THE RELATIVE INFLUENCE OF KNOWLEDGE SHARING/TRANSFER FOR MANAGEMENT PROCESS IN SUPPLY CHAIN INTEGRATION

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งานวิจัยนี้ดำเนินการเพื่อวัตถุประสงค์สำคัญ 3 ประการ ในการยกระดับประสิทธิภาพและประสิทธิผลของการจัดการโซ่อุปทาน สำหรับอุตสาหกรรมไฟฟ้าและอิเล็กทรอนิกส์ของประเทศไทย วัตถุประสงค์แรก คือการระบุถึงความแตกต่างของการแบ่งปันความรู้ และการถ่ายโอนความรู้ ในมุมมองเชิงปฏิบัติ โดยมุ่งเน้นความรู้สำหรับกระบวนการการจัดการโซ่อุปทานในบริบทของการบูรณาการโซ่อุปทานภายนอก วัตถุประสงค์ที่สอง คือการกลั่นกรองความรู้ที่จำเป็นสำหรับกระบวนการการจัดการโซ่อุปทาน ทั้ง 8 กระบวนการ อันได้แก่ การจัดการความสัมพันธ์กับลูกค้า การจัดการการบริการลูกค้า การจัดการความต้องการ การเติมเต็มคำสั่งซื้อ การจัดการการไหลของกระบวนการผลิต การจัดการความสัมพันธ์กับซัพพลายเออร์ การพัฒนาผลิตภัณฑ์และการค้า และ การจัดการการส่งกลับ ซึ่งควรได้รับการแบ่งปัน/ถ่ายโอน ในบริบทของการบูรณาการโซ่อุปทานภายนอก เพื่อส่งเสริมประสิทธิภาพโซ่อุปทาน วัตถุประสงค์ที่สาม คือการประเมินน้ำหนักความสัมพันธ์ของการแบ่งปันความรู้ และการถ่ายโอนความรู้ต่อการเพิ่มประสิทธิภาพโซ่อุปทาน โดยการพิจารณาจากรูปแบบโครงสร้างตามลำดับขั้น อันประกอบด้วย ขั้นที่ 1 (เกณฑ์หลัก) คือ การแบ่งปันความรู้ และการถ่ายโอนความรู้ ขั้นที่ 2 (เกณฑ์รองที่ 1) คือ บริบทของการบูรณาการโซ่อุปทานภายนอก 4 มุมมอง ขั้นที่ 3 (เกณฑ์รองที่ 2) คือ ความรู้ที่เกี่ยวข้องกับการจัดการโซ่อุปทาน ทั้ง 8 กระบวนการ ขั้นที่ 4 (เกณฑ์รองที่ 3) คือ ความรู้ที่จำเป็นสำหรับการจัดการโซ่อุปทานแต่ละกระบวนการ ขั้นที่ 5 (ทางเลือก) คือ ประสิทธิภาพของโซ่อุปทาน 3 ด้าน ได้แก่ ต้นทุน ความน่าไว้วางใจ การตอบสนอง เพื่อให้บรรลุวัตถุประสงค์ดังกล่าวข้างต้น จึงได้ดำเนินการตามระเบียบวิธีการวิจัยโดยแบ่งเป็น 2 ระยะ ระยะแรกเพื่อให้บรรลุวัตถุประสงค์สองประการแรก จึงทำการประยุกต์ใช้ แบบสอบถามกึ่งโครงสร้าง แบบสอบถามแบบเลือกได้หลายคำตอบ การสัมภาษณ์เชิงลึก การทดสอบการกระจายแบบปกติ การวิเคราะห์ช่วงความเชื่อมั่น ระยะที่สอง เพื่อให้บรรลุวัตถุประสงค์ประการที่สาม จึงทำการประยุกต์ใช้แบบสอบถามเปรียบเทียบเชิงคู่ และการวิเคราะห์ด้วยกระบวนการตัดสินใจหลายหลักเกณฑ์แบบฟัซซี่ โดยมีกลุ่มของผู้เชี่ยวชาญที่เข้าร่วมการวิจัยในระยะแรก จำนวน 15 กลุ่ม และระยะที่สอง จำนวน 60 กลุ่ม

ผลของงานวิจัยพบว่า ความแตกต่างที่สำคัญระหว่างการแบ่งปันความรู้ และการถ่ายโอนความรู้ คือ การถ่ายโอนความรู้จะนำไปสู่การประยุกต์ใช้ความรู้ที่ได้รับมา เพื่อให้บรรลุวัตถุประสงค์อย่างใดอย่างหนึ่ง ในขณะที่การแบ่งปันความรู้ไม่เน้นคุณลักษณะดังกล่าว ส่วนความแตกต่างรองอื่นๆ ได้แก่ เป้าหมาย กระบวนการ และรูปแบบของการแบ่งปัน และการถ่ายโอนความรู้ นอกจากนี้ ผลของงานวิจัยยังทำให้ทราบถึง ความรู้ที่จำเป็นสำหรับกระบวนการการจัดการโซ่อุปทาน ทั้ง 8 กระบวนการ ซึ่งควรได้รับการแบ่งปัน/ถ่ายโอน ในบริบทของการบูรณาการโซ่อุปทานภายนอก เพื่อส่งเสริมประสิทธิภาพโซ่อุปทาน อีกทั้งผลจากการวิเคราะห์น้ำหนักความสัมพันธ์ในภาพรวม แสดงให้เห็นว่าการแบ่งปันความรู้มีน้ำหนักความสัมพันธ์ต่อการเพิ่มประสิทธิภาพโซ่อุปทาน มากกว่าการถ่ายโอนความรู้ รวมถึงได้แสดงค่าน้ำหนักความสัมพันธ์ของเกณฑ์รองอื่นๆ และทางเลือก ทั้งหมด จากรูปแบบโครงสร้างตามลำดับอีกด้วย มากไปกว่านั้น งานวิจัยนี้ยังได้นำเสนอรูปแบบ การแบ่งปัน/ถ่ายโอนความรู้ที่จำเป็นสำหรับกระบวนการการจัดการโซ่อุปทานสำหรับแต่ละกลุ่มในบริบทของการบูรณาการโซ่อุปทานภายนอก โดยพบว่า กลุ่มผู้ประกอบ ควรให้น้ำหนักความสำคัญกับการแบ่งปันความรู้ที่จำเป็นสำหรับกระบวนการ การเติมเต็มคำสั่งซื้อ การจัดการความต้องการ และ การจัดการการบริการลูกค้า กลุ่มผู้ส่งมอบระดับที่ 1 ควรให้น้ำหนักความสำคัญกับการแบ่งปันความรู้ที่จำเป็นสำหรับกระบวนการ การจัดการการไหลของกระบวนการผลิต และ การพัฒนาผลิตภัณฑ์และการค้า กลุ่มผู้ส่งมอบระดับที่ 2 ควรให้น้ำหนักความสำคัญกับการถ่ายโอนความรู้ที่จำเป็นสำหรับกระบวนการ การจัดการการไหลของกระบวนการผลิต และ การพัฒนาผลิตภัณฑ์และการค้า

สาขาวิชา การจัดการด้านโลจิสติกส์	ลายมือชื่อนิสิต ....
ปีการศึกษา 2557	ลายมือชื่อ อ.ที่ปรึกษาหลัก ....
	ลายมือชื่อ อ.ที่ปรึกษาร่วม ....

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KEYWORDS: KNOWLEDGE SHARING / KNOWLEDGE TRANSFER / SUPPLY CHAIN INTEGRATION / SUPPLY CHAIN MANAGEMENT PROCESS / SUPPLY CHAIN PERFORMANCE / IN-DEPTH INTERVIEW / CHECKLIST QUESTIONNAIRE / NONPARAMETRIC ANALYSIS / FUZZY AHP

THANIDA SUNARAK: THE RELATIVE INFLUENCE OF KNOWLEDGE SHARING/TRANSFER FOR MANAGEMENT PROCESS IN SUPPLY CHAIN INTEGRATION. ADVISOR: ASSOC. PROF. PONGSA PORNCHAIWISESKUL, Ph.D., CO-ADVISOR: ASST. PROF. TARTAT MOKKHAMAKKUL, Ph.D., pp.

This research was conducted to achieve the following three major objectives: to raise an efficient and effective supply chain management (SCM) of Thailand’s electrical and electronics industry. The first objective was to clarify the distinction of knowledge sharing (KS) and knowledge transfer (KT) from a practical viewpoint specific to knowledge for the SCM process in the context of external integration. The second objective was to screen the required knowledge for all of the eight SCM processes, including customer relationship management, customer service management, demand management, order fulfillment, manufacturing flow management, supplier relationship management, product development and commercialization and returns management that should be shared or transferred in the context of external integration to enhance supply chain performance. The third objective was to evince the relative importance weights of KS and KT on enhancing supply chain performance with consideration based on the hierarchical structure model. The model consists of the first hierarchy (criteria) that is knowledge sharing and knowledge transfer. The second hierarchy (sub-criteria 1) is four dyads of supply chain integration focusing on external integration. The third hierarchy (sub-criteria 2) is knowledge related to the eight SCM processes. The forth hierarchy (sub-criteria 3) is the required knowledge for each SCM process. And the fifth hierarchy (alternative) is three attributes of supply chain performance i.e. costs, reliability and responsiveness. To accomplish the aforementioned objectives, the research methodology is separated to two phases. The first phase is to achieve the first two objectives by applying semi-structured questionnaires, checklist questionnaires, in-depth interviews, normality testing and confidence interval analysis. The second phase is to achieve the third objective by applying pair-wise questionnaires and Fuzzy Analytic Hierarchy Process (FAHP) analysis. The groups of experts involved in the first phase were composed of 15 samples and the second phase was composed of 60 samples.

This researcher discovered differences in the significance of knowledge sharing and knowledge transfer in that knowledge transfer leads to application of obtained knowledge in achieving an objective, while knowledge sharing does not particularly focus on the aforementioned attribute. The other minor differences are goals, processes and formats of knowledge sharing and transfer. Furthermore, the research revealed required knowledge for all eight supply chain management processes that should be shared/transferred within the context of external supply chain integration to promote supply chain performance. In addition, the overall relative importance weights analysis showed that knowledge sharing carries a more weighted relationship leaning toward improving the effectiveness of the supply chain more than knowledge transfer. Furthermore, the relative importance weights of all other sub-criteria and alternative according to respective structure formats were shown. Moreover, the research presented a model of knowledge sharing/transfer required to supply chain management processes for each stakeholder group in the context of external supply chain integration, whereby finding that assembly group should give importance weight to sharing required knowledge for processes, order fulfillment, demand management, and customer service management. First-tier supplier group should give importance weight on sharing required knowledge for processes, manufacturing flow management and product development and commercialization, while second-tier supplier group should give importance weight to transferring required knowledge for processes, manufacturing flow management and product development and commercialization.

Field of Study: Logistics Management	Student's Signature ....
Academic Year: 2014	Advisor's Signature ....
	Co-Advisor's Signature ....

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Abbreviations

ANP	Analytic network process
CBR	Case-based reasoning
CFA	Confirmatory factor analysis
CI	Consistency index
CR	Consistency ratio
CRM	Customer Relationship Management
CSM	Customer Service Management
DM	Demand Management
EFA	Exploratory factor analysis
ENM	Extent analysis method
FAHP	Fuzzy analytic hierarchy process
FST	Fuzzy Set Theory
K-Adv	Knowledge advantage framework
KM	Knowledge management
KS	knowledge sharing
KT	knowledge transfer
MAS	Multi-agent system
MCDM	Multicriteria decision making
MFM	Manufacturing Flow Management
MNCs	Multinational corporations
NGM	Normalization of the geometric mean
NPD	New product development
OF	Order Fulfillment
PDC	Product Development and Commercialization

RI	Random index
RM	Returns Management
SCI	Supply chain integration
SCKM	Supply chain knowledge management
SCM	Supply chain management
SCP	Supply chain performance
SECI	Socialization-externalization combination, internalization
SEM	Structural equation modeling
SLAs	Strategic level agreements
SRM	Supplier Relationship Management
SSCM	Sustainable supply chain management
TFN	Triangular fuzzy numbers
WEEKS	Web-centric extended enterprise knowledge sharing

Symbols

1^{st} C/M	First-tier customer
1^{st} S/P	First-tier supplier
2^{nd} S/P	Second-tier supplier
3^{rd} S/P	Third-tier supplier
Assb.	Assembly
C/M	Customer
C2F	Customer to Focal company
CC	Customer categorizing knowledge
CP	Capacity planning knowledge
DF	Demand forecasting knowledge
DNP	Distribution network planning knowledge
DRM	Disposition rule and method knowledge
DS	Downstream

DTP	Delivery and Transportation planning knowledge
F2C	Focal company to Customer
F2S	Focal company to Suppliers
Focal	Focal company
IEC	Internal and external coordination knowledge
INM	Inventory management knowledge
MFS	Manufacturing strategy knowledge
MS	Midstream
OTM	Optimization knowledge
PDD	Product design knowledge
PKD	Packaging design knowledge
PM	Purchasing Management knowledge
PPC	Production and planning control knowledge
QC	Quality control knowledge
S/P	Supplier
S2F	Suppliers to Focal company
SM	Sale and Marketing knowledge
SS	Sourcing Strategy knowledge
SSD	Supplier selection and development knowledge
US	Upstream
WM	Warehouse management knowledge

CHAPTER I
INTRODUCTION

1.1 Introduction

The idea of the supply chain originated in 1950 (Cavinato 1992) and has developed continually until the concept of supply chain management (SCM) emerged in 1998 when Lambert et al. defined “supply chain management is the integration of key business processes from end user through original suppliers providing products, services, and information with added value for customers and other stakeholders”(Lambert, Cooper et al. 1998, p.1). Since the term “supply chain management” was first used, it has been popularly applied to firms as a strategy capable of improving a firm’s performance. For this reason, research on supply chain management has been successively expanding to achieve more efficient and effective supply chains. Previous studies have revealed an important research area of supply chain management capable of providing an efficient and effective supply chain, namely, the concept of supply chain integration (SCI).

Several definitions of SCI have been introduced in literature without a clear definition for common use (Lummus, Vokurka et al. 2008). However, the literature review revealed that “SCI can be classified into the following two types: (1) internal-inter-functional integration within the firm and (2) external integration with key customers and major suppliers”(Braunscheidel, Suresh et al. 2010, p.884). In addition previous researches have indicated the terms collaboration and coordination used to describe the elements of SCI (Stank, Keller et al. 2001, Carr, Kaynak et al. 2008, Mackelprang, Robinson et al. 2012) and manifested “information transfer or sharing” acts as an important mechanism of the two terms (Frohlich and Westbrook 2001, Shah, Goldstein et al. 2002, Vickery, Jayaram et al. 2003, Pagell 2004, Vereecke and Muylle 2006). Moreover, Koçolu’s literature illustrates that information required for sharing to achieve potential supply chain integration because information sharing is extremely useful in decision-making and encourages achievement of a competitive advantage (Koçoğlu, İmamoğlu et al. 2011).

When decision-making processes become more complex, however, information sharing may not be enough. Done (2011) who pointed out that "although information sharing enhancing SCI, a few successful companies assert that continuing competitive advantage can gained by going beyond information sharing towards leveraging knowledge sharing with the supply chain partners" (Done 2011, p.3-4). In other words the concept of knowledge management (KM) has been applied to the modern era of supply chain management including supply chain integration.

Knowledge management has been playing a role in business since the 1990s (Gunasekaran, Lai et al. 2008). Shortly afterwards, the body of knowledge management literature began rapidly expanding and extensively applying to business issues as a key competitive asset (Miles, Snow et al. 2007). Preferably, knowledge management literature in the 21st century acts as a potential source of new insights adding deeply conceptual understanding to manage supply chains (Done 2011). Thus, knowledge management literature has been applied to several areas of the supply chain such as outsourcing, new product development, construction, decision support, risk management, build-to-order, procurement and organizational or supply chain performance (Fugate, Stank et al. 2009, Marra, Ho et al. 2012). These roles of knowledge management in supply chain management have been named by Marra, Ho et al. (2012) as "supply chain knowledge management (SCKM)" (Marra, Ho et al. 2012). However, the majority of existing knowledge management context has emphasized "mode of knowledge" and "knowledge management processes".

Mode of knowledge was revealed for first time in 1994 by Nonaka who identified two modes of knowledge, namely, explicit knowledge and tacit knowledge (Nonaka 1994). The knowledge management process has been classified in various models such as Demarest's model that identified the following four KM processes: construction, dissemination, embodiment and use. Alavi and Leidner's model suggested that "the KM process can be divided into four stages: knowledge creation, storage and retrieval, transfer, and applications" (Mansour, Alhawari et al. 2011, p.868). Sun and Hao's model that classified the KM process includes five main processes, namely, selection creation sharing preservation and retention updated (Rubenstein-Montano, Liebowitz et al. 2001, Mansour, Alhawari et al. 2011). However, nearly all models have to include the taxonomy of knowledge sharing and knowledge transfer, which are often used and discussed interchangeably (Jonsson 2008). Furthermore, the taxonomy of the KM process widely appears in the KM literature (Appleyard 1996, Paulin and Suneson 2012).

Knowledge sharing and knowledge transfer are not only extensively presented in the KM literature, but also gradually diffused to the SCKM literature as in the abovementioned studies of Done (2011) and Marra, Ho et al. (2012), particularly in the area of SCI (Easterby-Smith, Lyles et al. 2008, Myers and Cheung 2008, Wang, Fergusson et al. 2008, Park, Vertinsky et al. 2012) due to two important reasons. “First, there is a need to develop a finer-grained understanding of the process involved in transferring or sharing inter-organizational knowledge between external partners in the supply chain. Second, the supplier-manufacturer-customer triad needs to be considered in unison and the possible directional implications of knowledge transfer or knowledge sharing merit greater investigation” (Done 2011, p.3). However, current studies remain limited on knowledge sharing and knowledge transfer from either the supply side or the customer side of the manufacturer advocated by Done (2011) who found a dearth of research extending to the boundary of integrated supply chain to the upstream and downstream side simultaneously. In addition, “there is still the need to compare each of these knowledge transfer directions in a single piece of work” (Done 2011, p.4). Furthermore, prior researches have focused on establishing a system or software to help with sharing or transferring knowledge between partners (Al-Mutawah, Lee et al. 2008, Paton and McLaughlin 2008, Lopez and Eldrige 2010) and identifying the factors affecting the success of knowledge sharing and knowledge transfer (Holtbrugge and Berg 2004, Bandyopadhyay and Pathak 2007, Joshi, Sarker et al. 2007, Cheung and Myers 2008, Myers and Cheung 2008). Studies have rarely been conducted by concentrating on the relative importance weights of knowledge transfer or sharing affecting supply chain performance from the simultaneous perspectives of the supply side and customer side. Thus, this paper attempts to fill this gap by studying the relative importance weights of transferring or sharing knowledge in the context of the dyadic level of supply chain integration, including focal company to supplier,

supplier to focal company, focal company to customer and customer to focal company.

In additional previous researches on SCKM have emphasized only product development processes (Becker and Zirpoli 2003, Chen, Kang et al. 2008) exposing technical knowledge such as product design knowledge, despite the fact that there are eight process in supply chain management, namely, “customer relationship management, customer service management, demand management, order fulfillment, manufacturing flow management, supplier relationship management, product development and commercialization and returns management” (Croxton, Garcia-Dastugue et al. 2001, p.14). Studies have rarely revealed knowledge on all eight SCM processes or disclosed the priorities of these aspects of knowledge that are transferred or shared for stimulating supply chain performance.

As mentioned above, knowledge sharing and knowledge transfer are two terms not only extensively appearing in KM literature, but have also been frequently presented in SCKM literatures. However, a lot of evidence has shown that knowledge sharing and knowledge transfer are frequently used interchangeably (Jonsson 2008, Liyanage, Elhag et al. 2009) because “the definitions are somewhat unclear and have different meanings depending on the authors’ views” (Paulin and Suneson 2012, p.81). Conversely, some evidence has attempted to indicate the key similarities and differences between the two terms (Paulin and Suneson 2012). However, rarely has any evidence absolutely decided the difference between knowledge sharing and knowledge transfer from a practical stance, particularly from the viewpoint of experts in industries involving the SCM process.

Therefore, this research attempts to fill these gaps by surveying previous research in related areas by highlighting gaps in the current body of SCKM. The main three purposes of this study consist of clarifying the distinction of knowledge sharing and knowledge transfer from a practical viewpoint specific to knowledge for the SCM process; screening the required knowledge for all of the eight SCM processes that should be shared or transferred in the scope of SCI to enhance supply chain performance; and evincing the relative importance weights of the knowledge sharing and knowledge transfer in supply chain integration affecting supply chain performance classified by hierarchical structure. The first hierarchy is the relative importance weights of knowledge sharing and knowledge transfer. The second hierarchy is the relative importance weights of knowledge sharing and knowledge transfer in the dyadic level of the supply chain integration, including focal company to suppliers, suppliers to focal company, focal company to customer and customer to focal company. The third hierarchy is the relative importance weights of knowledge related to the eight SCM processes which should be shared or transferred in each dyad of supply chain integration. The forth hierarchy is the relative importance weights of required knowledge for each SCM process which should be shared or transferred in each dyad of supply chain integration. The fifth hierarchy is the relative importance weights of required knowledge for each SCM process that affects each attribute of supply chain performance i.e. cost, responsiveness and reliability. To achieve the purposes of this study, the methodology of both qualitative-research and quantitative-research was applied. Quantitative-research such as fuzzy analytic hierarchy process (FAHP) was employed to analyze the relative importance of hierarchical structure because FAHP can provide decision-making by hierarchical structuring in a fuzzy environment or "a situation that cannot clearly estimate the relative importance of each considered criterion in terms of numerical values" (Chen 2005, p.4). Furthermore, FAHP is not only used for making decisions, but can also develop the relative importance weights or priorities of some given criteria for indicating the relationship between criterion and goal (Kwong and Bai 2002, Chen 2005, Zeng, An et al. 2007, Fu, Chao et al. 2008). The results of the study provide useful insights on how organizations should benefit from knowledge transfer or sharing from the perspective of the SCM process and in the SCI context so as to improve supply chain performance.

1.2 Problem Statement

The literature of supply chain management has illustrated supply chain integration to be raised to achieve an efficient and effective supply chain with two key elements of supply chain integration indicated as "collaboration" and "coordination" (Stank, Keller et al. 2001, Carr, Kaynak et al. 2008, Mackelprang, Robinson et al. 2012). Moreover, the literature manifested information transferring or sharing acting as a significant mechanism of both elements due to effective decision-making. However, the information sharing may not be enough when processes become more complicated. Thus, knowledge transferring or sharing will go beyond in this situation (Done 2011).

Knowledge sharing and knowledge transfer are two terms of knowledge management processes that frequently appear in knowledge management research. Knowledge management emerged in the 1990s (Gunasekaran, Lai et al. 2008). Since then, it has been applied to several areas of supply chain management in the beginning of the 21st century such as outsourcing,, new product development, construction, decision support, risk management, build-to-order, procurement and organizational performance (Fugate, Stank et al. 2009, Marra, Ho et al. 2012). Marra, Ho et al. (2012) reviewed these roles of knowledge management in supply chain management and called it "supply chain knowledge management (SCKM)".

Knowledge sharing and knowledge transfer are also gradually diffused to supply chain knowledge management, especially in the area of supply chain integration. Previous studies, however, remain limited in knowledge sharing and knowledge transfer from either the supply side or the customer side of a manufacturer. Research has rarely extended to the boundary of an integrated supply chain to upstream and downstream sides simultaneously (Done 2011).

Moreover, prior researches on supply chain knowledge management have concentrated only on knowledge related to the product development process which is only one of the eight processes in supply chain management that consist of "customer relationship management, customer service management, demand management, order fulfillment, manufacturing flow management, supplier relationship management, product development and commercialization and returns management" (Croxton, Garcia-Dastugue et al. 2001, p.14). Few studies have uncovered required knowledge for all of the eight supply chain management processes. In addition, antecedent researches have focused on establishing systems or software to help sharing or transferring knowledge between partners (Al-Mutawah, Lee et al. 2008, Paton and McLaughlin 2008, Lopez and Eldrige 2010) or identifying the factors affecting the success of knowledge sharing and knowledge transfer (Holtbrugge and Berg 2004, Bandyopadhyay and Pathak 2007, Joshi, Sarker et al. 2007, Cheung and Myers 2008, Myers and Cheung 2008), rarely have studies concentrated on the relative importance weights of knowledge transfer or sharing affecting supply chain performance.

However, a lot of evidences has shown that knowledge sharing and knowledge transfer are frequently used interchangeably (Jonsson 2008, Liyanage, Elhag et al. 2009) because "the definitions are somewhat unclear and have different meanings depending on the authors' views" (Paulin and Suneson 2012, p.81). Conversely, some evidence has attempted to indicate the key similarities and differences between the two terms (Paulin and Suneson 2012). However, rarely has any evidence absolutely decided the difference between knowledge sharing and knowledge transfer from a practical view, particularly from the viewpoints of experts in industries involved in the SCM process.

Therefore, this research attempts to fill these gaps by clarifying the distinction of knowledge sharing and knowledge transfer from a practical viewpoint specific to knowledge for SCM process, screening the required knowledge for all of the eight SCM processes that should be shared or transferred in the scope of SCI to enhance supply chain performance and uncovering the relative importance weights of knowledge sharing and knowledge transfer that effect supply chain performance in perspective of simultaneous the supply side and the customer side of supply chain integration including focal company to supplier, supplier to focal company, focal company to customer and customer to focal company via hierarchical structuring.

1.3 Research Questions

1. What is the key distinction of knowledge sharing and knowledge transfer from a practical viewpoint specific to knowledge for the SCM process?
2. In order to enhance supply chain performance, what knowledge is required for the eight SCM processes to be transferred or shared?

3. How much should the relative importance weights of knowledge sharing and knowledge transfer enhance supply chain performance? Considering the following hierarchical structure:
   3.1 For the first hierarchy, knowledge sharing and knowledge transfer, how much should the relative importance weights of knowledge sharing and knowledge transfer be within the scope of external integration?
   3.2 For the second hierarchy, the dyadic level of supply chain integration, how much should the relative importance weights of knowledge sharing and knowledge transfer be in each dyad of supply chain integration, including focal company to supplier, supplier to focal company, focal company to customer and customer to focal company?
   3.3 For the third hierarchy, knowledge related to the eight SCM processes, how much should the relative importance weights of knowledge be related to the eight SCM processes, including customer relationship management, customer service management, demand management, order fulfillment, manufacturing flow management, supplier relationship management, product development and commercialization and return management?
   3.4 For the forth hierarchy, required knowledge for each SCM process, how much should the relative importance weights of required knowledge be for each SCM process?
   3.5 For the fifth hierarchy, attribute of supply chain performance, how much should the relative importance weights of required knowledge be for each SCM process affecting each attribute of supply chain performance?

1.4 Objectives

1. To clarify the distinction of knowledge sharing and knowledge transfer from a practical viewpoint specific to the SCM process knowledge for external integration.

2. To screen the required knowledge for all of the eight SCM processes that should be shared or transferred in the scope of external integration to enhance supply chain performance.
3. To evince the relative importance weights of knowledge sharing and knowledge transfer on enhancing supply chain performance, considering on hierarchical structure as follows:
   3.1 The first hierarchy is the relative importance weights of knowledge sharing and knowledge transfer.
   3.2 The second hierarchy is the relative importance weights of knowledge sharing and knowledge transfer in each dyad of supply chain integration, including focal company to suppliers, suppliers to focal company, focal company to customer and customer to focal company.
   3.3 The third hierarchy is the relative importance weights of knowledge related to the eight SCM processes which should be shared or transferred in each dyad of supply chain integration.
   3.4 The forth hierarchy is the relative importance weights of required knowledge for each SCM process which should be shared or transferred in each dyad of supply chain integration.
   3.5 The fifth hierarchy is the relative importance weights of required knowledge for each SCM process affecting each attribute of supply chain performance.

1.5 Contributions

The findings of this study can contribute to new territory in research areas on supply chain knowledge management that have not clarified the distinction of knowledge sharing and knowledge transfer from a practical viewpoint specific to SCM process knowledge for external integration, revealed the required knowledge related to the eight SCM processes or uncovered the relative importance weights of knowledge sharing and knowledge transfer in supply chain integration enhancing supply chain performance via the hierarchical structure. Since the first hierarchy is the relative importance weights of knowledge transfer or knowledge sharing, the second hierarchy is the relative importance weights in each dyad of supply chain integration, the third hierarchy is the relative importance weights of knowledge related to eight SCM processes, the forth hierarchy is the relative importance weights of required knowledge for each SCM process, and the fifth hierarchy is the relative importance weights of required knowledge for each SCM process affecting each attribute of supply chain performance, these contributions can be a pattern for entrepreneurs to learn about improving their supply chain performance from the perspective of knowledge transfer or knowledge sharing. In other words, entrepreneurs can learn from this research about the knowledge required to improve and enhance their supply chain performance, especially for the electrical and electronics industries.

Previous research addressing the methodological differences has not applied FAHP to studying the relationship between knowledge sharing/ knowledge transfer and supply chain performance. Because the research question for the present study would like to identify the relationship by prioritizing the relative importance weights of each hierarchy of the research model, the FAHP is a reasonable methodology.

CHAPTER II

LITERATURE REVIEW

This research attempts to fill highlighting gaps in the current body of supply chain knowledge management. The main purpose of this study is to clarify the distinction of knowledge sharing and knowledge transfer in practical viewpoint specific to knowledge for SCM process, to screen the required knowledge for all of the eight SCM processes that should be shared or transferred in the scope of SCI to enhance supply chain performance, and to evince the relative importance weights of the knowledge sharing and knowledge transfer in supply chain integration affecting supply chain performance considering on hierarchical structure. Therefore, this chapter proposes the literature review that related to the theory or principle that will be applied to this research as following topics;

2.1 Supply Chain Management

- 2.1.1 Supply Chain Management definition and application
- 2.1.2 Supply Chain Management Processes
- 2.1.3 Supply Chain Integration

2 Knowledge Management

- 2.2.1 Knowledge Management Definition
- 2.2.2 Knowledge Management Process
- 2.2.3 Knowledge Sharing and Knowledge Transfer

3 Supply Chain Knowledge Management

- 2.3.1 Mode of Knowledge
- 2.3.2 Knowledge Management Process
  - (1) Knowledge Acquisition
  - (2) Knowledge Creation
  - (3) Knowledge Sharing and Knowledge Transfer
- 2.3.3 Knowledge Sharing and Knowledge Transfer in Supply Chain Integration

2.3.4 Supply Chain Knowledge Management enhancing Supply Chain Performance

4 Analytic Hierarchy Process and Fuzzy Analytic Hierarchy Process

2.1 Supply Chain Management

2.1.1 Supply Chain Management definition and application

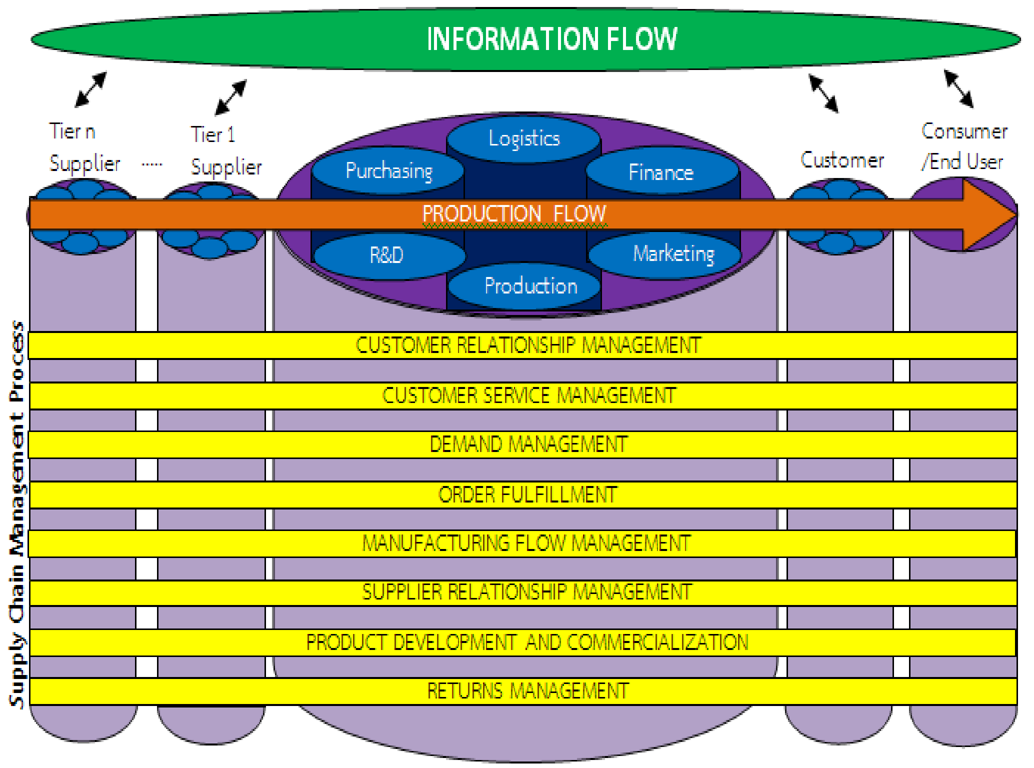
The first statement showed that the idea of supply chain management (SCM) is “the whole is greater than the sum of the parts” which has been appeared since 1950 (Cavinato 1992). After that many researches attempted to support this idea such as New (1997) discovered that complicated systems can be better understood by analyzing of its constituent; Antecedent researchers found that “instead of companies is trying to achieve cost reductions or profit improvement at the expense of their supply chain partners, companies should seek to make the entire supply chain to benefit thoroughly” (Done 2011, p.4). Several researchers have provided the concept of SCM. For example, The definition of SCM was provided as “the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders” (Lambert, Cooper et al. 1998, p.1). SCM was defined as the “a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer” (Mentzer, DeWitt et al. 2001, p.4). Moreover, Stock and Boyer (2009) illustrated an interesting work by identifying 173 different definitions of the term SCM that have been published in the literature since 1994.

Furthermore, there was a review of SCM concept as following: “SCM concept can be found in the Total Cost approach to distribution and logistics or other antecedents applied it initially along the lines of physical distribution and transport, using industrial techniques. The term SCM was first used in its popular sense through a consideration of strategic issues within the Logistics literature by Oliver and Weber (1982). SCM have been applied beyond logistics activities and planning and control of materials and information flows. SCM has been used to describe strategic, inter-organization issues such as Cox (1997), while others have used it to identify and describe the relationship a company develops with its suppliers such as Sako (1992), Lamming (1993), Hines (1995)" (Done 2011, p.6-7). In addition Burgess, Singh et al. (2006) has been reviewed the application of SCM and they found that SCM was employed to many constructs, namely, leadership, intra-organizational relationships, inter-organizational relationships, logistics, process improvement orientation, information systems, business results and outcomes and others.

The above discussion illustrated that SCM is the concept to be applied widely in a variety of fields especially in terms of challenges in management. For this reason, it is associated with knowledge in multidisciplinary for implementing this concept such as economics, strategic management, marketing, operations management, or engineering. The aforementioned idea advocated by New (1997) who recognized that research in SCM is suited to explanatory approaches which adopt multidisciplinary methodological pluralism. Krajewski (2002) stated that "the last two decades SCM has acquired substantial attention from multidisciplinary academic communities". Burgess, Singh et al. (2006) reviewed and summarized that the application of SCM associated with disciplines such as marketing/services, logistics, purchasing, strategic management, psychology/sociology, finance/ economics, information/communication and operations management. Done (2011) supported that SCM involved in multidisciplinary, especially, knowledge management proposed as the highlight disciplinary that will significantly apply to research stream of SCM in 21st century. Therefore, this study is interested in applying knowledge management to SCM which will demonstrate the details in knowledge management section.

2.1.2 Supply Chain Management Processes

As mention to the definition and application of SCM above, this section will describe to the key processes of SCM because these process is needed to manage the links across boundaries of supply chain. The key processes of SCM are called by Lambert 1998 as "SCM processes (SCM process)" as illustrated in Figure 2.1 which depicts that "a fundamental supply chain network structure consist of the flow of information and product, and the key SCM processes penetrating functional silos within the company as well as corporate silos across the supply chain" (Lambert, Cooper et al. 1998, p.1-2).



Source: Adapted from Douglas M. Lambert, Martha C. Cooper and Janus D. Pagh, "Supply Chain Management: Implementation Issues and Research Opportunities," *The International Journal of Logistics Management*, Vol. 9, No. 2 (1998), p. 2.

Figure 2. 1 Supply Chain Management: Integrating and Managing Business Processes across the Supply Chain

The key SCM processes include "(1) customer relationship management, (2) customer service management, (3) demand management, (4) order fulfillment, (5) manufacturing flow management, (6) supplier relationship management, (7) product development and commercialization and (8) returns management." (Croxton, Garcia-Dastugue et al. 2001, p.14).

Moreover to implement these processes, a framework of sub-processes and activities are contained in each process. The description of the eight processes and sub-processes shows as below (Croxton, Garcia-Dastugue et al. 2001, p.15-30).

(1) "Customer Relationship Management (CRM). This process provides the structure for how the relationships with customers will be developed and maintained. Management identifies key customers and customer groups to be targeted as part of the firm's business mission. The goal is to segment customers based on their value over time and increase customer loyalty by providing customized products and services."

"The sub-process of CRM associated with identify customer segments, provide criteria for categorizing customers, provide teams with guidelines for customizing the product and service offering and determine sale growth and their position, due to understanding of the customer(s) and developing improvement opportunities in sales, costs and service."

(2) "Customer Service Management (CSM). This process is the firm's face to the customer. It provides the key point of contact for administering the products and service agreement. Customer service provides the customer with real-time information on promised shipping dates and product availability through interfaces with the firm's functions such as manufacturing and logistics. The customer service process may also include assisting the customer with product applications."

"The sub-process of CSM is responsible for evaluating alternatives for managing the event with the least disruption to the customer and internal operations. Therefore, it requires the internal and external coordination and determining a set of alternative actions working jointly with the specialists in each of the functions affected by the event or that can contribute to implementing the solution."

(3) "Demand Management (DM). This process is the SCM process that balances the customers' requirements with the capabilities of the supply chain. With the right process in place, management can match supply with demand proactively and execute the plan with minimal disruptions. The process is not limited to forecasting. It includes synchronizing supply and demand, increasing flexibility, and reducing variability.”

“The sub-process of DM deals with matching the demand forecast to the firm's production capacity to manage inventories globally.”

(4) “Order Fulfillment (OF). This process involves more than just filling orders. It includes all activities necessary to define customer requirement and to design a network and a process that permits a firm to meet customer requests while minimizing the total delivered cost as well as filling customer orders. This is not just the logistics function, but instead needs to be implemented cross-functionally and with the coordination of key suppliers and customers. The objective is to develop a seamless process from the supplier to the organization and then on to its various customer segments.”

“The sub-process of OF emphasizes on design the distribution network and delivery planning because it is necessary to evaluate the network including: which plants produce which products; where warehouses, plants, and suppliers are located; and, which transportation modes should be used. In addition the process of warehouse and inventory such as documentary, picking is required.”

(5) “Manufacturing Flow Management (MFM). This process includes all activities necessary to move products through the plants and to obtain, implement and manage manufacturing flexibility in the supply chain. Manufacturing flexibility reflects the ability to make a wide variety of products in a timely manner at the lowest possible cost.”

“The sub-process of MFM involves determining manufacturing strategy such as push and pull, providing the manufacturing capabilities and constraints such as the minimum batch size and cycle time, planning and controlling the production line such as master plan scheduling (MPS), material requirement planning (MRP), capacity requirement planning (CRP), product quality and inventory management.”

(6) “Supplier Relationship Management (SRM). This process defines how a company interacts with its suppliers. A company will forge close relationships with a small subset of its suppliers, and manage arm-length relationships with others. Long-term relationships are developed with a small core group of suppliers. The desired outcome is a win-win relationship where both parties benefit."

"The sub-process of SRM focuses on reviewing sourcing strategies, identifying supplier segment and providing criteria for categorizing supplier. Criteria to examine might include, but are not limited to: the supplier's profitability, growth and stability; the criticality or required service level of the components purchased; the sophistication and compatibility of the supplier's process implementation; the supplier's technological capabilities and compatibility."

(7) "Product Development and Commercialization (PDC). This process provides the structure for developing and bringing to market products jointly with customers and suppliers. The product development and commercialization process team must coordinate with customer relationship management to identify customer articulated and unarticulated needs; select materials and suppliers in conjunction with the supplier relationship management process; and, develop production technology in manufacturing flow to manufacture and integrate into the best supply chain flow for the product/market combination."

"The sub-process of PDC associated with reviewing manufacturing and marketing strategies to determine how those plans will likely impact product development. Activities within this sub-process include market and promotion planning, product design, supplier selection, and transportation planning."

(8) "Returns Management (RM). This process associated with returns, reverse logistics, gate keeping, and avoidance are managed within the firm and across key members of the supply chain. The correct implementation of this process enables management not only to manage the reverse product flow efficiently, but to identify opportunities to reduce unwanted returns and to control reusable assets such as containers. Effective returns management is an important part of SCM and provides an opportunity to achieve a sustainable competitive advantage."

"The sub-process of RM requires understanding laws that apply to used products and products planned for disposal. It also needs to recognize rules associated with recall campaigns and packaging issues. Typical disposition options include return to supplier, refurbish or remanufacture, recycle, and landfill. For some firms, products may be routed to central returns centers where returned items are consolidated and examined. The sub process also determines what transportation programs the firm will employ"

2.1.3 Supply Chain Integration

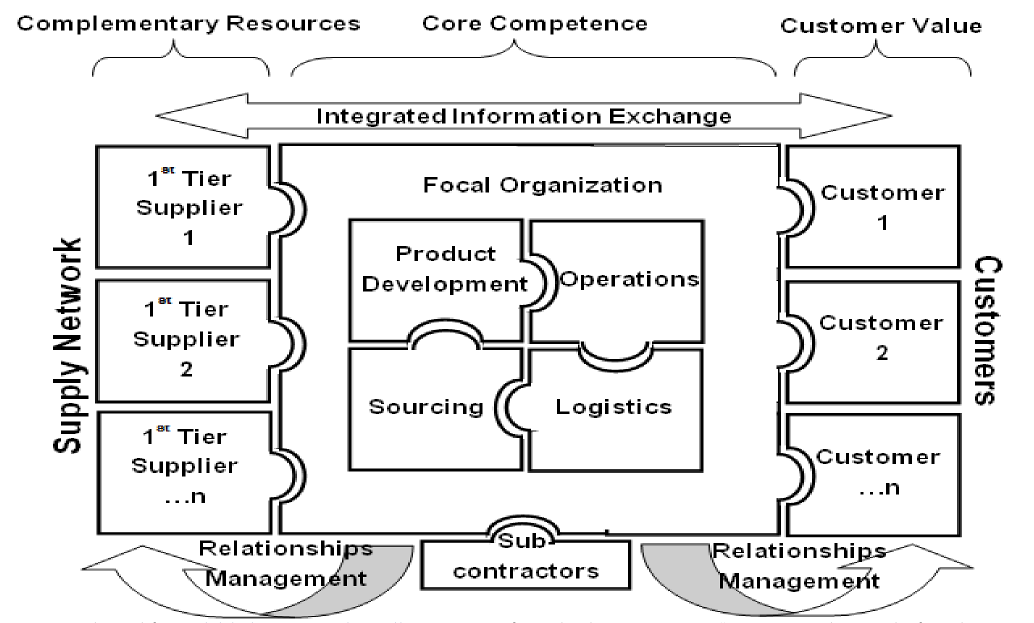
As mentioned above, SCM is an important area of research and "has received considerable attention from multidisciplinary academic communities over the last two decades" (Done 2011, p.1) because previous studies point out that SCM is a strategic management that can enhance firm's and supply chain performance. "Thus, several bodies of literature have contributed to the evolution of SCM theory and practice to date" (Done 2011, p.1), one of the area of supply chain management capable of providing an efficient and effective supply chain, namely, the concept of supply chain integration (SCI).

SCI originated from a systems perspective where optimization of the separated system cannot accomplish better performance than optimization of the whole systems. Then "the scope of SCI was studied to date varies considerably according to the author and the context. For example, Towill (1997) advocates a seamless supply chain, with integration from source to sink where all actors think and act as one. Conversely, many authors focus on the internal integration of functional areas such as marketing and production" (Childerhouse and Towill 2011, p.7443-7444). From the scope of SCI, in conclusion, SCI can be classified into two types (Braunscheidel, Suresh et al. 2010, p.883):

(1) "Internal integration, that is, inter-functional, integration within the firm."

(2) "External integration with key customers and major suppliers."

The most common SCI approached in Figure 2.2. Two types of SCI, being that of a focal organization which involved "internal integration of key functional areas such as product development, sourcing, logistics and operations and its integration .Downstream integration with customers and consumers is highlighted together and upstream integration with 1st tier suppliers and, in turn, the broader supply network" (Childerhouse and Towill 2011, p.7443).



Source: Adapted from Childerhouse,P and Towill,D.R., " Arcs of supply chain integration," International Journal of Production Research, Vol. 49, No. 24, 15 December 2011, p. 7444

Figure 2. 2 Integrated Supply Chain.

Not only the various perspectives of SCI but also several definitions of SCI have been proposed in the literature. For example, the term "SCI has been defined as the extent of engagement with suppliers and customers." (Leuschner, Rogers et al. 2013, p.34), "SCI which consists in aligning and coordinating the resources, decisions, methods, business processes and employees of the different stakeholders in the supply chain to improve their ability to work together in a continuous improvement process." (Palomero and Chalmeta 2012, p.2) or "SCI as a continuous process of improvement of the interactions and collaborations among supply chain network members to improve their ability to work together to reach mutually acceptable outcomes for their organization" (Palomero and Chalmeta 2012, p.4). "SCI is the scope and strength of linkages in supply chain processes across firms. Information, operational and relational integration facilitate the linkages in supply chain processes between firms, the scope of SCI can be integration with customers, suppliers, internal or external" (Leuschner, Rogers et al. 2013, p.34).

Although there are several definitions and perspectives of SCI, "SCI which without any common agreement being reached about its exact meaning" (Palomero and Chalmeta 2012, p.4), “SCI constitutes the major thrust of SCM initiatives because a sizable body of literature has shown that SCI leads to greater performance.” (Braunscheidel, Suresh et al. 2010, p.884). In addition, “Lee (2000) encouraged that a truly integrated supply chain did more than just reduce costs, since in fact it also created value for the company, its supply chain partners and its shareholders. Hence, SCI is an important issue and a critical component for enhancing competitive advantage” (Palomero and Chalmeta 2012, p.4).

Besides a gargantuan body of literature has studied how SCI leads to better performance, a prominent body of SCI literature has attempted to develop the effective and efficient of SCI by providing elements that effect to SCI and mechanisms which drives the success of SCI. Since Lee, Padmanabhan et al. (1997) investigated that the phenomena such as the “bullwhip effect” can be solved by SCI through partners working to share and coordinate flows of assets, data and information. “Lee (2000) has proposed three particularly powerful dimensions to supply chain integration: organizational relationship linkages; information integration; and co-ordination and resource sharing” (Childerhouse and Towill 2011, p.7443). Stank, Keller et al. (2001) indicated that the term “supply chain collaboration” is used to describe elements of SCI, as “collaboration begins with customers and extends back through the firm”. Handfield and Nicols Jr (2002) found that the relationship management result in more effective use of the combined resource base, together with better integrated information and material flows. Carr, Kaynak et al. (2008) evinced that supply chain coordination is used to explain elements of SCI. In addition, some researchers reviewed and found that “Shah et al. (2002) established a model that considered the alignment of a firm’s supply chain coordination mechanisms with their interorganizational information systems. They found that firms that align supply chain coordination activities with their interorganizational information systems tend to perform better than those that do not. Likewise, Vickery et al. (2003) empirically proved that integrative information technologies positively impact supply chain integration, in a study of first-tier automotive suppliers. Vereecke and Muylle (2006) studied the effects of supply chain collaboration on various performance measures in European firms; they also described buyer-supplier relationships as collaborative, involving both information exchange and structural collaboration with customers and suppliers." (Braunscheidel, Suresh et al. 2010, p.885).

The above literature has offered an abundant of frameworks including theories about diverse factors affecting on SCI such as information exchange, resource management, collaboration, coordination and relationships with supply chain partners. However, Mackelprang, Robinson et al. (2012) has manifested the terms of "supply chain collaboration" and "supply chain coordination" are two significant element of SCI. Moreover the information exchange via information systems or information technologies acts as an important mechanism of two terms. Moreover, (Koçoğlu, İmamoğlu et al. 2011) have showed that information needed to be shared for achieving the potential SCI because information sharing is extremely useful in decision-making and encourages achieving a competitive advantage.

Previous studies, for example, Magretta (1998) asserted information exchange via information system enhancing SCI. However, when decision-making processes become more complex, the information exchange includes sharing or transferring may not enough. "A few successful companies can achieved continuing competitive advantage by going beyond information sharing towards leveraging collaborative knowledge sharing with supply chain partners" (Done 2011, p.1). Furthermore, "Bowersox et al. (2000) stated that the future of supply chains, the need for mechanisms that extend beyond the integration of assets, data and information, towards collaborative development and sharing of knowledge-based dimensions" (Done 2011, p.2). "Frohlich and Westbrook (2001) suggested that the continued evolution of supply chain theory will require going beyond asset, data and information levels of integration to encompass human-centric issues of collaborative sharing and development of expertise and knowledge" (Done 2011, p.3). Notwithstanding, "the need for clearer conceptual understanding of these important knowledge-based dimensions, little academic works have been done in this area. Academics have identified such knowledge-based dimensions as representing a significant gap in the field, especially beyond the dyadic level of SCI analysis and considering impacts on supply chain performance" (Done 2011, p.2).

Aforementioned literature reviewed about definitions, scopes, benefits of SCI, particularly, the important mechanisms such as "information exchange" driving two significant elements of SCI which are "supply chain collaboration" and "supply chain coordination" affecting to SCI accomplishment. However, the literature highlighted that nowadays SCI researches requires more complex mechanism than "information exchange". Hence, they go beyond by focusing on "knowledge-based dimensions" for more complicated situation. In other words, the literature had been illustrated that the concept of knowledge management should have been applied to modern era of SCM including SCI area. Moreover, the literature manifested that there is still limited on the research in this theme, especially beyond the dyadic level of SCI analysis. Thus, this study attempt to fill this gap by applying knowledge management to the scope of SCI emphasize on dyadic level of SCI analysis. Therefore, next section presents the knowledge management concept and its application, especially on supply chain performance.

2.2 Knowledge Management

2.2.1 Knowledge Management Definition

Knowledge management (KM) has emerged in the business world since the beginning of 1990s. As KM received widely well known in the mid to late 1990s, the focus shifted into a practical approach by finding better ways to manage organizational knowledge because it is based on the belief that performance improvement of the organization can be achieved by adopting and retaining knowledge across the organization. Thus, many definitions of KM were published; consequently, KM definitions during the 1990s have been summarized by Nevo and Chan (2007) as shown in Table 2.1.

Table 2. 1 KM definitions

Year	KM definitions	Authors
2006	"KM addresses policies, strategies, and techniques aimed at supporting an organization's competitiveness by optimizing the conditions needed for efficiency improvement, innovation, and collaboration among employees."	C.A.A. Sousa, P.H.J. Hendriks,
2005	"KM is defined as doing what is needed to get the most out of knowledge resources."	R. Sabherwal, S. Sabherwal
2003	"KM is defined as the organized and systematic process of generating and disseminating information, and selecting, distilling, and deploying explicit and tacit knowledge to create unique value that can be used to achieve a competitive advantage in the marketplace by an organization."	G.T.M. Hult
2003	"KM may be defined as doing what is needed to get the most out of knowledge resources. KM focuses on organizing and making available important knowledge, wherever and whenever it is needed."	R. Sabherwal, I. Becerra-ernandez
2003	"KM concerns an organization's ability to develop and utilize a base of intellectual assets in ways that impact the achievement of strategic goals."	N.A. Morgan, S. Zou, .W.Vorhies, C.S. Katsikeas
2003	"KM as a process whose input is the individual knowledge of a person, which is created, transferred and integrated in work teams within the company, while its output is organizational knowledge, a source of competitive advantage."	C. Zarraga, J.M. Garcia-Falcon,
2001	"KM refers to identifying and leveraging the collective knowledge in an organization to help the organization compete. KM is largely regarded as a process involving various activities. At a minimum, one considers the four basic processes of creating, storing/retrieving, transferring, and applying knowledge."	M. Alavi, D.E. Leidner, Review
1999	"KM is the formal management of knowledge for facilitating creation, access, and reuse of knowledge, typically using advanced technology."	D. O'Leary
1999	"KM is a business process. It is the process through which firms create and use their institutional or collective knowledge. It includes three sub-processes: Organizational learning, Knowledge production, Knowledge distribution."	M. Sarvary
1999	"Managing knowledge is a multidimensional process. It requires the effective concurrent management of four domains: content, culture, process, and infrastructure."	L.P. Chait,

Table 2. 1 KM definitions (continued)

Year	KM definitions	Authors
1998	"KM is term which has now come to be used to describe everything from organizational learning efforts to database management tools."	R. Ruggles
1996	"The management of knowledge goes far beyond the storage and manipulation of data, or even of information. It is the attempt to recognize what is essentially a human asset buried in the minds of individuals, and leverages it into an organizational asset that can be accessed and used by a broader set of individuals on whose decisions the firm depends."	R. Maier
1994	"KM is a conceptual framework that encompasses all activities and perspectives required to making the organization intelligent-acting on a sustained basis. KM includes activities to gaining overview of, dealing with, and benefiting from the areas that require management attention by identifying salient alternatives, suggesting methods for dealing with them, and conducting activities to achieve desired results."	M.Wiig

Source: Adapted from Nevo, D., and Chan, (2007) Y.E.," A Delphi study of knowledge management systems: Scope and requirements," Information & Management, Vol. 44, p. 584.

Although there are various definition of KM, "In a broad sense, KM is a business concept, which includes concerted, coordinated, and deliberate efforts to manage the organization's knowledge through the processes of creating, structuring, disseminating and applying it to enhance organizational performance and create value, the KM strategy of an organization is predicated on shared learning, collaboration, and the sharing of knowledge" (Bose 2003, p.60).

Besides the aforementioned review about definition of KM, an important issue of KM research and practice was the discussion to mode of knowledge including tacit and explicit knowledge. Tacit and explicit knowledge was first appeared by the work of Polanyi (1967) and suggested by Nonaka (1994). "Tacit knowledge can be technical – representing skills and crafts – or cognitive, referring to beliefs, ideas and mental models". "Explicit knowledge can be expressed using language or other formal representation and communicated easily but tacit knowledge is personal or hidden and hard to formalize" (Nevo and Chan 2007, p.584).

Furthermore, many authors found that “the realization of KM is complete through a series of knowledge activities or knowledge processes. A prerequisite of implementation of KM is to understand and develop the infrastructure elements required to support the acquisition, management, and transformation of tacit and explicit knowledge” (Mansour, Alhawari et al. 2011, p.867). In addition, three importance areas of organizational knowledge infrastructure include the emphasis on people, process and technology. Therefore, KM process is another key addition to KM research proposed in next section.

2.2.2 Knowledge Management Process

The above discussion illustrated that one important area of KM research and practice was “knowledge management process (KM process)” which several authors attempted to build models to explain it. Hence, a number of existing process models in KM have been provided. For example, Rubenstein-Montano, Liebowitz et al. (2001) reviewed KM process from 1990 to 2000 and Mansour, Alhawari et al. (2011) reviewed KM process since 2001 to 2008 as summarized in Table 2.2.

Although Rubenstein-Montano et al. did not propose the KM process model, they recommended that KM process must be consistent with systems thinking. A series of recommendations presented as following (a.) the organizational strategies and goals must be linked to KM, (b.) planning should occur before KM process are undertaken, (c.) cultural aspects of an organization must be recognized and KM must occur in a manner compatible with the culture of the organization, and (d.) KM is an evolutionary, iterative process directed by feedback loops and learning.

Mansour et al. attempted to suggest that what a general process should include in KM process model. They found that “the main emphasis is laid upon the concept of (1) goal definition review, (2) validation, and (3) knowledge training process” (Mansour, Alhawari et al. 2011, p.876). Knowledge training process is the loop of knowledge identification, knowledge acquisition, knowledge validation, knowledge storage, knowledge distribution, knowledge application, and knowledge retention and update. The described of knowledge process as below:

- ***Knowledge Identification:*** the terms in group of knowledge identification starts with the realization or discovery of that a particular knowledge is importance or relative value to the organization which if utilized or deployed has an added value. This knowledge can exist in various formats or obtained from many sources like documents, reports, books, media, artifacts and internet or generated through the exchange of ideas.
- ***Knowledge Acquisition:*** the terms in group of knowledge acquisition is "extended to the collection of data, research into various sources or even knowledge generation via means of exchange of ideas, questionnaire or research" (Mansour, Alhawari et al. 2011, p.875).
- ***Knowledge Validation:*** the terms in group of knowledge validation is necessary in evaluation to estimate if the knowledge goals have been reached within this context. This requires an effort to validate the knowledge sources and the information obtained.
- ***Knowledge Storage*** *:* the terms in group of knowledge storage be involved in all kinds of activities such as coding, categorizing, classifying, designing and so on .In other words, this is an infrastructural process that will underpin all the later stages and therefore will require some conceptual and long term thinking to ensure further accumulation and renewal of knowledge.
- ***Knowledge Distribution:*** the terms in group of knowledge distribution is procedures that will ensure that all stored knowledge is shared, distributed, broadcasted or made accessible to all those who need knowledge or must know of its existence through any number of means from regular reports or updates to bulletins and publications.
- ***Knowledge Application:*** the terms in group of knowledge application focuses on "transformation of knowledge to products and services. This category is the critical process in KM whereby the proactive and direct involvement or intervention of management will be detrimental to the success of any KM program to be matched by full responsiveness from all those involved or targeted" (Mansour, Alhawari et al. 2011, p.875).

- ***Knowledge Retention and Update:*** the terms in group of "knowledge retention and update will need to be integrated to keep KM system in an up-to-date condition. We can imagine that there is a loop that goes from this stage to the second stage (acquisition) ensuring that new sources, references and knowledge is continuously feed back into the system and all obsolete knowledge is over-written or at least archived" (Mansour, Alhawari et al. 2011, p.876).

Considering to Rubenstein-Montano et al.'s recommendation and Mansour et al.'s general process model, we found two points that both of studies concluded similarly are; goal should link to KM process as the initiative point of process, and KM process is the loop implementation providing the feedback to the next iteration.

