

Supply Chain Management
Michael Eßig · Wolfgang Stölzle *Hrsg.*

RESEARCH

Irène Kilubi

Strategic Technology Partnering and Supply Chain Risk Management

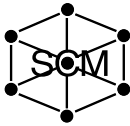
Five Selected Essays



Springer Gabler

Supply Chain Management

Beiträge zu Beschaffung und Logistik



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Industrielle Wertschöpfung wird immer komplexer. Der steigende Wettbewerbsdruck zwingt zu differenzierten Angeboten, gleichzeitig nimmt der Kostendruck zu. Unternehmen können diesen gestiegenen Anforderungen nur gerecht werden, wenn sie neben der Optimierung eigener Produktion besonderen Wert auf die Gestaltung effektiver und effizienter Netzwerke legen. Supply Chain Management befasst sich mit unternehmensübergreifenden Wertschöpfungsaktivitäten von der Rohstoffgewinnung bis zur Endkundendistribution. Die Schriftenreihe sieht sich dabei besonders den lange vernachlässigten betriebswirtschaftlichen Teildisziplinen Beschaffung und Logistik verpflichtet, die als Treiber des Supply Chain Management gelten.

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Strategic Technology Partnering and Supply Chain Risk Management

Five Selected Essays

 Springer Gabler

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Supply Chain Management

ISBN 978-3-658-19917-3

ISBN 978-3-658-19918-0 (eBook)

<https://doi.org/10.1007/978-3-658-19918-0>

Library of Congress Control Number: 2017955667

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Printed on acid-free paper

This Springer Gabler imprint is published by Springer Nature

The registered company is Springer Fachmedien Wiesbaden GmbH

The registered company address is: Abraham-Lincoln-Str. 46, 65189 Wiesbaden, Germany

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List of abbreviations

ACA	Author Co-citation Analysis
AMR	Advanced Market Research
AL	Alliance
AQ	Acquisition
CA	Consortia
CACM	Communications from Association for Computing Machinery
CIMO	Context-Intervention-Mechanisms-Outcome
CL	Cooperation/Contractual
CLONT	Complementary Capabilities, Learning & Exploitation Capabilities Organisational Capabilities, Network, Alliance, and Partnership Capabilities, Technological, Innovative, and Internal capabilities
CMI	Co-Managed Inventory
CN	Collaboration
CO	Conceptual
CS	Case Study
EE	Evolutionary Economics
ES	Economy/Society
GT	Game Theory
IM	Industry/Market
JIT	Just-in-time
JV	Joint Venture
KBV	Knowledge-based View
LC	Licensing
LR	Literature Review
MDS	Multidimensional Scaling
MIT	Massachusetts Institute of Technology
ML	Multilevel
MR	Merger
MVA	Multivariate Analysis

N/A	Not Applicable
NBF	New Biotechnology Firms
NPD	New Product Development
N/S	Not Specified
NW	Network
OL	Organisational Learning
OM	Operations Management
ON	Organisation
OT	Other Theories
PCA	Principal Component Analysis
RBV	Resourced-based View
R&D	Research and Development
ROT	Real Options Theory
SC	Supply Chain
SCM	Supply Chain Management
SCR	Supply Chain Risk
SCRM	Supply Chain Risk Management
SCT	Social Capital Theory
SLR	Systematic Literature Review
SMEs	Small and medium-sized Enterprise
SNT	Social Network Theory
SSCI	Social Science Citation Index
SPSS	Statistical Package for the Social Sciences
SQ	Survey/Questionnaire
SR	Secondary Database Research
STP	Strategic Technology Partnering/Partnership
TB	Theory Building
TCE	Transaction Cost Economy
TT	Theory Testing
VMI	Vendor Managed Inventory

