SUPPLY CHAIN AGILITY: FROM SYSTEMATIC REVIEW TO EMPIRICAL EXAMINATION

BY:

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A thesis submitted in fulfilment of the requirement for the degree of Master of Research

Macquarie Graduate School of Management

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Sydney – Australia

April 2017

CERTIFICATION

This thesis is submitted in fulfilment of the requirements of the degree of Master of Research, in Macquarie Graduate School of Management, Macquarie University. This represents the original work and contribution of the author.

I hereby certify that this has not been submitted for a higher degree to any other university or institution.

Eias Al Humdan

April 2017

Papers submitted by the author:

1. Al Humdan, E., Najmaei, A., & Behnia, M. Supply chain agility: a review on past research and suggestions for future. Paper submitted to Supply Chain Management: An International Journal in April 2017.

2. Al Humdan, E., Najmaei, A., & Behnia, M. Reinvestigating the impact of supply chain agility on financial performance: an Australian perspective. Paper submitted to 15th ANZAM Operations, Supply Chain and Services Management Symposium – Queenstown, NZ, 2017. (Submitted in March 2017)

Table of Contents

ABSTRACT

Supply chain agility (SCA) is a widely studied and discussed issue in supply chain and operations management. Despite this popularity, literature on SCA seems to suffer from definitional ambiguity and structural fragmentation. This study, in its first part, aims to rectify these issues by offering a systematic review which serves two primary purposes: 1) to develop a complete and new definition for SCA in order to reduce ambiguity surrounding the meaning of this concept; and 2) to develop an integrative framework for the antecedents and consequences of SCA.

The thesis further extends the review with empirical work in regard to supply chain agility performance. It argues that supply chain agility is a well-known enabler of a firm's financial performance. However, the link between the two seems to be more complex than a direct association. In order to investigate this relationship, the study proposes that supply chain agility is an operational capability which first enhances a firm's operational performance, through which the financial performance is enhanced. Using data from 222 small and medium enterprises (SMEs) in Australia with a lagged financial performance indicator, the study found empirical evidence for this relationship. The results suggest that operational performance is, in fact, a mediator of supply chain agility and financial performance. The thesis concludes with a discussion on implications, limitations and a future research agenda.

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

For decades, considerable attention has been paid to the concept of supply chain agility (SCA) as a linchpin for the long-term profitability and competitiveness of companies (e.g. Gligor, Holcomb, & Stank, 2013; Ismail & Sharifi, 2006). SCA is considered to be one of the fundamental characteristics needed for a supply chain to thrive in a turbulent, ever-changing and volatile environment (Agarwal, Shankar, & Tiwari, 2007; Braunscheidel & Suresh, 2009). Moreover, a firm's supply chain agility has been identified as a critical factor affecting its overall global competitiveness (Lee, 2004). It has been demonstrated that firms with supply chain agility can react and respond much better to unforeseen changes as they are able to better synchronise supply with demand (Swafford, Ghosh, & Murthy, 2008). Interest in SCA issues has steadily grown, including research from other business-related disciplines such as management, marketing, strategy and information systems. SCA has become more accepted as a valuable discipline.

Despite its success, the field of SCA has grown along different dimensions, causing the literature to become fragmented and the construct to become somewhat ambiguous from a definitional perspective (Gligor et al., 2013; Li, Chung, Goldsby, & Holsapple, 2008). Generally, a well-grounded and universally recognised definition of SCA is currently missing. Some authors define it in operational terms (e.g. Brusset, 2016; Yang, 2014); some view it as a management philosophy (e.g. Lin, Chiu, & Chu, 2006; Van Hoek, Harrison, & Christopher, 2001); and some view it in terms of strategy (e.g. Bal, Wilding, & Gundry, 1999; Fayezi, Zutshi, & O'Loughlin, 2016). In the same vein, theory development in the field of SCA has suffered from an ill-defined paradigm (Fayezi et al., 2016; Gligor, 2014; Gligor & Holcomb, 2012b) in which neither definitions nor antecedents and consequences of the construct are clear. These issues point to a need for an integrative state-of-the-art framework that not only defines the construct more carefully, but also illuminates its antecedents and consequences more clearly for further theory development and more accurate theory testing efforts in different contexts (Denyer & Tranfield, 2009; Rousseau, Manning, & Denyer, 2008).