Table 2. 2 Taxonomies of KM Process (1990-2008)

References	Sub dimension / dimension / Main description of process								
	1	2	3	4	5	6	7	8	9
Wiig (1993)	Creation and Sourcing	Compilation and Transformation	Dissemination Application	Value Realization					
Marquardt (1996)	Acquisition	Creation	Transfer and Utilization	Storage					
O'Dell (1996)	Identify	Collect	Adapt	Organize	Share	Create			
Demarest (1997)	Construction	Dissemination	Embodiment	Use					
Arthur Andersen Consulting (1997)	Evaluate	Define	Create	Identify processes	Implement				
Holsapple and Joshi (1997)	Acquiring Knowledge	Selecting Knowledge	Internalizing Knowledge	Using Knowledge	Generating Knowledge	Externalizing Knowledge			
Steier et al. (1997)	Find	Filter	Format	Forward	Feedback				
Ruggles (1997)	Generation	Codification	Transfer						
Van der Spek and Spijkervet (1997)	Developing New Knowledge	Securing New and Existing Knowledge	Distributing Knowledge	Combining Available Knowledge					
Van Heijst et al. (1997)	Development	Consolidation	Distribution	Combination					
Wielinga et al. (1997)	Conceptualize	Reflect	Act						
DiBella and Nevis (1998)	Acquisition	publication	use of knowledge						
Dataware Technologies (1998)	Identify the Business Problem	Prepare for Change	Create the KM Team	Perform the Knowledge Audit and Analysis	Define the Key Features of the Solution	Implement the Building Blocks for KM	Link Knowledge to People		

Table 2. 2 Taxonomies of KM Process (1990-2008) (continued)

References	Sub dimension / dimension / Main description of process								
	1	2	3	4	5	6	7	8	9
Buckley and Carter (1998)	Knowledge Characteristics	Knowledge Combination	Participants	Knowledge Leeds Transfer Methods	Governance	Performance			
Liebowitz and Beckman (1998)	Identify	Capture	Select	Store	Share	Apply	Create	Sell	
Van der Spek and de Hoog (1998)	Conceptualize	Reflect	Act	Review					
B. Smith, (1999)	Find [create knowledge centers]	Organize [motivate and recognize people]	Share						
H. Saint-Onge, (1998)	Gather Information	Learn	Transfer	Act					
Apostolou, Mentzas (1998)	generating knowledge	organizing knowledge	developing and distributing knowledge						
Ernst & Young (1999)	Knowledge Generation	Knowledge Representation	Knowledge Codification	Knowledge Application					
R. Young (1999)	Acquire	Develop	Retain	Share					
K.Wiig, (1999)	Leverage Existing Knowledge	Create New Knowledge	Capture and Store Knowledge	Organize and Transform Knowledge	Deploy Knowledge				
Skandia (1999)	networking and knowledge sharing	knowledge navigation by project teams	Intellectual capital development tool box						

Table 2. 2 Taxonomies of KM Process (1990-2008) (continued)

References	Sub dimension / dimension / Main description of process								
	1	2	3	4	5	6	7	8	9
Andersen Consulting (2000)	Acquire	Create	Synthesize	Share	Use	Environment			
Liebowitz (2000)	Transform Information into Knowledge	Identify and Verify Knowledge	Capture and Secure Knowledge	Organize Knowledge	Retrieve and Apply Knowledge	Combine Knowledge	Learn Knowledge	Create Knowledge	Distribute Sell Knowledge
Lai and Chu (2000)	Initiation	Generate	Modeling	Repository	Distributing and transfer	Use	Retrospect		
Parikh (2001)	Acquisition	Organize	Disseminate	Application					
Alavi and Leidner (2001)	Creation	Storage and retrieval	Transfer	Applications					
Rus and Lindvall (2002)	Originate/ create knowledge	Capture/ acquire knowledge	Transform/ organize knowledge	Deploy/ access knowledge	Apply knowledge				
Bouthillier and Shearer (2002)	Discovery	Acquire	Creation	Storage and organization	Sharing	Use and application			
Sunassee and Sewry (2002)	Create new knowledge	Verify	Capture & organize	Disseminate	Use	Create knowledge initially			
Miltiadis and Pouloudi (2003)	Relate value	Acquire	Organize	Enable	Reuse	Transfer and use			
Stollberg et al. (2004)	Identify	Acquire	Preparation	Allocation	Disseminate	Usage	Retention		

Table 2. 2 Taxonomies of KM Process (1990-2008) (continued)

References	Sub dimension / dimension / Main description of process								
	1	2	3	4	5	6	7	8	9
Abdullah et al. (2005)	Acquiring	Store	Disseminate	Use					
Peachey and Hall (2005)	Creation and generation	Storage And retrieval	Transfer	Application	Roles and skills				
Sun and Hao (2006)	Selection	Creation	Sharing	Preservation and retention	Updated				
Deng and Yu (2006)	Identify knowledge	Capture	Select	Stored	Knowledge service				
Supyuenyong and Islam (2006)	Organization and retention	Creation and acquisition	Dissemination	Utilization					
Abdullah et al. (2008)	Knowledge creation	Knowledge storage	Knowledge distribution	Knowledge application					
Alryalat and Alhawari (2008)	Process about knowledge	Process For knowledge	Process from knowledge						

We found that various taxonomies (or terms) have similar or overlapped meanings as illustrated in Table 2.2, thus we can classify these terms into same group basing on Mansour et al's model; shown as Table 2.3.

Table 2. 3 The overlapped taxonomies of KM process

Group	Similar/ overlapped taxonomies (or terms)
Identification	Creation and Sourcing, Creation, Identify, Create, Construction, Define, Generating, Find, Generation, Developing, Development,
Acquisition	Acquisition, Collect, Adapt, Acquiring, Capture, Acquire, Leverage
Validation	Evaluate, Selecting, Filter, Synthesize, Verify
Storage	Compilation and Transformation, Storage, Embodiment, Consolidation, Store, Gather, Stored
Distribution	Dissemination, Transfer, Share, Forward, Distributing, Distribution, Publication, Distribute, Disseminate, Allocation, Sharing
Application	Application, Utilization, Use, Implement, Using, Apply, Act, Deploy, Enable, Usage, Transform
Retention and Update	Securing, Review, Retain, Retention, Preservation

Table 2.3 illustrates that in each group appeared several terms. Some terms are the same but differentiate in the part of speech such as acquire, acquiring or acquisition. Some terms are not the same but the meaning is very similar such as dissemination, distribution or allocation. Some terms are used in overlapped meaning such as transfer and share. This depended on the perspectives of the authors and their scope of study. However, the overview meaning of each group provided by (Mansour, Alhawari et al. 2011) as described above.

Due to some terms in KM process having similar meaning or using in overlapped meaning, hence another important issue in KM world is deal with many different terms flying around, which some are more important and frequently used than others especially knowledge sharing and knowledge transfer that found in almost every model and has been widely appeared in the KM literatures. Moreover, this study will be applied both terms. Therefore, the next section will provide the detail of knowledge transfer and knowledge sharing.

2.2.3 Knowledge Sharing and Knowledge Transfer

Many authors provided definition of knowledge transfer (KT) such as "Shannon and Weaver's (1949) proposed theory of communication, where two functional or regional organizational divisions are identified as sources and recipients in the KT process. Szulanski (2000) stated that KT is frequently conceptualized as a transmission from source to recipient at the level of organizational division analysis, investigated that how knowledge in effective work practices or processes in one organizational division is transferred to another division" (Sole and Applegate 2010, p.1). "These definitions were combined the ideas about knowledge transfer and sharing to provide a deep understanding of the nature of knowledge exchange in cross-functional, geographically dispersed new product development teams" (Sole and Applegate 2010, p.24). Other definitions provided that "KT involves both the knowledge source and the acquisition and application of knowledge by the recipient. KT typically has been used to describe the movement of knowledge between different units, divisions, or organizations rather than individuals" (Wang and Noe 2010, p.117).

Likewise, several definitions of knowledge sharing (KS) proposed by various researchers for example, "KS is conceptualized as entailing bidirectional flows of knowledge, both from the group outwards to the greater organization and from outside back into the group. Sharing knowledge beyond the group is shown to be valuable to performance" (Sole and Applegate 2010, p.2). "KS can occur via written correspondence or face-to-face communications through networking with other experts, or documenting, organizing and capturing knowledge for others" (Wang and Noe 2010, p.117).

Beside the aforementioned definitions of KT and KS, The Encyclopedia of KM presented several definitions of KT and KS. All of the following quotations were taken from the encyclopedia (Paulin and Suneson 2012, p.83).

KT is defined, for example, as:

- "Includes a variety of interactions between individuals and groups; within, between, and across groups; and from groups to the organization."
- "The focused, unidirectional communication of knowledge between individuals, groups, or organizations."

KS is defined, for example, as:

- "The exchange of knowledge between and among individuals, and within and among teams, organizational units, and organizations."
- "This exchange may be focused or unfocused, but it usually does not have a clear a priori objective."

From definitions of KT and KS above we found that some overlapping contents are encouraged by previous studies for example, "Jonsson (2008) pointed out the blurriness by stating 'within the frame of reference both KS and KT are used and discussed interchangeably'. Liyanage et al. (2009) shown another example that is 'many authors and researchers have failed to provide a clear-cut definition for KT' and, at times, it has been discussed together with the term KS" (Paulin and Suneson 2012, p.83). In conclusion, these authors have pointed out to this confusion of two terms. KT and KS are frequently used interchangeably because the definitions are somewhat unclear and have different meanings depending on the authors' views.

Above discussion to illustrate the definition of KT and KS, due to two terms will apply to this study. Next sections, the roles of knowledge management in supply chain management and called it "supply chain knowledge management" will be presented.

2.3 Supply Chain Knowledge Management

The above discussion indicates that the concept of SCM has been considered from different points of view in different bodies of literature. Hence, SCM has been applied beyond logistics activities, planning and control of materials and information flows, strategic issue such as partner relationship, vertical integration or inter-organization issues. Furthermore, SCM has been examined from different perspectives, encompassing a multidisciplinary of research such as economics, strategic management, marketing, operations management and engineering. For this reason since KM has been playing a role in business in 1990s (Gunasekaran, Lai et al. 2008), shortly afterwards the body of KM literature has been rapidly expanded and extensively applied to business issues because it is a key competitive asset (Miles, Snow et al. 2007). Preferably, in 21st century "KM literature as a potential source of new insights to add conceptual depth and understanding to manage supply chains" (Done 2011, p.2).

Therefore, KM has been applied to several areas of SCM such as outsourcing, new product development, construction, decision support, risk management, build-to-order, procurement and organizational or supply chain performance (Fugate, Stank et al. 2009, Marra, Ho et al. 2012).These literatures demonstrated the role of KM in SCM which have been named by Marra, Ho et al. (2012) to "supply chain knowledge management (SCKM)". However, these areas are based on two contexts of KM which are: (1) mode of knowledge and (2) KM process.

2.3.1 Mode of knowledge

Since KM has emerged at beginning of 1990s, an important issue of KM research was the discussion of mode of knowledge including tacit and explicit knowledge. "Explicit knowledge can be expressed using language or other formal representation and communicated easily but tacit knowledge is personal or hidden and hard to formalize" (Nevo and Chan 2007, p.584). Later on, a framework based on multiagent systems was proposed to address the problem of sharing tacit knowledge in the manufacturing supply chain highlighted the importance of handling distributed knowledge (Al-Mutawah, Lee et al. 2008). A recently published article empirically investigated "the impact on performance of explicit knowledge transfer in the integrated supply chain between a manufacturer and its external suppliers and customers by surveying data from 338 companies, the result found that explicit KTs from upstream and downstream directions were positively related to a manufacturer's performance" (Done 2011, p.2). Another recently paper investigated that "how this tacit knowledge, which comprises international marketing expertise, knowledge about foreign cultures and tastes and managerial practices, impacts international joint venture (IJV) performance" (Park, Vertinsky et al. 2012, p.151).

2.3.2 Knowledge Management Process

Refer to the literature in section 2.2.2, we found a myriad of KM process. However, most taxonomies of KM process have been applied to SCM researches including knowledge acquisition, knowledge creation, and knowledge transfer and knowledge sharing.

2.3.2.1 Knowledge Acquisition

Almost SCKM researches attempted to verify how knowledge acquisition can enhance supply chain performance. For example, the data collection from 58 chains in a Fortune 500 firm and the structural equation model were applied to prove that a culture of competitiveness and knowledge development e.g. supply chain relationship, achieved memory, knowledge acquisition, information distribution and shared meaning had a positive impact to supply chain performance particularly cycle time (Hult, Ketchen et al. 2004). "The hypotheses of linking two knowledge-driven supply chain phenomena (i.e., knowledge development capacity and intellectual capital), innovation cost strategy, and action to firm-level performance were tested by using survey data from 489 firms and confirmatory factor analysis, a result found that performance is influenced by how well knowledge development capacity and intellectual capital efforts complement alternative chain strategies" (Craighead, Hult et al. 2009, p.405). "The relationship between power, knowledge acquisition and supply chain performance among the supply chain partners of a focal Chinese steel manufacturer was examined by using structured survey to collect data from 206 firm, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) to confirm the result , the finding showed that the flow of knowledge increased when supply chain actors had limited alternatives and when the more powerful actor exercised restraint in the use of power, moreover a positive relationship between knowledge acquisition and supply chain performance" (He, Ghobadian et al. 2013, p.605).

2.3.2.2 Knowledge Creation

For SCKM research, knowledge creation process was frequently found in the context of product development process supported by many researches. For example, "Corso et al. (2001) conducted a literature review on knowledge management in product innovation and found that the main streams in the literature on that topic was to concern with the scope of the knowledge creation system (single product innovation process, product innovation portfolio, relationship with external actors)" (Marra, Ho et al. 2012, p.6106). Furthermore, "Chen et al. (2008) proposed a model based on analytic network process (ANP) to cope with the problem of new product development (NPD) mix selection and combine the concept of knowledge creation to ensure the successful execution of the NPD strategy" (Marra, Ho et al. 2012, p.6107). Other areas related to supplier relationship management and customer relationship management process. For example, a study analyzed that "how organizational conditions, technology adoption, supplier relationship management and customer relationship management affect knowledge creation through socialization-externalization combination, internalization (SECI) modes, and various ba, in a supply chain" (Wu 2008, p.241). Many studies verified that "the factors e.g. organizational conditions, technology adoption, supplier relationship management and customer relationship management affect knowledge creation in a supply chain and could play an important role in the different phases of the knowledge conversion process" (Marra, Ho et al. 2012, p.6106). Moreover, another researcher claimed that the knowledge creation can enhance the success of procurements projects by proposing a knowledge value creation model and providing a case study to implement the model (Yeh 2008).

In addition, we found that knowledge creation was analyzed in the strategic level of SCM. For example, "Choi and Lee (2002) studied the link between knowledge management strategy and the knowledge creation process, presented a model which is derived on the basis of samples from 58 Korean firms and applied

ANOVA and cluster analysis to analyze the model, the study proposed that companies should align their knowledge strategies along with knowledge creation modes" (Marra, Ho et al. 2012, p.6106). "Lopez and Eldrige (2010) presented a working prototype to promote creation and control of knowledge in supply chain. A diagnosis module was designed and incorporated in a multi-user collaborative working prototype to examine user specified practices and to report a feedback to the user regarding the impact of these practices" (Marra, Ho et al. 2012, p.6107). Furthermore, another researcher provided "the knowledge maturity model and strategies of accelerating knowledge creation to understand and support the adoption of complex practices of SCM, applying the theories and two case companies" (Niemi, Huiskonen et al. 2010, p.132).

2.3.2.3 Knowledge Sharing and Knowledge Transfer

KS and KT have been widely appeared in the context of SCKM. For example, the questionnaire survey from 134 employees of semiconductor and semiconductor equipment companies and descriptive statistic was applied "to provide KS patterns in the semiconductor industry, the result showed that public sources of technical data play a larger role in knowledge diffusion in Japan than in the United States" (Appleyard 1996, p.137). Some studies attempted to provide pattern or typology of KS or KT by investigating "vertical knowledge transfers from inward-invested multinational enterprises to indigenous Chinese suppliers in the electrical and electronics industry in Wuxi, China, through 16 dyadic case studies. This study proposed a three-stage pathway of relationship development including initiating, developing and intensifying" (Duanmu and Fai 2007, p.449). Another research explored theories of supply chain management (SCM) and case-based reasoning (CBR) and formulated a conceptual model that supports an enterprise with its management of the supply chain members' knowledge resource sharing. The study highlighted to share knowledge along the supply chain is theoretically sound but a difficult task to realize in practice due to the complexity of KS between the different organizations (Wang, Fergusson et al. 2008). Moreover, another study illustrated "mechanisms of intra-organizational knowledge transfer within sustainable supply chain management (SSCM)" and design a conceptual framework by emphasizing on the transfer of knowledge and information between functional units. "The findings will be used as a basis to further develop a framework of intra-organizational SSCM knowledge and information transfer as well as cross-functional integration" (Harms 2011, p.121).

Another research area of KT or KS in SCKM found quite a lot was to indicate the factors that effect to KT or KS. For example, "Holtbrugge and Berg (2004) studied the KT process in German multinational corporations (MNCs) using an empirical study of 142 subsidiaries, the evidence showed that different firm-specific and country-specific variables such as the cultural distance between the subsidiary and the home country of the MNCs influence on the source of knowledge (external and internal) and the characteristics of knowledge flows. Maqsood et al. (2007) reviewed previous study and focused on the adoption of a knowledge advantage framework (K-Adv) which helps creating a culture of KS. The study concluded that trust and commitment were the key base of KS. Furthermore, the role of trust in enhancing KS was also assumed in the study by Cheng et al. (2008) of a relief supply chain .They suggested that trust, shared values and participation were positively related to learning capacity" (Marra, Ho et al. 2012, p 6104). "Bandyopadhyay and Pathak (2007) applied game theory to model the interaction between the host firm and the outsourcing firm, who have to share their knowledge and skill sets in order to work effectively as a team. This analysis demonstrated that cooperation plays an important role in enhancing KS and the role of top management in outsourcing activities is not only related to negotiating contracts, but also encouraging cooperation between employees. Cheung and Myers (2008) synthesized the findings in the literature with a multiple-case research design for addressing the main problems of sharing knowledge in global strategic networks. The finding showed that global supply chain included management fit, market-related fit, resource fit, shared identity, relational capital and flexibility affecting the sustainability of KS. Myers and Cheung (2008) conducted that a study on how KS provides value to buyers and suppliers in a global supply chain using in-depth study of more than 100 cross-national supply chain partnerships in the chemicals, consumer product, packaging, toy and apparel industries in multiple locations in 19 countries. The result illustrated that KS was influenced by market structure, and organizational similarities and dissimilarities between buyers and suppliers more than by their needs" (Marra, Ho et al. 2012, p.6110). Moreover, a few study highlighted on strategy, for example, Becker and Zirpoli (2003) analyzed the organization of the new product development process at a case study of FIAT from a resource-based perspective particularly on the theme of KT in outsourcing activities. The analysis emphasized on designing an outsourcing strategy to improve knowledge integration. The result proposed the strategy such as decomposition strategy to manage dispersed knowledge in outsourcing. Joshi, Sarker et al. (2007) examined the factors affecting the KT process within the team, using questionnaires survey from 114 teams of student enrolled in an information systems project management course and a database management course in a large US public university and employing confirmatory factor analysis (CFA) in structural equation modeling (SEM) to prove hypothesis. The result illustrated that credibility and extent of communication played important role on KT.

Beside the studies attempted to provide the factors that effect to KT and KS as mentioned above, some research worked to evince the influence of KT and KS on performance. For example, Raisinghani and Meade (2005) examined the linkage between dimensions of cost in SCM and dimensions of KM e.g. knowledge creation, knowledge storage and retrieval, knowledge transfer, knowledge application by applying analytic network process (ANP) with a case study of telecommunications company as the research methodology. The result showed that KT was the dimension of KM the most affecting the dimensions of cost in SCM especially inventory cost. Blumenberg, Wagner et al. (2009) proposed and tested model to evince the factors that impact on outsourcing performance by conducting a series of case studies in the German-speaking banking industry with their IT providers, semi-structured questionnaire, interviewing and analyzing the collected data using MAXQDA (an instrument for efficiently evaluating quantitative data). The results demonstrated that the KT process provided a positive impact on outsourcing performance and key mechanism were trainings, strategic level agreements (SLAs), and standards. Another researcher studied "consequence of information and KS on supplier's operational performance through supplier-buyer relationship, a conceptual model was formulated based on previous literature, a questionnaire based survey was performed and data from 30 Bangladeshi Readymade Garments Industry were collected through interview and mail survey, Path Analysis is performed for the identification of the validity of the model. The findings showed that information sharing is a prerequisite for KS and the close supplier-buyer relationship was a vital factor for escalating the supplier's operational performance" (Rashed, Azeem et al. 2010, p.61). Done (2011) investigated the impact of explicit knowledge transfer in the integrated supply chain between a manufacturer and its external suppliers and customers on inventory performance, using survey data from 338 companies of International Manufacturing to be a case study, confirmatory factor analysis to measure the valid and reliable scales, and regression techniques to test the hypothesis. The finding indicated that knowledge transfers from upstream and downstream directions were positively impact on a manufacturer's performance, and knowledge derived from customers was more powerful. Furthermore, another researcher investigated that "how different knowledge-management processes (i.e. knowledge acquisition and dissemination) affect the manufacturers' performance in collaborative economic exchanges with their suppliers" (Yang 2013, p.1984) by using data from 137 usable questionnaires which returned from manufacturers in China following sectors: electronics, mechanical engineering, telecommunications, chemicals, pharmaceuticals, construction, automobile manufacturing, and energy, and applying regression to analyze the result. "The findings of this study show strong support for these propositions. Theoretical and practical contributions of this study are also addressed" (Yang 2013, p.1984).

In addition, many studies in recent year focused on establishing the system or software to support KT or KS. For example, "Paton and McLaughlin (2008) provided a brief overview of services science and innovation and emphasized their attention on the importance of knowledge transfer in service exchange, in this case the focus was on the role of knowledge centered technological architecture in supporting knowledge workers" (Marra, Ho et al. 2012, p.6105). Al-Mutawah, Lee et al. (2008) proposed a framework that utilizes multi-agent system (MAS) techniques with a corresponding knowledge sharing mechanism dedicated to manufacturing supply chain. The results established a starting point for researchers interested in enhancing MSC performance using knowledge sharing management approach. Another study explored "the role of KS within a downstream two-echelon supply chain applying chaos theory and the literature on knowledge management and providing a real-world case study of knowledge management practice at a U.S. Fortune 40 firm. The web-centric extended enterprise knowledge sharing (WEEKS) system was developed by the case firm, along with the KS models which provided a viable framework for building a collaborative supply chain network to help supply chain mangers develop more pragmatic KM and SCM solutions" (Shih, Hsu et al. 2012, p.70).

Above literature illustrated that KT or KS are the taxonomy of KM process which widely applied to the SCKM. Furthermore, when considering on the SCM process perspective, we found that the new product development process is the process that has been employed to study the most, particularly for the taxonomy of knowledge creation because the new product development process usually establish new innovations or new products and services, and requires new knowledge all the time. Thus, knowledge creation can support this process by providing the new knowledge. However, a few studies appeared in supplier relationship management process (or procurement process) and customer relationship management process. Although some studies indicated that the knowledge is emerged from the new product development process, rarely has any study revealed the knowledge for all of the eight SCM processes which is the key process to manage the links across boundaries of supply chain as mentioned in section 1.2. Hence, this study attempted to fill this gap by exploring the knowledge for all of the eight SCM processes.

In addition, the research tools founded the most in the study of the relationship between cause factors and effect factors, either the effect of several factors to KM processes (knowledge acquisition, knowledge creation, knowledge transfer or knowledge sharing) or the effect of KM processes to performance were exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) base on structural equation model (SEM) because these tools is specific statistical tool for modeling and testing the relationship. Other methods applied to this theme e.g. depth interview based on case study, path analysis, regression techniques, game theory and analytic network process (ANP). Others themes in this area such as analyzing KM process to enhance SCM practices in the strategic level, building or modeling the pattern or typology of KM process especially KT or KS usually adopt case study and statistic method such as descriptive statistic, ANOVA, cluster analysis included to analyze or verify. Moreover, in recent year, the theme of research extend to the development or establishment framework, system or software to support KM process by employing the modeling method such as multi-agent system (MAS) based on case study.

Furthermore, we found that several industries appeared in SCKM research including steel, mechanical engineering, pharmaceuticals, construction, automobile manufacturing, and energy, garment, chemicals, consumer durables, industrial packaging, toy and apparel. However, the most appeared in electrical and electronics industry including a thin film transistor-liquid crystal display (TFT-LCD), an integrated circuit (IC), packaging and testing manufacturer, telecommunications equipment and semiconductor parts. Moreover, it extends to large US public university. Besides classifying by industry we found that some studies refer to the structure of company, particularly refer to multinational enterprises or multinational corporations (MNCs).

As mentioned above KT or KS is the taxonomy of KM process which widely applied to the SCKM, in next section we will discuss to this issue.

2.3.3 Knowledge Sharing and Knowledge Transfer in Supply Chain Integration

Refer to the scope of SCI which "can be classified into two types (1) Internal integration, that is, inter-functional, integration within the firm and (2) External integration with key customers and major suppliers" (Braunscheidel, Suresh et al. 2010, p.884), we found that many scopes of SCI appeared in aforementioned SCKM literature especially in the KS and KT process either internal integration or external integration.

Internal Integration such as KS patterns focusing on semiconductor industry (Appleyard 1996), intra-organizational knowledge transfer within SSCM (Harms 2011), KT process in German multinational corporations (MNCs) (Holtbrugge and Berg 2004) or KT process within the team (Joshi, Sarker et al. 2007).

External integration such as KT from inward-invested multinational enterprises to indigenous Chinese suppliers in the electrical and electronics industry (Duanmu and Fai 2007), KS between the host firm and the outsourcing firm (Bandyopadhyay and Pathak 2007), KS focusing on cross-national supply chain partnerships (Myers and Cheung 2008), KT in outsourcing activities (Becker and Zirpoli 2003), KT process from in German-speaking banking industry with their IT providers (Blumenberg, Wagner et al. 2009), knowledge flows within the manufacturing supply chain (Al-Mutawah, Lee et al. 2008), KS within a downstream two-echelon supply chain (Shih, Hsu et al. 2012).

For above SCI literature which indicated that to achieve the potential SCI nowadays, the information exchange including sharing or transferring may not enough. Particularly in the more complex decision making processes, thus companies can achieve continuing competitive advantage by going beyond information sharing towards to KS or KT with supply chain partners. This is an important reason that why KT and KS have been widely applied to the SCKM.

In addition, for external integration, two important reasons supported the vastly employing of KT or KS. “First, there is a need to develop a finer-grained understanding of the transfer processes involved in coordinating and sharing inter-organizational knowledge between external partners in the supply chain. Second, the supplier-manufacturer-customer triad needs to be considered in unison, and the possible directional implications of knowledge transfer merit greater investigation” (Done 2011, p.3).

However, current studies still limited on KT or KS from either the supply side or the customer side of a manufacturer advocated by the statement “rarely takes a more integrated supply chain perspective of simultaneous upstream and downstream flows. Hence, there is still the need to compare each of these KT or KS directions in a single piece of work” (Done 2011, p.2). Thus, this paper tries to fill this gap by studying the relative importance weights of transferring or sharing knowledge in the context of dyadic level of SCI including focal company to supplier, supplier to focal company, focal company to customer and customer to focal company. Moreover, this study will provide the relative importance weights of KT and KS in SCI context on supply chain performance. Therefore, next section will discuss this issue.

2.3.4 Supply Chain Knowledge Management enhancing Supply Chain Performance

Supply chain performance (SCP) is a sub-part of firm performance (Collins, Worthington et al. 2010) which refers to the performance of the various processes within the firm's supply chain function. Research in this area has begun around 1993 by Davis who proposed the examples of measures specifically the supplier performance (Srinivasan, Mukherjee et al. 2011). Thereafter, research in this field has been developed continuously. For example, the study focused on customer satisfaction measuring (Christopher 1992). "The research attended in inventory costs, number of on-time deliveries, product availability performance and customer response time" (Srinivasan, Mukherjee et al. 2011, p.260). "The work emphasized on dimensions of performance related to inter and intra organizational processes. The study proposed metrics for managing resources, output and flexibility of conjoined supply chain" (Ganga and Carpinetti 2011, p.178). Furthermore, Bowersox, Closs et al. (2002) presented identified metrics including customer service, cost management, asset management, quality, and productivity. In addition, Panayides and Venus Lun (2009) reviewed the study and found that the four 'competitive priorities' in the measurement of supply chain performance including speed, quality, cost and flexibility. However, some researchers predicated that among these measurement metrics should represent "a balanced approach and should be classified at strategic, tactical and operational levels, and be financial and non-financial measures as well" (Collins, Worthington et al. 2010, p.954).

This approach has been extensively accepted from academics and practices particularly the Supply Chain Operations Reference (SCOR) model developed by

Supply Chain Council since 1999. A framework of SCOR model (version 1.0) consists of Plan, Source, Make, and Deliver. After that, SCOR (version 4.0) was released in 2000 to introduce the new level 1 of Return process and it has been developed successively until lasted version (version 11.0) was released in 2012.

"The SCOR model proposes to analyze a supply chain from three perspectives are process, metrics and best practices. The SCOR framework maps the connections between the inter-organizational processes in each company in a supply chain. One of the advantages of this model is the creation of a common and standardized language among the companies within a supply chain, thus enabling companies to compare supply chain performance as a whole. Top level SCOR metrics focus on five performances attributes" (Ganga and Carpinetti 2011, p.178).

- "Reliability: the performance related to the delivery, i.e., whether the correct product (according to specifications) is delivered to the correct place, in the correct quantity, at the correct time, with the correct documentation and to the right customer, such as perfect order fulfillment, delivery performance, fill rate."
- "Responsiveness: the speed at which a supply chain provides the products to customers, such as order fulfillment cycle time."
- "Agility: the agility of a supply chain to respond to market changes in demand in order to gain or maintain its competitive advantage, such as supply chain flexibility, supply chain adaptability."
- "Cost: involves all the costs related to the operation of a supply chain, such as SCM cost, cost of goods sold."
- "Asset management: the efficiency of an organization in managing its resources to meet demand. This includes the management of all the resources: fixed and working capital, such as cash-to-cash cycle time, return on supply chain fixed assets, return on working capital."

For SCKM research especially in SCI area, some studies showed evidences that SCKM can enhance SCP. For example, Raisinghani and Meade (2005) examined the linkage between dimensions of cost in SCM e.g. information costs, inventory casts, facility costs, transportation costs; and dimensions of KM e.g. knowledge creation, knowledge storage and retrieval, knowledge transfer, knowledge application. Blumenberg, Wagner et al. (2009) proposed and tested model to evince the factor that impact on outsourcing performance measured in terms of service quality i.e. rating of the overall service quality, reliability of the service, responsiveness of the provider, proactivity of the provider. Done (2011) investigated the impact of explicit knowledge transfer in the integrated supply chain between a manufacturer and its external suppliers and customers on inventory investment. Yang (2013) verified how different knowledge-management processes (i.e. knowledge acquisition and dissemination) affecting the manufacturers' performance in collaborative buyer–supplier relationship (alliance performance). Furthermore, some researchers reviewed previous works and found that "managers have different perspectives on the value of sharing critical knowledge resources with their supply chain partners : those that buy and those that sell, depending on which group they identify, however both groups agree that sharing knowledge makes for more efficient supply chains (with lower costs and quicker speeds) and more effective organizations (with higher quality outputs and enhanced customer service)" (Myers and Cheung 2008, p.67). Other researchers "combined consequence of information and knowledge sharing on supplier's operational performance e.g. on-time delivery, perfect order fulfillment rate, delivery reliability/dependability, quality (e.g., ability to meet specifications), speed of response and manufacturing capability (e.g., capacity)" (Rashed, Azeem et al. 2010, p.61).

The aforementioned evidence demonstrated that SCKM can improve supply chain performance especially in the attributes of SCOR metrics consisting of reliability, responsiveness, and cost. However, among these researches, they have rarely studied about the relative importance weights of knowledge related to SCM process for each attribute of supply chain performance. Therefore, this study try to fill this gap by discovering the relative importance weights of knowledge related to SCM process on each attributes of supply chain performance focusing on reliability, responsiveness, and cost.

Normally to provide the relative importance weights between factors, the statistics tool such as SEM which well known today is likely to be applied more. However, this study will provide the relative importance weights applying Fuzzy Analytic Hierarchy Process (FAHP). Thus, next section will explain to FAHP theory and discuss to the reason that why this study will apply FAHP to provide the relative importance weights.

2.4 Analytic Hierarchy Process and Fuzzy Analytic Hierarchy Process

"There are many multicriteria decision making (MCDM) methods in use today, the main one of which is Analytic Hierarchy Process (AHP). AHP method, which was pioneered by Saaty in 1980, is developed to meet the great challenges of decision situations that are brought by multiple or even conflicting criteria" (Zhang 2010, p.15). "The AHP provides a comprehensive and rational framework for structuring a decision problem, for representing and quantifying its elements, for relating those elements to overall goals, and for evaluating alternative solutions. The essence of AHP process is to create a hierarchy tree based on the decomposition of a complex problem, with the goal at the top, criteria and/or sub-criteria at levels, and decision alternatives at the bottom, as shown in Figure 2.3. Elements are then compared in pairs to assess their relative preference and decisions are made according to the comparison and calculation" (Zhang 2010, p.16).

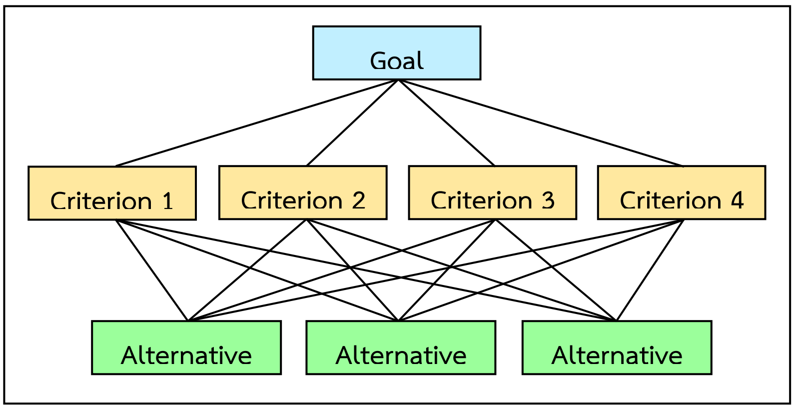


Figure 2. 3 Structure of AHP process

The basic principle of AHP includes the following procedures;

(1) Define the unstructured problem and state clearly the goal of the problem.
(2) Identify the factors that influence the overall goal.
(3) Decompose the complex overall evaluation goal into hierarchical structure with detailed decision criteria and variables, which are manageable.
(4) Employ pair-wise comparisons among decision criteria and form comparison matrices.
(5) Estimate the relative priorities (weight) of the decision criteria.
(6) Check the consistency property of matrices to ensure the judging consistence.
(7) Aggregate the final weight coefficient vector which represents the relative importance of each alternative with respect to the goal stated at the top of the hierarchy.

Among all, the pair-wise comparison matrix is particularly important because it is the key to transform subjective priorities to computable values according to decision makers' preferences. These pair-wise comparisons are usually gained by experts via questionnaire. They are made by using a preference scale to assign numerical values to different levels of preference. Usually, scale used for AHP is from 1 to 9 to reflect the importance of one factor over another. The fundamental scale for pair-wise comparisons is shown in Table 2.4.

Table 2. 4 Fundamental scale for pair-wise comparisons

Intensity of Importance	Definition	Explanation
1	Equal importance	“Two elements contribute equally to the objective”
3	Moderate importance	“Experience and judgment slightly favor one element over another”
5	Strong importance	“Experience and judgment strongly favor one element over another”
7	Very strong importance	“One element is favored very strongly over another; its dominance is demonstrated in practice”
9	Extreme importance	“The evidence favoring one element over another is of the highest possible order of affirmation”

Intensities of 2, 4, 6, and 8 can be used to express intermediate values.
Intensities 1.1, 1.2, 1.3,etc can be used for elements that are very close in importance.
The reciprocals, such as 1/3, 1/5, 1/7, 1/9, etc., indicate the opposite respectively of the values 3, 5, 7, 9, etc.

“Nevertheless, there is an extensive literature which addresses the situation in the real world where the comparison ratios are imprecise judgments. In many practical cases, the human preference is uncertain or decision makers might be reluctant or unable to assign exact numerical values to the comparison judgments or individual judgments in group decision making might be variant. Since some of the evaluation criteria are subjective and qualitative in nature, it is very difficult for the decision maker to express the preferences using exact numerical values and to provide exact pair-wise comparison judgments” (Zhang 2010, p.9). Furthermore, “sometime decision makers cannot compare two factors due to the lack of adequate information; AHP method has to be discarded due to the existence incomplete comparisons” (Kahraman and Kaya 2010, p.6277, Ertay, Kahraman et al. 2013, p.59). The classical deterministic AHP method tends to be less effective in conveying the imprecision and vagueness characteristics.

It is more desirable for the decision makers to use interval or fuzzy evaluations. Zadeh (1965) supported that "the key elements in human thinking are not numbers but labels of fuzzy sets". This led to adopting Fuzzy Set Theory (FST) to AHP, namely, Fuzzy AHP (FAHP) first appeared in a paper by Laarhoven and Pedrycz (1983). Thereafter, the applications of FAHP extended in the field of sustainability and sustainable developments such as supplier or firm selection, production process selection, market selection, facility location selection, resource allocation, personnel selection, quality issues, strategy prioritization, environmental issues, some other managerial issues (Başaran 2012).

The sets of memberships in possibility distributions can be effectively used in logical reasoning. Triangular fuzzy numbers is one of the major components which are wildly used. Saaty and Tran (2007) supported that triangular fuzzy numbers (TFN) are usually used in pair-wise comparisons to provide more fuzziness.

A triangular fuzzy number is the special class of fuzzy number whose membership is defined by three real numbers, expressed as (l, m, u). Figure 2.4 displays the structure of a triangular fuzzy number.

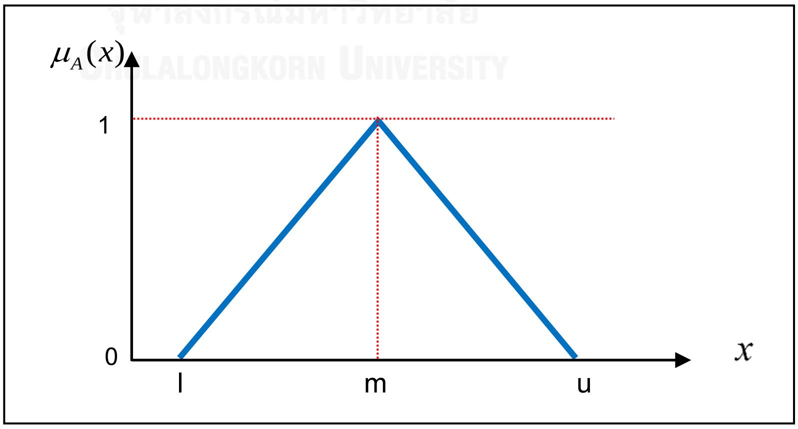


Figure 2. 4 Triangular Fuzzy Number structure

According to the definition of Laarhoven and Pedrycz (1983), a triangular fuzzy number should possess the following basic features.

$$\mu_A(x) = \begin{cases} (x-l)/(m-l), & l \le x \le m, \\ (u-x)/(u-m), & m \le x \le u, \\ 0, & otherwise \end{cases} \quad 1)$$

Where; $\mu_A(x)$ is membership function of X in fuzzy set A

l is the lower and *u* is the upper limit and *m* is the most likely value

The TFN is denoted as A = (l,m,u) and the following is the operational laws of two TFN A_1= (l_1,m_1,u_1) , A_2 = (l_2 ,m_2 ,u_2) , as shown below;

$$Fuzzy\ number\ addition \oplus : A_1 \oplus A_2 = (l_1, m_1, u_1) \oplus (l_2, m_2, u_2) = (l_1 + l_2, m_1 + m_2, u_1 + u_2) \quad 2)$$

$$Fuzzy\ number\ subtraction\ \Theta : A_1 \Theta A_2 = (l_1, m_1, u_1) \Theta (l_2, m_2, u_2) = (l_1 - l_2, m_1 - m_2, u_1 - u_2) \quad 3)$$

$$Fuzzy\ number\ multiplication \otimes : A_1 \otimes A_2 = (l_1, m_1, u_1) \otimes (l_2, m_2, u_2) = (l_1 x l_2, m_1 x m_2, u_1 x u_2) \quad 4)$$

$$Fuzzy\ number\ division\ \emptyset : A_1 \emptyset A_2 = (l_1, m_1, u_1) \emptyset (l_2, m_2, u_2) = (l_1 / u_2, m_1 / m_2, u_1 / l_2) \quad 5)$$

$$Fuzzy\ number\ reciprocal\ : (\tilde{A})^{-1} = (l, m, u)^{-1} \cong (1/u, 1/m, 1/l)\ for\ l, m, u > 0 \quad 6)$$

For acquiring TFN, many researches adopted the linguistic scale obtained from Saaty (1980), which is used to rate the sub options as shown in Table 2.5.

Table 2. 5 Fuzzy Triangular Numbers

linguistic term	Fuzzy number	Scale of fuzzy number	Scale of reverse fuzzy number
Equally important	1’	(1, 1, 1)	(1, 1, 1)
Weakly important	3’	(2, 3, 4)	(1/4, 1/3, 1/2)
Essentially important	5’	(4, 5, 6)	(1/6, 1/5, 1/4)
Very strongly important	7’	(6, 7, 8)	(1/8, 1/7, 1/6)
Absolutely important	9’	(9, 9, 9)	(1/9, 1/9, 1/9)
Intermediate values (x’)	2’, 4’, 6’, 8’	(x-1, x, x+1)	(1/x+1, 1/x, 1/x-1)

Another important consideration for applying FAHP is method to gain priority weight vector. There are two methods are employed superbly; the normalization of the geometric mean (NGM) by Buckley (1985) and an extent analysis method (ENM) by Chang (1996). “Notwithstanding, some evidence showed by examples that the priority vectors determined by the extent analysis method do not represent the relative importance of decision criteria or alternatives and the misapplication of the extent analysis method to fuzzy AHP problems may lead to a wrong decision to be made and some useful decision information such as decision criteria and fuzzy comparison matrices not to be considered”(Wang, Luo et al. 2008, p.735). Therefore, this study will apply the normalization of the geometric mean (NGM) method to calculate fuzzy weights from the fuzzy pair-wise comparison matrices which is given by;

$$\omega_i = a_i \Big/ \sum_{i=1}^{n} a_i \quad , where \quad a_i = \left[\prod_{j=1}^{n} a_{ij} \right]^{1/n} \qquad 7)$$

In the above equations a_i is geometric mean of criterion i. a_{ij} is the TFN comparison value of criterion i to criterion j. ω_i is the ith criterion's weight, where ω_i > 0.

NGM method provides fuzzy weights in term of TFN, according to Kwong and Bai (2002), a TFN can be defuzzified to a crisp number by equation below;

$$\tilde{A}\_crisp = \frac{(l + 4m + u)}{6} \qquad 8)$$

In addition, consistency ratio is an important issue for applying FAHP. “Saaty (1980) suggested the consistency index (CI) and consistency ratio (CR) to verify the consistency of the judgment matrix. Random index (RI) represents the average consistency index over numerous random entries of the same order reciprocal matrices. The value of RI depends on the value of n (the number of related criteria or alternative in decision matrices)"(Atef-Yekta, Karbasi et al. 2011, p.553) as shown in Table 2.6.

The consistency index is computed as follows:

$$C.I. = \frac{\lambda_{\max} - n}{n-1} \quad 9)$$

Where; λ max is the maximum Eigen value and n is the dimension of the matrix

The consistency ratio is computed as follows:

$$C.R. = \frac{C.I.}{R.I} \quad 10)$$

If C.R. < 0. 1, the estimation is acceptable else a new comparison matrix must be stablished.

Table 2. 6 Random index value depending on the number of criteria

N	1	2	3	4	5	6	7	8	9	10
R.I.	0	0	0.52	0.89	1.11	1.25	1.35	1.40	1.45	1.49

However, according to Buckley (1985), A'= [a_{ij}] is a fuzzy judgment matrix with a triangular fuzzy number a'_{ij} = (l_{ij}, m_{ij}, u_{ij}) and from A= [m_{ij}]. If A is consistent, then A' is also consistent as shown below. Many researches supported this rule such as Csutora and Buckley (2001) and Ky (2009).

From A= [m_{ij}]. If A is consistent, then A'= [l_{ij}, m_{ij}, u_{ij}] is also consistent 11)

In conclusion FAHP in this study will follow the step by;

Step 1: Identify goal, criteria, and sub-criteria and establish a hierarchal structure.

Step 2: Gather expert judgment which is based on the TFN linguistic scale and establish fuzzy pair wise comparison matrix for all criteria and sub-criteria.

Step 3: Calculate consistency ratio (CR) of pair wise comparisons based on Buckley (1985)'s rule.

Step 4: Calculate fuzzy weights applying the normalization of the geometric mean (NGM) method.

Step 5: Generate final preference weights by defuzzyfying employing Kwong and Bai (2002)'s formula.

Besides FAHP was tremendously applied to decision making problem, FAHP was also adopted to finding the relationship between factors. For example, Kwong and Bai (2002) applied FAHP to determine the relative importance weights of customer requirement in quality function deployment. Chen (2005) described the FAHP to determine the relationship weights of the perceived benefits and risks of various non-store retailing channels. Liu and Kong (2005) found out the key factors that affect success in E-commerce using FAHP. Zeng, An et al. (2007) structured and prioritized diverse risk factors to construction project risk assessment employing FAHP. Bozbura and Beskese (2007) applied FAHP to prioritize the organizational capital measurement indicators. Three main attributes were filled in the model including deployment of the strategic values, investment to the technology and flexibility of the structure. The results of the study showed that "deployment of the strategic values" was the most important attribute of the organizational capital. In addition, another researcher compared the decision choice of "Electronic-marketplace (EM) adoption between industries with various degree of market freedom, the decision choice of EM adoption consisted of many strategic factors that were constructed in terms of a three-layer hierarchical structure utilizing FAHP to estimate the relative importance of these individual strategic factors involved in the decision-making process of adopting third-party EM" (Fu, Chao et al. 2008, p.698).

Actually the acknowledged tool for considering the relationship between factors is the statistical tools especially famous today is structural equation model or SEM. SEM approach is used to test and eliminate causal relationship using a combination of statistical data and qualitative caused assumptions. It is the well-known approach because SEM unlike other methods. It does not have limitation on the number of variables. However, Punniyamoorty, Mathiyalagan et al. (2012) stated that SEM takes the confirmatory approach rather than the exploratory approach that mean the factors filled in SEM model must be illustrated, identified or proven to their relationship by previous study already. In the other word, this method is inappropriate for exploring the relationship between new factors. In this case EFA will be expected. However, EFA have limitation on the structure of the model that cannot provide in the hierarchical structure. Thus, FAHP can propose to the relationship approach especially when the model is in the hierarchical structure as the aforementioned example.

However, FAHP on relationship approach still has limitation in application to SCKM particularly studying the relationship between KT and KS in SCI scope and supply chain performance. Therefore, this study will fulfill this gap by applying FAHP to find the relative importance weights base on hierarchical structure consisting of the goal that is supply chain performance, criterion that is KS and KT, the first sub-criteria that is SCI scope, the second sub-criteria that is knowledge related to the SCM process and the third sub-criteria that is required knowledge for each SCM process.

Refer to above literature we can conclude the highlight gaps in all topics as below;

(1) SCM involved in multidisciplinary especially KM proposed as the highlight disciplinary that will significantly apply to research stream of SCM in 21st century.

(2) KM should have been applied to modern era of SCM that is called SCKM, especially for the scope of SCI. However, there is still limited on the research in this theme, especially beyond the dyadic level of SCI analysis.

(3) KS and KT are the taxonomies of KM processes which have been widely applied to the SCKM. However, a clear definition of KS and KT has still been limited

to study. Furthermore, current studies still limited on KS and KT from either the supply side or the customer side of a manufacturer. There is still the need to compare each of these directions in a single piece of work.

(4) The research areas of KS and KT in SCI focused on many themes. However, among these previous research areas, there remains a dearth of research indeed revealing that actually which knowledge should be shared or transfer in SCI scope to enhance supply chain performance. In particular, the required knowledge for SCM process which is the key process to manage the links across boundaries of supply chain.

(5) Although some studies identified product development and commercialization process (that is the one from the eight processes of SCM process) involving with several knowledge, any evidences have hardly revealed the knowledge for product development and commercialization process and knowledge for other SCM processes which are the key processes to manage the links across boundaries of supply chain.

(6) The evidence demonstrated that SCKM can improve supply chain performance especially in the attributes of SCOR metrics including reliability, responsiveness, and cost. However, among these researches, there is rarely study about the relative importance weights of knowledge related to the SCM process on each attribute of supply chain performance.

(7) FAHP can apply to the relationship approach especially when the model is in the hierarchical structure. However, it still has limitation in application to SCKM particularly studying the relationship between KS and KT in SCI scope and supply chain performance.

According to these highlight gaps, this study attempt to fulfill these critical gaps. Firstly, it is to clarify the distinction of KS and KT from a practical viewpoint specific to the SCM process knowledge for external integration. Secondly, it is to screen the required knowledge for all of the eight SCM processes that should be shared or transferred in the scope of external integration to enhance supply chain performance. Thirdly, it is to evince the relative importance weights of KS and KT in the scope of external integration on enhancing supply chain performance, considering on hierarchical structure. The first hierarchy is the relative importance weights of KS and KT. The second hierarchy is the relative importance weights of KS and KT in dyadic level of SCI including focal company to suppliers, suppliers to focal company, focal company to customer and customer to focal company. The third hierarchy is the relative importance weights of knowledge related to the eight SCM processes which should be shared or transferred in each dyad of supply chain integration. The forth hierarchy is the relative importance weights of required knowledge for each SCM process which should be shared or transferred in each dyad of supply chain integration. The fifth hierarchy is the relative importance weights of required knowledge for each SCM process affecting each attribute of supply chain performance including cost, responsiveness and reliability. To achieve these objectives, the methodology both qualitative-research and quantitative-research would be apply as the detail in the next chapter.

CHAPTER III

METHODOLOGY

In order to achieve the research objective, an exploratory research method was employed. Therefore, this chapter will propose the research framework and research methodology as described below.

3.1 Research Framework

This research aims to reveal the knowledge for the eight supply chain management processes (SCM process) and evaluates the relative importance weights of knowledge sharing (KS) and knowledge transfer (KT) in supply chain integration (SCI) that affect supply chain performance (SCP) as shown by the research framework in Figure 3.1

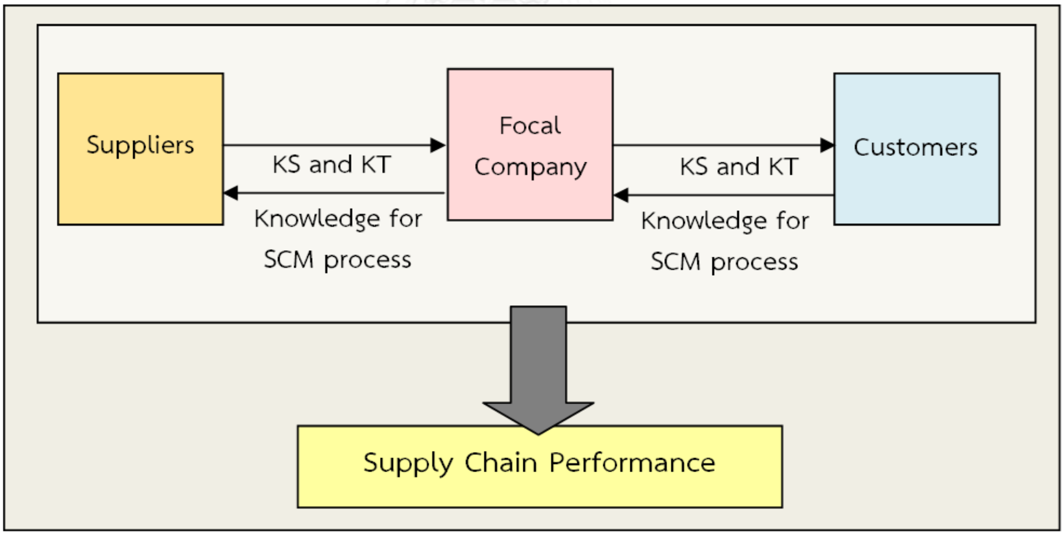


Figure 3. 1 Research Framework

Figure 3.1 demonstrates the research framework by considering the sharing and the transfer of knowledge related to eight SCM processes including customer relationship management (CRM), customer service management (CSM), demand management (DM), order fulfillment (OF) , manufacturing flow management (MFM), supplier relationship management (SRM), product development and commercialization (PCD) and returns management (RM) in the scope of supply chain integration focusing on external integration including KS and KT from focal company to suppliers, KS and KT from suppliers to focal company, KS and KT from focal company to customers and KS and KT from customers to focal company. Such knowledge has the relative importance weights to supply chain performance. However, prior to the relative importance weights analyzing there requires the clarification of the difference between KS and KT due to its frequent overlapped usage. Also, research on SCM perspectives has to be conducted. Moreover, screen required knowledge for SCM process must be first completed, since there is still lack of the related evidence. Hence, this research is divided into two phases with the details in the next section.

3.2 Research Methodology

3.2.1 Sample and Panel of Experts

The samples for the present study were composed of Thai manufacturers in the electrical and electronics industry focusing on mainly large sized companies. These are also the major global players in several product segments such as hard disk drives (HDDs), semiconductors, print circuit boards, electrical appliances and assembly of parts or devices. These companies deal directly with functions related to supply chain management.

A panel of specialists was formed to consider capability and experience in supply chain management. However, supply chain management involves multiple functions. Thus, the criteria for selecting the experts included persons who had experience in the field of supply chain management or related fields such as logistics management at the managerial level. Furthermore, to balance the representation of experts with multiple perspectives, experts selecting from different organizations had to be considered in the decision-making process (Somsuk and Simcharoen 2011).

3.2.2 Instrumentation and Procedure

This research consisted of two phases. The first phase aimed to achieve the first and second objectives by applying qualitative-research methodology while the second phase aimed to achieve the third objective by applying quantitative-research methodology. Therefore, this section illustrates the research methodology for two phases as detailed below.

3.2.2.1 Phase I

To gain the first and second objectives: (1) To clarify the distinction of KS and KT from a practical viewpoint specific to SCM process knowledge for external integration and (2) To screen the required knowledge for all of the eight SCM processes that should be shared or transferred in the scope of external integration to enhance supply chain performance, the research methodology is described below.

(1) Literature Review

The research methodology started with a review of related literature to understand similarities and differences in KS and KT, and to collect the required knowledge for the SCM process that should be shared or transferred in the scope of external integration with key customers and major suppliers to enhance supply chain performance.

This work resorted to a framework of sub-processes (activities or tasks) of SCM processes (section 2.1.2) as an initial reference for screening the required knowledge for the SCM process because there is a dearth of literature providing the required knowledge for the SCM process. Furthermore, activities or tasks in any processes can organize domain knowledge to satisfy the goal (Lai and Fan, 2002). In other words, tasks were the key element for constructing the knowledge for business processes. In addition, "the work process knowledge is constructed by employees while they are engaged in work, particularly when they are solving problems" (Boreham 2004, p.6). Therefore, knowledge for the SCM process was initially listed in Table 3.1 and this knowledge was discussed with the experts at the next step.

(2) Pre-Interviews to verify knowledge for the SCM process

Five SCM experts reviewed the knowledge for the SCM process that was yielded by the literature review in Table 3.1. The debriefing process (Chen, Tian et al. 2009) was employed to verify items of knowledge in each group of the SCM process; to clarify any ambiguity or other difficulties; and to offer any suggestions to improve these items. The interview participants then provided comments on the items of knowledge. Based upon their experience in responding to the items, some items were rewritten, combined or eliminated, and others were added as illustrated in Table 3.1. Moreover, the definitions of the required knowledge were also suggested for improvement.

Table 3.1 illustrates the comments of the interviewees and their reasons, which can be classified into the following four groups:

"Combine and adjust to" when these items should combine and adjust the name.

"Adjust to" when these items should adjust the name.

"Add" when these items should add into the group.

"Remain" when these items should still exist in the group.

Next, the researcher summarized the results on knowledge in each group of the SCM process before and after the pre-Interview process as shown in Table 3.2.

Table 3. 1 The Knowledge for each SCM Process (Comment-Reason)

Knowledge for each SCM Process (From Literature Review in section 2.1.2)	Comment	Reason
Customer Relationship Management		
- Identify customer segment knowledge	Combine and adjust to "Customer categorizing knowledge"	These item are the detail of "Customer categorizing knowledge"
- Provide criteria for categorizing customer knowledge		
- Provide team for customizing the product and service offering knowledge		
- Determine sales growth and their position knowledge	Adjust to "Sale and Marketing knowledge"	This item is the detail of "Sale and Marketing knowledge"
Customer Service Management		
- Internal and external coordination knowledge	Remain	-
- Determine a set of alternative action knowledge	Adjust to "Decision-making knowledge"	This item related to "Decision-making knowledge"
	Add "Quality Control knowledge"	This process usually involve to "Quality Control knowledge"
Demand Management		
- Demand forecasting knowledge	Remain	-
- Capacity planning knowledge	Remain	-
- Inventory management knowledge	Remain	-
Order Fulfillment		
- Design distribution network knowledge	Adjust to "Distribution network planning knowledge"	More suitable
- Delivery Planning knowledge	Adjust to "Delivery and Transportation planning knowledge"	More suitable
- Inventory management knowledge	Remain	-
- Warehouse management knowledge	Remain	-

Table 3. 1 The Knowledge for each SCM Process (Comment-Reason) (continued)

Knowledge for each SCM Process (From Literature Review in section 2.1.2)	Comment	Reason
Manufacturing Flow Management		
- Manufacturing strategy knowledge (push-pull, make or buy)	Remain	-
- Providing the manufacturing capabilities and constraints knowledge (such as minimum batch size and cycle time)	Adjust to "Optimization knowledge"	
- Production and planning control knowledge (MPS, MRP, CRP)	Remain	-
- Quality control knowledge	Remain	-
- Inventory management knowledge	Remain	-
Supplier Relationship Management		
- Sourcing strategy knowledge	Remain	-
- Identify supplier segment knowledge - Provide criteria for categorizing supplier knowledge	Combine and adjust to "Supplier selection and development knowledge"	Two item are the detail of "Supplier selection and development knowledge"
	Add "Purchasing Management Knowledge"	SRM Process also involve to "Purchasing Management Knowledge"
Product Development and Commercialization		
- Marketing and promotion planning knowledge	Adjust to "Sale and Marketing knowledge"	This item is the detail of "Sale and Marketing knowledge"
- Product design knowledge	Remain	-
- Supplier selection knowledge	Adjust to "Supplier selection and development knowledge"	More suitable
- Transportation planning knowledge	Adjust to "Delivery and Transportation planning knowledge"	More suitable
Returns Management		
- Packaging design knowledge	Remain	-
- Disposition knowledge	Adjust to "Disposition rule and method knowledge"	More suitable
- Transportation planning knowledge	Adjust to "Delivery and Transportation planning knowledge"	More suitable

Table 3. 2 Knowledge for each SCM Process (Before-After pre-interview)

Knowledge for each SCM Process (Before)	Knowledge for each SCM Process (After)
Customer Relationship Management	
1. Identify customer segment knowledge	1. Customer categorizing knowledge
2. Provide criteria for categorizing customer knowledge	
3. Provide team for customizing the product and service offering knowledge	
4. Determine sales growth and their position knowledge	2. Sale and Marketing knowledge
Customer Service Management	
1. Internal and external coordination knowledge	1. Internal and external coordination knowledge
2. Determine a set of alternative action knowledge	2. Decision-making knowledge
	3. Quality Control knowledge
Demand Management	
1. Demand forecasting knowledge	1. Demand forecasting knowledge
2. Capacity planning knowledge	2. Capacity planning knowledge
3. Inventory management knowledge	3. Inventory management knowledge
Order Fulfillment	
1. Design distribution network knowledge	1. Distribution network planning knowledge
2. Delivery Planning knowledge	2. Delivery and Transportation planning knowledge
3. Inventory management knowledge	3. Inventory management knowledge
4. Warehouse management knowledge	4. Warehouse management knowledge
Manufacturing Flow Management	
1. Manufacturing strategy knowledge	1. Manufacturing strategy knowledge
2. Providing the manufacturing capabilities and constraints knowledge	2. Optimization knowledge
3. Production and planning control knowledge	3. Production and planning control knowledge
4. Quality control knowledge	4. Quality control knowledge
5. Inventory management knowledge	5. Inventory management knowledge
Supplier Relationship Management	
1. Sourcing strategy knowledge	1. Sourcing strategy knowledge
2. Identify supplier segment knowledge	2. Supplier selection and development knowledge
3. Provide criteria for categorizing supplier knowledge	
	3. Purchasing Management Knowledge
Product Development and Commercialization	
1. Marketing and promotion planning knowledge	1. Sale and Marketing knowledge
2. Product design knowledge	2. Product design knowledge
3. Supplier selection knowledge	3. Supplier selection and development knowledge
4. Transportation planning knowledge	4. Delivery and Transportation planning knowledge
Returns Management	
1. Packaging design knowledge	1. Packaging design knowledge
2. Disposition knowledge	2. Disposition rule and method knowledge
3. Transportation planning knowledge	3. Delivery and Transportation planning knowledge

(3) Build semi-structured questionnaire

The semi-structured questionnaire was built by separation into two parts as shown in Appendix A. The first part contained open-ended questions to clarify the distinction of KS and KT from a practical viewpoint specific to the SCM process knowledge for external integration. More specifically, the following needed to be understood:

- What is the difference between knowledge sharing and knowledge transfer specific to the SCM process knowledge for external integration (KS and KT between focal company to suppliers or customers)?
- Is there knowledge sharing or knowledge transfer between you and your supplier or customers, specific to SCM process knowledge? And which one is more commonly encountered?

