Doctoral Dissertation

Supply Chain – Quality Management and Sustainability Performance: Empirical Evidence in Vietnam

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List of Abbreviations

QM: Quality management

SCM: Supply chain management

SCQM: Supply chain quality management

SP: Sustainability performance

TOPQ: Top management support for QM

TRAIN: Training on quality

DEGN: Product/service design

QDAT: Quality data and reporting

PCMT: Process management

CONTI: Continuous improvement

PROB: Problem solving

REW: Rewards

TOPS: Top management support for SCM

INFS: Information sharing

INFT: Information technology

PCINT: Process integration

SUPRE: Supplier relationship

CUSRE: Customer relationship.

CHAPTER 1: INTRODUCTION

1.1. Research motivation and objectives

According to statistics from World Bank (2016), during the last 50 years, the world population increased by more than a double. Demand for foods and other goods, as a result, has increased significantly. This has led to expanded production and excessive use of natural resources. People are enjoying higher quality of life with rapid economic growth, but they must also cope with serious environmental degradation (in terms of pollution, global warming, etc..) and social problems (such as diseases or inequality). This fact raises a globally universal call for actions towards "sustainable development", a movement that poses daunting challenges.

Sustainable development is an accelerating trend concerned with the entire humankind. Economic activities have significant influence on the global sustainable development. On the one side, they obviously facilitate the economic development, create wealth and increase living standard for the society. On the other side, they widen the gap between the rich and the poor. According to Human Development Report in 2016 from United Nations Development Program, Inequality-adjusted Income Index in Very high human development group is 0.723 whereas this feature for Low human development group is 0.377. The world average Gini coefficient 2010-2015 which measure the deviation of the distribution of income among individuals or households within a country from a perfectly equal distribution (a value of 0 represents absolute equality, a value of 100 absolute inequality), is 39.1 (United Nations Development Programme, 2016). These features illustrate a relatively large gap in income between the rich and the poor in the world. Additionally, economic activities are one of the main sources of environmental problems. Statistics on the air pollution by industries and household in the European Union show that household activities contributed 9% of total emissions of acidifying gases and 25% of total emissions of ozone precursors. The rest was attributed to economic activities such as manufacturing, transportation & storage, agriculture, forestry & fishing, mining & quarrying, electricity, gas, steam and air conditioning supply, other services, water supply & construction (Eurostat, 2016). It can be seen that the status of sustainable development is strongly affected by economic activities. In other words, sustainable development depends on attitudes and operational practices of enterprises towards sustainable development.

At the organizational level, sustainable development is described by the Triple Bottom Line framework with three aspects – social, environmental, and financial. Profitability is still the priority of most organizations. To increase financial benefits, many organizations sacrificed the environment aspects. Awareness of "sustainable development" motivated them to effectively balance among the three aspects – Finance, Environment, and Society. To do so, enterprises should implement "Sustainability management", which is defined as "accelerating the adoption of best management principles, models, and practices throughout the operations system, and enabling the environment to achieve sustainable development" (Kuei & Lu, 2013). Quality management and supply chain management, in this sense, are feasible approaches contributing to sustainability performance. Along with this, the question on *how enterprises' implementation of quality management practices and supply chain management practices affect sustainability performance*, therefore, is of great importance not only to practitioners, but also to policy makers and academic researchers.

Many previous studies examined the impact of quality management practices and supply chain management practices on a variety dimensions of performance such as operational performance (Miguel and Brito, 2011; Koh et al., 2007, Konecny and Thun, 2011; Salaheldin, 2009; Macinati, 2008), financial performance (Wang et al., 2012; Koc, 2011; Fuentes et al., 2006; Kaynak, 2003), production performance (Agus and Hassan, 2011), innovation performance (Hung et al., 2011; Sadikoglu and Zehir, 2010), quality performance (Zehir et al., 2012; Baird et al., 2011; Arauz et al., 2009; Zu, 2009; Zu et al., 2008; Kaynak, 2003), inventory performance (Baird et al., 2011; Kaynak, 2003), organizational performance (Khan, 2011), and business performance (Miyagawa and Yoshida, 2010). These performance dimensions are studied with the main purpose to increase profits regardless social or environmental protection.

Some scholars made efforts to conceptualize the link between quality management principles, supply chain management practices with sustainability performance. Isaksson (2006) highlighted possible synergies between total quality management (TQM) and sustainable development. Kuei and Lu (2013) developed conceptual frameworks that are derived from quality management principles and used them as the building block on how sustainability management system can be implemented. Seuring and Muller (2008) outlined the results of a literature review on the field of sustainability and supply chain management as well as provided a conceptual framework capturing related research. Carter & Rogers (2008) demonstrated the relationships among environmental, social and economic performance within a supply chain management context; and proposed a framework of sustainable supply chain management. Ashby et al. (2012) focused on environmental and social sustainability within supply chains and found out this integration is significant. These studies mainly stopped at the conceptual level. There is a lack of empirical study on the linkage between the best practices and sustainability performance.

Regarding research context, the industrial development is moving to developing countries, academic studies also switch to and pay attention more to developing countries. Vietnam is not an exception especially when many multinational companies have been establishing plants or offices in Vietnam such as Toyota, Coca-cola, Unilever, and so on. In Vietnam, the awareness of "sustainability" has been increasingly widespread in recent decade. By 2012, The Vietnamese Government has approved the Sustainable Development Strategy for the period 2011 – 2020 with targets "Sustainable and efficient growth coupled with progress, social justice, protection of natural resources and the environment, maintaining social and political stability, firmly protecting the independence, sovereignty, unity and territorial integrity of the country"

(Decision No. 432/QD-TTg). Those strategies and action plans, from a policy perspective, are visible evidences for a progress towards sustainability in Vietnam. From a practical side, the Vietnam Business Council for Sustainable Development was established under the approval by the government in 2010. This is a business-led organization with the mission to promote the business community for the implementation of the Strategic Orientation for Sustainable Development in Vietnam. From an academic perspective, sustainability is a concerned topic in some studies but mainly in the field of agriculture such as shrimp aquaculture (Lebel et al., 2002), peri-urban vegetable production (Jansen et al., 1996), biosphere reverse (Nguyen and Bosch, 2012), swidden agroecosystem (Dung et al., 2008). Studies related to sustainability in the industrial sector are relatively limited. Lin et al. (2013) examined how market demand affects green product innovation, and firm performance in Vietnamese motorcycle industry. Tencati et al. (2010) took Vietnam as a case study to investigate the impact that more sustainable sourcing policies by multinational companies are having on the suppliers located in developing countries such as Vietnam. There is almost no academic study examining quality management, supply chain management in the relationship towards sustainability performance.

Following the research stream switching to developing countries as well as to enrich literature review in the field of supply chain and quality management in developing countries, research context selected for my study is enterprises in Vietnam. As such, an empirical study on the influence of quality management practices and supply chain management practices on three aspects of sustainability performance is necessary for better understanding about supply chain – quality management towards sustainability performance in Vietnam in particular, and in the context of developing countries in general.

With dissertation entitled "Supply chain – quality management and sustainability performance: Empirical evidence in Vietnam", this study aims to empirically study:

(1) The impact of quality management practices on sustainability performance;

(2) The impact of supply chain management practices on sustainability performance;

(3) The underlying relationship between supply chain management practices and quality management practices in the impact on sustainability performance

1.2. Research methodology

This study adopted the empirical research method which has known as an useful approach to address the gap between operations management theory and practices (Flynn et al., 1990). First of all, after extensive literature review in the fields of Quality management (QM), Supply chain management (SCM) and Sustainability performance (SP), an overall research framework to address the research gaps is proposed. A survey questionnaire is developed and utilized to collected data in Vietnamese companies. The questionnaire is designed to measure the management's opinions about the implementation of Quality management practices (QM practices), Supply chain management practices (SCM practices) and Sustainability performance (SP) of the organization. Data were collected from a sample of cross-sectional enterprises in Vietnam in 2016 and 2017. Data collected were input, screening, and analyzed using SPSS 22.0 software.

1.3. Delimitations and limitations

- Delimitations: This study confined itself to studying about quality management, supply chain management and sustainability performance in the context of Vietnam.

- Limitations: Limitations of this study are gathering data via self-reported method from cross-sectional enterprises in Vietnam. Therefore, the study still somehow reflects subjective biases.

1.4. Organization of the dissertation

The dissertation is divided into eight chapters:

- Chapter 1 - Introduction: This chapter provides brief information on research motivation, objectives and methodologies.

- Chapter 2 - Literature review: This chapter reviews literature on Quality management, Supply chain management, and Sustainability performance.

- Chapter 3 - Research design and measurement analysis: This chapter provides research methodology from proposing research framework to fill research gaps to collecting and analyzing data methods. Besides, this chapter provides measurement analysis results of this study.

- Chapter 4 - The impact of Quality management practices on Sustainability performance: This chapter provide the empirical evidence on how quality management practices impact of on sustainability performance and moderating effect of QM experience time, type of industry, and firm size on the relationship between QM practices and SP.

- Chapter 5 – The impact of Supply chain management practices on Sustainability performance: This chapter provides the empirical evidence on how supply chain management practices impact of on sustainability performance and moderating effect of type of industry and firm size on the relationship between SCM practices and SP.

- Chapter 6 - The underlying mechanism of supply chain – quality management in relationship with sustainability performance: This chapter provides the empirical evidence on how quality management practices mediate the impact of supply chain management practices on sustainability performance, how supply chain management practices mediate the impact of quality management practices on sustainability performance, and how simultaneous implementation of quality management practices and supply chain management practices would generate synergy effects on sustainability performance.

- Chapter 7 – Overall implications: This chapter provides theoretical and managerial implications.

- Chapter 8 – Conclusions: This chapter provides summary of this research findings, limitations and suggestion for future research.

CHAPTER 2: LITERATURE REVIEW

This chapter reviews the literature on Quality management, Supply chain management, Supply chain quality management, and Sustainability performance. Then, research gaps are identified, and research objectives to address the research gaps are figured out.

2.1. Quality management

2.1.1. Historical background of quality management

Operations research has experienced growing studies on theories and applications of quality management regardless of industry, culture, or region. Quality management in the early 1900s primarily meant inspection to ensure quality product. In the 1930s, statistical analysis and control of quality were developed by Walter Shewhart. Around the 1950s, some quality gurus made huge contributions to quality management method diffusion. W. Edwards Deming taught managing quality through statistical techniques to control quality and reduce inspection to Japanese people (Schroeder et al. 2013). Joseph M. Juran introduced the concepts of controlling quality and managerial breakthrough. Phillip B. Crosby promoted zero defects for quality improvement. From the 1960s, quality management has been viewed from a broader perspective as "*companywide quality control*" (ASQ), "*an integrated approach to achieving and sustaining high quality output*" which involves *"all levels and all functions of the organization"* (B.B. Flynn, Schroeder, & Sakakibara, 1994). As such, quality management is made up by a set a companywide quality management practices and techniques (Dean and Bowen 1994; Yeung, Cheng, & Kee-hung, 2005; Molina, Llorens-Montes, & Ruiz-Moreno, 2007) with the purpose to deliver high quality products to customers.

Quality itself has been a multidimensional concept over the years (Ebrahimi & Sadeghi, 2013). For a general organization, quality has been defined as "conformance to requirements" (Crosby, 1979), "fitness for use" (Juran, 1986), or "meeting, or exceeding, customer requirements now and in the future" (Schroeder et al., 2013). In the manufacturing context, product quality can be understood based on eight dimensions namely performance, features, reliability, conformance, durability, serviceability, aesthetics, and perceived quality (Garvin 1984, 1987). More recently, it was defined by four dimensions including quality of design, quality of conformance, the abilities, and field service (Schroeder et al., 2013).

To support and encourage the quality improvement from an international perspective, International Organization for Standardization (ISO) has been established in 1987 including members from 163 countries. The organization provides ISO 9000 as a family of quality management standards and guidelines for organizations to ensure their product and service quality. ISO 9001 (2015) based on seven quality management principles: customer focus, leadership, engagement of people, process approach, improvement, evidence-based decision making, and relationship management. The framework of ISO 9001 (2015) standards follows the PDCA (Plan – Do – Check – Act) cycle (See Figure 2-1).

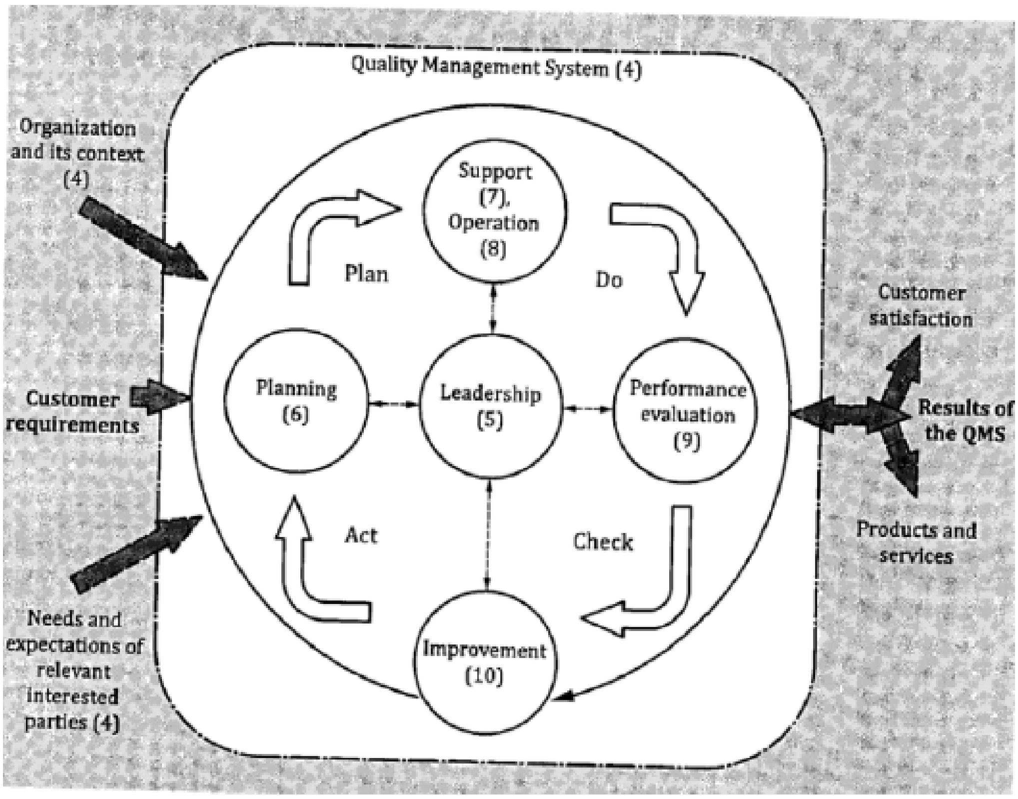

Figure 2-1: Framework of ISO 9001:2015 standards

(Source: Quality management system – Requirements ISO 9001:2015)

Later on, several national quality awards have been established with clear criteria to promote better quality management practices such as Malcolm Baldrige Award in US (1988), HKMA Quality Award in Hong Kong (1991), European Quality Award (1992), New Zealand Business Excellence Award (1993), Japan Quality Award (1996), Egyptian Quality Award (1998) (Flynn & Saladin, 2006).

Table 2-1: **National quality award criteria**

Award	Criteria
Malcolm Baldrige Award	Leadership; Strategic planning; Customer and market focus; Information and analysis; Human resource focus; Process management; Business results
HKMA Quality Award	Leadership; Strategic planning Customer and market focus; Information and analysis; Human resource focus; Process management; Business results
European Quality Award	Leadership; Policy and strategy; Partnership and resources; People management Process; People results; Customer results Society results; Key performance results
New Zealand Business Excellence Award	Leadership; Strategic planning; Customer and market focus; Measurement, analysis and knowledge management; Human resource focus; Process management; Business results
Japan Quality Award	Management vision and leadership; Strategic planning and development; Understanding customer and market and action taken; Information sharing and utilization; Human resource development and learning environment; Process management; Results of enterprise activities; Customer satisfaction
Egyptian Quality Award	Leadership; Planning; Customer and market focus; Information and analysis; Human resources; Process management; Business results

Source: Flynn & Saladin (2006).

Regarding academic research, one of the main research orientations in this theme is to develop and validate models and measures of quality management in various operational settings (Yeung et al., 2005):

Saraph, Benson, & Schroeder (1989) made a pioneering work to identify and confirm the reliability and validity of eight critical factors of quality management, namely (1) The role of management leadership and quality policy, (2) Role of the quality department, (3) Training, (4) Product/service design, (5) Supplier quality management, (6) Process management, (7) Quality data and reporting, and (8) Employee relations.

Flynn et al. (1994) validated seven key dimensions of quality management, including (1) Top management support, (2) Quality information system, (3) process management, (4) product design, (5) workforce management, (6) supplier involvement, and (7) customer involvement. Later on, *Flynn et al. (1995)* tested measurement instruments for quality management in the context of World Class Manufacturing. Eight key dimensions divided into Core Quality Management Practices are examined including Process flow management, Product design process, Statistical control and Feedback, and Quality Management Infrastructure Practices comprising Top management support, Workforce management, Work attitudes, Supplier relationship, and Customer relationship. This study also tested the impact of quality management practices on performance and competitive advantage and discussed in light of Garvin' eight dimensions of quality.

Anderson, Rungtusanatham, Schroeder, & Devaraj (1995), based on 14 Points of Deming, conducted a thorough analysis on the Deming Management Method and identified 7 underlying dimensions of quality management including 1-Visionary leadership, 2- Internal and external cooperation, 3-Learning, 4-Process management, 5-Continuous improvement, 6-Employee fulfillment, and 7-Customer satisfaction.

Those are pioneering and widely-adopted works in developing and validating measurement constructs for QM. After that, numerous studies have defined and measured quality management practices, and analyzed their implementation in enterprises (See more detailed in Table 2-2) in both developed countries such as *Japan* (Arauz, Matsuo, & Suzuki, 2009), *the U.S* (Kaynak, 2003; Parast, M.M., Adams, S.G., Jones, E.C., Rao, S.S. and Raghu-Nathan, 2006; Miyagawa & Yoshida, 2010), *Hong Kong* (Yeung et al., 2005), *Australia* (Baird et al., 2011; Gadenne & Sharma, 2009; Terziovski, Samson, & Dow, 1997), *New Zealand* (Terziovski et al., 1997), *Spain* (Martinez-Costa et al. 2008; Fuentes, Montes, & Fernández, 2006; Sánchez-Rodríguez & Martínez-Lorente, 2011; De Cerio, 2003), *Singapore* (Brah & Lim, 2006), *Italia*

(Rungtusanatham, Forza, Filippini, & Anderson, 1998); and developing countries such as *China* (Yeung et al., 2005; Wang, Chen, & Chen, 2012; Miyagawa & Yoshida, 2010), *South Korea and Taiwan* (Kull & Wacker, 2010), *Malaysia* (Agus & Hassan, 2011), *Turkey* (Zehir, Ertosun, Zehir, & Müceldilli, 2012; Sadikoglu & Zehir, 2010), *Thailand* (Vanichchinchai & Igel, 2011), *Mexico* (Parast, M.M., Adams, S.G., Jones, E.C., Rao, S.S. and Raghu-Nathan, 2006), *Ghana* (Appiah Fening, Pesakovic, & Amaria, 2008), *Tunisia* (Lakhal, Pasin, & Limam, 2006), *Vietnam* (Hoang, Igel, & Laosirihongthong, 2006; Nguyen & Robinson, 2015; Nguyen & Robinson, 2010).

Inherited from fundamental guidelines of quality gurus and findings of pioneers in the field of quality management, this study would like to focus on internal quality management and define quality management practices as companywide and cross-functional practices within the organization which emphasis on process management, product and service design for quality, quality-related problem solving and training, quality data and reporting, and continuous improvement. The study evaluates internal quality management practices based on eight constructs: 1-Top management support for quality management, 2- Training, 3- Product/service design, 4- Quality data and reporting, 5- Process management, 6- Continuous improvement, 7- Problem solving, 8- Rewards. These are widely accepted and adopted constructs for quality management practices from previous studies. The definition and supporting literature for each construct are shown in Table 3-1 (in Chapter 3).

2.1.2. Research on quality management and sustainability performance

There are several papers working on possible support of QM to sustainability performance. Kuei & Lu （2012) proposed a conceptual framework of quality-driven sustainability management systems by integrating quality management principles into sustainability management. The study also figured out implementation steps for cross-enterprise and functional units operations. Isaksson (2006) investigated possible synergies between total quality management (TQM) and sustainable development (SD) based on common values, methodologies and tools. Values of TQM: "focus on processes" and "systems perspective" and values of SD: "stakeholder focus", "accountability" and "sustainability" are discussed as values of the TQM-SD management system. Adopted process-based management methodology from TQM and GRI-guidelines for SD, a process model was proposed to describe the triple bottom line in which quality indicators were proposed to add to the economic dimension. Most of the papers regarding QM and three components of SP are conceptual studies to propose descriptive insight, model, proposition, framework, and ideas (Siva et al., 2016).

Instead, some further explorations on QM and SP usually concerned a single element of sustainable performance. Regarding economic aspect, there are empirical studies investigating the linkage between quality management practices and financial performance (Wang et al., 2012; Koc, 2011; Macinati, 2008; Fuentes et al., 2006; Kaynak, 2003), organizational performance (Muhammad Asif, 2011), and business performance (Miyagawa, M & Yoshida, 2010). Some studied examined QM and antecedent of economic performance such as operational performance (Konecny & Thun, 2011; Salaheldin, 2009; Macinati, 2008; Appiah Fening et al., 2008; Lakhal et al., 2006; Fuentes et al., 2006; Cua, McKone, & Schroeder, 2001; Barbara B Flynn, Schroeder, & Sakakibara, 1995), production performance (Agus & Hassan, 2011), and quality performance (Sadikoglu & Zehir, 2010; Baird et al., 2011; Arauz et al., 2009; Zu, 2009; Zu, Fredendall, & Douglas, 2008; Kaynak, 2003). Regarding environmental performance, empirical evidence shows that enterprises with QM implementation in accordance with ISO9001 intertwine with environmental management system ISO14001 obtain higher benefits than the others (To, Lee & Billy, 2012). Some studies found the contribution of quality management system to environmental performance (Wiengarten & Pagell, 2012; Zhu, Sarkis, & Lai, 2013; Bergenwall, Chen, & White, 2012; Yang et al., 2011). Regarding social performance, several empirical works examined the relationship of QM practices and some stakeholder-benefit aspects such as customer support and service (Phan, Abdallah, & Matsui, 2011), customer related performance (Agus & Hassan, 2011), customer satisfaction (Anderson et al., 1995; Rungtusanatham et al., 1998; Samson & Terziovski, 1999; Parast, M.M., Adams, S.G., Jones, E.C., Rao, S.S. and Raghu-Nathan, 2006; Gadenne & Sharma, 2009; Miyagawa, M & Yoshida, 2010; Wang et al., 2012), employee performance (Anderson et al., 1995; Rungtusanatham et al., 1998; Samson & Terziovski, 1999; Fuentes et al., 2006; Martinez-Costa et al., 2008; Sadikoglu and Zehir, 2010). These studies mainly considered employee and customer related performance, rather than community related performance.

Table 2-2: Summary of studies on quality management

No.	Author, Year	Purposes	Quality constructs	Performance constructs	Data collection and analysis	Main findings
1	Song and Su (2015)	To examine the relationship between quality management and new product development in China	• Core quality management practices: - Process management - Supplier management - Quality information analysis - Product design and manufacture • Infrastructure quality management practices: - Leadership - Quality strategy planning - Customer focus - Human resource management	- New product development capability -Design-manufacturing integration - Process innovation - Product innovation	- Questionnaire, collected 198 valid responses from Chinese companies - Path analysis	Core quality management practices have insignificant impact on New product development capability whereas Infrastructure quality management practices contribute to New product development capability. New product development capability supports the influence of quality management practices on new product development performance.
1	Konecny and Thun (2011)	To empirically analyze a conjoint implementation of TQM and TPM on plant performance to know whether they do separately or simultaneously	- Cross-functional product design - Customer focus - Supplier quality involvement - Process control management	Plant performance: - Time - Cost - Quality - Flexibility	- Questionnaire, collected from various countries, plants with > 100 employees, 238 valid responses - Multiple regression analysis and path analysis	TQM and TPM, with support of HRM, have potential contributions to plant performance. It is, however, not necessary to implement both systems at the same time to achieve superior performance due to scarce resource.
2	Salaheldin (2009)	To identify critical success factors TQM implementation as well as their impact on performance of SMEs	**Strategic factors** - Leadership - Organizational culture - Top management support - Continuous improvement - Benchmarking - Quality goals and policy	Primary measure: Operational performance Secondary measures: Organizational performance (financial measures,	- Questionnaire, data were collected in Qatari industrial sector, 139 feedbacks were returned and used in analysis - Path analysis	The results of this paper demonstrated a significant positive impact of TQM on operational and organizational performance, a statistical relationship between operational performance and organizational performance, and the

No.	Author, Year	Purposes	Quality constructs	Performance constructs	Data collection and analysis	Main findings
			Tactical factors - Team building and problem solving - Employee empowerment - Employee involvement - Employee training - Use of information technology - Supplier quality - Supplier relationships - Assessment of performance of suppliers **Operational factors** - Product and service design - Enterprise performance metrics for TQM - Process control - Customer orientation - Management of customer relationships - Resources value addition process - Realistic TQM implementation schedule - Customer and market knowledge - Resources conservation and utilization - Inspection and checking work	non-financial measures)		important role of strategic factor in TQM success in SMEs.
3	Martinez-Costa, Martinez-Lorente, and Choi (2008)	To simultaneously investigate the influence of TQM and ISO 9000 on performance and	- Leadership - Information - Process management - Design - HRM	**Internal results:** - Unit production costs - Fast delivery - Flexibility	- Questionnaire, Spanish industrial companies (over 100 employees), 713 valid returns	TQM and ISO 9000 have positive influence on performance improvement. Internal motivation is highly related to high performance while external motivation is not.

No.	Author, Year	Purposes	Quality constructs	Performance constructs	Data collection and analysis	Main findings
		motivation in Spanish companies	- Suppliers - Customers	- Cycle time **External results:** - Manufacturing quality - Design quality - Customer satisfaction - Market share - Employees' satisfaction	- Longitudinal study: t-test analysis	
4	Hoang et al., (2006)	To study the impact of total quality management on innovation in Vietnam	- Top management commitment - Employee involvement Employee empowerment - Education & training Teamwork - Customer focus - Process management - Information and analysis system - Strategic planning - Open organization - Service culture	Innovation performance	- Questionnaire, data were collected from 204 firms in Hochiminh City, Vietnam. - Path analysis	The study confirmed the previous result by considering TQM as a set of practices. The study demonstrates the positive contributions of some TQM practices to enhance firm innovation including process and strategic management, leadership and people management, and open organization.
5	Brah and Lim (2006)	To examine the impact of technology and TQM on the performance of logistics companies	- Top management leadership - Strategic planning - Process management - Information systems and analysis - Human resource management - Quality focus - Customer focus	- Operational performance - Quality performance - Technology performance	- Questionnaire, logistics companies in Singapore, 81 valid returns - Correlation analysis, t-test analysis	The results indicated significant relationship between quality management constructs and various performance including operational, quality, technology, and overall business. Besides, TQM firms and high-tech firms outperform non-TQM firms and low-tech firms.

No.	Author, Year	Purposes	Quality constructs	Performance constructs	Data collection and analysis	Main findings
6	Lakhal, Pasin, and Limam (2006)	To study quality management practices and their effects on performance	Infrastructure practices - Top management commitment and support - Organization for quality - Employee training - Employee participation - Supplier quality management - Customer focus - Continuous support Core practices - Quality system improvement - Information and analysis - Statistical quality techniques use	- Operational performance - Product quality - Financial performance	- Questionnaire, 133 valid returns from Tunisian plastic companies - Path analysis	The study illustrated general positive impact of both core and infrastructure quality management practices on organizational performance. Especially, the study figured out direct effect of core quality management practices on product quality performance and effect of infrastructure practices on operational performance.
7	Yeung et al., (2005)	To empirical study quality management in electronics industry	- Top Management Leadership - Communications and Cooperation - Learning and Teamwork - Employee Management System - Customer Focus - Supplier Management - Quality System Procedures - Work Information Sharing - Spread of Quality Responsibility - Process Control and Improvement	- Time-based efficiency - Cost-related efficiency - Customer satisfaction - Marketing performance - Financial performance	- Questionnaire – Data collected from 225 electronics firms in Hong Kong and China mainland – Path analysis	The study indicated that quality management system in the electronics industry comprising four modules – leadership, operational support systems, process management, and culture elements which generated chain effects on organizational performance. The study figured out that process management and customer focus are important elements in the electronics manufacturing.
8	Kaynak (2003)	To investigate the relationship between total quality management practices on firm performance	Adopt Saraph et al. (1989) - Management leadership - Role of the Quality department - Training - Employee relations	- Financial & Market performance - Quality performance	– Questionnaire, data were collected from 214 manufacturers in the US – Path analysis	This study supported, directly and indirectly, positive effects of quality management practices on various dimensions of enterprises' performance. Supplier quality management, product/service design,

No.	Author, Year	Purposes	Quality constructs	Performance constructs	Data collection and analysis	Main findings
			- Quality data and reporting - Supplier quality management - Product/service design - Process management	- Inventory Management performance		and process management have direct impact on operating performance. Management leadership, training, employee relations, and quality data and reporting have indirect effect on firms' performance.
9	De Cerio (2003)	To empirically test the linkage between quality management practices and operational performance in Spanish industry	- Design and new products development - Processes - Suppliers - Customers - Human Resources	Operational performance	- Questionnaires, 965 manufacturing plants in Spain - Multiple regression analysis	The results demonstrated that the relationship between quality management practices and performance (cost, quality, and flexibility) is significant. Quality management practices related to the human resource play an important role affecting operational performance.
10	Cua et al. (2001)	To study the relationship between TQM, JIT, and TPM and manufacturing performance	- Cross-functional product design - Process management - Supplier quality management - Customer involvement	- Quality - Cost - Delivery - Flexibility	- Questionnaire, data were collected from 163 manufacturing plants in the US, UK, Italy, Germany, and Japan – Multiple discriminant analysis	This study demonstrated the importance of implementing practices belonging to JIT, TQM, and TPM programs which better create positive impact on performance.
11	Samson and Terziovski (1999)	To empirically test the relationship between total quality management practices and operational performance	- Leadership - People management - Customer focus - Strategic planning - Information and analysis - Process management	- Product quality - Customer satisfaction - Employee morale - Productivity - Delivery performance	- Questionnaire, data were collected from 1024 manufacturing sites in Australia and New Zealand – Multiple regression analysis	The study indicated the significant and positive impact of soft quality management practices including leadership, customer focus and human resource management on performance.
12	Flynn et al., (1995)	To study the impact of quality management	- Top Management Support - Customer Relationship	- Operating performance:	– Questionnaires, data were collected from	The results indicated positive effects of statistical control/feedback and product

No.	Author, Year	Purposes	Quality constructs	Performance constructs	Data collection and analysis	Main findings
		practices on operating performance and competitive advantage	- Supplier Relationship - Workforce Management - Work Attitudes - Product Design Process - Process Flow Management - Statistical Control/Feedback	(1) Quality market outcomes, (2) Percent-passed final inspection with no rework, - Competitive advantage	42 manufacturing plants in the US – Path analysis	design process on perceived quality market outcomes. In addition, perceived quality market outcomes and percent pass final inspection without rework have significant impact on competitive advantage.
13	Anderson et al. (1995)	To empirically study a path analytic model of quality management under the Deming Management Method	- Visionary Leadership - Internal and External Cooperation - Learning - Process Management - Continuous Improvement - Employee Fulfillment	- Learning - Process Management - Continuous Improvement - Employee Fulfillment - Customer Satisfaction	- Questionnaire, data were collected from 41 manufacturing plants in the US. - Path analysis	The results showed significant influence of employee fulfilment on customer satisfaction while no statistical relationship between continuous improvement and customer satisfaction.

2.2. Supply chain management

2.2.1. Historical background of supply chain management

The concept of "supply chain management" is coined by Oliver and Webber in 1982 (Ullrich, 2014; Carter, Rogers, & Choi, 2015). Before that supply chain management was more likely understood as practices to manage logistics and physical distribution activities (Habib, 2011). After being introduced, the term "supply chain management" has been widespread and attracted increasing interest from both academicians and practitioners (Cooper et al., 1997; Mentzer et al., 2001). There have been numerous studies working on supply chain and supply chain management (Burgess, Singh, & Koroglu, 2006; Ullrich, 2014).

Despite the diffusion of the supply chain and supply chain management concepts, understanding about them still reveals considerable confusion (Mentzer et al., 2001) due to broad and distracting definitions from the literature (Ullrich, 2014). One approach to define supply chain is based on the vertical integration from upstream SC to downstream SC. A **supply chain** has been defined as "the alignment of firms that bring products or services to market" (Lambert et al., 1998), "a network of organizations that are involved, through upstream (suppliers) and downstream (distributions) linkages, in the different processes and activities that produce value in the form of products and services delivered to the ultimate consumers" (Christopher, 1992; Mentzer et al., 2001). This network entirely manages information flow, material flow and cash flow of business (Chen et al., 2004). In accordance with this point of view, **supply chain management** would be defined as "an integrative philosophy to manage the total flow of a distribution channel from supplier to the ultimate user" (Cooper et al., 1997), "supply chain management deals with the total flow of materials from suppliers through end users…" (Jones and Riley, 1985).

From a more horizontal approach, **supply chain** is defined as "the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain" (Mentzer et al., 2001). Another recent widely-accepted definition of SC by Chopra and Meindl (2012) is that "A supply chain consists of all parties involved, directly or indirectly, in fulfilling a customer request". From this definition, Stadtler (2005) (Ullrich, 2014) views supply chain comprising of two aspects: the inter-organizational aspect and the intra-organizational aspect. Consistent with the inter-organizational aspect, Simchi-Levi et al. (2003) provided definition of **supply chain management** as "a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses, and stores, so that merchandise is produced and distributed in the right quantities, to the right locations, and at the right time, in order to minimize system-wide costs while satisfying service level requirements". Consistent with the intra-organizational aspect, Heizer and Render (2011) defined supply chain management as "the integration of the activities that procure materials and services, transform them into intermediate goods and final products, and deliver them to customers".

Once the concept of SC and SCM has been increasingly aware, there is a call for theory building in SCM. One of the theoretical perspectives in the literature supporting for the positive linkage between SCM and performance is the resource-based view (Carr and Smeltzer, 1999; Sadler and Hines, 2002; Miguel & Brito, 2011). The original approach of resource-based view focuses on internal resources of a firm and how an individual firm can achieve competitive advantage from resources, assets and capabilities within the firm (Dyer and Singh, 1998). Dyer & Singh (1998) proposed a relational view which argues that more interfirm linkages are a source of a supernormal profit. The relational view is considered as a supplement to the resource-based view.