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Chapter I

Summary of the research

1 Introduction

1.1 Motivation and purpose

Modern literature has emphasised the significance of innovation, with “open and closed innovation” (Chesbrough, 2003), and supplier-led innovation (Narasimhan and Narayanan, 2013) being key aspects within supply networks highlighting the need to work in tandem with suppliers. Stakeholders appreciate the need for exploration and exploitation, which helps to perceive how suppliers and supply chain (SC) networks are contributing to commercialisation. Innovation concepts in the operations management (OM) and supply chain management (SCM) context are evolving, drawing on organisational learning theory, knowledge management, network theory, absorptive capacity, social exchange theory, etc. Indeed, considering the prevailing competition, innovation is vital within the OM discipline towards presenting relevant solutions from both perspectives, namely, the theoretical and practical perspective (Narasimhan, 2014). The demands of the market environment and the progression of emerging markets lead to the development of dynamic and complex SC networks (Braunscheidel and Suresh, 2009; Manuj and Mentzer, 2008a; Tummala and Schönherr, 2011; Spekman and Davis, 2004; Zsidisin *et al.*, 2004). Consequently, these effects lead to increased risk exposure; for instance due to short technology and product life cycles, increased demand for just-in-time (JIT) deliveries, reduced inventory buffers and e-business (Brindley, 2004; Fawcett *et al.*, 2011; Giunipero and Eltantawy, 2004; Hallikas *et al.*, 2004; Harland *et al.*, 2003; Narasimhan and Talluri, 2009). Fuelled by several well-documented events, such as natural disasters and events (e.g. Tsunami 2004, Hurricane Katrina 2005, Taiwan earthquakes 1999, 2009, 2010), diseases (e.g. foot- and mouth disease in the UK in 2001, the SARS-pandemic 2003/2004, avian influenza 2005, swine influenza 2009) and terrorist attacks (e.g. New York 2001, Madrid 2004, London, 2005, Jakarta 2009), the Iceland volcano eruption in 2010, the nuclear disaster in Fukushima, 2011 and Hurricane Sandy in 2012, interest in supply chain risk (SCR) issues has steadily grown.

The ability to withstand external threats and provide countermeasures to potential risks within SCs occupy primary concern. In spite of the incredible advance in SCRM concepts, parallel progression in theory improvement and endeavours to comprehend the social interactions in SCRM has stayed behind. Although supply chain risk management (SCRM) has become standard in SCM research, the term and concept to establish useful SCRM remains ambiguous and lacks adequate understanding. Apart from that, a generally accepted research or analytical framework is still missing: “The absence of any widely accepted framework for categorizing research in this field reflects the novel and evolving nature of SCRM as well as the SCM field itself” (Zsidisin and Ritchie, 2008, p. 5). Along with increasing SCRs due to environmental and economic changes, answering the question of how to reduce SCRs holds paramount importance (Chen *et al.*, 2013). Collaboration was found to support with environmental uncertainty (e.g. Eden *et al.*, 2008; Vilkamo and Keil, 2003; Dogsen, 1993). Facing fast technological changes and global competition, inter-organisational collaborations have become increasingly important for firms to enhance their competitiveness. Particularly, inter-organisational partnerships are critical for a firm’s innovativeness when firms lack sufficient internal research and development (R&D) resources (Un *et al.*, 2010; Smith and Sharif, 2007).

Hence, collaborations in R&D have become a common instrument for securing and leveraging technological competencies (Schulze *et al.*, 2014; Oxley and Sampson, 2004). A major, fundamental factor for wealth creation and superior performance is joint innovation by means of strategic technology partnering (STP) (Bidault and Cummings, 1994; Forrest and Martin, 1992; Kim and Lee, 2003; Lanctot and Swan, 2000; Mukherjee *et al.*, 2013; Sivadas and Dwyer, 2000; Un *et al.*, 2010). Many firms increasingly cooperate in their technological undertakings; they engage in STP for technological, commercial, industrial, or financial reasons. For that reason, STP is deemed imperative for easing the access to strands of technologies that are unknown to a company. Still, there is a paradox: companies frequently fail to reap the anticipated benefits of most of their STPs (Kale and Singh, 2009b). Although the benefits of inter-organisational partnerships have long been

recognised, evidence suggests that some organisations are better at creating and capturing value through their strategic partnerships than others (e.g. Heimeriks and Duysters, 2007; Kale *et al.* 2002; Anand and Khanna, 2000). From a resource-based perspective, such performance differentials reflect variance in STP capabilities across organisations. However, in spite of growing interest in this research stream, we lack a systematic theoretical and empirical understanding of those capabilities and their underlying elements (Sarkar *et al.*, 2009).