The second part contained a checklist questionnaire to screen the required knowledge for all of the eight SCM processes that should be shared or transferred in the scope of external integration to enhance supply chain performance. After debriefing from the experts as in the previous step, the items on knowledge for each SCM process were contained in the checklist questionnaire. However, to avoid leading the interview participants in screening knowledge for each SCM process, the groups of knowledge for each SCM process were broken into a single list. Then all knowledge items in the list were rearranged alphabetically. In the other words, a total of 20 items on knowledge in each SCM process were available for the experts to select into the group of required knowledge for all of the eight SCM processes. For example, one of the questions for the experts was:

- "Which knowledge do you think is required for each SCM process that should be shared or transferred between your company and your suppliers or customers to enhance supply chain performance?"

Academic experts reviewed the drafts of the checklist questionnaire to verify the clarity of construction and readability. Moreover, this process included preparing the definition of all knowledge in the checklist questionnaire for another round of considering and debriefing by the fifteen experts.

(4) Determine number of expert

In-depth Interviews via semi-structured questionnaires were applied to this phase. Thus, random sampling was not possible given the small number of experts in this field. Therefore, purposive sampling was carried out to meet with the experts. The target sample for this phase was fifteen experts from fifteen companies.

(5) In-depth Interviews

"The in-depth interview is an effective tool employed to obtain a rich understanding of a new phenomenon" (Tieman 2011, p.189). Thus, for obtaining a better understanding from the experts in the SCM area, perspectives about the differences between knowledge sharing and knowledge transfer focused on the knowledge for supply chain management process, in-depth interviews were applied. It was possible to conduct in-depth personal interviews at an average of one hour and 30 minutes per interview because the sample size was small with fifteen experts.

"The validity, accuracy or credibility of in-depth interview research consists of strategies to identify and rule out the threats that it might be wrong" (Tieman 2011, p.190). Therefore, the researcher was left with questions about whether or not the sample of fifteen experts from fifteen companies was sufficient, and whether or not the right experts were being interviewed. First, the panel of experts was formed based on their knowledge and skills with their experience in supply chain management. Second, the companies chosen were leaders in Thailand's electrical and electronics industry. Third, the people chosen were willing to share their opinions (Tieman 2011).

"Research bias is an important threat which is caused by lack of trust and rapport, or when the responses are misinterpreted or distorted" (Tieman 2011, p.190). To avoid lack of trust and rapport, two of the fifteen experts were persons the researcher had met on different occasions several times in the past, meaning that the researcher had an existing relationship with these persons. Other experts were introduced by persons with whom the researcher had close connections. Consequently, it can be assumed that there was a certain degree of trust and harmony in nature (Tieman 2011). The semi-structured built in the previous phase was employed to ensure that the interviewer was asking the right open-ended questions and reduce possible suggestions beyond the scope of the study by the interviewee (Tieman 2011). “Another threat is that not all data provided during the interview is captured and, therefore, not incorporated in the analysis” (Tieman 2011, p.190). To address this threat, voice recording was used. However, interviewees had to be willing to consent to voice recording. Therefore, nearly all of the in-depth interviews were recorded and transcribed literally, thereby allowing the entire interview to be reviewed and analyzed at a later phase of the research (Tieman 2011).

(6) Data Analysis

Data analysis for the in-depth interviews started with transcribing the words spoken followed by identifying, refining and categorizing important concepts (Engel and Schutt 2009, Tieman 2011, Woods 2011). Data analysis for the checklist questionnaire started with collecting data on the frequency of each aspect of knowledge for each SCM process as selected by the experts. Next, the Anderson-Darling normality test was applied to test whether these data sets of the frequency were normal distributions because this study was limited to fifteen experts. Finally, to screen the required knowledge with high frequency, parametric confidence interval was applied when normality testing illustrated the distributions to be normal. On the other hand, nonparametric confidence interval was applied when normality testing illustrated the distributions to not be normal. The results of this phase are illustrated in chapter 4 (section 4.1.2-4.1.3).

3.2.2.2 Phase II

To gain the third objective, to evince the relative importance weights of knowledge sharing and knowledge transfer on enhancing supply chain performance, consideration was based on the hierarchical structure. The research methodology is described below.

(1) Literature Review for identifying goals, criteria and sub-criteria

With reference to the research questions and research objectives, this study considered knowledge for supply chain management processes that should to be shared or transferred in the context of supply chain integration affecting supply chain performance. Thus, the goal of this research was supply chain performance; the criteria and sub-criteria are associated with knowledge sharing and knowledge transfer focused on knowledge for supply chain management processes in the context of supply chain integration.

Chapter 2 illustrated the literature about supply chain performance, knowledge sharing and knowledge transfer, supply chain integration and supply chain management processes capable of providing goals, criteria, the first sub-criteria and the second sub-criteria into the hierarchical structure as summarize in Table 3.3.

Table 3.3 illustrates the goal, namely, supply chain performance, focused on three attributes (alternatives) i.e. costs, reliability and responsiveness (section 2.3.4). The criteria are knowledge sharing and knowledge transfer (section 2.2.3). Moreover a clear distinguish of knowledge sharing and knowledge transfer from a practical viewpoint specific to the SCM process knowledge for external integration is proposed as a research finding from the first phase illustrated in chapter 4 (section 4.1.2). The first sub-criterion is supply chain integration scope focused on external integration including focal company to suppliers, suppliers to focal company, focal company to customer and customer to focal company (section 2.1.3). The second sub-criterion is knowledge related to the eight SCM processes including customer relationship management (CRM), customer service management (CSM), demand management (DM), order fulfillment (OF), manufacturing flow management (MFM), supplier relationship management (SRM), product development and commercialization (PCD) and returns management (RM) (section 2.1.2). The third sub-criterion is required knowledge for each SCM process in which the knowledge related to the sub-process of the SCM process was considered (section 2.1.2). The initial results of this knowledge are presented in Table 3.2. However, the final results of the required knowledge for each SCM process are a research finding from the first phase also proposed in Chapter 4 (Section 4.1.3).

Table 3. 3 Goal, criteria and sub-criteria in hierarchical structure (Partial)

Goal -Alternative	Criteria	Sub Criteria-1: KT and KS in SCI scope	Sub Criteria-2: Knowledge related to 8 SCM Processes	Sub Criteria-3: Required Knowledge for each SCM Process
Supply Chain Performance - Costs - Reliability - Responsiveness	- Knowledge Sharing (KS) *(Result from phase1)*	- KS from Focal company to Suppliers - KS from Suppliers to Focal company - KS from Focal company to Customer - KS from Customer to Focal company	Customer Relationship Management (CRM)	*(Result from phase1)*
			Customer Service Management (CSM)	*(Result from phase1)*
			Demand Management (DM)	*(Result from phase1)*
			Order Fulfillment (OF)	*(Result from phase1)*
	- Knowledge Transfer (KT) *(Result from phase1)*	- KT from Focal company to Suppliers - KT from Suppliers to Focal company - KT from Focal company to Customer - KT from Customer to Focal company	Manufacturing Flow Management (MFM)	*(Result from phase1)*
			Supplier Relationship Management (SRM)	*(Result from phase1)*
			Product Development and Commercialization (PDC)	*(Result from phase1)*
			Returns Management (RM)	*(Result from phase1)*

(2) Construction of the hierarchical structure model

After the goal, criteria and sub-criteria were reviewed and confirmed by interviewing the experts, the hierarchical structure was constructed as shown in Figure 3.2. However, it was still not complete following the Table 3.3 which shows that the criteria and the third sub-criterion presented as a finding from the first phase in chapter 4.

The first hierarchy (criteria) was constructed to provide the relative importance weights of knowledge sharing and knowledge transfer. The second hierarchy (sub-criteria1) was constructed to provide the relative importance weights of knowledge transfer and knowledge sharing in the dyadic level of supply chain integration including focal company to suppliers, suppliers to focal company, focal company to customer and customer to focal company. The third hierarchy (sub-criteria2) was constructed to provide the relative importance weights of knowledge related to eight SCM processes which should be shared or transferred in each dyad of supply chain integration. The forth hierarchy (sub-criteria3) was constructed to provide the relative importance weights of required knowledge for each SCM process which should be shared or transferred in each dyad of supply chain integration. The fifth hierarchy (alternative) was constructed to provide the relative importance weights of required knowledge for each SCM process affecting each attribute of supply chain performance.

(3) Construction of the questionnaire for FAHP analysis

The questionnaire was designed based on a pair-wise comparison which based on the TFN linguistic scale and the items were separated following the hierarchical structure model as shown in Appendix B.

(4) Determining the number of experts

A pair-wise comparison questionnaire was employed to this phase. Thus, random sampling was not possible given the specific number of experts. Therefore, purposive sampling was carried out to meet with experts. The target sample of this phase was composed of sixty groups of experts from sixty companies from whom data was collected by a questionnaire survey.

(5) Data Collection

Data collection was an important part of the process. The questionnaires were distributed to the experts and received from the experts in the sample group either in person (face to face) or by email, post or telephone. The aim of the survey was to collect evaluator opinions to measure the relative importance weights.

(6) Data Analysis

Next, the data were collected by questionnaire survey; FAHP was applied to evaluate the relative importance weights as in the following steps (Section 2.4):

Step 1: Identify the goals, criteria, and sub-criteria; then establish a hierarchal structure as shown in Figure 3.2.

Step 2: Gather expert judgment based on the TFN linguistic scale (Table 2.5) and establish a fuzzy pair-wise comparison matrix for all criteria and sub-criteria.

Step 3: Calculate the consistency ratio (CR) of pair-wise comparisons based on Buckley (1985)'s rule.

Step 4: Calculate fuzzy weights by applying the normalization of the geometric mean (NGM) method.

Step 5: Generate final preference weights by defuzzifying with application of Kwong and Bai (2002)'s formula.

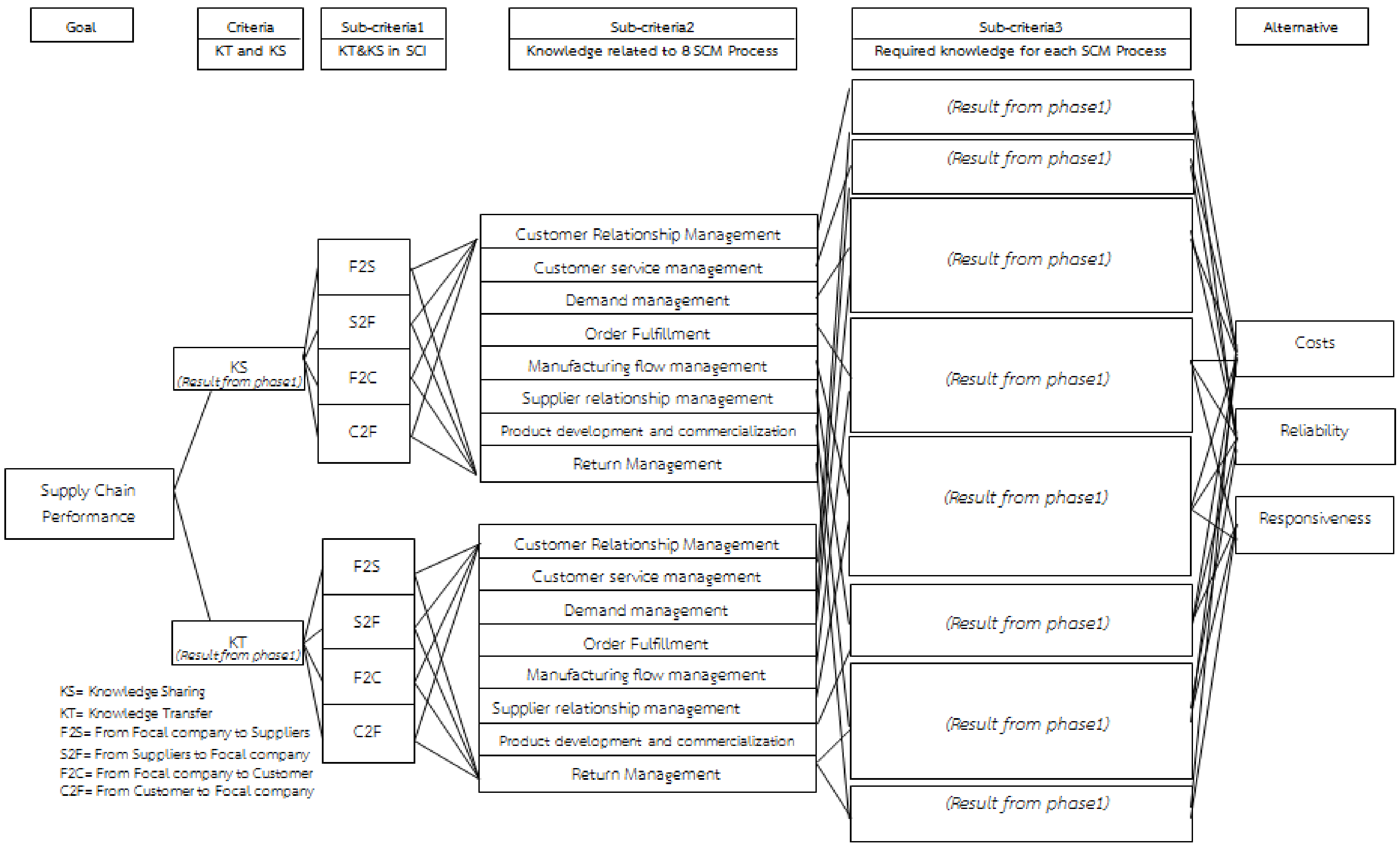


Figure 3. 2 Hierarchical Structure Model (Partial)

CHAPTER IV
DATA ANALYSIS AND RESULT DISCUSSION

Chapter 3 has illustrated the topic of research methodology, which is separated into two phases. The first phase focuses on data collection and qualitative-research data analysis including semi-structured questionnaire, checklist questionnaire, in-depth interview, normality testing, and confidence interval analysis. The second phase concentrates on data collection and quantitative-research data analysis including pair-wise questionnaire and FAHP analyzing. Thus, this chapter will discuss the results from data analysis, which will also be divided into two phases.

4.1 Data Analysis and Result Discussion for Phase I

The first and the second objective are to clarify the distinction of KS and KT in practical viewpoint specific to SCM process knowledge for external integration, and to screen the required knowledge for all of the eight SCM processes that should be shared or transferred in the scope of external integration to enhance supply chain performance. To gain the aforementioned objectives, the research methodology is sequentially processed as shown in section 3.2.2.1. Therefore, the data analysis, results and discussion are presented in this section as following topics;

4.1.1 Companies and Expert' demographic characteristics

4.1.2 The distinction of KS and KT specific to SCM process knowledge for external integration

4.1.3 The required knowledge for SCM processes

The detailed are illustrated as below.

4.1.1 Demographic characteristics of companies and expert

The target of the companies in this phase is Thai manufacturers in electrical and electronics industry mainly large size company, totally fifteen companies. According to the criteria of the Department of Industrial Works, a large company is the company that has more than 200 employees. Therefore, the companies chosen for this research work must have at least 200 employees. Table 4.1 shows the number of employee working in companies.

Table 4. 1 The number of employees working in companies

Number of employees	Number of companies	Percentage (%)
200-1000	2	13.33
1001-2000	5	33.33
2001-3000	4	26.67
3001-4000	1	6.67
4001-5000	1	6.67
>5001	2	13.33
Total	**15**	**100.00**
Minimum: 247 persons, Maximum: 26,156 persons, Median: 2040 persons, Average: 3791.80, Standard Deviation: 6,341.55		

A Number of employees working in companies range from 247 to 26,156. As illustrated in Table 4.1, the majority of the experts work in the companies of 1001-2000 employees in size (33.33%), followed by 2001-3000 employees (26.67%), 200-1000 employees (13.33%) equal to more than 5001 (13.33%), and 3001-4000 employees (6.67%) equal to 4001-5000 (6.67%). An average number of employees working in companies are 3791.8 persons, whereas the median is reported as 2040 persons.

The fifteen experts from fifteen companies was selected by purposive sampling due to the in-depth Interview via semi-structured questionnaire was applied to this phase, thus random sampling was not possible given the small number of experts in this field. Table 4.2 shows the expert's position and Table 4.3 shows expert's years of experience in supply chain functions.

Table 4. 2 The expert's position

Expert's position	Number of expert	Percentage (%)
Vice president	2	13.33
Deputy Managing Director	1	6.67
Director and Assistant Director	3	20.00
Senior General Manager and General manager	2	13.33
Senior managers, Manager and Division Head (related to SCM and logistics function)	7	46.67
Total	**15**	**100.00**

Table 4.2 displays fifteen experts from fifteen companies consisting of two vice president (13.33%), one deputy managing director (6.67%), three director and assistant director (20.00%), two senior general manager and general manager (13.33%), and seven senior manager, manager and division head related to supply chain management or logistics function (46.67%).

Table 4. 3 The expert's years of experience

Expert's years of experience	Number of experts	Percentage (%)
<10	1	6.67
10-15	4	26.67
16-20	4	26.67
21-25	4	26.67
>25	2	13.33
Total	**15**	**100.00**
Minimum: 9 years, Maximum: 30 years, Median: 20 years, Average: 18.93, Standard Deviation: 6.19		

Years of experience of respondents ranges from 9 to 30. As illustrated in Table 4.3, the majority of them have working experiences between 10-15 years (26.67%), 16-20 years (26.67%), 21-25 years (26.67%), followed by more than 25 years (13.33%) and less than 10 years (6.67%). An average age of working experience is 18.93 years, whereas the median is reported as 20 years.

4.1.2 The distinction of KS and KT specific to SCM process knowledge for external integration

The in-depth Interviews via semi-structured questionnaire (Appendix A- part I) were employed to clarify the distinction between KS and KT from a practical viewpoint specific to SCM process knowledge for external integration. To analyze the in-depth interviews, voice recordings were transcribed and coded to categorize patterns or themes found in the data. After analyzing the in-depth interviews, we found that more than fifty percent of the expert who have long working experience in the field of SCM provided the same trend to the key differences between KS and KT from a practical viewpoint specific to SCM process knowledge for external integration as shown a model in Figure 4.1.

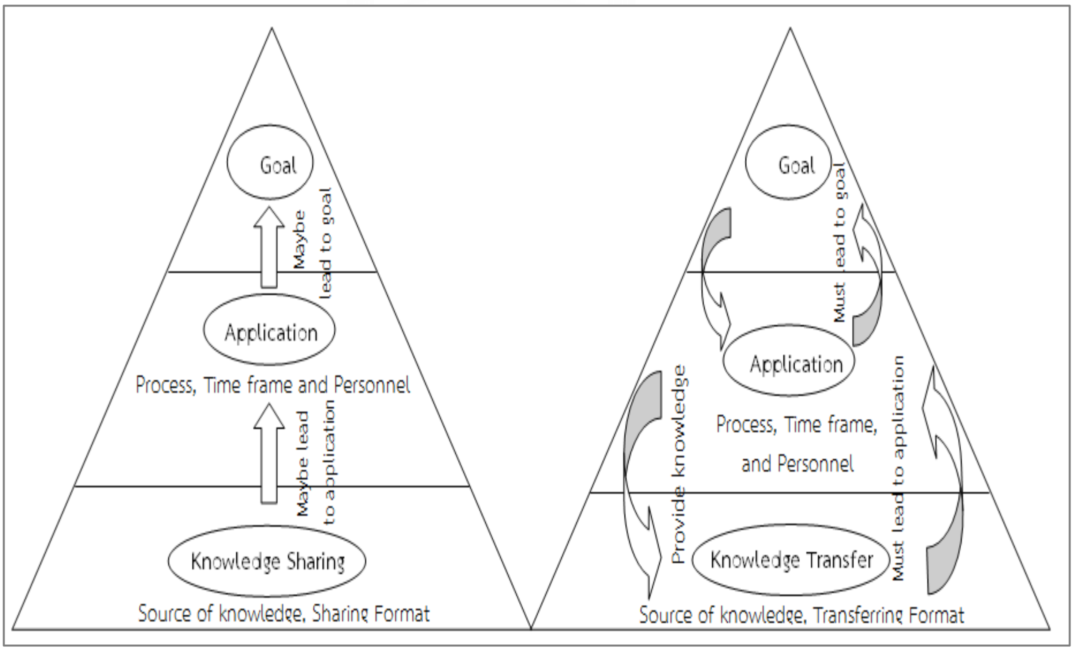


Figure 4. 1 Model for the key different of KS and KT in practical viewpoint

4.1.2.1 KS for external integration

The characteristics of KS for external integration (integrate with suppliers or customers) is knowledge derived from focal companies, suppliers or customers through such means as meetings, site visits or audits. This knowledge may be applied for some individual goals or not. However, if the knowledge is applied, it will typically be used for individual projects. Moreover, these projects do not usually have an exact duration of implementation after receiving the knowledge. Furthermore, the implementations of these projects do not have staffs or teams from the party who communicates knowledge involving them.

4.1.2.2 KT for external integration

The characteristics of KT for external integration (integrate with suppliers or customers) is knowledge derived from focal companies, suppliers or customers through such means as training, coaching or consulting. This knowledge has to be applied for some alignment goals or individual goals through joint or individual projects. However, the implementations of these projects need to have staffs or teams from the party who communicates knowledge involve with the projects for transferring related knowledge to the party who assimilates knowledge. Moreover, these projects usually have an exact duration of implementation after receiving the knowledge.

In other words, the beginning of KT within the context of external integration is often caused by two parties in a supply chain either focal companies and suppliers or focal companies and customers with certain alignment goals. This leads to the parties doing the project together and eventually leads to knowledge provision from the party who communicates knowledge to the party who assimilates knowledge in order to apply for achieving the alignment goals. Unlike KT, KS does not start with alignment goals or joint projects. It is usually the result of collaboration and interaction of the routine process such as meeting with suppliers or customers, making site visits or auditing suppliers or customers based on the degree of relationship.

From the explanation above, we can conclude the key distinction between KS and KT from a practical viewpoint specific to SCM process knowledge for external integration as shown in Table 4.4.

Table 4. 4 Key distinction between KS and KT from a practical viewpoint specific to SCM process knowledge for external integration

Dimension to consider	Knowledge Sharing (KS)	Knowledge Transfer (KT)
Goal	Ordinarily an **individual goal**	Ordinarily an **alignment goal**
Application	**Maybe lead to the goal**	**Must lead to the goal**
-Process	Generally an individual project	Joint project or individual project
-Personnel	Personnel from the party who communicates knowledge not involved with the projects	Personnel from party who communicates knowledge involved with the projects
-Timeframe	Usually no exact duration of implementation after receiving the knowledge	Usually has an exact duration of implementation after receiving the knowledge
Knowledge	**Maybe lead to applications**	**Must lead to applications**
-Sharing or transferring Format	Normally meeting, site visits, or audits, however sometimes are training, coaching or consulting	Normally training, coaching or consulting, however sometimes meeting, site visits, or audits
-Source of knowledge	Focal companies, suppliers or customers	Focal companies, suppliers or customers

Table 4.4 illustrates that the major difference between KS and KT from a practical viewpoint specific to SCM process knowledge for external integration is the matter of applying to achieve a goal. KT will lead to the application for accomplishing the goal while KS usually will not lead to the application to accomplish the goal. Nevertheless, in case of KS leading to application, another key difference was found between two terms in the details of the application, especially concerning personnel and timeframe. If KS leads to applications, the applications were found to not require personnel from the party with sources of knowledge involved with the projects. Moreover, the applications do not have an exact

timeframe of execution after knowledge is shared. Unlike KT, which must lead to the applications, KT requires personnel from the party with sources of knowledge involved with the projects for transferring related knowledge to the party receiving the knowledge. In addition, the applications usually have an exact timeframe of execution after knowledge is transferred. Other minor differences between KS and KT include goals, processes and sharing or transferring format. KT generally leads to alignment goals via joint or individual projects while KS generally leads to individual goals via individual projects. Although sharing formats were normally found to be meetings, site visits or audits; and transferring formats were found to be training, coaching or consulting, it was sometimes found that all formats can employ both KS and KT. However, sources of knowledge are the same between KS and KT because this study has a scope with external integration, including focal companies integrated with suppliers and focal companies integrated with customers. Therefore, knowledge can be shared or transferred from focal companies, suppliers or customers. For more details, some examples are shown below:

Example A: Company A producing appliance sensors sets a training project on the topic of inventory management. The objective of this project is to enhance the performance of suppliers with the expectation that suppliers would apply the knowledge to improve their work. As a result, Company A could also gain benefits. Company A invites their suppliers for one-month training (8 days a month) by supporting with a budget and location for training. This case is characteristic of KS because no evidence shows that Company A's suppliers applied the knowledge to improve their work, even though Company A had an exact objective and timeframe.

Example B: Company B producing compressors has a site visit at a warehouse of Company C producing air conditioners. The staff of Company C provides knowledge about warehouse management for improving warehouse efficiency to Company B during the site visit. Approximately one year later, Company B applied warehouse management knowledge derived from Company C to improve the efficiency of Company B's warehouse by Company B staff. Although Company B applied knowledge for achieving the goal that is warehouse efficiency improvement in this case, the case is characteristic of KS because no staff or team of Company C was involved during the project implementation. Furthermore, the project timeframe was unclear since knowledge had been shared. Moreover, the project was an individual project of Company B that led to the achievement of Company B's goal.

Example C: Company D producing hook ups and Company E producing hard disk drives join together in a lean management project to accomplish an alignment goal. The goal for Company D is to reduce unnecessary processes, work in process and inventory while the goal for Company E is to diminish production lead time. This project runs on an exact timeframe and Company E's team is involved throughout the duration of the project for communicating the knowledge related to lean management to Company D's team via meetings, site visits, coaching or consulting and training. As a result, Company D's team receives the knowledge and applies it to improve their process. This case is characteristic of KT because the knowledge led to application for accomplishing an alignment goal by a joint project. Moreover, this project had personnel from Company E who communicated knowledge involved with the projects under an exact duration of implementation after receiving the knowledge.

For the question, "Is there knowledge sharing or knowledge transfer between you and your suppliers or customers specific to SCM process knowledge? And which one is more?" because the characteristics of KT are more complicated to meet than KS, the answer displayed in the same direction that there was KS or KT between the companies and their suppliers or customers. However, KS appeared more often than KT specific to SCM process knowledge.

In addition, this study can separate the key distinction of KS and KT as discussed above. Table 4.5 presents the comparison of KS and KT discrepancies between previous studies and the present study. Previous studies have noted that KS usually does not have a clear goal/objective (Unfocused or Focused) while KT usually has a clear goal/objective (Clearly focused) (Paulin and Suneson 2012, p.83) similar to the present study. Moreover, this study found that KS emphasizes individual goals/objectives while KT emphasizes alignment goals/objectives.

Because the scope of this study is external integration, the communication level of both KS and KT was focused on dealings between organizations (specific to teams or units involving the SCM process). Unlike earlier research, both terms overlapped on a communication level from the individual, group, team, organizational unit and organization levels (Paulin and Suneson 2012, p.83).

In terms of direction, previous research clearly separates KS from KT by indicating that KS is multidirectional and KT is unidirectional (Paulin and Suneson 2012) while the present study is not specific to the direction. In Example A, the situation was defined as characteristic of KS as discussed above, even though Company A was the source of knowledge through one-way communication.

Precedent studies have stated that the three formats for KT that worked well in the framework of daily activity include training, coaching and mentoring (Valence 2006) whilst there are different formats from KS that include face-to-face communications or documenting (Biswas 2013, p.1). However, this study found an overlapping of formats for KS and KT. Once again referring the Example A, this case was defined as characteristic of KS as mentioned above, even though Company A employed a training format.

In addition, previous research distinguished that KT has a tendency towards the knowledge as an object (K-O) perspective while KS is drawn more towards the knowledge as a subjective contextual construction (K-SCC) perspective. The K-SCC differs from K-O where K-SCC is constructed within a social context (Paulin and Suneson 2012, p.89). Although this study was not specific to the aforementioned perspectives, both KS and KT were found to be constructed within a social context.

Table 4. 5 Comparison of KS and KT to previous studies

Dimension to consider	Previous Study	Present study
Goal/Objective	KS: "Unfocused or Focused"	KS: Unfocused or focused on individual goals
	KT: "Clearly focused"	KT: Clearly focused on alignment goals
Level of communication	KS: "Between and among individuals, and within and among teams, organizational units, and organizations"	KS: between organizations (scope of external integration); specific to team or units that involve SCM process)
	KT: "Between individuals and groups; within, between, and across groups; and from groups to the organization"	KT: between organizations (scope of external integration); specific to team or units that involve SCM process)
Direction	KS: "Multidirectional"	KS: Not specific
	KT: "Unidirectional"	KT: Not specific
Format	KS: "Face-to-face communications through networking with experts, or documenting, organizing and capturing knowledge for others"	KS: Normally meetings, site visits or audits; sometimes, however, training, coaching or consulting
	KT: Training, coaching or consulting	KT: Normally training, coaching or consulting, sometimes, however, meetings, site visits, or audits
K-O and K-SCC perspectives	KS: "K-SCC (knowledge as a subjective contextual construction) perspective"	KS: Not specific
	KT:"K-O (Knowledge as an object) perspective"	KT: Not specific

4.1.3 The required knowledge for SCM processes

The checklist questionnaire (Appendix A- part II) was employed to screen required knowledge for all of the eight SCM processes that should be shared or transferred within the scope of external integration to enhance supply chain performance. To analyze the checklist questionnaires after the fifteen experts had considered and selected the knowledge on the list, the first step was to determine the total frequency of each item of knowledge for all eight SCM processes as summarized in Table 4.6. Considering the frequency, if the frequency equals one, it means at least one expert claimed that this knowledge was necessary for each SCM process. Thus, the results showed that 10, 9, 15, 15, 16, 13, 13 and 9 knowledge items selected by the experts were the necessary knowledge for CRM, CSM, DM, OF, MFM, SRM, PDC and RM, respectively.

With reference to Table 3.2, the necessary knowledge for each SCM process from the literature with subsequence pre-interview was found to be less than expert screening. In other words, the necessary knowledge was assessed by the experts covering the knowledge in Table 3.2 (After). The main reason was to avoid leading the experts by listing all of the knowledge in a single list. Thus, the experts could select any knowledge item for each SCM process based on their respective experience. Another reason was that the tasks in the SCM process can work across function. For example, the CRM process may have some functions overlapping with the CSM process such as sales and marketing or customer categorizing. The DM process may have some functions overlapping with the MFM process such as capacity planning or demand forecasting. Thus, some experts selected the knowledge items in both processes. Moreover, some knowledge items such as quality control knowledge are important knowledge concerning all SCM process.

Table 4. 6 Nonparametric analysis of knowledge for all of the eight SCM processes

Knowledge	Frequency							
	CRM	CSM	DM	OF	MFM	SRM	PDC	RM
Capacity planning knowledge	3	0	*11*	2	2	2	0	0
Customer categorizing knowledge	*15*	3	2	0	0	0	2	1
Decision-making knowledge	1	2	2	3	1	0	5	0
Delivery and transportation planning knowledge	2	5	1	*13*	2	3	3	*13*
Demand forecasting knowledge	2	3	*14*	1	1	2	2	0
Disposition rule and method knowledge	0	0	0	0	1	0	0	*15*
Distribution network planning knowledge	1	0	1	*10*	1	0	0	1
Internal and external coordination knowledge	3	*12*	1	1	0	1	0	1
Inventory management knowledge	1	4	*9*	*9*	*8*	3	0	0
Manufacturing strategy knowledge	0	0	*8*	2	*14*	1	2	0
Optimization knowledge	0	0	1	0	*8*	2	3	0
Packaging design knowledge	0	0	0	0	0	0	*11*	4
Product design knowledge	0	0	0	0	2	0	*14*	0
Production and planning control knowledge	0	0	*8*	2	*14*	3	2	1
Purchasing management knowledge	0	0	0	1	0	*14*	2	0
Quality control knowledge	3	*11*	2	2	*8*	3	3	4
Sale and marketing knowledge	*15*	2	1	1	1	0	*8*	0
Sourcing strategy knowledge	0	0	1	1	1	*13*	0	0
Supplier selection and development knowledge	0	0	0	1	*8*	*15*	*8*	0
Warehouse management knowledge	0	4	1	*11*	5	1	0	1
Number of selected knowledge (Frequency ≥1)	**10**	**9**	**15**	**15**	**16**	**13**	**13**	**9**
P-value of Anderson-Darling Normality Test	<0.005*	0.008*	<0.005*	<0.005*	<0.005*	<0.005*	<0.005*	<0.005*
Sign confidence interval for median	(1.00, 7.11)	(2.23, 9.63)	(1.00, 8.00)	(1.00, 6.76)	(1.00, 8.00)	(1.68, 6.15)	(2.00, 8.00)	(1.00, 10.95)

$p < 0.05$ (the significance P-value of Anderson Darling Normality Test)

As mentioned above, the knowledge necessary for each SCM process could be preliminarily assessed based on data sets of frequency. However, the results showed that the range of frequencies for each SCM process in Table 4.6 varied from 1 to 15, 2 to 12, 1 to 14, 1 to 13, 1 to 14, 1 to 15, 2 to 14, and 1 to 15 for CRM, CSM, DM, OF, MFM, SRM, PDC and RM, respectively (frequency equal to 1 means that only one expert selected this knowledge and frequency equal to 15 means that all experts selected this knowledge). Therefore, in order to extract the knowledge needed the most in each group, a 95% confidence interval was applied for grading the knowledge. If any knowledge had frequency equal to or more than the upper limit, the aforementioned was classified in a highly preferred group. Nevertheless, before the step of the 95% confidence interval determination, the data sets of frequency were tested to verify the normal distribution due to the limitation of the number of experts possibly leading to non-normal distribution. Therefore, the next step for analyzing was normality testing.

The Anderson-Darling Test is comparatively the most common and reliable test deploy given the study characteristics and restrictions of other kinds of normality tests (Razali and Wah 2011). The null hypothesis for the Anderson-Darling normality test states that there is no difference between the data of the present study and the generated normal data. Thus, the null hypothesis would be rejected as the p value is less than 0.05; the data is highly non-normal, and parametric statistics should not be used (Gibbons and Chakraborti 2010). Table 4.6 also presents the results of the Anderson-Darling normality test in which the p values are equal to 0.008 and less than 0.005, which shows that the data sets of frequency for each SCM process were significantly different from the generated normal data. Therefore, it can be concluded that the data sets of frequency for each SCM process do not have a normal distribution. Although this test illustrated that the data sets were non-normally distributed and non-symmetrically skewed either to the left or right, no assumption was made about the shape of the population distribution.

Due to the absence of distributional assumptions, nonparametric statistics for the confidence interval of the median is more appropriate than statistics for the confidence interval of the mean in this situation (Gibbons and Chakraborti 2010).

Hence, the next step in screening for required knowledge was to grade the knowledge into a high score group. One-sample sign of the confidence interval was employed to extract the knowledge because it is a technique of nonparametric statistics for the confidence interval of the median that does not require the data from a normally distributed population and requires no assumptions about the population symmetry.

The one-sample sign confidence levels were calculated according to binomial probabilities and the middle confidence interval was found by a nonlinear interpolation procedure (Hettmansperger and Sheather 1986). At the requested confidence level of 95%, the results of the confidence limit for each SCM process data set are displayed in Table 4.6 The lower limit and upper limit of the data sets of frequency for CRM, CSM, DM, OF, MFM, SRM, PDC and RM were 1.00, 7.11; 2.23, 9.63; 1.00, 8.00; 1.00, 6.76; 1.00, 8.00; 1.68, 6.15; 2.00, 8.00 and 1.00, 10.95, respectively. As mentioned above, if any knowledge had a frequency value equal to or more than the upper limit, the aforementioned was classified as a highly preferred group. Consequently, the required knowledge was found for all of the eight SCM processes that should be shared or transferred within the scope of external integration to enhance supply chain performance as follows:

The ***CRM process*** consists of two knowledge items: (1) Customer categorizing knowledge and (2) Sale and marketing knowledge.

The ***CSM process*** consists of two knowledge items: (1) Internal and external coordination knowledge and (2) Quality control knowledge.

The ***DM process*** consists of five knowledge items: (1) Capacity planning knowledge; (2) Demand forecasting knowledge; (3) Inventory management knowledge; (4) Manufacturing strategy knowledge and (5) Production and planning control knowledge.

The ***OF process*** consists of four knowledge items: (1) Delivery and transportation planning knowledge; (2) Distribution network planning knowledge; (3) Inventory management knowledge and (4) Warehouse management knowledge.

The ***MFM process*** consists of six knowledge items: (1) Inventory management knowledge; (2) Manufacturing strategy knowledge; (3) Optimization knowledge; (4) Production and planning control knowledge; (5) Quality Control knowledge and (6) Supplier selection and development knowledge.

The ***SRM process*** consists of three knowledge items: (1) Purchasing management knowledge; (2) Sourcing strategies knowledge and (3) Supplier selection and development knowledge.

The ***PDC process*** consists of four knowledge items: (1) Packaging design knowledge; (2) Product design knowledge; (3) Sale and marketing knowledge and (4) Supplier selection and development knowledge.

The ***RM process*** consists of two knowledge items: (1) Delivery and transportation planning knowledge and (2) Disposition rule and method knowledge.

Recalling Table 3.2 (After), the following three processes were involved: CRM process, OF process and SRM process. The aforementioned processes required knowledge as listed above and in the preliminary list in Table 3.2 (After). Two processes, namely, the DM process and the MFM process, had some knowledge added to the list. For the DM process, manufacturing strategy knowledge and production and planning control knowledge were added to the list when the frequency equaled 8, which is equal to 8.00 of the upper limit. According to the justification, some experts indicated that the DM process might be related to the MFM process to gain flexible demand and was always related to the details of planning. Thus, manufacturing strategy knowledge such as, postponement, and production and planning control knowledge such as aggregate planning, were required. For the MFM process, supplier selection and development knowledge were added to the list when the frequency equals 8, which is equal to 8.00 of the upper limit. Some experts reasoned that any operating in this process has to meet quality standards. Thus, the standards and performance of suppliers must be taken into consideration. As a result, the aforementioned led to adding supplier selection and development knowledge to the list.

Two processes, namely, the CSM process and the RM process, had some knowledge cut off from the list. For the CSM process, decision-making knowledge was cut off from the list when the frequency was equal to 2, which is lower than 9.63 of the upper limit. For the results, nearly all of the experts remarked that this knowledge is too common to be required knowledge for any process. Similarly, the RM process on packaging design knowledge was cut off from the list when the frequency equaled 4, which is lower than 10.95 of the upper limit. The comment for this issue was that the packaging is usually assigned both specs and design for the return process. Thus, knowledge is not necessary for this process.

There is a process called the PDC process where both some knowledge was cut off from the list and other knowledge was added to the list. Packaging design knowledge was added to the list when the frequency equaled 11, which is greater than 8.00 of the upper limit. Delivery and Transportation planning was cut off from the list when the frequency equaled 3, which is lower than 8.00 of the upper limit. Due to the explanation, some experts explained that packaging is a necessary part for products and normally designed during the phase of product design and development. Thus, packaging design knowledge was added to the list. However, this process is not usually related to delivery and transportation planning. Hence, delivery and transportation planning knowledge was cut off from the list. The result of the required knowledge for SCM processes comparing between after pre-interview (Table 3.2) and after screening process are illustrated in Table 4.7

Apart from the above findings, the definitions of the required knowledge in the list were debriefed and these definitions were also provided in the results as shown in Appendix B.

Table 4. 7 Knowledge for each SCM Process (After Pre-Interview& After Screening Process)

Knowledge for each SCM Process (After Pre-Interview)	Required Knowledge for each SCM Process (After Screening Process)
Customer Relationship Management	
1. Customer categorizing knowledge	1. Customer categorizing knowledge
2. Sale and Marketing knowledge	2. Sale and Marketing knowledge
Customer Service Management	
1. Internal and external coordination knowledge	1. Internal and external coordination knowledge
2. Decision-making knowledge	2. Quality Control knowledge
3. Quality Control knowledge	
Demand Management	
1. Demand forecasting knowledge	1. Demand forecasting knowledge
2. Capacity planning knowledge	2. Capacity planning knowledge
3. Inventory management knowledge	3. Inventory management knowledge
	4. Manufacturing strategy knowledge
	5. Production and planning control knowledge
Order Fulfillment	
1. Distribution network planning knowledge	1. Distribution network planning knowledge
2. Delivery and Transportation planning knowledge	2. Delivery and Transportation planning knowledge
3. Inventory management knowledge	3. Inventory management knowledge
4. Warehouse management knowledge	4. Warehouse management knowledge
Manufacturing Flow Management	
1. Manufacturing strategy knowledge	1. Manufacturing strategy knowledge
2. Optimization knowledge	2. Optimization knowledge
3. Production and planning control knowledge	3. Production and planning control knowledge
4. Quality control knowledge	4. Quality control knowledge
5. Inventory management knowledge	5. Inventory management knowledge
	6. Supplier selection and development knowledge
Supplier Relationship Management	
1. Sourcing strategy knowledge	1. Sourcing strategy knowledge
2. Supplier selection and development knowledge	2. Supplier selection and development knowledge
3. Purchasing Management Knowledge	3. Purchasing Management Knowledge
Product Development and Commercialization	
1. Sale and Marketing knowledge	1. Sale and Marketing knowledge
2. Product design knowledge	2. Product design knowledge
3. Supplier selection and development knowledge	3. Supplier selection and development knowledge
4. Delivery and Transportation planning knowledge	4. Packaging design knowledge
Returns Management	
1. Packaging design knowledge	1. Disposition rule and method knowledge
2. Disposition rule and method knowledge	2. Delivery and Transportation planning knowledge
3. Delivery and Transportation planning knowledge	

From the research work of phase I, we can conclude the followings: (1) a clear distinction between KS and KT from practical viewpoint specific to SCM process knowledge for external integration and (2) The required knowledge for all of the eight SCM processes that should be shared or transferred in the scope of external integration to enhance supply chain performance. This will lead to the completion of the hierarchical structure model in the part of the criteria and the third sub-criteria, shown in Table 3.3 and Figure 3.2. Thus, a completed hierarchical structure is illustrated in Table 4.8 and Figure 4.2, and this structure will be subsequently analyzed in phase II.

Table 4. 8 Goal, criteria and sub-criteria in hierarchical structure (Full)

Goal -Alternative	Criteria	Sub Criteria-1: KT and KS in SCI scope	Sub Criteria-2: Knowledge related to 8 SCM Processes	Sub Criteria-3: Required Knowledge for each SCM Process	Symbol
Supply Chain Performance - Costs - Reliability - Responsiveness	- Knowledge Sharing (KS)	- KS from Focal company to Suppliers - KS from Suppliers to Focal company - KS from Focal company to Customer - KS from Customer to Focal company	Customer Relationship Management (CRM)	- Customer categorizing knowledge - Sale and Marketing knowledge	- CC - SM
			Customer Service Management (CSM)	- Internal and external coordination knowledge - Quality Control knowledge	- IEC - QC
			Demand Management (DM)	- Demand forecasting knowledge - Capacity planning knowledge - Inventory management knowledge - Manufacturing strategy knowledge - Production and planning control knowledge	- DF - CP - INM - MFS - PPC
	- Knowledge Transfer (KT)	- KT from Focal company to Suppliers - KT from Suppliers to Focal company - KT from Focal company to Customer - KT from Customer to Focal company	Order Fulfillment (OF)	- Inventory management knowledge - Distribution network planning knowledge - Delivery and Transportation planning knowledge - Warehouse management knowledge	- INM - DNP - DTP - WM
			Manufacturing Flow Management (MFM)	- Quality control knowledge - Inventory management knowledge - Manufacturing strategy knowledge - Production and planning control knowledge - Optimization knowledge - Supplier selection and development knowledge	- QC - INM - MFS - PPC - OTM - SSD
			Supplier Relationship Management (SRM)	- Sourcing Strategy knowledge - Supplier selection and development knowledge - Purchasing Management knowledge	- SS - SSD - PM
			Product Development and Commercialization (PDC)	- Sale and Marketing knowledge - Supplier selection and development knowledge - Product design knowledge - Packaging design knowledge	- SM - SSD - PDD - PKD
			Returns Management (RM)	- Delivery and Transportation planning knowledge - Disposition rule and method knowledge	- DTP - DRM

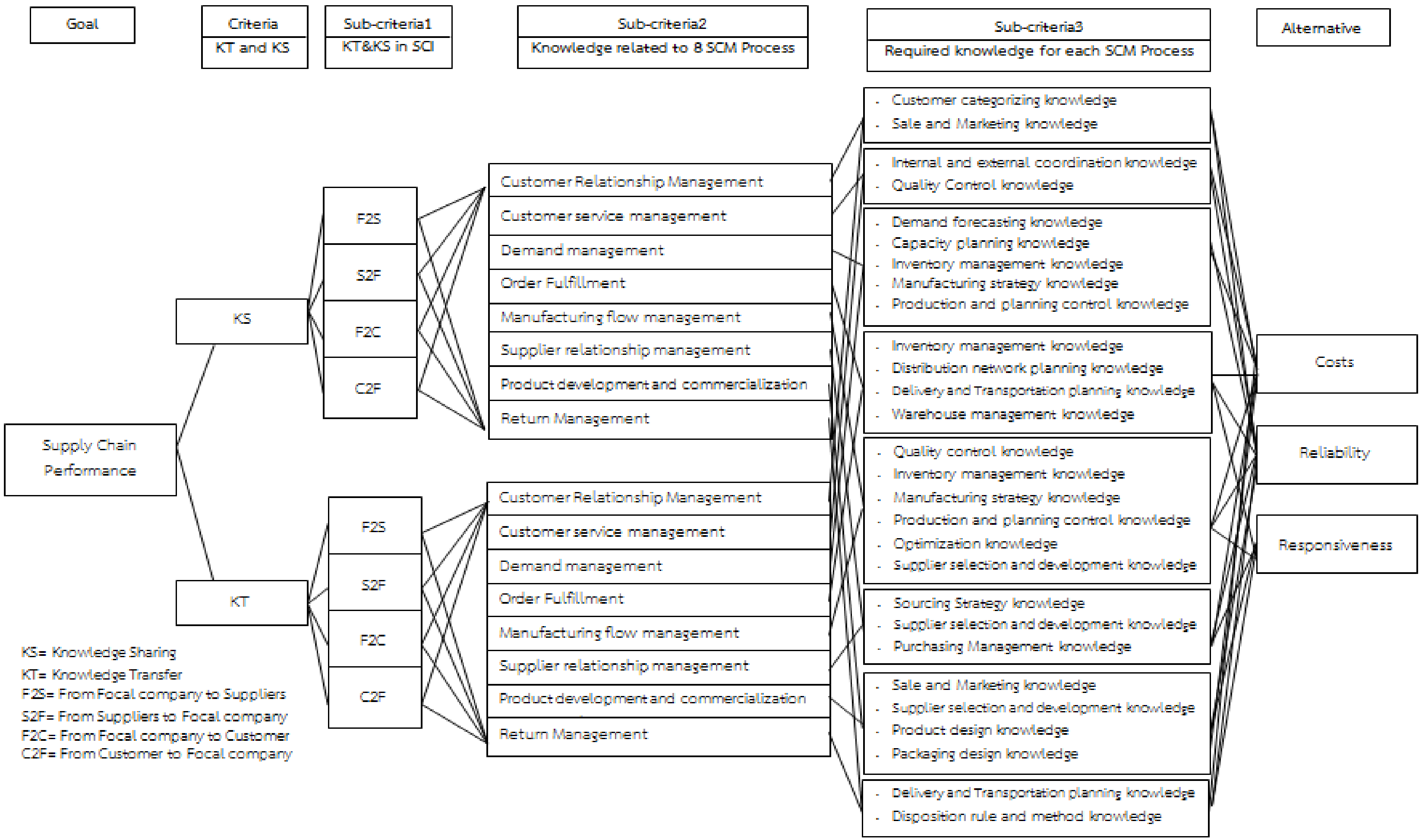


Figure 4. 2 Hierarchical Structure Model (Full)

4.2 Data Analysis and Result for Phase II

To gain the third objective that is to evince the relative importance weights of KS and KT on enhancing supply chain performance, considering on hierarchical structure that consist of (1) the first hierarchy (criteria) is knowledge sharing and knowledge transfer (2) the second hierarchy (sub-criteria1) is dyadic level of supply chain integration focusing on external integration (3) the third hierarchy (sub-criteria2) is knowledge related to the eight SCM processes (4) the forth hierarchy (sub-criteria3) is required knowledge for each SCM process and (5) The fifth hierarchy (alternative) is three attributes of supply chain performance. The research methodology is sequentially processed as shown in section 3.2.2.2. Therefore, the data analysis, result and discussion are presented in this section as following topics;

4.2.1 Companies and Expert' demographic characteristics
4.2.2 The relative importance weights of the first hierarchy (criteria)
4.2.3 The relative importance weights of the second hierarchy (sub-criteria1)
4.2.4 The relative importance weights of the third hierarchy (sub-criteria2)
4.2.5 The relative importance weights of the forth hierarchy (sub-criteria3)
4.2.6 The relative importance weights of the fifth hierarchy (alternative)
4.2.7 Global Weight
4.2.8 Comparative of three stakeholders
4.2.9 Additional Issue

The detailed are illustrated as below.

4.2.1 Demographic characteristics of companies and expert

The target of the companies in this phase is Thai manufacturers in electrical and electronics industry mainly large size company, totally sixty companies. According to the criteria of the Department of Industrial Works, a large company is the company that has more than 200 employees. Therefore, the companies chosen for this research work must have at least 200 employees. Table 4.9 shows the number of employee working in companies.

Table 4. 9 The number of employee working in companies

Number of employees	Number of companies	Percentage (%)
200-1000	27	45.00
1001-2000	14	23.33
2001-3000	9	15.00
3001-4000	3	5.00
4001-5000	3	5.00
>5001	4	6.67
Total	**60**	**100.00**
Minimum: 247 persons, Maximum: 26,156 persons, Median: 1207 persons, Average: 2148.63, Standard Deviation: 3645.97		

A Number of employees working in companies range from 247 to 26,156. As illustrated in Table 4.9, the majority of the experts work in the companies of 200-1000 employees in size (45.00%), followed by 1001-2000 employees (23.33%), 2001-3000 employees (15.00%), more than 5001 (6.67%), and 3001-4000 employees (5.00%) equal to 4001-5000 (5.00%). An average number of employees working in companies are 2148.63 persons, whereas the median is reported as 1207 persons

In this phase, the experts from sixty companies was selected by purposive sampling due to the pair-wise comparison questionnaire was applied to this phase, thus random sampling was not possible given the specific number of experts in this field. There were sixty groups of expert from sixty companies, who assessed the questionnaire in a part of FAHP. Mostly, each company had one expert who answered the questionnaire. However, the thirteen companies which had groups of expert responding the questionnaire, which each group consisted of 2-5 experts. Totally, there are seventy-nine experts participate in this phase. Table 4.10 shows the expert's position and Table 4.11 shows expert's years of experience in supply chain functions.

Table 4. 10 The expert's position

Expert's position	Number of expert	Percentage (%)
Vice president	2	2.53
Managing Director and Deputy Managing Director	3	3.80
Senior Director, Director and Assistant Director	4	5.06
Senior General Manager and General manager	9	11.39
Senior managers, Manager and Division Head (related to SCM and logistics function)	61	77.22
Total	**79 experts (from 60 companies)**	**100.00**

Table 4.10 displays seventy-nine experts from sixty companies consisting of two vice president (2.53%), three managing director and deputy managing director (3.80%), four senior director, director and assistant director (5.06%), nine senior general manager and general manager (11.39%), and sixty-one senior managers, manager or division head related to supply chain management or logistics function (77.22%).

Table 4. 11 The expert's years of experience

Expert's years of experience	Number of experts	Percentage (%)
<10	3	3.80
10-15	34	43.04
16-20	27	34.18
21-25	11	13.92
>25	4	5.06
Total	**79 experts**	**100.00**
Minimum: 9 years, Maximum: 30 years, Median: 16 years, Average: 16.52, Standard Deviation: 5.36		

Years of experience of respondents ranges from 9 to 30. As illustrated in Table 4.11, the majority of them have working experiences between 10-15 years (43.04%), followed by 16-20 years (34.18%), 21-25 years (13.92%), more than 25 years (5.06%) and less than 10 years (3.80%). An average age of working experience is 16.52 years, whereas the median is reported as 16 years.

SCB Economic Intelligence Center (SCB EIC) and National Institute of Development Administration (NIDA) analyzed cluster and supply chain of electrical and electronics industry. They indicated that this industry consisted of three levels which are upstream (third-tier suppliers), midstream (second-tier suppliers and first-tier suppliers) and downstream (assembly group). The detail for each group as list below;

Third-tier suppliers (3rd tier suppliers) provide wafer and circuit board designing, and raw material such as steel, copper, aluminium etc.

Second-tier suppliers (2nd tier suppliers) provide suspension, motor parts, sub-assembly and coil, Print Circuit Board: PCB, semiconductor devices including resistor, capacity, diode and transistor etc., other parts including cable and wire, plastic parts, and metal parts etc.

First-tier suppliers (1st tier suppliers) provide hard disk drive and parts, sensor, actuator, Printed Circuit Board Assembly (PCBA), integrated circuit(IC), semiconductor, motor, compressor etc.

Assembly provide electric appliance, electronics devices and electrical power devices.

This research focused on midstream (2nd suppliers and 1st suppliers) and downstream (assembly group) due to almost upstream (3rd suppliers) are foreign countries. Therefore, among these sixty companies in this research, there were entrepreneurs in assembly group in an amount of twenty-one companies (35.00%), first-tier suppliers group in an amount of twenty-seven companies (45.00%) and second-tier suppliers group in an amount of twelve companies (20.00%) as displayed in Table 4.12.

Table 4. 12 Three stakeholder in cluster and supply chain of electrical and electronics industry

Stakeholder	Number of companies	Percentage (%)
Assembly	21	35.00
First-tier suppliers (1st tier suppliers)	27	45.00
Second-tier suppliers (2nd tier suppliers)	12	20.00
Total	**60**	**100.00**

Section 4.2.2 – 4.2.6 would be showed the examples of FAHP step-by-step calculation consisting of five steps as in section 3.2.2.2-(6). Then the results would be illustrated following the hierarchical structure model.

4.2.2 The relative importance weights of the first hierarchy (criteria)

The first hierarchy (criteria) was constructed to provide the relative importance weights of KS and KT. Therefore, a result was evaluated as the following step;

Step 1: The dimensions of the first hierarchy (criteria) were KS and KT as shown in Figure 4.2

Step 2: An expert judgment based on the TFN linguistic scale, and then the pair-wise comparison matrices of dimensions would be obtained. The TFN linguistic scale was transferred to the corresponding fuzzy numbers as defined in Table 2.5. Then, an example of fuzzy pair-wise comparison matrix for criteria is shown in Table 4.13

Table 4. 13 An example of fuzzy pair-wise comparison of criteria

Criteria	Fuzzy pair-wise comparison	
	KS	KT
KS	1,1,1	4,5,6
KT	1/6,1/5,1/4	1,1,1

Step 3: Consistency ratio (CR) was estimated via equation 9-11 (section 2.4), thus the matrix of an expert was accepted because CR < 0. 1. Furthermore the result of the matrixes was equal zero because there were only two dimensions for comparison.

Step 4: The fuzzy weights applying the normalization of the geometric mean (NGM) method were calculated by equation 7; an example is shown in Table 4.14 and Table 4.15.

Table 4. 14 An example of geometric mean of criteria

Criteria	a_i	
KS	$a_1 = [a_{11} \otimes a_{12}]^{1/2} = (1x4)^{1/2}, (1x5)^{1/2}, (1x6)^{1/2}$	2.0,2.24,2.45
KT	$a_2 = [a_{21} \otimes a_{22}]^{1/2} = (1/6x1)^{1/2}, (1/5x1)^{1/2}, (1/4x1)^{1/2}$	0.41,0.45,0.5
	Total	**2.41,2.69,2.95**

Table 4. 15 An example of fuzzy weight of criteria

Criteria	ω_i	
KS	$\omega_1 = a_1 / \sum_{i=1}^{2} a_i$ = 2.0/2.95 , 2.24/2.69 , 2.45/2.41	0.68, 0.83, 1.02
KT	$\omega_2 = a_2 / \sum_{i=1}^{2} a_i$ = 0.41/2.95 , 0.45/2.69 , 0.5/2.41	0.14, 0.17, 0.21

Step 5: The defuzzy weights were calculated by equation 8; an example is shown in Table 4.16.

Table 4. 16 An example of weight of criteria

Criteria	Defuzzy ω_i	ω_i (Crip)
KS	ω_1 = (0.68+(4x0.83)+1.02)/6	0.84
KT	ω_2 = (0.14+(4x0.17)+0.21)/6	0.17

According to the expert group with sixty representatives about the relative importance weights of dimension, the same procedure for all experts' judgments were repeated as following step 2 to step 5.

Furthermore, for the first hierarchy; the evaluation would be separated to two parts that are (1) Current part (Appendix B-questionnaire item 1.1) and (2) Ideal part (Appendix B-questionnaire item 1.2) due to we would like to compare the current situation and the ideal situation (expected characteristics to enhance supply chain performance). Thus, the results of two parts would be illustrated in the section 4.2.2.1 and 4.2.2.2

4.2.2.1 Current part

As mentioned above that the same procedure for all experts' judgments were repeated as following step 2 to step 5 according to the expert group with sixty representatives about the relative importance weights of dimension. Therefore, the weights of criteria for all experts are presented in Table 4.17.

Table 4. 17 Weight of criteria (Current)

Criteria	Relative importance weights	Rank
KS	0.758	1
KT	0.242	2

Table 4.17 displays the evaluation of the current situation for KS and KT related to supply chain management for each dyad of supply chain integration. The results from the experts show that the current situation leans toward KS more than KT, with the relative importance weights of KS to be 0.758, while the relative importance weights of KT is 0.242.

