายนอก)							
การจัดการซัพพลายเออร์/ผู้จัดส่งสินค้าและวัตถุดิบ							
การใช้เทคโนโลยี (Enabling technology)							
การจัดการความขัดแย้ง							
การจัดการความเปลี่ยนแปลงและความซับซ้อน							
การมุ่งเน้นผลลัพธ์ (มุ่งการปฏิบัติ/ผลลัพธ์)							
การพัฒนาและการประยุกต์ใช้กลยุทธ์							
อื่นๆ โปรดระบุ.....							
อื่นๆ โปรดระบุ.....							
อื่นๆ โปรดระบุ.....							

ข้อคิดเห็นเพิ่มเติม.....

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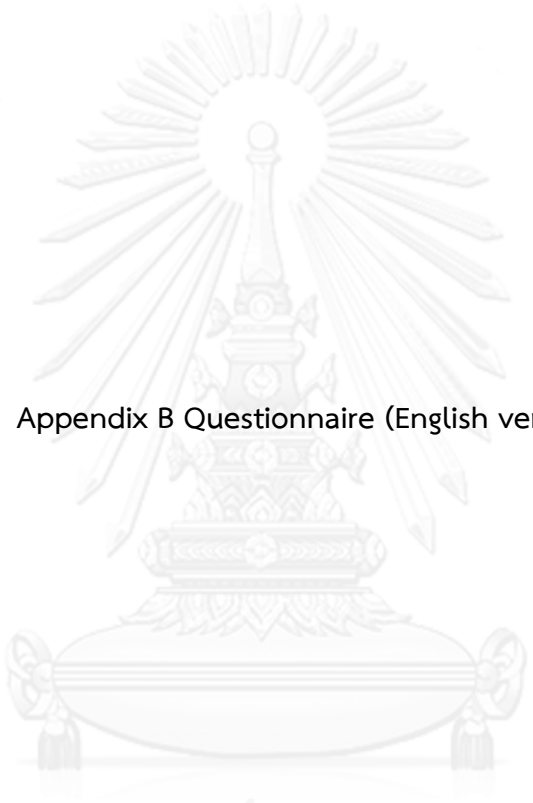
หากท่านต้องการรับทราบผลการศึกษาในครั้งนี้ กรุณากรอกรายละเอียดที่สามารถติดต่อได้

ชื่อ..... e-mail.....

ขอขอบคุณท่านอย่างยิ่งที่กรุณาตอบแบบสอบถาม



Appendix B Questionnaire (English version)

Chulalongkorn University
จุฬาลงกรณ์มหาวิทยาลัย
Pillar of the Kingdom

Questionnaire for a study on "Supply Chain Manager Competencies and Their Impact on Supply Chain Integration"

Welcome and thank you very much for your participation in "Supply Chain Manager Competencies and Their Impact on Supply Chain Integration", which is conducted for a dissertation completion as partial requirements for the degree of Doctor of Philosophy Program in Logistics Management, Graduate School, Chulalongkorn University, Bangkok Thailand.

Please be assured of its confidentiality as the result will be reported in the aggregate, and individual responses will not be shared.

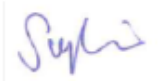
This questionnaire is designed to obtain perspective from companies on required supply chain managers competencies. The result from this survey will be used as a guidance to develop supply chain managers with skills and competencies to meet current and future industry requirement.

This questionnaire consists 3 sections and it will require 10-15 minutes to answer.

Section 1: General information
Section 2: Supply chain integration assessment
Section 3: Supply chain managers competencies assessment

We welcome any suggestions you may have to improve further this questionnaire, and for the benefits of interested parties in the study result. Once again, your time and effort to complete this questionnaire is well appreciated.

Sincerely yours,



Mr.Supachai Archiwaranguprok
PhD Student of Logistics Management,
Graduate School, Chulalongkorn University
Email: supachai.archiw@gmail.com
June 2013

Section 1: General Information

Respondent profile

1. What is your title? .....

2. How many years have you been working in supply chain areas? .....

3. What is your nationality? .....

4. In which countries are you working now? .....

5. What is your current work nature?
   - ☐ Supplier-relations management (supply planning, sourcing, procurement)
   - ☐ Logistics management (distribution, transportation, production planning)
   - ☐ Customer relations management (customer service, demand planning)
   - ☐ Other, please specify .....