On this note, Tidd (2014) calls for an enhanced understanding of the inherent mechanism and capabilities that contribute to fruitful interactions and outcomes of collaborative innovation activities. Hence, to encourage companies to secure their SCs, powerful strategies must be settled that fulfil two needs. In the first place, these strategies need to assist firms in minimising costs and enriching customer satisfaction. Second, those strategies need to empower organisations to carry forward their operational activities during and after a severe disruptive incident has happened (Tang, 2006b). Understanding how to respond to and mitigate SCRs comprehensively unveils a supplementary research challenge in SCM (Tang and Musa, 2010). Every organisation follows numerous routine activities, which could relate to how raw materials are processed, or how the executive management reviews the processes are undertaken to account for budgeting or strategy implementation, for example (Grant, 1991).

Considering the significance of both SCRM and STP as competitive features in turbulent and dynamic market conditions, it is to some degree astounding that the link between these two essential research strands has not been sufficiently focused on so far (Bierly *et al.*, 2014). Thus, this research aims at bridging this gap and seeks to combine SCRM and STP. The investigation will be carried out to understand the conditions under which the STP helps reduce and mitigate SCRs. SCRM is about preventing and providing countermeasures to risks and potential disruptions in a supply chain. Hence, SCRM aims at identifying sources and probabilities of risks as well as methods and processes to respond to and mitigate them. STP deals with entering collaborative relationships with other organisations in the area

of product design and R&D to achieve higher levels of innovativeness and to maintain the potential to perform in a highly competitive area of high technology. STP, therefore, aims at boosting innovativeness and thus, in turn achieves higher organisational performance. SCRM and STP can be viewed as opposite sides of the same coin, both dealing with an organisation's long-term profitability and viability, but approaching it from opposite angles. In the resource-based view (RBV) of the firm the organisation is viewed as a bundle of valuable resources, encompassing fundamental immaterial assets, which may provide the competitive advantage (e.g. Amit and Schoemaker, 1993). Therefore, the resources of a firm are considered to be a wellspring to the extent they are valuable, rare, distinct, uncommon, and hard to copy or substitute (e.g. Barney, 1991). Likewise, contended that social capital records highly among such immaterial assets and that a distinct incorporation of the role of social capital further fortifies the logical forces of the RBV connected with various issues (Schiele *et al.*, 2015).

Nowadays firms are working increasingly in network environments. By this progress, the network perspective has turned out to be more imperative in SCRM and academic research (Borgatti and Li, 2009; Kim *et al.*, 2011). Therefore, social capital, which analyses the value actors can derive from their network ties, has become increasingly popular in supply chain-related research (Autry and Griffis, 2008; Carter *et al.*, 2007). These issues consist of the comparative benefits of companies as organisational arrangements, the rationale of inter-organisational networks as means to spot business exchanges and the role of social capital as a governance mechanism in such networks (Chisholm and Nielson, 2009). In detail, the present study investigates issues on capabilities aimed at managing the broader SC network and business partnerships. While contemporary and emerging management research acknowledges cooperative partnerships as an enabler for organisational performance, understanding central firm resource configurations has been somehow under-researched. A narrowed emphasis in these research areas lies on solid practices and procedures that empower organisations to excel within inter-firm partnerships. Figure I-1 illustrates and explains the outline of the research summary, presented in Chapter I.