4.2.2.2 Ideal part

Likewise the current part, the same procedure for all experts' judgments were repeated as following step 2 to step 5 according to the expert group with sixty representatives about the relative importance weights of dimension. Therefore, the weights of criteria for all experts are presented in Table 4.18

Table 4. 18 Weight of criteria (Ideal)

Criteria	Relative importance weights	Rank
KS	0.568	1
KT	0.432	2

Table 4.18 displays the evaluation of the expected characteristics to enhance supply chain performance for KS and KT that relate to supply chain management for each dyad of supply chain integration, the results from the experts indicate that KS has larger relative importance weights for enhancing supply chain performance than KT in which KS has the relative importance weights of 0.568, and KT has the relative importance weights of 0.432.

When comparing the results from Table 4.17 and 4.18 we found that KS has larger relative importance weights than KT for both current part and ideal part for enhancing supply chain performance. However, the current part possesses larger difference of the relative importance weights between KS and KT than the ideal part to enhance supply chain performance. Specifically, currently the organization has protocols of KS much more than KT since KS can more easily occur such as during normal working process (e.g. meeting or conference, site visiting, auditing). However, KT has more difficulty, and it is likely to happen during the special working process that focuses on the efficiency between organizations, according to the difference between KS and KT in Table 4.4.

When considering the ideal part for enhancing supply chain performance, the assessment results from the experts show that KT will play more roles, leading to smaller difference of the relative importance weights between KS and KT. The main reason is the characteristic of KT that focuses on applying the obtained knowledge for better efficiency and effectiveness between organizations. It is convincing that it will be benefits for supply chain performance more than KS. Nevertheless, the relative importance weights of KS is still larger that of KT due to several limitations of difficulty in the actual scenarios.

4.2.3 The relative importance weights of the second hierarchy (sub-criteria1)

The second hierarchy (sub-criteria1) was constructed to provide the relative importance weights of knowledge transfer and knowledge sharing in dyadic level of supply chain integration including focal company to suppliers, suppliers to focal company, focal company to customer and customer to focal company**.** Therefore, a result was evaluated as the following step;

Step 1: The dimensions of the second hierarchy (sub-criteria1) were the dyadic level of supply chain integration including (1) focal company to suppliers (2) suppliers to focal company (3) focal company to customer and (4) customer to focal company as shown in Figure 4.2

Step 2: An expert judgment based on the TFN linguistic scale, and then the pair-wise comparison matrices of dimensions would be obtained. The TFN linguistic scale was transferred to the corresponding fuzzy numbers as defined in Table 2.5. Then, an example of fuzzy pair-wise comparison matrix for sub-criteria1 is shown in Table 4.19.

Table 4. 19 An example of fuzzy pair-wise comparison of sub-criteria1

Sub-criteria1	Fuzzy pair-wise comparison			
	F2S	S2F	F2C	C2F
F2S	1,1,1	1,1,1	6,7,8	6,7,8
S2F	1,1,1	1,1,1	6,7,8	6,7,8
F2C	1/8,1/7,1/6	1/8,1/7,1/6	1,1,1	1,1,1
C2F	1/8,1/7,1/6	1/8,1/7,1/6	1,1,1	1,1,1

Remark : F2S = "Focal company to Suppliers", S2F= "Suppliers to Focal company" , F2C= "Focal company to Customer", C2F= "Customer to Focal company"

Step 3: Consistency ratio (CR) was estimated via equation 9-11 (section 2.4 and Appendix C), thus the matrix of an expert was accepted because CR < 0. 1.

Step 4: The fuzzy weights applying the normalization of the geometric mean (NGM) method were calculated by equation 7; an example is shown in Table 4.20 and Table 4.21.

Table 4. 20 An example of geometric mean of sub-criteria1

Sub-criteria1	a_i	
F2S	$a_1 = [a_{11} \otimes a_{12} \otimes a_{13} \otimes a_{14}]^{1/4} =$ $(1x1x6x6)^{1/4}, (1x1x7x7)^{1/4}, (1x1x8x8)^{1/4}$	2.45,2.65,2.83
S2F	$a_2 = [a_{21} \otimes a_{22} \otimes a_{23} \otimes a_{24}]^{1/4} =$ $(1x1x6x6)^{1/4}, (1x1x7x7)^{1/4}, (1x1x8x8)^{1/4}$	2.45,2.65,2.83
F2C	$a_3 = [a_{31} \otimes a_{32} \otimes a_{33} \otimes a_{34}]^{1/4} =$ $(1/8x1/8x1x1)^{1/4}, (1/7x1/7x1x1)^{1/4}, (1/6x1/6x1x1)^{1/4}$	0.36,0.37,0.41
C2F	$a_4 = [a_{41} \otimes a_{42} \otimes a_{43} \otimes a_{44}]^{1/4} =$ $(1/8x1/8x1x1)^{1/4}, (1/7x1/7x1x1)^{1/4}, (1/6x1/6x1x1)^{1/4}$	0.36,0.37,0.41
Total		**(5.62,6.04,6.48)**

Table 4. 21 An example of fuzzy weight of sub-criteria1

Sub-criteria1	ω_i	
F2S	$\omega_1 = a_1 / \sum_{i=1}^{4} a_i$ = 2.45/6.48 , 2.65/6.04 , 2.83/5.62	0.38, 0.44, 0.50
S2F	$\omega_2 = a_2 / \sum_{i=1}^{4} a_i$ = 2.45/6.48 , 2.65/6.04 , 2.83/5.62	0.38, 0.44, 0.50
F2C	$\omega_3 = a_3 / \sum_{i=1}^{4} a_i$ = 0.36/6.48 , 0.37/6.04 , 0.41/5.62	0.06, 0.06, 0.07
C2F	$\omega_4 = a_4 / \sum_{i=1}^{4} a_i$ = 0.36/6.48 , 0.37/6.04 , 0.41/5.62	0.06, 0.06, 0.07

Step 5: The defuzzy weights were calculated by equation 8; an example is shown in Table 4.22.

Table 4. 22 An example of weight of sub-criteria1

Sub-criteria1	Defuzzy ω_i	ω_i (Crip)
F2S	ω_1 = (0.38+(4x0.44)+0.5)/6	0.44
S2F	ω_2 = (0.38+(4x0.44)+0.5)/6	0.44
F2C	ω_3 = (0.06+(4x0.06)+0.07)/6	0.06
C2F	ω_4 = (0.06+(4x0.06)+0.07)/6	0.06

According to the expert group with all representatives about the relative importance weights of dimension, the same procedure for all experts' judgments (on both KS and KT) were repeated as following step 2 to step 5.

Likewise the first hierarchy, for the second hierarchy; the evaluation would be separated to two parts that are (1) Current part (Appendix B-questionnaire item 2) and (2) Ideal part (Appendix B-questionnaire item 3) due to we would like to compare the current situation and the ideal situation (expected characteristics to enhance supply chain performance). Thus, the results of two parts would be illustrated in the section 4.2.3.1 and 4.2.3.2.

4.2.3.1 Current part

As mentioned above that the same procedure for all experts' judgments were repeated as following step 2 to step 5 according to the expert group about the relative importance weights of dimension. However, there are some companied could not be evaluated in this part because currently the sharing and transferring of knowledge between dyadic level of supply chain integration involving in SCM process still not complete four dyads. Totally, the expert group with fifty-seven representatives evaluated for KS and forty-eight representatives evaluated for KT. Therefore, the weights of sub-criteria1 for all experts are presented in Table 4.23.

Table 4. 23 Weight of sub-criteria1 (Current)

Sub-criteria1	Relative importance weights	Rank
KS (0.758)		
F2S	0.325	1
S2F	0.166	4
F2C	0.223	3
C2F	0.286	2
KT (0.242)		
F2S	0.343	1
S2F	0.182	4
F2C	0.203	3
C2F	0.272	2

From Table 4.23, the evaluation of the current part for the dyadic level of supply chain integration reveals that both KS and KT have the same trend. Sharing and transfer of knowledge for supply chain management process between each dyad of supply chain integration show the ordering according to ranks, which are F2S, C2F, F2C, and S2F. KS has the relative importance weights in order, ranging from 0.325, 0.286, 0.223, and 0.166, while KT has the relative importance weights ranging from 0.343, 0.272, 0.203 และ 0.182. The relative importance weights slightly different from KS and KT, resulted from some company has larger KT characteristic between F2S than other dyads, especially the group that produces hard disc drive. Thus, the relative importance weights of F2S has increased and pulled the scores of other dyads to be changed when compared to KS.

4.2.3.2 Ideal part

Likewise the current part, the same procedure for all experts' judgments were repeated as following step 2 to step 5 according to the expert group with sixty representatives about the relative importance weights of dimension. Therefore, the weights of sub-criteria1 for all experts presents are presented in Table 4.24.

Table 4. 24 Weight of sub-criteria1 (Ideal)

Sub-criteria1	Relative importance weights	Rank
KS (0.568)		
F2S	0.266	2
S2F	0.226	3
F2C	0.206	4
C2F	0.302	1
KT (0.432)		
F2S	0.267	2
S2F	0.219	3
F2C	0.206	4
C2F	0.308	1

Table 4.24 displays the evaluation of the expected characteristics to enhance supply chain performance for the dyadic level of supply chain integration reveals that both KS and KT agree the same trend. Sharing and transferring of knowledge of supply chain management between each dyad of supply chain integration show the ordering according to ranks, which are C2F, F2S, S2F and F2C. KS has the relative importance weights in order, ranging from 0.302, 0.266 ,0.226 and 0.206, while KT has the relative importance weights ranging from 0.308, 0.267, 0.219 and 0.206. We can easily see that the relative importance weights for each dyad are almost the same. The slight difference between KS and KT could come from the KT from customers to the company will support supply chain performance more than KS, which increases the relative importance weights of C2F and boost the scores of other dyads to be changed when compared to KS.

When comparing the results from Table 4.23 and 4.24, we found that the ranks for all four dyads (F2S, S2F, F2C, and C2F) for current part and the ideal for to enhance supply chain performance are different. That is, for current part, the organizations usually be the one who share and transfer knowledge of supply chain management to their own suppliers, instead of the suppliers being the ones who share or transfer knowledge back. In other words, the buyer organizations will share and transfer to the seller organizations more frequently than the case of the seller organizations sharing or transferring knowledge back. We can observe that the first two ranks – F2S and C2F – are the sharing and transferring from buyer organization to seller organization, while the last two ranks – F2C and S2F – are the sharing and transferring from seller organization to buyer organization. This is presumably the consequence from the fact that the buyer organization determines various aspects it might need such as cost, quality, and delivery. So, it becomes the one who shares and transfers knowledge to the seller so that the seller organization can develop its competency resulting in the buyer organization can meet requirement in various aspects. This could also be the consequence from preparedness in many factors such as budget or personnel, since the buyer organizations are usually larger than the seller organizations, resulting in more readiness in many aspects to be able to support sharing and transfer.

Furthermore, when considering the first two ranks, F2S has higher order than C2F. That is, nowadays, many organizations frequently are the sharing and transferring part to the suppliers of the organizations instead of receiving the sharing and transferring from the customers of the organizations. This is due to the fact that such organizations are the middle point between suppliers and the customers. Therefore, the organizations as the buyer from the suppliers will attempt to promote and push their suppliers to meet the requirement of the organizations so that the organizations will meet the requirement of the customers. If we consider this from the organizations as the seller to the customers, we will find that currently some customers will only provide requirement or information, but not in the level of knowledge sharing and transferring. This yields higher order of F2S than C2F. Furthermore, considering the last two ranks where F2C has higher order than S2F, we can analyze that nowadays, the organizations are sharing or transferring knowledge to their customers more frequently than receiving the knowledge sharing and transferring from the suppliers of the organizations, as a result of preparedness such as budget or personnel. Currently, many suppliers are 2nd tier suppliers, thus, they are less ready to support the knowledge sharing and transferring than the 1st tier suppliers or assembly group.

When considering the ideal part to enhance supply chain performance, we discover the changing of orders. Knowledge sharing and transferring should follow the chain by starting from customer to focal company, focal company to suppliers, and going back from supplier to focal company, and focal company to customer, since the experts agree that customer is the beginning of all need, and most customers are the manufacturing organizations. Thus, the knowledge should be based on the same fundamentals. If the knowledge sharing and transferring start from the customers more frequently than the current situation, it could enhance and promote supply chain performance. Also, most customers are huge companies, especially in the assembly group, they are ready and prepared to promote knowledge sharing and transferring more. The customers will then communicate the knowledge to share and transfer to others. Vice versa, if the suppliers have any knowledge, it should then be shared or transferred back.

When comparing the relative importance weights of the current part and the ideal part, the relative importance weights of all four dyads of the ideal part (both for KS and KT) are closer to each other than that of the current part. The experts speculate that KS and KT can occur with any supply chain dyad with equal level or similar level, which will significantly enhance supply chain performance. However, the truth in current situation, KS and KT for each dyad of supply chain integration are not in the same or similar level as the reasons mentioned above.

4.2.4 The relative importance weights of the third hierarchy (sub-criteria2)

The third hierarchy (sub-criteria2) was constructed to provide the relative importance weights of knowledge related to eight SCM processes which should be shared or transferred in each dyadic level of supply chain integration**.** Therefore, a result was evaluated as the following step;

Step 1: The dimensions of the third hierarchy (sub-criteria2) were knowledge related eight SCM processes including (1) Customer Relationship Management (CRM) (2) Customer service management (CSM) (3) Demand management (DM) (4) Order Fulfillment (OF) (5) Manufacturing flow management (MFM) (6) Supplier relationship management (SRM) (7) Product development and commercialization (PDC) (8) Return Management (RM) as shown in Figure 4.2

Step 2: An expert judgment based on the TFN linguistic scale, and then the pair-wise comparison matrices of dimensions would be obtained. The TFN linguistic scale was transferred to the corresponding fuzzy numbers as defined in Table 2.5. Then, an example of fuzzy pair-wise comparison matrix for sub-criteria2 is shown in Table 4.25.

Table 4. 25 An example of fuzzy pair-wise comparison of sub-criteria2

Sub-criteria2	Fuzzy pair-wise comparison							
	CRM	CSM	DM	OF	MFM	SRM	PDC	RM
CRM	1,1,1	1,1,1	1/4,1/3,1/2	1/9,1/8,1/7	1/9,1/8,1/7	1/9,1/8,1/7	1/9,1/8,1/7	1/9,1/8,1/7
CSM	1,1,1	1,1,1	1/9,1/8,1/7	1/9,1/8,1/7	1/9,1/8,1/7	1/9,1/8,1/7	1/9,1/8,1/7	1/9,1/8,1/7
DM	2,3,4	7,8,9	1,1,1	1,1,1	1,1,1	1,2,3	1,2,3	1,2,3
OF	7,8,9	7,8,9	1,1,1	1,1,1	1,1,1	1,2,3	1,2,3	1,2,3
MFM	7,8,9	7,8,9	1,1,1	1,1,1	1,1,1	1,2,3	1,1,1	1,2,3
SRM	7,8,9	7,8,9	1/3,1/2,1	1/3,1/2,1	1/3,1/2,1	1,1,1	1/4,1/3,1/2	1/3,1/2,1
PDC	7,8,9	7,8,9	1/3,1/2,1	1/3,1/2,1	1,1,1	2,3,4	1,1,1	2,3,4
RM	7,8,9	7,8,9	1/3,1/2,1	1/3,1/2,1	1/3,1/2,1	1,2,3	1/4,1/3,1/2	1,1,1

Step 3: Consistency ratio (CR) was estimated via equation 9-11 (section 2.4 and Appendix C), thus the matrix of an expert was accepted because CR < 0. 1.

Step 4: The fuzzy weights applying the normalization of the geometric mean (NGM) method were calculated by equation 7; an example is shown in Table 4.26 and Table 4.27.

Table 4. 26 An example of geometric mean of sub-criteria2

Sub-criteria2	a_i	
CRM	$a_1 = [a_{11} \otimes a_{12} \otimes a_{13} \otimes a_{14} \otimes a_{15} \otimes a_{16} \otimes a_{17} \otimes a_{18}]^{1/8} =$ $(1x1x1/4x1/9x1/9x1/9x1/9x1/9)^{1/8}, (1x1x1/3x1/8x1/8x1/8x1/8x1/8)^{1/8}, (1x1x1/2x1/7x1/7x1/7x1/7x1/7)^{1/8}$	0.21,0.24,0.27
CSM	$a_2 = [a_{21} \otimes a_{22} \otimes a_{23} \otimes a_{24} \otimes a_{25} \otimes a_{26} \otimes a_{27} \otimes a_{28}]^{1/8} =$ $(1x1x1/9x1/9x1/9x1/9x1/9x1/9)^{1/8}, (1x1x1/8x1/8x1/8x1/8x1/8x1/8)^{1/8}, (1x1x1/7x1/7x1/7x1/7x1/7x1/7)^{1/8}$	0.19,0.22,0.23
DM	$a_3 = [a_{31} \otimes a_{32} \otimes a_{33} \otimes a_{34} \otimes a_{35} \otimes a_{36} \otimes a_{37} \otimes a_{38}]^{1/8} =$ $(2x7x1x1x1x1x1x1)^{1/8}, (3x8x1x1x1x2x2x2)^{1/8}, (4x9x1x1x1x3x3x3)^{1/8}$	1.39,1.93,2.36
OF	$a_4 = [a_{41} \otimes a_{42} \otimes a_{43} \otimes a_{44} \otimes a_{45} \otimes a_{46} \otimes a_{47} \otimes a_{48}]^{1/8} =$ $(7x7x1x1x1x1x1x1)^{1/8}, (8x8x1x1x1x2x2x2)^{1/8}, (9x9x1x1x1x3x3x3)^{1/8}$	1.63,2.18,2.62
MFM	$a_5 = [a_{51} \otimes a_{52} \otimes a_{53} \otimes a_{54} \otimes a_{55} \otimes a_{56} \otimes a_{57} \otimes a_{58}]^{1/8} =$ $(7x7x1x1x1x1x1x1)^{1/8}, (8x8x1x1x1x2x1x2)^{1/8}, (9x9x1x1x1x3x1x3)^{1/8}$	1.63,2.00,2.28
SRM	$a_6 = [a_{61} \otimes a_{62} \otimes a_{63} \otimes a_{64} \otimes a_{65} \otimes a_{66} \otimes a_{67} \otimes a_{68}]^{1/8} =$ $(7x7x1/3x1/3x1/3x1x1/4x1/3)^{1/8}, (8x8x1/2x1/2x1/2x1x1/3x1/2)^{1/8}, (9x9x1x1x1x1x1/2x1)^{1/8}$	0.79,1.04,1.59
PDC	$a_7 = [a_{71} \otimes a_{72} \otimes a_{73} \otimes a_{74} \otimes a_{75} \otimes a_{76} \otimes a_{77} \otimes a_{78}]^{1/8} =$ $(7x7x1/3x1/3x1x2x1x2)^{1/8}, (8x8x1/2x1/2x1x3x1x3)^{1/8}, (9x9x1x1x1x4x1x4)^{1/8}$	1.47,1.86,2.45
RM	$a_8 = [a_{81} \otimes a_{82} \otimes a_{83} \otimes a_{84} \otimes a_{85} \otimes a_{86} \otimes a_{87} \otimes a_{88}]^{1/8} =$ $(7x7x1/3x1/3x1/3x1x1/4x1)^{1/8}, (8x8x1/2x1/2x1/2x2x1/3x1)^{1/8}, (9x9x1x1x1x3x1/2x1)^{1/8}$	0.90,1.23,1.82
Total		**(8.21,10.7,13.62)**

Table 4. 27 An example of fuzzy weight of sub-criteria2

Sub-criteria2	ω_i	
CRM	$\omega_1 = a_1 / \sum_{i=1}^{8} a_i$ = 0.21/13.62 , 0.24/10.7 , 0.27/8.21	0.02, 0.02, 0.03
CSM	$\omega_2 = a_2 / \sum_{i=1}^{8} a_i$ = 0.19/13.62 , 0.22/10.7 , 0.23/8.21	0.01, 0.02, 0.03
DM	$\omega_3 = a_3 / \sum_{i=1}^{8} a_i$ = 1.39/13.62 , 1.93/10.7 , 2.36/8.21	0.10, 0.18, 0.29
OF	$\omega_4 = a_4 / \sum_{i=1}^{8} a_i$ = 1.63/13.62 , 2.18/10.7 , 2.62/8.21	0.12, 0.20, 0.32
MFM	$\omega_5 = a_5 / \sum_{i=1}^{8} a_i$ = 1.63/13.62 , 2.00/10.7 , 2.28/8.21	0.12, 0.19, 0.28
SRM	$\omega_6 = a_6 / \sum_{i=1}^{8} a_i$ = 0.79/13.62 , 1.04/10.7 , 1.59/8.21	0.06, 0.10, 0.19
PDC	$\omega_7 = a_7 / \sum_{i=1}^{8} a_i$ = 1.47/13.62 , 1.86/10.7 , 2.45/8.21	0.11, 0.17, 0.30
RM	$\omega_8 = a_8 / \sum_{i=1}^{8} a_i$ = 0.90/13.62 , 1.23/10.7 , 1.82/8.21	0.07, 0.11, 0.22

Step 5: The defuzzy weights were calculated by equation 8; an example is shown in Table 4.28.

Table 4. 28 An example of weight of sub-criteria2

Sub-criteria2	Defuzzy ω_i	ω_i (Crip)
CRM	ω_2 =(0.01+(4x0.02)+0.03)/6	0.02
CSM	ω_3 =(0.1+(4x0.18)+0.29)/6	0.17
DM	ω_4 =(0.12+(4x0.2)+0.32)/6	0.21
OF	ω_5 =(0.12+(4x0.19)+0.28)/6	0.19
MFM	ω_6 =(0.06+(4x0.1)+0.19)/6	0.10
SRM	ω_7 =(0.11+(4x0.17)+0.3)/6	0.17
PDC	ω_8 =(0.07+(4x0.11)+0.22)/6	0.12
RM	ω_2 =(0.01+(4x0.02)+0.03)/6	0.02

According to the expert group with sixty representatives about the relative importance weights of dimension, the same procedure for all experts' judgments and all dyads of supply chain integration (on both KS and KT) were repeated as following step 2 to step 5.

Unlike the first and the second hierarchy, for the third hierarchy; the current part could not be evaluated due to currently the sharing and transferring of knowledge between dyadic levels of supply chain integration involving in SCM process still not complete eight processes. Therefore, the analysis focused only on ideal part. The weights of sub-criteria2 for all experts are presented in Table 4.29.

Table 4. 29 Weight of sub-criteria2 (Ideal)

KS (0.568)								
Sub-criteria2	F2S (0.266)		S2F (0.226)		F2C (0.206)		C2F (0.302)	
	Relative importance weights	Rank	Relative importance weights	Rank	Relative importance weights	Rank	Relative importance weights	Rank
CRM	0.092	7	0.096	7	0.120	6	0.120	6
CSM	0.107	5	0.110	5	0.140	3	0.135	3
DM	0.146	4	0.143	4	0.154	2	0.158	2
OF	0.153	2	0.150	2	0.135	4	0.133	4
MFM	0.163	1	0.157	1	0.133	5	0.124	5
SRM	0.104	6	0.107	6	0.077	8	0.076	8
PDC	0.148	3	0.146	3	0.156	1	0.170	1
RM	0.087	8	0.091	8	0.085	7	0.084	7
KT (0.432)								
Sub-	F2S (0.267)		S2F (0.219)		F2C (0.206)		C2F (0.308)	
CRM	0.092	7	0.093	7	0.121	6	0.120	6
CSM	0.107	5	0.111	5	0.139	3	0.137	3
DM	0.146	4	0.135	4	0.154	2	0.156	2
OF	0.154	2	0.153	2	0.136	4	0.133	4
MFM	0.162	1	0.162	1	0.131	5	0.124	5
SRM	0.104	6	0.107	6	0.076	8	0.075	8
PDC	0.150	3	0.150	3	0.160	1	0.172	1
RM	0.085	8	0.089	8	0.083	7	0.083	7

The evaluation of the expected characteristics to enhance supply chain performance for knowledge related to eight SCM processes reveals that both KS and KT have the same trend, that is, for F2S and S2F, KS and KT that relate to SCM processes follow the same rank – MFM, OF, PDC, DM, CSM, SRM, CRM, and RM. F2C and C2F also have KS and KT that relate to SCM processes with the same ranks – PDC, DM, CSM, OF, MFM, CRM, RM, and SRM, with the relative importance weights for each dyad separated by KS and KT shown in Table 4.29.

The experts provide the critical reasons that make F2S have the same order as S2F and make F2C have the same order as C2F as the following. Since they are the adhesive dyad, if the organization wishes to share or transfer knowledge related to any SCM processes to the supplier or customer, the organization will wish to receive the knowledge sharing and transferring about SCM processes from that supplier or customer as well.

For F2S and S2F, the evaluation results show that the knowledge related to SCM processes that should be shared and be transferred, as priority is the knowledge about MFM, OF, and PDC. The reason is that overall, the organization wishes that its supplier to develop the competency in manufacturing (MFM) more than other aspects since both organization and its suppliers are in the manufacturing group. Thus, the knowledge that will facilitate in increasing the ability or the competency of manufacturing is very important. The knowledge related to order fulfillment (OF) should be subsequently developed since the suppliers are often assessed for competency in order fulfillment for organizations the same way as the organizations are assessed for order fulfillment for customers. The knowledge related to product designing (PDC) is the next important issue since in many cases the suppliers and the organization will collaborate on product designing, and they already share information regarding to specifications of the products. Therefore, if they have more knowledge sharing and transferring related to designing than simply sharing specifications such as designing products to correspond to various factors such as materials and manufacturing process, it will be more beneficial for both parties.

For F2C and C2F, the evaluation results reveal that the knowledge related to SCM process that should be shared or transferred as first priorities is the knowledge related to PDC, CM, and SCM, and this is different from F2S and S2F. The reason why the knowledge related to PDC process is considered as the number one issue is similar to what we discussed above. Moreover, the F2C and C2F are the chain that is close to end user customer, which involves more of new product designing than the process in the middle chain. Thus, the importance of the knowledge related to PDC is critical. The next issue is the knowledge related to DM process composed of the main knowledge of demand forecasting. This is quite often originated from downstream and is translated in order. Thus, the F2C and C2F focus on the importance of the knowledge related to DM as the second issue, while the F2S and S2F consider this as issue number four (still less than the first three ranks) with the discussed reason. The next issue is the knowledge related to CSM process, which involves the knowledge about quality management and coordination among many sections for customer services. With a similar reason, F2C and C2F are in the chain that is closer to end user customer, hence, giving understanding the importance of the knowledge to promote customer services. Hence, the F2C and C2F prioritize the knowledge related to CSM as the third item in order, while the F2S and S2F have it as the fifth item in order (still less than the first four items) with the mentioned reason. For the knowledge related to OF process and MFM process, the F2C and C2F take it as number four and five, respectively, which is different from the F2C and C2F taking it as number two and number one respectively with the reason discussed above.

The last three ranks of both F2S & S2F and F2C & C2F are similar in the sense that SRM, CRM, and RM are only slightly different in order since the supply chain of the electric and electronic industrial whose research focuses on 1^{st} tier suppliers, 2^{nd} tire suppliers, and assembly is considered as the manufacturing group. Hence, the groups of customer in each stakeholder of the supply chain are quite clear. Also, the manufacturing group does not involve the marketing as directly as the selling group. Hence, the knowledge related to CRM process, which contains these two main themes is ranked last. However, the F2C and C2F will have the chain closer to the end user customer, thus, having the higher rank of CRM than F2S and S2F. Moreover, in many cases, the customers of the organization will determine or indicate suppliers for the organization, thus, the knowledge related to SRM containing knowledge of sourcing and supplier selection ranks toward the end. However, the F2S and S2F, which mostly is in the middle chain, will encounter fewer cases of the determination or supplier indication from the customer. Consequently, the ranking of SRM is higher than F2C and C2F. Most experts agree that the knowledge related to RM process is one of the last components since the process is prevented from happening since the manufacturing process, resulting in the last ranking.

Additionally, when comparing the relative importance weights for all four dyads both KS and KT are similar since the experts state that sharing and transferring knowledge related to all eight SCM processes can be in the same level or close to each other, which will significantly promote supply chain performance.

4.2.5 The relative importance weights of the forth hierarchy (sub-criteria3)

The forth hierarchy (sub-criteria3) was constructed to the relative importance weights of required knowledge for each SCM process which should be shared or transferred in each dyadic level of supply chain integration. Therefore, a result was evaluated as the following step;

Step 1: The dimensions of the forth hierarchy (sub-criteria3) were required knowledge for each SCM process which should be shared or transferred including; two knowledge for Customer Relationship Management (CRM), two knowledge Customer service management (CSM), five knowledge for Demand management (DM), four knowledge for Order Fulfillment (OF), six knowledge for Manufacturing flow management (MFM), three knowledge for Supplier relationship management (SRM), four knowledge for Product development and commercialization (PDC), two knowledge for Return Management (RM) as shown in Figure 4.2

Step 2: An expert judgment based on the TFN linguistic scale, and then the pair-wise comparison matrices of dimensions would be obtained. The TFN linguistic scale was transferred to the corresponding fuzzy numbers as defined in Table 2.5. Then, an example of fuzzy pair-wise comparison matrix for sub-criteria3 focusing on MFM is shown in Table 4.30.

Table 4. 30 An example of fuzzy pair-wise comparison of sub-criteria3 (MFM)

Sub-criteria3	**Fuzzy pair-wise comparison**					
	QC	INM	MFS	PPC	OTM	SSD
QC	1,1,1	4,5,6	2,3,4	9,9,9	4,5,6	4,5,6
INM	1/6,1/5,1/4	1,1,1	1,1,1	1,2,3	1,1,1	1,1,1
MFS	1/4,1/3,1/2	1,1,1	1,1,1	2,3,4	1,1,1	1,1,1
PPC	1/9,1/9,1/9	1/3,1/2,1	1/4,1/3,1/2	1,1,1	1/3,1/2,1	1/3,1/2,1
OTM	1/6,1/5,1/4	1,1,1	1,1,1	1,2,3	1,1,1	1,1,1
SSD	1/6,1/5,1/4	1,1,1	1,1,1	1,2,3	1,1,1	1,1,1

Remark: QC, INM, MFS, PPC, OTM, SSD are symbols referencing from Table4.8

Step 3: Consistency ratio (CR) was estimated via equation 9-11 (section 2.4 and Appendix C), thus the matrix of an expert was accepted because CR < 0. 1.

Step 4: The fuzzy weights applying the normalization of the geometric mean (NGM) method were calculated by equation 7; an example focusing on MFM is shown in Table 4.31 and Table 4.32.

Table 4. 31 An example of geometric mean of sub-criteria3 (MFM)

Sub-criteria3	a_i	
QC	$a_1 = [a_{11} \otimes a_{12} \otimes a_{13} \otimes a_{14} \otimes a_{15} \otimes a_{16}]^{1/6} =$ $(1x4x2x9x4x4)^{1/6}, (1x5x3x9x5x5)^{1/6}, (1x6x4x9x6x6)^{1/6}$	3.24,3.87,4.45
INM	$a_2 = [a_{21} \otimes a_{22} \otimes a_{23} \otimes a_{24} \otimes a_{25} \otimes a_{26}]^{1/6} =$ $(1/6x1x1x1x1x1)^{1/6}, (1/5x1x1x2x1x1)^{1/6}, (1/4x1x1x3x1x1)^{1/6}$	0.74,0.86,0.95
MFS	$a_3 = [a_{31} \otimes a_{32} \otimes a_{33} \otimes a_{34} \otimes a_{35} \otimes a_{36}]^{1/6} =$ $(1/4x1x1x2x1x1)^{1/6}, (1/3x1x1x3x1x1)^{1/6}, (1/2x1x1x4x1x1)^{1/6}$	0.89,1.0,1.12
PPC	$a_4 = [a_{41} \otimes a_{42} \otimes a_{43} \otimes a_{44} \otimes a_{45} \otimes a_{46}]^{1/6} =$ $(1/9x1/3x1/4x1x1/3x1/3)^{1/6}, (1/9x1/2x1/3x1x1/2x1/2)^{1/6}, (1/9x1x1/2x1x1x1)^{1/6}$	0.32,0.41,0.62
OTM	$a_5 = [a_{51} \otimes a_{52} \otimes a_{53} \otimes a_{54} \otimes a_{55} \otimes a_{56}]^{1/6} = (1/6x1x1x1x1x1)^{1/6}$ $, (1/5x1x1x2x1x1)^{1/6}, (1/4x1x1x3x1x1)^{1/6}$	0.74,0.86,0.95
SSD	$a_6 = [a_{61} \otimes a_{62} \otimes a_{63} \otimes a_{64} \otimes a_{65} \otimes a_{66}]^{1/6} = (1/6x1x1x1x1x1)^{1/6}$ $, (1/5x1x1x2x1x1)^{1/6}, (1/4x1x1x3x1*1)^{1/6}$	0.74,0.86,0.95
Total		**(6.67,7.86,9.04)**

Table 4. 32 An example of fuzzy weight of sub-criteria3 (MFM)

Sub-criteria3	ω_i	
QC	$\omega_1 = a_1 / \sum_{i=1}^{6} a_i$ = 3.24/9.04 , 3.87/7.86 , 4.45/6.67	0.36, 0.49, 0.67
INM	$\omega_2 = a_2 / \sum_{i=1}^{6} a_i$ = 0.74/9.04 , 0.86/7.86 , 0.95/6.67	0.08, 0.11, 0.14
MFS	$\omega_3 = a_3 / \sum_{i=1}^{6} a_i$ = 0.89/9.04 , 1.0/7.86 , 1.12/6.67	0.10, 0.13, 0.17
PPC	$\omega_4 = a_4 / \sum_{i=1}^{6} a_i$ = 0.32/9.04 , 0.41/7.86 , 0.62/6.67	0.04, 0.05, 0.09
OTM	$\omega_5 = a_5 / \sum_{i=1}^{6} a_i$ = 0.74/9.04 , 0.86/7.86 , 0.95/6.67	0.08, 0.11, 0.14
SSD	$\omega_6 = a_6 / \sum_{i=1}^{6} a_i$ = 0.74/9.04 , 0.86/7.86 , 0.95/6.67	0.08, 0.11, 0.14

Step 5: The defuzzy weights were calculated by equation 8; an example focusing on MFM is shown in Table 4.33.

Table 4. 33 An example of weight of sub-criteria3 (MFM)

Sub-criteria3	**Defuzzy** ω_i	ω_i **(Crip)**
QC	ω_1 = (0.36+(4x0.49)+0.67)/6	0.50
INM	ω_2 = (0.08+(4x0.11)+0.14)/6	0.11
MFS	ω_3 = (0.1+(4x0.13)+0.17)/6	0.12
PPC	ω_4 = (0.04+(4x0.05)+0.09)/6	0.05
OTM	ω_5 = (0.08+(4x0.11)+0.14)/6	0.11
SSD	ω_6 = (0.08+(4x0.11)+0.14)/6	0.11

According to the expert group with sixty representatives about the relative importance weights of dimension, the same procedure for all experts' judgments and all eight SCM processes (for all dyads of supply chain integration on both KS and KT) were repeated as following step 2 to step 5.

Unlike the first and the second hierarchy, for the forth hierarchy; the current part could not be evaluated due to currently the sharing and transferring of knowledge between dyadic level of supply chain integration involving in SCM process still not complete for all required knowledge. Therefore, the weights of sub-criteria3 for all experts are presented in Table 4.34 and Table 4.35.

The evaluation of the expected characteristics to enhance supply chain performance for required knowledge for each SCM process reveals that each dyad including F2S, S2F, F2C, and C2F for both KS and KT has relative importance weights shown in Table 4.34 and Table 4.35 and agrees the same trend for each dyad, as the followings.

The required knowledge for CRM process is in ordered as (1) Sale and Marketing knowledge (SM) and (2) Customer categorizing knowledge (CC), listed in the above section (section 4.2.4) is that both of required knowledge for CRM process have the relative importance weight in the last three orders with the discussed explanation. However, if we only consider these two tasks, the result shows higher order of SM since the supply chain of the electric and electronic industrial whose research focuses on 1^{st} tier suppliers, 2^{nd} tire suppliers, and assembly is considered as the manufacturing group. Hence, the customers in each stakeholder of the supply chain are quite clear. Additionally, the experts in the assembly group are relatively close to the downstream (end user customer) and involve in selling process and marketing more than other groups. Therefore, this group evaluates that SM should be shared and transferred within the supply chain more than CC. Thus, the relative importance weights of SM are higher than that of CC.

The required knowledge for CSM process is in ordered as (1) Quality Control knowledge (QC) and (2) Internal and external coordination knowledge (IEC) since the quality is still the foundation that the customers require especially in the group of manufacturing. Customer services will rely more on quality. Thus, QC should be shared and transferred within the supply chain more than IEC.

Table 4. 34 Weight of sub-criteria3 (Ideal for KS)

KS (0.568)																			
F2S (0.266)					S2F (0.226)					F2C (0.206)					C2F (0.302)				
		Sub-criteria3					Sub-criteria3					Sub-criteria3					Sub-criteria3		
		Relative importance weights		Rank			Relative importance weights		Rank			Relative importance weights		Rank			Relative importance weights		Rank
CRM	(0.092)	CC	0.413	2	CRM	(0.096)	CC	0.402	2	CRM	(0.120)	CC	0.430	2	CRM	(0.120)	CC	0.413	2
		SM	0.587	1			SM	0.598	1			SM	0.570	1			SM	0.587	1
CSM	(0.107)	IEC	0.341	2	CSM	(0.110)	IEC	0.342	2	CSM	(0.140)	IEC	0.354	2	CSM	(0.135)	IEC	0.346	2
		QC	0.659	1			QC	0.658	1			QC	0.646	1			QC	0.654	1
DM	(0.146)	DF	0.241	1	DM	(0.143)	DF	0.241	1	DM	(0.154)	DF	0.240	1	DM	(0.158)	DF	0.241	1
		CP	0.215	2			CP	0.223	2			CP	0.213	2			CP	0.216	2
		INM	0.153	5			INM	0.156	5			INM	0.155	5			INM	0.161	5
		MFS	0.185	4			MFS	0.184	4			MFS	0.187	4			MFS	0.185	4
		PPC	0.207	3			PPC	0.195	3			PPC	0.205	3			PPC	0.196	3
OF	(0.153)	INM	0.267	2	OF	(0.150)	INM	0.265	2	OF	(0.135)	INM	0.270	2	OF	(0.133)	INM	0.268	2
		DNP	0.180	4			DNP	0.179	4			DNP	0.180	4			DNP	0.182	4
		DTP	0.313	1			DTP	0.312	1			DTP	0.308	1			DTP	0.311	1
		WM	0.241	3			WM	0.244	3			WM	0.242	3			WM	0.239	3
MFM	(0.163)	QC	0.255	1	MFM	(0.157)	QC	0.265	1	MFM	(0.133)	QC	0.263	1	MFM	(0.124)	QC	0.264	1
		INM	0.115	6			INM	0.110	6			INM	0.113	6			INM	0.113	6
		MFS	0.165	3			MFS	0.159	3			MFS	0.158	3			MFS	0.155	3
		PPC	0.211	2			PPC	0.208	2			PPC	0.211	2			PPC	0.214	2
		OTM	0.130	4			OTM	0.131	4			OTM	0.131	4			OTM	0.130	4
		SSD	0.124	5			SSD	0.127	5			SSD	0.123	5			SSD	0.124	5
SRM	(0.104)	SS	0.360	1	SRM	(0.107)	SS	0.366	1	SRM	(0.077)	SS	0.364	1	SRM	(0.076)	SS	0.366	1
		SSD	0.331	2			SSD	0.324	2			SSD	0.326	2			SSD	0.328	2
		PM	0.310	3			PM	0.309	3			PM	0.310	3			PM	0.307	3
PDC	(0.148)	SM	0.218	4	PDC	(0.146)	SM	0.213	4	PDC	(0.156)	SM	0.215	4	PDC	(0.170)	SM	0.214	4
		SSD	0.252	2			SSD	0.250	2			SSD	0.249	2			SSD	0.255	2
		PDD	0.299	1			PDD	0.298	1			PDD	0.299	1			PDD	0.300	1
		PKD	0.231	3			PKD	0.239	3			PKD	0.237	3			PKD	0.231	3
RM	(0.087)	DTP	0.582	1	RM	(0.091)	DTP	0.573	1	RM	(0.085)	DTP	0.583	1	RM	(0.084)	DTP	0.571	1
		DRM	0.418	2			DRM	0.427	2			DRM	0.417	2			DRM	0.429	2

Remark: Symbols of sub-criteria3 reference from Table4.8

Table 4. 35 Weight of sub-criteria3 (Ideal for KT)

KT (0.432)																			
F2S (0.267)					S2F (0.219)					F2C (0.206)					C2F (0.308)				
		Sub-criteria3					Sub-criteria3					Sub-criteria3					Sub-criteria3		
		Relative importance weights		Rank			Relative importance weights		Rank			Relative importance weights		Rank			Relative importance weights		Rank
CRM	(0.092)	CC	0.408	2	CRM	(0.093)	CC	0.408	2	CRM	(0.121)	CC	0.431	2	CRM	(0.120)	CC	0.413	2
		SM	0.592	1			SM	0.592	1			SM	0.569	1			SM	0.587	1
CSM	(0.107)	IEC	0.342	2	CSM	(0.111)	IEC	0.356	2	CSM	(0.139)	IEC	0.354	2	CSM	(0.136)	IEC	0.346	2
		QC	0.658	1			QC	0.644	1			QC	0.646	1			QC	0.654	1
DM	(0.146)	DF	0.244	1	DM	(0.135)	DF	0.241	1	DM	(0.154)	DF	0.240	1	DM	(0.156)	DF	0.249	1
		CP	0.216	2			CP	0.218	2			CP	0.217	2			CP	0.213	2
		INM	0.157	5			INM	0.158	5			INM	0.161	5			INM	0.154	5
		MFS	0.184	4			MFS	0.186	4			MFS	0.184	4			MFS	0.185	4
		PPC	0.200	3			PPC	0.197	3			PPC	0.198	3			PPC	0.200	3
OF	(0.154)	INM	0.260	2	OF	(0.153)	INM	0.257	2	OF	(0.136)	INM	0.271	2	OF	(0.133)	INM	0.258	2
		DNP	0.180	4			DNP	0.188	4			DNP	0.180	4			DNP	0.180	4
		DTP	0.310	1			DTP	0.315	1			DTP	0.308	1			DTP	0.320	1
		WM	0.249	3			WM	0.240	3			WM	0.241	3			WM	0.242	3
MFM	(0.162)	QC	0.261	1	MFM	(0.162)	QC	0.259	1	MFM	(0.131)	QC	0.265	1	MFM	(0.124)	QC	0.263	1
		INM	0.109	6			INM	0.115	6			INM	0.114	6			INM	0.113	6
		MFS	0.161	3			MFS	0.161	3			MFS	0.157	3			MFS	0.155	3
		PPC	0.209	2			PPC	0.209	2			PPC	0.210	2			PPC	0.214	2
		OTM	0.134	4			OTM	0.130	4			OTM	0.131	4			OTM	0.130	4
		SSD	0.125	5			SSD	0.126	5			SSD	0.123	5			SSD	0.124	5
SRM	(0.104)	SS	0.360	1	SRM	(0.107)	SS	0.366	1	SRM	(0.076)	SS	0.364	1	SRM	(0.075)	SS	0.366	1
		SSD	0.331	2			SSD	0.324	2			SSD	0.326	2			SSD	0.326	2
		PM	0.309	3			PM	0.309	3			PM	0.310	3			PM	0.308	3
PDC	(0.150)	SM	0.213	4	PDC	(0.150)	SM	0.213	4	PDC	(0.160)	SM	0.215	4	PDC	(0.172)	SM	0.214	4
		SSD	0.257	2			SSD	0.250	2			SSD	0.249	2			SSD	0.255	2
		PDD	0.297	1			PDD	0.298	1			PDD	0.299	1			PDD	0.298	1
		PKD	0.232	3			PKD	0.239	3			PKD	0.237	3			PKD	0.233	3
RM	(0.085)	DTP	0.583	1	RM	(0.089)	DTP	0.581	1	RM	(0.083)	DTP	0.583	1	RM	(0.083)	DTP	0.571	1
		DRM	0.417	2			DRM	0.419	2			DRM	0.417	2			DRM	0.429	2

Remark: Symbols of sub-criteria3 reference from Table4.8

The required knowledge for DM process is in ordered as (1) Demand forecasting knowledge (DF) (2) Capacity planning knowledge (CP) (3) Production and planning control knowledge (PPC) (4) Manufacturing strategy knowledge (MFS) and (5) Inventory management knowledge (INM) since this process involves balancing between customer needs and manufacturing competency for responsiveness of customer needs. Hence, the experts evaluate DF and CP to be the first two knowledge items to be shared and transferred within the supply chain for efficient forecasting and capacity planning. Moreover, PPC and MFS are in the next order since, other than capacity planning, the supply side also involve other planning such as aggregate plan or rough-cut capacity plan. In many cases, both demand side and supply side will fluctuate. Thus, MFS such as postponement, lean, agile becomes essential. For INM, it is the knowledge related to production planning, and effective inventory management will be able to well answer the customer needs with efficiency.

The required knowledge for OF process is in ordered as (1) Delivery and Transportation planning knowledge (DTP) (2) Inventory management knowledge (INM) (3) Warehouse management knowledge (WM) and (4) Distribution network planning knowledge (DNP). Actually, this process relates to the distribution network designing and delivery planning. Thus, the first two issues to consider are DNP and DTP. However, we found that DTP has the evaluation result as number one, while DNP has the evaluation result as number four (ranked the last in group) since DNP involves the network evaluation including the following aspects - which plants produce what products; where warehouses, plants, and suppliers are located– to reach effective order fulfillment. Currently, manufacturing plants, supplier plant, distribution center or warehouse have precise location. Moreover, each plant is already determined of what to produce. Hence, DNP is not applied as frequently as DTP while the DTP must be applied more because the delivery to fulfill customer requirement can occur all the time. Therefore, this knowledge should be the first shared and transferred within the supply chain. The next knowledge is INM and WM since the order fulfillment requires knowledge and understanding of inventory management in order to recognize the proper level for the replenishment system.

Additionally, there must be warehouse management to cover storage, picking, and any document issuing.

The required knowledge for MFM process is in ordered as (1) Quality control knowledge (QC) (2) Production and planning control knowledge (PPC) (3) Manufacturing strategy knowledge (MFS) (4) Optimization knowledge (OTM) (5) (Supplier selection and development knowledge) SSD and (6) Inventory management knowledge (INM). As we mentioned above, for the manufacturing group, customer services will heavily rely on quality, in which the manufacturing is the process directly involved the quality control. Thus, this knowledge should be the first shared and transferred within the supply chain. Then, the knowledge directly related to the manufacturing including PPC, MFS, and OTM will be considered important respectively. Furthermore, for some cases of personnel, who perform in the manufacturing, there requires the selection and the development of supplier so that the supplier could produce materials with the target properties and quality to the manufacturing process. Thus, SSD becomes important as the next knowledge. Inventory management is the supporting step for manufacturing, thus its importance comes in as the last item in this group.

The required knowledge for SRM process is in ordered as (1) Sourcing Strategies knowledge (SS) (2) Supplier selection and development knowledge (SSD) (3) Purchasing Management knowledge (PM) due to the suitability of sourcing strategy for each group, leading to the maximum benefits for the organization in many aspects such as budget and sourcing service capital. Especially, today world is the time for competition and high dynamics for supply chain. Thus, SS should be the first shared and transferred within the supply chain. SSD will be next since its process could enhance the effective manufacturing process and quality as mentioned above. Hence, the experts agree that it is more important than PM, thus PM should be the last one in this group.

The required knowledge for PDC process is in ordered as (1) Product design knowledge (PDD) (2) Supplier selection and development knowledge (SSD) (3) Packaging design knowledge (PKD) (4) Sale and Marketing knowledge (SM) since the product designing is the main part of this process. The knowledge related to designing that is outside the scope of requirement or specifications such as product designing technique and method to correspond to various factors such as materials and manufacturing process should be shared and transferred within the supply chain at first. As mentioned above, in many cases the suppliers and the organization will collaborate on product designing, so SSD becomes crucial for personnel responsible for this designing process in the next order. PKD is the next item in the agenda since in many cases packaging will be designed in this process, but some will not, since the determination of specification of packaging has been completed. Lastly, SM is the last item of the group. As discussed, research focuses on 1^{st} tier suppliers, 2^{nd} tire suppliers, and assembly is considered as the manufacturing group. Hence, the customers in each stakeholder of the supply chain are quite clear. Therefore, for PDC process, this knowledge is ranked last when compared to other knowledge in the group.

The required knowledge for RM process is in ordered (1) Delivery and Transportation planning knowledge (DTP) and (2) Disposition rule and method knowledge (DRM) since if we can manage effective reverse transportations, we can save the transportation cost. Thus, DTP should be shared and transferred within the supply chain in the first order when compared to DRM.

Overall, for the results from evaluation for the dyadic level of external integration including F2S, S2F, F2C, and C2F of both KS and KT, the experts give the explanation that the relative importance weights of the knowledge related to eight SCM processes since the last topic (section 4.2.4) reveals that each dyad of external integration recognizes the importance of the knowledge related to which SCM process. Therefore, the required knowledge for each SCM process is the sub knowledge in each group, resulting in the same trend for evaluation for the dyadic level of external integration.

4.2.6 The relative importance weights of the fifth hierarchy (alternative)

The fifth hierarchy (alternative) was constructed to provide the relative importance weights of required knowledge for each SCM process that effect to each attribute of supply chain performance. Therefore, a result was evaluated as the following step;

Step 1: The dimensions of the fifth hierarchy (alternative) were the attributes of supply chain performance including costs, reliability and responsiveness as shown in Figure 4.2

Step 2: An expert judgment based on the TFN linguistic scale, and then the pair-wise comparison matrices of dimensions would be obtained. The TFN linguistic scale was transferred to the corresponding fuzzy numbers as defined in Table 2.5. Then, an example of fuzzy pair-wise comparison matrix for alternative focusing on CC in CRM is shown in Table 4.36.

Table 4. 36 An example of fuzzy pair-wise comparison of alternative (KS: F2S: CRM: CC)

Alternative	Fuzzy pair-wise comparison		
	Costs	Reliability	Responsiveness
Costs	1,1,1	2,3,4	1,1,1
Reliability	1/4,1/3,1/2	1,1,1	1/4,1/3,1/2
Responsiveness	1,1,1	2,3,4	1,1,1

Step 3: Consistency ratio (CR) was estimated via equation 9-11 (section 2.4 and Appendix C), thus the matrix of an expert was accepted because CR < 0. 1.

Step 4: The fuzzy weights applying the normalization of the geometric mean (NGM) method were calculated by equation 7; an example focusing on CC in CRM is shown in Table 4.37 and Table 4.38.

Table 4. 37 An example of geometric mean of alternative (KS: F2S: CRM: CC)

Alternative	a_i	
Costs	$a_1 = [a_{11} \otimes a_{12} \otimes a_{13}]^{1/3} =$ $(1x2x1)^{1/3},(1x3x1)^{1/3},(1x4x1)^{1/3}$	1.26,1.44,1.59
Reliability	$a_2 = [a_{21} \otimes a_{22} \otimes a_{23}]^{1/3} =$ $(1/4x1x1/4)^{1/3},(1/3x1x1/3)^{1/3},(1/2x1x1/2)^{1/3}$	0.40,0.48,0.63
Responsiveness	$a_3 = [a_{31} \otimes a_{32} \otimes a_{33}]^{1/3} =$ $(1x2x1)^{1/3},(1x3x1)^{1/3},(1x4x1)^{1/3}$	1.26,1.44,1.59
Total		**2.92,3.36,3.81**

Table 4. 38 An example of fuzzy weight of alternative (KS: F2S: CRM: CC)

Alternative	ω_i	
Costs	$\omega_1 = a_1 / \sum_{i=1}^{3} a_i$ = 1.26/3.81 , 1.44/3.36 , 1.59/2.92	0.33, 0.43, 0.54
Reliability	$\omega_2 = a_2 / \sum_{i=1}^{3} a_i$ = 0.40/3.81 , 0.48/3.36 , 0.63/2.92	0.10, 0.14, 0.22
Responsiveness	$\omega_3 = a_3 / \sum_{i=1}^{3} a_i$ = 1.26/3.81 , 1.44/3.36 , 1.59/2.92	0.33, 0.43, 0.54

Step 5: The defuzzy weights were calculated by equation 8; an example focusing on KS: F2S: CRM: CC is shown in Table 4.39.

Table 4. 39 An example example of weight of alternative (KS: F2S: CRM: CC)

Alternative	Defuzzy ω_i	ω_i (Crip)
Costs	ω_1 = (0.33+(4x0.43)+0.54)/6	0.43
Reliability	ω_2 = (0.1+(4x0.14)+0.22)/6	0.14
Responsiveness	ω_3 = (0.33+(4x0.43)+0.54)/6	0.43

According to the expert group with sixty representatives about the relative importance weights of dimension, the same procedure for all experts' judgments and all required knowledge for each SCM process (for all dyads of supply chain integration on both KS and KT) were repeated as following step 2 to step 5.

Unlike the first and the second hierarchy, for the fifth hierarchy; the current part could not be evaluated due to currently the sharing and transferring of knowledge between dyadic levels of supply chain integration involving in SCM process still not complete for all required knowledge. Therefore, the analysis focused only on ideal part. The weights and rank of alternative for all experts are presented in Table 4.40 to Table 4.43.