Contribute to theory development of SCM, several scholars proposed and validated framework and measurement constructs of SCM (Chen & Paulraj, 2004; Min & Mentzer, 2004; Li, Ragu-Nathan, Ragu-Nathan, & Subba Rao, 2006).

Chen & Paulraj (2004) synthesized over 400 articles to analyze and refine the measurements in the literature. Moreover, the study developed measurement framework and instruments of supply chain management. The measurement constructs, then, were empirically tested and validated. The measurement constructs include environmental uncertainty (supplier uncertainty, manufacturing uncertainty, and customer uncertainty); driving force for SCM (customer focus, top management support, supply strategy, and information technology); supply chain measurements (supply network structure, supply based reduction, long-term relationship, communication, cross-functional teams, supplier involvement, and logistics); and supply chain performance (supplier operational performance, buyer operational performance and buyer financial performance).

Min and Mentzer (2004) proposed a framework and measurement constructs of supply chain orientation (SCO) and SCM. SCO scale includes: Credibility, Benevolence, Commitment, Cooperative Norms, Compatibility, and Top management support. SCM scale includes: Agreement on vision and goals, Information sharing, Risk and reward sharing, Cooperation, Process integration, Long-term relationship, and Agreement on SC leadership. The measurement constructs are empirically tested to confirm unidimensionality, construct validity, and reliability.

Li et al. (2005) developed six measurement constructs of SCM practices including Customer relationship, Strategic supplier partnership, Information sharing, Information quality, Internal lean practices, and Postponement. The measurement constructs are empirically tested and validated to confirm content validity, unidimensionality, reliability, convergent validity, discriminant validity, and predictive validity.

Inherited from the literature, in my study, measurement of SCM practices comprises six constructs:

- Top management support for SCM
- Information sharing
- Information technology
- Process integration
- Strategic supplier relationship
- Customer relationship

These measurement constructs are widely accepted and adopted constructs for supply chain management practices from previous studies. The definition and supporting literature for each construct are shown in Table 3-2 (in Chapter 3).

2.2.2. Research on supply chain management and sustainability performance

The concept of SCM has attracted the attention from academicians and business managers. Many organizations have started recognizing SCM as one of the main factors to create a sustainable competitive (Li et al., 2005). Many studies worked on sustainable SCM-related topics such as green purchasing (Handfield et al., 2002; Leire and Mont, 2010; Pagell et al., 2010), green supply chain management (Sarkis, 2003; Holt and Ghobadian, 2009; Zhu and Sarkis, 2006, 2007; Zhu et al., 2008; Srivastava, 2007), sustainable supply chain management (Svensson, 2007; Seuring and Muller, 2008; Wittstruck and Teuteberg, 2011; Seuring, 2013; Pagell and Wu, 2009), or environmental supply chain management (Hall, 2000; Hagelaar and Van der Vorst, 2002).

Some studies contributed to the theoretical development of SCM towards sustainability by conceptualizing and providing implementation framework. Carter & Rogers (2008) demonstrated the relationships among environmental, social and economic performance within a supply chain management context; and proposed a framework for sustainable supply chain management. Seuring & Muller (2008) outlined the results of a literature review in the field of sustainability and supply chain management as well as provided a conceptual framework capturing related research. Ageron, Gunasekaran, & Spalanzani (2012) focused on upstream SC and developed a framework of sustainable supply management (SSM) which covers from reasons for SSM, performance criteria for SSM, barriers and benefits of SSM, characteristics of suppliers, and managerial approaches for SSM.

Several studies investigated the linkage between SCM and sustainability performance or possibility to achieve sustainability performance in the SCM context. Some studies adopted case study or field study as a research methodology. For example, Pagell & Wu (2009) based on case studies from 10 firms to propose a model which consists of essential elements to achieve sustainable supply chain. The model suggests integrating Design/Innovation capability with Managerial orientation toward sustainability, in a combination with new behaviors to Re-conceptualize who is in the supply chain and Focus on supply base continuity to achieve sustainability outcomes. Grimm, Hofstetter, & Sarkis (2014) collected data from two supply chain of the food industry and proposed fourteen critical factors toward sustainable food supply chain. They are focal firm related factors, relationship related factors, supply chain partner related factors, and context related factors.

Besides the case study methodology, some studies collected data by larger scale questionnaire surveys to empirically test the relationship between supply chain management practices and sustainability performance. Zhu & Sarkis (2004) and Zhu, Sarkis, & Geng (2005) empirically examined the relationship between green SCM practices and sustainability performance in terms of environmental and economic aspects. Vachon & Mao (2008) investigated the linkage between SC strength and environmental and social performance. More studies considered economic and customer related performance (Bernardes, 2010; Min et al., 2007; Hult, Ketchen Jr., Adams, & Mena, 2008; Kumar, Singh, & Shankar, 2015) (See more details in Table 2-3). From the literature, almost no research investigated the linkage between SCM practices and all three sustainability goals.

Table 2-3: Summary of studies on supply chain management

No.	Author, Year	Purpose	Supply chain constructs	Performance constructs	Data collection and analysis	Main findings
1	Truong et al. (2017)	To empirically examine the relationship between supply chain management practices and operational performance	- Process control and improvement - Top management support - Customer focus - Supplier management	- Operational performance	- Questionnaire, 7-point Likert scale - Data were collected from Vietnam-based garment companies, a total of 246 valid responses - Reliability, factor analysis, structural equation modelling	The results indicate that supplier management and customer focus have not only direct but also indirect effect on operational performance. Process control and improvement has only direct impact and top management support has indirect impact on operational performance through other practices.
2	Kumar et al. (2015)	To identify critical success factors of SCM implementation and test their impact on performance	- Top management commitment - Development of effective SCM strategy - Devoted resources for supply chain -Logistics synchronization - Use of modern technologies - Information sharing with SC members - Forecasting of demand on point of sale (POS) - Trust development in SC partners - Developing just in time (JIT) capabilities in system - Development of reliable suppliers - Higher flexibility in production system - Focus on core strengths	- Customer service and satisfaction - Innovation and growth - Financial performance - Internal business performance	- Questionnaire - 251 completed responses were acquired from Indian SMEs working in auto, plastic, electronic/electrical, light engineering and others. - One sample t-test, correlation and regression analysis.	The results indicate positive impact of critical success factor for SCM on all performance categories. Moreover, critical success factors show different impact on performance in different sectors.

No.	Author, Year	Purpose	Supply chain constructs	Performance constructs	Data collection and analysis	Main findings
			- Long-term vision for survival and growth			
3	Grimm et al. (2014)	To explore critical factors that help sub-supplier management to overcome the complexities and unique challenges in the food industry.	14 critical factors related to 4 groups: - focal firm-related - relationship-related - supply chain partner- related - context-related	In the context of sustainability and sub-supplier management	Field study to collect data from food company's supply chain	Identify and discuss on 14 critical factors for sustainable SCM
4	Ageron et al. (2012)	To develop a conceptual model for sustainable supply management, and then to operationalize the model in French companies	Sustainable supply management (SSM) constructs: - Reasons for SSM - Performance criteria for SSM - Greening supply chain - Characteristics of suppliers - Managerial approaches for SSM - Barriers for SSM - Benefits and motivation for SSM		- Questionnaire, 7 point Likert scale - Data were collected from French companies, 178 usable responses - Descriptive analysis	The study focused on upstream supply chain part, and develop a theoretical framework for sustainable supply management including seven elements, and validated it through empirical test. The study pointed out that SSM is significantly influenced by suppliers' demographic characteristics and size. Benefits such as supplier innovation, customer satisfaction, quality, and capacity stronger motivate enterprises towards SSM
5	Miguel & Brito (2011)	To investigate the relationship between supply chain management and operational performance	- Information sharing -Long-term relationship - Cooperation - Process integration	Operational performance: - Cost - Delivery - Quality - Flexibility	- Questionnaire - Data were collected from 103 Brazilian companies across more than 20 industries	The study indicates positive relationship between SCM and all operational performance dimensions. Moreover, operational competence mediates

No.	Author, Year	Purpose	Supply chain constructs	Performance constructs	Data collection and analysis	Main findings
					- Structural equation analysis method	the linkage between SCM and the competitive priorities.
6	Bernardes (2010)	From a social network perspective, to study the effects of supply management on aspects of social capital and on performance	- Strategic purchasing - Network relational embeddedness - Network-shared cognition	Customer responsiveness	- Questionnaire, 5-point Likert scale - Data were collected from the US manufacturing firms, 204 valid responses - Structural equation modelling.	The study found that SCM significantly impact on firm performance through a mechanism in which social capital is an antecedent of performance. The study suggested that SCM should be considered as a source of sustainable competitive advantage
7	Vachon and Mao (2008)	To investigate the impact of environmental collaborative activities between supply chain members on manufacturing performance	Supply chain strength	- Environmental performance (recycling rate, energy efficiency, greenhouse emissions, environmental innovation) - Corporate environmental practices (ISO 14001, responsible care, green corporatism) - Social sustainability (Fair labor practices, corporate social involvement, Gini Index)	- Data were extracted from the World Economic Forum's Executive Opinion Survey. In total 8729 responses, about 84 responses on average from each country. - Factor analysis, regression analysis	The results illustrate positive impact of supply chain strength on environmental performance in terms of recycling rate, greenhouse emissions, and environmental innovation; positive link with corporate environmental practices such as ISO 14001 and green corporatism; and impact on social sustainability in terms of fair labor practices and corporate social involvement.
8	Hult et al. (2008)	To study the linkage between supply chain	- Customer orientation - Competitor orientation - Value-chain coordination - Supplier orientation	Balanced scorecard performance: - Customer performance - Financial performance	- Questionnaire, - Online survey, 129 responses from CEOs, presidents, and vice	The results indicate positive effect of SCO on four balanced scorecard outcomes.

No.	Author, Year	Purpose	Supply chain constructs	Performance constructs	Data collection and analysis	Main findings
		orientation and performance	- Logistics orientation - Operations orientation	- Internal process performance - Innovation & learning performance	presidents in more than 28 countries - Structural equation analysis (using LISREL)	
9	Min et al. (2007)	To test the relationship between market orientation, supply chain orientation and supply chain management and performance	*Market orientation:* - Generate intelligent - Disseminate intelligent - Respond to intelligent *Supply chain orientation:* - Top management support - Credibility - Benevolence - Commitment - Cooperative norms - Organizational compatibility *Supply chain management:* - Agree on SC Vision & Focus - Agree on SC leadership - Share information - Build & maintain long-term relationship - Share risk & rewards - Integrate processes - Cooperation	Firm performance: - Growth - Profitability - Timeliness - Product & service offering - Availability	- In-depth interview with 28 senior executives - Survey questionnaire to collect 442 usable responses - Structural equation modelling	The results show significant effect of Market orientation on Supply chain orientation and Supply chain management. Especially, Supply chain orientation indicates the strongest direct impact on performance, followed by Market orientation and Supply chain management.
10	Koh Lenny et al. (2007)	To determine underlying dimensions of SCM practices and to empirically test a framework on the relationship among	- *Outsourcing and multi-suppliers (OMS):* +Outsourcing +E-procurement +3rd party logistics +Subcontracting +Many suppliers	*-Operational performance:* +Flexibility +Reduced lead time in production +Forecasting	- Questionnaire - Data were collected from 203 manufacturing SMEs operating in the manufacture of fabricated metal products and machinery	- The results indicate that both factors of SCLP and OMS have direct, positive and significant impact on operational performance. -In contrast, both SCLP and OMS do not have a significant

No.	Author, Year	Purpose	Supply chain constructs	Performance constructs	Data collection and analysis	Main findings
		SCM practices, operational performance and SCM-related organizational performance in SMEs in Turkey	*-Strategic collaboration and lean practices (SCLP):* +Close partnership with suppliers +Close partnership with customers +JIT supply +Supply chain benchmarking +Strategic planning +Holding safety stock +Few suppliers	+Resource planning and cost saving +Reduced inventory level *-SCM-related organizational performance:* + Increase in sales +More accurate costing +Increase in coordination between departments +Increase in coordination with suppliers +Increase in coordination with customers	-Path model	and direct impact on SCM-related organizational performance. - The direct relationship between the two performance-constructs was found significant, both factors of SCM practices have an indirect and significant positive effect on ORG through OPER.
11	Zhu et al. (2005)	To describe and assess drivers, practices, and performance of green supply chain management (GSCM) among Chinese manufacturing organizations	GSCM pressures: - SC pressure - Cost related pressure - Marketing - Regulations GSCM practices: - Internal environmental management - External GSCM - Eco-design - Investment recovery	GSCM performance: - Environmental performance - Operational performance - Positive economic performance - Negative economic performance	- Questionnaire, 5-point Likert scale - Data were collected from Chinese manufacturing and processing industries through a pilot test, convenience sampling and random survey, 314 valid responses - Exploratory factor analysis, descriptive analysis	The results indicate that Chinese firms have increased awareness of environmental issues but have lagged to adopt GSCM practices because they saw that if they provide environmental benefits, they may less see benefits from operational and economic performance.

No.	Author, Year	Purpose	Supply chain constructs	Performance constructs	Data collection and analysis	Main findings
12	Li et al. (2005)	To conceptualize, develop, and validate dimensions of SCM practices	-Strategic supplier partnership -Customer relationship -Information sharing -Information quality -Internal lean practices -Postponement	-Delivery dependability -Time to market	- Questionnaire, 196 valid responses. - Empirical scale refinement and validation through: Content validity, Uni-dimensionality, Reliability, Convergent validity, Predictive validity	The study found that Strategic supplier partnership, Customer relationship, Information sharing, Information quality, Internal lean practices significantly relate to Delivery dependability and Time to market
13	Chen and Paulraj (2004)	To identify and consolidate various supply chain initiatives and factors to develop key SCM constructs	-Environmental uncertainty - Customer focus - Top management support - Strategic purchasing -Information technology -Supply network structure -Buyer-supplier relationships +Supplier base reduction +Long-term relationship +Communication +Cross-functional teams +Supplier involvement -Logistics integration	- Supplier operational performance - Buyer operational performance - Buyer financial performance	- Questionnaire, 7-point Likert scale - Cross-sectional mail survey in the US, 232 responses	The study developed measurements for supply chain management, tested and confirmed the reliability and validity of the measurement constructs.
14	Shin et al. (2000)	To examine the impact of supply management orientation on suppliers' operational performance and	Supply management orientation: - Long-term supplier-buyer relationship - Supplier involved product development - Quality focus in selecting suppliers	*Supplier performance:* - Supplier cost - Supplier quality - Supplier delivery reliability - Supplier lead time	- Questionnaire - 176 valid responses from the US automotive industry - Structural equation model	The results illustrate that an improvement in supply management orientation improves both supplier performance and buyer performance. Furthermore, the impact of SMO on delivery and

No.	Author, Year	Purpose	Supply chain constructs	Performance constructs	Data collection and analysis	Main findings
		buyers' competitive priorities	- Reduced supplier base	- Supplier on time delivery ***Buyer performance:*** *Quality* - Product performance - Product features - Product reliability - Product conformance - Product durability *Delivery* - Production lead-time - Delivery speed - Delivery reliability *Flexibility* - Process flexibility - Volume flexibility *Cost* - Cost of poor quality - Production costs		quality performance is more significant than on cost or flexibility performance.

2.3. Supply chain quality management

2.3.1. Understanding of supply chain quality management

Quality management is used to be one of prior approaches for manufacturing and service organizations to build-up their competitive advantages. Much of academic work has investigated the effectiveness of QM principles and practices. The impact of QM practices on performance has proven as significant with operational performance but not always on business performance (Sousa and Voss, 2002; Robinson and Malhotra, 2005). That means capabilities from excellent quality management of an organization are no longer sufficient for the high competitive market nowadays (Robinson and Malhotra, 2005), Vanichchinchai and Igel, 2011). This dues to the fact that principles and practices of QM have been much internal focus (Foster, 2008; Zhang et al., 2011; Zeng, Phan, & Matsui, 2013). Meanwhile, an organization could not exist alone and performance well without cooperation from other partners.

Suggested by Resource Dependent Theory, resource acquisition is increasingly important to any organizations in the globally competitive market (Flynn & Flynn, 2005). This process would be strongly supported by the inter-organizational relationship (Oliver and Ebers, 1998; Flynn & Flynn, 2005). Moreover, with the globalization, organizations have no longer competed within the national boundary but in the global market (Vanichchinchai 2011, Flynn and Flynn, 2005, Kuei et al., 2001). In this context, inter-organizational relationship management or SCM has been increasingly concerned as a weapon to respond correctly, rapidly, and profitably to market demand (Zeng et al., 2013, Kuei et al., 2011).

QM and SCM are originally different initiatives but have evolved to merge towards the same goal of customer satisfaction (Li et al., 2006, Zhang et al., 2011). Internal capabilities from QM and external collaboration from SCM would complement and support each other. The integration of QM and SCM, therefore, is suggested by many scholars as a critical factor to the success of organization (Gustin 2Fos001, Narasimhan and Das 2001, Hutchins 2002, Pagell 2004, Miller, 2002). From the mid 2000s, supply chain quality management has become a fruitful research direction (Flynn & Flynn, 2005; Robinson & Malhotra, 2005; Foster, 2008; Kaynak and Hartley, 2008). Several studies made efforts to provide better understanding about SCQM and proposed SCQM as an emergent research field for the future (Robinson and Malhotra, 2005; Foster, 2008):

Robinson & Malhotra (2005) defined "supply chain quality management is the formal coordination and integration of business processes involving all partner organizations in the supply channel to measure, analyze and continually improve products, services, and processes in order to create value and achieve satisfaction of intermediate and final customers in the marketplace". This paper identified five thematic linkages in quality – supply chain management research: (1) Communication and partnership activities, (2) Process integration and management, (3) Management and leadership, (4) Strategy, and (5) Best practices. Taxonomy of SCQM themes described the traditional QM research which focuses on internal SC with intra-organizational practices and "SCQM" research which focuses on external SC with inter-organizational practices. The study emphasized the important of integration of "both service and production processes across the supply network and beyond the boundaries of individual firms". The study suggests further studies should seek to integrate quality improvement strategies across the entire SC.

Foster (2008) defined SCQM as ". . . a systems-based approach to performance improvement that leverages opportunities created by upstream and downstream linkages with suppliers and customers". This literature review research identified seven common themes related to supply chain quality management submitted to Journal of Operations Management: (1) Customer focus, (2) Quality practices, (3) Supplier relations, (4) Leadership, (5) HR practices, (6) Business results, and (7) Safety. The study opened a door for future research in the field of SCQM with some suggested areas such as SCM models, SC constructs, SC frameworks, SCQ strategy, SCQ assurance, SCQ control, SCQM, and SC service.

Other widely accepted definitions of SCQM are "SCQM does not only refer to the management of quality in a pan-supply chain organization but to all quality improvement activities that take place within a supply chain" by Sila (2006), and "Supply chain quality management (SCQM) is conceptualized as a mechanism for governing quality of resource flows between interdependent organizations" by Ford (2015).

In this study, supply chain – quality management is defined as a mutual supportive mechanism of quality improvement practices and supply chain management practices to ensure the quality of intra-organizational and inter-organizational activities and smoothly manage resource flows between the focal firm and supply chain partners.

2.3.2. Research on supply chain quality management

Although there is much attention on quality management and supply chain management in recent decades, the studies on these two fields tend to be separate (Vanichchinchai and Igel, 2011; Fernandes *et al*., 2017). From the mid 2000s, supply chain quality management has been started adopting a more integrated perspective. *Some studies that identified common practices of QM and SCM in the literature:*

Fernandes et al. (2017) conducted a study on the integration of SCM and QM by identifying their common key practices from the literature. The five common practices of SCM and QM are Leadership, Management and strategic planning, Stakeholders involvement and commitment, Information, Continuous improvement and innovation. The study proposes a conceptual model to present key areas of SCM and QM and the relationship between them. Also, the model suggests that integration and sustainability are important for both fields.

Foster et al. (2011) in a further research aims to better understanding of SCQM practices by comparing the management tools and methods of operations managers and supply chain managers. The results pointed out that more collaborative is management approach of supply chain managers whereas operations managers are likely to manage the supply chain through procedural methods. Moreover, the study found that on the job training, data analysis, supply chain management, customer relationship management, project management, and surveys are common practices adopted by both types of managers.

Quang et al. (2016) proposed a conceptual framework to test the effect of SCQM practices on firm performance. The proposed structural model describes multi-level linkages among SCQM practices and between SCQM and performance. The study emphasizes research gap on the interactions among SCQM practices and the consideration of information and supply chain integration as SCQM practices.

Mellat-Parast (2013) using a relational view of inter-organizational competitive advantage, developed a theoretical background for SCQM. The study reviewed the literature and proposed key practices of QM and SCM from the learning perspective. Quality practices at the firm level include Top management support, Information systems, Employee involvement, Process improvement, Product/service design, and Customer satisfaction. Quality practices at the supply chain level comprise Trust, Governance, Information integration, Process integration, and Cooperative learning.

Some scholars empirically studied the contributions of SCQM on organizational performance. They are:

Zeng et al. (2013) empirically study the relationships among internal QM, upstream QM, downstream QM and their effect on quality conformance and customer satisfaction. The results demonstrate a dominant role of QM in the SCQM which imply a necessity to effectively implement QM before moving towards SCQM. Downstream QM mediates the impact of internal QM on customer satisfaction while Upstream QM appears to be lack of influence on performance.

Vanichchinchai & Igel (2011) studies the linkages among TQM practices, SCM practices and firm's supply performance in Thailand's automotive industry. The study develops and validates measurement instruments. Analysis results using structural equation modelling indicate that the impact of TQM practices on firm's supply performance is significantly positive with not only direct effect but also indirect effect through SCM practices.

Kannan & Tan (2007) studies the impact of operational practices including customer input, supplier quality, design quality, JIT quality, process integrity and the interaction of customer input and design quality (CI * DQ), JIT quality and supplier quality (JQ * SQ), JIT quality and process integrity (JQ * PI) on product quality and customer service performance. Using regression analysis, the results show significantly positive impact of customer input, supplier quality, design quality, process integrity, and CI * DQ on product quality, and of customer input, design quality, and JIT quality on customer service.

Lin et al. (2005) study SCQM comprising QM practices, supplier participation strategy, and supplier selection strategy, in the relationship with organizational performance in Taiwan and Hong Kong. Using SEM technique, analysis results show that QM practices positively correlated with supplier participation and supplier selection. Supplier participation mediates the impact of QM practices on business results and customer satisfaction.

Flynn and Flynn (2005), under the perspective of resource dependence theory (Pfeffer and Salancik, 1978), figured out four feasible themes on the dependence between buyer and suppliers to create synergies including: (1) Cumulative capabilities in supply chain performance and quality, (2) Relationship between quality management practices and supply chain performance, (3) Relationship between co-makership and supply chain performance, and (4) Hierarchical relationship of practices supporting supply chain performance. The study provides empirical evidence supporting an integrated relationship between quality management and supply chain management.

Yeung (2005) focuses on strategic supply management to test the impact of strategic supply management on time-based efficiency, cost-related efficiency, customer satisfaction and business performance in the context of ISO 9000 certification, QM implementation, company size, and process type. The results found that QM implementation facilitates strategic supply management, and strategic supply management significantly affects organizational performance.

Han et al. (2007) examine the relationships among QM practices, SC integration and firm performance in 229 Chinese organizations. Using structural equation modeling, the results show that QM practices directly and positively impact on firm performance. SC integration does not directly affect firm performance but indirect affect through QM practices.

Kannan and Tan (2005) studies the correlations among JIT, quality management, and supply chain management as well as their effect on business performance. The results show significant correlations. The study emphasizes the essence of commitment to quality and understanding about supply chain dynamics in business operations.

Kuei (2001) studies the linkage between SCQM practices and organizational performance. Using K-means cluster analysis, the study breaks data into three groups based on the SCQM implementation level, then compares the organizational performance among three groups. The results show that high quality-tendency organizations obtain better organizational performance in terms of cost savings, productivity earning growth sales growth and employee satisfaction.

Kuei et al. (2011) proposed a global SCQM framework which would address new challenges and pressures to outsource, protect the environment, reduce wastes, develop communities, and adopt advanced technology. The study examines a multinational company in Taiwan and found that outsourcing and advanced technology are the most important concerns while developing communities appears to the least pressure. The framework is built-up based on three issues: design, system and a hierarchy of problem solving. From the case study, four themes of SCQM are identified including global leadership and HRM, SCM, international standards, and finally design for six-sigma.

Xu (2011) studies the importance of current information architecture adopting in SCQM. Some key technologies have been highlighted including service-oriented architecture, radio frequency identification, agent, workflow management, and the internet of things. The study pointed out that goal of SCM is sustainable competitive advantage (Li 2007). To do that, all partners in the SC must operate in an integrated manner. Information systems are on-going contribute to the better collaboration and integration in SC.

From the extensive literature review, existing body of work on supply chain quality management could be classified into following main categories: (1) to understand the integrated concept of supply chain quality management (Foster, 2008; Robinson and Malhotra, 2005); (2) to identify common practices of supply chain management and quality management and consider them as supply chain quality management practices (Fernandes et al., 2017; Foster et al., 2011, Quang et al., 2016). These studies mainly stop at the conceptual level; and (3) to empirical study supply chain quality management practices and organizational performance. However, these studies mostly focus on evaluating QM issues in the context of internal and external SC (Quang et al., 2016). As such, the constructs to measure supply chain quality management are an extension of quality management constructs into supplier relationship and customer relationship (Kaynak, 2008, Zeng, 2013, Lin et al., 2005). Other important practices of supply chain management such as information sharing, information technology, and process integration are somehow neglected. From this point of view, there is an obvious gap to study SCQM from a more holistic perspective.

Moreover, performance measurements in existing literature are operational performance, quality performance, customer satisfaction, etc. which are mainly related to economic aspect. Little work has considered how supply chain – quality management practices affect three dimensions of sustainability performance (economic, environmental, and social dimensions). To fill this research gap, this study seeks to answer a research question: *How would the integration of quality management practices and SCM practices affect sustainability performance?*

2.4. Sustainability

2.4.1. Understanding of sustainability

Sustainable development is an accelerating trend concerned by the entire humankind. A widely accepted definition of sustainability is "the development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987). Another definition of sustainability is "to improve the quality of life while living within the carrying capacity of living ecosystems" (The IUCN publication Caring for the Earth, 1991; cited in Warhurst, 2002). Global Reporting Initiative (2002) conceptualized sustainability is "balancing the complex relationships between current economic, environmental, and social needs in a manner that does not compromise future needs".

In general, the sustainability concept, either at strategic level or operational level, is supported by the triple bottom line which consists of three elements: the social equity bottom line (people), the environmental bottom line (planet), and the economic bottom line (profit). The social bottom line refers to equality and quality of life for all people either working for the organization or not (Delai and Takahashi, 2011). The environmental bottom line concerns the impact of the organization on "living and non-living natural systems" such as land, water, air and ecosystems (Global Reporting Initiative, 2002, pp. 48). The economic bottom line refers to both financial and non-financial values created by the organization that benefits not only shareholders but also stakeholder groups (Global Reporting Initiative, 2002). To achieve sustainability goals, the three aspects of the triple bottom line must be harmonized, integrated and balanced effectively.

Organizations are motivated towards sustainability because of pressures and/or drivers usually from stakeholders (Zhu et al., 2005). Stakeholders refer to parties, rather than shareholders, who are affected by business activities of the organization, and need to be concerned by the organization's strategy. Pressures and/or drivers would arise from different groups of stakeholders including internal stakeholders (employees) and external stakeholders (government, market, and community). According to the stakeholder theory, organizations should stick their responsibility with stakeholder benefits, rather than just focus on shareholder profits. The theory supports sustainability management in all kind of organizations regardless of industry, culture, and location.

2.4.2. Sustainability management

In the global economy today, business management has been increasingly aware of the need for sustainability management which aims to achieve social, environmental and economic performance simultaneously. Kuei and Lu (2013) defined sustainability management as "accelerating the adoption of best management principles, models, and practices throughout the operation system, and enabling the environment to achieve sustainable development".

Many operations practitioners and scholars have investigated and integrated their operations areas of interest with sustainability goals (Kleindorfer et al., 2005). Quality management system is one of feasible approaches towards sustainability performance. Several studies examined how sustainability challenges would be addressed by quality management initiatives such as quality management principles (Kuei and Lu, 2013), TQM (Isaksson, 2006), lean management (Martínez-Jurado and Moyano-Fuentes, 2014), JIT and ISO 9001 (Heras-Saizarbitoria and Boiral, 2013). Supply chain management is another approach to achieve sustainability performance. Many scholars have tried investigating supply chain related management models into sustainability such as green supply chain management (Zhu et al., 2005), reverse logistics and closed loop supply chain (Govindan et al., 2015), life cycle analysis (Seuring, 2004), and so on.

This study aims to interpret how the adoption of quality management and supply chain management systems would result in sustainability performance. The study adopts the definition of sustainability management from Kuei and Lu (2013), to define sustainability management in this study as the adoption of best management principles, models and practices from quality management and supply chain management throughout the operations to achieve sustainability performance.

2.4.3. Sustainability performance

Sustainability performance is conceptualized as a result of sustainability management. Sustainability performance can be defined as "the combination of its economic, social and environmental performance" Chardine-Baumann and Botta-Genoulaz (2014), "the performance of a company in all dimensions and for all drivers of corporate sustainability" (Schaltegger and Wagner, 2006). Chardine-Baumann and Botta-Genoulaz (2014) proposed a framework to assess sustainability performance including Economic dimension (Reliability, Responsiveness, Flexibility, Financial performance, and Quality), Environmental dimension (Environmental management, Use of resources, Pollution, Dangerousness, and Natural environment), and Social dimension (Work condition, Human rights, Societal commitment, Customers issues, and Business practices). This study confined itself at the conceptual level.

Besides academic works, there are several measurement standards of sustainability performance which have been published to provide references for organizations to evaluate their sustainability performance (See Table 2-4). In general, these sets of indicators cover all three components of sustainability (social, environmental, and economic performance).

Table 2-4: References of sustainability performance measurement

Name of Indicators	Source	Measurement
The Indicators of Sustainable Development	Commission on Sustainable Development (CSD Indicators)	- Economic performance: economic development, global economic partnership, and consumption and production patterns - Environmental performance: natural hazards, atmosphere, land, oceans, seas and coast, freshwater, and biodiversity - Social performance: poverty, governance, health, education, and demographics
The Sustainability Metrics	Institution of Chemical Engineers (IChemE)	- Economic indicators: profit, value, tax and investments. - Environmental indicators: resource usage (energy, material, water, and land), emission, effluents and waste. - Social indicators: workplace (employee situation, health and safety at work), and society performance.
GRI – G4	The Global Reporting Initiative	- Economic indicators: evaluate the impact of organization on economic systems and economic conditions of their stakeholders. - Environmental indicators: measure the impact of organization on "living and non-living natural systems" (air, land, water and ecosystems). - Social indicators: assess the impact of organization on labor practices and decent work, human rights, society, and product responsibility.

Source: Delai & Takahashi (2011)

This study defines sustainability performance which is the outcome of sustainability management is the balanced performance of three aspects – social, environmental, and economic performance. Adopted from Chardine-Baumann and Botta-Genoulaz (2014) with customizations, this research measures sustainability performance based on three aspects: economic performance, environmental performance, and social performance. The definition and supporting literature for each construct are shown in Table 3-3 (in Chapter 3). In the approach towards sustainability performance, we expect and usually assume that sustainability management would lead to simultaneously social, environmental, and economic performance. However, there is a controversy about the win-win situation of three sustainability components (Gong et al., 2016). Some literature argues that there might be a trade-off among three sustainability components. For example, if the organizations want to invest more in environmental and social aspects, they need to sacrifice some economic benefits. Some arguments expect that the beneficial conflicts among three sustainability performance would be in short-term, in long-term, the win-win situation would exist (Gong et al., 2016). In this study, it is expected that best management practices of QM, SCM, and SCQM would lead to the win-win scenario of sustainability goals.

2.5. Research gaps and research objectives

The operations management research theme experienced the evolution of quality management studies from around the 1950s, to supply chain management from early 1980s, and 2010s is supply chain quality management (Schroeder et al., 2013). From the extensive literature review covering topics of quality management, supply chain management, supply chain quality management, and sustainability performance, the author found followed research gaps:

Theoretical gaps:

QM and SCM have a longer history compared to supply chain quality management. Many studies contributed to theory building of QM and SCM by defining and developing measurement instruments of QM and SCM practices. The definitions and measurement instruments of QM practices and SCM practices from previous studies are somehow inconsistent and developed in a wide range of research settings (geography, culture, industry, etc.). To enrich the literature of QM and SCM, there is always a theoretical need to operationalize and confirm the effectiveness of adoption of QM and SCM practices in a specific research setting such as in Vietnam - a newly industrialized country.

Supply chain quality management is a recent concept which has increasingly concerned since the 2000s. Before that, scholars usually examined quality management and supply chain management separately. Several studies seek to identify common practices of QM and SCM and propose them as SCQM practices (Fernandes et al., 2017; Foster, 2011). Several studies developed SCQM by extending QM practices into upstream and downstream supply chain (Kaynak, 2008; Zeng et al., 2013). There is a lack of study investigating SCQM from a holistic perspective with simultaneous implementation of a set of QM practices and SCM practices. Thus, there is a theoretical gap for further understanding about the concept of SCQM and underlying mechanism of supply chain – quality management practices in the relationship with sustainability performance.

Sustainability performance is the goal of every organization. Many documents proposed a set of measurement indicators for sustainability performance. These indicators are mainly developed as the practical guideline for organization to self-evaluate their level of sustainability performance. There is a theoretical gap for academic work to consider and validate measurement instruments for sustainability performance.

Practical gaps:

Some studies demonstrated the influence of QM practices and SCM practices on organizational performance. These studies, however, seems to focus more on economic related performance. In an inter-relationship with environmental and social performance also, there is a controversy about the win-win situation of three sustainability components (Gong et al., 2016). In the approach towards sustainability performance, we expect that sustainability management would lead to social, environmental, and economic performance at the same time. However, it has never been easy from the practical view. There is a practical need to identify which quality and supply chain practices would be critical success factors leading to improvement of sustainability performance.

Regarding supply chain – quality management, quality management and supply chain management systems have been widely introduced and transferred from developed countries such as Japan and the USA to Vietnam since 1986. Despite being a follower and inherited best knowledge transferred on supply chain – quality management from the pioneers, the approach to adapt and design a supply chain – quality management system to reach sustainability goals is somehow neglected by academic works, especially in the context of Vietnam. From this, there is a practical gap for a customized implementation path of quality management and supply chain management to well integrate a supply chain - quality management system to pursue sustainability goals in Vietnam-based enterprises.

To address the theoretical and practical gaps, the purposes of this study are:

- To empirically validate the measurement instruments of QM practices, SCM practices, and sustainability performance

- To investigate the impact of QM practices on sustainability performance

- To examine the impact of SCM practices on sustainability performance

- To study how the integration of QM practices and SCM practices would affect sustainability performance

2.6. Summary of Chapter 2

This chapter provided a discussion on QM practices, SCM practices, supply chain – quality management practices, sustainability performance, the relationship between QM practices and sustainability performance, the relationship between SCM practices and sustainability performance, and the relationship between supply chain – quality management practices and sustainability performance. The literature review has indicated a number of theoretical and practical research gaps that are worthy of investigation. Finally, to address the research gaps, the purposes of this study are figured out.