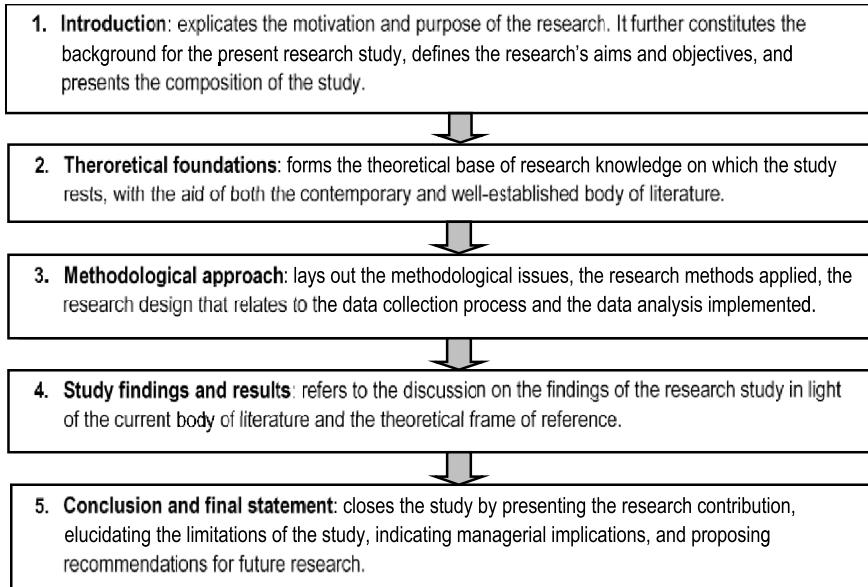


Figure I-1: Outline of the research summary.
Source: Own illustration.

1.2 Thematical boundaries and definitions

The risk of disruptions triggered both from dynamics within SCs and from external environmental action is of vital interest to both practitioners and researchers (Tummala and Schönherr, 2011). There are interruptions of different intensities and types in nearly all SCs (Blackhurst *et al.*, 2005; Greening and Rutherford, 2011). This comprises of interruptions in supply, demand, process, environmental systems, and controls (Christopher and Peck, 2004). Understanding the damaging effects of SCRs on the performance of supply chain networks and the severe consequences associated with these effects can help an organisation design efficient SCRM processes in order to mitigate the detrimental effects caused by these risk sources (Punniyamoorthy *et al.*, 2013). SCRs have been jeopardising the competitiveness and profitability of companies and organisations. As a result, academics and practitioners have become interested in SCRM approaches that

support the persistence and efficiency of their SC networks, as well as in practices for evaluating prospective risk sources (Fawcett *et al.*, 2011). The specific network background that we investigate is related to high-tech industries, characterised by the fast technological change that has a remarkable impact on the management of innovation, both within firms and partnerships (Powell, 1998; Hagedoorn *et al.*, 2006). At the node of internal and external technology advancements, one finds STPs where firms internalise capabilities that are at best, to a certain extent, exogenous to them (Hagedoorn and Duysters, 2002). In STPs, firms mainly cooperate closely in the areas of research and new technology development (Hagedoorn, 1993). Therefore, these forms of partnerships have a high influence on the long-term product-market arrangements of the respective firms (Kilubi, 2016; Vilkamo and Keil, 2003). Although STPs were practically unknown before the 1980s, they have turned out a lot more prevailing during the preceding two decades (De Man and Duysters, 2005). Given that R&D alliances may contribute to resource configurations in a different way than other types of alliances do, it is particularly worth examining that form of partnership (Eisenhardt and Schoonhoven, 1996; Schilke and Görzen, 2010) instead of strategic alliances in general. In the following, we are going to define the key terms representing the foundation of the present research study.

1.2.1 Defining Supply Chain Risk Management

The encompassing goal of SCRM is to ensure an efficient and continuous material flow from supplier to end customer (Waters, 2007). SCRM is characterised by a high level of intensity relating to cooperation, partnerships, integrated networks and consciously designed goal setting and planning processes within the SC. Any approach to SCRM should seek to understand, identify, and reduce risks to the SC as a whole through partners' coordination. Despite similar existing definitions of SCRM, an in-depth literature analysis reveals that, at present, there is no commonly and widely accepted definition of what constitutes SCRM. Taking into account the evolution of SCRM definitions, most of the proposals have only been modified slightly, either referring to existing definitions or resulting from theory

building processes (Kilubi and Haasis, 2015). A plausible explanation for the deviants arising in the definition process of the elements inherent in SCRM could be that many researchers only use the SCRM definition as a basis for their research, thus, slightly modifying extant definitions without developing a central and consistent definition. Besides, SCRM is a young cross-disciplinary, multi-faceted research field; it should be considered that previous definitions have primarily been developed on a conceptual basis. Therefore, SCRM definitions lack the empirical testing that could impede the creation of an universal definition. Further to this, the conducted research reveals that most researchers rather focus on defining ‘supply chain risk’ than on proposing a coherent definition of SCRM. Upon reviewing the literature, it becomes apparent that the authors give more consideration to the definition of ‘supply chain risk’ than to the definition of ‘supply chain risk management’ (cf. Harland *et al.*, 2003; Sinha *et al.*, 2004; Zsidisin *et al.*, 2004; Zsidisin and Ellram, 2003). A valuable indication of the level of maturity of a discipline is provided by the attitude of researchers concerning the definition of core concepts (Burgess *et al.*, 2009). It suggests that definitional consensus does not exist and that SCRM is still in the evolving stage and has not yet reached maturity. In the context of the present research study, we have embraced the following definition of SCRM:

“Supply chain risk management is to [collaborate] with partners in a supply chain apply risk management process tools to deal with risks and uncertainties caused by, or impacting on, logistics related activities or resources.” (Norrman and Jansson, 2004, p. 436).