Table 4. 40 Weight of alternative (Ideal-KS)

KS (0.568)																							
F2S (0.266)						S2F (0.226)						F2C (0.206)						C2F (0.302)					
			Alternative Relative importance weights						Alternative Relative importance weights						Alternative Relative importance weights						Alternative Relative importance weights		
			Costs	Rel.	Res.				Costs	Rel.	Res.				Costs	Rel.	Res.				Costs	Rel.	Res.
CRM	CC	0.413	0.282	0.315	0.403	CRM	CC	0.402	0.281	0.317	0.402	CRM	CC	0.430	0.283	0.316	0.401	CRM	CC	0.413	0.283	0.316	0.401
(0.092)	SM	0.587	0.228	0.353	0.419	(0.096)	SM	0.598	0.226	0.348	0.427	(0.120)	SM	0.570	0.226	0.348	0.427	(0.120)	SM	0.587	0.226	0.348	0.427
CSM	IEC	0.341	0.183	0.358	0.459	CSM	IEC	0.342	0.184	0.356	0.459	CSM	IEC	0.354	0.184	0.356	0.459	CSM	IEC	0.346	0.184	0.356	0.459
(0.107)	QC	0.659	0.253	0.417	0.331	(0.110)	QC	0.658	0.251	0.415	0.333	(0.140)	QC	0.646	0.251	0.415	0.333	(0.135)	QC	0.654	0.251	0.415	0.333
DM	DF	0.241	0.305	0.229	0.466	DM	DF	0.241	0.310	0.220	0.470	DM	DF	0.240	0.310	0.220	0.470	DM	DF	0.241	0.310	0.220	0.470
(0.146)	CP	0.215	0.337	0.247	0.416	(0.143)	CP	0.223	0.336	0.251	0.413	(0.154)	CP	0.213	0.336	0.251	0.413	(0.158)	CP	0.216	0.336	0.251	0.413
	INM	0.153	0.413	0.250	0.337		INM	0.156	0.413	0.250	0.337		INM	0.155	0.413	0.250	0.337		INM	0.161	0.413	0.250	0.337
	MFS	0.185	0.408	0.242	0.351		MFS	0.184	0.420	0.241	0.339		MFS	0.187	0.420	0.241	0.339		MFS	0.185	0.420	0.241	0.339
	PPC	0.207	0.407	0.245	0.348		PPC	0.195	0.414	0.245	0.341		PPC	0.205	0.414	0.245	0.341		PPC	0.196	0.414	0.245	0.341
OF	INM	0.267	0.402	0.253	0.344	OF	INM	0.265	0.401	0.255	0.344	OF	INM	0.270	0.401	0.255	0.344	OF	INM	0.268	0.401	0.255	0.344
(0.153)	DNP	0.180	0.421	0.229	0.349	(0.150)	DNP	0.179	0.421	0.229	0.349	(0.135)	DNP	0.180	0.421	0.229	0.349	(0.133)	DNP	0.182	0.421	0.229	0.349
	DTP	0.313	0.399	0.240	0.361		DTP	0.312	0.396	0.241	0.362		DTP	0.308	0.396	0.241	0.362		DTP	0.311	0.396	0.241	0.362
	WM	0.241	0.449	0.234	0.317		WM	0.244	0.441	0.240	0.319		WM	0.242	0.441	0.240	0.319		WM	0.239	0.441	0.240	0.319
MFM	QC	0.255	0.307	0.370	0.323	MFM	QC	0.265	0.290	0.376	0.334	MFM	QC	0.263	0.290	0.376	0.334	MFM	QC	0.264	0.290	0.376	0.334
(0.163)	INM	0.115	0.454	0.242	0.454	(0.157)	INM	0.110	0.454	0.242	0.454	(0.133)	INM	0.113	0.454	0.242	0.454	(0.124)	INM	0.113	0.454	0.242	0.454
	MFS	0.165	0.448	0.239	0.313		MFS	0.159	0.460	0.239	0.302		MFS	0.158	0.460	0.239	0.302		MFS	0.155	0.460	0.239	0.302
	PPC	0.211	0.420	0.258	0.322		PPC	0.208	0.427	0.258	0.315		PPC	0.211	0.427	0.258	0.315		PPC	0.214	0.427	0.258	0.315
	OT	0.130	0.445	0.243	0.313		OTM	0.131	0.445	0.245	0.310		OTM	0.131	0.445	0.245	0.310		OTM	0.130	0.445	0.245	0.310
	SSD	0.124	0.400	0.269	0.331		SSD	0.127	0.418	0.260	0.323		SSD	0.123	0.418	0.260	0.323		SSD	0.124	0.418	0.260	0.323
SRM	SS	0.360	0.440	0.257	0.303	SRM	SS	0.366	0.438	0.259	0.303	SRM	SS	0.364	0.438	0.259	0.303	SRM	SS	0.366	0.438	0.259	0.303
(0.104)	SSD	0.331	0.398	0.280	0.323	(0.107)	SSD	0.324	0.416	0.269	0.315	(0.077)	SSD	0.326	0.416	0.269	0.315	(0.076)	SSD	0.328	0.416	0.269	0.315
	PM	0.310	0.453	0.238	0.309		PM	0.309	0.450	0.238	0.311		PM	0.310	0.450	0.238	0.311		PM	0.307	0.450	0.238	0.311
PDC	SM	0.218	0.313	0.331	0.357	PDC	SM	0.213	0.311	0.325	0.364	PDC	SM	0.215	0.311	0.325	0.364	PDC	SM	0.214	0.311	0.325	0.364
(0.148)	SSD	0.252	0.437	0.251	0.313	(0.146)	SSD	0.250	0.438	0.250	0.311	(0.156)	SSD	0.249	0.438	0.250	0.311	(0.170)	SSD	0.255	0.438	0.250	0.311
	PDD	0.299	0.419	0.271	0.310		PDD	0.298	0.409	0.269	0.322		PDD	0.299	0.409	0.269	0.322		PDD	0.300	0.409	0.269	0.322
	PKD	0.231	0.414	0.280	0.306		PKD	0.239	0.411	0.282	0.307		PKD	0.237	0.411	0.282	0.307		PKD	0.231	0.411	0.282	0.307
RM	DTP	0.582	0.407	0.245	0.348	RM	DTP	0.573	0.405	0.246	0.350	RM	DTP	0.583	0.405	0.246	0.350	RM	DTP	0.571	0.405	0.246	0.350
(0.087)	DRM	0.418	0.273	0.340	0.387	(0.091)	DRM	0.427	0.290	0.330	0.380	(0.085)	DRM	0.417	0.290	0.330	0.380	(0.084)	DRM	0.429	0.290	0.330	0.380

Remark: Symbols of sub-criteria3 reference from Table 4.8, and “Rel” is “Reliability”, “Res.” Is “Responsiveness”

Table 4. 41 Weight of alternative (Ideal-KT)

KT (0.432)																							
F2S (0.267)						S2F (0.219)						F2C (0.206)						C2F (0.308)					
			Alternative Relative importance weights						Alternative Relative importance weights						Alternative Relative importance weights						Alternative Relative importance weights		
			Costs	Rel.	Res.				Costs	Rel.	Res.				Costs	Rel.	Res.				Costs	Rel.	Res.
CRM	CC	0.408	0.281	0.317	0.402	CRM	CC	0.408	0.281	0.317	0.402	CRM	CC	0.431	0.283	0.316	0.401	CRM	CC	0.413	0.283	0.316	0.401
(0.092)	SM	0.592	0.226	0.348	0.427	(0.093)	SM	0.592	0.226	0.348	0.427	(0.121)	SM	0.569	0.226	0.348	0.427	(0.120)	SM	0.587	0.226	0.348	0.427
CSM	IEC	0.342	0.184	0.356	0.459	CSM	IEC	0.356	0.184	0.356	0.459	CSM	IEC	0.354	0.184	0.356	0.459	CSM	IEC	0.346	0.184	0.356	0.459
(0.107)	QC	0.658	0.251	0.415	0.333	(0.111)	QC	0.644	0.251	0.415	0.333	(0.139)	QC	0.646	0.251	0.415	0.333	(0.137)	QC	0.654	0.251	0.415	0.333
DM	DF	0.244	0.314	0.225	0.461	DM	DF	0.241	0.310	0.220	0.470	DM	DF	0.240	0.310	0.220	0.470	DM	DF	0.249	0.310	0.220	0.470
(0.146)	CP	0.216	0.336	0.251	0.413	(0.135)	CP	0.218	0.336	0.251	0.413	(0.154)	CP	0.217	0.336	0.251	0.413	(0.156)	CP	0.213	0.336	0.251	0.413
	INM	0.157	0.413	0.250	0.337		INM	0.158	0.413	0.250	0.337		INM	0.161	0.413	0.250	0.337		INM	0.154	0.413	0.250	0.337
	MFS	0.184	0.420	0.241	0.339		MFS	0.186	0.420	0.241	0.339		MFS	0.184	0.420	0.241	0.339		MFS	0.185	0.420	0.241	0.339
	PPC	0.200	0.414	0.245	0.341		PPC	0.197	0.414	0.245	0.341		PPC	0.198	0.414	0.245	0.341		PPC	0.200	0.414	0.245	0.341
OF	INM	0.260	0.401	0.255	0.344	OF	INM	0.257	0.401	0.255	0.344	OF	INM	0.271	0.401	0.255	0.344	OF	INM	0.258	0.401	0.255	0.344
(0.154)	DNP	0.180	0.421	0.229	0.349	(0.153)	DNP	0.188	0.421	0.229	0.349	(0.136)	DNP	0.180	0.421	0.229	0.349	(0.133)	DNP	0.180	0.421	0.229	0.349
	DTP	0.310	0.396	0.241	0.362		DTP	0.315	0.396	0.241	0.362		DTP	0.308	0.396	0.241	0.362		DTP	0.320	0.396	0.241	0.362
	WM	0.249	0.441	0.240	0.319		WM	0.240	0.441	0.240	0.319		WM	0.241	0.441	0.240	0.319		WM	0.242	0.441	0.240	0.319
MFM	QC	0.261	0.290	0.376	0.334	MFM	QC	0.259	0.290	0.376	0.334	MFM	QC	0.265	0.290	0.376	0.334	MFM	QC	0.263	0.290	0.376	0.334
(0.162)	INM	0.109	0.454	0.242	0.454	(0.162)	INM	0.115	0.454	0.242	0.454	(0.131)	INM	0.114	0.454	0.242	0.454	(0.124)	INM	0.113	0.454	0.242	0.454
	MFS	0.161	0.460	0.239	0.302		MFS	0.161	0.460	0.239	0.302		MFS	0.157	0.460	0.239	0.302		MFS	0.155	0.460	0.239	0.302
	PPC	0.209	0.427	0.258	0.315		PPC	0.209	0.427	0.258	0.315		PPC	0.210	0.427	0.258	0.315		PPC	0.214	0.427	0.258	0.315
	OTM	0.134	0.445	0.245	0.310		OTM	0.130	0.445	0.245	0.310		OTM	0.131	0.445	0.245	0.310		OTM	0.130	0.445	0.245	0.310
	SSD	0.125	0.418	0.260	0.323		SSD	0.126	0.418	0.260	0.323		SSD	0.123	0.418	0.260	0.323		SSD	0.124	0.418	0.260	0.323
SRM	SS	0.360	0.438	0.259	0.303	SRM	SS	0.366	0.438	0.259	0.303	SRM	SS	0.364	0.438	0.259	0.303	SRM	SS	0.366	0.438	0.259	0.303
(0.104)	SSD	0.331	0.416	0.269	0.315	(0.107)	SSD	0.324	0.416	0.269	0.315	(0.076)	SSD	0.326	0.416	0.269	0.315	(0.075)	SSD	0.326	0.416	0.269	0.315
	PM	0.309	0.450	0.238	0.311		PM	0.309	0.450	0.238	0.311		PM	0.310	0.450	0.238	0.311		PM	0.308	0.450	0.238	0.311
PDC	SM	0.213	0.311	0.325	0.364	PDC	SM	0.213	0.311	0.325	0.364	PDC	SM	0.215	0.311	0.325	0.364	PDC	SM	0.214	0.311	0.325	0.364
(0.150)	SSD	0.257	0.438	0.250	0.311	(0.150)	SSD	0.250	0.438	0.250	0.311	(0.160)	SSD	0.249	0.438	0.250	0.311	(0.172)	SSD	0.255	0.438	0.250	0.311
	PDD	0.297	0.409	0.269	0.322		PDD	0.298	0.409	0.269	0.322		PDD	0.299	0.409	0.269	0.322		PDD	0.298	0.409	0.269	0.322
	PKD	0.232	0.411	0.282	0.307		PKD	0.239	0.411	0.282	0.307		PKD	0.237	0.411	0.282	0.307		PKD	0.233	0.411	0.282	0.307
RM	DTP	0.583	0.405	0.246	0.350	RM	DTP	0.581	0.405	0.246	0.350	RM	DTP	0.583	0.405	0.246	0.350	RM	DTP	0.571	0.405	0.246	0.350
(0.085)	DRM	0.417	0.290	0.330	0.380	(0.089)	DRM	0.419	0.290	0.330	0.380	(0.083)	DRM	0.417	0.290	0.330	0.380	(0.083)	DRM	0.429	0.290	0.330	0.380

Remark: Symbols of sub-criteria3 reference from Table 4.8, and “Rel” is “Reliability”, “Res.” Is “Responsiveness”

Table 4. 42 Rank of alternative (Ideal-KS)

KS (0.568)																							
F2S (0.266)						S2F (0.226)						F2C (0.206)						C2F (0.302)					
			Alternative						Alternative						Alternative						Alternative		
			Rank						Rank						Rank						Rank		
			Costs	Rel.	Res.				Costs	Rel.	Res.				Costs	Rel.	Res.				Costs	Rel.	Res.
CRM	CC	0.413	3	2	1	CRM	CC	0.402	3	2	1	CRM	CC	0.430	3	2	1	CRM	CC	0.413	3	2	1
(0.092)	SM	0.587	3	2	1	(0.096)	SM	0.598	3	2	1	(0.120)	SM	0.570	3	2	1	(0.120)	SM	0.587	3	2	1
CSM	IEC	0.341	3	2	1	CSM	IEC	0.342	3	2	1	CSM	IEC	0.354	3	2	1	CSM	IEC	0.346	3	2	1
(0.107)	QC	0.659	3	1	2	(0.110)	QC	0.658	3	1	2	(0.140)	QC	0.646	3	1	2	(0.135)	QC	0.654	3	1	2
DM	DF	0.241	2	3	1	DM	DF	0.241	2	3	1	DM	DF	0.240	2	3	1	DM	DF	0.241	2	3	1
(0.146)	CP	0.215	2	3	1	(0.143)	CP	0.223	2	3	1	(0.154)	CP	0.213	2	3	1	(0.158)	CP	0.216	2	3	1
	INM	0.153	1	3	2		INM	0.156	1	3	2		INM	0.155	1	3	2		INM	0.161	1	3	2
	MFS	0.185	1	3	2		MFS	0.184	1	3	2		MFS	0.187	1	3	2		MFS	0.185	1	3	2
	PPC	0.207	1	3	2		PPC	0.195	1	3	2		PPC	0.205	1	3	2		PPC	0.196	1	3	2
OF	INM	0.267	1	3	2	OF	INM	0.265	1	3	2	OF	INM	0.270	1	3	2	OF	INM	0.268	1	3	2
(0.153)	DNP	0.180	1	3	2	(0.150)	DNP	0.179	1	3	2	(0.135)	DNP	0.180	1	3	2	(0.133)	DNP	0.182	1	3	2
	DTP	0.313	1	3	2		DTP	0.312	1	3	2		DTP	0.308	1	3	2		DTP	0.311	1	3	2
	WM	0.241	1	3	2		WM	0.244	1	3	2		WM	0.242	1	3	2		WM	0.239	1	3	2
MFM	QC	0.255	3	1	2	MFM	QC	0.265	3	1	2	MFM	QC	0.263	3	1	2	MFM	QC	0.264	3	1	2
(0.163)	INM	0.115	1	3	2	(0.157)	INM	0.110	1	3	2	(0.133)	INM	0.113	1	3	2	(0.124)	INM	0.113	1	3	2
	MFS	0.165	1	3	2		MFS	0.159	1	3	2		MFS	0.158	1	3	2		MFS	0.155	1	3	2
	PPC	0.211	1	3	2		PPC	0.208	1	3	2		PPC	0.211	1	3	2		PPC	0.214	1	3	2
	OT	0.130	1	3	2		OTM	0.131	1	3	2		OTM	0.131	1	3	2		OTM	0.130	1	3	2
	SSD	0.124	1	3	2		SSD	0.127	1	3	2		SSD	0.123	1	3	2		SSD	0.124	1	3	2
SRM	SS	0.360	1	3	2	SRM	SS	0.366	1	3	2	SRM	SS	0.364	1	3	2	SRM	SS	0.366	1	3	2
(0.104)	SSD	0.331	1	3	2	(0.107)	SSD	0.324	1	3	2	(0.077)	SSD	0.326	1	3	2	(0.076)	SSD	0.328	1	3	2
	PM	0.310	1	3	2		PM	0.309	1	3	2		PM	0.310	1	3	2		PM	0.307	1	3	2
PDC	SM	0.218	3	2	1	PDC	SM	0.213	3	2	1	PDC	SM	0.215	3	2	1	PDC	SM	0.214	3	2	1
(0.148)	SSD	0.252	1	3	2	(0.146)	SSD	0.250	1	3	2	(0.156)	SSD	0.249	1	3	2	(0.170)	SSD	0.255	1	3	2
	PDD	0.299	1	3	2		PDD	0.298	1	3	2		PDD	0.299	1	3	2		PDD	0.300	1	3	2
	PKD	0.231	1	3	2		PKD	0.239	1	3	2		PKD	0.237	1	3	2		PKD	0.231	1	3	2
RM	DTP	0.582	1	3	2	RM	DTP	0.573	1	3	2	RM	DTP	0.583	1	3	2	RM	DTP	0.571	1	3	2
(0.087)	DRM	0.418	3	2	1	(0.091)	DRM	0.427	3	2	1	(0.085)	DRM	0.417	3	2	1	(0.084)	DRM	0.429	3	2	1

Remark: Symbols of sub-criteria3 reference from Table 4.8, and “Rel” is “Reliability”, “Res.” Is “Responsiveness”

Table 4. 43 Rank of alternative (Ideal-KT)

KT (0.432)																							
F2S (0.267)						S2F (0.219)						F2C (0.206)						C2F (0.308)					
			Alternative						Alternative						Alternative						Alternative		
			Rank						Rank						Rank						Rank		
			Costs	Rel.	Res.				Costs	Rel.	Res.				Costs	Rel.	Res.				Costs	Rel.	Res.
CRM	CC	0.408	3	2	1	CRM	CC	0.408	3	2	1	CRM	CC	0.431	3	2	1	CRM	CC	0.413	3	2	1
(0.092)	SM	0.592	3	2	1	(0.093)	SM	0.592	3	2	1	(0.121)	SM	0.569	3	2	1	(0.120)	SM	0.587	3	2	1
CSM	IEC	0.342	3	2	1	CSM	IEC	0.356	3	2	1	CSM	IEC	0.354	3	2	1	CSM	IEC	0.346	3	2	1
(0.107)	QC	0.658	3	1	2	(0.111)	QC	0.644	3	1	2	(0.139)	QC	0.646	3	1	2	(0.137)	QC	0.654	3	1	2
DM	DF	0.244	2	3	1	DM	DF	0.241	2	3	1	DM	DF	0.240	2	3	1	DM	DF	0.249	2	3	1
(0.146)	CP	0.216	2	3	1	(0.135)	CP	0.218	2	3	1	(0.154)	CP	0.217	2	3	1	(0.156)	CP	0.213	2	3	1
	INM	0.157	1	3	2		INM	0.158	1	3	2		INM	0.161	1	3	2		INM	0.154	1	3	2
	MFS	0.184	1	3	2		MFS	0.186	1	3	2		MFS	0.184	1	3	2		MFS	0.185	1	3	2
	PPC	0.200	1	3	2		PPC	0.197	1	3	2		PPC	0.198	1	3	2		PPC	0.200	1	3	2
OF	INM	0.260	1	3	2	OF	INM	0.257	1	3	2	OF	INM	0.271	1	3	2	OF	INM	0.258	1	3	2
(0.154)	DNP	0.180	1	3	2	(0.153)	DNP	0.188	1	3	2	(0.136)	DNP	0.180	1	3	2	(0.133)	DNP	0.180	1	3	2
	DTP	0.310	1	3	2		DTP	0.315	1	3	2		DTP	0.308	1	3	2		DTP	0.320	1	3	2
	WM	0.249	1	3	2		WM	0.240	1	3	2		WM	0.241	1	3	2		WM	0.242	1	3	2
MFM	QC	0.261	3	1	2	MFM	QC	0.259	3	1	2	MFM	QC	0.265	3	1	2	MFM	QC	0.263	3	1	2
(0.162)	INM	0.109	1	3	2	(0.162)	INM	0.115	1	3	2	(0.131)	INM	0.114	1	3	2	(0.124)	INM	0.113	1	3	2
	MFS	0.161	1	3	2		MFS	0.161	1	3	2		MFS	0.157	1	3	2		MFS	0.155	1	3	2
	PPC	0.209	1	3	2		PPC	0.209	1	3	2		PPC	0.210	1	3	2		PPC	0.214	1	3	2
	OTM	0.134	1	3	2		OTM	0.130	1	3	2		OTM	0.131	1	3	2		OTM	0.130	1	3	2
	SSD	0.125	1	3	2		SSD	0.126	1	3	2		SSD	0.123	1	3	2		SSD	0.124	1	3	2
SRM	SS	0.360	1	3	2	SRM	SS	0.366	1	3	2	SRM	SS	0.364	1	3	2	SRM	SS	0.366	1	3	2
(0.104)	SSD	0.331	1	3	2	(0.107)	SSD	0.324	1	3	2	(0.076)	SSD	0.326	1	3	2	(0.075)	SSD	0.326	1	3	2
	PM	0.309	1	3	2		PM	0.309	1	3	2		PM	0.310	1	3	2		PM	0.308	1	3	2
PDC	SM	0.213	3	2	1	PDC	SM	0.213	3	2	1	PDC	SM	0.215	3	2	1	PDC	SM	0.214	3	2	1
(0.150)	SSD	0.257	1	3	2	(0.150)	SSD	0.250	1	3	2	(0.160)	SSD	0.249	1	3	2	(0.172)	SSD	0.255	1	3	2
	PDD	0.297	1	3	2		PDD	0.298	1	3	2		PDD	0.299	1	3	2		PDD	0.298	1	3	2
	PKD	0.232	1	3	2		PKD	0.239	1	3	2		PKD	0.237	1	3	2		PKD	0.233	1	3	2
RM	DTP	0.583	1	3	2	RM	DTP	0.581	1	3	2	RM	DTP	0.583	1	3	2	RM	DTP	0.571	1	3	2
(0.085)	DRM	0.417	3	2	1	(0.089)	DRM	0.419	3	2	1	(0.083)	DRM	0.417	3	2	1	(0.083)	DRM	0.429	3	2	1

Remark: Symbols of sub-criteria3 reference from Table 4.8, and “Rel” is “Reliability”, “Res.” Is “Responsiveness”

The evaluation of the expected characteristics to enhance supply chain performance for the required knowledge for each SCM process that affects to each attribute of supply chain performance shows that each dyad including F2S, S2F, F2C, and C2F of both KS and KT has relative importance weights shown in Table 4.40 and Table 4.41 with the same trend for each dyad and can be divided into four groups as below.

Group No.1 is the knowledge that affects supply chain performance with the alternative ordering of (1) Costs (2) Responsiveness and (3) Reliability as the followings; the required knowledge for DM process including INM, MFS, PPC; the required knowledge for OF process including INM, DNP, DTP, WM; the required knowledge for MFM process including INM ,MFS ,PPC ,OTM ,SSD; the required knowledge for SRM process including SS, SSD, PM; the required knowledge for PDC process including SSD, PDD, PKD; and the required knowledge for RM process including DTP. The required knowledge in this group is useful for budget controlling such as inventory cost, manufacturing cost, transportation cost, etc.

Group no.2 is the knowledge that affects supply chain performance with the alternative ordering of (1) Responsiveness (2) Reliability and (3) Costs as the followings; the required knowledge for CRM process including CC, SM; the required knowledge for CSM process including IEC; the required knowledge for PDC process including SM; and the required knowledge for RM process including DRM because the required knowledge in this group concentrates on customer responding for coordinating, customer categorizing for fast services, and marketing for new products when customer needs change.

Group no.3 is the knowledge that affects supply chain performance with the alternative ordering of (1) Responsiveness (2) Costs and (3) Reliability as the followings; the required knowledge for DM process including DF, CP. We will see that the required knowledge in this group has effect to responsiveness as the first item as in group no. 2. However, here we have costs as the second item since effective demand forecasting and capacity planning are useful for cost control, while group no. 2 includes knowledge of regulation and product return protocols in which such knowledge affects to the creditability more than the cost aspect.

Group no.4 is the knowledge that affects supply chain performance with the alternative ordering of (1) Reliability (2) Responsiveness and (3) Costs as the followings; the required knowledge for CSM process and MFM process including QC. Quality can undoubtedly affect the creditability; hence, if the knowledge of quality management is promoted to be shared and be transferred within the supply chain, the creditability in product manufacturing will increase.

4.2.7 Global Weight

From the evaluation of the relative importance weights according to the research model shown in Figure 4.2, we found that result for each hierarchy is illustrated in section 4.2.2 to section 4.2.6 However, when one considers overall evaluation of all hierarchy or what we call "Global Weight", we will obtain the relative importance weights of the alternative of supply chain performance as stated in Table 4.44, calculated from the relative importance weights in each hierarchy as shown in Table 4.40 and Table 4.41. The calculation is displayed with the following sample.

The knowledge sharing of Customer categorizing knowledge (CC) is the knowledge related to CRM process from focal company to supplier (F2S) with effect to costs, reliability, and responsiveness as following.

Costs = KS x F2S x CRM x CC x Costs = 0.568 x 0.266 x 0.092 x 0.413 x 0.282
= 0.002

Reliability = KS x F2S x CRM x CC x Rel = 0.568 x 0.266 x 0.092 x 0.413 x 0.315
= 0.002

Responsiveness = KS x F2S x CRM x CC x Res = 0.568 x 0.266 x 0.092 x 0.413 x 0.403
= 0.002

For other required knowledge for each dyad of F2S, S2F, F2C, and C2F for both KS and KT, it can be calculated in similar fashion. By considering the total, the ranks are costs, responsiveness, and reliability with the relative importance weights to be 0.359, 0.354, and 0.287. In other words, the required knowledge sharing and transferring for SCM process under the context of external integration can affect supply chain performance in costs, responsiveness, and reliability, respectively. This could come from the fact that the electric and electronic industrial must encounters severe price competition and the industry has rapid technological change and mainly depends on the materials from foreign countries. Therefore, the knowledge that the experts assess to be shared and transferred within the supply chain under the context of external integration has become the knowledge to promote supply chain performance in costs and responsiveness with these two sides having very similar relative importance weights.

Table 4. 44 Global weight of alternative (Ideal)

KS (0.568)

F2S (0.266)			Alternative Relative importance weights		
			Costs	Rel.	Res.
CRM (0.092)	CC	0.413	0.002	0.002	0.002
	SM	0.587	0.002	0.003	0.003
CSM (0.107)	IEC	0.341	0.001	0.002	0.003
	QC	0.659	0.003	0.004	0.004
DM (0.146)	DF	0.241	0.002	0.001	0.002
	CP	0.215	0.002	0.001	0.002
	INM	0.153	0.001	0.001	0.001
	MFS	0.185	0.002	0.001	0.001
	PPC	0.207	0.002	0.001	0.002
OF (0.153)	INM	0.267	0.002	0.002	0.002
	DNP	0.180	0.002	0.001	0.001
	DTP	0.313	0.003	0.002	0.003
	WM	0.241	0.003	0.001	0.002
MFM (0.163)	QC	0.255	0.002	0.002	0.002
	INM	0.115	0.001	0.001	0.001
	MFS	0.165	0.002	0.001	0.001
	PPC	0.211	0.002	0.001	0.002
	OTM	0.130	0.001	0.001	0.001
	SSD	0.124	0.001	0.001	0.001
SRM (0.104)	SS	0.360	0.002	0.001	0.002
	SSD	0.331	0.002	0.001	0.002
	PM	0.310	0.002	0.001	0.002
PDC (0.148)	SM	0.218	0.002	0.002	0.002
	SSD	0.252	0.002	0.001	0.002
	PDD	0.299	0.003	0.002	0.002
	PKD	0.231	0.002	0.001	0.002
RM (0.087)	DTP	0.582	0.003	0.002	0.003
	DRM	0.418	0.002	0.002	0.002

S2F (0.226)			Alternative Relative importance weights		
			Costs	Rel.	Res.
CRM (0.096)	CC	0.402	0.001	0.002	0.002
	SM	0.598	0.002	0.003	0.003
CSM (0.110)	IEC	0.342	0.001	0.002	0.002
	QC	0.658	0.002	0.004	0.003
DM (0.143)	DF	0.241	0.001	0.001	0.002
	CP	0.223	0.001	0.001	0.002
	INM	0.156	0.001	0.001	0.001
	MFS	0.184	0.001	0.001	0.001
	PPC	0.195	0.001	0.001	0.001
OF (0.150)	INM	0.265	0.002	0.001	0.002
	DNP	0.179	0.001	0.001	0.001
	DTP	0.312	0.002	0.001	0.002
	WM	0.244	0.002	0.001	0.001
MFM (0.157)	QC	0.265	0.002	0.002	0.002
	INM	0.110	0.001	0.001	0.001
	MFS	0.159	0.001	0.001	0.001
	PPC	0.208	0.002	0.001	0.001
	OTM	0.131	0.001	0.001	0.001
	SSD	0.127	0.001	0.001	0.001
SRM (0.107)	SS	0.366	0.002	0.001	0.002
	SSD	0.324	0.002	0.001	0.001
	PM	0.309	0.002	0.001	0.001
PDC (0.146)	SM	0.213	0.001	0.001	0.001
	SSD	0.250	0.002	0.001	0.001
	PDD	0.298	0.002	0.002	0.002
	PKD	0.239	0.002	0.001	0.001
RM (0.091)	DTP	0.573	0.003	0.002	0.002
	DRM	0.427	0.001	0.002	0.002

F2C (0.206)			Alternative Relative importance weights		
			Costs	Rel.	Res.
CRM (0.120)	CC	0.430	0.002	0.002	0.002
	SM	0.570	0.002	0.003	0.003
CSM (0.140)	IEC	0.354	0.001	0.002	0.003
	QC	0.646	0.003	0.004	0.004
DM (0.154)	DF	0.240	0.001	0.001	0.002
	CP	0.213	0.001	0.001	0.002
	INM	0.155	0.001	0.001	0.001
	MFS	0.187	0.001	0.001	0.001
	PPC	0.205	0.002	0.001	0.001
OF (0.135)	INM	0.270	0.002	0.001	0.001
	DNP	0.180	0.001	0.001	0.001
	DTP	0.308	0.002	0.001	0.002
	WM	0.242	0.002	0.001	0.001
MFM (0.133)	QC	0.263	0.001	0.002	0.001
	INM	0.113	0.001	0.000	0.001
	MFS	0.158	0.001	0.001	0.001
	PPC	0.211	0.001	0.001	0.001
	OTM	0.131	0.001	0.000	0.001
	SSD	0.123	0.001	0.000	0.001
SRM (0.077)	SS	0.364	0.001	0.001	0.001
	SSD	0.326	0.001	0.001	0.001
	PM	0.310	0.001	0.001	0.001
PDC (0.156)	SM	0.215	0.001	0.001	0.001
	SSD	0.249	0.002	0.001	0.001
	PDD	0.299	0.002	0.001	0.002
	PKD	0.237	0.002	0.001	0.001
RM (0.085)	DTP	0.583	0.002	0.001	0.002
	DRM	0.417	0.001	0.001	0.002

C2F (0.302)			Alternative Relative importance weights		
			Costs	Rel.	Res.
CRM (0.120)	CC	0.413	0.002	0.003	0.003
	SM	0.587	0.003	0.004	0.005
CSM (0.135)	IEC	0.346	0.001	0.003	0.004
	QC	0.654	0.004	0.006	0.005
DM (0.158)	DF	0.241	0.002	0.001	0.003
	CP	0.216	0.002	0.001	0.002
	INM	0.161	0.002	0.001	0.001
	MFS	0.185	0.002	0.001	0.002
	PPC	0.196	0.002	0.001	0.002
OF (0.133)	INM	0.268	0.002	0.002	0.002
	DNP	0.182	0.002	0.001	0.001
	DTP	0.311	0.003	0.002	0.003
	WM	0.239	0.002	0.001	0.002
MFM (0.124)	QC	0.264	0.002	0.002	0.002
	INM	0.113	0.001	0.001	0.001
	MFS	0.155	0.002	0.001	0.001
	PPC	0.214	0.002	0.001	0.001
	OTM	0.130	0.001	0.001	0.001
	SSD	0.124	0.001	0.001	0.001
SRM (0.076)	SS	0.366	0.002	0.001	0.001
	SSD	0.328	0.002	0.001	0.001
	PM	0.307	0.002	0.001	0.001
PDC (0.170)	SM	0.214	0.002	0.002	0.002
	SSD	0.255	0.003	0.002	0.002
	PDD	0.300	0.004	0.002	0.003
	PKD	0.231	0.003	0.002	0.002
RM (0.084)	DTP	0.571	0.003	0.002	0.003
	DRM	0.429	0.002	0.002	0.002
Total KS			0.204	0.163	0.201

Remark: Symbols of sub-criteria3 reference from Table 4.8, "Rel" is "Reliability", "Res." Is "Responsiveness"

Table 4. 44 Global weight of alternative (Ideal) (Continued)

KT (0.432)																							
F2S (0.267)						S2F (0.219)						F2C (0.206)						C2F (0.308)					
			Alternative Relative importance weights						Alternative Relative importance weights						Alternative Relative importance weights						Alternative Relative importance weights		
			Costs	Rel.	Res.				Costs	Rel.	Res.				Costs	Rel.	Res.				Costs	Rel.	Res.
CRM	CC	0.408	0.001	0.001	0.002	CRM	CC	0.408	0.001	0.001	0.001	CRM	CC	0.431	0.001	0.001	0.002	CRM	CC	0.413	0.002	0.002	0.003
(0.092)	SM	0.592	0.001	0.002	0.003	(0.093)	SM	0.592	0.001	0.002	0.002	(0.121)	SM	0.569	0.001	0.002	0.003	(0.120)	SM	0.587	0.002	0.003	0.004
CSM	IEC	0.342	0.001	0.002	0.002	CSM	IEC	0.356	0.001	0.001	0.002	CSM	IEC	0.354	0.001	0.002	0.002	CSM	IEC	0.346	0.001	0.002	0.003
(0.107)	QC	0.658	0.002	0.003	0.003	(0.111)	QC	0.644	0.002	0.003	0.002	(0.139)	QC	0.646	0.002	0.003	0.003	(0.137)	QC	0.654	0.003	0.005	0.004
DM	DF	0.244	0.001	0.001	0.002	DM	DF	0.241	0.001	0.001	0.001	DM	DF	0.240	0.001	0.001	0.002	DM	DF	0.249	0.002	0.001	0.002
(0.146)	CP	0.216	0.001	0.001	0.001	(0.135)	CP	0.218	0.001	0.001	0.001	(0.154)	CP	0.217	0.001	0.001	0.001	(0.156)	CP	0.213	0.001	0.001	0.002
	INM	0.157	0.001	0.001	0.001		INM	0.158	0.001	0.001	0.001		INM	0.161	0.001	0.001	0.001		INM	0.154	0.001	0.001	0.001
	MFS	0.184	0.001	0.001	0.001		MFS	0.186	0.001	0.001	0.001		MFS	0.184	0.001	0.001	0.001		MFS	0.185	0.002	0.001	0.001
	PPC	0.200	0.001	0.001	0.001		PPC	0.197	0.001	0.001	0.001		PPC	0.198	0.001	0.001	0.001		PPC	0.200	0.002	0.001	0.001
OF	INM	0.260	0.002	0.001	0.002	OF	INM	0.257	0.001	0.001	0.001	OF	INM	0.271	0.001	0.001	0.001	OF	INM	0.258	0.002	0.001	0.002
(0.154)	DNP	0.180	0.001	0.001	0.001	(0.153)	DNP	0.188	0.001	0.001	0.001	(0.136)	DNP	0.180	0.001	0.000	0.001	(0.133)	DNP	0.180	0.001	0.001	0.001
	DTP	0.310	0.002	0.001	0.002		DTP	0.315	0.002	0.001	0.002		DTP	0.308	0.001	0.001	0.001		DTP	0.320	0.002	0.001	0.002
	WM	0.249	0.002	0.001	0.001		WM	0.240	0.002	0.001	0.001		WM	0.241	0.001	0.001	0.001		WM	0.242	0.002	0.001	0.001
MFM	QC	0.261	0.001	0.002	0.002	MFM	QC	0.259	0.001	0.001	0.001	MFM	QC	0.265	0.001	0.001	0.001	MFM	QC	0.263	0.001	0.002	0.001
(0.162)	INM	0.109	0.001	0.000	0.001	(0.162)	INM	0.115	0.001	0.000	0.001	(0.131)	INM	0.114	0.001	0.000	0.001	(0.124)	INM	0.113	0.001	0.000	0.001
	MFS	0.161	0.001	0.001	0.001		MFS	0.161	0.001	0.001	0.001		MFS	0.157	0.001	0.000	0.001		MFS	0.155	0.001	0.001	0.001
	PPC	0.209	0.002	0.001	0.001		PPC	0.209	0.001	0.001	0.001		PPC	0.210	0.001	0.001	0.001		PPC	0.214	0.002	0.001	0.001
	OTM	0.134	0.001	0.001	0.001		OTM	0.130	0.001	0.000	0.001		OTM	0.131	0.001	0.000	0.000		OTM	0.130	0.001	0.001	0.001
	SSD	0.125	0.001	0.001	0.001		SSD	0.126	0.001	0.001	0.001		SSD	0.123	0.001	0.000	0.000		SSD	0.124	0.001	0.001	0.001
SRM	SS	0.360	0.002	0.001	0.001	SRM	SS	0.366	0.002	0.001	0.001	SRM	SS	0.364	0.001	0.001	0.001	SRM	SS	0.366	0.002	0.001	0.001
(0.104)	SSD	0.331	0.002	0.001	0.001	(0.107)	SSD	0.324	0.001	0.001	0.001	(0.076)	SSD	0.326	0.001	0.001	0.001	(0.075)	SSD	0.326	0.001	0.001	0.001
	PM	0.309	0.002	0.001	0.001		PM	0.309	0.001	0.001	0.001		PM	0.310	0.001	0.001	0.001		PM	0.308	0.001	0.001	0.001
PDC	SM	0.213	0.001	0.001	0.001	PDC	SM	0.213	0.001	0.001	0.001	PDC	SM	0.215	0.001	0.001	0.001	PDC	SM	0.214	0.002	0.002	0.002
(0.150)	SSD	0.257	0.002	0.001	0.001	(0.150)	SSD	0.250	0.002	0.001	0.001	(0.160)	SSD	0.249	0.002	0.001	0.001	(0.172)	SSD	0.255	0.003	0.001	0.002
	PDD	0.297	0.002	0.001	0.002		PDD	0.298	0.002	0.001	0.001		PDD	0.299	0.002	0.001	0.001		PDD	0.298	0.003	0.002	0.002
	PKD	0.232	0.002	0.001	0.001		PKD	0.239	0.001	0.001	0.001		PKD	0.237	0.001	0.001	0.001		PKD	0.233	0.002	0.002	0.002
RM	DTP	0.583	0.002	0.001	0.002	RM	DTP	0.581	0.002	0.001	0.002	RM	DTP	0.583	0.002	0.001	0.002	RM	DTP	0.571	0.003	0.002	0.002
(0.085)	DRM	0.417	0.001	0.001	0.002	(0.089)	DRM	0.419	0.001	0.001	0.001	(0.083)	DRM	0.417	0.001	0.001	0.001	(0.083)	DRM	0.429	0.001	0.002	0.002
																		Total KT			0.155	0.124	0.153
																		Total KS&KT			0.359	0.287	0.354

Remark: Symbols of sub-criteria3 reference from Table 4.8, “Rel” is “Reliability”, “Res.” Is “Responsiveness”

4.2.8 Comparative of three stakeholders

The scope of this research is the supply chain of the electric and electronic industrial composed of the 1^{st} tier suppliers (1^{st} S/P) group, the 2^{nd} tire suppliers (2^{nd} S/P) group, and the assembly (Assb.) group (section 4.2.1: Table 4.12). The earlier research results show the outcome of relative importance weights and the priority of the knowledge sharing and transferring for eight SCM processes under the context of external integration, which increases the SCM performance for all three tiers mentioned above. However, we can separately consider each group to observe the same or the different results from the overall by the results show in Figure 4.3 to 4.12. We have analyzed the first hierarchy (criteria), the second hierarchy (sub-criteria1) ,the third hierarchy (sub-criteria2) and the forth hierarchy (sub-criteria3) since they are hierarchy that is analyzed by external integration for all four dyads including F2S, S2F, F2C, and C2F and they are hierarchy that focuses on the required knowledge for SCM process.

Figure 4.3 shows the separated analysis results for the first hierarchy (criteria) with the same results and the differences from the overall analysis. In other words, the overall picture has KS with a number-one rank. When considered individually, however, the 2^{nd} S/P group (2^{nd} S/P is a focal company) has the number-one rank of KT while the Assb. group and the 1^{st} S/P group (Assb. is a focal company and 1^{st} S/P is a focal company) are the same as in the overall analysis.

Figure 4.3 shows the separated analysis result for the second hierarchy (sub-criteria1) to demonstrate that the results are the same as overall analysis. That is, we have the knowledge sharing and transferring related to supply chain performance between each dyad in the chain ranked C2F, F2S, S2F, and F2C has the same trend for both KS and KT. Example from the Figure 4.3, by considering at the Assb. group (Assb. is a focal company), we have the knowledge sharing and transferring from customer (1^{st} C/M) to focal company (Assb.) to rank number 1 (number 2, number 3, and number 4 are focal company (Assb.) to supplier (1^{st} S/P), supplier (1^{st} S/P) to focal company (Assb.), and focal company (Assb.) to customer (1^{st} C/M), respectively), which is the same as considering at the 1^{st} S/P group (1^{st} S/P is a focal company) and the 2^{nd} S/P group (2^{nd} S/P is a focal company).

Figure 4.4 shows the separated analysis result for the third hierarchy (sub-criteria2) by considering only the knowledge related to eight SCM processes with number one rank in each group (Table 4.29). We found that there exist the same results and the difference from overall analysis. That is, for overall picture of every group, F2S and S2F have knowledge sharing and transferring related to MFM process in the first rank while F2C and C2F have PDC in the first rank. However, by separating the analysis, we find the followings.

- The Assb. group (Assb. is a focal company), in with different result from the 1st S/P group and the 2nd S/P group (1st S/P is a focal company and 2nd S/P is a focal company) and different result from the overall picture, that is, F2S, S2F and F2C with OF as number one while C2F with PDC as number one.

- The 1st S/P group and the 2nd S/P group (1st S/P is a focal company and 2nd S/P is a focal company) are the same result with the overall picture, that is, F2S and S2F have MFM in the first rank while F2C and C2F have PDC in the first rank.

The reason could be that the Assb. group is closer to the downstream (end user customer) which has to focus on the replenishment system to be on time with customer needs. Hence, the knowledge related to OF should be first shared and transferred for both giving to supplier and receiving from supplier, including giving to customer as well. For the 1st S/P group and the 2nd S/P group that requires the MFM knowledge for both giving to supplier and receiving from supplier as first, this could come from both of the aforementioned groups were manufacturers and shared similar products (parts and components such as IC, PCB and capacitors). Therefore, the knowledge that would improve production capacity or potential is highly important.

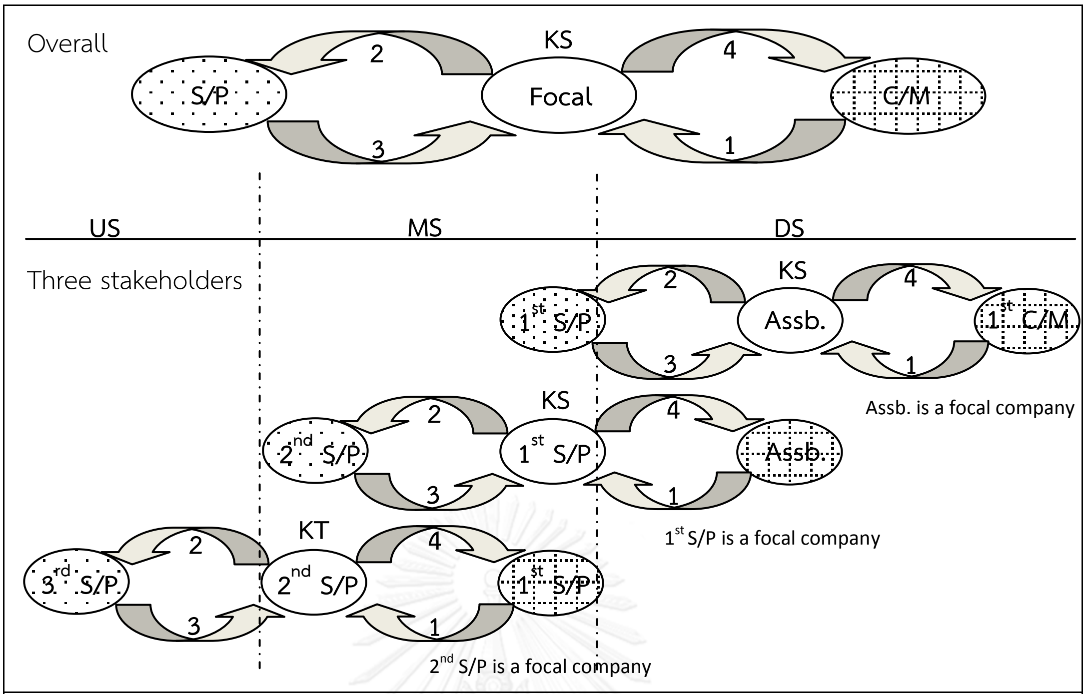
Figure 4.5 to 4.12 shows the separated analysis result for the forth hierarchy (sub-criteria3) by considering only the required knowledge for each SCM process with number one rank in each group (Table 4.34-4.35). We found that there exists the same results and the difference from overall analysis. The same results are the required knowledge for CRM, CSM, PDC, and RM, while the differences are the required knowledge for DM, OF, MFM, and SRM.

For the required knowledge for DM process, the overall picture is demand forecasting knowledge (DF) with number one rank, but when we separately consider, the 2nd S/P group (2nd S/P is a focal company) gincludin F2S, S2F, F2C and C2F has the number one rank of production and planning control knowledge (PPC) while the Assb. group and the 1st S/P group (Assb. is a focal company and 1st S/P is a focal company) are the same as overall. This could presumably because many companies in the 2nd S/P group stays close to the early process (upstream), focusing on manufacturing to swiftly correspond to customer needs. Thus, technical knowledge related to manufacturing is very important for the 2nd S/P group when compared to others as receiver and giver.

For the required knowledge for OF process, the overall picture is delivery and transportation planning knowledge (DTP) with number one rank, but when we separately consider, the group of 2nd S/P (2nd S/P is a focal company) including F2S, S2F, F2C and C2F has the number one rank of warehouse management knowledge (WM) while the Assb. group and the 1st S/P group (Assb. is a focal company and 1st S/P is a focal company) are the same as overall. This could presumably because the 2nd S/P group has the products, which are various material groups for the group of 1st S/P. Thus, technical knowledge related to warehouse management to support replenishment system is very important for the 2nd S/P group when compared to others as receiver and giver.

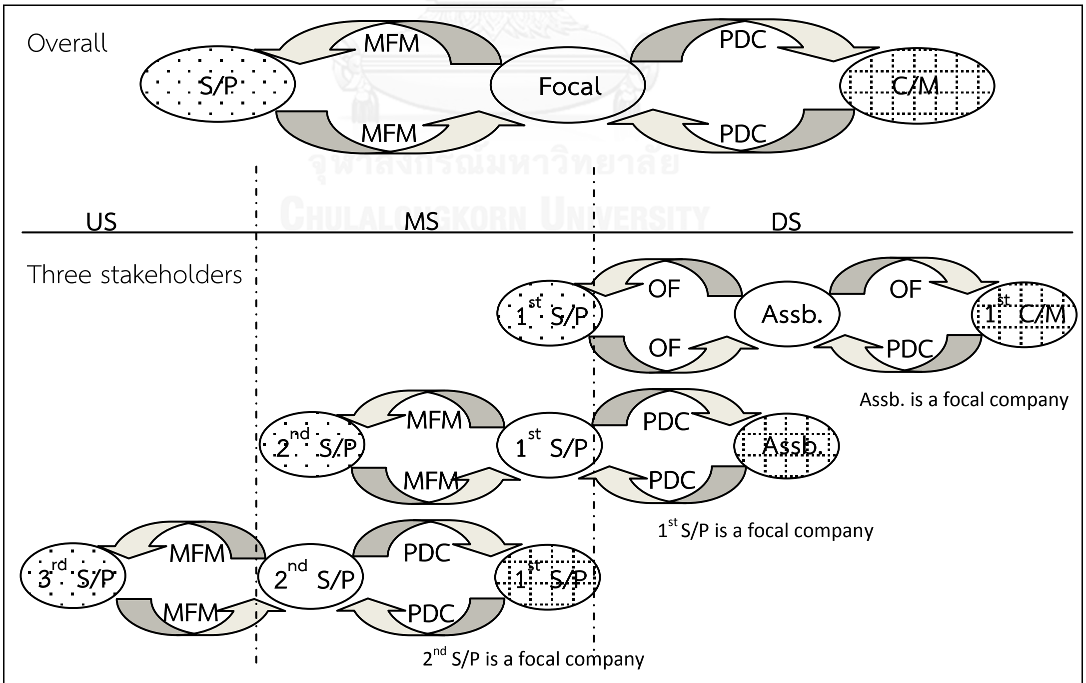
For the required knowledge for MFM process, the overall picture is quality control knowledge (QC) with number one rank, but when we separately consider, the Assb. group (Assb. is a focal company) including F2S, S2F, F2C and C2F has the number one rank of production and planning control knowledge (PPC) while the 1st S/P group and the 2nd S/P group (1st S/P is a focal company and 2nd S/P is a focal company) are the same as overall. This maybe because, in many cases, the Assb. group participates with the modification of manufacturing process of the suppliers to achieve better performance especially found frequently in the hard disk drive company. Thus, technical knowledge related to manufacturing is very important for the Assb. group when compared to others as receiver and giver.

For the required knowledge for SRM process, the overall picture is sourcing strategies knowledge (SS) with number one rank, but when we separately consider, the 2nd S/P group (2nd S/P is a focal company) Including F2S, S2F, F2C and C2F has the number one rank of purchasing management knowledge (PM) while the Assb. group and the 1st S/P group (Assb. is a focal company and 1st S/P is a focal company) are the same as overall. This could presumably because the 2nd S/P group imports materials from foreign countries, focusing on techniques of purchasing for low cost and good cycle time for materials to be on time with manufacture. Thus, technical knowledge related to purchasing is very important for the 2nd S/P group when compared to others as receiver and giver.



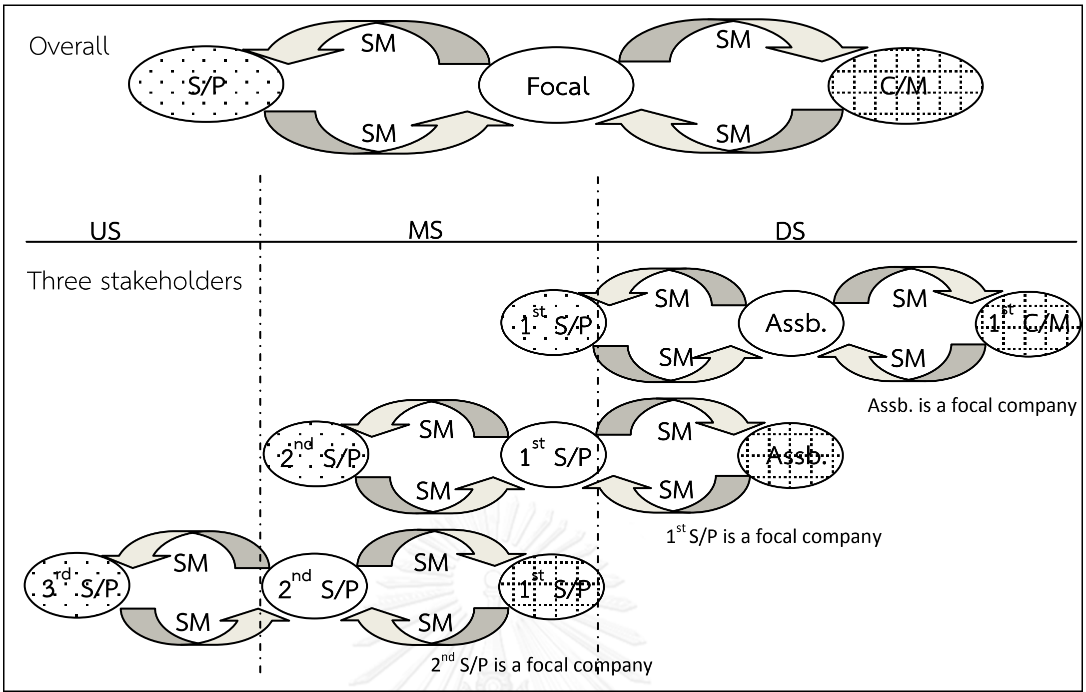
Remark- Focal: Focal company, S/P: Supplier, C/M: Customer, US: Upstream, MS: Midstream, DS: Downstream, Assb.: Assembly, 1^{st} S/P: First-tier supplier, 2^{nd} S/P: Second-tier supplier, 3^{rd} S/P: Third-tier supplier, 1^{st} C/M: First-tier customer, KS: Knowledge Sharing, KT: Knowledge Transfer.

Figure 4. 3 The dyadic level of supply chain integration (Three stakeholders)



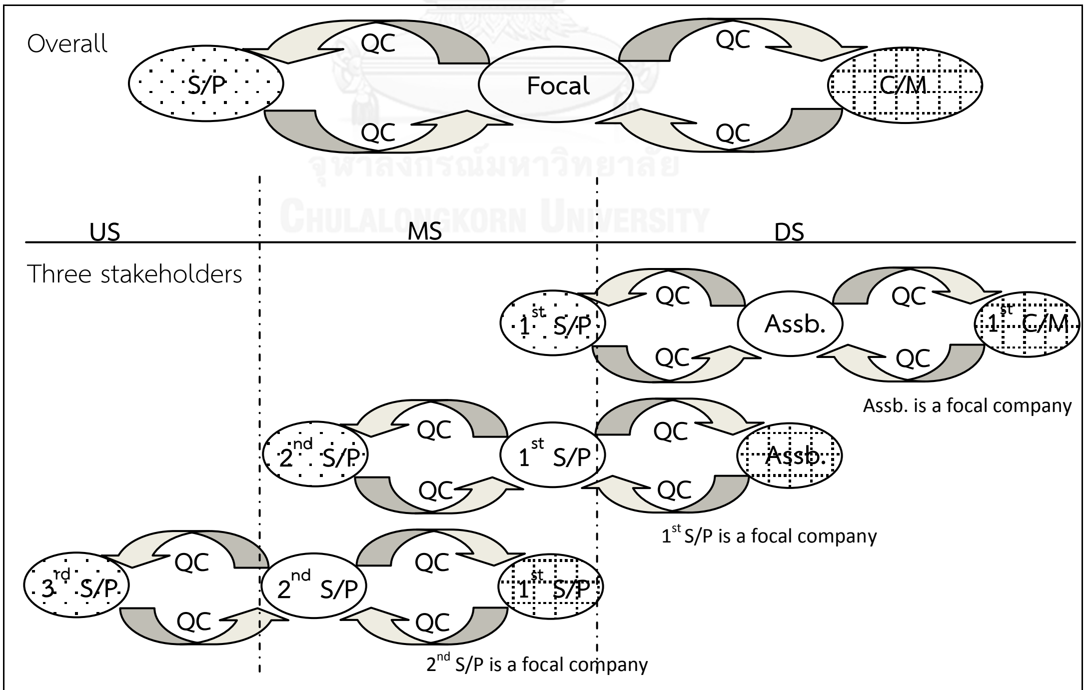
Remark- Focal: Focal company, S/P: Supplier, C/M: Customer, US: Upstream, MS: Midstream, DS: Downstream, Assb.: Assembly, 1^{st} S/P: First-tier supplier, 2^{nd} S/P: Second-tier supplier, 3^{rd} S/P: Third-tier supplier, 1^{st} C/M: First-tier customer, KS: Knowledge Sharing, KT: Knowledge Transfer, MFM : Manufacturing Flow Management, PDC: Product Development and Commercialization, OF: Order Fulfillment, OF: Order Fulfillment.

Figure 4. 4 Knowledge related to eight SCM processes (Three stakeholders)



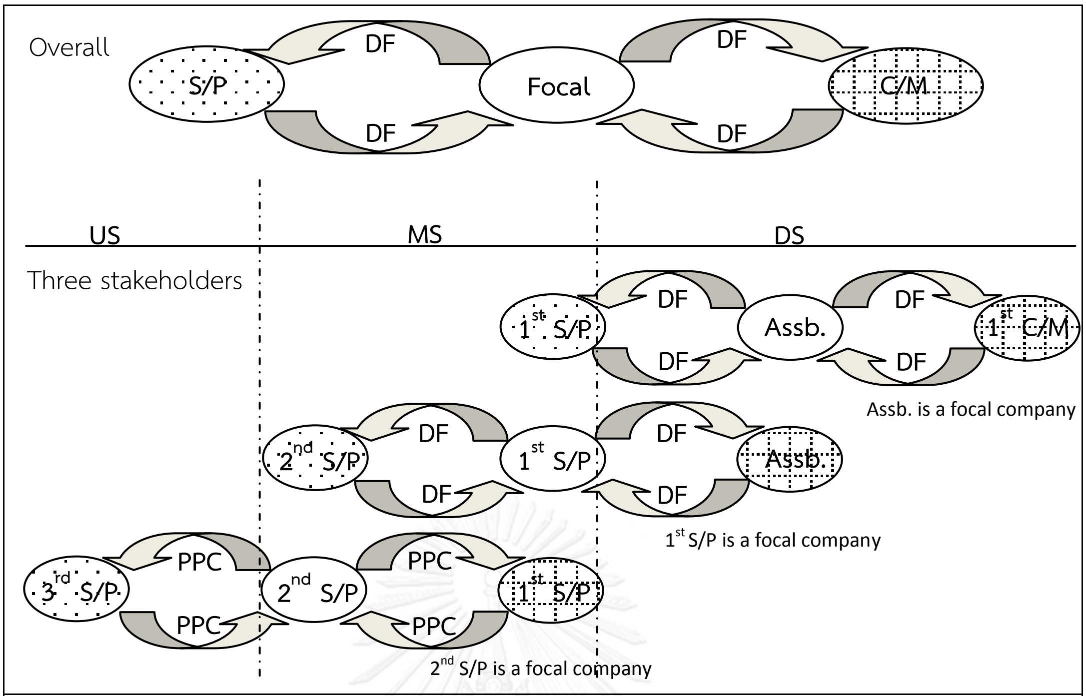
Remark- Focal: Focal company, S/P: Supplier, C/M: Customer, US: Upstream, MS: Midstream, DS: Downstream, Assb.: Assembly, 1st S/P: First-tier supplier, 2nd S/P: Second-tier supplier, 3rd S/P: Third-tier supplier, 1st C/M: First-tier customer, SM: Sale and Marketing knowledge.

Figure 4. 5 Required knowledge for CRM process (Three stakeholders)



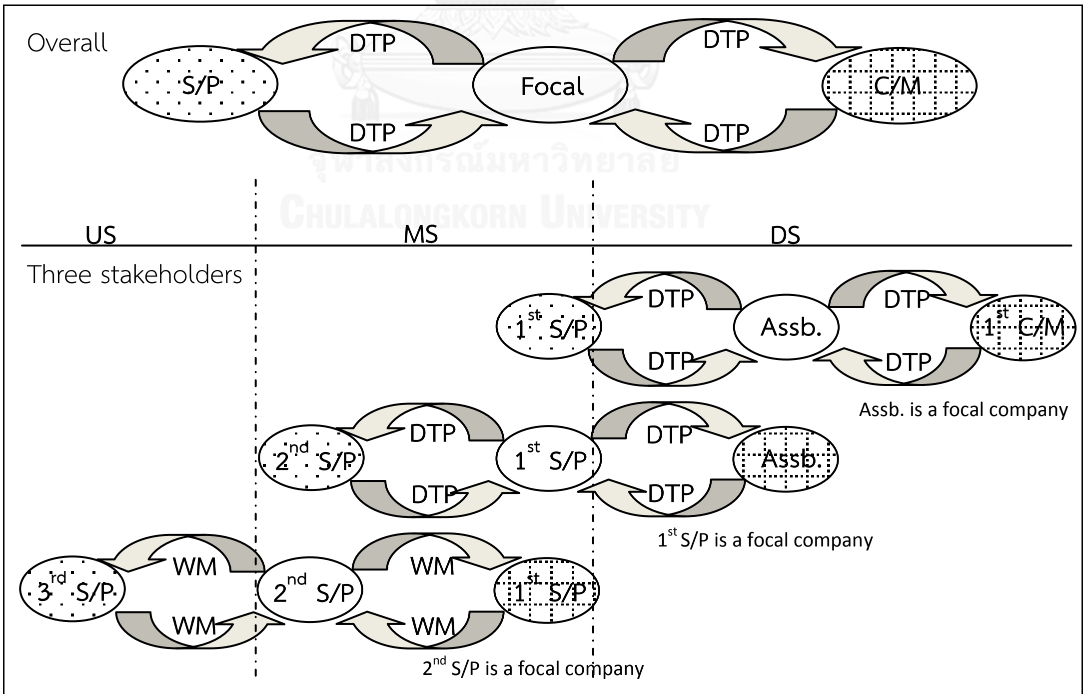
Remark- Focal: Focal company, S/P: Supplier, C/M: Customer, US: Upstream, MS: Midstream, DS: Downstream, Assb.: Assembly, 1st S/P: First-tier supplier, 2nd S/P: Second-tier supplier, 3rd S/P: Third-tier supplier, 1st C/M: First-tier customer, QC: Quality Control knowledge.

Figure 4. 6 Required knowledge for CSM process (Three stakeholders)



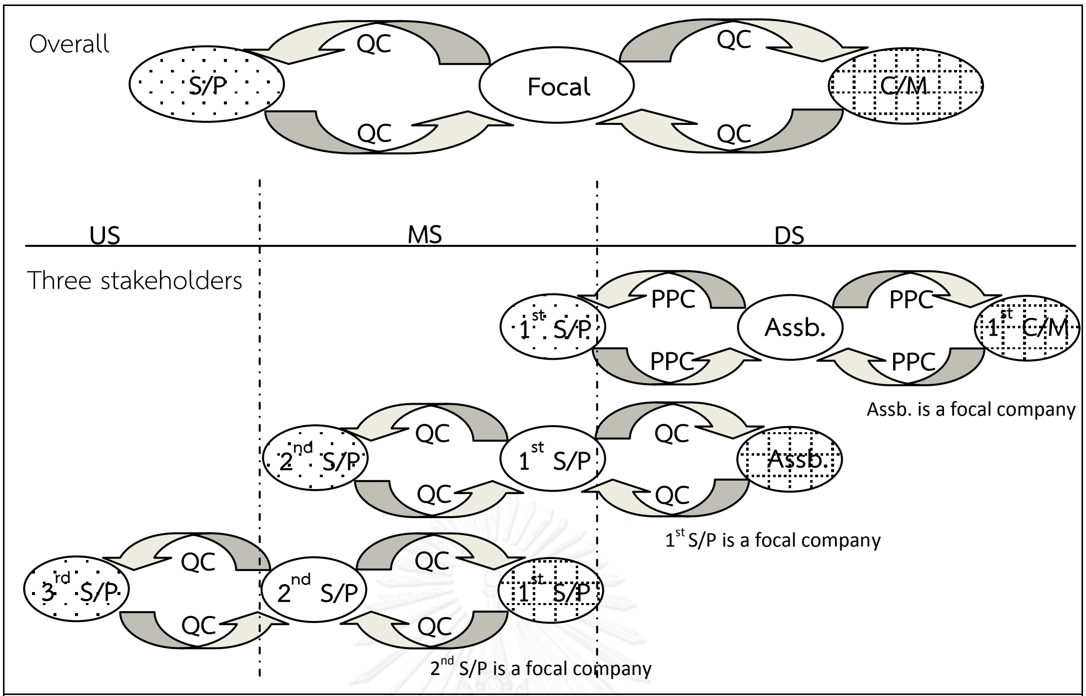
Remark- Focal: Focal company, S/P: Supplier, C/M: Customer, US: Upstream, MS: Midstream, DS: Downstream, Assb.: Assembly, 1st S/P: First-tier supplier, 2nd S/P: Second-tier supplier, 3rd S/P: Third-tier supplier, 1st C/M: First-tier customer, DF: Demand forecasting knowledge, PPC: Production and planning control knowledge.