In light of the above, we follow the procedures outlined by Moher, Liberati, Tetzlaff, and Altman (2009) and Tranfield, Denyer, and Smart (2003) to structure this systematic review. Through a rigorous ten-phase process, this systematic review captures 48 highly impacted articles spread across 17 journals through a well-developed search string. In addition to delivering an encompassing definition, the review synthesises SCA antecedents and consequences. It also examines other variables (such as yearly publications, type of method used and location of studies).

As a result of the literature review, especially in regard to the irresolute results when investigating the consequences of SCA (outcomes), the study complements and extends the review by delivering an empirical investigation of the relationship between SCA and the firm's performance. Recent research on SCA has examined the impact of SCA on organisations' performance (e.g. Blome, Schoenherr, & Rexhausen, 2013; Eckstein, Goellner, Blome, & Henke, 2015; Gligor & Holcomb, 2012a; Gligor, Holcomb, & Feizabadi, 2016; Qrunfleh & Tarafdar, 2014; Sangari & Razmi, 2015; Tarafdar & Qrunfleh, 2016; Tse, Zhang, Akhtar, & MacBryde, 2016; Yang, 2014). In particular, a great deal of research has examined the impact of SCA on firms' performance by operationalising performance only at operating levels, as Blome et al. (2013) do, while others, like Gligor, Esmark, and Holcomb (2015) measure only financial performance; still others, such as Eckstein et al. (2015), Yang (2014) and DeGroote and Marx (2013), measure performance at multiple levels. However, the empirical examination of the relationship between SCA and financial and operational performance is somewhat irresolute. Measuring performance at varying levels may be the reason why such studies still generate ambivalent results (Kaynak, 2003) and, hence, inconsistent empirical findings were generated, as demonstrated in more detail in the theoretical section in part two. The inconclusive and, at times, contradictory results demand further investigation of the association between SCA and a firm's performance. Thus, a more consolidated performance model for SCA is needed hopefully to lead to more consistent results. This will be achieved by examining how SCA is related to selected measures of

operational and financial performance. As such, one may argue that SCA may not necessarily have the lowest cost, especially when comparing it with the lean supply chain (Gligor et al., 2015; Jain, Benyoucef, & Deshmukh, 2008; Qrunfleh & Tarafdar, 2013; Van Hoek et al., 2001; Yusuf et al., 2004). However, if begetting SCA would be costly and thus negatively affect the financial performance, so how can SCA be linked to competitiveness? Considering this argument, there is a need for research to investigate the link between SCA and multiple dimensions of performance.

This paper extends the literature on SCA by attempting to answer the questions: what is the impact of SCA on a firm's financial performance? And can a firm's operational performance mediate this relationship? This part contributes to the SCA performance literature by exploring the effect of SCA on five dimensions of operational performance and four dimensions of financial performance in a sample of 222 Australian SMEs. This allows the building of a holistic understanding of the relationship between SCA and multiple performance dimensions, and thus sheds some light on inconclusive empirical results.

The thesis is split into two parts: part one tackles the systematic literature review and is divided into three stages. Stage one defines the scope of the review, along with addressing the research protocol. Stage two presents the procedures followed to retrieve the related articles. Stage three analyses the results of the review and concludes by addressing a discussion of major findings. Part two is related to the empirical work and is divided into six sections. Section one reviews the literature and previous studies that explore the impact of SCA on performance, followed by the hypotheses generation in section two. Section three describes the research methodology and designs, including data collection and measures. The measures are tested in terms of their unidimensionality and reliability in section four. Section five provides the hypotheses testing results whereas section six discusses major findings titled as discussion. Before the thesis concludes, it addresses implications for scholars and professionals, limitations and avenues for further research for both parts.

2. PART ONE: A SYSTEMATIC ANALYSIS OF SUPPLY CHAIN AGILITY

OVERVIEW

STAGE I   PLANNING THE REVIEW
PHASE 1   IDENTIFICATION OF THE NEED FOR THE REVIEW
PHASE 2   DEFINING THE REVIEW AIMS AND OBJECTIVES
PHASE 3   DEVELOPING THE REVIEW PROTOCOL
STAGE II   CONDUCTING THE REVIEW
PHASE 4   IDENTIFYING RESEARCH ARTICLES
PHASE 5   SELECTING THE RELEVANT ARTICLES
PHASE 6   QUALITY ASSESSMENT
PHASE 7   DATA EXTRACTION
PHASE 8   DATA SYNTHESIS
STAGE III   REPORTING AND DISSEMINATION
PHASE 9   DESCRIPTIVE AND THEMATIC ANALYSIS
PHASE 10   DISCUSSION

This part utilises a systematic literature review as a main methodological approach. Initially employed largely by medical researchers and more recently adopted in the field of management, this form of review has typically three defined stages of planning, conducting and reporting the review. It adapts the framework from Tranfield, Denyer, and Smart (2003) that will serve as a roadmap throughout the systematic review, including the objectives, review protocol and the entire systematic review.