6. Given a scale of 0-99 to describe the level of your role and responsibility, (where 0 = the lowest, and 99 = the highest), please put the corresponding level for each below statement.

Roles and Responsibilities	Level (0-99)
▪ I ensure operations flexibility to meet both current customer's demand and future requirements.	
▪ I foster strategic relationship with suppliers and customers.	
▪ I am responsible for the company's strategic move to sustain competitive advantage.	
▪ I drive operational team to achieve daily and weekly targets.	
▪ I personally involve in corrective actions to most problems related to supply chain activities.	
▪ I deal with suppliers and/or customers to minimize all possible problems that will obstruct short-medium term supply chain operations	

Company profile

1. Company name.....

2. Which type of industry you are in?.....

3. Nationality of major shareholders .....

4. Total numbers of employees (both plants & offices)
   - ☐ Less than 100 ☐ 100 – 500 ☐ 500-1,000
   - ☐ 1,000-3,000 ☐ 3,000-5,000 ☐ More than 5,000

5. Total numbers of employees working in supply chain areas (both plants & offices)
   - ☐ Less than 10 ☐ 10 – 50 ☐ 50-100
   - ☐ 100-300 ☐ 300-500 ☐ More than 500

Section 2: Supply Chain Integration Assessment

Given a scale of 0-99 to describe the level of supply chain integration in your organization, (where 0 = the lowest, and 99 = the highest), please put the corresponding level for each below statement.

Supply Chain Integration	Level of Integration
Internal integration	0 - 99
▪ Responsiveness between departments to meet each other requirement	
▪ Integration and connections among all internal functions from raw material management through production, distribution and sales	
▪ Our organization emphasizes on cross-function team on process improvement and product development	
Supplier integration	0-99
▪ Our organization exchanges information with our major suppliers through information technologies	
▪ Our organization has a strategic partnership with our suppliers	
▪ Our organization has joint planning with our suppliers to obtain rapid response ordering process, including new product development	
▪ Our major suppliers share their capability of operations flexibility	
Customer integration	
▪ Our organization exchanges market information with major customers	
▪ Our organization shares information to major customers through information technologies on operations flexibility	
▪ Our organization has joint planning and forecasting with major customers to anticipate demand visibility	
▪ Our customers are involved in our product development process	

Section 3: Supply Chain Managers Competencies Assessment

In which role do you assess supply chain manager competencies?.

- ☐ You're supply chain manager yourself
- ☐ You're subordinate of supply chain manager
- ☐ You're superior of supply chain manager

Given a scale of 0-99 to describe both current and required level of supply chain managers competencies in your organization, (where 0 = the lowest, and 99 = the highest), please put the corresponding level for each competency entry.

List of Competencies	Competency Level (0-99)		Need In 5 years Less → More				
	Current	Required	1	2	3	4	5
Example: Control of emotion	50	85			x		
Interpersonal skills							
Effective communication							
Integrity							
Building effective teams							
Personal learning & self-development							
Post secondary education							
Math, statistics and analytical thinking							
Supply chain fundamentals							
Business process knowledge							
International business rules & regulations							
Technical logistics/supply chain functions							
Work processes management							
Supply chain synchronization							
Customer focus (internal / external)							
Supplier management							
Enabling technology							
Conflict management							
Change & complexity management							
Focus on the bottom line (action oriented /results)							
Strategy development & application							
Other (please specify).....							
Other (please specify).....							

Recommendation.....
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.....
.....

Thank you very much for completing this questionnaire

VITA

Mr.Supachai Archiwaranguprok was born in May, 1972. He received his bachelor degree from the Faculty of Arts in 1994 and his master degree of Business Administration in 1999, both from Chulalongkorn University. He is a Ph.D. student of Logistics Management, Graduate School, Chulalongkorn University. Professionally, he has more than 20-year experiences in various functions in supply chain fields, including airlines logistics and sales, manufacturing planning and customer service, distribution and warehouse. He is currently working for Essilor, the world leader of ophthalmic lens, and recently in the position of Supply Chain Manager for Asia Operations Mass Production. His areas of interest include competency development of supply chain professionals and supply chain improvement initiatives.