CHAPTER 3: RESEARCH DESIGN AND MEASUREMENT ANALYSIS

This chapter presents research methodology employed in this study. It started with a description of the overall research framework to fill the research gaps, followed by research design section to describe the procedures of data collection and analysis. The last section presents data description and measurement analysis results of this study.

3.1. Overall research framework

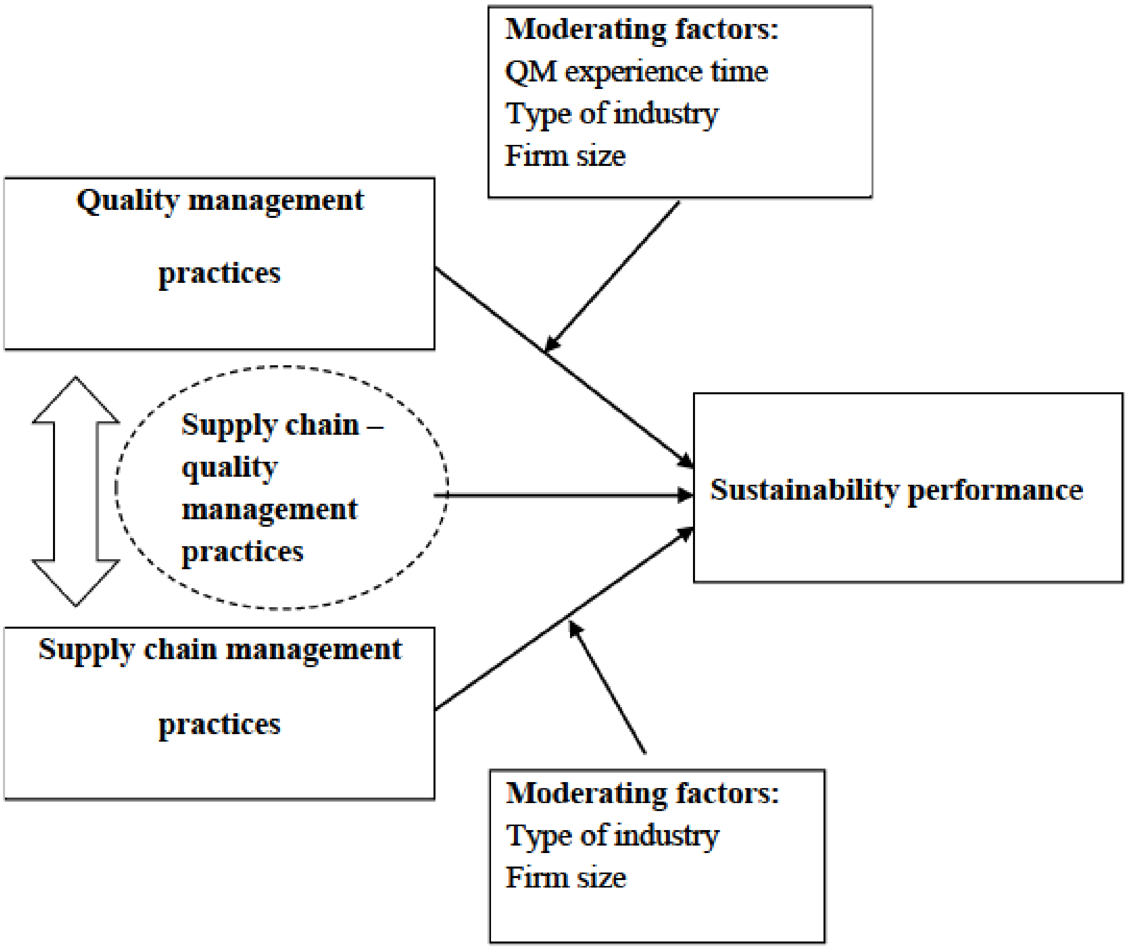

Figure 3-1: Overall research framework

The overall research framework depicts three main causal relationships:

First is the impact of quality management practices on sustainability performance. This part of the research framework aims to address the research questions related to quality management and sustainability performance: *"What are the measurement instruments of QM practices? What are the measurement instruments of sustainability performance? How do quality management practices impact on sustainability performance? How do QM experience time, type of industry, and firm size moderate the relationship between QM practices and SP?"*. These questions will be answered in Chapter 4: The impact of quality management practices on sustainability performance. After confirming the validity and reliability of QM practices and SP constructs, the impact of QM practices on sustainability performance will be empirically tested. To understand more about this relationship, further empirical evidence on moderating effects of experience time of QM implementation, type of industry, and firm size will be provided and discussed. This chapter is expected to fill the theoretical gap on validating measurement instruments of QM practices and SP, and empirical testing the impact of QM practices on SP; as well as fill the practical gap on identifying critical QM practices contributing to sustainability performance in the context of Vietnam-based enterprises.

Second is the impact of supply chain management practices on sustainability performance. This part of the research framework aims to address the research questions related to supply chain management and sustainability performance: *"What are the measurement instruments of SCM practices? How do SCM practices impact on sustainability performance? How do type of industry and firm size moderate the relationship between SCM practices and SP?"*. These questions will be answered in Chapter 5: The impact of supply chain management practices on sustainability performance. After confirming the validity and reliability of SCM practices constructs, the impact of SCM practices on sustainability performance will be empirically tested. Furthermore, to understand more about this relationship, empirical evidence on moderating effects of industry and size will be provided and discussed. The chapter is expected to fill the theoretical gap on validating the measurement instruments of SCM practices, and empirical testing the impact of SCM practices on SP; as well as fill the practical gap on identifying critical SCM practices contributing to sustainability performance in the context of Vietnam-based enterprises.

Third is the relationship between supply chain – quality management practices and sustainability performance. This part of the research framework aims to address the research question: *"How would the integration of QM practices and SCM practices affect SP?"*. This question will be answered in Chapter 6: The underlying mechanism of supply chain – quality management in relationship with sustainability performance. Supply chain – quality management practices are measured by a combination set of QM practices and SCM practices. To test the underlying mechanism of SCQM, three proposed models on the possible integration or mutual support of QM and SCM systems are tested. The first model is the impact of QM on SP with a mediating effect by SCM. The second model is the impact of SCM on SP with a mediating effect by QM. The third model is the synergy or offsetting effect from simultaneous implementation of QM and SCM. The chapter is expected to fill the theoretical gap on how QM and SCM systems would integrate to create a SCQM system which best fit toward sustainability performance. From the empirical results, the chapter is expected to fill the practical gap by recommending a proper implementation path of SCQM to attain higher sustainability performance in Vietnamese enterprises.

3.2. Research methodology

3.2.1. Designing questionnaire

A questionnaire was first developed in English by using measurement items from previous studies. The content of the questionnaire was thoroughly reviewed by professors in the field of operations management. After receiving comments from professors, the questionnaire was revised accordingly. Then, the questionnaire was discussed at PhD seminar with professors and PhD students in the field of operations management. During this period, the questionnaire was provided to a former plant manager of a company to get comments from a practical view. After three months of continuous reviewing, discussing and revising, English version of the questionnaire was finalized.

The final questionnaire includes 189 question items on QM practices, SCM practices, SP, and demographic information.

- To measure QM practices, eight scales are constructed: (1) Top management support for QM, (2) Training, (3) Product/service design, (4), Quality data and reporting, (5) Process management, (6) Continuous improvement, (7) Problem solving, (8) Rewards. Eight scales of QM practices are constructed to ask about the extent respondent agree with given statements by a five-point Likert scale from 1 = strongly disagree to 5 = strongly agree. Question items of QM practices are adopted from Saraph (1989), Flynn et al. (1995), Cua et al. (2001), Kaynak (2003), Arauz et al. (2009), Sadikoglu and Zehir (2010), and Phan et al. (2011), Hung et al. (2011), and ISO 9001 (2015).

- To measure SCM practices, six scales are constructed: (1) Top management support for SCM, (2) Information sharing, (3) Information technology, (4) Process integration, (5) Strategic supplier relationship, (6) Customer relationship. Six scales of SCM practices are constructed to ask about the extent respondent agree with given statements by a five-point Likert scale from 1 = strongly disagree to 5 = strongly agree. Question items of SCM practices are adopted from Chen and Paulraj (2004), Li et al. (2005), and Min et al. (2007).

- To measure sustainability performance, three scales are constructed: (1) Economic performance, (2) Environmental performance, (3) Social performance. Three scales of SP ask about the level of performance improvement of the organization in recent 2 years by a five-point Likert scale from 1 = significant decreased to 5 = significant increased. In addition, relating to SP, there are four question items asking about strength of factors (pressures/drivers) that affect the organization toward sustainability performance by choosing from 1 = not at all important to 5 = extremely important. Question items of sustainability performance are adopted from Chardine-Baumann & Botta-Genoulaz (2014) and Zhu and Sarkis (2007).

- Demographic information about the organization includes five question items regarding type of the organization, main ownership, time experience with QM, number of employees, and industry.

The questionnaire was translated into Vietnamese and Japanese. A cover letter was prepared to send greetings and basic information on the survey and the questionnaire to respondents. The final set of four documents including a cover letter, an English questionnaire version, a Vietnamese questionnaire version, and a Japanese questionnaire version was sent to respondents. Contents of the questionnaire were also input and uploaded on Surveymonkey (surveymonkey.com) to provide more option for the respondent to answer the questionnaire at their convenience.

Table 3-1: Definition of QM measurement constructs and supporting literature

Constructs	Definition/Description	Supported literature
Top management support for QM	This construct measures how top management involves and supports for quality-related goal-setting and issues.	Song and Su (2015), Kumar et al. (2014), Wang et al. (2012), Zehir et al. (2012), Phan et al. (2011), Khan (2011), Koc (2011), Hung et al. (2011), Miyagawa and Yoshida (2010), Sadikoglu and Zehir (2010), Salaheldin (2009), Arauz et al. (2009), Zu et al. (2009), Macinati (2008), Parast et al. (2006), Yeung et al. (2005), Kaynak (2003), Samson and Terziovski (1999), Cua et al. (2001); Flynn et al. (1995), Anderson et al. (1995).
Training on quality	This construct measures whether the organization provides quality-related training throughout the organization	Song and Su (2015), Duy and Oanh (2015), Kumar et al. (2014), Phan et al. (2011), Koc (2011), Sadikoglu and Zehir (2010), Gadenne and Sharme (2009), Lakhal et al. (2006), Fuentes et al. (2006), Kaynak (2003), Saraph (1989)
Product/service design	This construct measures how quality is emphasized in the product/service design process to ensure that product/service could meet customers' requirements.	Song and Su (2015), Baird et al. (2011), Konecny and Thun (2011), Sanchez-Rodriguez and Martinez-Lorente (2011), Arauz et al. (2009), Salaheldin (2009), Zu et al. (2009), Martinez-Costa et al. (2008), Zu et al. (2008),

Constructs	Definition/Description	Supported literature
		Kaynak (2003), De Cerio (2003), Cua et al. (2001), Flynn et al. (1995), Saraph (1989)
Quality data and reporting	This construct measures whether quality-related data are available and ready for managers and employees	Sadikoglu and Zehir (2010), Phan and Matsui (2010), Martinez-Costa et al. (2008), Brah and Lim (2006), Samson and Terziovski (1999), Flynn et al. (1995), Saraph (1989)
Process management	This scale evaluates how the organization manages process related issues such as process objectives, authority & responsibility for process management, process risks, and process standardization to achieve the overall outcome of QM system	ISO 9001 (2015), Song and Su (2015), Wang et al. (2012), Zehir et al. (2012), Baird et al. (2011), Konecny and Thun (2011), Khan (2011), Koc (2011), Phan and Matsui (2010), Sadikoglu and Zehir (2010), Salaheldin (2009), Arauz et al. (2009), Zu et al. (2009), Macinati (2008), Brah and Lim (2006), Yeung et al. (2005), Kaynak (2003), Cua et al. (2001), Samson and Terziovski (1999), Flynn (1999)
Continuous improvement	This scale measures whether people in the organization are constantly looking for continuous improvement while doing their works	Wang et al. (2012), Zehir et al. (2012), Agus and Hassan (2011), Khan (2011), Hung et al. (2011), Sadikoglu and Zehir (2010), Salaheldin (2009), Gadenne and Sharme (2009), Brah and Lim (2006), Flynn et al. (1999), Anderson et al. (1995).
Problem solving	This scale measures whether problem solving teams contribute to performance improvement.	Kumar et al. (2014), Phan et al. (2011), Salaheldin (2009), Zhang et al. (2012), Flynn (1995)
Rewards	This scale evaluates whether managers or staff of the organization are rewarded with they contribute to quality improvement	Daniel et al. (2014), Chen and Tjosvold (2012), Nohria, Groysberg, and Lee (2008); Nguyen and Robinson (2010), Flynn et al. (1995)

Table 3-2: Definition of SCM measurement constructs and supporting literature

Constructs	Definition/Description	Supported literature
Top management support for SCM	This scale measures how top management supports the purchasing and inter-organizational collaborative activities.	Truong et al. (2017), Kumar et al. (2015), Chen and Paulraj (2004)
Information sharing	This scale measures whether the organization frequently exchanges information with suppliers and customers	Miguel & Brito (2011), Kumar et al. (2015), Min et al. (2007), Li et al. (2005), Chen and Paulraj (2004)
Information technology	This scale measures whether the organization is equipped with facilities which support for inter-organizational information exchange process and coordination	Chen and Paulraj (2004)
Process integration	This scale assesses how the organization and supply chain members integrate their	Truong et al. (2017), Miguel & Brito (2011), Min et al. (2007), Chen and Paulraj (2004)

Constructs	Definition/Description	Supported literature
	operations to smoothly exchange information, materials and cash.	
Strategic supplier relationship	This scale measures whether the organization has a tight and long-lasting partnership with key suppliers which allow to invite them to involve in some business activities of the organizations such as new product development, strategy planning and goal-setting activities, or continuous improvement programs.	Koh et al. (2007), Miguel & Brito (2011), Ulusoy (2003), Shin et al. (2000), Min et al. (2007), Bernardes (2010), Truong et al. (2017), Li et al. (2005), Chen and Paulraj (2004)
Customer relationship	This scale measures whether the organization build a long-term relationship with customer, keep close contact with them, frequently interact with them to ask for their satisfaction and expectation, as well as follow up with their feedback	Koh et al. (2007), Miguel & Brito (2011), Ulusoy (2003), Min et al. (2007), Li et al. (2005), Chen and Paulraj (2004), Arauz et al. (2009), Flynn et al. (1995), Cua et al (2001)

Table 3-3: Definition of SP measurement constructs and supporting literature

Constructs	Definition/Description	Supported literature
Economic performance	This scale measures the performance change of the organization in terms of financial return, financial expense, and market expansion	Chardine-Baumann & Botta-Genoulaz (2014), Zhu and Sarkis (2007)
Environmental performance	This scale measures the performance change of the organization in terms of waste emitted to the environment and consumption of natural resources	Chardine-Baumann & Botta-Genoulaz (2014), Zhu and Sarkis (2007)
Social performance	This scale measures the performance change of the organization in terms of human-related management and contribution to local community	Chardine-Baumann & Botta-Genoulaz (2014), Zhu and Sarkis (2007)

3.2.2. Sampling and data collection

Sampling: In this study, the target population is Vietnam-based enterprises. Contact information of the companies was collected from three sources: the main source is the website of informative porter for business establishment in Vietnam (http://vtown.vn/en/), the second source is a list of companies from Jetro Vietnam, the third source is a list of enterprises that attend numerous conferences and/or workshops in fields of operations management, quality management, and supply chain management. Target contact people are top management, therefore, the information from various sources is collected and screening. A total of 611 companies with information on personal contact was selected.

Data collection: The set of questionnaire was sent to each of 611 companies by email. In the email, the link of the questionnaire on surveymoney.com was also included. After sending email the first time, reminding email was sent twice after every two weeks, followed by a phone call at the third time of reminding. Besides the main method to collect data by email, some responses were collected by snowball technique in which the questionnaire was sent to my friends and colleagues, and then they help me send them to their networks. The data collection period is nine months divided into two phases: the first phase was from July 2016 to September 2016, the second phase was from November 2016 to March 2017. The data collection procedures were the same as described above. Finally, a total of 158 responses were received. After screening the responses, a sample of 144 responses was valid and used in the analysis (response rate at 23.5%). The other 14 responses were rejected because of many missing answers.

3.2.3. Data analysis techniques

- None-response bias: to test whether there is a significant difference in the data from respondents and non-respondents (Chen and Paulraj, 2004).

- Construct/Convergent validity is utilized to make sure that all question items within a construct are convergent to measure one latent variable (Yeung, 2008).

- Discriminant validity refers to the uniqueness of each latent construct which is enough to be distinguished from other constructs (Yeung, 2008).

- Reliability refers to the degree of the inter-correlation coefficient of each item with each other in the same construct, also known as the internal consistency (Cronbach and Meehl, 1955). Reliability test is used to confirm the internal consistency of the measurement constructs.

- Analysis of variance (ANOVA) with Tukey pairwise comparison test*:* to investigate the similarity or difference in the degree of QM and SCM implementation level across subgroups (divided by different demographic characteristics, see more detailed in each chapter 4 and 5).

- Multi-regression analysis: to test the impact of independent variables (here are QM practices or SCM practices) on dependent variables (here is SP).

- Chow test and multi-regression analysis with dummy variables: Chow test is conducted to determine whether the data is structurally stable or break. F statistics are calculated by following formula:

$F = [(SSR_p - \Sigma SSR_i)/k]/[\Sigma SSR_i /(n-i*k)]$

where

SSR_p is the sum of squared residuals from a linear regression model for the pooled sample

SSR_i is the sum of squared residuals from a linear regression model for the i^{th} subsample

i is the number of subgroups

k is the number of independent variables

n is the number of total observations.

After calculating F statistic, this value is compared with F(k, n-i*k) given by F table. If calculated F is greater than F(k, n-i*k), it can be concluded that the data structurally break which means independent variables have different impact on dependent variables across subgroups and vice versa.

- Mediation analysis: to test the underlying mechanism of QM and SCM in the relationship with SP. Specifically, mediation analysis is used to test how QM practices mediate the relationship between SCM and SP, and how SCM practices mediate the relationship between QM and SP.

Data analyses were conducted by SPSS 22.0 software.

3.3. Data description and measurement analysis

3.3.1. Data description

A total of 158 responses were received during data collection in 2016. Data screening suggested that 14 responses should be rejected due to value missing. A final sample of 144 valid responses was used in the analysis.

Table 3-4: Characteristics of the companies

QM experience timeline	No. of company	Firm size (No. of employee)	No. of company	Type of industry	No. of company
Less than 5 years	38	No more than 50	58	Industrial	64
5 to 10 years	35	51-300	49	Consumer goods	30
More than 10 years	29	More than 300	37	Basic materials	25
Missing	42	Missing	0	Consumer services	22
				Missing	3
Total	144	Total	144	Total	144

A total of 102 over 144 respondents filled the question items on Experience time of quality management implementation (42 missing corresponding to 29.2%). Based on a descriptive analysis, the sample of 102 responses would be divided into 3 groups:

- Less than 5 years with 38 companies (accounted for 26.4%),

- From 5 to 10 years with 35 companies (accounted for 24.3%), and

- More than 10 years with 29 companies (accounted for 20.1%).

A total of 141 over 144 respondents filled the question items on the industry of the organization (3 missing corresponding to 2.1%). Based on a descriptive analysis, the sample of 141 responses would be divided into 4 groups categorized by industry type:

- Industrial with 64 companies (accounted for 44.4%),

- Consumer goods with 30 companies (stood at 20.8%),

- Basic materials with 25 companies (accounted for 17.4%), and

- Consumer services with 22 companies (represented 15.3%).

All 144 respondents filled the question items on the number of employees of the organization. Based on a descriptive analysis, the sample of 144 responses would be divided into 3 groups categorized by firm size:

- Small size with no more than 50 employees (accounted for 58 companies, corresponding to 40.3% of the total respondents),

- Medium size companies with from 51 to 300 employees (accounted for 49 companies, corresponding to 34%), and

- Large size companies with more than 300 employees (accounted for 37 companies, corresponding to 25.7%).

3.3.2. Measurement analysis

- Non-response bias: In this study, non-response bias is evaluated by first phase non-response bias. The total sample is split into two groups: one group includes responses from the first phase of data collection, the other group includes responses from the second phase of data collection. The latter group comprises companies in the original list to contact but did not respond in the first phase of data collection. Thus, the author considers the latter group as the first phase non-response and test the non-response bias by comparing these two groups. To test the non-response bias, t-test is conducted with three demographic variables (number of employees, industry, type of organization) and twenty random variables selected from QM practices, SCM practices and SP. The t-test results show no statistically significant difference between the two groups (at 95% significant level), it can be concluded that non-response bias does not appear (See Table 3-7).

Table 3-5: Results of non-response bias test

Random question item No.	t-test for Equality of Means				
	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
1	.794	142	.429	.109	.137
2	-.552	141	.582	-.072	.130
3	-.432	142	.667	-.061	.140
4	.094	140	.925	.017	.178
5	.024	139	.981	.003	.147
6	.181	138	.857	.026	.141
7	.683	138	.496	.106	.155
8	-.895	141	.372	-.129	.144
9	-.572	141	.568	-.081	.142
10	1.268	141	.207	.175	.138
11	.253	140	.801	.033	.130
12	-1.054	142	.294	-.156	.148
13	-1.109	142	.269	-.154	.139
14	.442	135	.659	.067	.151
15	.995	131	.322	.224	.225
16	.739	127	.461	.125	.169
17	-.455	130	.650	-.070	.153
18	-.351	129	.726	-.049	.140
19	-.658	129	.512	-.092	.140
20	-.099	129	.922	-.017	.168
QM experience timeline	1.568	100	.120	.28296	.18041
Type of industry	1.330	142	.186	.32323	.24312
Number of employees	1.221	142	.224	.35152	.28782

- Content validity: content validity of the questionnaire is confirmed by extensive review of previous literature on QM practices, SCM practices and SP. Table 3-1, 3-2, and 3-3 showed numerous empirical studies which support the utilization of measurement constructs in this study. It can be seen that content validity of measurement instrument in this study is demonstrated.

- Convergent validity: The question items in this study are mainly adopted from previous studies which were thoroughly tested and confirmed the reliability and validity. Therefore, convergent validity in this study is tested by confirmatory factor analysis or within scale factor analysis. In this study, factor analysis is conducted with Maximum likelihood method and Promax rotation. Criteria for factor analysis are: KMO and Bartlett's Test values which measure sampling adequacy need to be greater than 0.5 with Sig. value smaller than 0.5; each factor is uni-dimensionality with a minimum eigenvalue of 1; and factor loading of each item is greater than 0.4. In this study, the factor analysis results for QM practices and SCM practices satisfy all of these requirements for the original constructs. Factor loadings of QM practices range from 0.468 to 0.903, factor loadings of SCM practices range from 0.489 to 0.908. The factor analysis of SP breaks the original three constructs of SP into seven sub-constructs: Economic return, Cost reduction, and Market performance belong to Economic performance construct; Emission reduction and Resource consumption belong to Environmental performance; Internal social performance (refers to social performance which has impact on internal stakeholders) and External social performance (refers to social performance which has impact on external stakeholders) belong to Social performance. The factor analysis results for these seven sub-constructs of SP satisfy all validity requirements. Factor loadings of SP range from 0.429 to 0.925. (See more detailed in Table 3-8).

- Discriminant validity: In this study, discriminant validity is evaluated by comparing the square root of the Average Variance Extracted (AVE) of each construct with the correlation coefficients between that construct with the others. If the square root of a construct' AVE value is greater than the correlation coefficients of that construct with the other constructs, that means the discriminant validity is supported (Fornell & Larcker, 1981). Table 3-7 shows the correlation matrix with the square root of AVE on the diagonal. The comparison results illustrate that square root of AVE value of each QM constructs, SCM constructs, and SP constructs is greater than the correlation coefficients of that construct with the others, indicating strong evidence of discriminant validity.

- Reliability: From the results (Table 3-6) the Cronbach's Alpha values of all constructs in this study exceed the suggested threshold of 0.6 (Nunnally, 1978). Cronbach's Alpha values of QM constructs range from 0.730 to 0.888. Cronbach's Alpha values of SCM constructs range from 0.811 to 0.867. Cronbach's Alpha values of SP constructs range from 0.613 to 0.871 (See more details in Table 3-6). As such, it can be concluded that the reliability of all constructs is confirmed.

Table 3-6: Reliability and validity test results

Variables	Constructs	No. of valid items	Alpha value	Factor loading range
QM practices	Top management support for QM	4	0.730	0.521-0.769
	Training on quality	6	0.836	0.535-0.815
	Product/service design	5	0.802	0.505-0.780
	Quality data and reporting	4	0.752	0.468-0.903
	Process management	6	0.862	0.656-0.775
	Continuous improvement	5	0.888	0.637-0.900
	Problem solving	3	0.886	0.783-0.894
	Rewards	3	0.869	0.719-0.903
SCM practices	Top management support for SCM	4	0.811	0.489-0.908
	Information sharing	6	0.855	0.529-0.808
	Information technology	4	0.832	0.638-0.872
	Process integration	7	0.847	0.526-0.773
	Supplier relationship	6	0.865	0.576-0.817
	Customer relationship	6	0.867	0.705-0.757
Sustainability performance	Economic performance – Economic return	3	0.731	0.593-0.748
	Economic performance – Cost reduction	4	0.745	0.429-0.877
	Economic performance – Market performance	3	0.613	0.505-0.665
	Environmental performance – Emission reduction	5	0.871	0.561-0.925
	Environmental performance – Resource consumption reduction	3	0.793	0.674-0.811
	Social performance – Internal social performance	2	0.642	0.583-0.810
	Social performance – External social performance	3	0.788	0.698-0.779

3.4. Summary of Chapter 3

To fill the research gaps presented in the literature review chapter, a research framework is formulated as a foundation for further investigation. Next, the empirical research methodology employed by this study is described from the initial stage of designing questionnaire to collecting and analyzing data methods. Finally, the chapter presented a description analysis as well as measurement test results of the collected data.

Table 3-7: Correlations analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(18)	(19)	(20)	(21)	(22)
1.TOPQ	.644	.662**	.578**	.589**	.564**	.593**	.556**	.404**	.570**	.418**	.323**	.459**	.417**	.496**	.209*	.094	.393**	.007	-.21*	.418**	.366**
2.TRAIN	.662**	.681	.532**	.649**	.557**	.669**	.544**	.480**	.552**	.503**	.345**	.543**	.448**	.619**	.340**	.019	.420**	.001	-.22**	.317**	.497**
3.DEGN	.578**	.532**	.685	.590**	.648**	.608**	.661**	.543**	.431**	.472**	.428**	.500**	.507**	.612**	.355**	.058	.405**	.118	-.122	.427**	.472**
4.QDAT	.589**	.649**	.590**	.672	.646**	.612**	.608**	.445**	.419**	.622**	.426**	.678**	.475**	.585**	.237**	.203*	.363**	.055	-.038	.291**	.420**
5.PCMT	.564**	.557**	.648**	.646**	.717	.659**	.676**	.467**	.502**	.693**	.556**	.668**	.457**	.575**	.229**	.016	.338**	.030	-.18*	.431**	.440**
6.CONTI	.593**	.669**	.608**	.612**	.659**	.789	.676**	.564**	.462**	.554**	.394**	.537**	.493**	.653**	.290**	.052	.464**	-.029	-.24**	.406**	.527**
7.PROB	.556**	.544**	.661**	.608**	.676**	.676**	.852	.516**	.364**	.539**	.365**	.525**	.579**	.642**	.133	.127	.321**	.073	-.157	.379**	.418**
8.REW	.404**	.480**	.543**	.445**	.467**	.564**	.516**	.836	.300**	.381**	.390**	.451**	.392**	.462**	.348**	.070	.317**	.074	-.28**	.316**	.352**
9.TOPS	.570**	.552**	.431**	.419**	.502**	.462**	.364**	.300**	.743	.373**	.293**	.383**	.211*	.353**	.142	-.005	.213*	-.166	-.35**	.303**	.209*
10.INFS	.418**	.503**	.472**	.622**	.693**	.554**	.539**	.381**	.373**	.716	.499**	.689**	.418**	.530**	.120	.190*	.267**	.021	-.040	.323**	.392**
11.INFT	.323**	.345**	.428**	.426**	.556**	.394**	.365**	.390**	.293**	.499**	.751	.562**	.429**	.312**	.187*	.195*	.212*	.197*	.021	.321**	.292**
12.PCINT	.459**	.543**	.500**	.678**	.668**	.537**	.525**	.451**	.383**	.689**	.562**	.674	.591**	.559**	.205*	.058	.337**	-.004	-.103	.328**	.454**
13.SUPR	.417**	.448**	.507**	.475**	.457**	.493**	.579**	.392**	.211*	.418**	.429**	.591**	.723	.525**	.272**	.029	.250**	.113	-.017	.376**	.446**
14.CUSR	.496**	.619**	.612**	.585**	.575**	.653**	.642**	.462**	.353**	.530**	.312**	.559**	.525**	.725	.262**	.024	.350**	.116	-.108	.305**	.551**
15.RETN	.209*	.340**	.355**	.237**	.229**	.290**	.133	.348**	.142	.120	.187*	.205*	.272**	.262**	.697	.111	.378**	.238**	-.117	.374**	.439**
16.COST	.094	.019	.058	.203*	.016	.052	.127	.070	-.005	.190*	.195*	.058	.029	.024	.111	.688	.012	.506**	.404**	-.064	.012
17.MAKT	.393**	.420**	.405**	.363**	.338**	.464**	.321**	.317**	.213*	.267**	.212*	.337**	.250**	.350**	.378**	.012	.596	.098	-.25**	.448**	.518**
18.EMIS	.007	.001	.118	.055	.030	-.029	.073	.074	-.166	.021	.197*	-.004	.113	.116	.238**	.506**	.098	.778	.435**	.088	.069
19.CONS	-.21*	-.22**	-.122	-.038	-.18*	-.24**	-.157	-.28**	-.35**	-.040	.021	-.103	-.017	-.108	-.117	.404**	-.25**	.435**	.756	-.106	-.112
20.INTSO	.418**	.317**	.427**	.291**	.431**	.406**	.379**	.316**	.303**	.323**	.321**	.328**	.376**	.305**	.374**	-.064	.448**	.088	-.106	.706	.513**
21.EXTSO	.366**	.497**	.472**	.420**	.440**	.527**	.418**	.352**	.209*	.392**	.292**	.454**	.446**	.551**	.439**	.012	.518**	.069	-.112	.513**	.745

Note: ** significant at 1%, * significant at 5%

TOPQ: Top management support for QM; TRAIN: Training on quality; DEGN: Product/service design; QDAT: Quality data and reporting; PCMT: Process management; CONTI: Continuous improvement; PROB: Problem solving; and REW: Rewards; TOPS: Top management support for SCM; INFS: Information sharing; INFT: Information technology; PCINT: Process integration; SUPR: Supplier relationship; CUSR: Customer relationship; RETN: Economic return; COST: Cost reduction; MAKT: Market performance; EMIS: Emission reduction; CONS: Resource consumption reduction; INTSO: Internal social performance; EXTSO: External social performance.

CHAPTER 4: THE IMPACT OF QUALITY MANAGEMENT PRACTICES ON SUSTAINABILITY PERFORMANCE

This chapter presents the empirical evidence on how quality management practices impact of on sustainability performance as well as how this relationship is moderated by QM experience time, type of industry, and firm size in the Vietnamese context.

4.1. Introduction

Rapid globalization is perhaps making the world's economy better but simultaneously posting challenges for all nations, especially emerging countries. To exist and grow in such intensive ever-changing competitive environment, developing economies are seeking to create capabilities that would enable them to compete in both domestic and international markets (Salaheldin, 2009). It is necessary to equip themselves with advanced technology, updated information system or adopt worldwide accepted operations management practices. One idea of operations management is quality management which has attracted widespread attention from both practitioners and academicians for the last several decades (Jung & Wang, 2006; Salaheldin, 2009). Quality management practices have demonstrated as a good contributor to organizational performance which enables firms to sustain competitive advantages (Kaynak, 2003; Kim et al., 2012).

Vietnam has been facing enormous challenges while seeking to compete in the global market. Starting from a poor economy severely affected by the consequences of the war, Vietnam nowadays is more likely known as an active player in the regional and global business (Nguyen and Robinson, 2015). To be accepted in the international playground, Vietnamese companies have started to pay greater attention to "quality-focus" growth pattern.

In Vietnam, the importance of quality management has been widely recognized for recent 30 years. According to Directorate for Standards, Metrology and Quality of Vietnam, quality management tools and systems such as Quality Inspection, Quality Control, Total Quality Control, and Total Quality Management have been implemented in many Vietnamese enterprises including both FDI and local ones. There are several studies related to some specific quality management practices in Vietnamese companies such as continuous improvement (Nguyen and Robinson 2010, 2015), and process improvement (Machikita and Ueki 2013). One of the previous study in which the author is a co-author was about "ISO 9000 implementation and performance: empirical evidence from Vietnamese companies" published in 2016. The study provided empirical evidence on how QM practices following ISO 9001 standard impact on performance. The study focused on four QM practices including Employee training, supplier control, process control and documentation level and three aspects of performance comprising quality performance (incoming quality, in-process quality, out-going quality - reflected by defect rate), on-time delivery, and customer satisfaction. The study found significant and positive impact of QM practices on performance and the impact is different across company groups with different time experience with ISO 9000 certification.

From the extensive literature review, there is still a limited academic work on the holistic picture of quality management practices as well as how they affect firms' sustainability performance in Vietnam context. To address the research gap and the limitation from our previous study, this study aims to empirically test the direct impact of QM practices on SP, and moderating effects of QM experience time, type of industry, and firm size on the relationship between QM practices and SP. A simple analytical framework is developed and depicted as in Figure 4-1.