Figure 4. 7 Required knowledge for DM process (Three stakeholders)



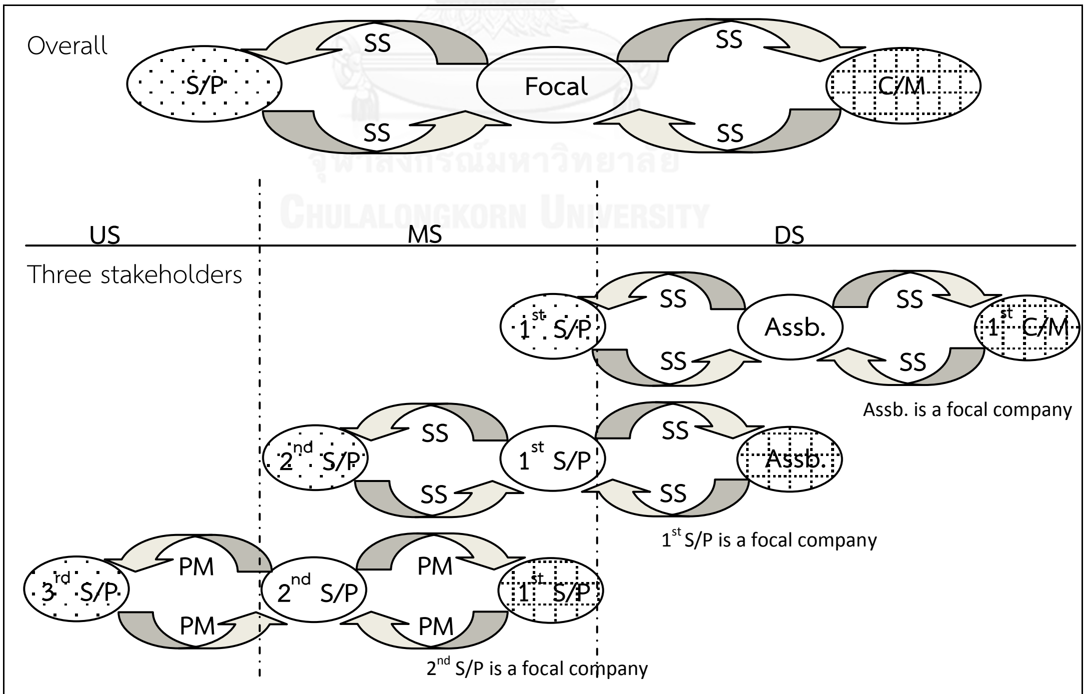
Remark- Focal: Focal company, S/P: Supplier, C/M: Customer, US: Upstream, MS: Midstream, DS: Downstream, Assb.: Assembly, 1st S/P: First-tier supplier, 2nd S/P: Second-tier supplier, 3rd S/P: Third-tier supplier, 1st C/M: First-tier customer, DTP: Delivery and Transportation planning knowledge, WM: Warehouse management knowledge.

Figure 4. 8 Required knowledge for OF process (Three stakeholders)



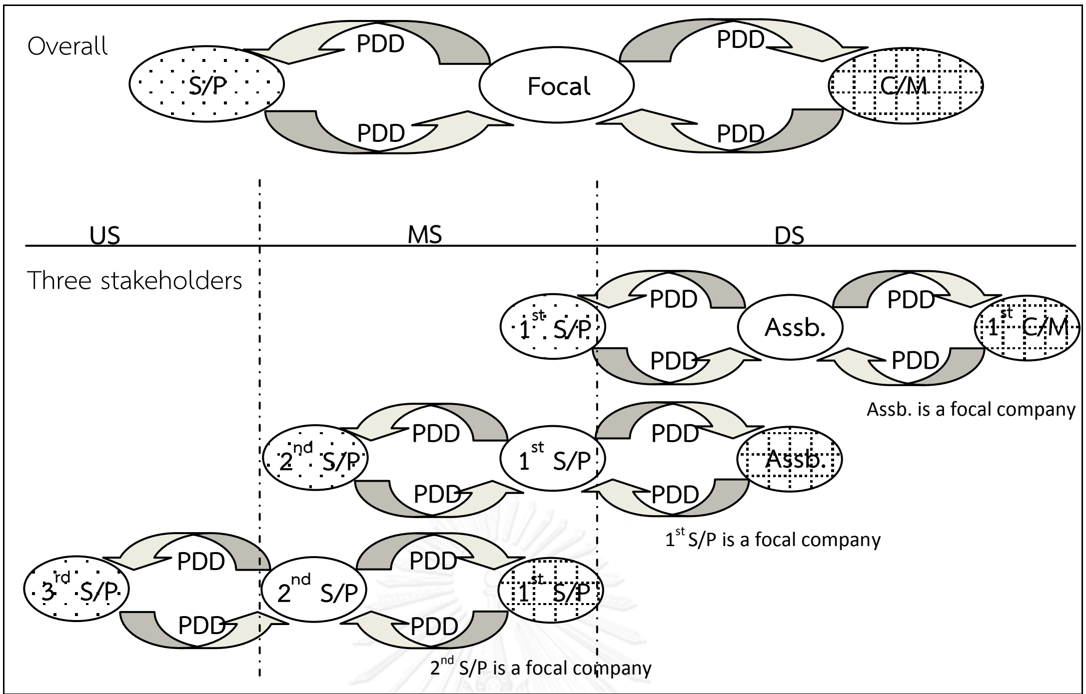
Remark- Focal: Focal company ( ), S/P: Supplier ( ), C/M: Customer ( ), US: Upstream, MS: Midstream, DS: Downstream, Assb.: Assembly, 1st S/P: First-tier supplier, 2nd S/P: Second-tier supplier, 3rd S/P: Third-tier supplier, 1st C/M: First-tier customer, QC: Quality Control knowledge, PPC: Production and planning control knowledge.

Figure 4. 9 Required knowledge for MFM process (Three stakeholders)



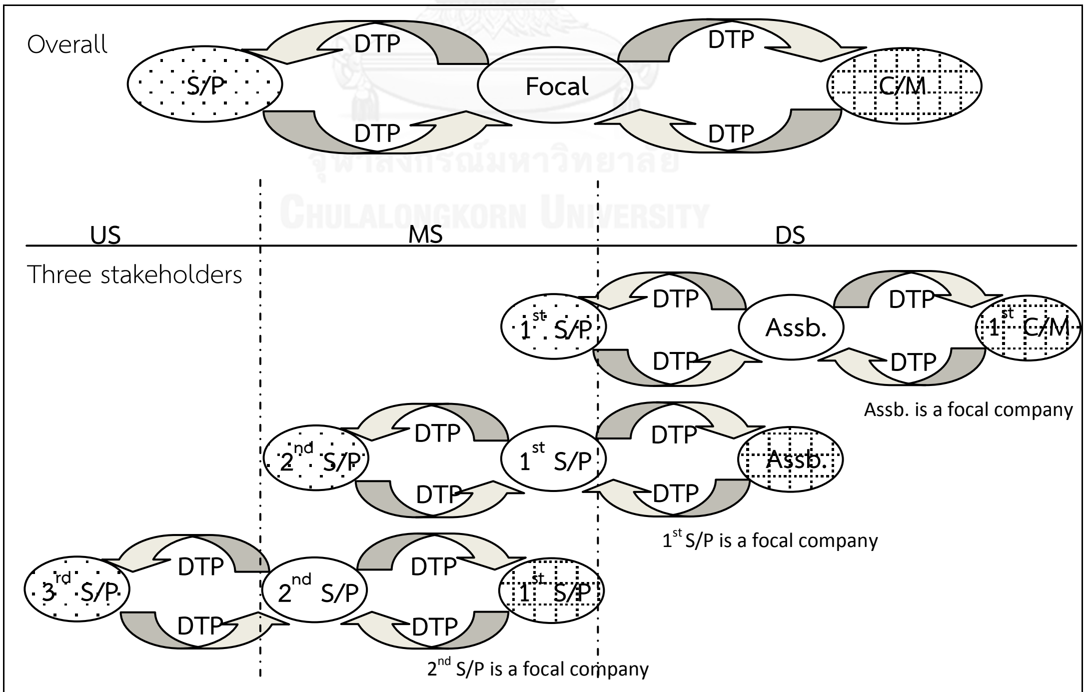
Remark- Focal: Focal company ( ), S/P: Supplier ( ), C/M: Customer ( ), US: Upstream, MS: Midstream, DS: Downstream, Assb.: Assembly, 1st S/P: First-tier supplier, 2nd S/P: Second-tier supplier, 3rd S/P: Third-tier supplier, 1st C/M: First-tier customer, SS: Sourcing Strategy knowledge, PM: Purchasing Management knowledge.

Figure 4. 10 Required knowledge for SRM process (Three stakeholders)



Remark- Focal: Focal company, S/P: Supplier, C/M: Customer, US: Upstream, MS: Midstream, DS: Downstream, Assb.: Assembly, 1st S/P: First-tier supplier, 2nd S/P: Second-tier supplier, 3rd S/P: Third-tier supplier, 1st C/M: First-tier customer, PDD: Product design knowledge.

Figure 4. 11 Required knowledge for PDC process (Three stakeholders)



Remark- Focal: Focal company, S/P: Supplier, C/M: Customer, US: Upstream, MS: Midstream, DS: Downstream, Assb.: Assembly, 1st S/P: First-tier supplier, 2nd S/P: Second-tier supplier, 3rd S/P: Third-tier supplier, 1st C/M: First-tier customer, DTP: Delivery and Transportation planning knowledge.

Figure 4. 12 Required knowledge for RM process (Three stakeholders)

Apart from the aforementioned stakeholder-specific analysis, this research present model of sharing/transferring the required knowledge for the SCM process in enhancing SCM performance for each stakeholder, as shown in Figure 4.13. The relative importance weights of required knowledge for eight SCM processes of three stakeholders are illustrated in Appendix D.

According to Figure 4.13, the 2^{nd} S/P group (2^{nd} S/P is a focal company) gives greater importance weight to KT than KS, possibly due to the fact that seven of the twelve sample companies in this 2^{nd} S/P group in the present research, or over 50 percent of the total number of samples in this group, were Thai entrepreneurs and organizationally smaller than the Assb. group (Assb. is a focal company) and the 1^{st} S/P group (1^{st} S/P is a focal company). Hence, if knowledge was transferred from the 1^{st} S/P group, which largely consisted of foreign entrepreneurs or multinational enterprises, which were larger organizationally and more ready in various aspects, the 2^{nd} S/P group would be able to greatly expand its potential. Concurrently, the research conducted by Punyasavatsut (2008) on the automobile and clothing industries showed the multinational enterprises located in Thailand to make up the sources of technology and knowledge ready to be transferred to domestic suppliers or local supplies, especially SMEs. Moreover, the aforementioned study indicated that first-tier suppliers are the parties transferring technology and knowledge to lower-tier suppliers, while lower-tier suppliers (from second-tier suppliers and below) share a rather small amount of knowledge.

Meanwhile, the Assb. group (Assb. is a focal company) and the 1^{st} S/P group (1^{st} S/P is a focal company) gave greater priority to KS than KT due to the assumption that KT had limitations concerning the difficulty of making it actually happen, even though KT was more focused on obtaining and adapting knowledge for mutual effectiveness and efficiency among organizations than KS.

For order of sharing and transferring the knowledge between each dyad of the supply chain, the Assb. group, the 1^{st} S/P group and the 2^{nd} S/P group (Assb. is a focal company, 1^{st} S/P is a focal company and 2^{nd} S/P is a focal company) also shared and transferred required knowledge for managing the supply chain between each dyad by the same rank. In other words, sharing and transferring knowledge should keep with the characteristics of the supply chain, starting with the customer to the focal company, then from the focal company to the supplier, and returning from the supplier to the focal company and from the focal company to the customer. Raising an example from the Figure 4.13, a look at the 1^{st} S/P group (1^{st} S/P is a focal company) illustrates sharing from customers (Assb.) to focal company (1^{st} S/P) ranked first, followed by focal company (1^{st} S/P) to suppliers (2^{nd} S/P), which ranked second, and supplier (2^{nd} S/P) to focal company (1^{st} S/P) ranked third and focal company (1^{st} S/P) to customer (Assb.) ranked fourth.

This might have been due to the assumption that demands originate with customers. Also, the majority of corporations and organizations of customers are larger organizations equipped in various aspects with ability to support sharing and transfer of knowledge more effectively. Afterwards, the parts after the customers obtain those knowledge then later share and transfer them to suppliers, and in reverse, suppliers should also share or transfer knowledge.

For the part of the required knowledge for the SCM process that should be shared or transferred between each dyad of supply chain:

When considering the Assb. group (Assb. is a focal company), on Assb. and the 1^{st} C/M, Assb. to the 1^{st} C/M was found to give importance weight to the required knowledge for the OF, DM and CSM processes as the top three ranks, while the 1^{st} C/M to Assb. Give importance weight to the required knowledge for the PDC, DM and OF processes as its top three ranks.

Assb. and the 1^{st} S/P gave importance weight to the required knowledge for the OF process as the first rank on both the giving and receiving ends. However, there are differences in the second and third ranks, which were conversed in order. In other words, Assb. to the 1^{st} S/P gave greater weighted of importance to the required knowledge for the DM and MFM processes, respectively, while the 1^{st} S/P to Assb. gave importance weight to the required knowledge for the MFM and DM processes, respectively.

When considering the 1^{st} S/P group (1^{st} S/P is a focal company), on the 1^{st} S/P and Assb. gave importance weight to the required knowledge for the PDC and DM processes as the first two ranks on both the giving and receiving ends. However, differences lie in the third rank. The 1st S/P to Assb. gave greater importance weight to the required knowledge for the MFM processes, while Assb. to the 1st S/P gave importance weight to the required knowledge for the OF process.

For the 1st S/P and the 2nd S/P, it was found that the 1st S/P to the 2nd S/P, importance weight was given to the required knowledge for the MFM, DM and OF processes as the top three ranks, while the 2nd S/P to the 1st S/P gave importance weight to the required knowledge for the MFM, PDC and DM as the top three ranks.

When considering the 2nd S/P group (2nd S/P is a focal company) , the 2nd S/P and the 1st S/P gave importance weight to the required knowledge for the PDC process as the top rank on both the giving and receiving ends. However, differences were found in the second and third ranks, which were ordered conversely. In other words, the 2nd S/P to the 1st S/P gave importance weight to the knowledge essential to the MFM and DM processes, respectively, while the 1st S/P to the 2nd S/P gave importance weight to the required knowledge for the DM and MFM processes, respectively.

For the 2nd S/P and 3rd S/P, it found that the 2nd S/P to 3rd S/P gave importance weight to the required knowledge for the MFM, PDC and OF processes as the top three ranks, while the 3rd S/P to 2nd S/P gave importance weight to the required knowledge for the PDC, MFM, DM processes as the top three ranks.

The aforementioned findings revealed that the Assb. group (Assb. is a focal company), the 1st S/P group (1st S/P is a focal company) and the 2nd S/P group (2nd S/P is a focal company) shared and transferred the required knowledge for the SCM process similarly from an overall point of view, but differ in details of levels of weights of priority. In other words, the required knowledge for the SCM process that should be shared or transferred is the knowledge for the MFM, DM, OF and PDC processes as the top ranks but differ in terms of weighted levels and importance. In other words:

From the perspective of the Assb. group (Assb. is a focal company), importance weight was given to the required knowledge for the OF and DM processes first or second in almost every dyad. This may be due to the assumption that the Assb. group was located downstream, which requires focus on fulfilling goods to adequately meet consumer demands. Furthermore, demand forecasting usually occurs from downstream and involves processes in steps. As a result, the Assb. group realizes that the required knowledge for the OF and DM processes should be shared and transferred first.

At the same time, from the perspectives of the 1st S/P group (1st S/P is a focal company) and the 2nd S/P group (2nd S/P is a focal company), importance weight was given to the required knowledge for the MFM and PDC processes first or second in nearly every dyad. This finding might have been due to the assumption that both of the aforementioned groups were manufacturers and shared similar products (parts and components such as IC, PCB and capacitors). Therefore, the knowledge that would improve production capacity or potential is highly important. Moreover, focal company and suppliers or focal company and customers in many instances are required to co-design products, and knowledge sharing already takes place concerning product specifications. Hence, if sharing or transferring knowledge required for designs occurs more than sharing specifications, e.g. product design methods consistent with various factors such as materials and production processes, tremendous benefit stands to be gained. Moreover, both of the aforementioned groups were found to give importance weight to the required knowledge for the MFM as their first rank from both the focal company to suppliers and suppliers to the focal company, possibly due to the assumption that organizations prefer that their own suppliers be developed in terms of production potential over other aspects in order to benefit the effectiveness and efficiency of the organization's production. As shown in the research, production level networks exist between first-tier and lower-tier suppliers including in-house production and plant management. The aforementioned research concentrated on technology transfer networks and became cases studies in the automotive industry (Punyasavatsut 2008).

Furthermore, the Assb. group (Assb. is a focal company) was found to have different required knowledge for the CSM process from the 1st S/P group (1st S/P is a focal company) and the 2nd S/P group (2nd S/P is a focal company) with importance weight ranking third for Assb. to 1st C/M. For the same reasons that the Assb. group was closer to end user customers, importance weight was given to knowledge that can be used to support customer service, especially on quality management knowledge, which is required for CSM processes and held the top importance weight.

Moreover, it was found that the required knowledge for the DM processes ranked one in three in importance weight in the 1st S/P group (1st S/P is a focal company) and the 2nd S/P group (2nd S/P is a focal company) in nearly every dyad. The main reason for this may be that the required knowledge for the DM process did not only concern customer demand management but also concerned production management capabilities to respond to customers. Therefore, not only did the Assb. group give importance to DM but also the 1st S/P group and the 2nd S/P group in enabling the ability to balance demand and supply.

In addition, there were variances in the importance weights of each aspect of knowledge in the SCM process. For example, when viewing the Assb. group (Assb. is a focal company), the demand forecasting knowledge (DF) was required knowledge for the DM process, which ranked first in importance weight. A look at the 2nd S/P group (2nd S/P is a focal company) shows production and planning control knowledge (PPC) to be required knowledge for the DM process, which ranked first in terms of importance weights. This might be due to position within the supply chain, namely, downstream channels were usually the starting point of demands. Therefore, customer demand forecasting generally occurs downstream first before moving forward, while the upstream channels generally need to give importance to production management capacity in meeting demands.

For the 1st S/P group (1st S/P is a focal company), when considering the 1st S/P to Assb., the required knowledge for the PDC process was ranked, that is, PDD, PKD, SSD and SM, while, when considering Assb. to the 1st S/P, the required knowledge for the PDC process contained ranks, namely PDD, SSD, PKD and SM. Differences were found in ranks two and three, possibly due to the assumption that, Assb. was the determiner of suppliers for the 1st S/P in many instances. Hence, the 1st S/P did not select its own suppliers. Therefore, according to the perspectives of the 1st S/P, if the aforementioned supplier selection knowledge (SSD) was shared from Assb., the 1st S/P might benefit in needing to select more of its own suppliers. Conversely, the 1st

S/P, viewed that readiness to share SSD back to Assb. was lower, and as a result, the imported weights ranked differently as previously mentioned.

At any rate, overlaps were found to result from the differences in perspectives. For example, when looking at the Assb. group (Assb. is a focal company) for supplier (1^{st} S/P) to focal company (Assb.), Assb. held the view that the required knowledge for the OF, MFM and DM processes should be shared from the 1^{st} S/P , respectively. When looking from the perspective of the 1^{st} S/P group (1^{st} S/P is a focal company) for focal company (1^{st} S/P) to customer (Assb.), the 1^{st} S/P held the view that the required knowledge for the PDC, DM and MFM processes should be shared to Assb., respectively. For the abovementioned reasons, all perspectives should be considered in order to maximally promote SCM performance.

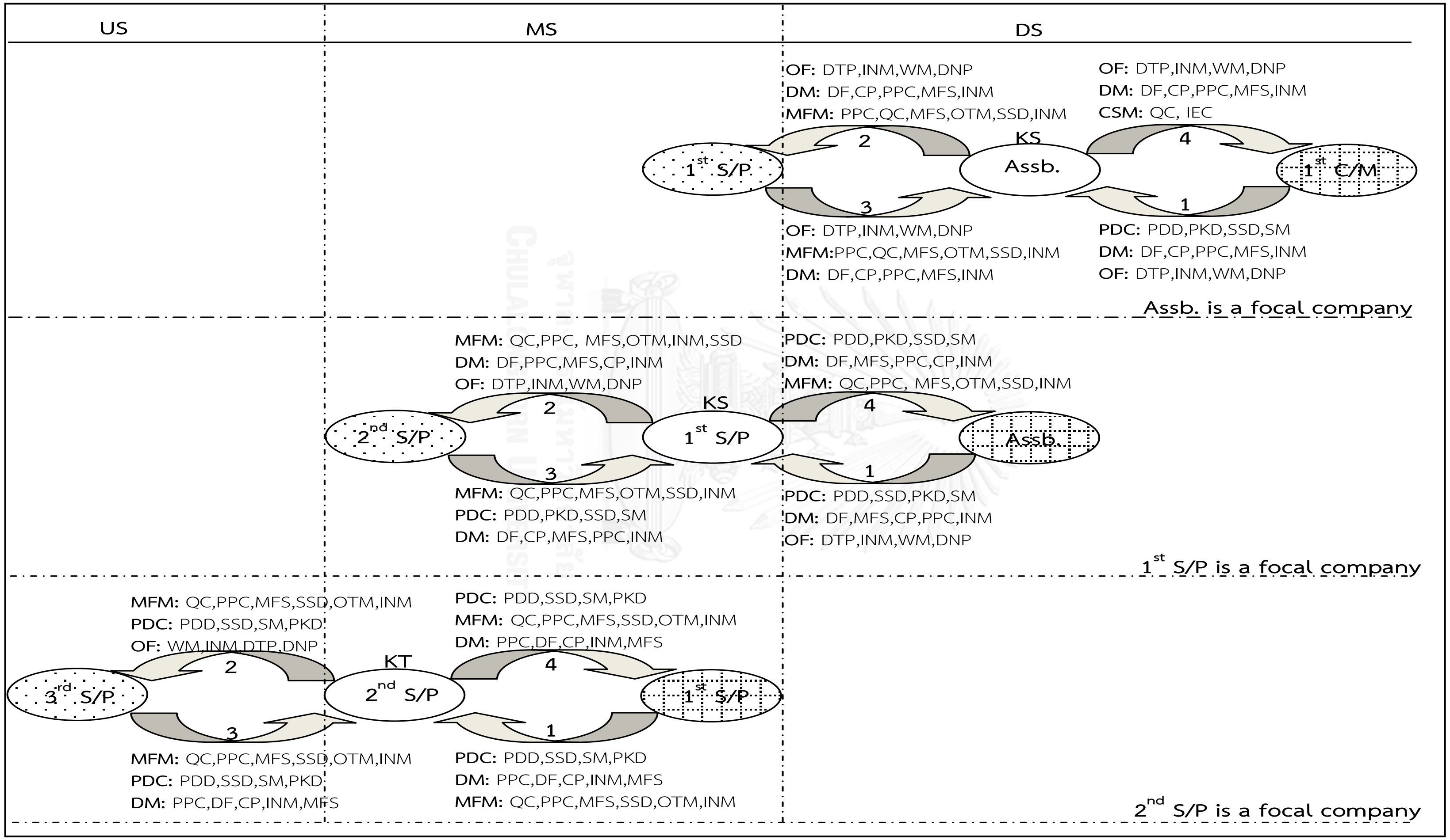


Figure 4. 13 Model of knowledge for supply chain management process: sharing and transferring in the scope of supply chain integration (Three stakeholders)

4.2.9 Additional Issue

Other than the main research result shown in section 4.2.2 to 4.2.8, we provide additional result in this topic. We survey the experts on the level of the overall sharing and transferring of knowledge related to SCM process to enhance SCM performance for both supplier and customer. We want to determine the level of such relation by choosing the scale of 0 to 10. We found that KS has the overage of 4.35, and KT has the average of 2.17. This result agrees well with section 4. , showing that KS has larger relative importance weights than KT.

We also survey on possibility level for promoting and enhancing the sharing and transferring of knowledge related to SCM process for both supplier and customer to enhance SCM performance that at what level the organization assesses its possibility level by choosing scale of 0 to 10. We found that the possibility score for KS is 7.07, and that of KT is 4.20 which are found that KS is more feasible than KT. Since KT is focused to take the knowledge to apply for efficiency and effectiveness between organizations, which always face limitation in term of difficulty. However, if it is actually applicable, it will be useful for supply chain. Hence, many experts advocate for supporting knowledge transferring.

Moreover, the experts have determined the factors to promote and to prohibit for the knowledge sharing and transferring among organizations in supply chain. The main obstacle is the business relationship and trust. Some organizations still have doubt about the business competition. However, the experts agree that sharing and transferring are not business secret revelation since each organization is unique. The knowledge has to be accordingly adjusted to its own style and business nature. On the other hand, the main factor that supports is co-benefits by realizing the importance of supply chain cost. When the organizations realize the co-benefits, it will be a critical driven force for collaboration and certainly knowledge sharing and transferring.

There could be other factors to promote or to prohibit such as executive policy, understanding and coordination from staffs in the organizations, the readiness of time, budget and staffs. That is, if the policy from the executives supports and understands the importance of this matter, combined with good understanding and collaboration from employees in the organization, and readiness in time, budget, and personnel (as giver and receiver), it will be very supportive for SCM knowledge sharing and transferring to increase SCM performance under the supply chain. On the other hand, if the executives have a prohibitive policy and do not focus in the matters, and the employees lack of understanding and collaboration, without resources in time, budget, and personnel, this will be a huge obstacle for SCM knowledge sharing and transferring to increase SCM performance under the supply chain.

CHAPTER V
RESEARCH CONCLUSION

5.1 Conclusion

This research attempts to achieve three major purposes to raise an efficient and effective supply chain management of Thailand's electrical and electronics industry;

The first purpose is to clarify the distinction of KS and KT from a practical viewpoint specific to SCM process knowledge for external integration. An in-depth interview with 15 experts was employed to understand this issue. The findings discovered that the key difference between KS and KT in practical viewpoint focusing on external integration for SCM process knowledge is the application to achieve the goal. KT will lead to the application for accomplishing the goal while KS usually not emphasize on this characteristic. Another key difference between two terms is the detail of the application including personnel and time frame. KS does not require personnel from the party who communicates knowledge involving with the projects while KT requires. KS does not usually have an exact time frame of implementation after sharing knowledge whilst KT usually has an exact time frame of implementation after transferring knowledge. Other minor differences between KS and KT include goal, process and sharing or transferring format. KT generally leads to alignment goal via joint project or individual project while KS generally leads to individual goal via individual project. Moreover, we found KS formats normally are meeting, site visiting, or auditing while KT formats normally are training, coaching or consulting.

The second purpose is to screen the required knowledge for all of the eight SCM processes that should be shared or transferred in the scope of external integration to enhance supply chain performance. To accomplish this purpose, the checklist questionnaire was developed for consideration by fifteen experts; Anderson-Darling normality test; and one-sample sign confidence interval for median were applied to analyze. The results revealed that high required knowledge for CRM, CSM, DM, OF, MFM, SRM, PDC and RM process are shown as the list below.

Furthermore, the definitions of the required knowledge in the list were debriefed and these definitions also provide in the results.

- CRM process consists of two knowledge; (1) Customer categorizing knowledge, (2) Sale and marketing knowledge.
- CSM process consists of two knowledge; (1) Internal and external coordination knowledge, (2) Quality control knowledge.
- DM process consists of five knowledge; (1) Capacity planning knowledge, (2) Demand forecasting knowledge, (3) Inventory management knowledge, (4) Manufacturing strategy knowledge, (5) Production and planning control knowledge.
- OF process consists of four knowledge; (1) Delivery and transportation planning knowledge, (2) Distribution network planning knowledge, (3) Inventory management knowledge, (4) Warehouse management knowledge.
- MFM process consists of six knowledge; (1) Inventory management knowledge, (2) Manufacturing strategy knowledge, (3) Optimization knowledge, (4) Production and planning control knowledge, (5) Quality Control knowledge, (6) Supplier selection and development knowledge.
- SRM process consists of three knowledge; (1) Purchasing management knowledge, (2) Sourcing strategies knowledge, (3) Supplier selection and development knowledge.
- PDC process consists of four knowledge; (1) Packaging design knowledge, (2) Product design knowledge, (3) Sale and marketing knowledge, (4) Supplier selection and development knowledge.
- RM process consists of two knowledge; (1) Delivery and transportation planning knowledge, (2) Disposition rule and method knowledge.

The third purpose is to evince the relative importance weights of KS and KT on enhancing supply chain performance, considering on hierarchical structure model that consist of (1) the first hierarchy (criteria) is knowledge sharing and knowledge transfer (2) the second hierarchy (sub-criteria1) is four dyads of supply chain integration focusing on external integration (3) the third hierarchy (sub-criteria2) is knowledge related to eight SCM processes (4) the forth hierarchy (sub-criteria3) is required knowledge for each SCM process and (5) the fifth hierarchy (alternative) is three attributes of supply chain performance. From the first and second objectives, we build the hierarchical structure model to analyze the relative importance weights by applying pair-wise questionnaire and FAHP analyzing. The sixty groups of experts involved in this phase. The outcomes illustrated as below;

- The first hierarchy (criteria):
    - *Current part*: the relative importance weights of knowledge sharing (KS) is more than knowledge transfer (KT); with the value as shown in Table 5.1.
    - *Ideal part*: the relative importance weights of knowledge sharing (KS) is more than knowledge transfer (KT); with the value as shown in Table 5.1 and 5.2. However, the ideal part possesses smaller difference of the relative importance weights between KS and KT than the current part.
- The second hierarchy (sub-criteria1):
    - *Current part*: The relative importance weights could be ranked as following (1) focal company to supplier (2) customer to focal company (3) focal company to customer and (4) supplier to focal company; with the value as shown in Table 5.1
    - *Ideal part*: The relative importance weights could be ranked as following (1) customer to focal company (2) focal company to supplier (3) supplier to focal company and (4) focal company to customer; with the value as shown in Table 5.1 and 5.2. Moreover, the relative importance weights of all four dyads of the ideal part (both for KS and KT) are closer to each other than that of the current part.
- The third hierarchy (sub-criteria2): For F2S and S2F, there exists the sharing and transferring the knowledge related to supply chain management with the relative importance weights: in the following orders MFM, OF, PDC, DM, CSM, SRM, CRM, and RM. While in F2C and C2F, the orders are PDC, DM, CSM, OF, MFM, CRM, RM, and SRM; with the value as shown in Table 5.2.

- The forth hierarchy (sub-criteria3): The relative importance weights of the required knowledge for each SCM process could be ranked the same as in each process for each dyad of external integration with the value as shown in Table 5.2.
- The fifth hierarchy (alternative): The relative importance weights of required knowledge for each SCM process that effect to each attribute of supply chain performance can be divided into four groups as Table 5.3. Moreover, the global relative importance weights could be ranked as following (1) Costs (2) Responsiveness and (3) Reliability; with the value of global weight as shown in Table 5.4.

Table 5. 1 Comparison the relative importance weights of first and second hierarchy (Current part & Idea part)

Relative importance weights (priority rank)					
Current part			Ideal part		
	KS (0.758)	KT (0.242)		KS (0.568)	KT (0.432)
(1) F2S	0.325	0.343	(1) C2F	0.302	0.308
(2) C2F	0.286	0.272	(2) F2S	0.266	0.267
(3) F2C	0.223	0.203	(3) S2F	0.226	0.219
(4) S2F	0.166	0.182	(4) F2C	0.206	0.206

Table 5. 2 The relative importance weights of required knowledge for eight SCM processes

Relative importance weights (priority rank) of required knowledge for eight SCM processes											
KS (0.568)						KT (0.432)					
	F2S (0.266)	S2F (0.226)		F2C (0.206)	C2F (0.302)		F2S (0.267)	S2F (0.219)		F2C (0.206)	C2F (0.308)
(1) MFM	**0.163**	**0.157**	**(1) PDC**	**0.156**	**0.170**	**(1) MFM**	**0.162**	**0.162**	**(1) PDC**	**0.160**	**0.172**
(1.1) QC	0.255	0.265	(1.1) PDD	0.299	0.300	(1.1) QC	0.261	0.259	(1.1) PDD	0.299	0.298
(1.2) PPC	0.211	0.208	(1.2) SSD	0.249	0.255	(1.2) PPC	0.209	0.209	(1.2) SSD	0.249	0.255
(1.3) MFS	0.165	0.159	(1.3) PKD	0.237	0.231	(1.3) MFS	0.161	0.161	(1.3) PKD	0.237	0.233
(1.4) OTM	0.130	0.131	(1.4) SM	0.215	0.214	(1.4) OTM	0.134	0.130	(1.4) SM	0.215	0.214
(1.5) SSD	0.124	0.127				(1.5) SSD	0.125	0.126			
(1.6) INM	0.115	0.110				(1.6) INM	0.109	0.115			
(2) OF	**0.153**	**0.150**	**(2) DM**	**0.154**	**0.158**	**(2) OF**	**0.154**	**0.153**	**(2) DM**	**0.154**	**0.156**
(2.1) DTP	0.313	0.312	(2.1) DF	0.240	0.241	(2.1) DTP	0.310	0.315	(2.1) DF	0.240	0.249
(2.2) INM	0.267	0.265	(2.2) CP	0.213	0.216	(2.2) INM	0.260	0.257	(2.2) CP	0.217	0.213
(2.3) WM	0.241	0.244	(2.3) PPC	0.205	0.196	(2.3) WM	0.249	0.240	(2.3) PPC	0.198	0.200
(2.4) DNP	0.180	0.179	(2.4) MFS	0.187	0.185	(2.4) DNP	0.180	0.188	(2.4) MFS	0.184	0.185
			(2.5) INM	0.155	0.161				(2.5) INM	0.161	0.154
(3) PDC	**0.148**	**0.146**	**(3) CSM**	**0.140**	**0.135**	**(3) PDC**	**0.150**	**0.150**	**(3) CSM**	**0.139**	**0.137**
(3.1) PDD	0.299	0.298	(3.1) QC	0.646	0.654	(3.1) PDD	0.297	0.298	(3.1) QC	0.646	0.654
(3.2) SSD	0.252	0.250	(3.2) IEC	0.354	0.346	(3.2) SSD	0.257	0.250	(3.2) IEC	0.354	0.346
(3.3) PKD	0.231	0.239				(3.3) PKD	0.232	0.239			
(3.4) SM	0.218	0.213				(3.4) SM	0.213	0.213			
(4) DM	**0.146**	**0.143**	**(4) OF**	**0.135**	**0.133**	**(4) DM**	**0.146**	**0.135**	**(4) OF**	**0.136**	**0.133**
(4.1) DF	0.241	0.241	(4.1) DTP	0.308	0.311	(4.1) DF	0.244	0.241	(4.1) DTP	0.308	0.320
(4.2) CP	0.215	0.223	(4.2) INM	0.270	0.268	(4.2) CP	0.216	0.218	(4.2) INM	0.271	0.258
(4.3) PPC	0.207	0.195	(4.3) WM	0.242	0.239	(4.3) PPC	0.200	0.197	(4.3) WM	0.241	0.242
(4.4) MFS	0.185	0.184	(4.4) DNP	0.180	0.182	(4.4) MFS	0.184	0.186	(4.4) DNP	0.180	0.180
(4.5) INM	0.153	0.156				(4.5) INM	0.157	0.158			
(5) CSM	**0.107**	**0.110**	**(5) MFM**	**0.133**	**0.124**	**(5) CSM**	**0.107**	**0.111**	**(5) MFM**	**0.131**	**0.124**
(5.1) QC	0.659	0.658	(5.1) QC	0.263	0.264	(5.1) QC	0.658	0.644	(5.1) QC	0.265	0.263
(5.2) IEC	0.341	0.342	(5.2) PPC	0.211	0.214	(5.2) IEC	0.342	0.356	(5.2) PPC	0.210	0.214
			(5.3) MFS	0.158	0.155				(5.3) MFS	0.157	0.155
			(5.4) OTM	0.131	0.130				(5.4) OTM	0.131	0.130
			(5.5) SSD	0.123	0.124				(5.5) SSD	0.123	0.124
			(5.6) INM	0.113	0.113				(5.6) INM	0.114	0.113
(6) SRM	**0.104**	**0.107**	**(6) CRM**	**0.120**	**0.120**	**(6) SRM**	**0.104**	**0.107**	**(6) CRM**	**0.121**	**0.120**
(6.1) SS	0.360	0.366	(6.1) SM	0.570	0.587	(6.1) SS	0.360	0.366	(6.1) SM	0.569	0.587
(6.2) SSD	0.331	0.324	(6.2) CC	0.430	0.413	(6.2) SSD	0.331	0.324	(6.2) CC	0.431	0.413
(6.3) PM	0.310	0.309				(6.3) PM	0.309	0.309			
(7) CRM	**0.092**	**0.096**	**(7) RM**	**0.085**	**0.084**	**(7) CRM**	**0.092**	**0.093**	**(7) RM**	**0.083**	**0.083**
(7.1) SM	0.587	0.598	(7.1) DTP	0.583	0.571	(7.1) SM	0.592	0.592	(7.1) DTP	0.583	0.571
(7.2) CC	0.413	0.402	(7.2) DRM	0.417	0.429	(7.2) CC	0.408	0.408	(7.2) DRM	0.417	0.429
(8) RM	**0.087**	**0.091**	**(8) SRM**	**0.077**	**0.076**	**(8) RM**	**0.085**	**0.089**	**(8) SRM**	**0.076**	**0.075**
(8.1) DTP	0.582	0.573	(8.1) SS	0.364	0.366	(8.1) DTP	0.583	0.581	(8.1) SS	0.364	0.366
(8.2) DRM	0.418	0.427	(8.2) SSD	0.326	0.328	(8.2) DRM	0.417	0.419	(8.2) SSD	0.326	0.326
			(8.3) PM	0.310	0.307				(8.3) PM	0.310	0.308

Remark: Symbols of required knowledge for eight SCM processes reference from Table 4.8

Table 5. 3 The required knowledge for each SCM process that effects to each attribute of supply chain performance

Group	Rank of SCP	SCM process	Required knowledge for SCM process
1	(1) Costs (2) Responsiveness (3) Reliability	DM	INM, MFS, PPC
		OF	INM, DNP, DTP, WM
		MFM	INM, MFS, PPC, OTM, SSD
		SRM	SS, SSD, PM
		PDC	SSD, PDD, PKD
		RM	DTP
2	(1) Responsiveness (2) Reliability (3) Costs	CRM	CC, SM
		CSM	IEC
		PDC	SM
		RM	DRM
3	(1) Responsiveness (2) Costs (3) Reliability	DM	DF, CP
4	(1) Reliability (2) Responsiveness (3) Costs	CSM	QC
		MFM	QC

Table 5. 4 Conclusion of global relative importance weights of supply chain performance

Supply Chain performance	Relative importance weights
(1) Costs	0.359
(2) Responsiveness	0.354
(3) Reliability	0.287

Moreover, model of sharing/transferring the required knowledge for the SCM process in enhancing SCM performance for each stakeholder can be summarized as follows:

- Assembly group: Greater importance weights is given to KS than KT by ranking the of knowledge between each dyad in the supply chain from customer to focal company, then focal company to supplier, then returning to supplier to focal company and focal company to customer. This group gives importance weights to the required knowledge for the OF and DM processes with top priority. The group also gives greater importance weights to the required knowledge for the CSM process than first-tier and second-tier suppliers.

- First-tier suppliers group: Greater importance weights is given to KS than KT by ranking the level of knowledge sharing between each dyad in the supply chain starting with customer to focal company, then focal company to supplier, then returning to supplier to focal company and focal company to customer. This group gives importance weights to the required knowledge for the MFM and PDC processes with top priority.
- Second-tier suppliers group: Greater importance weights is given to KT than KS by ranking the level of knowledge sharing between each dyad in the supply chain from customer to focal company, then focal company to supplier, then returning to supplier to focal company and focal company to customer. This group gives importance weights to the required knowledge for the MFM and PDC processes with top priority.

5.2 Managerial Implications

5.2.1 Application for industry

In Thailand's electrical and electronics industry, at present, there is no defining the difference between KS and KT obviously. However in practical, the two terms are different as summarized above. Therefore, a clear definition may help the industry applying the two words more explicitly under its context.

Actually, there are evidences of Information sharing or transferring more than KS or KT because they are a new theme for driving supply chain management. Moreover, they are quite limited to apply particularly in terms of confidential know-how. However, many companies have increasingly realized the importance of KS and KT. Although KT between focal company and their suppliers or customers is less than KS because the characteristic of KT is more sophisticated to reach than KS, effectiveness of KT is clearly visible because KT needs to be applied usually by a joint project for an alignment purpose as discussed above. Thus, the results from this research may motivate the companies recognizing the importance of KT more than previous. In addition, KS will be continued to the application more than current in order to enhance the better performance throughout the supply chain.

Furthermore, both KS and KT are in the form of sharing or transferring between individuals or between a team across organize. The knowledge has not been systematic managed to store and disperse it for other persons, teams, or units in their organizations. Thus, this research introduced the organizations should provide a system to manage the knowledge after these are shared or transferred for supreme benefit in the future.

In fact for Thailand's electrical and electronics industry, the staffs or teams who are responsible for the SCM and related functions within the companies have to employ this required knowledge for SCM process in their routine work. This knowledge is often transmitted to each others in their teams or units via learning by doing. Thus, it is difficult that this knowledge will be shared or transferred to their suppliers or customers. Notwithstanding, the companies perceive in nowadays that the information sharing or transferring may not enough, it should go beyond towards the KS or KT. Therefore, to enhance supply chain performance, the required knowledge for all eight SCM processes as listed in the research's results should be encouraged to share or transfer between the focal company and their suppliers or customers more than previous.

Furthermore, this list will be a guideline facilitating the companies for selecting the knowledge to share or transfer with their suppliers or customers by priority. That is, the research results show that if we want to enhance the supply chain performance, sharing and transferring the knowledge related to SCM process from customer to organization is unavoidable since the relative importance weights is the first priority for criteria. Therefore, if the organization is in the customer status, it should share and transfer all required knowledge to supplier for the organization so the suppliers will be able to share and transfer such knowledge to their suppliers. The supplier also should send useful knowledge back to the customer. We also find that the organization and the supplier should put effort to share and transfer the manufacturing knowledge especially the quality control and management. While the organization and the customer should focus on the product development and commercialized, especially knowledge of product designing. For the next issues, we can consider from the relative importance weights, which finally will lead to the competency development of the supply chain performance for all three aspects – costs, responsiveness, and reliability.

Furthermore, for the organization that already has the activities or the project for sharing and transferring the knowledge related to SCM process, this research will certainly be a guideline to support the activities or the next projects in the future. The organization will realize the importance weight of the activities and the projects to the supply chain performance.

5.2.2 Application for academics research

As shown in the evidence of the previous research regarding to overlapping of KS and KT, it causes the confusion to researchers for citing, adopting and analyzing these two terms. Therefore, the clear differentiation of KS and KT will lead to various benefits for further researches. This will make researchers find supporting evidence for the adoption of these two terms to match with their research topics appropriately, especially the research on supply chain management, which its topic tends to relate to the area of KS and KT. For example, the analysis on the relationship level of organization and organization's supplier or customer affecting knowledge sharing or knowledge transfer, that is, the level of close relationship between organization and organization's supplier or customer may lead to the knowledge transfer rather than the knowledge sharing. If the differentiation of KS and KT is unclear, there may not be evidence supporting the analysis in such type of researches.

The results in section 5.1 and the implications in section 5.2 can be mapped as Table 5.5.

Table 5. 5 Results and Implications

Result	Managerial Implications
	Application for academics research
The key difference between KS and KT in practical viewpoint focusing on external integration for SCM process knowledge is the application to achieve the goal. *(Section 4.1.2)*	The clear differentiation of KS and KT will lead to various benefits for further researches. This will make researchers find supporting evidence for the adoption of these two terms to match with their research topics appropriately, especially the research on supply chain management, which its topic tends to relate to the area of KS and KT.
	Application for industry
The key difference between KS and KT in practical viewpoint focusing on external integration for SCM process knowledge is the application to achieve the goal. *(Section 4.1.2)*	The findings of this section in the present research may aid entrepreneurs, especially in the supply chains of the electrical and electronic industries, in gaining greater understanding about the differences in these two terms and may lead to suitable applications at the corporate level.
To enhance supply chain performance (idea part) in overall, the relative importance weights of KS is more than KT. However, the ideal part possesses smaller difference of the relative importance weights between KS and KT than the current part. *(Section 4.2.2.1&4.2.2.2, Table 5.1)*	The findings of this section of the present research may aid entrepreneurs, particularly those in the supply chains of the electrical and electronic industries, in placing priority on awareness and greater application of KS and KT. The research illustrated that KS and KT are important in boosting supply chain performance. Furthermore, the research revealed that the effectiveness of KT is clearly visible because KT need to be applied the obtained knowledge for an alignment purpose. Thus, the results from this research may motivate the companies recognizing the importance of KT more than previous.
To enhance supply chain performance, knowledge sharing and transferring should follow the chain by starting from customer to focal company, focal company to suppliers, and going back from supplier to focal company, and focal company to customer.	The findings of this section of the present research may aid entrepreneurs, especially in the supply chains of the electrical and electronic industries, in giving priority to awareness of the sharing/ transferring of the required knowledge for SCM process from customer organizations to supplier

Table 5. 5 Results and Implications (Continued)

Result	Managerial Implications
	Application for industry
Moreover, the relative importance weights of all four dyads of the ideal part (both for KS and KT) are closer to each other than that of the current part. *(Section 4.2.3.1&4.2.3.2, Table 5.1)*	organizations in addition to only stating their own requirements as at present with the findings of the research illustrate that sharing/transferring the required knowledge for SCM process from customers to focal company carried the greatest weight in supply chain performance. Moreover, the findings of the present research may motivate entrepreneurs in the supply chain to share/transfer the required knowledge for SCM process on a more intimate level for each dyad within the supply chain, whether customer to focal company, focal company to suppliers and going back from supplier to focal company and focal company to customer, since the findings of the research illustrated that weighted priority scores share greater similarities than the current characteristics.
The relative importance weights of required knowledge for eight SCM processes in overall as Table 5.2. (*Section 4.2.4, Section 4.2.5,Table 5.2)*	The required knowledge for all eight SCM processes as listed in the research's results should be encouraged to share or transfer between the focal company and their suppliers or customers more than previous to enhance supply chain performance. This list will be a guideline facilitating the companies especially in the supply chain of electrical and electronics industry, for selecting the knowledge to share or transfer with their suppliers or customers by priority.
The required knowledge for each SCM process that effect to each attribute of supply chain performance can be divided into four groups as Table 5.3. (*Section 4.2.6, Table 5.3)*	The findings of this section of the present research can become a guideline for entrepreneurs, especially in the supply chains of the electrical and electronic industries, in promoting each attribute of supply chain performance by sharing/transferring the required knowledge for SCM process.

Table 5. 5 Results and Implications (Continued)

Result	Managerial Implications
	Application for industry
	In other words, if the organization and supplier or customer of the organization wants to cooperatively promote reliability, they should focus on sharing/transferring the required knowledge for CSM and MFM processes such as quality control knowledge, etc.
Model of sharing/transferring the required knowledge for the SCM process in enhancing SCM performance for each stakeholder can be summarized as follows: ▪ Assembly group: Greater importance weights is given to **KS** than KT by ranking the of knowledge between each dyad in the supply chain from customer to focal company, then focal company to supplier, then returning to supplier to focal company and focal company to customer. This group gives importance weights to the required knowledge for the **OF** and **DM** processes with top priority. The group also gives greater importance weights to the required knowledge for the **CSM** process than first-tier and second-tier suppliers. ▪ First-tier suppliers group: Greater importance weights is given to **KS** than KT by ranking the level of knowledge sharing between each dyad in the supply chain starting with customer to focal company, then focal company to supplier, then returning to supplier to focal company and focal company to customer. This group gives importance weights to the required knowledge for the **MFM** and **PDC** processes with top priority.	In boosting supply chain performance, entrepreneurs, especially in the supply chains of the electrical and electronic industries, may apply this part of the present research as practice guidelines by taking into consideration the suitability for each stakeholder as follows: ▪ Assembly group (downstream level) should give top priority to sharing the required knowledge for the OF and DM processes, such as DTP, INM, WM, DNP DF, CP, PPC and MFS, as well as they should focus on the required knowledge for the CSM process such as QC and IEC. ▪ First-tier suppliers group (midstream level) should give top priority to sharing the required knowledge for the **MFM** and **PDC** processes, such as QC, PPC, MFS, OTM, INM, SSD, PDD, SSD, PKD, SM.

Table 5. 5 Results and Implications (Continued)

Result	Managerial Implications
	Application for industry
▪ Second-tier suppliers group: Greater importance weights is given to **KT** than KS by ranking the level of knowledge sharing between each dyad in the supply chain from customer to focal company, then focal company to supplier, then returning to supplier to focal company and focal company to customer. This group gives importance weights to the required knowledge for the **MFM** and **PDC** processes with top priority. *(Section 4.2.8, Figure 4.13)*	▪ Second-tier suppliers group (midstream level) should give top priority to transferring the required knowledge for the **MFM** and **PDC** processes, such as QC, PPC, MFS, OTM, INM, SSD, PDD, SSD, PKD, SM. Hence, the organizations of each stakeholder should give importance to the aforementioned sharing/transferring the required knowledge for SCM between each dyad in the supply chain by beginning from customer to focal company, then focal company to supplier, and then coming back to supplier to focal company and focal company to customer.

5.3 Limitations and future works

Although this research was developed under the systematic research methodologies, certain imperfections are worth to pinpoint for future research as below.

5.3.1 Knowledge for SCM process

In this research, there is an analysis on the relative weight of the required knowledge for SCM process. The analysis of such knowledge starts from the analysis on activities or sub processes of each SCM process as described in the previous chapter. However, the operational process of each firm may divide functions relating to the SCM process differently based on departments or sections, such as sales department, procurement department, research and design department, planning department, production department, warehouse department, delivery department, logistics department, etc. This causes the scope of this research to be overall knowledge which is not specified each department. As a result, if evaluating experts do not understand the overview of tasks relating to the SCM process, it possibly causes the deviation of evaluation. Therefore, if knowledge is collected by focusing on each department regarding SCM and logistics as shown in the above examples, deep knowledge may be acquired based on departments which is possibly more specific knowledge. In addition, the expert selection will be easier and the scope of evaluation from experts will be narrower, resulting to positive effect on the quality of evaluation.

5.3.2 Numbers of entrepreneur in each stakeholder

In this research, there were 60 groups of expert from 60 companies, who assessed the questionnaire in a part of FAHP. Mostly, each company had 1 expert who answered the questionnaire. However, there are thirteen companies that had groups of expert responding the questionnaire, which each group consisted of 2-5 experts. Among these 60 companies, there were entrepreneurs in the 2^{nd} tire supplier group in an amount of twelve companies, the 1^{st} tier supplier group in an amount of twenty-seven companies, and the assembly group in an amount of twenty-one company. It was found that each stakeholder would have different numbers of entrepreneurs or expert groups. This may affect the analysis on comparative of three stakeholders (section 4.2.8) which is the analysis on the stakeholder basis. It possibly causes the bias of group-based analysis results. However, this is the research limitation which the number of stakeholders cannot be controlled equally because the participation of experts in assessing the questionnaire must be conducted willingly. Therefore, regarding to further researches, if the number of entrepreneurs in each stakeholder can be controlled equally, it will help reduce the bias.

5.3.3 Different demographic characteristics

This study focused on electrical and electronics industry; the findings may not comprehensively reflect other industries such as automobile & parts, garment, food & beverage etc. Moreover, this research emerge from the local area; results may differ for companies located on different countries that are operating in different cultural. These limitations should take into account in further study to compare the results that reported from different industries or different countries.

5.3.4 Other future works

Besides that, as mentioned above, a clear definition term of KS and KT may lead to various useful analyzing in the future. Future research may study the factors that effect to KS and KT such as degree of relationship between focal company and their suppliers or customers, resource i.e. personnel, time or budget, etc. Furthermore, other interesting research areas are the development of process models or systems applied in managing knowledge which are shared or transferred from suppliers or customers. It is to maintain such acquired knowledge of persons, teams, or sections and also allow other persons, teams, or sections in organizations to learn such knowledge for the utmost benefits of the organizations.

In addition, other quantitative methodologies such as multicriteria decision making (MCDM) e.g. analytic network process (ANP), Fuzzy TOSIS, or statistical methods e.g. structural equation modeling (SEM) may be applied to analyze the priority of the required knowledge for SCM process and may go further to explore the relationship between these knowledge and supply chain performance. The results from other quantitative methodologies may be compared with this research.

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APPENDICES

Appendix A

Interview Guideline and Checklist Questionnaire (Phase I)

Interview Guideline and Checklist Questionnaire

My name is Thanida Sunarak, a doctoral candidate in the Logistics Management Program at the Chulalongkorn University. I am in the process of writing my doctoral dissertation in the topic of **"The relative influence of knowledge sharing for supply chain management process in supply chain integration scope on supply chain performance".** Two of the main purposes of this study are:

1. To clarify the distinction of KS and KT in practical viewpoint specific to SCM process knowledge for external integration.
2. To screen the required knowledge for all of the eight SCM processes that should be shared or transferred in the scope of external integration to enhance supply chain performance.

To achieve above purpose, semi-structured questionnaire for interview and checklist questionnaire are employed. Your contribution to this will be highly recognized for our research. This research will succeed only with the help from you and your organization. Therefore, we would like you to assist in answering this questionnaire including more interviews. All provided information and your individual responses will be kept full confidential according to the Academic Ethics Regulation. **We would like to thank you very much for spending your precious time for interviewing and filling the questionnaire.**

If you or your organization wishes to receive a summary of our survey findings, please provide us at
Miss Thanida Sunarak
Graduated School, Department of Logistics Management, Chulalongkorn University
Phone: 089-120-8220, Email: thanidasunarak@gmail.com
(The research will be delivered when the work has been published)

Brief of Personal Information

- Date answered:____________________
- Name:____________________Surname:____________________
- Position:____________________ Experience in SCM (Years):__________
- Mobile or telephone:____________________ E-mail:____________________
- Company Name:____________________
- Electrical and Electronics industry; Please specify your product:____________________
  ____
- Company Size : Number of employees:____________________
- Main raw material from key suppliers (please specify)____________________
- Main product of key customers (please specify)____________________

Part 1: Interview Guideline

- What is the difference between knowledge sharing and knowledge transfer, specific to SCM process knowledge for external integration (KS and KT between focal company to suppliers or customers)?
- Is there knowledge sharing or knowledge transfer between you and your supplier or customers, specific to SCM process knowledge? And which one is more?
  - Knowledge sharing ☐Yes ☐No

    -From Focal company to Supplier ☐Yes ☐No; Pleases provide the example________

    -From Supplier to Focal company ☐Yes ☐No; Pleases provide the example________

    -From Focal company to Customer ☐Yes ☐No; Pleases provide the example________

    -From Customer to Focal company ☐Yes ☐No; Pleases provide the example________

    [Estimate proportion for four aspects (%)]

  - Knowledge transfer ☐Yes ☐No

    -From Focal company to Supplier ☐Yes ☐No; Pleases provide the example________

    -From Supplier to Focal company ☐Yes ☐No; Pleases provide the example________

    -From Focal company to Customer ☐Yes ☐No; Pleases provide the example________

    -From Customer to Focal company ☐Yes ☐No; Pleases provide the example________

    [Estimate proportion for four aspects (%)]

  ☐ Knowledge sharing more than Knowledge transfer [Estimate proportion %]

  ☐ Knowledge sharing more than Knowledge transfer [Estimate proportion %]

- How knowledge are transferred or shared?
  - Meeting / Conference
  - Site visit
  - Training
  - Coaching
  - Mentoring
  - So on

- Additional issue

Part 2: Checklist Questionnaire

- Do you think which knowledge shown in the table below is necessary to each supply chain management processes out of 8 process as specified from Item 1 to 8? **Such knowledge is shared or transferred, or should be shared or transferred among organizations** and it is important to the improvement of supply chain performance. *[Please check the selected answer]. You can add additional knowledge in the table.*

Example

For Customer Relationship Management (CRM) process

	Required Knowledge	Selected
1	Capacity planning knowledge	✓
2	Customer categorizing knowledge	✓
3	Decision making knowledge	✓
4	Delivery and transportation planning knowledge	
5	Demand forecasting knowledge	
6	Disposition rule and method knowledge	
7	Distribution network planning knowledge	
8	Internal and external coordination knowledge	
9	Inventory management knowledge	
10	Manufacturing strategy knowledge	
11	Optimization knowledge	
12	Packaging design knowledge	
13	Product design knowledge	
14	Production and planning control knowledge	
15	Purchasing management knowledge	
16	Quality control knowledge	
17	Sale and marketing knowledge	
18	Sourcing strategies knowledge	
19	Supplier selection and development knowledge	
20	Warehouse management knowledge	
21	Others Knowledge 1	✓
22	Others Knowledge 2	✓
23	Others...	

Item 1. For Customer Relationship Management (CRM) process

Required Knowledge		Selected
1	Capacity planning knowledge	
2	Customer categorizing knowledge	
3	Decision-making knowledge	
4	Delivery and transportation planning knowledge	
5	Demand forecasting knowledge	
6	Disposition rule and method knowledge	
7	Distribution network planning knowledge	
8	Internal and external coordination knowledge	
9	Inventory management knowledge	
10	Manufacturing strategy knowledge	
11	Optimization knowledge	
12	Packaging design knowledge	
13	Product design knowledge	
14	Production and planning control knowledge	
15	Purchasing management knowledge	
16	Quality control knowledge	
17	Sale and marketing knowledge	
18	Sourcing strategy knowledge	
19	Supplier selection and development knowledge	
20	Warehouse management knowledge	
21	Others Knowledge 1	
22	Others Knowledge 2	
23	Others..	

Item 2. For Customer Service Management (CSM) process

Required Knowledge		Selected
1	Capacity planning knowledge	
2	Customer categorizing knowledge	
3	Decision-making knowledge	
4	Delivery and transportation planning knowledge	
5	Demand forecasting knowledge	
6	Disposition rule and method knowledge	
7	Distribution network planning knowledge	
8	Internal and external coordination knowledge	
9	Inventory management knowledge	
10	Manufacturing strategy knowledge	
11	Optimization knowledge	
12	Packaging design knowledge	
13	Product design knowledge	
14	Production and planning control knowledge	
15	Purchasing management knowledge	
16	Quality control knowledge	
17	Sale and marketing knowledge	
18	Sourcing strategy knowledge	
19	Supplier selection and development knowledge	
20	Warehouse management knowledge	
21	Others Knowledge 1	
22	Others Knowledge 2	
23	Others...	

Item 3. For Demand Management (DM) process

Required Knowledge		Selected
1	Capacity planning knowledge	
2	Customer categorizing knowledge	
3	Decision-making knowledge	
4	Delivery and transportation planning knowledge	
5	Demand forecasting knowledge	
6	Disposition rule and method knowledge	
7	Distribution network planning knowledge	
8	Internal and external coordination knowledge	
9	Inventory management knowledge	
10	Manufacturing strategy knowledge	
11	Optimization knowledge	
12	Packaging design knowledge	
13	Product design knowledge	
14	Production and planning control knowledge	
15	Purchasing management knowledge	
16	Quality control knowledge	
17	Sale and marketing knowledge	
18	Sourcing strategy knowledge	
19	Supplier selection and development knowledge	
20	Warehouse management knowledge	
21	Others Knowledge 1..	
22	Others Knowledge 2..	
23	Others...	