Stage I includes three phases and identifies the need for a review (phase 1), the aims and objectives of the review (phase 2), and leads to the review protocol (phase 3).

Stage II includes the next five stages which describe the review protocol in more detail. Phase 4 identifies the research articles, followed by a methodology chosen to select relevant articles (phase 5). Phase 6 assesses the relevant articles for quality while phase 7 extracts and retains relevant data for further analysis; phase 8 selects and codes the main relevant themes.

Stage III consists of phase 9, which addresses descriptive and thematic analyses generated from data synthesis and phase 10, which sums up with a discussion.

2.1 STAGE I: PLANNING THE REVIEW

STAGE I
PLANNING THE REVIEW

PHASE 1
IDENTIFICATION OF THE NEED FOR THE REVIEW

PHASE 2
DEFINING THE REVIEW AIMS AND OBJECTIVES

PHASE 3
DEVELOPING THE REVIEW PROTOCOL

STAGE II
CONDUCTING THE REVIEW

PHASE 4
IDENTIFYING RESEARCH ARTICLES

PHASE 5
SELECTING THE RELEVANT ARTICLES

PHASE 6
QUALITY ASSESSMENT

PHASE 7
DATA EXTRACTION

PHASE 8
DATA SYNTHESIS

STAGE III
REPORTING AND DISSEMINATION

PHASE 9
DESCRIPTIVE AND THEMATIC ANALYSIS

PHASE 10
DISCUSSION

Planning the review consists of three phases.

Phase 1: Identification of the need for a review. This grounding phase is necessary as it examines whether a similar review has been conducted previously and thus eliminates duplication of research. No previous systematic reviews that address the current questions were found and thus the need for the review is established.

Phase 2: Defining the research aims and objectives. This part of the thesis aims to analyse and synthesise a comprehensive structured analysis of the literature on SCA to assist in future research directions. It builds its scope by addressing major research objectives encompassing the research trends in SCA literature. To supplement the significance of this study, many tabulations and graphs are depicted to provide a sound understating of SCA research trends.

Phase 3: Developing the review protocol. Identifying the aims and objectives should lead naturally to developing the review protocol, including the methodology to address the objectives.

PHASE 1: IDENTIFICATION OF THE NEED FOR A REVIEW

A preliminary search for previous systematic reviews was carried out to determine whether an exact review has been done before. A consultation was sought with a specialist librarian in business studies at Macquarie University, and under Dr. Arash Najmaei's recommendation (Operations Management academician) two databases were eventually suggested and utilised to limit research bias (Web of Science, and ABA/INFORM Global). Both databases are well-established, possessing a wide repository of business research articles; they are kept up to date. The Web of Science database was accessed via the Macquarie University online library, while ABI/INOFOM Global was accessed by the State Library of New South Wales (e-resources) granting a library membership. This process was conducted on 20 September 2016. Applying a Boolean logic (AND, OR) (Hart, 2001), the search string 'supply chain agility' OR 'agile supply chain*' AND 'systematic literature review' OR 'literature review' was used, as shown in Table 1, with no limitation on document type to assure inclusiveness. This resulted in two hits, neither of which was relevant. Thus, this initial assessment permits the conducting of a systematic review.

Table 1. Searching for systematic reviews

SR	Database	Search in	No. of hits	No. of relevant hits
1	Web of Science	Topic	2	0
2	ABI/INOFOM Global	Anywhere except full text	0	0

It is noted here that the rationale for conducting this review is discussed in the introduction and in phase 2.