4.2. Analytical framework and hypotheses development

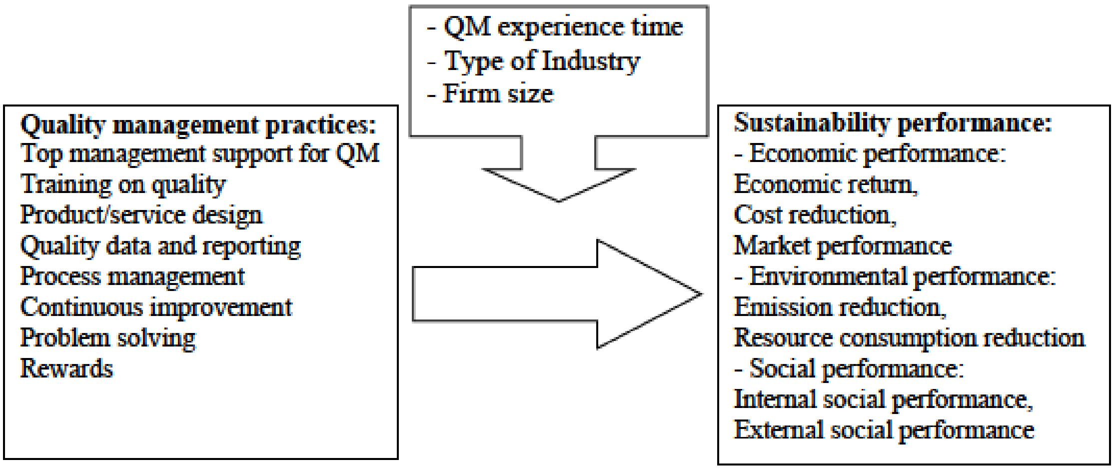

Figure 4-1: Analytical framework of study on the impact of QM practices on SP

As shown in measurement analysis results (Chapter 3), the measurement instruments for QM practices are confirmed the validity and reliability with eight constructs:

- Top management support for QM
- Training on quality
- Product/service design
- Quality data and reporting
- Process management
- Continuous improvement
- Problem solving
- Rewards

The measurement instruments for SP are confirmed the validity and reliability with seven sub-constructs belonging to three components of sustainability performance:

- Economic performance
  - Economic return
  - Cost reduction

- Market performance

- Environmental performance
  - Emission reduction
  - Resource consumption reduction
- Social performance
  - Internal social performance
  - External social performance

Many previous empirical studies have examined the linkage between quality management practices and various performance dimensions. Although utilizing different measurement instruments in different research settings, some studies have demonstrated positive contributions of QM practices to economic-related performance (Wang et al., 2012; Koc, 2011; Macinati, 2008; Fuentes et al., 2006; Kaynak, 2003), environmental-related performance (Wiengarten and Pagell, 2012; Zhu et al., 2013; Bergenwall et al., 2012; Yang et al., 2011), and social-related performance (Miyagawa and Yoshida 2010; Phan et al., 2011; Wang et al. 2012; Sadikoglu and Zehir, 2010).

The Cost of Poor Quality (Harrington, 1987) would be considered as a supporting theory for the linkage between QM and sustainability performance. Cost of Poor Quality (Harrington, 1999) refers to the losses and wastes that would disappear if systems, processes, and products were perfect (Isaksson, 2005). High Cost of Poor Quality means lower sustainability performance. QM practices is an approach to reduce Cost of Poor Quality, and in turn, improve sustainability performance. Dominant empirical evidence has supported the positive contributions of each quality management practice to organizations' performance:

Top management leadership for quality plays a vital role in setting the quality goals and strategies of the organization to achieve the goals (Flynn et al., 1995). The support from top management would encourage behaviors and performance throughout the organization toward sustainability goals. The positive influence of top management leadership for quality on other quality management practices and performance is well supported by empirical evidence in Zehir et al. (2012), Phan et al. (2011), Kaynak (2003), and Anderson et al. (1995).

Providing *Training on quality* will enhance skills of employees, especially quality-related skills. Having a good policy on internal human resource is a contribution to social sustainability. In addition, by improving skills, employees would improve the accuracy of the production processes, and in turns, reduce defects and increase the quality performance in general. This contributes to environmental and economic sustainability. This argument is supported in the literature by Kaynak (2003), De Cerio (2003), and Flynn et al. (1995).

The importance of *Design* for high quality and defect-free product was emphasized by both Joseph Juran and Genichi Taguchi (Foster, 2013). As a result, it would contribute to a reduction in wastes and material consumption, and in turns, contribute to environmental sustainability. In addition, design for producibility and simplify would better standardize components, make it easier to produce, and lead to higher process efficiency (Kaynak, 2003; Ahire and Dreyfus, 2000; Flynn *et al.*, 1995). The positive contribution of product design was demonstrated by Sanchez-Rodriguez and Martinez-Lorente (2011) and Zu (2009).

Quality data and reporting refers to the availability of information on the quality-related performance which would help managers make appropriate decisions timely based on the facts (Samson and Terziovski, 1999) and quickly detect and prevent quality problems (Phan et al., 2011; Yeung et al., 2005; Flynn et al., 1995). This contributes to not only the improvement of economic efficiency but also environmental performance through defect reduction.

Seven tools for statistical quality control were developed and disseminated by Kaoru Ishikawa (Foster, 2013). Thorough *process control* using statistical techniques is postulated to reduce process variance which, in turns, prevents defective components or products (Phan et al., 2011; Flynn et al., 1995). As a result, economic and environmental performance would be improved by reduction of material consumption as well as waste emission. The positive impact of process control on is supported by empirical studies by Baird et al. (2011), Zehir et al. (2012), Miyagawa and Yoshida (2010), Kaynak (2003), Fuentes et al. (2006), and Yeung et al. (2005).

With *continuous improvement*, organizations take never-ending efforts to improve their products and processes which, in turns, are expected to result in better overall sustainability performance. The contribution of continuous improvement is indicated in Agus and Hassan (2011), Hung et al. (2011), and Rungtusanatham et al. (2005).

Problem-solving teams are usually formed with cross-functional members to deal with quality-related problems. Finding and addressing the causes of problems would prevent a repetition of the same defect type, leading to an improvement in both environmental and economic performance. This argument is supported by Flynn et al. (1995) and Phan et al. (2011).

Rewards are incentives for good ideas or performance with a purpose to encourage working attitudes of employees. This practice would promote overall performance, and especially contribute to social performance through employee satisfaction. The contribution of rewards is indicated in Flynn et al. (1995), Nguyen and Robinson (2010).

Based on the literature, hypotheses for the impact of QM practices on SP are stated as followed:

- *H1a: QM practices positively impact on economic performance*
- *H1b: QM practices positively impact on environmental performance*
- *H1c: QM practices positively impact on social performance*

When experience time with QM implementation is taken into consideration as a moderating variable, it is likely that companies with a couple of years implementing QM often experience a lot of changes in both practices and performance. They try to comprehensively improve the whole systems which would lead to some significant achievements. Once they achieve a certain higher performance level than before QM implementation, the contributions of QM practices, then, are not so obvious as at the early stage. Organizations with the longer time experience in QM would see little improvement or even stable practices and performance. From this argument, hypotheses for the effect of QM experience timeline on the relationship between QM practices and SP are stated as followed:

- *H2a: Companies with shorter QM experience time have higher level of QM practices implementation than the ones with longer time experience*
- *H2b: Companies with shorter QM experience time see more significant impact of QM practices on SP than the ones with longer time experience*

Characteristics of organizations are suggested to have some effect on QM implementation (Quazi et al., 2002). Firm's size and type of industry have been demonstrated to influence QM implementation by Sharma (2006), Sila (2007), and Daniel et al. (2014). As such, hypotheses for the effect of industry and size on the relationship between QM practices and SP are stated as followed:

- *H3a: There are significant differences in level of QM practices implementation across groups with different types of industry*
- *H3b: There are significant differences in the impact of QM practices on SP across groups with different types of industry*
- *H4a: There are significant differences in level of QM practices implementation across groups with different firm size*
- *H4b: There are significant differences in the impact of QM practices on SP across groups with different firm size*

4.3. Hypothesis testing

4.3.1. The impact of QM practices on sustainability performance

In this section, Hypotheses H1a, H1b, and H1c on the impact of QM practices on SP will be tested.

H1a: QM practices positively impact on economic performance

H1b: QM practices positively impact on environmental performance

H1c: QM practices positively impact on social performance

Prior to test hypotheses by regression analysis, correlation analysis was conducted to check correlations among quality management practices. As the results in Table 3-7 (Chapter 3), eight QM practices are significantly correlated with each other. The correlation coefficients ranged from 0.404 to 0.676 (significant at 5%). The results raise a possibility of multi-collinearities among independent variables which affect the results of the regression analysis. Therefore, in this study, the Variance Inflation Factor (VIF) values were calculated to examine this possibility. Values of VIF in Table 4-1 are all smaller than the threshold of 4 - the acceptable VIF value, indicating that multi-collinearities do not have an undue effect on regression results.

Regression analysis was adopted to investigate the relationship between QM practices and SP and test the H1a, H1b, and H1c hypotheses. Seven multiple regression models were established with independent variables are 8 constructs of QM practices: Top management support for QM, Training on quality, Product/service design, Quality data and reporting, Process management, Continuous improvement, Problem solving, and Rewards; and dependent variable for each model is Economic return, Cost reduction, Market performance, Emission reduction, Resource consumption reduction, Internal social performance, and External social performance. Regression analysis results are presented in Table 4-1.

In general, QM practices have statistically significant impact on economic performance in terms of economic return, cost reduction, and market performance; on environmental performance in terms of resource consumption reduction; and social performance in terms of internal and external social performance at 5% significant level. Meanwhile, QM practices do not show a statistical effect on emission reduction (significant value of this regression model is 0.74).

Table 4-1: Regression analysis on the impact of QM practices on SP

	Economic			Environmental		Social		
	Return	Cost Reduction	Market Perf.	Emission Reduction	Resource Consumption Reduction	Internal Social Perf.	External Social Perf.	
R	0.49	0.35	0.52	0.21	0.39	0.53	0.60	
R2	0.25	0.12	0.27	0.04	0.15	0.28	0.36	
df	117	117	117	117	117	117	117	
Sig.	0.00	0.05	0.00	0.74	0.01	0.00	0.00	
	Coef.	**Coef.**	**Coef.**	**Coef.**	**Coef.**	**Coef.**	**Coef.**	**VIF**
Constant	2.13	2.48	1.92	2.97	4.23	1.40	1.68	
Top management support for QM	-0.15	0.18	0.09	-0.04	-0.17	0.30**	0.08	2.220
Training on quality	0.26**	-0.32**	0.11	-0.08	-0.22	-0.11	0.19**	2.638
Product/service design	0.32**	-0.12	0.15*	0.18	0.15	0.13	0.16**	2.460
Quality data and reporting	-0.02	0.44**	0.03	0.06	0.39**	-0.12	0.03	2.327
Process management	0.02	-0.27**	-0.05	0.02	-0.10	0.21*	0.03	2.725
Continuous improvement	0.08	0.00	0.21**	-0.22	-0.15	0.12	0.21**	2.848
Problem solving	-0.27**	0.17	0.08	0.10	0.01	0.02	0.00	2.517
Rewards	0.17**	0.06	0.02	0.08	-0.23**	0.05	0.00	1.645

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

❖ The impact of QM practices on Economic return: From the Table 4.1, R-square is 0.25 indicating that these QM practices would explain 25% of the variance in economic return. Among eight QM practices, the impact of Training on quality, Product/service design, Problem solving, and Rewards on economic return are significant at 5% confident interval while the other QM practices reveal no statistically significant impact on economic return. Product/service design shows the most significant impact on economic return with the highest beta coefficient value of 0.32. Following are Training and Rewards with positive coefficient values of 0.26 and 0.17, respectively, and Problem solving with a negative coefficient value of -0.27.

- ❖ The impact of QM practices on Cost reduction: R-square of this regression model is 0.12, indicating that these QM practices would explain 12% of the variance in cost reduction. Among eight QM practices, Training on quality, Quality data and reporting, and Process management illustrate significant effect on cost reduction at 5% confident interval whereas the other practices have no statistically significant impact. Quality data and reporting presents the most significant impact on cost reduction with the highest beta coefficient value of 0.44. Training on quality and Process management follows by strong but negative impact with coefficient values of -0.32 and -0.27, respectively.

- ❖ The impact of QM practices on Market performance: R-square of this regression model is 0.27 indicating that these QM practices would explain 27% of the variance in market performance. Continuous improvement shows the most significant impact on market performance with a beta coefficient of 0.21 (at 5% confident interval), followed by Product/service design with beta coefficient of 0.15 (at 10% confident interval). The other QM practices do not show statistically significant impact on market performance.

- ❖ The impact of QM practices on Resource consumption reduction: R-square of this regression model stands for 0.15, indicating that QM practices would explain 15% of the variance in resource consumption reduction. Among eight QM practices, Quality data and reporting and Rewards illustrate a statistically significant impact on resource consumption reduction but in opposite directions. On the one hand, quality data and reporting presents a positive impact with a beta coefficient of 0.39; on the other hand, Rewards shows a negative one with beta coefficient of -0.23.

- ❖ The impact of QM practices on Internal social performance: R-square of this model is 0.28, indicating that these QM practices would explain 28% of the variance in internal social performance. Among QM practices, Top management support for QM plays the most important role with the highest beta coefficient of 0.30 (significant at 5%). In addition, Process management has a smaller influence with a coefficient of 0.21 (significant at 10%). The other QM practices do not show a statistically significant impact on internal social performance.

- ❖ The impact of QM practices on External social performance: R-square of this model is 0.36, indicating that these QM practices would explain 36% of the variance in external social performance. Among eight QM practices, Training on quality, Product/service design, and Continuous improvement show statistically impact on external social performance (significant at 5%). Continuous improvement has the strongest influence with a beta coefficient of 0.21, followed by Training on quality and Product/service design with beta coefficients of 0.19 and 0.16, respectively.

In summary, QM practices statistically affect sustainability performance even though different practices show different impacts on dimensions of sustainability performance. As the results indicated, hypothesis H1a could not be rejected with four practices: Product/service design, Quality data and reporting, Continuous improvement, and Rewards. Hypothesis H1b could not be rejected with Quality data and reporting practices. Hypothesis H1c could not be rejected with Top management support for quality management, Training on quality, Product/service design, Process management, and Continuous improvement.

4.3.2. Timeline effect on QM practices

In this section, Hypotheses on the effects of QM experience time on the relationship between QM practices and SP will be tested.

H2a: Companies with shorter QM experience time have higher level of QM practices implementation than the ones with longer time experience.

H2b: Companies with shorter QM experience time see more significant impact of QM practices on SP than the ones with longer time experience.

To test the hypothesis H2a, One-way ANOVA test with Turkey pairwise comparison technique is conducted to compare QM practices implementation level across three groups: *Group T1:* Less than 5 years with 38 companies (accounted for 26.4%), *Group T2:* From 5 to 10 years with 35 companies (accounted for 24.3%), *Group T3:* More than 10 years with 29 companies (accounted for 20.1%).

The analysis result shows that there is no significant difference across three groups. Hypothesis H2a is rejected.

Table 4-2: Differences in QM practices implementation level across different timeline groups

Dependent Variable	I	J	Mean Difference (I-J)	Std. Error	Sig.
Top management support for QM	Group T1	Group T2	-.06222	.12791	.878
		Group T3	-.10458	.13462	.718
	Group T2	Group T3	-.04236	.13710	.949
Training on quality	Group T1	Group T2	-.05589	.13482	.910
		Group T3	-.01845	.14189	.991
	Group T2	Group T3	.03744	.14450	.964
Product/service design	Group T1	Group T2	.10437	.13121	.707
		Group T3	.04217	.13957	.951
	Group T2	Group T3	-.06220	.14046	.898
Quality data and reporting	Group T1	Group T2	.00846	.13885	.998
		Group T3	-.15041	.14614	.560
	Group T2	Group T3	-.15887	.14883	.536
Process management	Group T1	Group T2	-.03033	.13553	.973
		Group T3	-.17877	.14264	.425
	Group T2	Group T3	-.14844	.14526	.565
Continuous improvement	Group T1	Group T2	.10617	.15757	.779
		Group T3	-.04319	.16584	.963
	Group T2	Group T3	-.14936	.16889	.651
Problem solving	Group T1	Group T2	.06109	.16056	.923
		Group T3	-.01335	.16743	.997
	Group T2	Group T3	-.07444	.16854	.898
Rewards	Group T1	Group T2	.05689	.17219	.942
		Group T3	-.12734	.18123	.762
	Group T2	Group T3	-.18424	.18456	.580

Table 4-3: The impact of QM practices on SP among different timeline groups

	Economic			Environmental		Social	
	Return	Cost Reduction	Market Perf.	Emission Reduction	Resource Consumption Reduction	Internal Social Perf.	External Social Perf.
R	0.68	0.61	0.70	0.57	0.54	0.65	0.70
R2	0.46	0.37	0.49	0.32	0.29	0.42	0.48
Adjusted R2	0.25	0.12	0.29	0.06	0.02	0.20	0.28
df	67	67	67	67	67	67	67
Sig.	0.005	0.099	0.002	0.245	0.402	0.021	0.002
	Coef.	**Coef.**	**Coef.**	**Coef.**	**Coef.**	**Coef.**	**Coef.**
(Constant)	2.621	2.770	.607	.845	3.478	.568	1.666
T2	-.926	-.916	2.388	1.596	.563	1.895	.321
T3	.305	-1.416	.168	2.817	-.916	1.286	-.242
TOPQ	-.005	-.349	.216	-.248	-.668	.706	-.160
TRAIN	.580	-.086	.173	.106	-.060	.153	.566
DEGN	-.112	-.026	.382	.343	.131	-.258	-.215
QDAT	-.183	.301	-.098	.398	.615	-.201	-.139
PCMT	.337	-.358	.039	-.183	.092	.378	.597
CONTI	-.299	-.029	.025	-.068	-.049	.122	-.365
PROB	-.176	.675	.056	.155	.009	-.181	-.009
REW123	.230	-.050	.032	.114	-.159	.113	.332
T2xTOPQ	-.075	.345	-.400	-.300	.852	-.713**	.315
T2xTRAIN	-.818**	-.341	-.073	-.363	-.619	-.548	-.773***
T2xDEGN	.615**	-.113	.018	.313	-.026	.284	.458
T2xQDAT	.466	.684	.403	-.056	-.362	.428	.154
T2xPCMT	-.424	.199	-.108	.575	-.080	-.506	-.705**
T2xCONTI	.290	-.616	-.044	-.947	.157	.166	.926***
T2xPROB	-.069	-.123	-.269	.398	.180	.427	-.279
T2xREW	.169	.224	-.100	.028	-.326	-.018	-.264
T3xTOPQ	-.388	.958	.282	.469	.821	-.653	.206
T3xTRAIN	.273	-.726	-.425	-.561	-.237	-.230	-.614
T3xDEGN	.313	.451	-.369	.068	.515	.266	.193
T3xQDAT	-.141	-.275	.267	-.902	-.338	.221	.090
T3xPCMT	.105	-.038	-.218	.526	-.314	-.277	-.352
T3xCONTI	.622**	.154	.088	.490	-.053	-.116	.872***
T3xPROB	-.601	-.380	.162	-.552	-.340	.194	-.035
T3xREW	-.354	.121	.082	-.265	.052	.243	-.408

Note: TOPQ: Top management support for QM; TRAIN: Training on quality; DEGN: Product/service design; QDAT: Quality data and reporting; PCMT: Process management; CONTI: Continuous improvement; PROB: Problem solving; and REW: Rewards.

To test the hypothesis H2b, regression analysis with pool sample is conducted with dummy variables for Group T2 (From 5 to 10 years) and Group T3 (More than 10 years) to compare the difference between Group T2 and Group T3 (longer QM implementation experience timeline) with Group T1. Analysis results show that QM practices have significantly different impact on economic return and social performance across three groups.

Regarding economic return, Group T2 experienced weaker impact of Training on quality (coefficient of -0.818) but stronger impact of Product/service design (coefficient of 0.615) compared to Group T1, and Group T3 experienced stronger impact of Continuous improvement (coefficient of 0.622) compared to Group T1.

About social performance, Top management support for quality, Training on quality, and Process management show weaker impact in Group T2 (with coefficients of -0.713, -0.773, and -0.705, respectively) in comparison to Group T1 whereas Continuous improvement indicate stronger impact in both Group T2 and T3 compared to Group T1 (with coefficients of 0.926 and 0.872, respectively).

In summary, as the results indicated, there is no significant difference in QM implementation level across three groups, it can be concluded that Hypothesis 2a is rejected. With respect to the difference in the impact of QM practices on SP, the results are mixed: Group T1 with less than 5-year experience time recognized stronger influence of Top management support for quality, Training on quality, and Process management than Group T2 with longer experience time. Meanwhile, Product/service design and Continuous improvement have stronger effect in groups with more than 5-year experience than in Group T1. Therefore, hypothesis H2b could not be rejected with three practices: Top management support for quality, Training on quality, and Process management. As such, it can be stated that there are some significant differences in the impact of QM practices on sustainability performance across three groups with different QM experience time.

4.3.3. Industrial effect on QM practices

In this section, hypotheses on the effects of type of industry on the relationship between QM practices and SP will be tested.

- *H3a: There are significant differences in level of QM practices implementation across groups with different types of industry*
- *H3b: There are significant differences in the impact of QM practices on SP across groups with different types of industry*

To test the hypothesis H3a, One-way ANOVA test with Turkey pairwise comparison technique is conducted to compare QM practices implementation level across four groups based on type of industry: Group I1: Industrial with 64 companies (accounted for 44.4%), Group I2: Consumer goods with 30 companies (stood at 20.8%), Group I3: Basic materials with 25 companies (accounted for 17.4%), and Group I4: Consumer services with 22 companies (represented 15.3%). The analysis result shows that there is no significant difference across four groups. Hypothesis H3a is rejected.

Table 4-4: Difference in QM practices implementation level across four type-of-industry groups

Dependent Variable	I	J	Mean Difference (I-J)	Std. Error	Sig.
Top management support for QM	Group I1	Group I2	.06771	.12769	.952
		Group I3	.06104	.13611	.970
		Group I4	.12831	.14262	.805
	Group I2	Group I3	-.00667	.15628	1.000
		Group I4	.06061	.16198	.982
	Group I3	Group I4	.06727	.16870	.978
Training on quality	Group I1	Group I2	-.03281	.12968	.994
		Group I3	.04385	.13823	.989
		Group I4	-.01160	.14485	1.000
	Group I2	Group I3	.07667	.15871	.963
		Group I4	.02121	.16451	.999
	Group I3	Group I4	-.05545	.17133	.988
Product/service design	Group I1	Group I2	.08257	.13745	.932
		Group I3	.13540	.14464	.785
		Group I4	-.13839	.15987	.823
	Group I2	Group I3	.05283	.16541	.989
		Group I4	-.22096	.17889	.606
	Group I3	Group I4	-.27379	.18447	.450
Quality data and reporting	Group I1	Group I2	-.05651	.13968	.978
		Group I3	.13516	.14889	.801
		Group I4	-.08984	.15602	.939

Dependent Variable	I	J	Mean Difference (I-J)	Std. Error	Sig.
	Group I2	Group I3	.19167	.17095	.677
		Group I4	-.03333	.17719	.998
	Group I3	Group I4	-.22500	.18454	.616
Process management	Group I1	Group I2	-.00556	.13447	1.000
		Group I3	.01167	.14333	1.000
		Group I4	-.00985	.15020	1.000
	Group I2	Group I3	.01722	.16458	1.000
		Group I4	-.00429	.17059	1.000
	Group I3	Group I4	-.02152	.17766	.999
Continuous improvement	Group I1	Group I2	-.00396	.15012	1.000
		Group I3	.10804	.16002	.906
		Group I4	.12150	.16768	.887
	Group I2	Group I3	.11200	.18373	.929
		Group I4	.12545	.19044	.912
	Group I3	Group I4	.01345	.19834	1.000
Problem solving	Group I1	Group I2	-.04667	.17158	.993
		Group I3	.19267	.17625	.694
		Group I4	.16444	.19898	.842
	Group I2	Group I3	.23933	.20550	.650
		Group I4	.21111	.22530	.785
	Group I3	Group I4	-.02822	.22887	.999
Rewards	Group I1	Group I2	-.09031	.16876	.950
		Group I3	-.12571	.17776	.894
		Group I4	.04762	.19302	.995
	Group I2	Group I3	-.03540	.20524	.998
		Group I4	.13793	.21859	.922
	Group I3	Group I4	.17333	.22561	.869

To test the hypothesis H3b, Chow test is conducted to determine whether the data is structurally stable or break (Chow, 1960). After dividing the pooled sample into four sub-groups representing for four types of industry, regression models are established to compare the impact of QM practices on SP across four sub-groups.

After calculating F-statistic (formula was provided in Chapter 3), this value is compared with F(k, n-i*k) given by F table. In the regression models of moderating effects from types of industry, a critical value of F(k, n-i*k) is F(8, 93) which almost equals to F (8, 100) = 2.03 (significant at 5%). If calculated F-statistic is greater than 2.03, that means there is a structural break in the data, and it could be concluded that the impact of QM practices on SP is different among four sub-groups. The results in detailed are as followed:

Table 4-5: Moderating effect of type of industry on the relationship between QM practices and Economic return

	Group 1: Industrial	Group 2: Consumer goods	Group 3: Basic materials	Group 4: Consumer services
R	0.670	0.780	0.680	0.449
R2	0.450	0.608	0.463	0.202
Adjusted R2	0.354	0.433	0.194	-0.710
Residual sum of square	9.642	2.992	4.790	5.764
df	46	18	16	7
Sig.	0.000	0.013	0.169	0.975
	Coef.	**Coef.**	**Coef.**	**Coef.**
(Constant)	2.176	2.481	1.968	4.252
Top management support for QM	-.046	-.613***	.155	.303
Training on quality	.114	.515**	.667	.076
Product/service design	.564***	.108	-.317	.101
Quality data and reporting	-.159	-.116	.004	-.025
Process management	-.212	.240	-.361	.263
Continuous improvement	.128	.471	.128	-.381
Problem solving	-.357**	-.178	-.109	-.436
Rewards	.350***	-.045	.260	-.005

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

F = 5.05 > F (8, 100) = 2.03. The result indicates that the impacts of QM practices on Economic return are significantly different among four sub-groups. QM practices have significant impact on Economic return in the Industrial and Consumer goods groups while reveal insignificant impact in the Basic material and Consumer services groups. Specifically, from the results, it is possible to identify positive determinants of QM practices to Economic return are Product/service design and Rewards in the Industrial group (with coefficient of 0.564 and 0.350, respectively), and Training in the Consumer goods group (with coefficient of 0.515).

Table 4-6: Moderating effect of type of industry on the relationship between QM practices and Cost reduction

	Group 1: Industrial	Group 2: Consumer goods	Group 3: Basic materials	Group 4: Consumer services
R	0.472	0.785	0.741	0.781
R2	0.223	0.617	0.548	0.610
Adjusted R2	0.088	0.446	0.323	0.164
Residual sum of square	23.772	4.236	4.403	2.913
df	46	18	16	7
Sig.	0.138	0.011	0.062	0.347
	Coef.	**Coef.**	**Coef.**	**Coef.**
(Constant)	2.163	2.504	2.374	2.360
Top management support for QM	-.044	-.076	.862**	.065
Training on quality	-.505	.137	-.561*	-.129
Product/service design	-.075	.471	-.569**	1.149
Quality data and reporting	.476	.473*	.503**	-.430
Process management	-.078	-1.073**	-.382	-.104
Continuous improvement	-.033	-.880	.234	-.167
Problem solving	.337	.783**	-.177	.120
Rewards	.152	.327	.168	-.456

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

$F = 6.30 > F(8, 100) = 2.03$. The result indicates that the impacts of QM practices on Cost reduction are significantly different among four sub-groups. QM practices have significant impact on Cost reduction in Consumer goods and Basic materials groups. Quality data and reporting is identified as a contributor to Cost reduction in both groups. Moreover, Top management support for QM is critical for the Basic materials, and Problem solving is important in the Consumer goods group with respect to Cost reduction purpose. QM practices, meanwhile, reveal insignificant impact in the other two sub-groups of Industrial and Consumer services groups.

Table 4-7: **Moderating effect of type of industry on the relationship between QM practices and Market performance**

	Group 1: Industrial	Group 2: Consumer goods	Group 3: Basic materials	Group 4: Consumer services
R	0.354	0.677	0.733	0.934
R2	0.125	0.458	0.537	0.873
Adjusted R2	-0.027	0.218	0.306	0.728
Residual sum of square	10.786	5.898	2.469	.475
df	46	18	16	7
Sig.	0.586	0.122	0.072	0.014
	Coef.	**Coef.**	**Coef.**	**Coef.**
(Constant)	3.002	1.103	2.793	.544
Top management support for QM	-.076	.104	-.333	-.082
Training on quality	.153	.138	.614**	.076
Product/service design	.138	-.575	.117	.324
Quality data and reporting	.069	-.245	-.193	.366*
Process management	-.191	.278	.197	.101
Continuous improvement	.147	.288	.241*	-.016
Problem solving	-.033	.422	-.194	-.040
Rewards	.045	.242	-.165	.102

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

$F = 3.03 > F(8, 100) = 2.03$. The result indicates that the impacts of QM practices on Market performance are significantly different among four sub-groups. QM practices have significant impact on Market performance in the Basic materials group (significant at 10%) and in the Consumer services group (significant at 5%). In the Basic materials groups, Training and Continuous improvement have positive influence on Market performance (with coefficient of 0.614 and 0.241, respectively). In the Consumer services group, Quality data and reporting is identified as a determinant for Market performance. Meanwhile, insignificant impact of QM practices on Market performance is found.

Table 4-8: Moderating effect of type of industry on the relationship between QM practices and Emission reduction

	Group 1: Industrial	Group 2: Consumer goods	Group 3: Basic materials	Group 4: Consumer services
R	0.199	0.616	0.508	0.776
R2	0.040	0.379	0.258	0.602
Adjusted R2	-0.127	0.103	-0.113	0.147
Residual sum of square	34.699	7.635	6.632	5.185
df	46	18	16	7
Sig.	0.982	0.272	0.692	0.362
	Coef.	**Coef.**	**Coef.**	**Coef.**
(Constant)	3.524	4.341	2.526	1.638
Top management support for QM	-.036	-.635	.365	-.061
Training on quality	-.230	.761	-.092	-.519
Product/service design	-.152	.202	.082	.866
Quality data and reporting	-.044	-.966	-.035	.971
Process management	.263	-.018	-.381	.417
Continuous improvement	.101	-.593	-.276	-.282
Problem solving	-.140	.658	.436	-.685
Rewards	.182	.397	.065	-.309

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

F = 3.42 > F (8, 100) = 2.03. The result indicates that the impacts of QM practices on Emission reduction are significantly different among four sub-groups. However, insignificant impact of QM practices on Emission reduction is found in all four groups.

Table 4-9: Moderating effect of type of industry on the relationship between QM practices and Resource consumption reduction

	Group 1: Industrial	Group 2: Consumer goods	Group 3: Basic materials	Group 4: Consumer services
R	0.304	0.728	0.862	0.853
R2	0.093	0.530	0.743	0.728
Adjusted R2	-0.065	0.321	0.615	0.418
Residual sum of square	32.403	5.116	2.889	2.288
df	46	18	16	7
Sig.	0.784	0.048	0.001	0.139
	Coef.	**Coef.**	**Coef.**	**Coef.**
(Constant)	4.644	4.672	6.038	3.217
Top management support for QM	-.333	-.522*	-.043	-.407
Training on quality	-.257	.961***	-.408	-.640
Product/service design	.038	.091	-.017	.888
Quality data and reporting	.206	.094	.548***	.567
Process management	.032	-.839**	-.480*	.570
Continuous improvement	-.078	.452	-.377**	.029
Problem solving	.176	-.583*	.316**	-.678
Rewards	-.195	-.128	-.320**	-.392

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

F = 4.84 > F (8, 100) = 2.03. The result indicates that the impacts of QM practices on Resource consumption reduction are significantly different among four sub-groups. QM practices have significant effect on Resource consumption reduction in Consumer goods and Basic materials groups (significant at 5%) but insignificant impact in the Industrial and Consumer services groups. Training on quality indicates the strongest positive impact in the Consumer goods group (with coefficient of 0.961, significant at 1%) while Quality data and reporting presents the strongest positive impact in the Basic materials groups (with coefficient of 0.548, significant at 1%). It is interesting that Problem solving, on the one hand, reveal a negative impact in the Consumer goods group, on the other hand, illustrate a positive impact in the Basic material groups. This may due to the natural of the two industries: Consumer goods seems to work closer with ultimate customers, they have a diversified customer demand, so there may be many kinds of problems which consume much time and effort to solving. On the other hand, Basic materials' customers are usually organizations, and it seems customer demand are not as diversified as Consumer goods. Therefore, once they can solve a problem, it would result in higher performance and contribute to reduce resources consumption.

Table 4-10: Moderating effect of type of industry on the relationship between QM practices and Internal social performance

	Group 1: Industrial	Group 2: Consumer goods	Group 3: Basic materials	Group 4: Consumer services
R	0.470	0.790	0.438	0.825
R2	0.221	0.624	0.192	0.680
Adjusted R2	0.086	0.457	-0.212	0.314
Residual sum of square	11.454	4.536	6.592	3.341
df	46	18	16	7
Sig.	0.141	0.010	0.856	0.214
	Coef.	**Coef.**	**Coef.**	**Coef.**
(Constant)	2.165	.767	2.171	2.489
Top management support for QM	.094	-.001	.413	.647
Training on quality	.006	.429*	-.254	-.354
Product/service design	.193	.130	.157	-1.332
Quality data and reporting	-.152	-.416	-.010	.680
Process management	.095	.280	.127	.479
Continuous improvement	.027	.574*	.070	-.136
Problem solving	.110	-.394	.081	.159
Rewards	.070	.084	-.133	.300

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

F = 4.14 > F (8, 100) = 2.03. The result indicates that the impacts of QM practices on Internal social performance are significantly different among four sub-groups. Significant values of regression models indicate that QM practices have significant impact in the Consumer goods group while reveal insignificant effect in the other groups. Continuous improvement and Training on quality are identified as determinants in the Consumer goods group.

Table 4-11: Moderating effect of type of industry on the relationship between QM practices and External social performance

	Group 1: Industrial	Group 2: Consumer goods	Group 3: Basic materials	Group 4: Consumer services
R	0.535	0.824	0.842	0.743
R2	0.286	0.679	0.709	0.553
Adjusted R2	0.162	0.536	0.564	0.041
Residual sum of square	8.463	3.001	1.660	1.986
df	46	18	16	7
Sig.	0.036	0.003	0.003	0.466
	Coef.	**Coef.**	**Coef.**	**Coef.**
(Constant)	2.047	1.248	1.068	.904
Top management support for QM	.000	.005	.556**	-.501
Training on quality	.111	-.004	.224	.382
Product/service design	-.038	.437	-.120	.303
Quality data and reporting	-.034	.188	.099	-.021
Process management	.135	-.059	-.763***	.258
Continuous improvement	.355**	.556	.203*	-.108
Problem solving	-.164	-.395*	.227**	.267
Rewards	.077	-.104	.194*	.225

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

F = 4.48 > F (8, 100) = 2.03. The result indicates that the impacts of QM practices on External social performance are significantly different among four sub-groups. QM practices have significant impact on External social performance in the Industrial, Consumer goods, and Basic materials groups while show insignificant impact in the Consumer services group. In the Industrial group, Continuous improvement show the strongest positive effect on External social performance (with coefficient of 0.355, significant at 5%). In the Basic materials group, QM practices present mixed impact with positive effect from Top management support for QM, Continuous improvement, Problem solving, and Rewards, and negative effect from Process management practices. In the Consumer goods group, Problem solving reveal a significant but negative impact with coefficient of -0.395, significant at 10%).