1.2.2 Defining Strategic Technology Partnering

Farr and Fischer (1992, p. 57) understand cooperation in R&D as “any method by which firms or governments cooperate to make better use of their collective research and development resources to include technical information exchange, harmonising of requirements, codevelopment, interdependent research and development and agreement on standards.” Similarly, Ingham and Mothe (1998, p. 250) refer to R&D partnership as “an agreement between independent

organisations that combine tangible and/or intangible resources to cooperate in R&D activities”. Hagedoorn (2002, p. 478) defines “R&D partnerships as the particular set of different modes of inter-firm collaboration where two or more firms that remain independent economic agents and organisations share some of their R&D activities.” According to Vilkamo and Keil (2003, p. 195) “A strategic technology alliance or strategic technology partnering relationship can be understood as “a long-term, continuous and mutually beneficial vertical non-equity relationship where confidential information on future plans and visions are shared proactively to support both companies to focus their resources in the right direction”. According to Hagedoorn and Schakenraad (1994, p. 291) “strategic technology partnering is the establishment of cooperative agreements aimed at joint innovative efforts or technology transfer that can have a lasting effect on the product-market positioning of participating companies.” All these definitions emphasise the sharing of valuable resources and their combination, at least involving two different parties. In the present study, we are going to use the word strategic technology partnering/partnership (STP) to replace other terms such as alliance, collaboration, or joint venture. Considering the purpose of this study, we define STP as follows:

A collaboration between companies that activate and pool their individual tacit and physical assets in the strategic development of technological products to gain mutual benefits and compete in a highly dynamic environment.

1.2.3 Defining Capabilities

Organisation and management research have emphasised the dynamic capabilities theory (Eisenhardt and Martin, 2000; Teece *et al.*, 1997) as an effective method to profit from inter-organisational partnerships and networks (cf. Kale and Singh, 2007; McGrath and O’Toole, 2013; Mitrega *et al.*, 2012; Möller and Svahn, 2003; Ritter *et al.* 2002; Walter *et al.*, 2006). The firm’s capabilities are not solely related to the available resources; they also entail the extent of coordination between the individuals within the organisation and their way of synchronising the accessible

resources. The organisational routines within a firm refer to the daily activities that are repeated by the members therein, while capability refers to the summation of multiple routine activities (Nelson and Winter, 1982). Correspondingly, capabilities are complex sets of skills and aggregated knowledge, acquired through organisational processes, that enable companies to leverage their assets (Day, 1994) and refer to “a firm’s capacity to deploy resources, usually in combination, using organisational processes to effect a desired end” (Amit and Schoemaker, 1993, p. 35). Eisenhardt and Martin (2000, p. 1107) define ‘capabilities’ as “the firm’s processes that use resources – specifically the processes to integrate, reconfigure, gain and release resources – to match and even create market change”. Furthermore, capability is regarded as “the ability to make use of resources to perform some task or activity” (Hafeez *et al.*, 2002, p. 40), for example, Apple’s capability to generate radical, breakthrough innovations. These definitions are in line with Wang and Ahmad (2009) who conclude that capabilities are ‘first-order’, and when companies prove abilities of deploying assets to achieve a wanted target, then those capabilities are likely to result in improved performance. Hence, companies need several skills acquired within and beyond their organisational boundaries to innovate in the light of change and complexity. Along these lines, firm capabilities can be associated with several competitive objectives, such as profitable new market entry, lean and agile SCM, effective new product development (NPD), excellence in manufacturing technology, etc. For the purpose of this research and in accordance with Dosi and Teece (1998, p. 284), we define capabilities as “the reflection of a company’s ability to “organize, manage, coordinate, or govern sets of activities”.