Item 4. For Order Fulfillment (OF) process

Required Knowledge		Selected
1	Capacity planning knowledge	
2	Customer categorizing knowledge	
3	Decision-making knowledge	
4	Delivery and transportation planning knowledge	
5	Demand forecasting knowledge	
6	Disposition rule and method knowledge	
7	Distribution network planning knowledge	
8	Internal and external coordination knowledge	
9	Inventory management knowledge	
10	Manufacturing strategy knowledge	
11	Optimization knowledge	
12	Packaging design knowledge	
13	Product design knowledge	
14	Production and planning control knowledge	
15	Purchasing management knowledge	
16	Quality control knowledge	
17	Sale and marketing knowledge	
18	Sourcing strategy knowledge	
19	Supplier selection and development knowledge	
20	Warehouse management knowledge	
21	Others Knowledge 1	
22	Others Knowledge 2	
23	Others..	

Item 5. For Manufacturing Flow Management (MFM) process

Required Knowledge		Selected
1	Capacity planning knowledge	
2	Customer categorizing knowledge	
3	Decision-making knowledge	
4	Delivery and transportation planning knowledge	
5	Demand forecasting knowledge	
6	Disposition rule and method knowledge	
7	Distribution network planning knowledge	
8	Internal and external coordination knowledge	
9	Inventory management knowledge	
10	Manufacturing strategy knowledge	
11	Optimization knowledge	
12	Packaging design knowledge	
13	Product design knowledge	
14	Production and planning control knowledge	
15	Purchasing management knowledge	
16	Quality control knowledge	
17	Sale and marketing knowledge	
18	Sourcing strategy knowledge	
19	Supplier selection and development knowledge	
20	Warehouse management knowledge	
21	Others Knowledge 1	
22	Others Knowledge 2	
23	Others...	

Item 6. For Supplier Relationship Management (SRM) process

Required Knowledge		Selected
1	Capacity planning knowledge	
2	Customer categorizing knowledge	
3	Decision-making knowledge	
4	Delivery and transportation planning knowledge	
5	Demand forecasting knowledge	
6	Disposition rule and method knowledge	
7	Distribution network planning knowledge	
8	Internal and external coordination knowledge	
9	Inventory management knowledge	
10	Manufacturing strategy knowledge	
11	Optimization knowledge	
12	Packaging design knowledge	
13	Product design knowledge	
14	Production and planning control knowledge	
15	Purchasing management knowledge	
16	Quality control knowledge	
17	Sale and marketing knowledge	
18	Sourcing strategy knowledge	
19	Supplier selection and development knowledge	
20	Warehouse management knowledge	
21	Others Knowledge 1	
22	Others Knowledge 2	
23	Others..	

Item 7. For Product Development and Commercialization (PDC) process

Required Knowledge		Selected
1	Capacity planning knowledge	
2	Customer categorizing knowledge	
3	Decision-making knowledge	
4	Delivery and transportation planning knowledge	
5	Demand forecasting knowledge	
6	Disposition rule and method knowledge	
7	Distribution network planning knowledge	
8	Internal and external coordination knowledge	
9	Inventory management knowledge	
10	Manufacturing strategy knowledge	
11	Optimization knowledge	
12	Packaging design knowledge	
13	Product design knowledge	
14	Production and planning control knowledge	
15	Purchasing management knowledge	
16	Quality control knowledge	
17	Sale and marketing knowledge	
18	Sourcing strategy knowledge	
19	Supplier selection and development knowledge	
20	Warehouse management knowledge	
21	Others Knowledge 1..	
22	Others Knowledge 2..	
23	Others..	

Item 8. For Returns Management (RM) process

Required Knowledge		Selected
1	Capacity planning knowledge	
2	Customer categorizing knowledge	
3	Decision-making knowledge	
4	Delivery and transportation planning knowledge	
5	Demand forecasting knowledge	
6	Disposition rule and method knowledge	
7	Distribution network planning knowledge	
8	Internal and external coordination knowledge	
9	Inventory management knowledge	
10	Manufacturing strategy knowledge	
11	Optimization knowledge	
12	Packaging design knowledge	
13	Product design knowledge	
14	Production and planning control knowledge	
15	Purchasing management knowledge	
16	Quality control knowledge	
17	Sale and marketing knowledge	
18	Sourcing strategy knowledge	
19	Supplier selection and development knowledge	
20	Warehouse management knowledge	
21	Others Knowledge 1..	
22	Others Knowledge 2..	
23	Others..	

- **Additional issue**

♦Thank you for taking your valuable time to interview and answer this questionnaire ♦

Appendix B

Questionnaire (Phase II)

Questionnaire Sheet 1

My name is Thanida Sunarak, a doctoral candidate in the Logistics Management Program at the Chulalongkorn University. I am in the process of writing my doctoral dissertation in the topic of **"The relative influence of knowledge sharing for supply chain management process in supply chain integration scope on supply chain performance".** One of the main purposes of this study is:

To evince the relative influence of KS and KT on enhancing supply chain performance, considering on hierarchical structure as follow;

1. The first hierarchy for evaluating the relative importance weights of **knowledge transfer (KS)** or **knowledge sharing (KT)** on enhancing supply chain performance (**Criteria** as show in Table 1).
2. The second hierarchy for evaluating the relative importance weights of knowledge transfer or knowledge sharing in each dyad of supply chain integration (SCI) on enhancing supply chain performance (**Sub Criteria-1** as show in Table 1).
3. The third hierarchy for evaluating the relative importance weights of knowledge related eight supply chain management (SCM) processes in each dyad of supply chain integration on enhancing supply chain performance (**Sub Criteria-2** as show in Table 1).
4. The forth hierarchy for evaluating the relative importance weights of required knowledge for each SCM process in each dyad of supply chain integration on enhancing supply chain performance (**Sub Criteria-3** as show in Table 1).
5. The fifth hierarchy for evaluating the relative importance weights of required knowledge for each SCM process that effect to each attribute of supply chain performance (**Goal and alternative** as show in Table 1).

To achieve above purpose, we would like to know relative importance weights of those criteria and sub-criteria in your mind. This study employs Fuzzy Analytic Hierarchy Process (FAHP) method. The detail and procedures of doing this questionnaire will be presented next.

Your contribution to this will be highly recognized for our research. This research will succeed only with the help from you and your organization. Therefore, we would like you to assist in answering this questionnaire including more interviews. All provided information and your individual responses will be kept full confidential according to the Academic Ethics Regulation. **We would like to thank you very much for spending your precious time for interviewing and filling the questionnaire.**

If you or your organization wishes to receive a summary of our survey findings, please provide us at
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(The research will be delivered when the work has been published)

Table 1 Goal/Alternative Criteria and Sub-criteria

Goal / Alternative	Criteria	Sub Criteria-1: KT and KS in SCI scope	Sub Criteria-2: Knowledge related 8 to SCM Processes	Sub Criteria-3: Required Knowledge for each SCM Process
Supply Chain Performance / - Costs - Reliability - Responsiveness	- Knowledge Sharing (KS) - Knowledge Transfer (KT)	- KS from Focal company to Suppliers - KS from Suppliers to Focal company - KS from Focal company to Customer - KS from Customer to Focal company - KT from Focal company to Suppliers - KT from Suppliers to Focal company - KT from Focal company to Customer - KT from Customer to Focal company	1.Customer Relationship Management (CRM)	- Customer categorizing knowledge - Sale and Marketing knowledge
			2.Customer Service Management (CSM)	- Internal and external coordination knowledge - Quality Control knowledge
			3.Demand Management (DM)	- Demand forecasting knowledge - Capacity planning knowledge - Inventory management knowledge - Manufacturing strategy knowledge - Production and planning control knowledge
			4.Order Fulfillment (OF)	- Inventory management knowledge - Distribution network planning knowledge - Delivery and Transportation planning knowledge - Warehouse management knowledge
			5.Manufacturing Flow Management (MFM)	- Quality control knowledge - Inventory management knowledge - Manufacturing strategy knowledge - Production and planning control knowledge - Optimization knowledge - Supplier selection and development knowledge
			6.Supplier Relationship Management (SRM)	- Sourcing Strategies knowledge - Supplier selection and development knowledge - Purchasing Management knowledge
			7.Product Development and Commercialization (PDC)	- Sale and Marketing knowledge - Supplier selection and development knowledge - Product design knowledge - Packaging design knowledge
			8.Returns Management (RM)	- Delivery and Transportation planning knowledge - Disposition rule and method knowledge

Remark : SCI is Supply chain integration, SCM is Supply chain management

The definition of Knowledge Sharing, Knowledge Transfer, **Goal / Alternative**, **Sub Criteria-2** and **Sub Criteria-3** are provide in attached document

Details of the questionnaire

As mentioned above that this research would like to evaluate the relative importance weights of goal/ alternative, criteria, sub- criteria by applying Fuzzy Analytic Hierarchy Process (FAHP) method. Therefore, almost of the item of questionnaire are evaluated in form of **pair-wise comparison**. However, some questions are in form of open-end question or likert scale. For pair-wise comparison, the linguistic term and fuzzy number are provided in Table 2.

Table 2 Scale for pair-wise comparison (Saaty,1980)

Linguistic Term	Fuzzy Number
Equally important weight	1'
Weakly more important weight	3'
Essentially more important weight	5'
Very strongly more important weight	7'
Absolutely more important weight	9'
Intermediate values : x'	2', 4', 6', 8'

Example for answering

- Each row in this questionnaire has one paired criteria: one is in the first left column and the other is in the last right hand column, i.e., the comparison between "**Knowledge Sharing**" and "**Knowledge Transfer**". From the scale in Table 2, the respondents can score by the following example.

Example 1:

Knowledge Sharing	9'	8'	**7'**	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Knowledge Transfer

- For this example, It means "**Knowledge Sharing**" is **very strongly more important weight** and roughly 7 times more influential than "**Knowledge Transfer**"

Example 2:

Knowledge Sharing	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	**5'**	6'	7'	8'	9'	Knowledge Transfer

- For this example, It means "**Knowledge Transfer**" is **essentially more important weight** and roughly 5 times more influential than "**Knowledge Sharing**"

Example 3:

Knowledge Sharing	9'	8'	7'	6'	5'	4'	3'	2'	**1'**	2'	3'	4'	5'	6'	7'	8'	9'	Knowledge Transfer

- For this example, It means "**Knowledge Sharing**" and **Knowledge Transfer**" are **equally important weight** (In case of the two criteria are equally influential, just circle scale 1)

Caution (Consistency of evaluating within 1 metric)

Example: Considering 3 criteria; price, quality and after sale service

Price	**9'**	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Quality
Price	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	**9'**	After sale service
Quality	**9'**	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	After sale service

- Row 1: it means "price" is absolutely more important weight than "quality" **[**price **>** quality (roughly 9 times)**]**
- Row 2: it means "after sale service" is absolutely more important weight than "price" [after sale service > price (roughly 9 times)]
- From row 1 and 2, we found "after sale service > price> quality" or we can mention that the important weight of "after sale service" must greater than "quality" as well
- However, row 3 means "quality" is absolutely more important weight than "after sale service" [quality> After sale service (roughly 9 times)]. Row 3 is inconsistency **with row 1 and 2. In this case, therefore, the respondents need to evaluate again.**

Part 1: Brief of Personal Information

- Date answered:____
- Name:_______________________Surname:____________________________
- Position:__________________________ Experience in SCM (Years):_____________
- Mobile or telephone:________________________ E-mail:____________________
- Company Name:____
- Electrical and Electronics industry; Please specify your product:_________________________

  ____
- Company Size : Number of employees:____________________________________
- Role in supply chain ☐ Due with both suppliers and customers

  ☐ Due with only suppliers ☐ Due with only customers

*[**Suppliers**, herein, focusing on parts/electrical and electronics manufacturers.]*

*[**Customers**, herein, focusing on parts/electrical and electronics manufacturers, agency company etc. but regardless of the end user]*

- **Main raw material** from key suppliers (please specify)___________________________

  :____
- **Main product of key customers** (please specify)________________________________

  :____

Part 2: The study of the relative importance weights of knowledge transfer or knowledge sharing on enhancing supply chain performance

Item 1: [There are 2 sub-questions. Question 1.1 refers the existing nature of the organization (current part). Question 1.2 refers the nature supposed to be for affecting the enhancement of the supply chain performance (Ideal part).] Attention: **"Knowledge" is different from "Information"** In this research; only knowledge is considered, excluding information. [Please see the definition of "Knowledge", "Knowledge Sharing" and "Knowledge Transfer" in attach file].

(1.1) Considering **knowledge sharing** and **knowledge transfer** relating to the supply chain management process (for enhancing the supply chain performance), which one does **your organization currently is more?**

☐ Only knowledge sharing (Skip to 1.3) ☐ Only knowledge transfer (Skip to 1.3)

☐ Both of them (Answer the question in the table below)

knowledge sharing (KS)	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	knowledge transfer (KT)

(1.2) Considering **knowledge sharing** (KS) and **knowledge transfer** (KT) relating to the supply chain management process, **which one is more significant to the enhancement of the supply chain performance?**

knowledge sharing (KS)	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	knowledge transfer (KT)

Reason:____

.____

(1.3) What are the factors do cause the existing nature (Assessment result of Question 1.1) to be different from what it is supposed to be for affecting the enhancement of supply chain performance (Assessment result of Question 1.2) :____

.____

.____

Part 3: The study of the relative importance weights of knowledge transfer or knowledge sharing in each dyad of supply chain integration on enhancing supply chain performance

[Question 2. refers the existing nature of the organization (current part). Question 3 refers the nature supposed to be for affecting the enhancement of the supply chain performance (ideal part).]

Item 2: (2.1) Currently your organization has *knowledge sharing (KS)* relating to the supply chain management process (for enhancing the supply chain performance) ***between which dyad*** in the supply chain that are greater?

☐ Unable to answer in the table below because **currently** there is not completely such action in the organization (Skip to 2.2)

☐ Able to answer in the table below (Answer the question in the table below)

KS from Focal company to Suppliers	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	KS from Suppliers to Focal company
KS from Focal company to Suppliers	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	KKS from Focal company to Customer
KS from Focal company to Suppliers	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	KS from Customer to Focal company
KS from Suppliers to Focal company	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	KS from Focal company to Customer
KS from Suppliers to Focal company	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	KS from Customer to Focal company
KS from Focal company to Customer	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	KS from Customer to Focal company

(2.2) Currently your organization has *knowledge transfer (KT)* relating to the supply chain management process (for enhancing the supply chain performance) ***between which dyad*** in the supply chain that are greater?

☐ Unable to answer in the table below because **currently** there is not completely such action in the organization (Skip to 3)

☐ Able to answer in the table below; Answer same as 2.1 ☐ Yes (Skip to 3.1) ☐ No (Answer the question in the table below)

KT from Focal company to Suppliers	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	KT from Suppliers to Focal company
KT from Focal company to Suppliers	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	KT from Focal company to Customer
KT from Focal company to Suppliers	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	KT from Customer to Focal company
KT from Suppliers to Focal company	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	KT from Focal company to Customer
KT from Suppliers to Focal company	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	KT from Customer to Focal company
KT from Focal company to Customer	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	KT from Customer to Focal company

Item 3: (3.1) You think that *knowledge sharing (KS)* relating to the supply chain management process ***between which dyad*** in the supply chain are **more important** to the enhancement of supply chain performance?

KS from Focal company to Suppliers	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	KS from Suppliers to Focal company
KS from Focal company to Suppliers	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	KKS from Focal company to Customer
KS from Focal company to Suppliers	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	KS from Customer to Focal company
KS from Suppliers to Focal company	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	KS from Focal company to Customer
KS from Suppliers to Focal company	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	KS from Customer to Focal company
KS from Focal company to Customer	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	KS from Customer to Focal company

(3.2) You think that *knowledge transfer (KT)* relating to the supply chain management process ***between which dyad*** in the supply chain are **more important** to the enhancement of supply chain performance?

Answer same as 3.1 ☐ Yes (Skip to Item 3.3) ☐ No (Answer the question in the table below)

KT from Focal company to Suppliers	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	KT from Suppliers to Focal company
KT from Focal company to Suppliers	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	KT from Focal company to Customer
KT from Focal company to Suppliers	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	KT from Customer to Focal company
KT from Suppliers to Focal company	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	KT from Focal company to Customer
KT from Suppliers to Focal company	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	KT from Customer to Focal company
KT from Focal company to Customer	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	KT from Customer to Focal company

(3.3) What are the factors do cause the existing nature (Assessment result of Question 2.1 and 2.2) to be different from what it is supposed to be for affecting the enhancement of supply chain performance (Assessment result of Question 3.1 and 3.2) ;____

____

Item 4: Please provide the example of **projects/ activities/ operations** focusing on knowledge sharing relating to supply chain management process between your organization and your suppliers or customers in order to help enhance the supply chain performance [Please fill the answer in the table below]

Knowledge Sharing	
1. From focal company to suppliers	2. From suppliers to focal company
▪ **Projects/ activities/ operations** ex. sharing knowledge about inventory management in the conference program jointly etc.	▪ **Projects/ activities/ operations** ex. sharing knowledge about inventory management in the conference program jointly etc.
▪ Supporting evidence for **Projects/ activities/ operations** (if any) ex. work/ activity plans, MOU etc. [Don't attach the real evidence, just identify the example]	▪ Supporting evidence for **Projects/ activities/ operations** (if any) ex. work/ activity plans, MOU etc. [Don't attach the real evidence, just identify the example]
▪ The effect of improving supply chain and logistics performance ex. reduces inventory cost, on time delivery etc.	▪ The effect of improving supply chain and logistics performance ex. reduces inventory cost, on time delivery etc.

Knowledge sharing	
3. From focal company to customers	4. From customers to focal company
▪ **Projects/ activities/ operations** ex. sharing knowledge about inventory management in the conference program jointly etc.	▪ **Projects/ activities/ operations** ex. sharing knowledge about inventory management in the conference program jointly etc.
▪ Supporting evidence for **Projects/ activities/ operations** (if any) ex. work/ activity plans, MOU etc. [Don't attach the real evidence, just identify the example]	▪ Supporting evidence for **Projects/ activities/ operations** (if any) ex. work/ activity plans, MOU etc. [Don't attach the real evidence, just identify the example]
▪ The effect of improving supply chain and logistics performance ex. reduces inventory cost, on time delivery etc.	▪ The effect of improving supply chain and logistics performance ex. reduces inventory cost, on time delivery etc.

[If the space in the table is not enough, you can add table or fill in the end of this questionnaire]

Item 5: Please provide the example of **projects/ activities/ operations** focusing on <u>knowledge transfer</u> relating to supply chain management process between your organization and your suppliers or customers in order to help enhance the supply chain performance [Please fill the answer in the table below]

Knowledge Transfer	
1. From focal company to suppliers	2. From suppliers to focal company
▪ **Projects/ activities/ operations** ex. suppliers training in the topic of delivery and transportation planning etc.	▪ **Projects/ activities/ operations** ex. suppliers consults focal company team about warehouse management etc.
▪ Supporting evidence for **Projects/ activities/ operations** (if any) ex. work/ activity plans, MOU etc. [Don't attach the real evidence, just identify the example]	▪ Supporting evidence for **Projects/ activities/ operations** (if any) ex. work/ activity plans, MOU etc. [Don't attach the real evidence, just identify the example]
▪ The effect of improving supply chain and logistics performance ex. reduces inventory cost, on time delivery etc.	▪ The effect of improving supply chain and logistics performance ex. reduces inventory cost, on time delivery etc.

Knowledge Transfer	
3. From focal company to customers	4. From customers to focal company
▪ **Projects/ activities/ operations** ex. focal company consult customer about material return management etc.	▪ **Projects/ activities/ operations** ex customers consult focal company about quality management etc.
▪ Supporting evidence for **Projects/ activities/ operations** (if any) ex. work/ activity plans, MOU etc. [Don't attach the real evidence, just identify the example]	▪ Supporting evidence for **Projects/ activities/ operations** (if any) ex. work/ activity plans, MOU etc. [Don't attach the real evidence, just identify the example]
▪ The effect of improving supply chain and logistics performance ex. reduces inventory cost, on time delivery etc.	▪ The effect of improving supply chain and logistics performance ex. reduces inventory cost, on time delivery etc.

[If the space in the table is not enough, you can add table or fill in the end of this questionnaire]

Part 4: The study of the relative importance weights of knowledge related eight SCM processes in each dyad of supply chain integration on enhancing supply chain

Item 6: (6.1) Considering ***knowledge sharing** from focal company to suppliers,* you think that knowledge sharing relating to ***which** supply chain management process* is **more important** to the enhancement of supply chain performance?

Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Customer Service Management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Demand management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Order Fulfillment
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Demand management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Order Fulfillment
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Order Fulfillment
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Manufacturing flow management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Manufacturing flow management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Manufacturing flow management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Supplier relationship management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Supplier relationship management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Product development & commercialization	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management

(6.2) Considering ***knowledge transfer** from focal company to suppliers,* you think that knowledge transfer relating to ***which** supply chain management process* is **more important** to the enhancement of supply chain performance?

Answer same as 6.1 ☐ Yes (Skip to item 7)
☐ No (Skip to sheet **2 item 1** and back to sheet 1 item 7)

Item 7: (7.1) Considering ***knowledge sharing** from suppliers to focal company,* you think that knowledge sharing relating to ***which** supply chain management process* is **more important** to the enhancement of supply chain performance?

Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Customer Service Management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Demand management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Order Fulfillment
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Demand management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Order Fulfillment
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Order Fulfillment
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Manufacturing flow management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Manufacturing flow management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Manufacturing flow management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Supplier relationship management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Supplier relationship management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Product development & commercialization	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management

(7.2) Considering ***knowledge transfer** from suppliers to focal company,* you think that knowledge transfer relating to ***which** supply chain management process* is **more important** to the enhancement of supply chain performance?

Answer same as 7.1 ☐ Yes (Skip to item 8)
☐ No (Skip to sheet **2 item 2** and back to sheet 1 item 8)

Item 8: (8.1) Considering **knowledge sharing** *from focal company to customers,* you think that knowledge sharing relating to ***which*** supply chain management process is **more important** to the enhancement of supply chain performance?

Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Customer Service Management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Demand management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Order Fulfillment
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Demand management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Order Fulfillment
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Order Fulfillment
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Manufacturing flow management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Manufacturing flow management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Manufacturing flow management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Supplier relationship management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Supplier relationship management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Product development & commercialization	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management

(8.2) Considering **knowledge transfer** *from focal company to customers,* you think that knowledge transfer relating to ***which*** supply chain management process is **more important** to the enhancement of supply chain performance?

Answer same as 8.1

☐ Yes (Skip to item 9)
☐ No (Skip to sheet **2 item 3** and back to sheet 1 item 9)

Item 9: (9.1) Considering **knowledge sharing** *from customers to focal company,* you think that knowledge sharing relating to ***which*** supply chain management process is **more important** to the enhancement of supply chain performance?

Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Customer Service Management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Demand management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Order Fulfillment
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Demand management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Order Fulfillment
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Order Fulfillment
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Manufacturing flow management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Manufacturing flow management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Manufacturing flow management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Supplier relationship management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Supplier relationship management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Product development & commercialization	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management

(9.2) Considering **knowledge transfer** *from customers to focal company,* you think that knowledge transfer relating to ***which*** supply chain management process is **more important** to the enhancement of supply chain performance?

Answer same as 9.1

☐ Yes (Skip to item 10)
☐ No (Skip to sheet **2 item 4** and back to sheet 1 item 10)

Part 5: The study of the relative importance weights of required knowledge for each SCM process in each dyad of supply chain integration on enhancing supply chain performance

Item 10: Considering ***knowledge sharing from focal company to suppliers,*** you think that the sharing of ***which required knowledge*** is more important to the enhancement of supply chain performance?

(10.1) Considering required knowledge for **Customer Relationship Management** process

Customer categorizing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Sale and Marketing knowledge

(10.2) Considering required knowledge for **Customer Service Management** process

Internal and external coordination knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Quality Control knowledge

(10.3) Considering required knowledge for **Demand management** process

Demand forecasting knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Capacity planning knowledge
Demand forecasting knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Inventory management knowledge
Demand forecasting knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Demand forecasting knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Capacity planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Inventory management knowledge
Capacity planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Capacity planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge

(10.4) Considering required knowledge for **Order Fulfillment** process

Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Distribution network planning knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Delivery and Transportation planning
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Warehouse management knowledge
Distribution network planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Delivery and Transportation planning
Distribution network planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Warehouse management knowledge
Delivery and Transportation planning	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Warehouse management knowledge

(10.5) Considering required knowledge for **Manufacturing flow management** process

Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	ความรู้ Inventory management knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Production and planning control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Production and planning control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Optimization knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge

(10.6) Considering required knowledge for **Supplier relationship management** process

Sourcing Strategies knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Sourcing Strategies knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Purchasing Management knowledge
Supplier selection and development knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Purchasing Management knowledge

(10.7) Considering required knowledge for **Product development & commercialization** process

Sale and Marketing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Sale and Marketing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product design knowledge
Sale and Marketing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Packaging design knowledge
Supplier selection and development knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product design knowledge
Supplier selection and development knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Packaging design knowledge
Product design knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Packaging design knowledge

(10.8) Considering required knowledge for **Returns Management** process

Delivery and Transportation planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Disposition rule and method knowledge

[For the question in this part, if you consider that knowledge sharing and knowledge transfer in each dyad of the supply chain, either;

knowledge sharing from focal company to suppliers (that you done in 10.1-10.8) or
knowledge transfer from focal company to suppliers or
knowledge sharing from suppliers to focal company or
knowledge transfer from suppliers to focal company or
knowledge sharing from focal company to customers or
knowledge transfer from focal company to customers or
knowledge sharing from customers to focal company or
knowledge transfer from customers to focal company or, which provides the same

answers, you have to continue completing this questionnaire. However, if the answers are different, you can skip to sheet 2 item 5 (5.1-5.8) and then back to complete the questionnaire in sheet 1.]

☐The same answers in each dyad of the supply chain (Skip to part 6)

☐The different answers in each dyad of the supply chain (Skip to sheet 2 item 5 (5.1-5.8) and then back to complete the questionnaire in sheet 1)

Part 6: The study of the relative importance weights of required knowledge for each SCM process that should be shared or transferred effecting to each attribute of supply chain performance

As there is some knowledge relating to more than one supply chain management process, such as knowledge of inventory management concerning to demand management process, order fulfillment process, and manufacturing flow management process, questions in this part are divided into 2 groups;

Group 1: Knowledge relating to only one supply chain management process.

Group 2: Knowledge relating to more than one supply chain management process.

Item 11: Considering ***knowledge sharing from focal company to suppliers,*** you think which aspects of ***supply chain performance*** are more affected by knowledge in the following list?

Group 1: Knowledge relating to only one supply chain management process.

(11.1) Customer categorizing knowledge

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(11.2) Internal and external coordination knowledge

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(11.3) Demand forecasting knowledge

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(11.4) Capacity planning knowledge

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(11.5) Distribution network planning knowledge

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(11.6) Warehouse management knowledge

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(11.7) Optimization knowledge

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(11.8) Sourcing Strategies knowledge

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(11.9) Purchasing **M**anagement knowledge

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(11.10) Product design knowledge

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(11.11) Packaging design knowledge

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(11.12) Disposition rule and method knowledge

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

Group 2: Knowledge relating to more than one supply chain management process.

(11.13) Sale and **M**arketing knowledge

A. For Customer Relationship **M**anagement process

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

B. For Product development & commercialization process

Answer same as 11.13 A ☐ Yes (Skip to 11.14) ☐ No (Answer in table below)

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(11.14) Quality Control knowledge

A. For Customer Service Management process

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

B. For Manufacturing flow management process

Answer same as 11.14 A ☐ Yes (Skip to 11.15) ☐ No (Answer in table below)

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(11.15) Inventory management knowledge

A. For Demand management process

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

B. For Order Fulfillment process

Answer same as 11.15 A ☐ Yes (Skip to 11.15 C) ☐ No (Answer in table below)

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

C. For Manufacturing flow management process

Answer same as 11.15 A ☐ Yes (Skip to 11.16) ☐ No (Answer in table below)

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(11.16) Supplier selection and development knowledge

A. For Manufacturing flow management process

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

B. For Supplier relationship management process

Answer same as 11.16 A ☐ Yes (Skip to 11.16 C) ☐ No (Answer in table below)

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

C. For Product development & commercialization process

Answer same as 11.16 A ☐ Yes (Skip to 11.17) ☐ No (Answer in table below)

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(11.17) Delivery and Transportation planning knowledge

A. For Order Fulfillment process

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

B. For Returns Management process

Answer same as 11.17 A ☐ Yes (Skip to 11.18) ☐ No (Answer in table below)

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(11.18) Manufacturing strategy knowledge

A. For Demand management process

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

B. For Manufacturing flow management process

Answer same as 11.18 A ☐ Yes (Skip to 11.19) ☐ No (Answer in table below)

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(11.19) Production and planning control knowledge

A. For Demand management process

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

B. For Manufacturing flow management process

Answer same as 11.19 A ☐ Yes (Skip to part 7) ☐ No (Answer in table below)

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

[For the question in this part, if you consider that knowledge sharing and knowledge transfer in each dyad of the supply chain, either;

knowledge sharing from focal company to suppliers (done in 11.1-11.19) or
knowledge transfer from focal company to suppliers or
knowledge sharing from suppliers to focal company or
knowledge transfer from suppliers to focal company or
knowledge sharing from focal company to customers or
knowledge transfer from focal company to customers or
knowledge sharing from customers to focal company or
knowledge transfer from customers to focal company or, which provides the same answers, you have to continue completing this questionnaire. However, if the answers are different, you can skip to sheet 2 item 6 (6.1-6.19) and then back to complete the questionnaire in sheet 1.]

☐The same answers in each dyad of the supply chain (Skip to part 7.)

☐The different answers in each dyad of the supply chain (Skip to sheet 2 item 6 (6.1-6.19) and then back to complete the questionnaire in sheet 1)

Part 7: Additional issue of knowledge sharing and knowledge transfer for supply chain management process in supply chain integration scope on supply chain performance

Item 12: Considering overall, what level of **knowledge sharing** relating to supply chain management process does **your organization currently** has with your suppliers or customers in order to help enhance the supply chain performance?

0	1	2	3	4	5	6	7	8	9	10

[0=**None**, 10=**Highest** level greatly promoting the enhancement of supply chain performance]

Item 13: Considering overall, what level of **knowledge transfer** relating to supply chain management process does **your organization currently** has with your suppliers or customers in order to help enhance the supply chain performance?

0	1	2	3	4	5	6	7	8	9	10

[0=**None**, 10=**Highest** level greatly promoting the enhancement of supply chain performance]

Item 14: What is the level of possibility to **increasingly** promote the **knowledge sharing** relating to supply chain management process with your suppliers or customers for the enhancement of the supply chain performance?

0	1	2	3	4	5	6	7	8	9	10

[0=Impossible, 10= **Highest** level of possibility]

Reason :

Item 15: What is the level of possibility to **increasingly** promote the **knowledge transfer** relating to supply chain management process with your suppliers or customers for the enhancement of the supply chain performance?

0	1	2	3	4	5	6	7	8	9	10

[0=Impossible, 10= **Highest** level of possibility]

Reason :

Item 16: Factors supporting or obstructing the **knowledge sharing and knowledge transfer** among organizations in the supply chain (Please specify the answer in blank spaces of the table)

Factors **supporting** the **knowledge sharing** among organizations in the supply chain:	Factors **obstructing** the **knowledge sharing** among organizations in the supply chain:
Factors **supporting** the **knowledge transfer** among organizations in the supply chain:	Factors **obstructing** the **knowledge transfer** among organizations in the supply chain:

Item 17: Additional comment:______________________________
:

◆ End of Questionnaire sheet 1 ◆

◆ Thank you for taking your valuable time to answer this questionnaire ◆

Questionnaire Sheet 2

The study of the relative importance weights of knowledge related eight **SCM** processes in each dyad level of supply chain integration on enhancing supply chain

Item 1: Considering ***knowledge transfer from focal company to suppliers,*** you think that knowledge transfer relating to ***which*** supply chain management process is **more important** to the enhancement of supply chain performance?

Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Customer Service Management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Demand management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Order Fulfillment
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Demand management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Order Fulfillment
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Order Fulfillment
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Manufacturing flow management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Manufacturing flow management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Manufacturing flow management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Supplier relationship management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Supplier relationship management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Product development & commercialization	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management

(Back to sheet 1 item 7)

Item 2: Considering ***knowledge transfer from suppliers to focal company,*** you think that knowledge transfer relating to ***which*** supply chain management process is **more important** to the enhancement of supply chain performance?

Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Customer Service Management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Demand management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Order Fulfillment
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Demand management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Order Fulfillment
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Order Fulfillment
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Manufacturing flow management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Manufacturing flow management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Manufacturing flow management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Supplier relationship management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Supplier relationship management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Product development & commercialization	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management

(Back to sheet 1 item 8)

Item 3: Considering ***knowledge transfer from focal company to customers***, you think that knowledge transfer relating to ***which*** supply chain management process is **more important** to the enhancement of supply chain performance?

Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Customer Service Management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Demand management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Order Fulfillment
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Demand management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Order Fulfillment
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Order Fulfillment
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Manufacturing flow management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Manufacturing flow management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Manufacturing flow management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Supplier relationship management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Supplier relationship management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Product development & commercialization	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management

(Back to sheet 1 item 9)

Item 4: Considering ***knowledge transfer from customers to focal company***, you think that knowledge transfer relating to ***which*** supply chain management process is **more important** to the enhancement of supply chain performance?

Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Customer Service Management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Demand management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Order Fulfillment
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Customer Relationship Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Demand management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Order Fulfillment
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Customer Service Management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Order Fulfillment
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Demand management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing flow management
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Order Fulfillment	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Manufacturing flow management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier relationship management
Manufacturing flow management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Manufacturing flow management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Supplier relationship management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product development & commercialization
Supplier relationship management	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management
Product development & commercialization	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Returns Management

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The study of the relative importance weights of required knowledge for each **SCM** process in each dyad of supply chain integration on enhancing supply chain performance

Item 5: You think that the sharing and transferring of ***which required knowledge*** is more important to the enhancement of supply chain performance?

(5.1) Considering required knowledge for **Customer Relationship Management** process

(5.1.1) *Based on* ***knowledge transfer*** *from* ***focal company to suppliers***

Customer categorizing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Sale and Marketing knowledge

(5.1.2) *Based* ***on knowledge sharing*** *from* ***suppliers to focal company***

Customer categorizing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Sale and Marketing knowledge

(5.1.3) *Based on* ***knowledge transfer*** *from* ***suppliers to focal company***

Customer categorizing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Sale and Marketing knowledge

(5.1.4) *Based on* ***knowledge sharing*** *from* ***focal company to customers***

Customer categorizing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Sale and Marketing knowledge

(5.1.5) *Based on* ***knowledge transfer*** *from* ***focal company to customers***

Customer categorizing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Sale and Marketing knowledge

(5.1.6) *Based on* ***knowledge sharing*** *from* ***customers to focal company***

Customer categorizing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Sale and Marketing knowledge

(5.1.7) *Based on* ***knowledge transfer*** *from* ***customers to focal company***

Customer categorizing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Sale and Marketing knowledge

(5.2) Considering required knowledge for **Customer Service Management** process

(5.2.1) *Based on* ***knowledge transfer*** *from* ***focal company to suppliers***

Internal and external coordination knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Quality Control knowledge

(5.2.2) *Based* ***on knowledge sharing*** *from* ***suppliers to focal company***

Internal and external coordination knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Quality Control knowledge

(5.2.3) *Based on* ***knowledge transfer*** *from* ***suppliers to focal company***

Internal and external coordination knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Quality Control knowledge

(5.2.4) *Based on* ***knowledge sharing*** *from* ***focal company to customers***

Internal and external coordination knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Quality Control knowledge

(5.2.5) *Based on* ***knowledge transfer*** *from* ***focal company to customers***

Internal and external coordination knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Quality Control knowledge

(5.2.6) *Based on* ***knowledge sharing*** *from* ***customers to focal company***

Internal and external coordination knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Quality Control knowledge

(5.2.7) *Based on* ***knowledge transfer*** *from* ***customers to focal company***

Internal and external coordination knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Quality Control knowledge

(5.3) Considering required knowledge for **Demand management** process

(5.3.1) *Based on knowledge transfer from focal company to suppliers*

Demand forecasting knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Capacity planning knowledge
Demand forecasting knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Inventory management knowledge
Demand forecasting knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Manufacturing strategy knowledge
Demand forecasting knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Production and planning control knowledge
Capacity planning knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Inventory management knowledge
Capacity planning knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Manufacturing strategy knowledge
Capacity planning knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Production and planning control knowledge
Inventory management knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Manufacturing strategy knowledge
Inventory management knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Production and planning control knowledge
Manufacturing strategy knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Production and planning control knowledge

(5.3.2) *Based on knowledge sharing from suppliers to focal company*

Demand forecasting knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Capacity planning knowledge
Demand forecasting knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Inventory management knowledge
Demand forecasting knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Manufacturing strategy knowledge
Demand forecasting knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Production and planning control knowledge
Capacity planning knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Inventory management knowledge
Capacity planning knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Manufacturing strategy knowledge
Capacity planning knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Production and planning control knowledge
Inventory management knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Manufacturing strategy knowledge
Inventory management knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Production and planning control knowledge
Manufacturing strategy knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Production and planning control knowledge

(5.3.3) *Based on knowledge transfer from suppliers to focal company*

Demand forecasting knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Capacity planning knowledge
Demand forecasting knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Inventory management knowledge
Demand forecasting knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Manufacturing strategy knowledge
Demand forecasting knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Production and planning control knowledge
Capacity planning knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Inventory management knowledge
Capacity planning knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Manufacturing strategy knowledge
Capacity planning knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Production and planning control knowledge
Inventory management knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Manufacturing strategy knowledge
Inventory management knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Production and planning control knowledge
Manufacturing strategy knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Production and planning control knowledge

(5.3.4) *Based on knowledge sharing from focal company to customers*

Demand forecasting knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Capacity planning knowledge
Demand forecasting knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Inventory management knowledge
Demand forecasting knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Manufacturing strategy knowledge
Demand forecasting knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Production and planning control knowledge
Capacity planning knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Inventory management knowledge
Capacity planning knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Manufacturing strategy knowledge
Capacity planning knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Production and planning control knowledge
Inventory management knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Manufacturing strategy knowledge
Inventory management knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Production and planning control knowledge
Manufacturing strategy knowledge	9’	8’	7’	6’	5’	4’	3’	2’	1’	2’	3’	4’	5’	6’	7’	8’	9’	Production and planning control knowledge

(5.3.5) *Based on* ***knowledge transfer*** *from* ***focal company to customers***

Demand forecasting knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Capacity planning knowledge
Demand forecasting knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Inventory management knowledge
Demand forecasting knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Demand forecasting knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Capacity planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Inventory management knowledge
Capacity planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Capacity planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge

(5.3.6) *Based on* ***knowledge sharing*** *from* ***customers to focal company***

Demand forecasting knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Capacity planning knowledge
Demand forecasting knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Inventory management knowledge
Demand forecasting knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Demand forecasting knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Capacity planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Inventory management knowledge
Capacity planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Capacity planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge

(5.3.7) *Based on* ***knowledge transfer*** *from* ***customers to focal company***

Demand forecasting knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Capacity planning knowledge
Demand forecasting knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Inventory management knowledge
Demand forecasting knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Demand forecasting knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Capacity planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Inventory management knowledge
Capacity planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Capacity planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge

(5.4) Considering required knowledge for **Order Fulfillment** process

(5.4.1) *Based on* ***knowledge transfer*** *from* ***focal company to suppliers***

Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Distribution network planning knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Delivery and Transportation planning knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Warehouse management knowledge
Distribution network planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Delivery and Transportation planning knowledge
Distribution network planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Warehouse management knowledge
Delivery and Transportation planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Warehouse management knowledge

(5.4.2) *Based on knowledge sharing from suppliers to focal company*

Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Distribution network planning knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Delivery and Transportation planning knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Warehouse management knowledge
Distribution network planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Delivery and Transportation planning knowledge
Distribution network planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Warehouse management knowledge
Delivery and Transportation planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Warehouse management knowledge

(5.4.3) *Based on knowledge transfer from suppliers to focal company*

Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Distribution network planning knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Delivery and Transportation planning knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Warehouse management knowledge
Distribution network planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Delivery and Transportation planning knowledge
Distribution network planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Warehouse management knowledge
Delivery and Transportation planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Warehouse management knowledge

(5.4.4) *Based on knowledge sharing from focal company to customers*

Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Distribution network planning knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Delivery and Transportation planning knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Warehouse management knowledge
Distribution network planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Delivery and Transportation planning knowledge
Distribution network planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Warehouse management knowledge
Delivery and Transportation planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Warehouse management knowledge

(5.4.5) *Based on knowledge transfer from focal company to customers*

Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Distribution network planning knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Delivery and Transportation planning knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Warehouse management knowledge
Distribution network planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Delivery and Transportation planning knowledge
Distribution network planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Warehouse management knowledge
Delivery and Transportation planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Warehouse management knowledge

(5.4.6) *Based on knowledge sharing from customers to focal company*

Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Distribution network planning knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Delivery and Transportation planning knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Warehouse management knowledge
Distribution network planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Delivery and Transportation planning knowledge
Distribution network planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Warehouse management knowledge
Delivery and Transportation planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Warehouse management knowledge

(5.4.7) *Based on knowledge transfer from customers to focal company*

Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Distribution network planning knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Delivery and Transportation planning knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Warehouse management knowledge
Distribution network planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Delivery and Transportation planning knowledge
Distribution network planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Warehouse management knowledge
Delivery and Transportation planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Warehouse management knowledge

(5.5) Considering required knowledge for **Manufacturing flow management** process

(5.5.1) *Based on* ***knowledge transfer*** *from* ***focal company to suppliers***

Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	ความรู้ Inventory management knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Production and planning control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Production and planning control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Optimization knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge

(5.5.2) *Based on* ***knowledge sharing*** *from* ***suppliers to focal company***

Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	ความรู้ Inventory management knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Production and planning control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Production and planning control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Optimization knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge

(5.5.3) *Based on* ***knowledge transfer*** *from* ***suppliers to focal company***

Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	ความรู้ Inventory management knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Production and planning control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Production and planning control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Optimization knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge

(5.5.4) *Based on* ***<u>knowledge sharing</u>*** *from* ***<u>focal company to customers</u>***

Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	ความรู้ Inventory management knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Production and planning control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Production and planning control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Optimization knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge

(5.5.5) *Based on* ***<u>knowledge transfer</u>*** *from* ***<u>focal company to customers</u>***

Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	ความรู้ Inventory management knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Production and planning control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Production and planning control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Optimization knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge

(5.5.6) *Based on* ***<u>knowledge sharing</u>*** *from* ***<u>customers to focal company</u>***

Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	ความรู้ Inventory management knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Production and planning control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Production and planning control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Optimization knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge

(5.5.7) *Based on **knowledge transfer** from **customers to focal company***

Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	ความรู้ Inventory management knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Quality control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Manufacturing strategy knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Inventory management knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Production and planning control knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Manufacturing strategy knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Production and planning control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Optimization knowledge
Production and planning control knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Optimization knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge

(5.6) Considering required knowledge for **Supplier relationship management** process

(5.6.1) *Based on **knowledge transfer** from **focal company to suppliers***

Sourcing Strategies knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Sourcing Strategies knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Purchasing Management knowledge
Supplier selection and development knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Purchasing Management knowledge

(5.6.2) *Based on **knowledge sharing** from **suppliers to focal company***

Sourcing Strategies knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Sourcing Strategies knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Purchasing Management knowledge
Supplier selection and development knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Purchasing Management knowledge

(5.6.3) *Based on **knowledge transfer** from **suppliers to focal company***

Sourcing Strategies knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Sourcing Strategies knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Purchasing Management knowledge
Supplier selection and development knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Purchasing Management knowledge

(5.6.4) *Based on **knowledge sharing** from **focal company to customers***

Sourcing Strategies knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Sourcing Strategies knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Purchasing Management knowledge
Supplier selection and development knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Purchasing Management knowledge

(5.6.5) *Based on **knowledge transfer** from **focal company to customers***

Sourcing Strategies knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Sourcing Strategies knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Purchasing Management knowledge
Supplier selection and development knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Purchasing Management knowledge

(5.6.6) *Based on **knowledge sharing** from **customers to focal company***

Sourcing Strategies knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Sourcing Strategies knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Purchasing Management knowledge
Supplier selection and development knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Purchasing Management knowledge

(5.6.7) Based on knowledge transfer from customers to focal company

Sourcing Strategies knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Sourcing Strategies knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Purchasing Management knowledge
Supplier selection and development knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Purchasing Management knowledge

(5.7) Considering required knowledge for **Product development & commercialization** process

(5.7.1) Based on knowledge transfer from focal company to suppliers

Sale and Marketing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Sale and Marketing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product design knowledge
Sale and Marketing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Packaging design knowledge
Supplier selection and development knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product design knowledge
Supplier selection and development knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Packaging design knowledge
Product design knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Packaging design knowledge

(5.7.2) Based on knowledge sharing from suppliers to focal company

Sale and Marketing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Sale and Marketing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product design knowledge
Sale and Marketing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Packaging design knowledge
Supplier selection and development knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product design knowledge
Supplier selection and development knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Packaging design knowledge
Product design knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Packaging design knowledge

(5.7.3) Based on knowledge transfer from suppliers to focal company

Sale and Marketing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Sale and Marketing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product design knowledge
Sale and Marketing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Packaging design knowledge
Supplier selection and development knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product design knowledge
Supplier selection and development knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Packaging design knowledge
Product design knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Packaging design knowledge

(5.7.4) Based on knowledge sharing from focal company to customers

Sale and Marketing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Sale and Marketing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product design knowledge
Sale and Marketing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Packaging design knowledge
Supplier selection and development knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product design knowledge
Supplier selection and development knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Packaging design knowledge
Product design knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Packaging design knowledge

(5.7.5) Based on knowledge transfer from focal company to customers

Sale and Marketing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Sale and Marketing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product design knowledge
Sale and Marketing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Packaging design knowledge
Supplier selection and development knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product design knowledge
Supplier selection and development knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Packaging design knowledge
Product design knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Packaging design knowledge

(5.7.6) *Based on* ***knowledge sharing*** *from* ***customers to focal company***

Sale and Marketing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Sale and Marketing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product design knowledge
Sale and Marketing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Packaging design knowledge
Supplier selection and development knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product design knowledge
Supplier selection and development knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Packaging design knowledge
Product design knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Packaging design knowledge

(5.7.7) *Based on* ***knowledge transfer*** *from* ***customers to focal company***

Sale and Marketing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Supplier selection and development knowledge
Sale and Marketing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product design knowledge
Sale and Marketing knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Packaging design knowledge
Supplier selection and development knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Product design knowledge
Supplier selection and development knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Packaging design knowledge
Product design knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Packaging design knowledge

(5.8) Considering required knowledge for **Returns Management** process

(5.8.1) *Based on* ***knowledge transfer*** *from* ***focal company to suppliers***

Delivery and Transportation planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Disposition rule and method knowledge

(5.8.2) *Based on* ***knowledge sharing*** *from* ***suppliers to focal company***

Delivery and Transportation planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Disposition rule and method knowledge

(5.8.3) *Based on* ***knowledge transfer*** *from* ***suppliers to focal company***

Delivery and Transportation planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Disposition rule and method knowledge

(5.8.4) *Based on* ***knowledge sharing*** *from* ***focal company to customers***

Delivery and Transportation planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Disposition rule and method knowledge

(5.8.5) *Based on* ***knowledge transfer*** *from* ***focal company to customers***

Delivery and Transportation planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Disposition rule and method knowledge

(5.8.6) *Based on* ***knowledge sharing*** *from* ***customers to focal company***

Delivery and Transportation planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Disposition rule and method knowledge

(5.8.7) *Based on* ***knowledge transfer*** *from* ***customers to focal company***

Delivery and Transportation planning knowledge	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Disposition rule and method knowledge

The study of the relative importance weights of required knowledge for each SCM process that should be shared or transferred effecting to each attribute of supply chain **performance**

Item 6: You think which aspects of ***supply chain performance*** are more affected by knowledge in the following list?

Group 1: Knowledge relating to only one supply chain management process.

(6.1) Customer categorizing knowledge

(6.1.1) *Based on **knowledge transfer** from **focal company to suppliers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.1.2) *Based **on knowledge sharing** from **suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.1.3) *Based on **knowledge transfer** from **suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.1.4) *Based on **knowledge sharing** from **focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.1.5) *Based on **knowledge transfer** from **focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.1.6) *Based on **knowledge sharing** from **customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.1.7) *Based on **knowledge transfer** from **customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.2) Internal and external coordination knowledge

(6.2.1) *Based on **knowledge transfer** from **focal company to suppliers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.2.2) *Based **on knowledge sharing** from **suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.2.3) *Based on **knowledge transfer** from **suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.2.4) *Based on **knowledge sharing** from **focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.2.5) *Based on **knowledge transfer** from **focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.2.6) *Based on **knowledge sharing** from **customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.2.7) *Based on **knowledge transfer** from **customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.3) Demand forecasting knowledge

(6.3.1) *Based on knowledge transfer from focal company to suppliers*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.3.2) *Based on knowledge sharing from suppliers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.3.3) *Based on knowledge transfer from suppliers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.3.4) *Based on knowledge sharing from focal company to customers*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.3.5) *Based on knowledge transfer from focal company to customers*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.3.6) *Based on knowledge sharing from customers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.3.7) *Based on knowledge transfer from customers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.4) Capacity planning knowledge

(6.4.1) *Based on knowledge transfer from focal company to suppliers*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.4.2) *Based on knowledge sharing from suppliers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.4.3) *Based on knowledge transfer from suppliers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.4.4) *Based on knowledge sharing from focal company to customers*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.4.5) *Based on knowledge transfer from focal company to customers*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.4.6) *Based on knowledge sharing from customers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.4.7) *Based on knowledge transfer from customers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.5) Distribution network planning knowledge

(6.5.1) *Based on knowledge transfer from focal company to suppliers*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.5.2) *Based on knowledge sharing from suppliers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.5.3) *Based on knowledge transfer from suppliers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.5.4) *Based on knowledge sharing from focal company to customers*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.5.5) *Based on knowledge transfer from focal company to customers*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.5.6) *Based on knowledge sharing from customers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.5.7) *Based on knowledge transfer from customers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.6) Warehouse management knowledge

(6.6.1) *Based on knowledge transfer from focal company to suppliers*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.6.2) *Based on knowledge sharing from suppliers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.6.3) *Based on knowledge transfer from suppliers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.6.4) *Based on knowledge sharing from focal company to customers*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.6.5) *Based on knowledge transfer from focal company to customers*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.6.6) *Based on knowledge sharing from customers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.6.7) *Based on knowledge transfer from customers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.7) Optimization knowledge

(6.7.1) *Based on knowledge transfer from focal company to suppliers*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.7.2) *Based on knowledge sharing from suppliers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.7.3) *Based on knowledge transfer from suppliers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.7.4) *Based on knowledge sharing from focal company to customers*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.7.5) *Based on knowledge transfer from focal company to customers*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.7.6) *Based on knowledge sharing from customers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.7.7) *Based on knowledge transfer from customers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.8) Sourcing Strategies knowledge

(6.8.1) *Based on knowledge transfer from focal company to suppliers*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.8.2) *Based on knowledge sharing from suppliers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.8.3) *Based on knowledge transfer from suppliers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.8.4) *Based on knowledge sharing from focal company to customers*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.8.5) *Based on knowledge transfer from focal company to customers*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.8.6) *Based on knowledge sharing from customers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.8.7) *Based on knowledge transfer from customers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.9) Purchasing Management knowledge

(6.9.1) *Based on knowledge transfer from focal company to suppliers*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.9.2) *Based on knowledge sharing from suppliers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.9.3) *Based on knowledge transfer from suppliers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.9.4) *Based on knowledge sharing from focal company to customers*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.9.5) *Based on knowledge transfer from focal company to customers*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.9.6) *Based on knowledge sharing from customers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.9.7) *Based on knowledge transfer from customers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.10) Product design knowledge

(6.10.1) *Based on knowledge transfer from focal company to suppliers*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.10.2) *Based on knowledge sharing from suppliers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.10.3) *Based on knowledge transfer from suppliers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.10.4) *Based on knowledge sharing from focal company to customers*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.10.5) *Based on knowledge transfer from focal company to customers*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.10.6) *Based on knowledge sharing from customers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.10.7) *Based on knowledge transfer from customers to focal company*

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.11) Packaging design knowledge

(6.11.1) *Based on* ***knowledge transfer*** *from* ***focal company to suppliers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.11.2) *Based* ***on knowledge sharing*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.11.3) *Based on* ***knowledge transfer*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.11.4) *Based on* ***knowledge sharing*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.11.5) *Based on* ***knowledge transfer*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.11.6) *Based on* ***knowledge sharing*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.11.7) *Based on* ***knowledge transfer*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.12) Disposition rule and method knowledge

(6.12.1) *Based on* ***knowledge transfer*** *from* ***focal company to suppliers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.12.2) *Based* ***on knowledge sharing*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.12.3) *Based on* ***knowledge transfer*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.12.4) *Based on* ***knowledge sharing*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.12.5) *Based on* ***knowledge transfer*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.12.6) *Based on* ***knowledge sharing*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.12.7) *Based on* ***knowledge transfer*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

Group 2: Knowledge relating to more than one supply chain management process.

(6.13) Sale and Marketing knowledge

A. For Customer Relationship Management process

(6.13.1A) *Based on* ***knowledge transfer*** *from* ***focal company to suppliers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.13.2A) *Based* ***on knowledge sharing*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.13.3A) *Based on* ***knowledge transfer*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.13.4A) *Based on* ***knowledge sharing*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.13.5A) *Based on* ***knowledge transfer*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.13.6A) *Based on* ***knowledge sharing*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.13.7A) *Based on* ***knowledge transfer*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

B. For Product development & commercialization process

Answer same as 6.13.1A-6.13.7A ☐ Yes (Skip to 6.14) ☐ No (Answer in 6.13.1B-6.13.7B)

(6.13.1B) *Based on* ***knowledge transfer*** *from* ***focal company to suppliers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.13.2B) *Based* ***on knowledge sharing*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.13.3B) *Based on* ***knowledge transfer*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.13.4B) *Based on* ***knowledge sharing*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.13.5B) *Based on* ***knowledge transfer*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.13.6B) *Based on* ***knowledge sharing*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.13.7B) *Based on* ***knowledge transfer*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.14) Quality Control knowledge

A. For Customer Service Management process

(6.14.1A) Based on ***knowledge transfer*** *from* ***focal company to suppliers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.14.2A) Based ***on knowledge sharing*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.14.3A) Based on ***knowledge transfer*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.14.4A) Based on ***knowledge sharing*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.14.5A) Based on ***knowledge transfer*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.14.6A) Based on ***knowledge sharing*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.14.7A) Based on ***knowledge transfer*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

B. For Manufacturing flow management process

Answer same as 6.14.1A-6.14.7A ☐ Yes (Skip to 6.15) ☐ No (Answer in 6.14.1B-6.14.7B)

(6.14.1B) Based on ***knowledge transfer*** *from* ***focal company to suppliers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.14.2B) Based ***on knowledge sharing*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.14.3B) Based on ***knowledge transfer*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.14.4B) Based on ***knowledge sharing*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.14.5B) Based on ***knowledge transfer*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.14.6B) Based on ***knowledge sharing*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.14.7B) Based on ***knowledge transfer*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.15) Inventory management knowledge

A. For Demand management process

(6.15.1A) Based on ***knowledge transfer*** *from* ***focal company to suppliers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.15.2A) Based ***on knowledge sharing*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.15.3A) Based on ***knowledge transfer*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.15.4A) Based on ***knowledge sharing*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.15.5A) Based on ***knowledge transfer*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.15.6A) Based on ***knowledge sharing*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.15.7A) Based on ***knowledge transfer*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

B. For Order Fulfillment process

Answer same as 6.15.1A-6.15.7A ☐ Yes (Skip to 6.15C) ☐ No (Answer in 6.15.1B-6.15.7B)

(6.15.1B) Based on ***knowledge transfer*** *from* ***focal company to suppliers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.15.2B) Based ***on knowledge sharing*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.15.3B) Based on ***knowledge transfer*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.15.4B) Based on ***knowledge sharing*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.15.5B) Based on ***knowledge transfer*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.15.6B) Based on ***knowledge sharing*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.15.7B) Based on ***knowledge transfer*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

C. For **M**anufacturing flow management process

Answer same as 6.15.1A-6.15.7A ☐ Yes (Skip to 6.16) ☐ No (Answer in 6.15.1C-6.15.7C)

(6.15.1C) *Based on* ***knowledge transfer*** *from* ***focal company to suppliers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.15.2C) *Based* ***on knowledge sharing*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.15.3C) *Based on* ***knowledge transfer*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.15.4C) *Based on* ***knowledge sharing*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.15.5C) *Based on* ***knowledge transfer*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.15.6C) *Based on* ***knowledge sharing*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.15.7C) *Based on* ***knowledge transfer*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.16) Supplier selection and development knowledge

A. For **M**anufacturing flow management process

(6.16.1A) *Based on* ***knowledge transfer*** *from* ***focal company to suppliers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.16.2A) *Based* ***on knowledge sharing*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.16.3A) *Based on* ***knowledge transfer*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.16.4A) *Based on* ***knowledge sharing*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.16.5A) *Based on* ***knowledge transfer*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.16.6A) *Based on* ***knowledge sharing*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.16.7A) *Based on* ***knowledge transfer*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

B. For Supplier relationship management process

Answer same as 6.16.1A-6.16.7A ☐ Yes (Skip to 6.16C) ☐ No (Answer in 6.16.1B-6.16.7B)

(6.16.1B) *Based on* ***knowledge transfer*** *from* ***focal company to suppliers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.16.2B) *Based* ***on knowledge sharing*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.16.3B) *Based on* ***knowledge transfer*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.16.4B) *Based on* ***knowledge sharing*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.16.5B) *Based on* ***knowledge transfer*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.16.6B) *Based on* ***knowledge sharing*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.16.7B) *Based on* ***knowledge transfer*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

C. For Product development & commercialization process

Answer same as 6.16.1A-6.16.7A ☐ Yes (Skip to 6.17) ☐ No (Answer in 6.16.1C-6.16.7C)

(6.16.1C) *Based on* ***knowledge transfer*** *from* ***focal company to suppliers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.16.2C) *Based* ***on knowledge sharing*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.16.3C) *Based on* ***knowledge transfer*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.16.4C) *Based on* ***knowledge sharing*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.16.5C) *Based on* ***knowledge transfer*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.16.6C) *Based on* ***knowledge sharing*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.16.7C) *Based on* ***knowledge transfer*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.17) Delivery and Transportation planning knowledge

A. For Order Fulfillment process

(6.17.1A) *Based on* **knowledge transfer** *from* **focal company to suppliers**

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.17.2A) *Based* **on knowledge sharing** *from* **suppliers to focal company**

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.17.3A) *Based on* **knowledge transfer** *from* **suppliers to focal company**

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.17.4A) *Based on* **knowledge sharing** *from* **focal company to customers**

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.17.5A) *Based on* **knowledge transfer** *from* **focal company to customers**

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.17.6A) *Based on* **knowledge sharing** *from* **customers to focal company**

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.17.7A) *Based on* **knowledge transfer** *from* **customers to focal company**

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

B. For Returns Management process

Answer same as 6.17.1A-6.17.7A ☐ Yes (Skip to 6.18) ☐ No (Answer in 6.17.1B-6.17.7B)

(6.17.1B) *Based on* **knowledge transfer** *from* **focal company to suppliers**

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.17.2B) *Based* **on knowledge sharing** *from* **suppliers to focal company**

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.17.3B) *Based on* **knowledge transfer** *from* **suppliers to focal company**

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.17.4B) *Based on* **knowledge sharing** *from* **focal company to customers**

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.17.5B) *Based on* **knowledge transfer** *from* **focal company to customers**

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.17.6B) *Based on* **knowledge sharing** *from* **customers to focal company**

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.17.7B) *Based on* **knowledge transfer** *from* **customers to focal company**

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.18) **M**anufacturing strategy knowledge

A. For Demand management process

(6.18.1A) *Based on* ***knowledge transfer*** *from* ***focal company to suppliers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.18.2A) *Based* ***on knowledge sharing*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.18.3A) *Based on* ***knowledge transfer*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.18.4A) *Based on* ***knowledge sharing*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.18.5A) *Based on* ***knowledge transfer*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.18.6A) *Based on* ***knowledge sharing*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.18.7A) *Based on* ***knowledge transfer*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

B. For **M**anufacturing flow management process

Answer same as 6.18.1A-6.18.7A ☐ Yes (Skip to 6.19) ☐ No (Answer in 6.18.1B-6.18.7B)

(6.18.1B) *Based on* ***knowledge transfer*** *from* ***focal company to suppliers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.18.2B) *Based* ***on knowledge sharing*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.18.3B) *Based on* ***knowledge transfer*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.18.4B) *Based on* ***knowledge sharing*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.18.5B) *Based on* ***knowledge transfer*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.18.6B) *Based on* ***knowledge sharing*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.18.7B) *Based on* ***knowledge transfer*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.19) Production and planning control knowledge

A. For Demand management process

(6.19.1A) Based on ***knowledge transfer*** *from* ***focal company to suppliers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.19.2A) Based ***on knowledge sharing*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.19.3A) Based on ***knowledge transfer*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.19.4A) Based on ***knowledge sharing*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.19.5A) Based on ***knowledge transfer*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.19.6A) Based on ***knowledge sharing*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.19.7A) Based on ***knowledge transfer*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

B. For Manufacturing flow management process

Answer same as 6.19.1A-6.19.7A ☐ Yes (End sheet 2) ☐ No (Answer in 6.19.1B-6.19.7B)

(6.19.1B) Based on ***knowledge transfer*** *from* ***focal company to suppliers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.19.2B) Based ***on knowledge sharing*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.19.3B) Based on ***knowledge transfer*** *from* ***suppliers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.19.4B) Based on ***knowledge sharing*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.19.5B) Based on ***knowledge transfer*** *from* ***focal company to customers***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.19.6B) Based on ***knowledge sharing*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

(6.19.7B) Based on ***knowledge transfer*** *from* ***customers to focal company***

Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Reliability
Costs	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness
Reliability	9'	8'	7'	6'	5'	4'	3'	2'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Responsiveness

◆End of Questionnaire sheet 2 Thank you for taking your valuable time to answer this questionnaire◆

Definition

Table C1: Knowledge and Information

Attention: Knowledge is different from information. In this research, only knowledge is considered, excluding information.
Knowledge : "Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms." (Davenport and Prusak, 2000: 5): , **Examples of knowledge** are "Inventory Management Method" or "Demand Forecasting Method", etc.
Information : "For data to become information, it must be contextualized, categorized, calculated and condensed" (Davenport & Prusak 2000) **Examples of information** include "Inventory status" or "Demand Forecasting report", etc.