Table 4-12: Regression analysis on the impact of QM practices on SP across four type of industry groups with dummy variables

	Economic			Environmental		Social	
	Return	Cost Reduct.	Market Perf.	Emission Reduct.	Resource Consump. Reduct.	Internal Social Perf.	External Social Perf.
R	0.67	0.63	0.64	0.48	0.60	0.67	0.73
R2	0.44	0.40	0.41	0.23	0.36	0.45	0.54
Adjusted R2	0.23	0.17	0.18	-0.06	0.11	0.24	0.36
df	88	88	88	88	88	88	88
Sig.	0.004	0.022	0.015	0.783	0.096	0.002	0.000
	Coef.	**Coef.**	**Coef.**	**Coef.**	**Coef.**	**Coef.**	**Coef.**
(Constant)	2.115	2.066	3.005	3.374	4.460	2.101	2.065
I2	.242	.313	-.953	.629	.285	-.605	-.425
I3	-.049	.103	-.070	-.283	.526	.023	-.332
I4	.534	.073	-.615	-.434	-.311	.097	-.290
TOPQ	-.079	-.097	-.075	-.118	-.434	.059	.010
TRAIN	.205	-.359	.149	-.005	.019	.102	.085
DEGN	.583	-.045	.137	-.105	.095	.213	-.043
QDAT	-.174	.451	.069	-.082	.159	-.168	-.030
PCMT	-.223	-.095	-.191	.236	-.001	.083	.138
CONTI	.104	-.071	.148	.043	-.150	.002	.362
PROB	-.362	.329	-.033	-.153	.160	.104	-.163
REW	.345	.144	.045	.169	-.211	.065	.078
I2xTOPQ	-.212	.098	.088	-.123	.122	.028	-.018
I2xDEGN	-.209	.303	-.357	.223	.084	-.012	.232
I2xQDAT	.087	.104	-.159	-.299	.143	-.063	.092
I2xPCMT	.198	-.543*	.235	-.210	-.522	.063	-.089
I2xCONTI	.228	-.333	.068	-.208	.436	.333	.084
I2xPROB	.091	.225	.227	.403	-.375	-.250	-.116
I2xREW	-.204	.077	.099	.091	.013	0.00	-.089
I3xTOPQ	.078	.320	-.086	.161	.130	.118	.182
I3xTRAIN	.154	-.067	.155	-.029	-.143	-.119	.047
I3xDEGN	-.300***	-.175	-.006	.062	-.037	-.019	-.026
I3xQDAT	.059	.017	-.087	.016	.130	.053	.043
I3xPCMT	-.046	-.096	.129	-.205	-.160	.014	-.300***
I3xCONTI	.008	.102	.031	-.106	-.075	.023	-.053
I3xPROB	.085	-.169	-.054	.196	.052	-.008	.130
I3xREW	-.028	.008	-.070	-.035	-.036	-.066	.039
I4xTOPQ	.096	.041	-.002	.014	.007	.147	-.128
I4xTRAIN	-.032	.057	-.018	-.129	-.165	-.114	.074
I4xDEGN	-.120	.299*	.047	.243	.198	-.386***	.086
I4xQDAT	.037	-.220	.074	.263	.102	.212	.002
I4xPCMT	.121	-.002	.073	.045	.143	.099	.030
I4xCONTI	-.121	-.024	-.041	-.081	.045	-.034	-.118
I4xPROB	-.018	-.052	-.002	-.133	-.209	.014	.107
I4xREW	-.088	-.150*	.014	-.119	-.045	.059	.037

Note: I2: Consumer goods; I3: Basic materials; I4: Consumer services; TOPQ: Top management support for QM; TRAIN: Training on quality; DEGN: Product/service design; QDAT: Quality data and reporting; PCMT: Process management; CONTI: Continuous improvement; PROB: Problem solving; and REW: Rewards. *significant at 10%, ** significant at 5%, *** significant at 1% (2-tailed test)

To further examine the differences in QM implementation among four type of industry groups, regression analysis with pool sample is conducted with dummy variables for Group I2 (Consumer goods), Group I3 (Basic materials), and Group I4 (Consumer services) to compare the difference between Group I2, Group I3 and Group I3 with Group I1. Analysis results show that Group I1 (Industrial) experienced significantly different impact of QM practices on economic return, cost reduction, internal and external social performance (significant at 5% level) but no different impact on market performance and environmental performance, compared to the other three type-of-industry groups. With respect to *economic return*, the impact of Product/service design is weaker in the basic materials group compared to industrial group (with coefficient of -0.300 significant at 1%). About *cost reduction* performance, the consumer goods group experiences weaker impact of process management than the industrial group (with coefficient of -0.543, significant at 10%). In addition, the consumer services group sees stronger impact of Product/service design (coefficient of 0.299 significant at 10%) but weaker influence from Rewards (coefficient of -0.150 significant at 10%) compared to the industrial group. Regarding internal and external social performance, the effect of Product/service design on internal social performance is weaker in the consumer services group (coefficient of -0.386 significant at 1%), the effect of Process management on external social performance is weaker in the basic materials group (coefficient of -0.300 significant at 1%), compared to the industrial group.

In summary, as the results indicated, there is no significant difference in QM implementation level across four different industrial groups, it can be concluded that Hypothesis H3a is rejected. With respect to the difference in the impact of QM practices on SP, it can be stated that there are significant differences in the impact of QM practices on economic, environmental and social performance across four type of industrt groups. As such, hypothesis H3b cannot be rejected.

4.3.4. Size effect on QM practices

In this section, the effect from firm size on the QM practices will be tesed with following hypotheses:

- *H4a: There are significant differences in level of QM practices implementation across groups with different firm size*
- *H4b: There are significant differences in the impact of QM practices on SP across groups with different firm size*

To test the hypothesis H4a, One-way ANOVA test with Turkey pairwise comparison technique is conducted to compare QM practices implementation level across three groups: Small: Small size with no more than 50 employees (accounted for 58 companies, corresponding to 40.3% of the total respondents), Medium: Medium size companies with from 51 to 300 employees (accounted for 49 companies, corresponding to 34%), and Large: Large size companies with more than 300 employees (accounted for 37 companies, corresponding to 25.7%). The analysis results show that there are significant differences across three groups in the Process management and Continuous improvement practices. In addition, there are significant differences between medium and large size companies in terms of Quality data and reporting practice, and between small and large size companies in terms of Rewards practice. For all the differences, larger organizations reported higher implementation level compared to smaller ones.

To test the hypothesis H4b, Chow test is conducted to determine whether the data is structurally stable or break (Chow, 1960). After dividing the pooled sample into three sub-groups representing for three firm sizes, regression models are established to compare the impact of QM practices on SP across three sub-groups.

Table 4-13: Difference in QM practices implementation level across three different firm size groups

Dependent Variable	I	J	Mean Difference (I-J)	Std. Error	Sig.
Top management support for QM	Small	Medium	-.11292	.11100	.567
		Large	-.21680	.12036	.173
	Medium	Large	-.10388	.12459	.683
Training on quality	Small	Medium	.03835	.11210	.938
		Large	-.22383	.12155	.160
	Medium	Large	-.26218	.12583	.097
Product/service design	Small	Medium	-.05747	.12149	.884
		Large	-.18398	.13069	.340
	Medium	Large	-.12651	.13622	.623
Quality data and reporting	Small	Medium	.08152	.11951	.774
		Large	-.28340	.12959	.077
	Medium	Large	-.36491**	.13415	.020
Process management	Small	Medium	.02982	.11374	.963
		Large	-.31776**	.12334	.029
	Medium	Large	-.34758**	.12767	.020
Continuous improvement	Small	Medium	-.03950	.12539	.947
		Large	-.47102**	.13596	.002
	Medium	Large	-.43151***	.14074	.007
Problem solving	Small	Medium	.10771	.14765	.746
		Large	-.22266	.15894	.343
	Medium	Large	-.33036	.15751	.094
Rewards	Small	Medium	-.26705	.14432	.157
		Large	-.39148**	.15535	.034
	Medium	Large	-.12444	.15984	.717

After calculating F-statistic (formula was provided in Chapter 3), this value is compared with F(k, n-i*k) given by F table. In the regression models of moderating effects from firm size, critical value of F(k, n-i*k) is F(8, 101) which almost equals to F (8, 100) = 2.03 (significant at 5%). If calculated F-statistic is greater than 2.03, that means there is a structural break in the data, and it could be concluded that the impact of QM practices on SP is different among three sub-groups. The results in detailed are as followed:

Table 4-14: Moderating effect of Firm size on the relationship between QM practices and Economic return

	Group 1: Small size	Group 2: Medium size	Group 3: Large size
R	0.662	0.670	0.729
R2	0.438	0.449	0.531
Adjusted R2	0.320	0.323	0.387
Residual sum of square	7.366	8.874	6.899
df	38	35	26
Sig.	0.003	0.004	0.005
	Coef.	**Coef.**	**Coef.**
(Constant)	.704	1.351	3.074
Top management support for QM	-.078	.105	-.585**
Training on quality	.471***	.070	1.035**
Product/service design	.214*	.526**	.263
Quality data and reporting	-.179	.038	-.044
Process management	.268	-.383**	.168
Continuous improvement	-.318**	.311**	-.061
Problem solving	.140	-.296**	-.779***
Rewards	.295**	.196*	.187*

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

F = 5.52 > F (8, 100) = 2.03. The result indicates that the impacts of QM practices on Economic return are significantly different among three sub-groups. QM practices show significant but mixed impact on Economic return in all three sub-groups. Positive determinants in each group are different. For the Small size group, Training on quality and Rewards present strong positively effects with coefficients of 0.471 and 0.295, respectively (significant at 5%). In the Medium size group, Product/service design and Continuous improvement have positive influence with coefficient of 0.526 and 0.311, respectively (significant at 5%). And in the Large size group, Training on quality represents the strongest positive impact with coefficient of 1.035 (significant at 5%).

Table 4-15: Moderating effect of Firm size on the relationship between QM practices and Cost reduction

	Group 1: Small size	Group 2: Medium size	Group 3: Large size
R	0.508	0.443	0.646
R2	0.258	0.196	0.418
Adjusted R2	0.102	0.012	0.238
Residual sum of square	17.462	14.731	11.398
df	38	35	26
Sig.	0.143	0.408	0.049
	Coef.	**Coef.**	**Coef.**
(Constant)	3.418	2.306	1.304
Top management support for QM	-.431	.637	.499*
Training on quality	-.255	-.316	-.808*
Product/service design	-.027	-.418	-.005
Quality data and reporting	.672	.348	.594**
Process management	-.367	-.199	-.390
Continuous improvement	-.099	.057	-.267
Problem solving	.491	-.113	.685
Rewards	-.048	.148	.106

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

F = 3.15 > F (8, 100) = 2.03. The result indicates that the impacts of QM practices on Cost reduction are significantly different among three sub-groups. QM practices show significant impact on Cost reduction in the Large size group whereas reveal insignificant effect on the other two groups with smaller firm size. For the Large size group, Quality data and reporting indicates the strongest positive impact on Cost reduction with coefficient of 0.594 (significant at 5%).

Table 4-16: Moderating effect of Firm size on the relationship between QM practices and Market performance

	Group 1: Small size	Group 2: Medium size	Group 3: Large size
R	0.416	0.725	0.610
R2	0.173	0.526	0.372
Adjusted R2	-0.001	0.417	0.179
Residual sum of square	9.045	5.753	6.670
df	38	35	26
Sig.	0.455	0.000	0.099
	Coef.	**Coef.**	**Coef.**
(Constant)	2.256	1.395	1.356
Top management support for QM	.044	.034	.477
Training on quality	.294	-.046	-.255
Product/service design	.021	.078	.147
Quality data and reporting	-.023	.161	.058
Process management	-.089	-.010	.119
Continuous improvement	.082	.412***	.231
Problem solving	.091	-.037	-.374
Rewards	.004	.040	.157

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

F = 1.92 < F (8, 100) = 2.03. The result indicates that the impacts of QM practices on Market performance are not significantly different among three sub-groups. However, the impact of QM practices on Market performance across three firm size groups are still somehow different because the F value of 1.92 is very close to the critical F value of 2.03. For example, QM practices show significant impact in the Medium size group (significant at 1%), in the Large size group (significant at 10%), while reveal insignificant impact in the Small size group. In the Medium size group, Continuous improvement illustrates the strongest positive impact on market performance (with coefficient of 0.412, significant at 1%).

Table 4-17: Moderating effect of Firm size on the relationship between QM practices and Emission reduction

	Group 1: Small size	Group 2: Medium size	Group 3: Large size
R	0.389	0.264	0.428
R2	0.151	0.070	0.184
Adjusted R2	-0.028	-0.143	-0.068
Residual sum of square	29.289	18.484	15.312
df	38	35	26
Sig.	0.569	0.950	0.664
	Coef.	**Coef.**	**Coef.**
(Constant)	2.556	2.455	2.997
Top management support for QM	-.202	.231	-.277
Training on quality	-.023	.076	-.018
Product/service design	-.094	.152	.626
Quality data and reporting	.127	-.120	.121
Process management	.075	-.122	.295
Continuous improvement	-.511	-.232	-.073
Problem solving	.558	.088	-.380
Rewards	.307	.122	-.208

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

$F = 1.40 < F(8, 100) = 2.03$. The result indicates that the impacts of QM practices on Emission reduction are not different among three sub-groups. QM practices show insignificant impact in all three sub-groups.

Table 4-18: Moderating effect of Firm size on the relationship between QM practices and Resource consumption reduction

	Group 1: Small size	Group 2: Medium size	Group 3: Large size
R	0.511	0.600	0.488
R2	0.262	0.360	0.238
Adjusted R2	0.106	0.213	0.004
Residual sum of square	24.258	11.454	13.673
df	38	35	26
Sig.	0.135	0.032	0.447
	Coef.	**Coef.**	**Coef.**
(Constant)	3.727	4.679	2.117
Top management support for QM	-.614	.203	-.133
Training on quality	.089	-.621***	.156
Product/service design	.268	-.230	.503
Quality data and reporting	.666	.496**	.259
Process management	-.406	-.157	-.088
Continuous improvement	-.220	-.099	.295
Problem solving	.538	-.064	-.443
Rewards	-.466	.021	-.443

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

F = 2.83 > F (8, 100) = 2.03. The result indicates that the impacts of QM practices on Resource consumption reduction are significantly different among three sub-groups. QM practices show significant impact on Resource consumption reduction in the Medium size group while reveal insignificant impact in the Small and Large size groups. In the Medium size group, on the one hand, Training has negative effect on Resource consumption reduction (with coefficient of -0.621, significant at 1%), on the other hand, Quality data and reporting show positive impact (with coefficient of 0.496, significant at 5%).

Table 4-19: Moderating effect of Firm size on the relationship between QM practices and Internal social performance

	Group 1: Small size	Group 2: Medium size	Group 3: Large size
R	0.748	0.537	0.694
R2	0.560	0.288	0.481
Adjusted R2	0.468	0.125	0.321
Residual sum of square	7.697	15.082	5.130
df	38	35	26
Sig.	0.000	0.117	0.016
	Coef.	**Coef.**	**Coef.**
(Constant)	-.565	1.573	1.362
Top management support for QM	.460***	.389	.371*
Training on quality	.237*	-.221	-.384
Product/service design	.036	.331	.146
Quality data and reporting	-.243*	-.318	.048
Process management	.459**	.093	.151
Continuous improvement	-.103	.149	.508**
Problem solving	.199	.093	-.471**
Rewards	.074	-.006	.187*

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

$F = 3.27 > F(8, 100) = 2.03$. The result indicates that the impacts of QM practices on Internal social performance are significantly different among three sub-groups. QM practices have significant effect in the Small and Large size groups while illustrate insignificant impact in the Medium size group. In the Small size group, Top management support for QM and Process management show strongly positive impact on Internal social performance (with coefficient of 0.460 and 0.459, respectively). In the Large size group, Continuous improvement illustrates the strongest significant impact with coefficient of 0.508 (significant at 5%).

Table 4-20: Moderating effect of Firm size on the relationship between QM practices and External social performance

	Group 1: Small size	Group 2: Medium size	Group 3: Large size
R	0.639	0.788	0.652
R2	0.409	0.622	0.426
Adjusted R2	0.284	0.535	0.249
Residual sum of square	5.626	4.456	6.015
df	38	35	26
Sig.	0.006	0.000	0.043
	Coef.	**Coef.**	**Coef.**
(Constant)	1.634	.990	1.208
Top management support for QM	-.244**	.112	.354
Training on quality	.398***	.023	-.320
Product/service design	.104	-.118	.261*
Quality data and reporting	.103	.014	.018
Process management	.045	.065	.277
Continuous improvement	.072	.389***	.369
Problem solving	.067	.178**	-.445**
Rewards	.048	.030	.076

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

F = 3.79 > F (8, 100) = 2.03. The result indicates that the impacts of QM practices on External social performance are significantly different among three sub-groups. QM practices show significant impact on External social performance in all three sub-groups, but determinants of each group are different. In the Small size group, QM practices present mixed impacts in which Training on quality show the strongest positive influence (with coefficient of 0.398, significant at 1%) but Top management support for QM reveals a negative impact (with coefficient of -0.244, significant at 5%). In the Medium size group, QM practices show significant but negative impact of Continuous improvement and Problem solving (with coefficient of 0.389 and 0.178, respectively, significant at 5%). In the Large size group, QM practices indicate mixed impacts with the strongest negative impact of Problem solving (coefficient of -0.445, significant at 5%) and positive impact of Product/service design (coefficient of 0.261, significant at 10%).

Table 4-21: Regression analysis on the impact of QM practices on SP across three different firm size groups with dummy variables

	Economic			Environmental		Social	
	Return	Cost Reduct.	Market Perf.	Emission Reduct.	Resource Consump. Reduct.	Internal Social Perf.	External Social Perf.
R	0.69	0.544	0.604	0.372	0.556	0.656	0.715
R2	0.48	0.296	0.364	0.138	0.309	0.430	0.511
Adjusted R2	0.34	0.111	0.198	-0.088	0.128	0.281	0.382
df	99	99	99	99	99	99	99
Sig.	0.000	0.052	0.003	0.925	0.033	0.000	0.000
	Coef.	**Coef.**	**Coef.**	**Coef.**	**Coef.**	**Coef.**	**Coef.**
(Constant)	.704	3.418	2.256	2.556	3.727	-.565	1.634
M	.647	-1.111	-.862	-.101	.952	2.138	-.644
L	2.370	-2.114	-.901	.441	-1.610	1.926	-.426
TOPQ	-.078	-.431	.044	-.202	-.614	.460	-.244
TRAIN	.471	-.255	.294	-.023	.089	.237	.398
DEGN	.214	-.027	.021	-.094	.268	.036	.104
QDAT	-.179	.672	-.023	.127	.666	-.243	.103
PCMT	.268	-.367	-.089	.075	-.406	.459	.045
CONTI	-.318	-.099	.082	-.511	-.220	-.103	.072
PROB	.140	.491	.091	.558	.538	.199	.067
REW	.295	-.048	.004	.307	-.466	.074	.048
MxTOPQ	.183	1.068***	-.011	.433	.817**	-.071	.356
MxTRAIN	-.401	-.061	-.340	.099	-.710*	-.458	-.374*
MxDEGN	.312	-.391	.057	.246	-.498	.295	-.222
MxQDAT	.217	-.324	.184	-.247	-.171	-.075	-.088
MxPCMT	-.651**	.168	.079	-.197	.249	-.366	.020
MxCONTI	.629**	.156	.330	.278	.121	.251	.317
MxPROB	-.436*	-.604*	-.128	-.470	-.602*	-.106	.110
MxREW	-.099	.196	.036	-.184	.487	-.080	-.018
LxTOPQ	-.507	.930**	.433	-.074	.481	-.088	.599**
LxTRAIN	.565	-.552	-.550	.005	.067	-.621	-.717*
LxDEGN	.049	.022	.126	.720	.235	.110	.157
LxQDAT	.135	-.078	.081	-.006	-.407	.291	-.085
LxPCMT	-.099	-.022	.207	.220	.318	-.308	.231
LxCONTI	.257	-.168	.149	.437	.515	.611	.297
LxPROB	-.919***	.194	-.464	-.938	-.981**	-.670**	-.512**
LxREW	-.108	.154	.153	-.514	.023	.112	.028

Note: M: Medium size; L: Large size; TOPQ: Top management support for QM; TRAIN: Training on quality; DEGN: Product/service design; QDAT: Quality data and reporting; PCMT: Process management; CONTI: Continuous improvement; PROB: Problem solving; and REW: Rewards. *significant at 10%, ** significant at 5%, *** significant at 1% (2-tailed test)

To further compare the impact of QM practices on SP across three groups, regression analysis with pool sample is conducted with dummy variables for Group Medium size and Group Large size organizations to compare the difference between Group Medium and Group Large size organizations with Group Small size ones. Analysis results show that Small size group experienced significantly different impact of QM practices on economic performance in terms of economic return and cost reduction, on environmental performance in terms of resource consumption reduction, and on both internal and external social performance (significant at 5% level), compared to the Medium and Large size groups.

With respect to economic return, Medium size companies experience weaker impact of Process management (coefficient of -0.651 significant at 5%) but stronger impact of Continuous improvement (coefficient of 0.629 significant at 5%), compared to Small size companies. Moreover, the effect of Problem solving in both the Medium and Large size companies is weaker compared to the Small size group (coefficient of -0.436 and -0.919, respectively).

About cost reduction, the influence of Top management support for QM in both the Medium and Large size groups is stronger than in the Small size group (with coefficient of 1.068 and 0.930, respectively, significant at 5%). The impact of Problem solving in the Medium size group, however, is weaker compared to the Small size group (coefficient of -0.604 significant at 10%).

Regarding resource consumption reduction, the Medium size group experiences stronger impact of Top management support for QM (coefficient of 0.817 significant at 5%) while weaker impact of Training on quality (coefficient of -0.710 significant at 10%) compared to the Small size group. Moreover, the effect of Problem solving in both the Medium and Large size groups is weaker than the Small size group (with coefficient of -0.602 and -0.981, respectively).

With social performance, data for the Large size group presented stronger impact of Top management support for QM (coefficient of 0.599 significant at 5%) but weaker impact of Problem solving (coefficient of -0.670 on internal social performance and 0.512 on external social performance, significant at 5%). Furthermore, both the Medium and Large size groups are under weaker effect from Training on quality compared to Small size group (with coefficients of -0.374 and -0.717, respectively, significant at 10%).

In summary, as the results indicated, there are some significant differences in QM *implementation level across three different size groups, it can be concluded that Hypothesis H4a cannot be rejected. With respect to the difference in the impact of QM practices on SP, it can be stated that there are significant differences in the impact of QM practices on economic return, Cost reduction, Resource consumption reduction, Internal and External social performance across three groups. As such, Hypothesis H4b cannot be rejected.*

4.4. Findings and Discussions

The analysis results show that QM practices have significant impact on dimensions of sustainability performance. It is likely that more QM practices have significant impact on economic performance, followed by social performance, and environmental performance. QM practices have mixed impact on economic and environmental performance while have positive impact on social performance.

Some QM practices show mixed impact on different dimensions of SP such as *Training on quality*, *Rewards*, and *Process management*. When the organizations provide more training, they would attain higher economic return but also have to exert higher cost. Offering more Rewards to employees seems to motivate them to bring back more return but also consume more resources. Rigorous Process management costs more, but would improve internal social performance of the organization. These facts would be understood as a trade-off of benefits among three aspects of the triple bottom line. This argument is supported by Schuler and Cording (2006) and Gong et al. (2016).

From the analysis results, four QM practices are identified with overall contribution to three dimensions of sustainability performance: *Top management support for QM*, *Product/service design*, *Quality data and reporting*, and *Continuous improvement*. The impact of these practices on SP does not include negative impact which implies that these practices do not lead to a sacrifice of any performance aspect. These practices would be considered as critical factors for the possibility of win-win scenario of the triple bottom line. The contributions of these practices are also highlighted in the literature. For instance, the role of top management support (Samson and Terziovski, 1999; Yeung *et al.*, 2005; Lakhal *et al.*, 2006); Product/service design (Flynn et al., 1995; Ahire and Dreyfus, 2000; Sanchez-Rodriguez and Martinez-Lorente, 2011); Quality data and reporting (Phan et al., 2011; Yeung et al., 2005); and Continuous improvement (De Cerio, 2003; Kaynak, 2003).

In the comparison between company groups with different QM experience time, it is interesting that the implementation levels of QM practices are somehow homogeneous among three groups regardless of experience time. This would be explained by the fact of labor market in Vietnam in which turn-over rate is rather low. Employees in Vietnamese companies usually change their jobs around 3 to 5 years. Therefore, the differences due to experience timeline may not be clearly recognized in the context of Vietnamese enterprises. Regarding the differences in the impact of QM practices on SP across three groups, it appears that the effect of *Training on quality*, *Top management support for QM* and *Process management* on SP in longer QM experience time companies is less significant. This finding supports the hypothesis of this study that companies with shorter QM experience time (less than 5 years) see more significant impact of QM practices on SP than the ones with longer time experience. The finding is supported by our previous research (Phan et al., 2016) in which we found that employee training and process control have the strongest effect in group with 2 to 5-year QM experience. As such, it would be concluded that companies with around 2 to 5-year experience would see the most significant contribution of Training on quality, Top management support and Process management to performance. Moreover, the impact of *Continuous improvement* on SP in longer experience time companies is more significant (especially on social performance). This finding is understandable because the effect of continuous improvement needs long time to be recognized.

Regarding the contextual effects of type of industry on QM implementation, the study found insignificant difference in the level of QM implementation across four type of industry groups. That means four examined type of industry groups have relatively homogenous attention to and investment in QM practices. Silla (2007) presented supported finding with similar level of TQM implementation across subgroups with different scope of operations. The impacts of QM practices on SP, however, are significantly different across four type of industry subgroups. For example, it appears that the Industrial group experienced stronger impact from Process management on cost reduction compared to Consumer goods; or stronger impact from Product/service design on economic return compared to Basic materials group. The differences would result from the nature of different types of industry. For instance, Industrial firms are characterized with more standardized processes with rigous process management. Consumer goods firms usually have a variety of product lines with smaller lots. Therefore, process management in the industrial group would better lead to cost reduction than that in the consumer goods group. Another characteristic is that industrial firms usually require well-design products for mass production whereas basic materials organizations such as mining, metal processing with unstandardized products are usually not required much product design. Thus, good product/service design would bring back industrial firms higher economic return compared to the basic materials companies. The significant moderating effects from industry have been highlighted in Singaporean firms (Quazi et al., 2002), and Queensland businesses (Sharma, 2006).

With respect to the effect of firm size on QM implementation, the study found some significant differences in terms of QM practices implementation level such as *Quality data and reporting*, *Process management*, *Continuous improvement*, and *Rewards* in which Larger size organizations reported higher implementation level. It is likely that larger firms have larger resources as well as spend considerable investment in QM practices implementation. The impacts of QM practices on SP, furthermore, are also significantly different among three groups. Generally, it seems Medium and Large size organizations saw stronger impact of Top management support for QM on SP, but weaker influence of Problem solving on SP, compared to Small size group. The former may be explained by the huge resources and capabilities of the larger size organizations which Top management would support for QM activities. These supports result in higher performance in larger organizations compared to smaller ones. The latter would be understandable by the characteristic of Small size organization with less number of employees, problem solving practices would be easier to be controlled, and would be a source of better performance than the larger size firms. The differences in QM implementation affected by firm size have been emphasized in Singaporean firms (Quazi et al., 2002), Queensland businesses (Sharma, 2006), and Chinese firms (Daniel et al., 2014).

Table 4-22: QM critical practices matrix

	Industrial	Consumer goods	Basic materials	Consumer services
Small	Rewards Product/service design	Training on quality	Top management support for QM Training on quality Rewards	Product/service design Process management
Medium	Rewards Product/service design Continuous improvement	Quality data and reporting Problem solving	Quality data and reporting Continous improvement Problem solving Rewards	Quality data and reporting Product/service design
Large	Rewards Product/service design Continuous improvement	Training on quality Quality data and reporting	Top management support for QM Quality data and reporting Training on quality Continuous improvement Rewards	Quality data and reporting Product/service design

Combining the findings from the effects of industry and firm size on the relationship between QM practices and SP, critical QM practices which have positive impact on SP are identified for each group (See Table 4-22). This finding provides managerial implications for enterprises to better position themselves in the QM critical practices matrix and found the important QM practices to pursue their SP.

4.5. Summary of Chapter 4

This chapter empirically investigates how quality management practices impact of on sustainability performance as well as how this relationship is moderated by QM experience time, type of industry, and firm size. Analysis of Variance (ANOVA), Chow-test, and regression techniques were used to test the hypotheses. The study showed mixed impacts of eight Quality management practices on different dimensions of sustainability performance. Especially, the results figured out four Quality management practices which have significantly positive impact on Sustainability performance, namely: Top management support for Quality management, Design for quality, Quality data and reporting, and Continuous improvement. These practices could be considered as critical success factors for Quality management implementation. Regarding the level of Quality management practices implementation, there are some significant differences across groups with different firm size, but insignificant difference is revealed among groups categorized by Quality management experience time and type of industry. Besides, the impacts of Quality management practices on Sustainability performance are significantly different across groups with different Quality management experience time, type of industry, and firm size.

CHAPTER 5: SUPPLY CHAIN MANAGEMENT AND SUSTAINABILITY PERFORMANCE

This chapter presents the empirical evidence on how supply chain management practices impact of on sustainability performance as well as how this relationship is moderated by type of industry and firm size.

5.1. Introduction

When globalization has become a worldwide trend, intensive competition has forced companies to work more closely with each other to improve efficiencies and become more competitive. Organizations have started recognizing that only concentration on internal practices such as quality management to improve performance is no longer sufficient (Quang et al., 2016). The establishment and management of supply chain would maximize product/service's values for customers as well as gain competitive advantages in the global marketplace (Li et al., 2006). Supply chain management, therefore, has been becoming a highly concerned topic by both scholars and practitioners.

Supply chains nowadays are not simply within national boundaries but extending to access new markets and resources (Flynn and Flynn, 2005). Developing countries such as Vietnam, China, India, etc. are potential supply chain nodes since they not only possess huge markets but also hold massive and inexpensive material and labour sources (Babba, 2008). Those are valuable resources of competitiveness for global corporations. It is obvious that many multinational corporations have off-shored production in developing countries. However, limited literature provided insights about efficient managing supply chain networks in those countries.

Particularly in Vietnam, apart from FDI firms, supply chain management has been recently concerned by local firms. Before that, they are more familiar with separate concepts of logistics, transportations, and warehouse management - parts of the broad supply chain management concept which refers to activities managing the total flow of a distribution channel from suppliers to ultimate users (Cooper et al., 1997). According to a test result of a training on "Basics of Supply chain management" for Vietnam's companies by CEL Consulting, over 80% of personnel working in supply chain and logistics only get 30% of requirement score (Ho Chi Minh City People's Committee, 2014). This means Vietnamese employees have limited knowledge on the overall supply chain management in spite of doing supply chain management works every day.

Regarding academic works on SCM in Vietnam, one paper, in which the author is a co-author, entitled "Supply chain management in developing countries: empirical evidence from Vietnamese manufacturing companies" has been accepted to publish in a forthcoming issue of International Journal of Productivity and Quality Management. The study investigates the linkage between supply chain management practices (including upstream SCM practices and downstream SCM practices) and operational capabilities in Vietnamese enterprises. The results illustrate contributions of SCM practices to dimensions of operational capabilities, especially more significant impact is recognized by downstream SCM practices. Another recent publication was found in 2017 on "SCM practices and firms' operational performance" in Vietnamese garment enterprises (Truong et al., 2017). The study found both direct and indirect impact of supplier management and customer focus on operational performance. In addition, process control shows direct effect and top management support has indirect influence on operational performance. It is likely that studying on SCM is an emergent research stream in Vietnam recently.

From extensive literature review on SCM (in Chapter 2), there is a need for further study on how SCM practices would contribute to sustainability performance. To address this need, the purpose of this chapter is to investigate the impact of supply chain management practices on three dimensions of sustainability performance, and the moderating effects of type of industry and firm size on this relationship in the context of enterprises in Vietnam. Following the introduction, analytical framework of this study will be developed and depicted in the next section. The third section describes data analysis and results. Finally, findings and discussions for this chapter are presented.

5.2. Analytical framework and hypotheses development

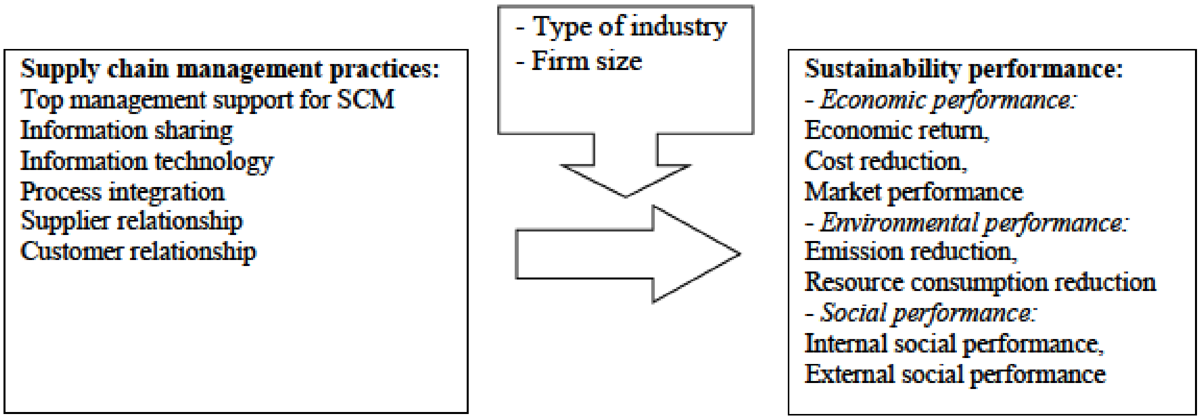

Figure 5-1: Analytical framework – The impact of SCM practices on SP

As shown in the measurement analysis results (see Chapter 3), the measurement instruments for SCM practices are confirmed the validity and reliability with six constructs:

- Top management support for SCM
- Information sharing
- Information technology
- Process integration
- Supplier relationship
- Customer relationship

The measurement instruments for SP are confirmed the validity and reliability with seven sub-constructs belonging to three components of sustainability performance:

- Economic performance

- Economic return
- Cost reduction
- Market performance
- Environmental performance
- Emission reduction
- Resource consumption reduction
- Social performance
- Internal social performance
- External social performance

Top management support for SCM refers to the support of top management for the supply chain-related functions in terms of time, human resources and financial resources because they recognize the vital role of supply chain management department and aware of benefits generated from effective supply – buyer relationships (Chen and Paulraj, 2004). The support from top management would facilitate effective implementation of SCM by investing in information system, allowing inter-organization collaboration, and supporting long-term relationship with partners. As a result, the practice would directly or indirectly contribute to economic performance by enabling quality product/service at lower cost and shorter delivery time, to environmental performance by reduction of unnecessary transportation routes due to unreliable partners, and to social performance by supporting working conditions for employees, providing sufficient resources as requested (internal stakeholders), and supporting long-term relationships with partners (external stakeholders) toward ultimate goal of customer satisfaction (external stakeholders). The role of top management support of SCM has been widely highlighted in the literature (Chen & Paulraj, 2004; Kumar et al., 2015; Min et al., 2007; Truong et al., 2017).