1.3 Research aims and objectives

The literature on SCRM is highly fragmented, hindering an entire understanding of the current state of research and what to study next (Pfohl *et al.*, 2010). Likewise, discussion on STP capabilities is of broad interest, and the related term can be traced back to different theoretical approaches (Richards and De Carolis, 2003).

Thus, providing a comprehensive overview is challenging. For that reason, we aim to synthesise the existing research findings to provide a clear overview. Despite the increasing attention given to the research area of STP (e.g. Lee *et al.*, 2001; Li *et al.*, 2008; Trott *et al.*, 1995; Mowery *et al.* 1996; Pennings and Harrianto, 1992; Steensma and Corley, 2000), and the recent developments highlighting the interest in and importance of SCRM-related research (cf. Li *et al.*, 2014; Marley *et al.*, 2014; Vilko and Hallikas, 2012; Zhao *et al.*, 2013), the complexity of the intricated issues requires a systematic literature review (SLR), discovering major issues of the extant landscape of empirical, conceptual, as well as theoretical evidence (Kamal and Irani, 2014; Lightfoot *et al.*, 2013; Meier, 2011; Phene and Tallman, 2012) to update and motivate researchers to further investigate this issue. Accordingly, Boote and Bailey (2005) bring forward the argument that in order to promote our shared cognition, scientists must comprehend what has previously been done, the strengths and weaknesses of the existing research, and their underlying meaning. Thus, a thorough literature review is a precondition for doing robust, evident, and valid research.

Cassiman *et al.* (2009, p. 218) correctly pointed out that “as firms increasingly use external relationships to acquire new knowledge, they need to develop the capability for governing these relationships”. Hence, the settings above constitute our motivation to analyse current issues and trends in SCRM and STP. There remains noteworthy potential to enrich our knowledge on SCRM and STP since there are many diverse ways of defining concepts. Moreover, the applicability of organisation and management studies in industrial settings is still open to discussion (Daft and Lewin, 1990; Rynes, *et al.* 2001; Tranfield and Starkey, 1998), with a couple of researchers ascribing this issue to deficient communication (e.g. Hambrick, 1994). Some scholars (e.g. van Aken, 2004) attribute the problematic issue to the investigated content being excessively analytical, descriptive and distracted with the hypothetical knowledge to the detriment of enthusiasm for taking care of field problems. It leads to the assumption that typical scientific research in organisation and management has a tendency to concentrate “on analysis and explanation, on

problems and their causes” (Denyer *et al.*, 2008, p. 393). Indeed, “it criticises everyday accounts and practices... but does not seek to transform them except in the general sense of demonstrating their incorrectness.” (Whitley 1984, pp. 371).

It is required to understand how organisations can achieve as well as maintain their competitive advantage. On the basis of conventional and emerging literature, we suppose that companies engaged in STPs are better able to mitigate and respond to SCRs since uncertainty can be managed through cooperation (Spekman *et al.*, 1998). We focus on creative solutions on how to react to supply chain disturbances which merit more consideration (Bode *et al.*, 2011). In the present study, we argue that both STP and SCRM are critical success factors for company performance and can be seen as massive empowering agents. More precisely, we advocate that the capabilities needed for STP serve as enablers for effective SCRM. On that basis, the study at hand is concerned with the fusion of the two research streams SCRM and STP as an innovative solution to an ever changing world in the industry environment. The economic downturn has triggered a decline in demand, but with the help of supplier networks it has been possible for organisations like Nokia, Ikea and Dell to manage and retain their growth through flexibility. Vertical and horizontal networking are being used by organisations to manage risks, and they pursue knowledge transfer through joint creation of technology and new knowledge (Kogut and Zander, 1996; Powell *et al.*, 1996; Teece, 2000). Thus, the authors devote the following research to the main question: How can the integration of STP and SCRM effectively be used to manage successfully supply chain risks? Stated, the purpose of this analysis is to examine the nexus of linkages between SCRM and STP. Hence, the present study aims at developing a tentative conceptual framework that clusters identified research on conjoint SCRM-STP capabilities that may be, in light of empirical advancement, embraced and further developed into measurement constructs in future research.

With the frame of reference, the spectrum of the scientific concepts and management disciplines to be examined are designed. This design is based on the research