Table C2: Key distinction of Knowledge Sharing and Knowledge Transfer in practical viewpoint specific to **SCM** process knowledge for external integration

Dimension to consider	Knowledge Sharing (KS)	Knowledge Transfer (KT)
Goal	Ordinarily is **individual goal**	Ordinarily is **alignment goal**
Application	**Maybe lead to the goal**	**Must lead to the goal**
-Process	Generally is individual project	Joint project or individual project
-Personnel	Personnel from party who communicates knowledge do not involve with the projects	Personnel from party who communicates knowledge involve with the projects
-Time frame	Usually do not have an exact duration of implementation after receiving the knowledge	Usually have an exact duration of implementation after receiving the knowledge
Knowledge	**Maybe lead to the applications**	**Must lead to the applications**
-Sharing or transferring format	Normally are meeting, site visiting, or auditing, however sometimes are training, coaching or consulting	Normally are training, coaching or consulting, however sometimes are meeting, site visiting, or auditing
-Source of knowledge	Focal company, suppliers or customers	Focal company, suppliers or customers

Table C3: Goal / Alternative: Supply chain performance

Attributes	Definition
Costs	The performance related to the cost attribute describing the cost of operating the process. It includes labor costs, material costs, and transportation costs. The SCOR® KPIs include Cost of Goods Sold, and Supply Chain Management Cost. These two indicators cover all supply chain spend. Cost is an internally focused attribute.
Reliability	The performance related to the delivery, i.e., whether the correct product (according to specifications) is delivered to the correct place, in the correct quantity, at the correct time, with the correct documentation and to the right customer, The SCOR® KPIs such as perfect order fulfillment, delivery performance, fill rate, etc.
Responsiveness	The performance related to the speed at which a supply chain provides the products to customers, including the response to changes in the supply chain that will need to rapidly respond to ensure for the competitiveness. The SCOR® KPIs include such as order fulfillment cycle time, etc.

Table C4: Sub Criteria-2: Knowledge related 8 Supply chain management (SCM) Processes

SCM Processes	Definition
(1) Customer Relationship Management process (CRM process)	The process provides the structure for how the relationships with customers will be developed and maintained. Management identifies key customers and customer groups to be targeted as part of the firm's business mission. The goal is to segment customers based on their value over time and increase customer loyalty by providing customized products and services. Required knowledge for CRM process considering on two aspects i.e. Customer categorizing knowledge, Sale and Marketing knowledge [The definition of these aspects are provided in the Table C5]
(2) Customer Service Management process (CSM process)	This process is the firm's face to the customer. It provides the key point of contact for administering the products and service agreement. Customer service provides the customer with real-time information on promised shipping dates and product availability through interfaces with the firm's functions such as manufacturing and logistics. The customer service process may also include assisting the customer with product applications. Required knowledge for CSM process considering on two aspects i.e. Internal and external coordination knowledge, Quality Control knowledge [The definition of these aspects are provided in the Table C5]

SCM Processes	Definition
(3) Demand Management process (DM process)	This process is the SCM process that balances the customers' requirements with the capabilities of the supply chain. With the right process in place, management can match supply with demand proactively and execute the plan with minimal disruptions. The process is not limited to forecasting. It includes synchronizing supply and demand, increasing flexibility, and reducing variability. Required knowledge for DM process considering on five aspects i.e. Demand forecasting knowledge, Capacity planning knowledge, Inventory management knowledge, Manufacturing strategy knowledge, Production and planning control knowledge [The definition of these aspects are provided in the Table C5]
(4) Order Fulfillment process (OF process)	This process involves more than just filling orders. It includes all activities necessary to define customer requirement and to design a network and a process that permits a firm to meet customer requests while minimizing the total delivered cost as well as filling customer orders. This is not just the logistics function, but instead needs to be implemented cross-functionally and with the coordination of key suppliers and customers. The objective is to develop a seamless process from the supplier to the organization and then on to its various customer segments. Required knowledge for OF process considering on four aspects i.e. Inventory management knowledge, Distribution network planning knowledge, Delivery and Transportation planning knowledge, Warehouse management knowledge [The definition of these aspects are provided in the Table C5]
(5) Manufacturing Flow Management process (MFM process)	This process includes all activities necessary to move products through the plants and to obtain, implement and manage manufacturing flexibility in the supply chain. Manufacturing flexibility reflects the ability to make a wide variety of products in a timely manner at the lowest possible cost. . Required knowledge for MFM process considering on six aspects i.e. Quality control knowledge, Inventory management knowledge, Manufacturing strategy knowledge, Production and planning control knowledge, Optimization knowledge, Supplier selection and development knowledge [The definition of these aspects are provided in the Table C5]

SCM Processes	Definition
(6) Supplier Relationship Management process (SRM process)	This process defines how a company interacts with its suppliers. A company will forge close relationships with a small subset of its suppliers, and manage arm-length relationships with others. Long-term relationships are developed with a small core group of suppliers. The desired outcome is a win-win relationship where both parties benefit. Required knowledge for SRM process considering on three aspects i.e, Sourcing Strategies knowledge, Supplier selection and development knowledge, Purchasing Management knowledge. [The definition of these aspects are provided in the Table C5]
(7) Product Development and Commercialization process (PDC process)	This process provides the structure for developing and bringing to market products jointly with customers and suppliers. The product development and commercialization process team must coordinate with customer relationship management to identify customer articulated and unarticulated needs; select materials and suppliers in conjunction with the supplier relationship management process; and, develop production technology in manufacturing flow to manufacture and integrate into the best supply chain flow for the product/market combination. Required knowledge for PDC process considering on four aspects i.e, Sale and Marketing knowledge, Supplier selection and development knowledge, Product design knowledge, Packaging design knowledge. [The definition of these aspects are provided in the Table C5]
(8) Returns Management process (RM process)	This process associated with returns, reverse logistics, gate keeping, and avoidance are managed within the firm and across key members of the supply chain. The correct implementation of this process enables management not only to manage the reverse product flow efficiently, but to identify opportunities to reduce unwanted returns and to control reusable assets such as containers. Effective returns management is an important part of SCM and provides an opportunity to achieve a sustainable competitive advantage. Required knowledge for RM process considering on two aspects i.e, Delivery and Transportation planning knowledge, Disposition rule and method knowledge. [The definition of these aspects are provided in the Table C5]

Table C5: Sub Criteria-3: Required Knowledge for SCM Process

Required Knowledge for SCM Process	Definition
Customer categorizing knowledge	Knowledge relating to customer categorizing such as principle to provide team for categorizing, method to define criteria for categorizing customer, a process of categorizing customers, principle of customer behavior analysis to identify customer groups for customizing the product and service etc., including the use of a system or software related (if any).
Sale and Marketing knowledge	Knowledge relating to marketing and sales, such as rules on analysis of marketing direction and position, method of sale growth analysis, method of promotion setting, knowledge of price mechanism and margin of products based on customer types and groups, etc., including the application of related systems or software (if any)
Internal and external coordination knowledge	Knowledge contributing to effective internal and external coordination of organizations, such as techniques of communication and coordination, method of data source access, and right group of individuals for problem-solving, etc., including the application of related systems or software (if any)
Quality Control knowledge	Knowledge relating to quality control, such as quality control tool (e.g. fishbone diagram, control chart, process capability, measurement system and analysis), method of product quality assessment and inspection, calibration of tools used for product inspection, product competency analysis, etc., including the application of related systems or software (if any)
Demand forecasting knowledge	Knowledge relating to demand forecasting, such as method of data collection for forecasting, techniques of forecasting (e.g. Single Moving Average, Weighted Moving Average, Single Exponential Smoothing, Linear Moving Average, Decomposition), etc., including the application of related systems or software (if any)
Capacity planning knowledge	Knowledge relating to capacity planning, such as method of data collection for capacity planning, techniques of capacity planning (e.g. rough cut capacity planning, capacity requirement planning), etc., including the application of related systems or software (if any)
Inventory management knowledge	Knowledge relating to inventory management, such as rules on inventory level analysis, method of establishing max-min inventory, method of establishing safety stock, etc. including the application of related systems or software (if any).

Required Knowledge for SCM Process	Definition
Manufacturing strategy knowledge	Knowledge relating to production strategies, such as pushed-pull strategy, postponement strategy, lean strategy, agile strategy, etc.
Production and planning control knowledge	Knowledge relating to production planning and control, such as master plan scheduling (MPS), material requirement planning (MRP), scheduling technique, program evaluation and review technique (PERT), critical Path Method (CPM) , etc., including the application of related systems or software (if any).
Distribution network planning knowledge	Knowledge relating to design of distribution network, such as techniques for selecting location of plant, warehouse and goods distribution center, establishment of goods distribution channel, e.g. distribution through distribution center, etc., including the application of related systems or software (if any).
Delivery and Transportation planning knowledge	Knowledge relating to delivery and transportation planning, such as techniques of delivery scheduling, techniques of linear transportation model for analyzing locations of goods delivery and numbers of goods, applied techniques of goods distribution, e.g. selection of appropriate transportation methods (Shortest path method), selection of transportation route (Vehicle Routing), rules on design of transportation network, e.g. Milk Run, Distribution center etc., analysis on transportation cost, method of goods management on transporting trucks, etc., including the application of related systems or software (if any).
Warehouse management knowledge	Knowledge relating to warehouse management, such as method of product picking (e.g. picking to order, batch picking), storage strategies e.g. Commodity System, Part Number System, Fixed Location System, warehouse layout, visual control, etc., including the application of related systems or software (if any).
Optimization knowledge	Knowledge relating to techniques of providing the manufacturing capabilities and constraints (optimization under existing limitations), such as optimization of batch size under existing production resources, optimization cycle time under existing production resources, etc., including the application of related systems or software (if any).

Required Knowledge for SCM Process	Definition
Supplier selection and development knowledge	Knowledge relating to supplier selection and development, such as identifying supplier segment knowledge, providing criteria for categorizing supplier knowledge, establishment of rules on supplier selection, method of supplier assessment and selection, planning and establishment of supplier development approach, etc.
Sourcing Strategies knowledge	Knowledge relating to sourcing strategies to provide appropriate strategy for each material group, such as outsourcing, group purchasing etc, including strategies of supplier relationship development e.g. arm-length relationship, alliance strategic, joint venture , etc. to provide suitable
Purchasing Management Knowledge	Knowledge relating to purchasing, such as planning and analyzing principles on order quantity (e.g. Economic Order Quantity, Periodic Order Quantity, Fixed Order Quantity), etc., including the application of related systems or software (if any).
Product design knowledge	Knowledge relating to product design such as analysis on product cost, principles of product design corresponding to factors , for example; types of material, manufacturing process and customer requirement , etc., including the application of related systems or software (if any).
Packaging design knowledge	Knowledge relating to packaging design, such as analysis on packaging cost, principles of packaging design corresponding to factors, for example; types of material which are suitable and able to protect products, including maintain product quality, extend product life cycle, provide convenience of usage and cost-effective transportation, etc., including the application of related systems or software (if an
Disposal Rule and method	Knowledge relating to rules, regulations and methods of product return management such as refurbish or remanufacture, recycle and landfill, etc.

Appendix C

Consistency Ratio

1. Consistency Ratio for sub-criteria1 (Example for table 4.19)

Sub-criteria1	Fuzzy pair-wise comparison			
	F2S	S2F	F2C	C2F
F2S	1,1,1	1,1,1	6,7,8	6,7,8
S2F	1,1,1	1,1,1	6,7,8	6,7,8
F2C	1/8,1/7,1/6	1/8,1/7,1/6	1,1,1	1,1,1
C2F	1/8,1/7,1/6	1/8,1/7,1/6	1,1,1	1,1,1

Refer to equation 11:

From A= [m_{ij}] . If A is consistent, then A'=[l_{ij}, m_{ij}, u_{ij}] is also consistent , thus we consider m_{ij} in table above.

Step 1. Complete comparisons matrix.

Sub-criteria1	Fuzzy pair-wise comparison			
	F2S	S2F	F2C	C2F
F2S	1	1	7	7
S2F	1	1	7	7
F2C	1/7	1/7	1	1
C2F	1/7	1/7	1	1

Step 2. Calculate the total of each column.

Sub-criteria1	Fuzzy pair-wise comparison			
	F2S	S2F	F2C	C2F
F2S	1	1	7	7
S2F	1	1	7	7
F2C	1/7	1/7	1	1
C2F	1/7	1/7	1	1
Total	2.2857	2.2857	16.0000	16.0000

Step 3. Adjust the total of each column to equal 1 and sum of horizontal / no. of elements

Sub-criteria1	Fuzzy pair-wise comparison				Sum	Sum/n
	F2S	S2F	F2C	C2F		
F2S	1/ 2.2857 =0.4375	1/ 2.2857 =0.4375	7/ 16 =0.4375	7/ 16 =0.4375	1.7500	1.7500/4 =**0.4375**
S2F	1/ 2.2857 =0.4375	1/ 2.2857 =0.4375	7/ 16 =0.4375	7/ 16 =0.4375	1.7500	1.7500/4 =**0.4375**
F2C	(1/7)/ 2.2857 =0.0625	(1/7)/ 2.2857 =0.0625	1/ 16 =0.0625	1/ 16 =0.0625	0.2500	0.2500/4 =**0.0625**
C2F	(1/7)/ 2.2857 =0.0625	(1/7)/ 2.2857 =0.0625	1/ 16 =0.0625	1/ 16 =0.0625	0.2500	0.2500/4 =**0.0625**
Total	**1.0000**	**1.0000**	**1.0000**	**1.0000**		**1.0000**

Remark: n=4 due to there are four dimension

Step 4. Calculate λ_{max}

λ_{max} = (2.2857x0.4375) + (2.2857x0.4375) + (16.0000x0.0625) + (16.0000x0.0625) = 4

Step 5. Calculate consistency index (C.I.), refer to equation 9;

$$C.I. = \frac{\lambda_{max} - n}{n-1} = \frac{4-4}{4-1} = \frac{0}{3} = 0$$

Step 6. Calculate consistency ratio (C.R.), refer to equation 10;

$$C.R. = \frac{C.I.}{R.I} = \frac{0}{0.89} = 0$$ [R.I. = 0.89 when n=4 (refer to Table 2.6)]

2. Consistency Ratio for sub-criteria2 (Example for table 4.25)

Sub-criteria2	Fuzzy pair-wise comparison							
	CRM	CSM	DM	OF	MFM	SRM	PDC	RM
CRM	1,1,1	1,1,1	1/4,1/3,1/2	1/9,1/8,1/7	1/9,1/8,1/7	1/9,1/8,1/7	1/9,1/8,1/7	1/9,1/8,1/7
CSM	1,1,1	1,1,1	1/9,1/8,1/7	1/9,1/8,1/7	1/9,1/8,1/7	1/9,1/8,1/7	1/9,1/8,1/7	1/9,1/8,1/7
DM	2,3,4	7,8,9	1,1,1	1,1,1	1,1,1	1,2,3	1,2,3	1,2,3
OF	7,8,9	7,8,9	1,1,1	1,1,1	1,1,1	1,2,3	1,2,3	1,2,3
MFM	7,8,9	7,8,9	1,1,1	1,1,1	1,1,1	1,2,3	1,1,1	1,2,3
SRM	7,8,9	7,8,9	1/3,1/2,1	1/3,1/2,1	1/3,1/2,1	1,1,1	1/4,1/3,1/2	1/3,1/2,1
PDC	7,8,9	7,8,9	1/3,1/2,1	1/3,1/2,1	1,1,1	2,3,4	1,1,1	2,3,4
RM	7,8,9	7,8,9	1/3,1/2,1	1/3,1/2,1	1/3,1/2,1	1,2,3	1/4,1/3,1/2	1,1,1

Refer to equation 11:

From A= [m_{ij}] . If A is consistent, then A'=[l_{ij}, m_{ij}, u_{ij}] is also consistent , thus we consider m_{ij} in table above.

Step 1. Complete comparisons matrix.

Sub-criteria2	Fuzzy pair-wise comparison							
	CRM	CSM	DM	OF	MFM	SRM	PDC	RM
CRM	1	1	1/3	1/8	1/8	1/8	1/8	1/8
CSM	1	1	1/8	1/8	1/8	1/8	1/8	1/8
DM	3	8	1	1	1	2	2	2
OF	8	8	1	1	1	2	2	2
MFM	8	8	1	1	1	2	1	2
SRM	8	8	1/2	1/2	1/2	1	1/3	1/2
PDC	8	8	1/2	1/2	1	3	1	3
RM	8	8	1/2	1/2	1/2	2	1/3	1

Step 2. Calculate the total of each column.

Sub-criteria2	Fuzzy pair-wise comparison							
	CRM	CSM	DM	OF	MFM	SRM	PDC	RM
CRM	1	1	1/3	1/8	1/8	1/8	1/8	1/8
CSM	1	1	1/8	1/8	1/8	1/8	1/8	1/8
DM	3	8	1	1	1	2	2	2
OF	8	8	1	1	1	2	2	2
MFM	8	8	1	1	1	2	1	2
SRM	8	8	1/2	1/2	1/2	1	1/3	1/2
PDC	8	8	1/2	1/2	1	3	1	3
RM	8	8	1/2	1/2	1/2	2	1/3	1
Total	**45.0000**	**50.0000**	**4.9583**	**4.7500**	**5.2500**	**12.2500**	**6.9167**	**10.7500**

Step 3. Adjust the total of each column to equal 1 and sum of horizontal / no. of elements

Sub-criteria2	Fuzzy pair-wise comparison								Sum	Sum/n
	CRM	CSM	DM	OF	MFM	SRM	PDC	RM		
CRM	1/45 =0.0222	1/50 =0.0200	(1/3)/4.9583 =0.0672	(1/8)/4.75 =0.0263	(1/8)/5.25 =0.0238	(1/8)/12.25 =0.0102	(1/8)/6.9167 =0.0181	(1/8)/10.75 =0.0116	0.1995	0.1995/8 =**0.0249**
CSM	1/45 =0.0222	1/50 =0.0200	(1/8)/4.9583 =0.0252	(1/8)/4.75 =0.0263	(1/8)/5.25 =0.0238	(1/8)/12.25 =0.0102	(1/8)/6.9167 =0.0181	(1/8)/10.75 =0.0116	0.1575	0.1575/8 =**0.0197**
DM	3/45 =0.0667	8/50 =0.1600	1/4.9583 =0.2017	1/4.75 =0.2105	1/5.25 =0.1905	2/12.25 =0.1633	2/6.9167 0.2892	2/10.75 =0.1860	1.4678	1.4678/8 =**0.1835**
OF	8/45 =0.1778	8/50 =0.1600	1/4.9583 =0.2017	1/4.75 =0.2105	1/5.25 =0.1905	2/12.25 =0.1633	2/6.9167 =0.2892	2/10.75 =0.1860	1.5789	1.5789/8 =**0.1974**
MFM	8/45 =0.1778	8/50 =0.1600	1/4.9583 =0.2017	1/4.75 =0.2105	1/5.25 =0.1905	1/12.25 =0.1633	1/6.9167 =0.1446	2/10.75 =0.1860	1.4344	1.4344/8 =**0.1793**
SRM	8/45 =0.1778	8/50 =0.1600	(1/2)/4.9583 =0.1008	(1/2)/4.75 =0.1053	(1/2)/5.25 =0.0952	(1/3)/12.25 =0.0816	(1/3)/6.9167 =0.0482	(1/2)/10.75 =0.0465	0.8155	0.8155/8 =**0.1019**
PDC	8/45 =0.1778	8/50 =0.1600	(1/2)/4.9583 =0.1008	(1/2)/4.75 =0.1053	1/5.25 =0.1905	1/12.25 =0.2449	1/6.9167 =0.1446	3/10.75 =0.2791	1.4029	1.4029/8 =**0.1754**
RM	8/45 =0.1778	8/50 =0.1600	(1/2)/4.9583 =0.1008	(1/2)/4.75 =0.1053	(1/2)/5.25 =0.0952	(1/3)/12.25 =0.1633	(1/3)/6.9167 =0.0482	1/10.75 =0.0930	0.9436	0.9436/8 =**0.1180**
Total	**1.0000**	**1.0000**	**1.0000**	**1.0000**	**1.0000**	**1.0000**	**1.0000**	**1.0000**		**1.0000**

Remark: n=8 due to there are eight dimension

Step 4. Calculate λ_{max}

λ_{max} = (45.0000x0.0249) + (50.0000x0.0197) + (4.9583x0.1835) + (4.7500x0.1974) + (5.2500x0.1793) + (12.2500x0.1019) + (6.9167x0.1754) + (10.7500x0.1180)

= 8.62

Step 5. Calculate consistency index (C.I.), refer to equation 9;

$$C.I. = \frac{\lambda_{max} - n}{n-1} = \frac{8.62-8}{8-1} = \frac{0.8243}{7} = 0.0892$$

Step 6. Calculate consistency ratio (C.R.), refer to equation 10;

$$C.R. = \frac{C.I.}{R.I} = \frac{0.0892}{1.40} = 0.0637$$ [R.I. = 1.40 when n=8 (refer to Table 2.6)]

3. Consistency Ratio for sub-criteria3 (Example for table 4.30)

Sub-criteria3	Fuzzy pair-wise comparison					
	QC	INM	MFS	PPC	OTM	SSD
QC	1,1,1	4,5,6	2,3,4	9,9,9	4,5,6	4,5,6
INM	1/6,1/5,1/4	1,1,1	1,1,1	1,2,3	1,1,1	1,1,1
MFS	1/4,1/3,1/2	1,1,1	1,1,1	2,3,4	1,1,1	1,1,1
PPC	1/9,1/9,1/9	1/3,1/2,1	1/4,1/3,1/2	1,1,1	1/3,1/2,1	1/3,1/2,1
OTM	1/6,1/5,1/4	1,1,1	1,1,1	1,2,3	1,1,1	1,1,1
SSD	1/6,1/5,1/4	1,1,1	1,1,1	1,2,3	1,1,1	1,1,1

Refer to equation 11:

From A= [m_{ij}] . If A is consistent, then A'=[l_{ij}, m_{ij}, u_{ij}] is also consistent , thus we consider m_{ij} in table above.

Step 1. Complete comparisons matrix.

Sub-criteria3	Fuzzy pair-wise comparison					
	QC	INM	MFS	PPC	OTM	SSD
QC	1	5	3	9	5	5
INM	1/5	1	1	2	1	1
MFS	1/3	1	1	3	1	1
PPC	1/9	1/2	1/3	1	1/2	1/2
OTM	1/5	1	1	2	1	1
SSD	1/5	1	1	2	1	1

Step 2. Calculate the total of each column.

Sub-criteria3	Fuzzy pair-wise comparison					
	QC	INM	MFS	PPC	OTM	SSD
QC	1	5	3	9	5	5
INM	1/5	1	1	2	1	1
MFS	1/3	1	1	3	1	1
PPC	1/9	1/2	1/3	1	1/2	1/2
OTM	1/5	1	1	2	1	1
SSD	1/5	1	1	2	1	1
Total	**2.0444**	**9.5000**	**7.3333**	**19.0000**	**9.5000**	**9.5000**

Step 3. Adjust the total of each column to equal 1 and sum of horizontal / no. of elements

Sub-criteria3	Fuzzy pair-wise comparison						Sum	Sum/n
	QC	INM	MFS	PPC	OTM	SSD		
QC	1/2.0444 =0.4891	5/9.5 =0.5263	3/7.3333 =0.4091	9/19 =0.4737	5/9.5 =0.5263	5/9.5 =0.5263	2.9509	2.9509/6 =**0.4918**
INM	(1/5)/2.0444 =0.0978	1/9.5 =0.1053	1/7.3333 =0.1364	2/19 =0.1053	1/9.5 =0.1053	1/9.5 =0.1053	0.6552	0.6552/6 =**0.1092**
MFS	(1/3)/2.0444 =0.1630	1/9.5 =0.1053	1/7.3333 =0.1364	3/19 =0.1579	1/9.5 =0.1053	1/9.5 =0.1053	0.7731	0.7731/6 =**0.1288**
PPC	(1/9)/2.0444 =0.0543	(1/2)/9.5 =0.0526	(1/3)/7.3333 =0.0455	1/19 =0.0526	(1/2)/9.5 =0.0526	(1/2)/9.5 =0.0526	0.3103	0.3103/6 =**0.0517**
OTM	(1/5)/2.0444 =0.0978	1/9.5 =0.1053	1/7.3333 =0.1364	2/19 =0.1053	1/9.5 =0.1053	1/9.5 =0.1053	0.6552	0.6552/6 =**0.1092**
SSD	(1/5)/2.0444 =0.0978	1/9.5 =0.1053	1/7.3333 =0.1364	2/19 =0.1053	1/9.5 =0.1053	1/9.5 =0.1053	0.6552	0.6552/6 =**0.1092**
Total	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		1.0000

Remark: n=6 due to there are six dimension

Step 4. Calculate λ_{max}

λ_{max} = (2.0444x0.4918) + (9.5000x0.1092) + (7.3333x0.1288) + (19.0000x0.0517) + (9.5000x0.1092) + (9.5000x0.1092)

= 6.0455

Step 5. Calculate consistency index (C.I.), refer to equation 9;

$$C.I. = \frac{\lambda_{max} - n}{n-1} = \frac{6.0455-6}{6-1} = \frac{0.0455}{5} = 0.0091$$

Step 6. Calculate consistency ratio (C.R.), refer to equation 10;

$$C.R. = \frac{C.I.}{R.I} = \frac{0.0091}{1.25} = 0.0073$$ [R.I. = 1.25 when n=6 (refer to Table 2.6)]

4. Consistency Ratio for alternative (Example for table 4.36)

Alternative	Fuzzy pair-wise comparison		
	Costs	Reliability	Responsiveness
Costs	1,1,1	2,3,4	1,1,1
Reliability	1/4,1/3,1/2	1,1,1	1/4,1/3,1/2
Responsiveness	1,1,1	2,3,4	1,1,1

Refer to equation 11:

From A= [m_{ij}] . If A is consistent, then A'=[l_{ij}, m_{ij}, u_{ij}] is also consistent , thus we consider m_{ij} in table above.

Step 1. Complete comparisons matrix.

Alternative	Fuzzy pair-wise comparison		
	Costs	Reliability	Responsiveness
Costs	1	3	1
Reliability	1/3	1	1/3
Responsiveness	1	3	1

Step 2. Calculate the total of each column.

Alternative	Fuzzy pair-wise comparison		
	Costs	Reliability	Responsiveness
Costs	1	3	1
Reliability	1/3	1	1/3
Responsiveness	1	3	1
Total	2.3333	7.0000	2.3333

Step 3. Adjust the total of each column to equal 1 and sum of horizontal / no. of elements

Alternative	Fuzzy pair-wise comparison			Sum	Sum/n
	Costs	Reliability	Responsiveness		
Costs	1/2.3333 =0.4286	3/7 =0.4286	1/2.3333 =0.4286	1.2857	1.2857/3 =**0.4286**
Reliability	(1/3)/2.3333 =0.1429	1/7 =0.1429	(1/3)/2.3333 =0.1429	0.4286	0.4286/3 =**0.1429**
Responsiveness	1/2.3333 =0.4286	3/7 =0.4286	1/2.3333 =0.4286	1.2857	1.2857/3 =**0.4286**
Total	**1.0000**	**1.0000**	**1.0000**		**1.0000**

Remark: n=3 due to there are three dimension

Step 4. Calculate $\lambda_{\max}$

$$\lambda_{\max} = (2.3333 \times 0.4286) + (7.0000 \times 0.1429) + (2.3333 \times 0.4286) = 3$$

Step 5. Calculate consistency index (C.I.), refer to equation 9;

$$C.I. = \frac{\lambda_{\max} - n}{n-1} = \frac{3-3}{3-1} = \frac{0}{2} = 0$$

Step 6. Calculate consistency ratio (C.R.), refer to equation 10;

$$C.R. = \frac{C.I.}{R.I} = \frac{0}{0.52} = 0$$ [R.I. = 0.52 when n=3 (refer to Table 2.6)]

Appendix D

Relative importance weights of required knowledge for eight SCM processes of three stakeholders

Table D.1 Relative importance weights of required knowledge for eight SCM processes for the assembly group

Relative importance weights (priority rank) of required knowledge for eight SCM processes															
KS (0.639)								KT (0.361)							
	F2S		S2F		F2C		C2F		F2S		S2F		F2C		C2F
	(0.291)		(0.211)		(0.205)		(0.294)		(0.283)		(0.202)		(0.198)		(0.316)
(1) OF	0.170	(1) OF	0.171	(1) OF	0.162	(1) PDC	0.165	(1) OF	0.170	(1) OF	0.175	(1) OF	0.165	(1) PDC	0.168
(1.1) DTP	0.346	(1.1) DTP	0.346	(1.1) DTP	0.346	(1.1) PDD	0.292	(1.1) DTP	0.346	(1.1) DTP	0.346	(1.1) DTP	0.346	(1.1) PDD	0.292
(1.2) INM	0.246	(1.2) INM	0.246	(1.2) INM	0.246	(1.2) PKD	0.246	(1.2) INM	0.246	(1.2) INM	0.246	(1.2) INM	0.246	(1.2) PKD	0.246
(1.3) WM	0.244	(1.3) WM	0.244	(1.3) WM	0.244	(1.3) SSD	0.240	(1.3) WM	0.244	(1.3) WM	0.244	(1.3) WM	0.244	(1.3) SSD	0.240
(1.4) DNP	0.164	(1.4) DNP	0.164	(1.4) DNP	0.164	(1.4) SM	0.222	(1.4) DNP	0.164	(1.4) DNP	0.164	(1.4) DNP	0.164	(1.4) SM	0.222
(2) DM	0.149	(2) MFM	0.154	(2) DM	0.149	(2) DM	0.154	(2) DM	0.151	(2) MFM	0.163	(2) DM	0.147	(2) DM	0.152
(2.1) DF	0.270	(2.1) PPC	0.249	(2.1) DF	0.270	(2.1) DF	0.270	(2.1) DF	0.270	(2.1) PPC	0.249	(2.1) DF	0.270	(2.1) DF	0.270
(2.2) CP	0.242	(2.2) QC	0.237	(2.2) CP	0.242	(2.2) CP	0.242	(2.2) CP	0.242	(2.2) QC	0.237	(2.2) CP	0.242	(2.2) CP	0.242
(2.3) PPC	0.183	(2.3) MFS	0.145	(2.3) PPC	0.183	(2.3) PPC	0.183	(2.3) PPC	0.183	(2.3) MFS	0.145	(2.3) PPC	0.183	(2.3) PPC	0.183
(2.4) MFS	0.166	(2.4) OTM	0.132	(2.4) MFS	0.166	(2.4) MFS	0.166	(2.4) MFS	0.166	(2.4) OTM	0.132	(2.4) MFS	0.166	(2.4) MFS	0.166
(2.5) INM	0.139	(2.5) SSD	0.128	(2.5) INM	0.139	(2.5) INM	0.139	(2.5) INM	0.139	(2.5) SSD	0.128	(2.5) INM	0.139	(2.5) INM	0.139
		(2.6) INM	0.109							(2.6) INM	0.109				
(3) MFM	0.149	(3) DM	0.133	(3) CSM	0.147	(3) OF	0.148	(3) MFM	0.147	(3) DM	0.131	(3) CSM	0.146	(3) OF	0.149
(3.1) **PPC**	0.249	(3.1) **DF**	0.270	(3.1) **QC**	0.650	(3.1) **DTP**	0.346	(3.1) **PPC**	0.249	(3.1) **DF**	0.270	(3.1) **QC**	0.650	(3.1) **DTP**	0.346
(3.2) QC	0.237	(3.2) CP	0.242	(3.2) IEC	0.350	(3.2) INM	0.246	(3.2) QC	0.237	(3.2) CP	0.242	(3.2) IEC	0.350	(3.2) INM	0.246
(3.3) MFS	0.145	(3.3) PPC	0.183			(3.3) WM	0.244	(3.3) MFS	0.145	(3.3) PPC	0.183			(3.3) WM	0.244
(3.4) OTM	0.132	(3.4) MFS	0.166			(3.4) DNP	0.164	(3.4) OTM	0.132	(3.4) MFS	0.166			(3.4) DNP	0.164
(3.5) SSD	0.128	(3.5) INM	0.139					(3.5) SSD	0.128	(3.5) INM	0.139				
(3.6) INM	0.109							(3.6) INM	0.109						
(4) PDC	0.139	(4) SRM	0.117	(4) PDC	0.130	(4) CSM	0.141	(4) PDC	0.140	(4) SRM	0.112	(4) PDC	0.136	(4) CSM	0.142
(4.1) **PDD**	0.292	(4.1) **SS**	0.362	(4.1) **PDD**	0.292	(4.1) **QC**	0.650	(4.1) **PDD**	0.292	(4.1) **SS**	0.362	(4.1) **PDD**	0.292	(4.1) **QC**	0.650
(4.2) PKD	0.246	(4.2) SSD	0.343	(4.2) PKD	0.246	(4.2) IEC	0.350	(4.2) PKD	0.246	(4.2) SSD	0.343	(4.2) PKD	0.246	(4.2) IEC	0.350
(4.3) SSD	0.240	(4.3) PM	0.295	(4.3) SSD	0.240			(4.3) SSD	0.240	(4.3) PM	0.295	(4.3) SSD	0.240		
(4.4) SM	0.222			(4.4) SM	0.222			(4.4) SM	0.222			(4.4) SM	0.222		
(5) SRM	0.101	(5) PDC	0.111	(5) CRM	0.127	(5) CRM	0.128	(5) SRM	0.101	(5) PDC	0.109	(5) CRM	0.126	(5) CRM	0.129
(5.1) **SS**	0.362	(5.1) **PDD**	0.292	(5.1) **SM**	0.369	(5.1) **SM**	0.631	(5.1) **SS**	0.362	(5.1) **PDD**	0.292	(5.1) **SM**	0.631	(5.1) **SM**	0.631
(5.2) SSD	0.343	(5.2) PKD	0.246	(5.2) CC	0.631	(5.2) CC	0.369	(5.2) SSD	0.343	(5.2) PKD	0.246	(5.2) CC	0.369	(5.2) CC	0.369
(5.3) PM	0.295	(5.3) SSD	0.240					(5.3) PM	0.295	(5.3) **SSD**	0.240				
		(5.4) SM	0.222							(5.4) SM	0.222				
(6) RM	0.100	(6) CSM	0.107	(6) MFM	0.116	(6) RM	0.101	(6) CSM	0.099	(6) CSM	0.108	(6) MFM	0.115	(6) MFM	0.100
(6.1) **DTP**	0.579	(6.1) **QC**	0.650	(6.1) **PPC**	0.249	(6.1) **DTP**	0.579	(6.1) **QC**	0.650	(6.1) **QC**	0.650	(6.1) **PPC**	0.249	(6.1) **PPC**	0.249
(6.2) DRM	0.421	(6.2) IEC	0.350	(6.2) QC	0.237	(6.2) DRM	0.421	(6.2) IEC	0.350	(6.2) IEC	0.350	(6.2) QC	0.237	(6.2) QC	0.237
				(6.3) MFS	0.145							(6.3) MFS	0.145	(6.3) MFS	0.145
				(6.4) **OTM**	0.132							(6.4) **OTM**	0.132	(6.4) **OTM**	0.132
				(6.5) SSD	0.128							(6.5) SSD	0.128	(6.5) SSD	0.128
				(6.6) INM	0.109							(6.6) INM	0.109	(6.6) INM	0.109
(7) CSM	0.099	(7) RM	0.105	(7) RM	0.100	(7) MFM	0.101	(7) RM	0.099	(7) RM	0.103	(7) RM	0.097	(7) RM	0.098
(7.1) QC	0.650	(7.1) **DTP**	0.579	(7.1) **DTP**	0.579	(7.1) PPC	0.249	(7.1) **DTP**	0.579	(7.1) **DTP**	0.579	(7.1) **DTP**	0.579	(7.1) **DTP**	0.579
(7.2) IEC	0.350	(7.2) DRM	0.421	(7.2) DRM	0.421	(7.2) QC	0.237	(7.2) DRM	0.421	(7.2) DRM	0.421	(7.2) DRM	0.421	(7.2) DRM	0.421
						(7.3) MFS	0.145								
						(7.4) OTM	0.132								
						(7.5) SSD	0.128								
						(7.6) INM	0.109								
(8) CRM	0.093	(8) CRM	0.101	(8) SRM	0.069	(8) SRM	0.062	(8) CRM	0.093	(8) CRM	0.099	(8) SRM	0.067	(8) SRM	0.062
(8.1) SM	0.631	(8.1) SM	0.631	(8.1) SS	0.362	(8.1) SS	0.362	(8.1) SM	0.631	(8.1) SM	0.631	(8.1) SS	0.362	(8.1) SS	0.362
(8.2) CC	0.369	(8.2) CC	0.369	(8.2) SSD	0.343	(8.2) SSD	0.343	(8.2) CC	0.369	(8.2) CC	0.369	(8.2) SSD	0.343	(8.2) SSD	0.343
				(8.3) PM	0.295	(8.3) PM	0.295					(8.3) PM	0.295	(8.3) PM	0.295

Table D.2 Relative importance weights of required knowledge for eight SCM processes for the first-tier suppliers group

Relative importance weights (priority rank) of required knowledge for eight SCM processes															
KS (0.544)								KT (0.456)							
	F2S (0.253)		S2F (0.249)		F2C (0.231)		C2F (0.266)		F2S (0.259)		S2F (0.238)		F2C (0.224)		C2F (0.279)
(1) MFM	**0.167**	**(1) MFM**	**0.170**	**(1) PDC**	**0.168**	**(1) PDC**	**0.167**	**(1) MFM**	**0.166**	**(1) PDC**	**0.178**	**(1) PDC**	**0.169**	**(1) PDC**	**0.168**
(1.1) QC	0.247	(1.1) QC	0.268	(1.1) PDD	0.297	(1.1) PDD	0.298	(1.1) QC	0.261	(1.1) PDD	0.295	(1.1) PDD	0.297	(1.1) PDD	0.294
(1.2) PPC	0.189	(1.2) PPC	0.182	(1.2) PKD	0.256	(1.2) SSD	0.260	(1.2) PPC	0.186	(1.2) PKD	0.260	(1.2) PKD	0.256	(1.2) SSD	0.260
(1.3) MFS	0.187	(1.3) MFS	0.174	(1.3) SSD	0.248	(1.3) PKD	0.244	(1.3) MFS	0.177	(1.3) SSD	0.250	(1.3) SSD	0.247	(1.3) PKD	0.248
(1.4) OTM	0.133	(1.4) OTM	0.135	(1.4) SM	0.200	(1.4) SM	0.198	(1.4) OTM	0.143	(1.4) SM	0.195	(1.4) SM	0.200	(1.4) SM	0.198
(1.5) INM	0.122	(1.5) SSD	0.130					(1.5) SSD	0.125						
(1.6) SSD	0.122	(1.6) INM	0.110					(1.6) INM	0.108						
(2) DM	**0.152**	**(2) PDC**	**0.160**	**(2) DM**	**0.162**	**(2) DM**	**0.165**	**(2) DM**	**0.152**	**(2) MFM**	**0.160**	**(2) DM**	**0.163**	**(2) DM**	**0.152**
(2.1) DF	0.231	(2.1) PDD	0.295	(2.1) DF	0.229	(2.1) DF	0.232	(2.1) DF	0.238	(2.1) QC	0.257	(2.1) DF	0.229	(2.1) DF	0.250
(2.2) PPC	0.209	(2.2) PKD	0.260	(2.2) MFS	0.212	(2.2) MFS	0.208	(2.2) MFS	0.205	(2.2) PPC	0.184	(2.2) MFS	0.206	(2.2) MFS	0.208
(2.3) MFS	0.207	(2.3) SSD	0.250	(2.3) PPC	0.206	(2.3) CP	0.203	(2.3) CP	0.202	(2.3) MFS	0.178	(2.3) CP	0.204	(2.3) CP	0.196
(2.4) CP	0.202	(2.4) SM	0.195	(2.4) CP	0.197	(2.4) PPC	0.186	(2.4) PPC	0.195	(2.4) OTM	0.133	(2.4) PPC	0.190	(2.4) PPC	0.194
(2.5) INM	0.151			(2.5) INM	0.157	(2.5) INM	0.170	(2.4) INM	0.160	(2.5) SSD	0.127	(2.5) INM	0.170	(2.5) INM	0.153
										(2.6) INM	0.122				
(3) OF	**0.150**	**(3) DM**	**0.154**	**(3) MFM**	**0.138**	**(3) OF**	**0.135**	**(3) OF**	**0.150**	**(3) OF**	**0.148**	**(3) MFM**	**0.137**	**(3) OF**	**0.149**
(3.1) **DTP**	0.314	(3.1) **DF**	0.233	(3.1) **QC**	0.266	(3.1) **DTP**	0.311	(3.1) **DTP**	0.309	(3.1) **DTP**	0.318	(3.1) **QC**	0.269	(3.1) **DTP**	0.330
(3.2) INM	0.273	(3.2) CP	0.219	(3.2) PPC	0.189	(3.2) INM	0.275	(3.2) INM	0.258	(3.2) INM	0.251	(3.2) PPC	0.187	(3.2) INM	0.254
(3.3) WM	0.211	(3.3) MFS	0.207	(3.3) MFS	0.172	(3.3) WM	0.209	(3.3) WM	0.229	(3.3) DNP	0.222	(3.3) MFS	0.169	(3.3) WM	0.213
(3.4) DNP	0.203	(3.4) PPC	0.184	(3.4) OTM	0.136	(3.4) DNP	0.205	(3.4) DNP	0.205	(3.4) WM	0.209	(3.4) OTM	0.135	(3.4) DNP	0.203
		(3.5) INM	0.157	(3.5) SSD	0.121							(3.5) SSD	0.121		
				(3.6) INM	0.116							(3.6) INM	0.119		
(4) PDC	**0.145**	**(4) OF**	**0.138**	**(4) CSM**	**0.133**	**(4) MFM**	**0.133**	**(4) PDC**	**0.148**	**(4) DM**	**0.142**	**(4) CSM**	**0.132**	**(4) CSM**	**0.142**
(4.1) **PDD**	0.296	(4.1) DTP	0.313	(4.1) QC	0.656	(4.1) QC	0.266	(4.1) PDD	0.292	(4.1) DF	0.233	(4.1) QC	0.656	(4.1) QC	0.674
(4.2) SSD	0.254	(4.2) INM	0.270	(4.2) IEC	0.344	(4.2) PPC	0.196	(4.2) SSD	0.266	(4.2) MFS	0.209	(4.2) IEC	0.344	(4.2) IEC	0.326
(4.3) PKD	0.243	(4.3) WM	0.216			(4.3) MFS	0.165	(4.3) PKD	0.247	(4.3) CP	0.208				
(4.4) SM	0.207	(4.4) DNP	0.201			(4.4) OTM	0.132	(4.4) SM	0.195	(4.4) PPC	0.188				
						(4.5) SSD	0.123			(4.5) INM	0.162				
						(4.6) INM	0.117								
(5) CSM	**0.167**	**(5) CSM**	**0.108**	**(5) OF**	**0.123**	**(5) CSM**	**0.125**	**(5) CSM**	**0.107**	**(5) SRM**	**0.110**	**(5) OF**	**0.125**	**(5) CRM**	**0.129**
(5.1) QC	0.684	(5.1) **QC**	0.683	(5.1) **DTP**	0.304	(5.1) QC	0.674	(5.1) QC	0.683	(5.1) **SS**	0.386	(5.1) **DTP**	0.304	(5.1) **SM**	0.542
(5.2) IEC	0.316	(5.2) IEC	0.317	(5.2) INM	0.280	(5.2) IEC	0.326	(5.2) IEC	0.317	(5.2) SSD	0.319	(5.2) INM	0.283	(5.2) CC	0.458
				(5.3) **WM**	0.212					(5.3) PM	0.296	(5.3) **WM**	0.211		
				(5.4) DNP	0.203							(5.4) DNP	0.203		
(6) SRM	**0.103**	**(6) SRM**	**0.104**	**(6) CRM**	**0.118**	**(6) CRM**	**0.114**	**(6) SRM**	**0.103**	**(6) CSM**	**0.098**	**(6) CRM**	**0.119**	**(6) MFM**	**0.100**
(6.1) **SS**	0.371	(6.1) **SS**	0.386	(6.1) **SM**	0.503	(6.1) **SM**	0.542	(6.1) **SS**	0.372	(6.1) **QC**	0.651	(6.1) **SM**	0.501	(6.1) **QC**	0.266
(6.2) SSD	0.333	(6.2) SSD	0.319	(6.2) CC	0.497	(6.2) CC	0.458	(6.2) SSD	0.333	(6.2) IEC	0.349	(6.2) CC	0.499	(6.2) PPC	0.196
(6.3) PM	0.296	(6.3) PM	0.296					(6.3) PM	0.296					(6.3) MFS	0.165
														(6.4) OTM	0.132
														(6.5) SSD	0.123
														(6.6) INM	0.118
(7) CRM	**0.145**	**(7) CRM**	**0.085**	**(7) RM**	**0.080**	**(7) SRM**	**0.084**	**(7) CRM**	**0.090**	**(7) RM**	**0.082**	**(7) RM**	**0.078**	**(7) RM**	**0.098**
(7.1) SM	0.541	(7.1) SM	0.565	(7.1) **DTP**	0.577	(7.1) SS	0.384	(7.1) SM	0.553	(7.1) **DTP**	0.573	(7.1) **DTP**	0.577	(7.1) **DTP**	0.551
(7.2) CC	0.459	(7.2) CC	0.435	(7.2) DRM	0.423	(7.2) SSD	0.326	(7.2) CC	0.447	(7.2) DRM	0.427	(7.2) DRM	0.423	(7.2) DRM	0.449
						(7.3) PM	0.289								
(8) RM	**0.086**	**(8) RM**	**0.082**	**(8) SRM**	**0.077**	**(8) RM**	**0.077**	**(8) RM**	**0.083**	**(8) CRM**	**0.081**	**(8) SRM**	**0.077**	**(8) SRM**	**0.062**
(8.1) **DTP**	0.576	(8.1) **DTP**	0.555	(8.1) SS	0.381	(8.1) **DTP**	0.551	(8.1) **DTP**	0.578	(8.1) SM	0.553	(8.1) SS	0.381	(8.1) SS	0.385
(8.2) DRM	0.424	(8.2) DRM	0.445	(8.2) SSD	0.323	(8.2) DRM	0.449	(8.2) DRM	0.422	(8.2) CC	0.447	(8.2) SSD	0.323	(8.2) SSD	0.323
				(8.3) PM	0.296							(8.3) PM	0.296	(8.3) PM	0.292

Table D.3 Relative importance weights of required knowledge for eight SCM processes for the second-tier suppliers group

Relative importance weights (priority rank) of required knowledge for eight SCM processes															
KS (0.497)								KT (0.503)							
	F2S (0.252)		S2F (0.200)		F2C (0.151)		C2F (0.397)		F2S (0.257)		S2F (0.205)		F2C (0.178)		C2F (0.360)
(1) MFM	0.175	(1) MFM	0.166	(1) PDC	0.178	(1) PDC	0.186	(1) MFM	0.175	(1) MFM	0.182	(1) PDC	0.180	(1) PDC	0.188
(1.1) QC	0.305	(1.1) QC	0.305	(1.1) PDD	0.317	(1.1) PDD	0.317	(1.1) QC	0.305	(1.1) QC	0.305	(1.1) PDD	0.317	(1.1) PDD	0.317
(1.2) PPC	0.192	(1.2) PPC	0.192	(1.2) SSD	0.268	(1.2) SSD	0.268	(1.2) PPC	0.192	(1.2) PPC	0.192	(1.2) SSD	0.268	(1.2) SSD	0.268
(1.3) MFS	0.151	(1.3) MFS	0.151	(1.3) SM	0.237	(1.3) SM	0.237	(1.3) MFS	0.151	(1.3) MFS	0.151	(1.3) SM	0.237	(1.3) SM	0.237
(1.4) SSD	0.121	(1.4) SSD	0.121	(1.4) PKD	0.178	(1.4) PKD	0.178	(1.4) SSD	0.121	(1.4) SSD	0.121	(1.4) PKD	0.178	(1.4) PKD	0.178
(1.5) OTM	0.119	(1.5) OTM	0.119					(1.5) OTM	0.119	(1.5) OTM	0.119				
(1.6) IINM	0.111	(1.6) IINM	0.111					(1.6) INM	0.111	(1.6) INM	0.111				
(2) PDC	0.171	(2) PDC	0.160	(2) MFM	0.149	(2) DM	0.148	(2) PDC	0.171	(2) PDC	0.165	(2) MFM	0.147	(2) DM	0.148
(2.1) SM	0.237	(2.1) PDD	0.317	(2.1) QC	0.305	(2.1) PPC	0.243	(2.1) PDD	0.317	(2.1) PDD	0.317	(2.1) QC	0.305	(2.1) PPC	0.243
(2.2) SSD	0.268	(2.2) SSD	0.268	(2.2) PPC	0.192	(2.2) DF	0.210	(2.2) SSD	0.268	(2.2) SSD	0.268	(2.2) PPC	0.192	(2.2) DF	0.210
(2.3) PDD	0.317	(2.3) SM	0.237	(2.3) MFS	0.151	(2.3) CP	0.200	(2.3) SM	0.237	(2.3) SM	0.237	(2.3) MFS	0.151	(2.3) CP	0.200
(2.4) PKD	0.178	(2.4) PKD	0.178	(2.4) SSD	0.121	(2.4) INM	0.181	(2.4) PKD	0.178	(2.4) PKD	0.178	(2.4) SSD	0.121	(2.4) INM	0.181
				(2.5) OTM	0.119	(2.5) MFS	0.167					(2.5) OTM	0.119	(2.5) MFS	0.167
				(2.6) INM	0.111							(2.6) INM	0.111		
(3) OF	0.133	(3) DM	0.132	(3) DM	0.145	(3) MFM	0.146	(3) OF	0.135	(3) DM	0.135	(3) DM	0.145	(3) MFM	0.147
(3.1) WM	0.305	(3.1) PPC	0.243	(3.1) PPC	0.243	(3.1) QC	0.305	(3.1) WM	0.305	(3.1) PPC	0.243	(3.1) PPC	0.243	(3.1) QC	0.305
(3.2) INM	0.288	(3.2) DF	0.210	(3.2) DF	0.210	(3.2) PPC	0.192	(3.2) INM	0.288	(3.2) DF	0.210	(3.2) DF	0.210	(3.2) PPC	0.192
(3.3) DTP	0.252	(3.3) CP	0.200	(3.3) CP	0.200	(3.3) MFS	0.151	(3.3) DTP	0.252	(3.3) CP	0.200	(3.3) CP	0.200	(3.3) MFS	0.151
(3.4) DNP	0.155	(3.4) INM	0.181	(3.4) INM	0.181	(3.4) SSD	0.121	(3.4) DNP	0.155	(3.4) INM	0.181	(3.4) INM	0.181	(3.4) SSD	0.121
		(3.5) MFS	0.167	(3.5) MFS	0.167	(3.5) OTM	0.119			(3.5) MFS	0.167	(3.5) MFS	0.167	(3.5) OTM	0.119
						(3.6) INM	0.111							(3.6) INM	0.111
(4) CSM	0.124	(4) CSM	0.130	(4) CSM	0.141	(4) CSM	0.145	(4) CSM	0.124	(4) CSM	0.126	(4) CSM	0.143	(4) CSM	0.144
(4.1) QC	0.617	(4.1) QC	0.617	(4.1) QC	0.617	(4.1) QC	0.617	(4.1) QC	0.617	(4.1) QC	0.617	(4.1) QC	0.617	(4.1) QC	0.617
(4.2) IEC	0.383	(4.2) IEC	0.383	(4.2) IEC	0.383	(4.2) IEC	0.383	(4.2) IEC	0.383	(4.2) IEC	0.383	(4.2) IEC	0.383	(4.2) IEC	0.383
(5) DM	0.124	(5) OF	0.126	(5) CRM	0.114	(5) CRM	0.119	(5) DM	0.123	(5) OF	0.115	(5) CRM	0.114	(5) CRM	0.119
(5.1) PPC	0.243	(5.1) WM	0.305	(5.1) SM	0.613	(5.1) SM	0.613	(5.1) PPC	0.243	(5.1) WM	0.305	(5.1) SM	0.613	(5.1) SM	0.613
(5.2) DF	0.210	(5.2) INM	0.288	(5.2) CC	0.387	(5.2) CC	0.387	(5.2) DF	0.210	(5.2) INM	0.288	(5.2) CC	0.387	(5.2) CC	0.387
(5.3) CP	0.200	(5.3) DTP	0.252					(5.3) CP	0.200	(5.3) DTP	0.252				
(5.4) INM	0.181	(5.4) DNP	0.155					(5.4) INM	0.181	(5.4) DNP	0.155				
(5.5) MFS	0.167							(5.5) MFS	0.167						
(6) SRM	0.110	(6) CRM	0.112	(6) OF	0.111	(6) OF	0.104	(6) SRM	0.110	(6) CRM	0.106	(6) OF	0.111	(6) OF	0.104
(6.1) PM	0.366	(6.1) SM	0.613	(6.1) WM	0.305	(6.1) WM	0.305	(6.1) PM	0.366	(6.1) SM	0.613	(6.1) WM	0.305	(6.1) WM	0.305
(6.2) SS	0.330	(6.2) CC	0.387	(6.2) INM	0.288	(6.2) INM	0.288	(6.2) SS	0.330	(6.2) CC	0.387	(6.2) INM	0.288	(6.2) INM	0.288
(6.3) SSD	0.304			(6.3) DTP	0.252	(6.3) DTP	0.252	(6.3) SSD	0.304			(6.3) DTP	0.252	(6.3) DTP	0.252
				(6.4) DNP	0.155	(6.4) DNP	0.155					(6.4) DNP	0.155	(6.4) DNP	0.155
(7) CRM	0.093	(7) SRM	0.091	(7) SRM	0.091	(7) SRM	0.083	(7) CRM	0.093	(7) SRM	0.085	(7) SRM	0.091	(7) SRM	0.083
(7.1) SM	0.613	(7.1) PM	0.366	(7.1) PM	0.366	(7.1) PM	0.366	(7.1) CC	0.613	(7.1) PM	0.366	(7.1) PM	0.366	(7.1) PM	0.366
(7.2) CC	0.387	(7.2) SS	0.330	(7.2) SS	0.330	(7.2) SS	0.330	(7.2) SM	0.387	(7.2) SS	0.330	(7.2) SS	0.330	(7.2) SS	0.330
		(7.3) SSD	0.304	(7.3) SSD	0.304	(7.3) SSD	0.304			(7.3) SSD	0.304	(7.3) SSD	0.304	(7.3) SSD	0.304
(8) RM	0.068	(8) RM	0.083	(8) RM	0.070	(8) RM	0.068	(8) RM	0.068	(8) RM	0.085	(8) RM	0.069	(8) RM	0.067
(8.1) DTP	0.601	(8.1) DTP	0.601	(8.1) DTP	0.601	(8.1) DTP	0.601	(8.1) DTP	0.601	(8.1) DTP	0.601	(8.1) DTP	0.601	(8.1) DTP	0.601
(8.2) DRM	0.399	(8.2) DRM	0.399	(8.2) DRM	0.399	(8.2) DRM	0.399	(8.2) DRM	0.399	(8.2) DRM	0.399	(8.2) DRM	0.399	(8.2) DRM	0.399

VITA

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