Information sharing means the company and partners keep communicating and exchanging necessary information timely. With information sharing, members of a supply chain would reduce bullwhip effect to understand the exact need of ultimate customers (Li et al., 2005), and in turns, more efficiently formulate business plans and cut cost by reducing shortages and inventories (Prajogo & Olhager, 2012). As a result, not only economic performance would be improved, but also environmental performance because efficient business plan would eliminate ineffective transportation and resource consumption. The contribution of information sharing is well supported by the supply chain literature (Tan et al., 2001; Min & Mentzer, 2004; Li et al., 2005; Min et al., 2007; Kumar et al., 2015; Miguel & Brito, 2011; Prajogo & Olhager, 2012).

Information technology refers to the usage of technology to facilitate information exchanges between the organization and partners such as computer-to-computer links, technology-enabled transaction processing, telecommunications, or electronic devices. Information technology, on the one hand, directly supports supply chain management processes such as purchasing or order fulfilment (Prajogo and Olhager, 2012); on the other hand, enables management to more actively control processes and monitor activities (Gunasekaran et al., 2004). As a result, the practice would contribute to overall SC performance of the organization. The important role of information technology in SCM has been highlighted by Prajogo and Olhager (2012), Mcafee (2002), and Chen & Paulraj (2004).

Process integration refers to how the organization and partners integrate operations with each other and jointly manage supply chain-related activities to have smooth flows of information, materials and cash. Together with information sharing and supported by information technology, process integration enables the organization to accurately establish business plans, to obtain sufficient materials at the minimized inventory and transportation cost (Chen & Paulraj, 2004). In addition, by well-integrated processes of each other, members of the supply chain would develop complementary resources and unique assets (Miguel and Brito, 2011). The benefits of process integration in SCM has been discussed in the literature such as Miguel and Brito (2011), Min and Mentzer (2004), Chen & Paulraj (2004), Prajogo and Olhager (2012), Zhao et al. (2008), Flynn et al. (2010).

A huge literature has discussed the benefits of *strategic supplier relationship* in SCM (Chen & Paulraj, 2004; Ulusoy, 2003; Li et al., 2005; Flynn et al., 2010; Truong et al., 2017; Bernardes, 2010). Burton, 1988 (cited in Chen & Paulraj, 2004) noted that around 30% of quality problems belongs to suppliers' responsibility. The long-term relationship with strategic suppliers allows to reduce transaction costs (Miguel and Brito, 2011). Their involvement in some business activities of the organization such as planning, new product development, and continuous improvement would result in mutual benefits in terms of accurate information on demand and capacity of each other which allows reducing time of product/service design and production planning, eliminating inventory obsolescence and wastes, as well as being more responsive to customer requirements (Flynn et al., 2010). As such, this practice helps to improve economic and environmental performance. Moreover, concerning about suppliers, from perspective of the stakeholder theory, would contribute to social performance of the organization.

The benefits of *customer relationship* have been well documented in the literature (Ulusoy, 2003; Li et al., 2005; Flynn et al., 2010; Truong et al., 2017). Keeping close relationship and frequently contacting with customers allow the organization to better understand about customers' preferences and feedback and hence to respond quicker to market change (Li et al., 2005). From this point of view, customer relationship would contribute to overall performance of the organization.

It can be seen that each SCM practice is expected to improve sustainability performance. Good management of the supply chain would create a sustainable network which provides stable jobs for community and contribute to social performance. From these arguments, Hypotheses for the impact of SCM practices on SP are established as followed:

H1a: SCM practices positively impact on economic performance

H1b: SCM practices positively impact on environmental performance

H1c: SCM practices positively impact on social performance

Contextual factors such as firm size, type of industry, etc. are suggested to have some influence on SCM practices (Li et al., 2006; Flynn et al., 2010). Several studies have investigated the effect of size and type of industry on SCM implementation such as Burgess et al. (2006) and Eckstein et al. (2015). As such, hypotheses about the effects of type of industry and firm size on the relationship between SCM practices and SP are stated as followed:

H2a: There are significant differences in level of SCM practices implementation across groups with different type of industry

H2b: There are significant differences in the impact of SCM practices on SP across groups with different type of industry

H3a: There are significant differences in level of SCM practices implementation across groups with different firm size

H3b: There are significant differences in level of SCM practices implementation across groups with different firm size

5.3. Hypothesis testing

5.3.1. The impact of SCM practices on sustainability performance

In this section, Hypotheses H1a, H1b and H1c regarding the impact of SCM practices on SP will be tested.

H1a: SCM practices positively impact on economic performance

H1b: SCM practices positively impact on environmental performance

H1c: SCM practices positively impact on social performance

Before testing the hypotheses by regression analysis, correlation analysis was conducted to check correlations among supply chain management practices. Results in Table 5.1 indicate that six SCM practices are significantly correlated with each other. The correlation coefficients ranged from 0.211 to 0.689 (significant at 5%). The results raise a possibility of multi-collinearities among independent variables which affect the results of the regression analysis. Therefore, in this study, the Variance Inflation Factor (VIF) values were calculated to examine this possibility. Values of VIF in Table 5.2 range from 1.263 to 2.730 which are all smaller than the threshold of 4 - the acceptable VIF value, indicating that multi-collinearities do not have an undue effect on regression results.

Table 5-1: Correlations among SCM practices

	(1)	(2)	(3)	(4)	(5)	(6)
(1) Top management support for SCM	1					
(2) Information sharing	.373**	1				
(3) Information technology	.293**	.499**	1			
(4) Process integration	.383**	.689**	.562**	1		
(5) Supplier relationship	.211*	.418**	.429**	.591**	1	
(6) Customer relationship	.353**	.530**	.312**	.559**	.525**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Regression analysis was adopted to investigate the relationship between SCM practices and SP and test the proposed hypotheses. Seven multiple regression models were established with independent variables are six constructs of SCM practices: Top management support for SCM, Information sharing, Information technology, Process integration, Supplier relationship, and Customer relationship; and dependent variable for each model is Economic return, Cost reduction, Market performance, Emission reduction, Resource consumption reduction, Internal social performance, and External social performance. Regression analysis results are presented in Table 5.2.

Table 5-2: The impact of SCM practices on SP

	Economic			Environmental		Social		
	Return	Cost Reduct.	Market Perf.	Emission Reduct.	Resource Consump. Reduct.	Internal Social Perf.	External Social Perf.	
R	0.33	0.29	0.4	0.37	0.39	0.47	0.6	
R2	0.11	0.08	0.16	0.14	0.15	0.22	0.36	
df	129	129	130	129	129	129	129	
Sig.	0.02	0.082	0.001	0.003	0.002	0.000	0.000	
	Coef.	**Coef.**	**Coef.**	**Coef.**	**Coef.**	**Coef.**	**Coef.**	**VIF**
Constant	2.67	2.56	2.52	3.20	4.10	1.92	1.88	
Top management support for SCM	0.05	-0.07	0.04	-0.28***	-0.43***	0.17**	-0.02	1.263
Information sharing	-0.11	0.28***	-0.01	-0.02	0.16	0.08	0.02	2.149
Information technology	0.07	0.19**	0.02	0.31***	0.15	0.09	0.01	1.587
Process integration	0.02	-0.22*	0.13	-0.28**	-0.19*	-0.05	0.09	2.730
Supplier relationship	0.12	-0.02	0.00	0.06	0.04	0.19***	0.10**	1.710
Customer relationship	0.17**	-0.05	0.17**	0.23**	-0.03	0.05	0.30***	1.751

Note: *** significant at 1%, ** significant at 5%, * significant at 10% (1-tailed test).

Generally, SCM practices have statistically significant impact on economic performance in terms of economic return, cost reduction, and market performance; on environmental performance in terms of emission reduction and resource consumption reduction, and on both internal and external social performance. The significant levels of these regression models are at 5%, except for the model of SCM practices and cost reduction with significant level at 10%. The impact of SCM practices on economic and social performance is positive whereas a mixed impact of SCM practices is revealed on environmental performance.

The impact of SCM practices on Economic return: From the Table 4.1, R-square is 0.11 indicating that these SCM practices would explain 11% of the variance in Economic return. Among six SCM practices, only Customer relationship shows a significant and positive impact on Economic return with a beta coefficient of 0.17 significant at 5%. The other SCM practices reveal no statistically significant impact on Economic return.

The impact of SCM practices on Cost reduction: R-square of this regression model is 0.08, indicating that these SCM practices would explain 8% of the variance in Cost reduction. Among six SCM practices, Information sharing and Information technology show statistically significant effect on Cost reduction while the other SCM practices illustrate insignificant impact. Information sharing has the greatest influence on Cost reduction with beta coefficient of 0.28 significant at 1%, followed by Information technology with coefficient of 0.19 significant at 5%.

The impact of SCM practices on Market performance: R-square value of this regression model is 0.16, illustrating that these SCM practices would explain 16% of the variance in Market performance. Experience the same pattern with the regression model on SCM practices and Economic return linkage, only Customer relationship represents a statistically significant and positive impact on Market performance with a beta coefficient of 0.17, significant at 5%. The other SCM practices reveal no statistically significant impact on Market performance.

The impact of SCM practices on Emission reduction: R-square of this model is 0.14, indicating that these SCM practices would explain 14% of the variance in Emission reduction. SCM practices have mixed impacts on Emission reduction. On the one hand, Information technology and Customer relationship show significant and positive impact with beta coefficients of 0.31 (at 1% significant level) and 0.23 (at 5% significant level), respectively. On the other hand, Top management support for SCM and Process integration reveal significant but negative effect with the same beta coefficient value of -0.28 (at 5% significant level). The other SCM practices shows insignificant impact on Emission reduction.

The impact of SCM practices on Resource consumption reduction: R-square of this model is 0.15, illustrating that these SCM practices would explain 15% of the variance in Resource consumption reduction. SCM practices have negative influence on Resource consumption reduction through Top management support for SC and Process integration. Top management support for SCM has the strongest impact on Resource consumption reduction with a beta coefficient of -0.43 (significant at 1%), followed by Process integration with a beta coefficient of -0.19 (significant at 10%).

The impact of SCM practices on Internal social performance: R-square of this regression model is 0.22, indicating that these SCM practices would explain 22% of the variance in Internal social performance. Among six SCM practices, Top management support for SCM and Supplier relationship show statistically significant impact on the Internal social performance. Supplier relationship has the greatest influence with a beta coefficient of 0.19 (significant at 1%), followed by Top management support for SCM with a beta coefficient of 0.17 (significant at 5%). The other SCM practices reveal insignificant impact on the Internal social performance.

The impact of SCM practices on External social performance: R-square of this regression model is 0.36, illustrating that these SCM practices would explain 36% of the variance of External social performance. Among six SCM practices, Supplier relationship and Customer relationship show statistically significant effect on External social performance while the other SCM practices illustrate insignificant impact. Customer relationship represents the strongest impact on External social performance with a beta coefficient of 0.30 (significant at 1%), followed by Supplier relationship with a beta coefficient of 0.10 (significant at 5%).

In summary, SCM practices have generally significant effect on sustainability performance even though different practices show different impacts on dimensions of sustainability performance. As the results indicated, hypothesis H1a could not be rejected with three SCM practices: Information sharing, Information technology, and Customer relationship; Hypothesis H1b could not be rejected with Information technology and Customer relationship; Hypothesis H1c could not be rejected with Top management support for supply chain management, Supplier relationship and Customer relationship.

5.3.2. Industrial effect on SCM practices

In this section, Hypotheses H2a and H2b on the effect of type of industry on the relationship between SCM practices and SP will be tested.

H2a: There are significant differences in level of SCM practices implementation across groups with different type of industry

H2b: There are significant differences in the impact of SCM practices on SP across groups with different type of industry

To test the hypothesis H2a, One-way ANOVA test with Turkey pairwise comparison technique is conducted to compare SCM practices implementation level across four type of industry groups: Group I1: Industrial with 64 companies (accounted for 44.4%), Group I2: Consumer goods with 30 companies (stood at 20.8%), Group I3: Basic materials with 25 companies (accounted for 17.4%), and Group I4: Consumer services with 22 companies (represented 15.3%).

The analysis results show that significant differences are found in the level of implementation two SCM practices: Top management support for SCM and Supplier relationship practices among Industrial, Basic materials, and Consumer services groups. Regarding Top management support for SCM, Industrial group and Basic materials group recognized higher implementation level compared to Consumer services group (significant at 5% level). With respect to Supplier relationship, Basic materials group experienced lower implementation level compared to Industrial group and Consumer Services group (significant at 10% level).

Table 5-3: Comparison of SCM practices implementation level among four type of industry groups

Dependent Variable	I	J	Mean Difference (I-J)	Std. Error	Sig.
Top management support for SCM	Industrial	Consumer goods	.08429	.14426	.937
		Basic materials	-.08071	.15362	.953
		Consumer services	.41611	.16088	.052
	Consumer goods	Basic materials	-.16500	.17518	.782
		Consumer services	.33182	.18158	.265
	Basic materials	Consumer services	.49682*	.18911	.047
Information sharing	Industrial	Consumer goods	-.00549	.15681	1.000
		Basic materials	.09229	.16715	.946
		Consumer services	.03532	.17515	.997
	Consumer goods	Basic materials	.09778	.19192	.957
		Consumer services	.04081	.19892	.997
	Basic materials	Consumer services	-.05697	.20717	.993
Information technology	Industrial	Consumer goods	-.20376	.17704	.659
		Basic materials	.04124	.18859	.996
		Consumer services	-.19013	.19754	.771
	Consumer goods	Basic materials	.24500	.21557	.668
		Consumer services	.01364	.22344	1.000
	Basic materials	Consumer services	-.23136	.23270	.753
Process integration	Industrial	Consumer goods	.04652	.14681	.989
		Basic materials	.33810	.15648	.140
		Consumer services	-.00644	.16398	1.000
	Consumer goods	Basic materials	.29159	.17967	.369
		Consumer services	-.05296	.18623	.992
	Basic materials	Consumer services	-.34455	.19395	.289
Supplier relationship	Industrial	Consumer goods	-.01393	.17593	1.000
		Basic materials	.44273	.18735	.089
		Consumer services	-.16569	.20728	.855
	Consumer goods	Basic materials	.45667	.21365	.147
		Consumer services	-.15175	.23132	.913
	Basic materials	Consumer services	-.60842	.24012	.059
Customer relationship	Industrial	Consumer goods	-.09010	.14265	.922
		Basic materials	.24323	.15206	.382
		Consumer services	-.08404	.15934	.952
	Consumer goods	Basic materials	.33333	.17459	.229
		Consumer services	.00606	.18097	1.000
	Basic materials	Consumer services	-.32727	.18847	.309

To test the hypothesis H2b, Chow test is conducted to determine whether the data is structurally stable or break (Chow, 1960). After dividing the pooled sample into four sub-groups representing for four types of industry, regression models are established to compare the impact of SCM practices on SP across four sub-groups.

After calculating F-statistic (formula was provided in Chapter 3), this value is compared with F(k, n-i*k) given by F table. In the regression models of moderating effects from type of industry, critical value of F(k, n-i*k) is F(6, 111) which almost equals to F (6, 100) = 2.19 (significant at 5%). If calculated F-statistic is greater than 2.19, that means there is a structural break in the data, and it could be concluded that the impact of SCM practices on SP is different among four sub-groups. The results in detailed are as followed:

Table 5-4: Moderating effect of type of industry on the relationship between SCM practices and Economic return

	Group 1: Industrial	Group 2: Consumer goods	Group 3: Basic materials	Group 4: Consumer services
R	0.243	0.645	.466	.481
R2	0.059	0.416	0.217	0.231
Adjusted R2	-0.050	0.263	-0.044	-0.153
Residual sum of square	16.579	4.466	6.980	6.184
df	52	23	18	12
Sig.	0.774	0.038	0.561	0.724
	Coef.	**Coef.**	**Coef.**	**Coef.**
(Constant)	2.941	1.703	2.759	2.238
Top management support for SCM	.041	.077	.334	-.106
Information sharing	-.045	-.170	-.267	.117
Information technology	.105	.200	-.157	-.066
Process integration	.075	-.239	.325	-.568
Supplier relationship	.041	.348**	.003	.353
Customer relationship	.020	.327*	.037	.681

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

F = 3.46 > F (6, 100) = 2.19. The result indicates that the impacts of SCM practices on Economic return are significantly different among four sub-groups. SCM practices have significant impact on Economic return in the Consumer goods group (at 5% significant level) whereas show insignificant impact in the other three groups. In the Consumer goods group, SCM practices present positive impact with the strongest one from Supplier relationship (coefficient of 0.348, significant at 5%), followed by Customer relationship (coefficient of 0.327, significant at 10%).

Table 5-5: Moderating effect of type of industry on the relationship between SCM practices and Cost reduction

	Group 1: Industrial	Group 2: Consumer goods	Group 3: Basic materials	Group 4: Consumer services
R	0.520	0.437	0.465	0.276
R2	0.270	0.191	0.217	0.076
Adjusted R2	0.186	-0.020	-0.044	-0.386
Residual sum of square	23.156	9.072	7.638	7.793
df	52	23	18	12
Sig.	0.009	0.509	0.562	0.982
	Coef.	**Coef.**	**Coef.**	**Coef.**
(Constant)	2.328	2.711	3.721	3.012
Top management support for SCM	-.261*	.285	.125	.005
Information sharing	.447***	.468	.279	.053
Information technology	.370***	.117	-.097	-.081
Process integration	-.267	-.374	-.147	-.318
Supplier relationship	-.271**	.133	.133	.208
Customer relationship	.126	-.483	-.502	.120

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

F = 4.48 > F (6, 100) = 2.19. The result indicates that the impacts of SCM practices on Cost reduction are significantly different among four sub-groups. One the one side, SCM practices show significant impact in the Industrial group, on the other side, SCM practices indicate insignificant impact on the other three groups. In the Industrial group, SCM practices present mixed impact on Cost reduction. Information sharing and Information technology show the strongest and positive impact with coefficients of 0.447 and 0.370, respectively, significant at 1%. Meanwhile, Top management support for SCM and Supplier relationship show negative impact with coefficients of -0.261 and -0.271, respectively.

Table 5-6: Moderating effect of type of industry on the relationship between SCM practices and Market performance

	Group 1: Industrial	Group 2: Consumer goods	Group 3: Basic materials	Group 4: Consumer services
R	0.483	0.650	0.508	0.700
R2	0.233	0.422	0.258	0.489
Adjusted R2	0.146	0.271	0.010	0.234
Residual sum of square	9.649	6.369	3.959	2.052
df	52	23	18	12
Sig.	0.024	0.034	0.432	0.159
	Coef.	**Coef.**	**Coef.**	**Coef.**
(Constant)	3.557	.599	2.922	2.259
Top management support for SCM	-.262***	.106	.202	.063
Information sharing	-.031	.243	.025	-.280
Information technology	.004	.342*	-.233	.134
Process integration	.347***	-.058	.079	.396
Supplier relationship	-.009	.143	-.064	-.027
Customer relationship	.090	.046	.227	.134

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

$F = 5.84 > F(6, 100) = 2.19$. The result indicates that the impacts of SCM practices on Market performance are significantly different among four sub-groups. SCM practices have significant impact in the Industrial and Consumer goods groups (at 5% significant level) while reveal insignificant impact in the Basic materials and Consumer services groups. In the Industrial group, Process management presents significant and positive impact with coefficient of 0.347 (significant at 1%) while Top management support for SCM reveals significant but negative impact with coefficient of -0.262 (significant at 1%). In the Consumer goods group, Information technology illustrates significantly positive impact with coefficient of 0.342, significant at 10%.

Table 5-7: Moderating effect of type of industry on the relationship between SCM practices and Emission reduction

	Group 1: Industrial	Group 2: Consumer goods	Group 3: Basic materials	Group 4: Consumer services
R	0.337	0.555	0.727	0.616
R2	0.114	0.308	0.529	0.379
Adjusted R2	0.011	0.127	0.372	0.069
Residual sum of square	33.692	8.869	4.206	8.485
df	52	23	18	12
Sig.	0.368	0.165	0.021	0.360
	Coef.	**Coef.**	**Coef.**	**Coef.**
(Constant)	3.681	3.639	3.673	4.141
Top management support for SCM	-.328	.022	-.523***	-.243
Information sharing	.182	-.022	.334**	-.849
Information technology	.307	.482	-.279**	.450
Process integration	-.270	-.911	-.074	.455
Supplier relationship	-.112	.306	.259**	-.100
Customer relationship	.121	.043	.266*	.105

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

$F = 3.71 > F(6, 100) = 2.19$. The result indicates that the impacts of SCM practices on Emission reduction are significantly different among four sub-groups. SCM practices have significant impact in the Basic materials group (at 5% significant level) while reveal insignificant impact in the other three groups. In the Basic materials group, SCM practices show mixed impacts on Emission reduction with positive impact from Information sharing, Supplier relationship and Customer relationship (with coefficients of 0.334, 0.259, and 0.266) and negative impact from Top management support for SCM and Information technology (with coefficients of -0.523 and -0.279, respectively).

Table 5-8: Moderating effect of type of industry on the relationship between SCM practices and Resource consumption reduction

	Group 1: Industrial	Group 2: Consumer goods	Group 3: Basic materials	Group 4: Consumer services
R	0.474	0.539	0.553	0.442
R2	0.225	0.290	0.306	0.196
Adjusted R2	0.136	0.105	0.074	-0.207
Residual sum of square	28.377	8.596	7.817	7.667
df	52	23	18	12
Sig.	0.033	0.202	0.298	0.806
	Coef.	**Coef.**	**Coef.**	**Coef.**
(Constant)	4.231	5.456	4.560	3.583
Top management support for SCM	-.356**	-.034	-.498	-.337
Information sharing	.448**	.091	.158	-.153
Information technology	.269**	-.384	.119	.217
Process integration	-.637***	-.179	-.155	.220
Supplier relationship	-.059	.270	.206	-.212
Customer relationship	-.026	-.386	-.256	.151

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

$F = 4.48 > F(6, 100) = 2.19$. The result indicates that the impacts of SCM practices on Resource consumption reduction are significantly different among four sub-groups. SCM practices show significant impact in the Industrial group (at 5% significant level) while indicate insignificant impact in the other three groups. In the Industrial group, SCM practices have mixed impacts on Resource consumption reduction with positive influence from Information sharing and Information technology (coefficients of 0.448 and 0.269, respectively, significant at 5%), and negative effect from Top management support for SCM and Process integration (coefficients of -0.356 and -0.637, respectively, significant at 1%).

Table 5-9: Moderating effect of type of industry on the relationship between SCM practices and Internal social performance

	Group 1: Industrial	Group 2: Consumer goods	Group 3: Basic materials	Group 4: Consumer services
R	0.600	0.839	0.472	0.765
R2	0.361	0.703	0.223	0.585
Adjusted R2	0.287	0.626	-0.036	0.377
Residual sum of square	9.580	3.816	6.338	4.336
df	52	23	18	12
Sig.	0.000	0.000	0.541	0.060
	Coef.	**Coef.**	**Coef.**	**Coef.**
(Constant)	2.401	-.401	3.388	2.650
Top management support for SCM	.130	.096	.145	-.196
Information sharing	.122	-.236	.037	-.298
Information technology	.165**	.205	-.409	.300*
Process integration	-.169	.163	.266	1.155**
Supplier relationship	.326***	.264*	-.027	.091
Customer relationship	-.129	.537***	.171	-.623*

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

F = 11.26 > F (6, 100) = 2.19. The result indicates that the impacts of SCM practices on Internal social performance are significantly different among four sub-groups. SCM practices have significant impact in the Industrial and Consumer goods (at 1% significant level) and in the Consumer services group (at 10% significant level) while reveal insignificant impact in the Basic materials group. In the Industrial group, SCM practices have positive influence on Internal social performance with strong impact of Supplier relationship and Information technology (coefficients of 0.362 and 0.165, significant at 1% and 5%, respectively). In the Consumer goods group, Customer relationship present the strongest and positive impact with coefficient of 0.537, significant at 1%, followed by Supplier relationship with coefficient of 0.264, significant at 10%. In the Consumer services group, SCM practices illustrate mixed impacts with the strongest and positive impact from Process integration (coefficient of 1.155, significant at 5%), but negative impact from Customer relationship (coefficient of -0.623, significant at 10%).

Table 5-10: Moderating effect of type of industry on the relationship between SCM practices and External social performance

	Group 1: Industrial	Group 2: Consumer goods	Group 3: Basic materials	Group 4: Consumer services
R	0.542	0.835	0.712	0.816
R2	0.293	0.697	0.507	0.666
Adjusted R2	0.212	0.617	0.342	0.499
Residual sum of square	8.679	2.984	2.817	1.487
df	52	23	18	12
Sig.	0.005	0.000	0.030	0.020
	Coef.	**Coef.**	**Coef.**	**Coef.**
(Constant)	2.487	.300	2.162	1.655
Top management support for SCM	-.087	.169	.135	-.096
Information sharing	.219**	.017	-.315**	-.020
Information technology	.069	.163	-.089	-.064
Process integration	.031	-.115	.217	.529*
Supplier relationship	.111	.403***	.009	-.016
Customer relationship	.034	.272*	.438***	.281

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

F = 6.80> F (6, 100) = 2.19. The result indicates that the impacts of SCM practices on External social performance are significantly different among four sub-groups. SCM practices have significant impact in all four groups but significant determinants are different. In the Industrial group, Information sharing has the greatest influence on External social performance with coefficient of 0.219 (significant at 5%). In the Consumer goods group, Supplier relationship and Customer relationship are found with significantly positive impact on External social performance with coefficients of 0.403 and 0.272, significant at 1% and 10%, respectively. In the Basic materials group, SCM practices show mixed impact on External social performance with positive effect from Customer relationship (coefficient of 0.438, significant at 1%) and negative impact from Information sharing (coefficient of -0.315, significant at 5%). In the Consumer services group, Process integration is found with significant and positive impact on External social performance (coefficient of 0.529, significant at 10%).

To further investigate the differences of SCM practices among four type of industry groups, regression analysis with pool sample is conducted with dummy variables for Group I2 (Consumer goods), Group I3 (Basic materials), and Group I4 (Consumer services) to compare the difference between Group I2, Group I3 and Group I3 with Group I1. Analysis results show that Group I1 experiences significantly different impact of SCM practices on Economic performance in terms of Market performance (significant at 1%), on Environmental performance in terms of Emission reduction (significant at 10%) and Resource consumption reduction (significant at 5%), and on Social performance in terms of Internal and External social performance (significant at 1%), compared to the other three groups.

Table 5-11: Regression analysis on the impact of SCM practices on SP across four type of industry groups with dummy variables

	Economic			Environmental		Social	
	Return	Cost Reduct.	Market Perf.	Emission Reduct.	Resource Consump. Reduct.	Internal Social Perf.	External Social Perf.
R	0.460	0.489	0.589	0.527	0.548	0.709	0.724
R2	0.212	0.239	0.347	0.278	0.301	0.503	0.524
Adjusted R2	0.009	0.043	0.181	0.092	0.121	0.375	0.402
df	105	105	106	105	105	105	105
Sig.	0.418	0.236	0.004	0.076	0.034	0.000	0.000
	Coef.	**Coef.**	**Coef.**	**Coef.**	**Coef.**	**Coef.**	**Coef.**
(Constant)	2.941	2.328	3.557	3.681	4.231	2.401	2.487
I2	-.619	.192	-1.479	-.021	.612	-1.401	-1.093
I3	-.061	.464	-.212	-.003	.109	.329	-.108
I4	-.176	.171	-.325	.115	-.162	.062	-.208
TOPS	.041	-.261	-.262	-.328	-.356	.130	-.087
INFS	-.045	.447	-.031	.182	.448	.122	.219
INFT	.105	.370	.004	.307	.269	.165	.069
PCINT	.075	-.267	.347	-.270	-.637	-.169	.031
SUPRE	.041	-.271	-.009	-.112	-.059	.326	.111
CUSRE	.020	.126	.090	.121	-.026	-.129	.034
I2xTOPS	.018	.273	.184*	.175	.161	-.017	.128
I2xINFS	-.062	.010	.137	-.102	-.178	-.179	-.101
I2xINFT	.048	-.126	.169	.088	-.327**	.020	.047
I2xPCINT	-.157	-.054	-.203	-.321	.229	.166	-.073
I2xSUPRE	.153	.202	.076	.209	.165	-.031	.146
I2xCUSRE	.153	-.305	-.022	-.039	-.180	.333***	.119
I3xTOPS	.098	.129	.155**	-.065	-.047	.005	.074
I3xINFS	-.074	-.056	.019	.051	-.097	-.028	-.178***
I3xINFT	-.087	-.156	-.079	-.195*	-.050	-.192***	-.053
I3xPCINT	.083	.040	-.089	.065	.161	.145	.062
I3xSUPRE	-.013	.134	-.018	.124	.088	-.118*	-.034
I3xCUSRE	.006	-.209	.046	.048	-.077	.100	.135**
I4xTOPS	-.037	.067	.081	.021	.005	-.081	-.002
I4xINFS	.040	-.099	-.062	-.258**	-.150	-.105	-.060
I4xINFT	-.043	-.113	.033	.036	-.013	.034	-.033
I4xPCINT	-.161	-.013	.012	.181	.214	.331**	.125
I4xSUPRE	.078	.120	-.004	.003	-.038	-.059	-.032
I4xCUSRE	.165	-.002	.011	-.004	.044	-.123	.062

Note: I2: Consumer goods; I3: Basic materials; I4: Consumer services; TOPS: Top management support for SCM; INFS: Information sharing; INFT: Information technology; PCINT: Process integration; SUPRE: Supplier relationship; CUSRE: Customer relationship; *significant at 10%, ** significant at 5%, *** significant at 1% (2-tailed test).

With respect to Market performance, the impact of Top management support in Consumer goods and Basic materials groups is stronger than in Industrial group with coefficient of 0.184 (significant at 10%) and 0.155 (significant at 5%), respectively.

About Emission reduction, Basic materials group experienced weaker effect of Information technology (with coefficient of -0.195 significant at 10%) while Consumer Services group experienced weaker influence of Information sharing (with coefficient of -0.258 significant at 5%), compared to Industrial group.

Regarding Resource consumption reduction, the effect of Information technology is weaker in Consumer goods industry (with coefficient of -0.327, significant at 5%) than in the Industrial group.

About the impact on Internal social performance, Consumer goods group experienced stronger impact of Customer relationship (with coefficient of 0.333, significant at 1%) and Consumer services group saw stronger impact of Process integration (with coefficient of 0.331, significant at 5%), compared to Industrial group. Meanwhile, Basic materials experienced weaker influence from Information technology (with coefficient of -0.192, significant at 1%) and Supplier relationship (coefficient of -0.118, significant at 10%) than Industrial group.

With regard to External social performance, Basic materials group, on the one side, experienced weaker effect from Information sharing (coefficient of -0.178, significant at 1%), on the other side, saw stronger impact from Customer relationship (coefficient of 0.135, significant at 5%).

In general, as the results indicated, there are some significant differences among different type of industry groups in terms of Top management support for SCM and Supplier relationship. Therefore, it can be concluded that Hypothesis H2a could not be rejected. With respect to the difference in the impact of SCM practices on SP, it can be stated that there are significant differences in the impact of SCM practices on economic, environmental and social performance across four industrial groups. As such, hypothesis H2b cannot be rejected.

5.3.3. Size effect on SCM practices

In this section, Hypotheses H3a and H3b regarding the effect of firm size on the relationship between SCM practices and SP will be tested.

H3a: There are significant differences in level of SCM practices implementation across groups with different firm size

H3b: There are significant differences in the impact of SCM practices on SP across groups with different firm size

To test the hypothesis H3a, One-way ANOVA test with Turkey pairwise comparison technique is conducted to compare QM practices implementation level across three groups divided by different size: (1) Small: Small size with no more than 50 employees, (2) Medium: Medium size companies with from 51 to 300 employees, and (3) Large: Large size companies with more than 300 employees.

The analysis results show that there are significant different across three groups in Top management support for SCM, Information sharing, Process integration, and Customer relationship. The Small and Medium groups have significantly different implementation level of Top management support for SCM and Process integration (significant at 5%) and Information sharing (significant at 10%). The Medium group differs from The Large group in terms of Process integration and Customer relationship (significant at 5%). For all differences, larger organizations reported higher implementation level compared to smaller ones.

To test the hypothesis H3b, Chow test is conducted to determine whether the data is structurally stable or break (Chow, 1960). After dividing the pooled sample into three sub-groups representing for three firm size, regression models are established to compare the impact of SCM practices on SP across three sub-groups.

Table 5-12: Comparison of SCM practices implementation level among three different firm size groups

Dependent Variable	I	J	Mean Difference (I-J)	Std. Error	Sig.
Top management support for SCM	Small	Medium	-.11958	.12603	.610
		Large	-.36516*	.13893	.026
	Medium	Large	-.24558	.14318	.203
Information sharing	Small	Medium	-.05298	.13395	.917
		Large	-.31356	.14525	.082
	Medium	Large	-.26058	.15036	.197
Information technology	Small	Medium	-.07822	.15510	.869
		Large	-.25051	.16715	.295
	Medium	Large	-.17230	.17321	.581
Process integration	Small	Medium	.03309	.12636	.963
		Large	-.36181*	.13702	.025
	Medium	Large	-.39491*	.14184	.017
Supplier relationship	Small	Medium	.22162	.15870	.346
		Large	.15060	.17286	.659
	Medium	Large	-.07102	.17912	.917
Customer relationship	Small	Medium	.11993	.12339	.596
		Large	-.27656	.13380	.100
	Medium	Large	-.39649*	.13850	.013

After calculating F-statistic (formula was provided in Chapter 3), this value is compared with F(k, n-i*k) given by F table. In the regression models of moderating effects from firm size, critical value of F(k, n-i*k) is F(6, 117) which almost equals to F (6, 100) = 2.19 (significant at 5%). If calculated F-statistic is greater than 2.19, that means there is a structural break in the data, and it could be concluded that the impact of SCM practices on SP is different among three sub-groups. The results in detailed are as followed:

Table 5-13: Moderating effect of Firm size on the relationship between SCM practices and Economic return

	Group 1: Small size	Group 2: Medium size	Group 3: Large size
R	0.485	0.469	0.240
R2	0.235	0.220	0.057
Adjusted R2	0.141	0.097	-0.145
Residual sum of square	10.856	12.580	13.866
df	49	38	28
Sig.	0.034	0.128	0.939
	Coef.	**Coef.**	**Coef.**
(Constant)	2.087	2.394	3.735
Top management support for SCM	.050	.112	-.053
Information sharing	-.087	-.072	-.073
Information technology	.092	.054	.132
Process integration	-.027	-.111	.286
Supplier relationship	.159	.326	-.082
Customer relationship	.288**	.083	-.169

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

F = 1.72 < F (6, 100) = 2.19. The result indicates that the impacts of SCM practices on Economic return are not significantly different among three sub-groups. However, based on the regression analysis results, some differences could be found: on the one hand, SCM practices have significant impact on Economic return in the Small size group, on the other hand, SCM practices reveal insignificant impact in the other two bigger size groups. With Small size group, Customer relationship has the strongest positive effect on Economic return with coefficient of 0.288 (significant at 5%).