PHASE 2: DEFINING THE REVIEW AIM AND OBJECTIVES

Review aim

Following the earlier reviews conducted by Gligor and Holcomb (2012b), Gligor (2014) and more recently Fayezi et al. (2016) on SCA, this study attempts to broaden the scope of their reviews by further delivering an inclusive definition of SCA, discussing SCA enablers and consequences so as to bring up a comprehensive framework of the field. Although these studies have tackled different yet limited aspects of the SCA field, there is still a lack of scholarly research in identifying factors to achieve SCA and its performance effects (Eckstein et al., 2015; Sangari & Razmi, 2015). Additionally, the focus of the three mentioned studies is limited to only one direction, making the contribution of this paper uniquely comprehensive. The central aim of this thesis is to provide an insightful analysis as a comprehensive summary of the supply chain agility literature which is expected to aid the signposting of future research directions.

Review objectives

This part of the thesis intends to appraise the extant research published on SCA by embracing a profiling approach to analyse different aspects of SCA. The use of two databases along multiple search strings with no time frame generates a powerful research tool and secures research bias in the SCA domain to better assist in the delivery of the outcomes and decipher any area surrounding the concept of SCA. This part is descriptive and inductive as it addresses an interest in understanding the concept of SCA and its distinctiveness as practised by many diverse scholars around the globe addressing emergent areas of SCA. It is therefore the overall objective of this paper to simply enhance the understanding of SCA research, with an expectation that this descriptive information will assist in guiding the development of explanatory models in future research endeavourers.

PHASE 3: DEVELOPING THE REVIEW PROTOCOL

The development of the above aims and objectives is critical to the development of the protocol. The review protocol describes the methods of the review and thus is used as a guide to carry out the review. The components of the protocol are summarised in Table 2, as adapted from Booth, Sutton, and Papaioannou (2016) and more fully explicated in Stages II and III.

Table 2. Review protocol

Background	Supply chain agility is widely regarded as a powerful paradigm that enables organisations to compete in a highly turbulent environment. While the field is fragmented into many sub-fields, the lack of an existing synthesis disables the field from developing to a mature state and hampers its practical implications. To fill this gap, this part systematically analyses the concept of SCA to decipher its concepts and provides an overview of the most influential literature, thus addressing future directions for research endeavours.
Objectives	This review aims to assess the extant research on SCA. More precisely, this study provides a formal definition of SCA, categorises its enablers and appraises its outcomes to develop a comprehensive framework.
Inclusion/Exclusion Criteria	- Highly ranked business peer-reviewed articles in the English language - Empirical and concept-based articles - From the first article to appear to 20 September 2016 - Articles should have a clear focus on SCA
Search Strategy	Two databases are recruited (Web of Science and ABI/INFORM Global) applying the refining Boolean logic (AND, OR) through well-defined search string keywords.
Articles Selection	Articles are assessed through three-level filters to identify the most relevant articles aligned with the study's specific objectives.
Quality Assessment	To ensure including only robust studies, only articles published in highly ranked journals are considered.

Data Extraction	A data extraction form is created highlighting the main themes of the retrieved articles in terms of author, year and significance.
Data Synthesis	The data are synthesised by a combination of qualitative and quantitative review aligned with the study's objectives.
Timeframe	<u>1 July–20 September 2016:</u> Extensive reading by the author till reached an acceptable and matured level of SCA knowledge. <u>21 September–30 November 2016:</u> Performing the search strategy, including selecting and filtering articles as well as extracting and synthesising data. <u>31 November–3 March 2017:</u> Drafting findings.

2.2 STAGE II: CONDUCTING THE REVIEW

STAGE I
PLANNING THE REVIEW

PHASE 1
IDENTIFICATION OF THE NEED FOR THE REVIEW

PHASE 2
DEFINING THE REVIEW AIMS AND OBJECTIVES

PHASE 3
DEVELOPING THE REVIEW PROTOCOL

STAGE II
CONDUCTING THE REVIEW

PHASE 4
IDENTIFYING RESEARCH ARTICLES

PHASE 5
SELECTING THE RELEVANT ARTICLES

PHASE 6
QUALITY ASSESSMENT

PHASE 7
DATA EXTRACTION

PHASE 8
DATA SYNTHESIS

STAGE III
REPORTING AND DISSEMINATION

PHASE 9
DESCRIPTIVE AND THEMATIC ANALYSIS

PHASE 10
DISCUSSION

Conducting the review includes the next five phases: (4) identifying research articles; (5) selecting the relevant articles; (6) quality assessment; (7) data extraction; and (8) data synthesis.