Table 5-14: Moderating effect of Firm size on the relationship between SCM practices and Cost reduction

	Group 1: Small size	Group 2: Medium size	Group 3: Large size
R	0.576	0.360	0.344
R2	0.331	0.130	0.118
Adjusted R2	0.249	-0.008	-0.071
Residual sum of square	16.919	16.884	17.257
df	49	38	28
Sig.	0.002	0.475	0.708
	Coef.	**Coef.**	**Coef.**
(Constant)	2.558	2.815	1.862
Top management support for SCM	-.368***	.055	.254
Information sharing	.504***	-.008	.145
Information technology	.246**	.322	-.176
Process integration	-.407**	-.343	.214
Supplier relationship	.134	.026	-.057
Customer relationship	.014	-.026	-.117

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

F = 3.11 > F (6, 100) = 2.19. The result indicates that the impacts of SCM practices on Cost reduction are significantly different among three sub-groups. SCM practices show significant effect on Cost reduction in the Small size group (significant at 1%) while indicate insignificant impact in the Medium and Large size groups. With the Small size group, SCM practices illustrate mixed impacts with both positive sign from Information sharing and Information technology (coefficients of 0.504 and 0.246, respectively, significant at 5%) and negative sign from Top management support for SCM and Process integration (coefficients of -0.368 and -0.407, respectively, significant at 5%).

Table 5-15: Moderating effect of Firm size on the relationship between SCM practices and Market performance

	Group 1: Small size	Group 2: Medium size	Group 3: Large size
R	0.385	0.591	0.575
R2	0.148	0.349	0.331
Adjusted R2	0.044	0.249	0.188
Residual sum of square	9.585	8.009	7.106
df	49	38	28
Sig.	0.227	0.008	0.062
	Coef.	**Coef.**	**Coef.**
(Constant)	3.269	2.102	1.871
Top management support for SCM	-.125	.191**	.064
Information sharing	-.068	.079	.054
Information technology	.143	-.064	.179
Process integration	.214	-.089	.271
Supplier relationship	-.033	.221*	-.233**
Customer relationship	.057	.137	.136

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

F = 3.36 > F (6, 100) = 2.19. The result indicates that the impacts of SCM practices on Market performance are significantly different among three sub-groups. SCM practices have insignificant impact in the Small size group. In the Medium size group, SCM practices show positively significant impact (at 1% significant level) on Market performance with strong effect from Top management support for SCM (coefficient of 0.191, significant at 5%) and from Supplier relationship (coefficient of 0.221, significant at 10%). In the Large size group, SCM practices show significant impact (at 10%) but with negative sign from Supplier relationship (coefficient of -0.233, significant at 5%).

Table 5-16: Moderating effect of Firm size on the relationship between SCM practices and Emission reduction

	Group 1: Small size	Group 2: Medium size	Group 3: Large size
R	0.542	0.314	0.502
R2	0.294	0.098	0.252
Adjusted R2	0.208	-0.044	0.092
Residual sum of square	26.022	19.181	14.020
df	49	38	28
Sig.	0.007	0.658	0.191
	Coef.	**Coef.**	**Coef.**
(Constant)	3.185	2.659	3.820
Top management support for SCM	-.500***	.084	-.561
Information sharing	.130	-.027	-.277
Information technology	.430***	.253	.132
Process integration	-.531**	-.349	.183
Supplier relationship	.278*	.045	-.059
Customer relationship	.239	.143	.450

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

F = 2.34 > F (6, 100) = 2.19. The result indicates that the impacts of SCM practices on Emission reduction are significantly different among three sub-groups. SCM practices have significant impact on Emission reduction in the Small size group (significant at 1%) whereas reveal insignificant impact in the Medium and Large size group. In the Small size group, SCM practices show a mixed impact on Emission reduction with positive influence from Information technology (coefficient of 0.430, at 1% significant level) and Supplier relationship (coefficient of 0.278, at 10% significant level); and negative effect from Top management support for SCM (coefficient of -0.500, significant at 1%) and Process integration (coefficient of -0.531, significant at 5%).

Table 5-17: **Moderating effect of Firm size on the relationship between SCM practices and Resource consumption reduction**

	Group 1: Small size	Group 2: Medium size	Group 3: Large size
R	0.421	0.442	0.651
R2	0.177	0.195	0.424
Adjusted R2	0.077	0.068	0.300
Residual sum of square	30.253	14.929	10.349
df	49	38	28
Sig.	0.127	0.192	0.012
	Coef.	**Coef.**	**Coef.**
(Constant)	3.320	4.470	3.498
Top management support for SCM	-.366	-.279	-.711***
Information sharing	.431	-.171	.005
Information technology	.180	.120	.081
Process integration	-.396	.116	-.146
Supplier relationship	.195	-.067	-.155
Customer relationship	-.105	-.137	.664***

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

F = 3.38 > F (6, 100) = 2.19. The result indicates that the impacts of SCM practices on Resource consumption reduction are significantly different among three sub-groups. SCM practices have significant impact in the Large size group (significant at 5%) while reveal insignificant impact in the Small and Medium size groups. In the Large size group, SCM practices show a mixed impact on Resource consumption reduction with positive influence from Customer relationship (coefficient of 0.664, significant at 1%) but negative effect from Top management support for SCM (coefficient of -0.711, significant at 1%).

Table 5-18: Moderating effect of Firm size on the relationship between SCM practices and Internal social performance

	Group 1: Small size	Group 2: Medium size	Group 3: Large size
R	0.692	0.492	0.651
R2	0.479	0.242	0.424
Adjusted R2	0.415	0.123	0.300
Residual sum of square	9.241	16.145	5.696
df	49	38	28
Sig.	0.000	0.086	0.011
	Coef.	**Coef.**	**Coef.**
(Constant)	1.501	2.237	2.434
Top management support for SCM	.234**	.216*	-.188
Information sharing	.013	.373**	-.024
Information technology	.283***	-.241*	.215*
Process integration	-.081	-.102	.435**
Supplier relationship	.222**	.013	.054
Customer relationship	-.007	.154	-.084

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

F = 4.80 > F (6, 100) = 2.19. The result indicates that the impacts of SCM practices on Internal social performance are significantly different among three sub-groups. SCM practices have significant impact on Internal social performance in both the Small size group (at 1% significant level), the Medium size group (at 10% significant level) and in the Large size group (at 5% significant level). In the Small size group, SCM practices show positive impact with the strongest influence from Information technology (coefficient of 0.283, significant at 1%), followed by Top management support for SCM and Supplier relationship (coefficients of 0.234 and 0.222, respectively, significant at 5%). In the Medium size group, Information sharing and Top management support for SCM indicate strong and positive impact (coefficient of 0.373 and 0.216, significant at 5% and 10%, respectively) while Information technology reveals a negative impact (coefficient of -0.241, significant at 10%). In the Large size group, Process integration and Information technology show positive impact with coefficients of 0.435 and 0.215, significant at 5% and 10%, respectively.

Table 5-19: Moderating effect of Firm size on the relationship between SCM practices and External social performance

	Group 1: Small size	Group 2: Medium size	Group 3: Large size
R	0.665	0.710	0.490
R2	0.442	0.504	0.240
Adjusted R2	0.374	0.425	0.077
Residual sum of square	5.511	5.954	7.958
df	49	38	28
Sig.	0.000	0.000	0.223
	Coef.	**Coef.**	**Coef.**
(Constant)	1.804	1.387	2.163
Top management support for SCM	-.017	.089	-.091
Information sharing	.014	-.090	.216
Information technology	-.051	.092	.154
Process integration	.297**	.031	-.012
Supplier relationship	.076	.060	.004
Customer relationship	.249***	.406***	.161

*significant at 10%, ** significant at 5%, *** significant at 1% (1-tailed test)

F = 2.42 > F (6, 100) = 2.19. The result indicates that the impacts of SCM practices on External social performance are significantly different among three sub-groups. SCM practices have positively significant impact on External social performance in the Small and Medium size groups while indicate insignificant impact in the Large size group. In the Small and Medium size, Customer relationship is found as strong determinants with coefficients of 0.249 and 0.406, respectively, significant at 1%. In the Small size group, moreover, Process integration also show significantly positive impact with coefficient of 0.297, significant at 5%.

Table 5-20: Regression analysis on the impact of SCM practices on SP across three different firm size groups with dummy variables

	Economic			Environmental		Social	
	Return	Cost Reduct.	Market Perf.	Emission Reduct.	Resource Consump. Reduct.	Internal Social Perf.	External Social Perf.
R	0.425	0.456	0.528	0.481	0.525	0.610	0.653
R2	0.181	0.208	0.279	0.232	0.276	0.372	0.426
Adjusted R2	0.038	0.070	0.155	0.098	0.150	0.263	0.326
df	115	115	116	115	115	115	115
Sig.	0.214	0.090	0.004	0.037	0.005	0.000	0.000
	Coef.	**Coef.**	**Coef.**	**Coef.**	**Coef.**	**Coef.**	**Coef.**
(Constant)	2.087	2.558	3.269	3.185	3.320	1.501	1.804
E2_3	.307	.257	-1.168	-.525	1.150	.736	-.416
E3_3	1.648	-.696	-1.399	.636	.178	.933	.360
TOPS1234	.050	-.368	-.125	-.500	-.366	.234	-.017
INFSall	-.087	.504	-.068	.130	.431	.013	.014
INFT	.092	.246	.143	.430	.180	.283	-.051
PCINTall	-.027	-.407	.214	-.531	-.396	-.081	.297*
SUPRE	.159	.134	-.033	.278	.195	.222	.076
CUSRE	.288	.014	.057	.239	-.105	-.007	.249**
E2xTOPS	.062	.423*	.316**	.584**	.086	-.018	.106
E2xINFS	.016	-.512*	.147	-.157	-.602**	.360	-.103
E2xINFT	-.038	.076	-.207	-.178	-.061	-.524***	.143
E2xPCINT	-.084	.064	-.303	.182	.513	-.020	-.266
E2xSUPRE	.167	-.108	.254	-.233	-.262	-.209	-.016
E2xCUSRE	-.205	-.041	.079	-.096	-.032	.161	.156
E3xTOPS	-.103	.622*	.188	-.061	-.345	-.422**	-.074
E3xINFS	.015	-.360	.122	-.407	-.426	-.037	.202
E3xINFT	.040	-.423	.036	-.299	-.099	-.069	.205
E3xPCINT	.313	.620	.057	.713*	.251	.517*	-.309
E3xSUPRE	-.241	-.191	-.200	-.337	-.350	-.168	-.072
E3xCUSRE	-.457	-.131	.078	.211	.768**	-.077	-.088

To further examine the difference in the impact of SCM practices among three groups, regression analysis with pool sample is conducted with dummy variables for group Medium and Large size to compare the difference between group Medium and Large size organizations with group Small size ones. Analysis results show that group Small size experiences significantly differences in the impact of SCM practices on Economic performance in terms of Cost reduction (significant at 10%) and Market performance (significant at 1%), Environmental performance in terms of Emission reduction (significant at 5%) and Resource consumption reduction (significant at 1%), and Internal and External social performance (significant at 1%), compared to the other two groups.

About the impact on Cost reduction, the effect of Top management support for SCM is stronger in Medium and Large size groups (with coefficient of 0.423 and 0.622, respectively, significant at 10%) compared to Small size group. Meanwhile, the impact of Information sharing in Medium size group is weaker than in Small size group with coefficient of -0.512, significant at 10%.

Regarding Market performance, Medium size group experienced a stronger impact of Top management support than Small size group with coefficient of 0.316, significant at 5%.

With respect to Emission reduction, Medium size group saw a stronger impact of Top management support for SCM (with coefficient of 0.584, significant at 5%) while Large size group saw a stronger effect of Process integration (with coefficient of 0.713, significant at 10%), compared to Small size group.

About Resource consumption reduction, there is a weaker impact of Information sharing in Medium size group (with coefficient of -0.602, significant at 5%) whereas there is a stronger effect of Customer relationship in Large size group (with coefficient of 0.768, significant at 5%), compared to Small size group.

With regard to Internal social performance, the effect of Information sharing in Medium size group is weaker than in Small size group with coefficient of -0.524, significant at 1%. Moreover, Large size group experienced a weaker impact of Top management support for SCM (with coefficient of -0.422, significant at 5%) but a stronger impact of Process integration (with coefficient of 0.517, significant at 10%), compared to Small size group.

In summary, as the results indicated, there are some significant differences in SCM implementation level across three different size groups in terms of Top management support for SCM, Information sharing, Process integration, and Customer relationship practices. Thus, it can be concluded that Hypothesis H3a cannot be rejected. With respect to the difference in the impact of SCM practices on SP, it can be stated that there are significant differences in the impact of SCM practices on economic, environmental and social performance across three groups. As such, Hypothesis H3b cannot be rejected.

5.4. Findings and Discussions

The analysis results indicate that SCM practices have significant impact on dimensions of sustainability performance. SCM practices have positive influence on economic and social performance while have mixed effect on environmental performance.

From the analysis results, four SCM practices are identified with positive impact on three dimensions of sustainability performance, namely Information sharing, Information technology, Supplier relationship, and Customer relationship. Information sharing shows positive impact on cost reduction while Information technology presents positive effect on both cost reduction and emission reduction. With accurate and timely information sharing and advanced information technology, costs, wastes and emissions from incorrect or redundant physical transactions would be reduced or eliminated. It can be seen that information management plays an important role in improving supply chain efficiency which, in turns, leads to better economic performance and environmental performance. This contribution of information management in supply chain management is highlighted by Zhou and Benton (2007), Gunasekaran and Ngai (2004), and Prajogo and Olhager (2012). It is interesting that Supplier relationship shows a positive effect on internal and external social performance while Customer relationship has a great influence on all economic, environmental and social performance. This finding indicates that keeping good relationship with stakeholders would reduce the transaction cost, improve overall sustainability performance, especially the relationship with downstream supply chain. This finding is supported by Nguyen et al. (2017, in press) - our previous study conducted in Vietnamese SCM. The study found greater contribution of downstream SCM to performance compared to upstream SCM. Moreover, the importance of stakeholder relationship is highlighted in Carter and Rogers (2008) by depicting stakeholder engagement as a part of the better sustainability zone.

Different from positive impact of the four above SCM practices, Top management support for SCM reveals a mixed effect on environmental and social performance. Specifically, the practices, on the one hand, shows positive impact on internal social performance, on the other hand, stresses negative impact on reduction of emission and resource consumption. It appears that once Top management provides more supports and investments in SCM practices, more physical transactions would be performed which also requires more resource consumption. A consensus argument is found in Chen & Paulraj (2004) which notes that the support from top management is characterized by resources and times to strategic purchasing, SC partner relationship development, and information technology adoption. However, strong support from Top management would create a comfort working condition for employees which not only motivates them work better but also make them more satisfied. This finding highlights the contribution of Top management support to the internal social performance. Supporting for this finding, the role of Top management is confirmed as an essential supply chain orientation in a cross-national basis (Min et al., 2007), and a critical success factor for SCM implementation in Indian SMEs (Kumar et al., 2015).

Interestingly, Process integration reveals a negative impact on cost reduction and environmental performance. This finding is opposite to a finding from previous study Miguel and Brito (2011) which indicated that significantly positive impact of Process integration on operational performance. It seems that in case of Vietnam, to well integrate operations and/or develop interlocking programs with each other in the supply chain network, the organization has to incur relatively high costs and resources. Moreover, many of Vietnamese enterprises are at early stage of SCM adoption, it is likely that they are mainly in an investment period in process integration rather than a gaining period from successful process integration. A possible contribution of Process integration which should be tested is the indirect effect on sustainability performance through operational performance. Otherwise, the mixed impact of Top management support for SCM and the negative impact of Process integration on SP would be considered as a trade-off of benefits among three aspects of the triple bottom line in the current context of Vietnam.

With regard to the effect of type of industry on SCM practices implementation, there are significant differences across four type-of-industry groups in terms of SCM practices implementation level and the impact of SCM practices on SP. The differences in SCM implementation level were found in Top management support for SCM and Supplier relationship practices, and mainly between Consumer services with Industrial and Basic materials groups. It is likely that Industrial and Basic materials groups received stronger support from Top management for SCM activities compared to Consumer services group whereas Consumer services organizations pay more attention to manage supplier relationship. In terms of the effect of SCM practices on SP, it is interesting that although the implementation levels of Information sharing and Information technology are rather homogenous across four groups, Industrial group seems to obtain better benefits from Information sharing and Information technology practices compared to the other groups, especially in terms of environmental and social performance. The reason for this would be explained by higher standardization level of the industrial firms which allows employees easier to share and understand information. This finding somehow reflects the more efficient information management in the industrial group compared to the others. Another interesting finding is that Top management support in the Consumer goods and Basic materials groups show stronger effect on Market performance compared to Industrial group. This may be explained by the operations characteristics of different industries. For consumer goods and basic materials industries, products are usually more customized than products of the industrial companies. Especially, customers of the basic materials companies are usually large organizations, they work directly with top management on each project. Therefore, with top management support in these two industries, market performance which refers to market share and customer satisfaction would be better improved compared to the industrial group.

Regarding the effect of firm size on SCM implementation, the results indicate that larger organization reported higher level of SCM practices implementation. Moreover, the support from Top management for SCM activities in larger organization also have stronger impact on SP. This may due to the fact that SCM practices have recently adopted in Vietnamese organizations and the implementation of SCM practices requires initial investment in terms of financial and human resources. With smaller size organizations, these investments and support from top management would be less than in larger organizations. Therefore, the level of adoption as well as the impact of top management support for SCM are somehow higher in the larger organizations. On the other hand, Smaller organizations saw more significant impact of Information sharing on SP. This is understandable because an advantage of small size organization is less number of employees which allows them to easier share information as well as obtain benefits from this practice.

Combining the findings from moderating effects of industry and size on the relationship between SCM practices and SP, critical SCM practices which have positive impact on SP are identified for each group (See Table 5-21). This finding provides managerial implications for enterprises to better position themselves in the SCM critical practices matrix and found the important SCM practices towards their SP.

Table 5-21: SCM critical practices matrix

	Industrial	Consumer goods	Basic materials	Consumer services
Small	Information sharing, Information technology, Process integration, Supplier relationship.	Information technology, Supplier relationship, Customer relationship.	Information sharing, Supplier relationship, Customer relationship	Information technology, Process integration.
Medium	Information sharing, Supplier relationship	Supplier relationship, Customer relationship	Information sharing, Supplier relationship, Customer relationship	Process integration, Customer relationship
Large	Information technology, Process integration	Information technology, Customer relationship	Customer relationship	Process integration, Customer relationship

5.5. Summary of Chapter 5

This chapter empirically examines how supply chain management practices impact of on sustainability performance and how this relationship is moderated by type of industry and firm size. Analysis of Variance (ANOVA), Chow-test, and regression techniques were used to test the hypotheses. The study shows mixed effects of six Supply chain management practices on different dimensions of sustainability performance. The results, especially, identified four Supply chain management practices which have significantly positive impact on Sustainability performance, including: Information sharing, Information technology, Supplier relationship, and Customer relationship. These practices could be considered as critical success factors for Supply chain management implementation. Also, the level of Supply chain management practices implementation and the impacts of Supply chain management practices on Sustainability performance are significantly different across groups categorized by different type of industry and firm size.

CHAPTER 6: SUPPLY CHAIN – QUALITY MANAGEMENT: UNDERLYING RELATIONSHIP TOWARDS SUSTAINABILITY PERFORMANCE

This chapter presents the empirical evidence on how quality management practices mediate the impact of supply chain management practices on sustainability performance, how supply chain management practices mediate the impact of quality management practices on sustainability performance, and how simultaneous implementation of quality management practices and supply chain management practices would generate a synergy effect or offsetting effect on sustainability performance.

6.1. Introduction

Quality management and Supply chain management are different operations management initiatives but both towards the same objective of customer satisfaction (Li et al., 2008; Zhang et al., 2011). Quality management is often regarded as a weapon to gain competitive advantages over a long period. However, quality management is criticized for too much internal focus (Foster, 2008). Resource dependence theory suggests that single organization cannot self-sufficient with their internal resources; instead, resource acquisition is necessary to create complementary resources (Flynn and Flynn, 2005). In the global market, lack of self-sufficiency forces organizations to shift from internal practices alone into the supply chain (Flynn and Flynn, 2005; Kaynak and Hartley, 2008). Supply chain management, therefore, has attracted huge research interests. However, supply chain management is still somehow criticized for narrow orientation with over emphasis on cost and efficiency (Huo et al., 2016). In this context, the integration of QM principles and SCM is suggested to expectedly achieve cumulative competitive capabilities (Flynn and Flynn, 2005).

Many previous studies investigated separately quality management and supply chain management in the literature. The concept of supply chain quality management has been more recently concerned since the 2000s. SCQM is suggested as a fruitful research field for the future (Foster, 2008). Several studies made efforts to conceptualize and provide better understand about SCQM (Robinson and Malhotra, 2005; Foster, 2008). Some studies compared principles of QM and SCM as well as identified common practices of QM and SCM and proposed them as SCQM practices (Fernandes *et al.*, 2017; Foster, 2011). Some scholars empirically studied the contributions of SCQM on organizational performance (Zeng et al., 2013; Azar et al., 2009; Kaynak and Hartley, 2008). Research methodologies are variously adopted including literature review and prescriptive suggestions (Foster, 2008), case studies (Robinson and Malhotra, 2005; Zu and Kaynak, 2012; Kuei et al., 2011), and empirical studies (Zeng et al., 2013; Kaynak and Hartley, 2008).

In the context of Vietnam, Vietnam would be positioned itself as a follower in QM and SCM adoption. To effectively implement QM and SCM from the beginning, it is necessary to establish an SCQM model as well as propose an effective implementation path towards sustainability performance. Before that, examining the underlying mechanism between SCM and QM is the first step toward structuring an SCQM system (Foster, 2008; Huo et al., forthcoming). Although there are pioneer works in this field, more empirical evidence in a specific research setting of Vietnam is needed because from the best knowledge of the author, there is no academic work concerning SCQM in a developing country in general, and in Vietnam in particular. To address this gap, this chapter aims to test the underlying mechanism between SCM and QM towards sustainability performance.

6.2. Analytical framework and hypotheses development

From the literature review of SCQM, it can be seen that SCQM is viewed from different perspectives. The first point of view considers supply chain quality management as an extension of quality management into supplier management and customer management (Kaynak, 2008; Zeng et al., 2013). The second point of view finds supply chain quality management as applying systems-based approach of quality management into the whole supply chain network (Foster, 2008). The third point of view demonstrates synergy effect when simultaneously implement supply chain management and quality management systems (Flynn and Flynn, 2005). From these different perspectives, the underlying mechanism between SCM and QM is tested by three models:

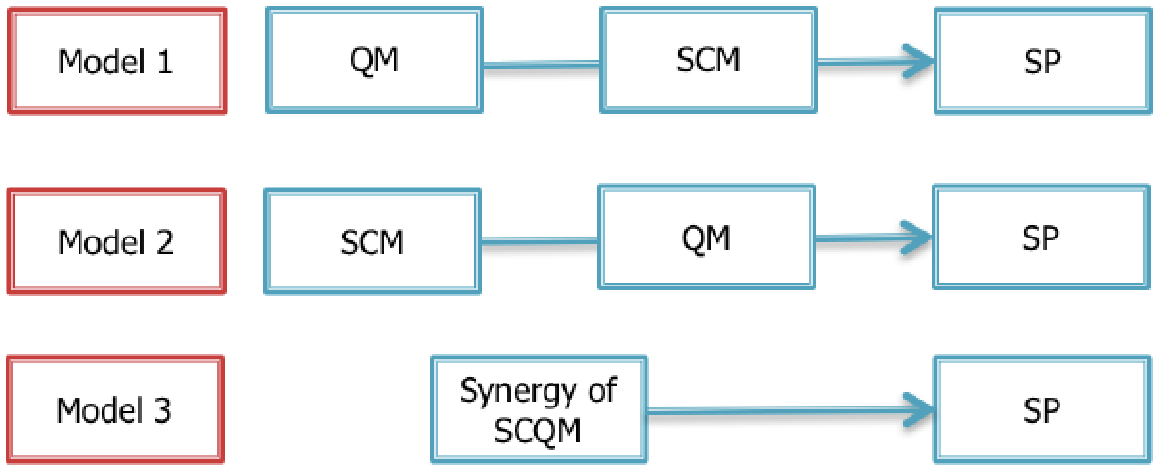

Figure 6-1: Analytical framework on the underlying relationship between QM and SCM towards SP

Model 1: ***Mediating effect of supply chain management on the relationship between quality management practices and sustainability performance.***

Quality management initiatives have been used to be a weapon to gain competitive advantages since the 1950s. The birth of supply chain management is considered as a response to the movement of competition from single firms to the supply chain. Supply chain quality management, from this point of view, refers to an extension quality management into upstream and downstream supply chain (Kaynak and Hartley, 2008) in which supply chain management practices would be considered as a support for a more comprehensive and effective quality management system. In another word, QM is considered as a critical foundation for SCM (Vanichchinchai and Igel, 2011; Yeung, 2008). Supporting this argument, Vanichchinchai and

Igel (2011) found significant indirect and positive impact of QM practices on performance through SCM practices. Moreover, Lin et al. (2005) also found that QM practices significantly impact on organizational performance through mediating of supplier participation. The literature discussed above leads to the following hypothesis:

Hypothesis H1: SCM practices positively mediate the relationship between QM practices and sustainability performance

Model 2: ***Mediating effect of quality management on the relationship between supply chain management practices and sustainability performance***

From SCM standpoint, SCM is a broad management picture in which QM plays a critical role. The principle of QM – the system-based approach – would be applied into SCM to create an efficient SCQM system (Foster, 2008). High quality internal coordination and activities must strongly support external partnerships in supply chain management (Lambert and Cooper 2000; Vanichchinchai & Igel 2011). As such, QM practices are expected to facilitate SCM practices (Vanichchinchai and Igel, 2011). Supporting this argument, Han et al. (2007) found that SC integration does not directly affect firm performance but indirect affect through QM practices. Additionally, Zhu and Sarkis (2004) found empirical evidence that higher QM adoption level facilitates stronger impact of green SCM on performance. From the literature, Hypothesis H2 is stated as followed:

Hypothesis H2: QM practices positively mediate the relationship between SCM practices and sustainability performance

Model 3: ***Synergy effect of supply chain management practices and quality management practices on sustainability performance***

The third perspective concerns SCQM as an integrated result of simultaneous implementation of QM and SCM. Vanichchinchai and Igel (2009) found that QM and SCM are similar in terms of philosophical perspectives and ultimate goals, but different in terms of the primary goal. Therefore, simultaneous implementation of QM and SCM would result in a synergy or a conflict (Vanichchinchai and Igel, 2011). Flynn and Flynn (2005) figured out the potential to pursuit quality goals and supply chain goal at the same time to create cumulative capabilities and demonstrated this argument by providing an empirical evidence. Kannan and Tan (2007) investigated the effect of operational QM practices in the supply chain context and found some significant synergy of internal and external practices. From the literature, hypothesis H3 is stated as followed:

Hypothesis H3: Simultaneous implementation of QM practices and SCM practices yields a synergy effect on sustainability performance

6.3. Hypothesis testing

In this study, mediating effect is tested using PROCESS macro with the bootstrap method suggested by Hayes and Rockwook (2017, in press). Hypotheses are tested based on both aggregate constructs and individual constructs.

Aggregate constructs of QM practices and SCM practices are established by calculating mean scores of 8 QM practices constructs and 6 SCM practices constructs, respectively. Reliability and validity of the aggregate QM constructs and SCM constructs are confirmed by Cronbach's Alpha and Factor analysis.

6.3.1. The mediating effect of SCM practices on the relationship between QM practices and SP

Testing Model 1 with Hypothesis H1: *SCM practices positively mediate the relationship between QM practices and sustainability performance*

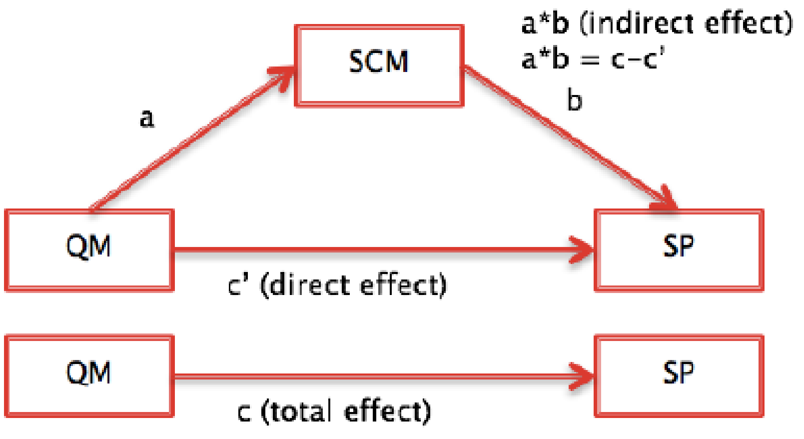

Figure 6-2: Model 1 - mediating effect of SCM on the relationship between QM and SP

Table 6-1: Analysis results on mediating effect of SCM on the relationship between QM and SP (aggregate constructs)

	Economic performance			Environmental perf.		Social perf.	
	RETURN	**COST REDUC.**	**MARKET PERF.**	**EMISS REDUC.**	**CONSUM. REDUC.**	**INT. SOCIAL**	**EXT. SOCIAL**
Total effect	0.38***	0.14	0.46***	0.076	-0.35*	0.55***	0.53***
Direct effect	0.41**	0.003	0.53***	-0.055	-0.62*	0.37*	0.34**
Indirect effect	-0.03	0.13	-0.08	0.13	0.27	0.19	0.20

To test Model 1, Total effect of QM on SP (c), Direct effect of QM on SP when SCM holds a constant (c'), and Indirect effect of QM on SP through SCM (a*b) (Figure 6-2) are calculated. If direct effect is insignificant while indirect effect is significant, then SCM can be deemed as mediator of QM's effect on SP, and vice-versa. For the Model 1, the analysis results show that there is no significant meditating effect (indirect effect) of SCM practices on the relationship between QM practices and sustainability performance. Significant total impacts are mainly derived from direct impact of QM practices on SP.

Specifically, aggregate construct of QM practices has significantly direct and positive impact on Economic performance in terms of economic return and market performance with coefficients of 0.41 and 0.53, respectively (significant at 5%) which lead to significant total effect with coefficients of 0.38 and 0.46, respectively (significant at 1%). Despite negative indirect effect through SCM practices, the effect is insignificant with very small coefficient values. Thus, the indirect effect through SCM practices almost has no influence on economic performance.

Similarly, on social performance, QM practices have direct and positive effect on internal social performance with coefficient of 0.37 (significant at 10%) and external social performance with coefficient of 0.34 (significant at 5%) which result in significant total effect with coefficients of 0.55 and 0.53, respectively (significant at 1%). The indirect effect through SCM practices is not statistically significant but the coefficient values are rather high which help strengthen total impact of QM practices on social performance.

On environmental performance, interestingly, QM practices have significantly direct but negative impact on environmental performance in terms of resource consumption reduction with coefficient of -0.62 (significant at 10%) which lead to a negative total effect with coefficient of -0.35 (significant at 10%). The lower negative total effect of this regression model is a result from positive indirect effect from SCM practices (coefficient of 0.27). Although the indirect effect through SCM practices is insignificant but the coefficient is rather high and support for a reduction in negative impact of QM practices.

To better understand about the mediating effect of SCM practices on the relationship between QM practices and SP, mediating effect is examined with individual construct of QM practices and SCM practices (See Appendix B). In the table results of mediating test using individual constructs, the first column is independent variables (here are QM practices), the first row is dependent variables (here are SP constructs), intersection squares of the first row and the first column are mediators (here are SCM practices). In the table, only SCM practices which have complete mediating effect (direct effect is insignificant) which lead to significant total effect.

From the results, it can be seen that Supplier relationship and Customer relationship positively mediate the impact of Top management support for QM, Quality data and reporting, and Process management on Economic performance. Process integration and Customer relationship positively mediate the impact of Problem solving on Market performance. Moreover, Customer relationship positively mediates the impact of Top management support for QM, Quality data and reporting, Problem solving, and Rewards on External social performance. Differently, Top management support for SCM has significant but negative mediating effect on the relationship of QM practices (except for Rewards) and Resource consumption reduction which leads to negative total effect on this performance.

In summary, the analysis results using aggregate constructs show insignificant mediating effect of SCM practices on the relationship between QM practices and SP. However, in a deeper look at the results using individual constructs, Supplier relationship, Customer relationship and Process integration show some significantly positive mediating effect on the relationship between QM practices and SP. As such, hypothesis H1 cannot be rejected.

6.3.2. Mediating effect of QM practices on the relationship between SCM practices and SP

Testing Model 2 with *Hypothesis H2: QM practices positively mediate the relationship between SCM practices and sustainability performance*

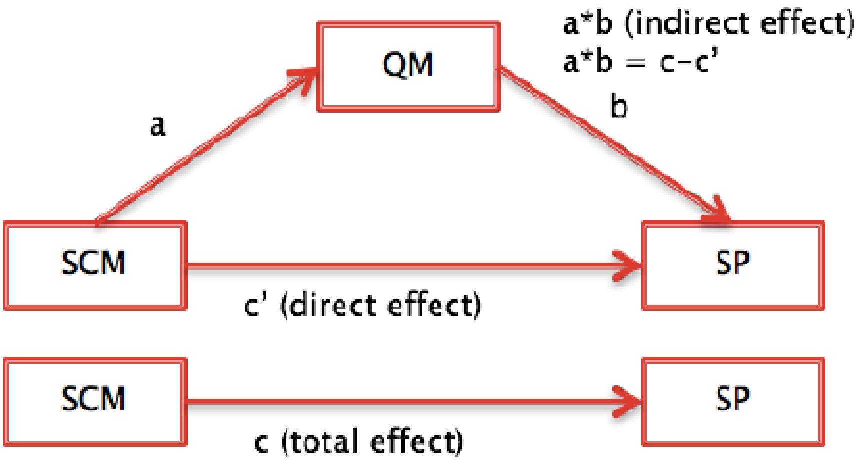

Figure 6-3: Model 2 - mediating effect of QM on the relationship between SCM and SP

To test Model 2, Total effect of SCM on SP (c_2), Direct effect of SCM on SP when QM holds a constant (c_2'), and Indirect effect of SCM on SP through QM (a_2*b_2) (Figure 2) are calculated. If direct effect is insignificant while indirect effect is significant, then QM can be deemed as mediator of SCM's effect on SP, and vice-versa. For Model 2, the analysis results show that QM practices have complete mediating effect (indirect effect) on the relationship between SCM practices and economic return, market performance, resource consumption reduction, internal social performance, and external social performance. Meanwhile, aggregate SCM practices represent insignificant direct impact on all dimensions of sustainability performance.