Phase 4: Identifying research articles. This phase identifies the keyword search string, developing selection criteria (search limit) and how/where to find relevant studies. The search string is developed after reading many related journal articles until reaching an acceptable level of knowledge. The research is run on the two mentioned academic databases seeking scholarly peer-reviewed articles.

Phase 5: Selecting the relevant articles. A three-filter level is adopted in this phase to choose the most relevant articles.

Phase 6: Quality assessment. Further quality control criteria are chosen to deliver a high-quality piece of research.

Phase 7: Data extraction. In this phase, a data extraction form is commissioned from EndNote software to extract and retain relevant data from articles.

Phase 8: Data synthesis. Articles are classified according to themes to prepare them for further thematic analysis and discussion.

PHASE 4: IDENTIFYING RESEARCH ARTICLES

The systematic search for relevant articles starts with the identification of keywords and keyword search strings (Tranfield et al., 2003). To obtain a broader exposure and minimise the threat of missing relevant studies, a search string was developed taking into account the following issues:

> ➢ While some scholars use the term 'supply chain agility', others approach the same meaning by utilising the term 'agile supply chain' (ASC).
>
> ➢ Many articles discuss supply chain agility as a distinct supply chain strategy combined with the 'leanness' strategy termed 'leagility' or 'leagile'.
>
> ➢ Some articles deploy the word 'chain' or 'chains' while discussing SCA.

These remarks were recognised by the author during the reading stage. Consequently, it was decided to use a search string 'supply chain agility' OR 'agile supply chain*' OR 'supply chain leagility' OR 'leagile supply chain*' in the two nominated databases. The search provided a significant hit rate for relevant SCA literature across multiple disciplines. However, this also created some duplication, so it was necessary to cross-check the search results from each database to ensure that the correct number of hits was recorded. In line with the research protocol discussed in phase 3, the following search limits are applied while searching:

- *Peer-reviewed journal articles*

While relevant information can be obtained either from scholarly peer-reviewed articles in journals, or from grey literature (unpublished papers, books' chapters, conference papers, newsletters), one purpose of a systematic review is to provide an explicitly auditable and repeatable method to systematically find the most relevant articles that help tackle the research objectives. Using the rationale of Denyer and Tranfield (2009) to ensure this study's quality, it was decided to systematically include only peer-reviewed journal articles found in

academic databases. "Journal articles have been through a review process that acts as a screen for quality, allowing us to distil studies meeting a certain level of conceptual and methodological rigor" (David & Han, 2004, p. 42). In fact, most journals apply strict requirements for publications and thus it is assumed that high impact research on the subject of supply chain agility will stem from the peer-reviewed journal articles.

Another reason for choosing peer-reviewed articles is the symmetrical format and terminology. All journal articles enjoy similar formatting and layout. A typical article layout includes an abstract, literature review, methodology, findings, implications and conclusions. A bibliography usually follows to allow for further reference. This layout is seldom found in grey literature. Therefore, this limit is performed by selecting 'Articles' from the 'Document Type' option in the Web of Science and by limiting ABI/INFORM Global to 'Scholar Journals' in the 'Source Type' option, all within the broad definition of business, management and economics.

- *Articles in the English language*

Presumably highly-validated knowledge with highly accepted concepts and methodologies is available in, or will be translated into, English. It is therefore believed that no highly influential articles will be missed having restricted the language.

- *Time frame*

The databases were scanned for the defined search strings with no time limit to ensure wider exposure—thus articles were retrieved from the first article's appearance in 1999 through September 2016, as to ensure addressing the most current developments in SCA literature.

Table 3 depicts the details of this phase. 259 articles were nominated to next phase. Managing the references is conducted via reference management software, EndNote X7.

Table 3. Database search results

Search string: 'supply chain agility' OR 'agile supply chain*' OR 'supply chain leagility' OR 'leagile supply chain*'		
Database	**Search in**	**Retrieved Records**
Web of Science	Topic	228
ABI/INFORM Global	Abstract, titles and keywords	116
TOTAL		344
TOTAL after eliminating duplications		**259**

PHASE 5: SELECTING THE RELEVANT ARTICLES

As a gauge of selection, a test of the relevance of retrieved articles was performed through a three-level filtering process according to Bettany-Saltikov (2010).

- *The Level 1 filter*

Since deciding to exclude articles based on keywords might threaten the validity of the study (Thomé, Scavarda, & Scavarda, 2016), and to ensure the rigour of this systematic review and reduce selection bias accordingly, articles were first assessed based on their titles, being inclusive-oriented. If a title held limited information to judge the article's relevance, it was included. The aim in this filtering level was to include the least likely articles in case they might contain relevant data. In this first screening process, 227 articles were identified.

- *The Level 2 filter*

In the second filtering level, all remaining 227 articles' abstracts and keywords were carefully scrutinised. Likewise, articles with less informative abstracts were included. However, articles must demonstrate a clear focus on SCA and thus those that seemed non-relevant to the study's objectives were excluded. Articles' applicability was emphasised through requesting the existence of the concept of SCA or ACS in either abstracts or keywords. At the end of this second filtering level, 142 articles remained.

- *The Level 3 filter*

Articles' substantive applicability was emphasised in this level by thoroughly reading the entire paper to create an alignment between selecting papers and the objectives of the study. Consistent with the research protocol, it was ensured that the selected articles were not only concept-based: empirical-based papers were also included. Moreover, articles where SCA was a very ancillary part of the article's focus were excluded. Forty-three records were hence excluded for providing no relevance to the research topic, leaving a total of 99 articles.

During this stage, the author's knowledge started to grow in the field, noticing that an exhaustive review was needed to improve understanding of supply chain agility. Since the databases might not have captured all related papers, a backward snowballing approach was conducted from the reference lists (Jalali & Wohlin, 2012; Thomé et al., 2016) to look for scholars' seminal works related to SCA. Consequently, nine articles were manually added to ensure the accuracy and comprehensiveness of the review (Bal et al., 1999; Dwayne Whitten, Green, & Zelbst, 2012; Fayezi et al., 2016; Lee, 2002, 2004; Li, Lin, Wang, & Yan, 2006; Naylor, Naim, & Berry, 1999; Power, Sohal, & Rahman, 2001; Tarafdar & Qrunfleh, 2016). These aforementioned steps resulted in a total database of 108 peer-reviewed journals papers.

PHASE 6: QUALITY ASSESSMENT

"In the context of effectiveness reviews study quality is often used as a criterion on which to base decisions about including or excluding particular studies […] it is important to differentiate clearly between more and less robust studies" (Popay et al., 2006, p. 10). Although quality of paper selection is justified through phase 4 by including only peer-reviewed journals articles, it has been decided to further enhance quality control by limiting the articles to those cited in the most influential journals (A and A*) according to the Australian Business Dean Council (ABDC) Quality Journal List 2016.[1] This brings the total number of papers for synthesis to 48.

PRISMA Diagram

A flow diagram is adopted from Moher et al. (2009) to visually illustrate the search retrieval findings known as PRISMA (preferred reporting items for systematic reviews and meta-analyses), as shown in Figure 1.

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[1] The ranking list can be accessed via http://www.abdc.edu.au/pages/2016-review.html
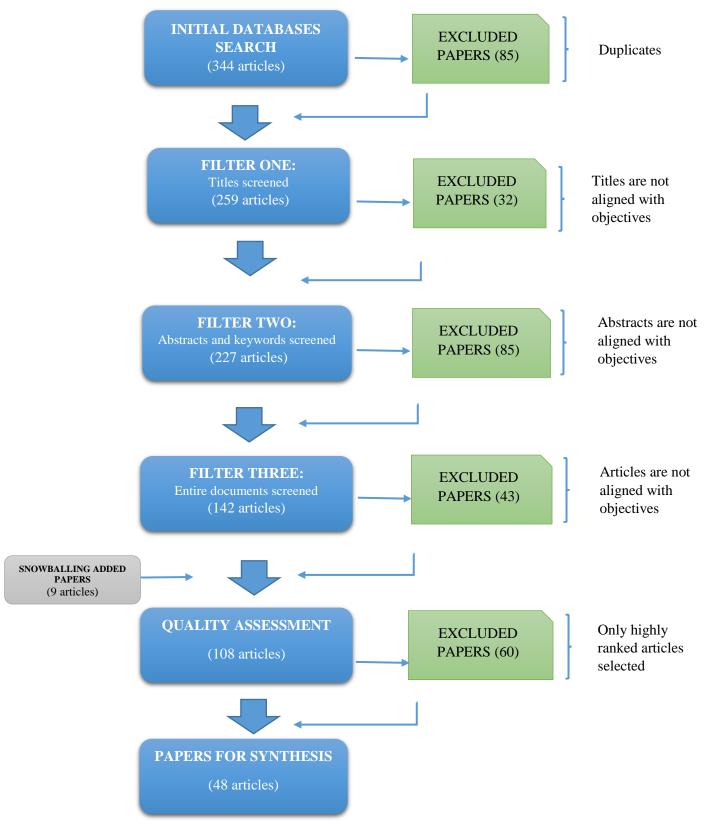
Figure 1. PRISMA diagram (adapted from Moher et al., 2009)