Table 6-2: Analysis results on mediating effect of QM on the relationship between SCM and SP (aggregate constructs)

	Economic performance			Environmental perf.		Social perf.	
	RETURN	COST REDUC.	MARKET PERF.	EMISS REDUC.	CONSUM REDUC.	INT. SOCIAL	EXT. SOCIAL
Total effect	0.30**	0.16	0.34***	0.11	-0.18	0.51***	0.50***
Direct effect	-0.03	0.16	-0.09	0.15	0.32	0.22	0.23
Indirect effect	0.33**	0.00	0.43***	-0.04	-0.50**	0.29*	0.27**

Regarding Economic performance, SCM practices have significant and positive indirect effect through QM practices on Economic return and Market performance with coefficients of 0.33 and 0.43, respectively (significant at 5%) which lead to significant total effect of 0.30 and 0.34, respectively (significant at 5%). The direct effect of SCM practices on these two performance aspects is in a negative sign but the values are rather small. Thus, the indirect effect through QM practices almost has no influence on economic performance.

About Social performance, similarly, SCM practices have significant and positive indirect effect through QM practices on Internal social performance (with coefficient of 0.29, significant at 10%) and on External social performance (with coefficient of 0.27, significant at 5%). The direct effect of SCM practices on social performance is insignificant but somehow contributes to strengthening total effect on Internal and External social performance (coefficients of total effect are 0.51 and 0.50, respectively, significant at 1%).

With respect to environmental performance, there is no significant direct or indirect impact of SCM practices on emission reduction. Meanwhile, SCM practices show significantly indirect but negative effect on Resource consumption reduction with coefficient of -0.50, significant at 5%. Total effect, however, is insignificant with coefficient of -0.18. This may due to a positive direct effect of SCM even though the direct effect is insignificant but still somehow eliminate negative indirect effect through QM practices.

To better understand the mediating effect of QM practices on the relationship between SCM practices and SP, mediating effect is examined with individual construct of QM practices and SCM practices (See Appendix C). The findings illustrate similar results as analysis using aggregate constructs.

In summary, the analysis results show some significantly positive mediating effect of QM practices on the relationship between SCM practices and economic return, market performance, internal and external social performance. As such, hypothesis H2 cannot be rejected.

6.3.3. Synergy effect from simultaneous implementation of QM practices and SCM practices

Testing Model 3 with Hypothesis H3: Simultaneous implementation of QM practices and SCM practices yields a synergy effect on sustainability performance

Table 6-3: Analysis results on the effect of simultaneous implementation of QM practices and SCM practices on SP (aggregate constructs)

	Economic performance			Environmental perf.		Social perf.	
	RETURN	COST REDUC.	MARKET PERF.	EMISS REDUC.	CONSUM. REDUC.	INT. SOCIAL	EXT. SOCIAL
R	0.38	0.12	0.48	0.18	0.27	0.49	0.57
R2	0.15	0.014	0.23	0.03	0.07	0.24	0.32
Sig.	0.00	0.57	0.00	0.22	0.02	0.00	0.00
	Coef.	*Coef.*	*Coef.*	*Coef.*	*Coef.*	*Coef.*	*Coef.*
Constant	-1.55	2.14	1.33	01.52	2.74	-0.76	1.00
QM	1.40***	0.07	0.73*	1.10	-0.26	0.97**	0.49
SCM	1.04**	0.23	0.12	1.51	0.70	0.87*	0.40
QM*SCM	-0.27**	-0.02	-0.05	-0.31	-0.10	-0.16	-0.04

To test the synergy effect from simultaneous implementation of QM and SCM practices on sustainability performance, regression analysis was adopted with independent variables are aggregate constructs of QM practices, SCM practices, and QM practices multiplied by SCM practices (QM*SCM – which represents for synergy effect); dependent variables are seven sub-constructs of sustainability performance. From the analysis results, only a significant offsetting effect was found in the relationship with economic return (coefficient of -0.27, significant at 5%). In the relationship with other dimensions of sustainability performance, simultaneous implementation of QM and SCM reveals insignificant either offsetting or synergy effect.

To further explore possible synergy effect from simultaneous implementation of QM and SCM practices, synergy effect test was conducted with each couple of individual SCM-QM practices (See Appendix D). The results show some significant synergy effect from supply chain – quality management practices on Market performance, Internal social performance, and External social performance:

On Market performance, synergy effect is created from simultaneous implementation of Quality data and reporting and Information technology (coefficient of 0.16, significant at 5%), Quality data and reporting and Process integration (coefficient of 0.13, significant at 10%), and Process management and Information technology (coefficient of 0.13, significant at 10%).

On Internal social performance, synergy effect is created from simultaneous implementation of Quality data and reporting and Information technology (coefficient of 0.14, significant at 10%), and Quality data and reporting and Process integration (coefficient of 0.17, significant at 10%).

On External social performance, synergy effect is created from simultaneous implementation of Information technology and Top management support for QM (coefficient of 0.19, significant at 1%), Information technology and Quality data and reporting (coefficient of 0.17, significant at 1%), Information technology and Continuous improvement (coefficient of 0.16, significant at 1%), and Information technology and Rewards (coefficient of 0.10, significant at 10%).

In summary, the analysis results show some synergy effect from simultaneous implementation of individual QM and SCM practices on market performance, internal and external social performance. As such, hypothesis H3 cannot be rejected.

6.4. Findings and Discussions

Based on the results using aggregate constructs of QM practices and SCM practices, it can be seen that simultaneous implementation of QM and SCM would result in an offsetting impact on economic return. That means if the organization invests a huge amount in developing comprehensive QM system and SCM system at the same time, it may have negative influence on their economic performance. This finding is contradicted to an empirical result demonstrated by Flynn and Flynn (2005). This is due to the different utilization of measurement constructs between two studies. Flynn and Flynn (2005) found a synergy effect from supply base reduction, percentage incoming materials, and JIT delivery by suppliers which are narrowly related to upstream supply chain. This study uses aggregate constructs from a more comprehensive set of QM practices and SCM practices. Thus, it is not easy to directly compare the result of this study to that of Flynn and Flynn (2005). The reason for the offsetting effect would be explained by different primary goals of QM and SCM (on the one hand, QM towards high quality performance; on the other hand, SCM priories responsive delivery performance (Vanichchinchai and Igel, 2009). Due to resource constraints in Vietnamese enterprises, it would be better for organization to step by step adopted either QM or SCM first, and followed by the other system later.

The impact of supply chain – quality management practices on sustainability performance is strongly facilitated by QM. QM practices have directly significant effect on SP which constitute the significant total effect of SCQM practices on SP even with or without mediating role of SCM practices. Meanwhile, SCM practices represent insignificant direct impact on SP but significant indirect impact on SP through QM practices. The reason would be because Vietnamese firms have longer implementation experience of QM compared to SCM. Currently, QM has been adopted and improved to achieve a certain performance level. Meanwhile, SCM is a newly concerned management system in Vietnam. Therefore, the impact of SCM on SP is strongly mediated by QM. This finding is consistent with the argument that SCM broadens the management scope into external relationships, but it could not work well without the support from internal collaboration and high-quality performance of personnel within the organization (Lambert and Cooper, 2000). In this situation, quality management, despite being criticized for too internal focus, has become an essential foundation for supply chain management (Vanichchinchai and Igel, 2011). This argument is supported by Flynn et al. (2010) which emphasized the prerequisite role of internal integration to external integration which, in turns, affect business performance. This finding implies a suggestion on how enterprises should allocate their limited resources to achieve their prior goals effectively. For the context of Vietnam, findings from this study recommend enterprises to well implement QM before adopting SCM.

The results, based on the analysis of individual constructs of QM practices and SCM practices, show that QM practices and SCM practices are tightly correlated in the relationship with sustainability performance. Despite viewing the mechanism from the standpoint of either QM practices or SCM practices, both systems seem to support each other toward sustainability goals.

From the QM standpoint, QM plays a fundamental role in facilitating SCM and the overall impact of supply chain – quality management practices on sustainability performance. Supply chain management practices including Supplier relationship, Customer relationship and Process integration were identified as strong mediators for QM practices towards sustainability goals. A similar finding is highlighted by Lin et al. (2005) which QM practices significantly impact on organizational performance through mediating of supplier participation. Similarly, Yeung (2011) found that QM implementation facilitates strategic supply management, and strategic supply management significantly affect organizational performance. Moreover, Sila et al. (2006) support for this result by finding that partnership with supply chain members could improve quality performance of product.

From SCM perspective, SCM is a critical management system which covers a broader scope and would be more sufficient to respond to global competitiveness and towards sustainability performance. The benefits of well QM implementation would support and mediate stronger impact of SCM on sustainability performance. Empirical evidence, in this chapter, has well supported for this assumption. QM practices strongly mediate the effect of SCM practices on economic performance and social performance. Supported finding is highlighted by Han et al. (2007) which found that SC integration does not directly affect firm performance but indirect affect through QM practices.

From SCQM point of view, the synergy test using individual constructs figured out simultaneous implementation of SCQM practices Quality data and reporting, Process management, Information technology, and Process integration would create synergy effects on economic performance and social performance. This finding is supported by Quang et al. (2016) which emphasized the important role of data and information management which, in turns, will support for excellent process management and integration. Significant synergy effect from simultaneous implementation of QM and SCM practices has been supported by empirical evidence by Flynn and Flynn (2005), and Kannan and Tan (2007).

However, besides positive mediating effect from QM and SCM on each other which leads to significant improvement in economic and social performance, the mediating effect also results in negative impact on Resource consumption reduction. This finding is somehow consistent with the finding from synergy effect test. It is likely that simultaneous implementation of SCM and QM results in some benefits but also requires enormous investment in terms of time and resources. Therefore, it is necessary to identify key SC-QM practices which are critical success factors towards sustainability performance (See more in Chapter 7).

6.5. Summary of Chapter 6

This study empirically tests the possible integration or mutual support of Quality management and Supply chain management systems in the relationship with Sustainability performance. Three analysis models have been proposed and tested. They are on (1) how quality management practices mediate the impact of supply chain management practices on sustainability performance, (2) how supply chain management practices mediate the impact of quality management practices on sustainability performance, and (3) how simultaneous implementation of quality management practices and supply chain management practices would generate synergy effects on sustainability performance. The results found a mutual and supportive relationship between Quality management and Supply chain management practices. Quality management practices appear to play a more fundamental and antecedent role compared to Supply chain management practices towards sustainability goals. Moreover, the study found an offsetting effect from simultaneous implementation of Quality management and Supply chain management on economic return.

CHAPTER 7: OVERALL IMPLICATIONS

From the analysis results presented in Chapter 4, Chapter 5, and Chapter 6, this chapter integrates the main findings and presents the overall theoretical and managerial implications of this study.

7.1. Theoretical implications

This study contributes to the literature in several ways:

Firstly, this study contributes to the literature on sustainability by proposing and validating measurement constructs of sustainability performance. The measurement constructs are following the Triple bottom line with seven sub-constructs belonging to three bottom lines: (1) economic performance: economic return, cost reduction, and market performance; (2) environmental performance: emission reduction, and resource consumption reduction; (3) social performance: internal social performance, and external social performance. These measurements should be considered to be used in future research on sustainability-related topics.

Secondly, this study contributes to QM literature by proposing and validating measurement constructs of eight QM practices including Top management support for QM, Training, Product/service design, Quality data and reporting, Process management, Continuous improvement, Problem solving, and Rewards. These constructs are adopted from well-known previous works, also are customized to more appropriately measure QM practices in cross-sectional companies. In addition, the study enriches the literature by providing new empirical evidence of QM adoption to achieve sustainability goals in the context of Vietnam – a dramatically developing country.

Thirdly, this study contributes to SCM literature by developing and validating measurement constructs of six SCM practices including Top management support for SCM, Information sharing, Information technology, Process integration, Strategic supplier relationship, and Customer relationship. These constructs are adopted from highly cited academic works which are widely accepted and referred in the literature. Moreover, the study strengthens the literature by offering new empirical evidence of SCM adoption to achieve sustainability goals in Vietnam.

Fourthly, the study provides insights into the controversy concerning the underlying relationship of QM and SCM towards sustainability performance. Although it is likely that QM practices play an antecedent role facilitating SCM toward efficient SCQM implementation because QM practices show both significant direct and indirect impact on SP, there are still significant evidence for mutual support each other as mediators from individual practices of QM and SCM. The findings suggest some possible synergies from simultaneous implementation of some QM practices and SCM practices.

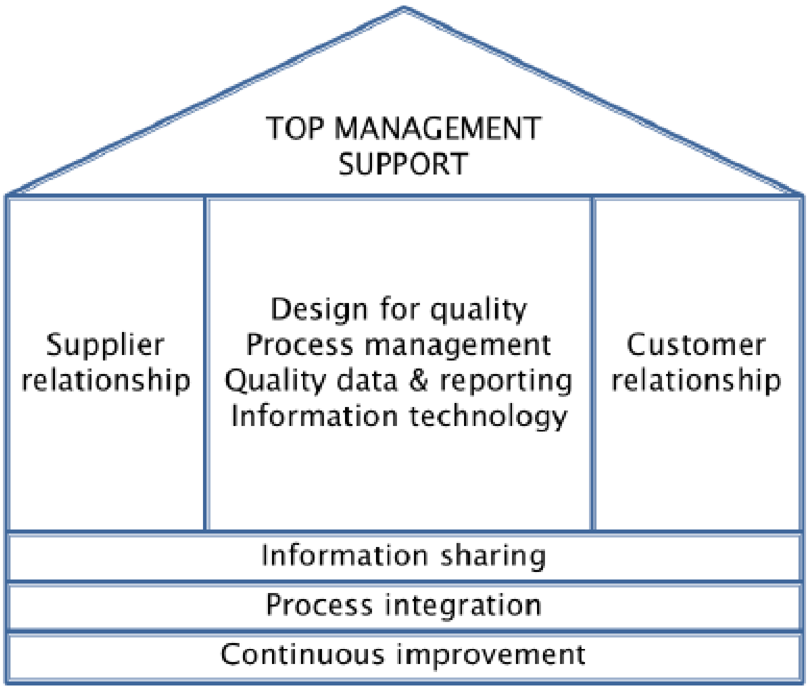

Table 7-1: Proposed SCQM framework

Last but not least, from the empirical findings, an SCQM practices model is proposed including critical QM and SCM practices which have a positive impact on SP and be well integrated to possibly create synergy effect on sustainability performance. The model is built in a shape of an SCQM House. The roof of the SCQM House is Top management support for the whole management system. Central of the SCQM House includes internally critical QM practices. Two sides of the SCQM House are practices related to supply chain partners. And the foundation for SCQM House should be Information sharing, Process integration and Continuous improvement. These practices are necessary for effective SCQM House and should involve not only the focal organization but also supply chain partners. This model is suggested to be considered in future research.

7.2. Practical implications

Practically, the results of this study are fruitful for managers to consider their approach to establish supply chain – quality management system. Due to resource constraints, the study suggests two different approaches to build up the organization' management systems:

Approach 1: to separately implement QM system and SCM systems. This approach would be appropriate for organizations with limited investment in management systems. They should choose either QM system or SCM system to adopt and implement first. The empirical results from this study suggested that internal QM would be considered as a prerequisite for SCQM system. Therefore, it is recommended to, first of all, focus on adopting and implementing internal QM practices. After well implement internal QM practices, the organization should gradually broaden management scope into the supply chain by building up long-term lasting relationship with suppliers and customers. After efficiently operating the extended QM system, the organization should consider adopting other SCM practices. The study suggests that managers should consider this path to develop an effective SCQM system towards sustainability performance.

Approach 2: to implement SCQM system. This approach would be appropriate for organizations which would like to establish a comprehensive SCQM system from the beginning. In this situation, they should better prioritize critical success SCQM practices and implement them. From the result, the study proposed the SCQM framework which comprises critical QM and SCM practices which have positive impact on SP and be well integrated to possibly create synergy effect on sustainability performance. They are Top management support, Design for quality, Process management, Quality data and reporting, Information technology, Information sharing, Supplier relationship, Customer relationship, Process integration, and Continuous improvement. The study recommends managers to consider this model to establish an effective SCQM system towards sustainability performance.

These recommended approaches are especially appropriate for new firms or start-up that are seeking for effective management techniques in the current market. For existing organizations, to help them better position themselves in the SCQM map, a matrix of the best SCQM practices towards SP is proposed for each group with different examined types of industry and firm size. (See more in Table 4-22 and Table 5-21)

CHAPTER 8: CONCLUSIONS

This final chapter is started with a summary of the main findings from the previous chapters. Next, limitations of this study are discussed, and directions to overcome these limitations in the future research are suggested.

8.1. Summary of main findings

In the previous chapters, besides the intensive literature review and research design parts, empirical evidence has provided on the relationship between QM practices and SP, the relationship between SCM practices and SP, and the underlying relationship of SCQM towards SP. Overall findings are discussed as followed:

Firstly, the study shows mixed impacts of eight QM practices on different dimensions of sustainability performance. Especially, the results figured out four QM practices which have significantly positive impact on SP, namely: Top management support for QM, Design for quality, Quality data and reporting, and Continuous improvement. These practices could be considered as critical success factors for QM implementation.

Secondly, the study shows mixed effects of six SCM practices on different dimensions of sustainability performance. The results, especially, identified four SCM practices which have significantly positive impact on SP, including: Information sharing, Information technology, Supplier relationship, and Customer relationship. These practices could be considered as critical success factors for SCM implementation.

Thirdly, the results from testing underlying relationship between QM and SCM found a mutual and supportive relationship of QM and SCM practices. The findings are considered as a response to the calls from Foster (2008), Flynn and Flynn (2005), Robinson and Malhotra (2005), and Li et al. (2004) for further investigation of possible integration between two disciplines. QM practices appear to play a more fundamental and antecedent role compared to

SCM practices towards sustainability goals. This result is consistent with Zeng et al. (2013) and Vanichchinchai and Igel (2011) which found that QM implementation within the organization is considered as a foundation for SCM implementation and as a prerequisite for effective SCQM implementation. Moreover, the study found an offsetting effect from simultaneous implementation of QM and SCM on economic return. This finding would be explained by the situation of resource constraints in Vietnam-based enterprises. From this finding, enterprises with limited investment in management systems is suggested to well implement QM system before adopting SCM.

Fourthly, by further exploring possible synergy using individual constructs of QM and SCM, the study found some significant synergies from simultaneous implementation of two QM practices and two SCM practices including Quality data and reporting and Process management (QM practices) Information technology and Process integration (SCM practices). It is interesting that singly each of these four construct reveals insignificant impact on Market performance, Internal and External social performance. However, simultaneous implementation of these four practices would yield synergy effect on Market performance, Internal and External social performance. This finding, together with findings on the critical QM and SCM success factors, implies a set of SCQM practices which includes the critical QM practices and SCM practices which have positive impact on SP and would well integrate with each other. The set of SCQM practices includes ten practices: Top management support, Design for quality, Process management, Quality data and reporting, Information technology, Information sharing, Supplier relationship, Customer relationship, Process integration, and Continuous improvement.

8.2. Limitations and suggestion for future research

Although the study has some contributions to the literature and practices, it is important to view the study from a perspective of its limitations. Methodologically, the study suffers a similar limitation to many empirical studies due to a survey based subjective. The study collects cross-sectional data by the self-reported questionnaire which comprises question items regarding both practices and performance evaluating based on a five-point Likert scale. Although the author tried to address the issue of bias by asking for multiple respondents from each organization, perceptual and individual bias may still exist. This limitation would be somehow overcome by adding more objective question items.

The second limitation relates to the measure of QM practices. The measurement of QM practices is adopted from previous studies which are mainly examined QM practices in the manufacturing context. Although the author also referred to some references possibly applying in service context and customized the question items to more appropriate evaluate in a cross-sectional context, demographic characteristics of respondents in this study show some industrial bias with more manufacturing based respondents. The reason why is that fourteen responses which are rejected due to many missing variables are mainly service-based organizations. Future research would overcome this limitation by designing different questionnaires based on different industrial characteristics and collect data from a larger sample size.

The third limitation relates to the measure of SP. It is difficult to measure SP because it requires a long-term performance report. To address this issue, the question items on SP are evaluated based on the performance change in the recent two years. Future studies should consider collecting longitudinal data to improve explanation power to the relationship related to SP.

The fourth limitation regards to moderating variables. In this study, firm size and type of industry are utilized as moderating variables for the relationship between QM practices and SP, and the relationship between SCM practices and SP. Moreover, for the former relationship, experience time of QM implementation was taken into consideration as a quality-related moderating variable. For the latter relationship, supply chain specific contextual variable has not been considered yet. The results of the relationship between SCM and SP would be further improved if future research considers more supply chain moderating variables such as supply chain uncertainty or environment uncertainty.

Finally, this study investigates the underlying relationship between QM and SCM which is regarded as the first step to structure an SCQM system (Foster, 2007, Huo et al., 2016, in press). From the initial findings, the study proposed an SCQM framework. Future research should continue to validate this model and provide futher empirical evidenc on the contribution of SCQM practices to SP.

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Appendix A: Questionnaire items

Question items	Factor loading
Top management support for quality management (Alpha= 0.730; KMO= 0.740; Eigenvalue= 2.222, % of variance= 55.557)	
Our organization has a comprehensive goal-setting process for quality	0.6
We always review of quality issues in top management meetings	0.661
Our top management considers quality improvement as a way to increase profits	0.769
All major department heads within our company accept their responsibility for quality	0.521
*Department heads provide personal leadership for quality products and quality improvement	-
*Department heads communicates a vision focused on quality improvement	-
Top management support for supply chain management (Alpha= 0.811; KMO= 0.752; Eigenvalue= 2.594; % of variance= 64.848)	
Top management is supportive of our efforts to improve the purchasing department	0.684
Top management considers purchasing to be a vital part of our corporate strategy	0.908
Top management emphasizes the purchasing function's strategic role.	0.824
Requests for increased resources supporting for supply chain management are mostly satisfied by top management.	0.489
Top management supports the need for inter-organizational information systems	-
Training on quality (Alpha= 0.836; KMO=0.773; Eigenvalue= 3.311; % of variance= 55.188)	
We provide specific work-skills training to employees throughout the organization.	0.815
We provide quality-related training to hourly employees throughout the organization.	0.815
We provide quality-related training to managers and supervisors throughout the organization.	0.709
We provide training on the "total quality concept" (i.e., philosophy of company-wide responsibility for quality) throughout the organization.	0.558
Our employees receive training and development in workplace skills on a regular basis.	0.595
Management at our company believes that continual training and upgrading of employee skills is important	0.535
Design for quality (Alpha= 0.802; KMO= 0.784; Eigenvalue= 2.849; % of variance= 56.983)	
*Quality of new products is emphasized in relation to cost or schedule objectives.	-
*In the design process, we make an effort to list only the specifications that are really needed.	-
We work in teams, with members from a variety of areas, to introduce new products	0.683
We design for producibility	0.674
New product designs are thoroughly reviewed before the product is produced	0.748
Customer requirements are thoroughly analyzed in the new product design process	0.78
In product development, we emphasize the importance of offering products that are distinctive.	0.505
Quality data and reporting (Alpha= 0.752; KMO= 0.645; Eigenvalue= 2.304; % of variance= 57.610)	
Quality data are always provided in a timely fashion.	0.468
*We rarely use quality data (cost of quality, defects, errors, scrap, etc.) as a tool to manage quality.	-
We use quality data to evaluate performance	0.498
Information on quality data is readily available to employees	0.903
Information on productivity is readily available to employees	0.725
Information sharing (Alpha= 0.855; KMO= 0.836; Eigenvalue= 3.524; % of variance= 58.736)	
We inform trading partners in advance of changing needs.	0.597
Our trading partners share proprietary information with us.	0.529

Question items	Factor loading
We and our trading partners exchange information that helps our business planning	0.808
We and our trading partners keep each other informed about events that may affect the other party	0.788
Sharing information between partners and us takes place frequently	0.799
We and our trading partner exchange performance feedback.	0.728
Information technology **(Alpha= 0.832; KMO= 0.755; Eigenvalue= 2.678; % of variance= 66.961)**	
There are direct computer-to-computer links with key suppliers	-
Inter-organizational coordination is achieved using electronic links.	0.638
We use information technology-enabled transaction processing.	0.732
We contact with customers by telecommunications or electronic devices	0.872
We use electronic transfer of purchase orders	0.743
We transfer invoices by electronic means	-
Process management **(Alpha= 0.862; KMO= 0.824; Eigenvalue= 3.565; % of variance= 59.418)**	
We clearly define objectives of the processes necessary to achieve.	0.656
We establish responsibility for managing processes	0.685
We manage processes' interrelations as a system to achieve quality objectives	0.772
We analyze the effect of modifications to individual processes on the system as a whole.	0.775
We manage risks that can affect outputs of the processes	0.683
We have standardized process instructions which are given to personnel	0.724
Process integration **(Alpha= 0.847; KMO= 0.860; Eigenvalue= 3.706; % of variance= 52.939)**	
Information flows smoothly between our partners and us.	0.582
Our supply chain members try to integrate operations with each other.	0.714
Inter-functional teams from our company and partners regularly have meetings to serve mutual customers better.	0.773
Our supply chain members develop interlocking programs with each other	0.758
Our supply chain members jointly manage logistics activities	0.756
Material flows smoothly between our partners and us.	0.559
We and suppliers together manage inventory in the supply chain	0.526
Supplier relationship **(Alpha= 0.865; KMO= 0.836; Eigenvalue= 3.602; % of variance= 60.041)**	
We view our suppliers as an extension of our company.	0.591
We involve our key suppliers in goal-setting activities	0.73
We expect our relationship with key suppliers to last a long time	-
The suppliers see our relationship as a long-term alliance.	0.576
We regularly solve problems jointly with our suppliers	-
We have continuous improvement programs that include our key suppliers	0.767
Our key suppliers participate in our strategic planning activities	0.815
We actively involve our key suppliers in new product development processes	0.817
Customer relationship **(Alpha= 0.867; KMO= 0.812; Eigenvalue= 3.625; % of variance= 60.421)**	
We frequently interact with customers to set standards	-
We frequently measure customer satisfaction	0.727
We frequently determine future customer expectations	0.757
We periodically evaluate the importance of our relationship with our customers	0.718
We follow up with customer feedback.	0.735
We emphasize the importance of building long-term relationships with customers.	0.705
We frequently are in close contact with our customers	0.705
Problem solving **(Alpha= 0.886; KMO= 0.736; Eigenvalue= 2.445; % of variance= 81.516)**	
Our company forms teams to solve problems	0.894
Problem solving teams have helped improve performance in our organization	0.875

Question items	Factor loading
In the past three years, many problems have been solved through small group sessions	0.783
Continuous improvement (Alpha= 0.888; KMO= 0.848; Eigenvalue= 3.467; % of variance= 69.332)	
Continuous quality improvement is an important goal of this organization	0.637
People in this organization are continually looking for better ways of doing their work	0.9
People in this organization are constantly improving their business process	0.87
All employees believe that it is their responsibility to improve quality	0.807
Continuous improvement of quality is stressed in all work processes throughout our organization.	0.701
Quality improvement is not a high priority for me.	
Reward (Alpha= 0.869; KMO= 0.713; Eigenvalue= 2.382; % of variance= 79.384)	
Staff are rewarded for quality improvement	0.903
Managers are rewarded for making continuous improvements.	0.875
We pay a group incentive for quality improvement ideas	0.719
Economic Return (Alpha= 0.731; KMO= 0.673; Eigenvalue= 1.959; % of variance= 65.293)	
Revenue	0.739
Profit	0.748
Return on investment	0.593
Cost reduction (Alpha= 0.745; KMO= 0.722; Eigenvalue= 2.342; % of variance= 58.548)	
Cost of poor quality	0.429
Cost of energy consumption	0.701
Fees for waste treatment	0.877
General operations cost	0.669
Market performance (Alpha= 0.613; KMO= 0.637; Eigenvalue= 1.699; % of variance= 56.625)	
Responsiveness to customers' requirements	0.506
Market share	0.605
Customer satisfaction	0.665
Emission reduction (Alpha= 0.871; KMO= 0.820; Eigenvalue= 3.373; % of variance= 67.467)	
Frequency of environmental accidents	0.656
Air emissions	0.925
Waste water	0.87
Solid wastes	0.818
Consumption of hazardous materials	0.561
Resource consumption reduction (Alpha= 0.793; KMO= 0.700; Eigenvalue= 2.134; % of variance= 71.122)	
Raw material consumption	0.674
Energy consumption	0.811
Water consumption	0.776
Internal social (Alpha= 0.642; KMO= 0.564; Eigenvalue= 1.773; % of variance= 44.318)	
Health insurance coverage	-
Attention to human resource development	0.583
Discrimination	-
Compliance with regulations	0.81
External social (Alpha= 0.788; KMO= 0.703; Eigenvalue= 2.107; % of variance= 70.230)	
Number of jobs provided	0.698
Involvement in local communities	0.779
Contributions to the local economy	0.756

Appendix B: Analysis results on mediating effect of SCM on the relationship between QM and SP (individual constructs)

Independent	Economic Return	Cost reduction	Market perform.	Emission reduction	Resource consumption reduction	Internal social perform.	External social perform.
TOPQ	SUPRE (0.09**) CUSRE (0.10**)				TOPS (-0.26***)		CUSRE (0.20***)
TRAIN					TOPS (-0.23***)		
DEGN					TOPS (-0.19***)		
QDAT	SUPRE (0.09**); CUSRE (0.10*)				TOPS (-0.21***)		CUSRE (0.21***)
PCMT	SUPRE (0.09*) CUSRE (0.10**)				TOPS (-0.22***)		
CONT					TOPS (-0.16***)		
PROB			PCINT (0.09**) CUSRE (0.11**)		TOPS (-0.13***)		CUSRE (0.21***)
REW							CUSRE (0.15***)

Note: TOPQ: Top management support for QM; TRAIN: Training; DEGN: Product/service design; QDAT: Quality data and reporting; PCMT: Process management; CONT: Continuous improvement; PROB: Problem solving; REW: Rewards. TOPS: Top management support for SCM; PCINT: Process integration; SUPRE: Supplier relationship; CUSRE: Customer relationship.

Appendix C: Analysis results on mediating effect of QM on the relationship between SCM and SP (individual constructs)

Independent	Economic Return	Cost reduction	Market performance	Emission reduction	Resource consumption reduction	Internal social performance	External social performance
TOPS	TOPQ (0.10*), TRAIN (0.18***), DEGN (0.13***), QDAT (0.08**), PCMT (0.09**), CONTI (0.11***), REW (0.09***)	QDAT (0.11**)	TOPQ (0.17***), TRAIN (0.18***), DEGN (0.13***), QDAT (0.10***), PCMT (0.12***), CONTI (0.16***), PROB (0.08***), REW (0.06***)			TOPQ (0.19***), DEGN (0.14***), PCMT (0.17***), CONTI (0.14***)	TOPQ (0.16***), TRAIN (0.23***), DEGN (0.15***), QDAT (0.13***), PCMT (0.17***), CONTI (0.19***), PROB (0.11***), REW (0.07***)
INFS	TOPQ (.06**), TRAIN (0.15***), DEGN (0.14***), QDAT (0.13**), PCMT (0.16***), CONTI (0.14***), REW (0.11***)		TOPQ (0.10***), TRAIN (0.14***), DEGN (0.12***), QDAT (0.14***), PCMT (0.14**), CONTI (0.18***), PROB (0.09**), REW (0.07***)		TOPQ (-0.10***), TRAIN (-0.15***) PCMT (-0.22**) CONTI (-0.19***), REW (-0.13***)	PCMT (0.23***), CONTI (0.15**), PROB (0.14***)	QDAT (0.13**), PCMT (0.16***), CONTI (0.17***)
INFT	TOPQ (0.04**), TRAIN (0.08***), DEGN (0.10***), QDAT (0.06**), PCMT (0.07**), CONTI (0.07***), REW (0.09***)		TOPQ (0.07***), TRAIN (0.08***), DEGN (0.10***), QDAT (0.09***), PCMT (0.11***), CONTI (0.11***) PROB (0.06**), REW (0.07***)		TOPQ (-.08**), TRAIN (-0.09**) CONTI (-0.11***)	DEGN (0.12***), PCMT (0.15***), CONTI (0.10***)	TRAIN (0.10***), DEGN (0.12***), QDAT (0.10***), PCMT (0.14***), CONTI (0.12***)
PCINT	TOPQ (0.06*), TRAIN (0.15***), DEGN (0.15***), QDAT (0.10**), CONTI (0.11**) REW (0.13***)	QDAT (0.20***)	TRAIN (0.13***), QDAT (0.12***), PCMT (0.10*), CONTI (0.16***)	DEGN (0.10*)	TOPQ (-0.10**), TRAIN (-0.14**) CONTI (-0.15***), REW (-0.15***)	DEGN (0.16***), PCMT (0.23***), CONTI (0.15**), PROB (0.14***)	
SUPRE	DEGN (0.11***)		TOPQ (0.09***), TRAIN (0.11***), DEGN (0.12***), QDAT (0.09***), PCMT (0.08***), CONTI (0.14***), PROB (0.09**), REW (0.06***)		TOPQ (-0.10***), TRAIN (-0.12***) PCMT (-0.08*) CONTI (-0.14***) REW (-0.12***)		

Independent	Economic Return	Cost reduction	Market performance	Emission reduction	Resource consumption reduction	Internal social performance	External social performance
CUSRE	TRAIN (0.16***), DEGN (0.17***), CONTI (0.12**), REW (0.12***)	QDAT (0.17***)	TRAIN (0.15***), CONTI (0.20***)		TOPQ (-0.11**), TRAIN (-0.18**) CONTI (-0.22***) REW (-0.15***)	TOPQ (0.15***), TRAIN (0.12**), DEGN (0.22***), PCMT (0.20***), CONTI (0.21***), PROB (0.18***), REW (0.10**)	

Note: TOPQ: Top management support for QM; TRAIN: Training; DEGN: Product/service design; QDAT: Quality data and reporting; PCMT: Process management; CONT: Continuous improvement; PROB: Problem solving; REW: Rewards. TOPS: Top management support for SCM; INFS: Information sharing; INFT: Information technology; PCINT: Process integration; SUPRE: Supplier relationship; CUSRE: Customer relationship.

Appendix D: Analysis on the effect of simultaneous implementation of QM practices and SCM practices on SP (individual constructs)

	Economic Return	Cost reduction	Market perform.	Emission reduction	Resource consumption reduction	Internal social performance	External social performance
Top management support for quality							INFT (.19***)
Training							
Product/service design							
Quality data and reporting			INFT (.16**), PCINT (.13*)			INFT (.14*), PCINT (.17*)	INFT (.17***)
Process management			INFT (.13*),				
Continuous improvement							INFT (.16***)
Problem solving							
Rewards							INFT(.10*)

Note: INFT: Information technology; PCINT: Process integration