PHASE 7: DATA EXTRACTION

In order to accurately extract relevant data from the selected articles, a data extraction form was created according to Tranfield et al. (2003). This phase allowed examination of any present elements of data in each selected article (Booth et al., 2016). The data extraction form contained author of each article, published year and the significance of the study. According to Tranfield et al. (2003), the form acts as a historical record which can be used to document the process and as a repository from which the later data synthesis emerges (see Phase 8). This form was of great importance to the author. It acted as a reference guide during the entire study.

PHASE 8: DATA SYNTHESIS

This phase included the synthesis of the data refined from relevant studies guided by the data extraction form. An inductive and interpretative (rather than integrative) approach was utilised in this phase that included detailed readings of raw data to derive concepts and themes (Thomas, 2006). According to Thomas, one of the purposes of the inductive approach is to establish clear links between the research objectives and the summary findings derived from the raw data. This is achieved through looking for common themes and sub-themes within selected articles. Accordingly, this approach results in making connections between the individual studies, overall themes and generalisations.

More precisely, this phase was split into two parts: (1) data analysis, or 'dissecting' individual studies into their components parts and extracting key themes; and (2) data synthesis, or re-casting the data into a new arrangement. To accomplish both parts, two columns were added to the data extraction form: comments and codes. While the comments column summarises relevant data, the codes column adds symbols that correspond to each of the themes, meaning that each article that provided data in regard to formal definitions, enablers and consequences of SCA was coded and utilised comprehensively in the descriptive and thematic phase (Phase 9).[2]

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[2] See Appendix III for complete data extraction form and data synthesis.

2.3 STAGE III: REPORTING AND DISSEMINATION

STAGE I **PLANNING THE REVIEW**
PHASE 1 IDENTIFICATION OF THE NEED FOR THE REVIEW
PHASE 2 DEFINING THE REVIEW AIMS AND OBJECTIVES
PHASE 3 DEVELOPING THE REVIEW PROTOCOL
STAGE II **CONDUCTING THE REVIEW**
PHASE 4 IDENTIFYING RESEARCH ARTICLES
PHASE 5 SELECTING THE RELEVANT ARTICLES
PHASE 6 QUALITY ASSESSMENT
PHASE 7 DATA EXTRACTION
PHASE 8 DATA SYNTHESIS
STAGE III **REPORTING AND DISSEMINATION**
PHASE 9 **DESCRIPTIVE AND THEMATIC ANALYSIS**
PHASE 10 **DISCUSSION**

Reporting and dissemination consists of the final two phases: (9) descriptive and thematic analysis and (10) discussion.

Phase 9: Descriptive and thematic analysis.

The remaining papers are first assessed by means of a descriptive analysis: (1) How are publications distributed across the time period? (2) In which journals are such articles published? (3) What research methodologies are applied? (4) What is the geographical allocation of the papers? This is followed by thematic analysis that analyses the research objectives.

Phase 10: Discussion

In the final phase, a general discussion of the findings highlighting major issues is addressed, along with conveying an over-arching comprehensive SCA framework.

PHASE 9: DESCRIPTIVE AND THEMATIC ANALYSIS

Descriptive analysis

The 48 papers identified were analysed in this phase with respect to annual publications, types of methodology, journals and locations in order to understand the trend in this body of literature relevant to the research objectives. This descriptive analysis was achieved using information from the data extraction form (phase 7).

Annual publications and methodology

As shown in Figure 2, the articles range from the years 1999 to 2016, with more than half (52%) from 2011 or later. Overall, this current increasing trend in quality publications addresses the awareness and importance of SCA among researchers and professionals. The number of publications fluctuates across the time range. Most noticeably, the largest number of papers comes from 2016, although only three-quarters of this year is involved in the review. A commonly accepted vision of SCA is, however, still missing. It is thus expected that this number is subject to an increase, given the highly volatile market characteristics and the fact that future research is required to consolidate knowledge of SCA.
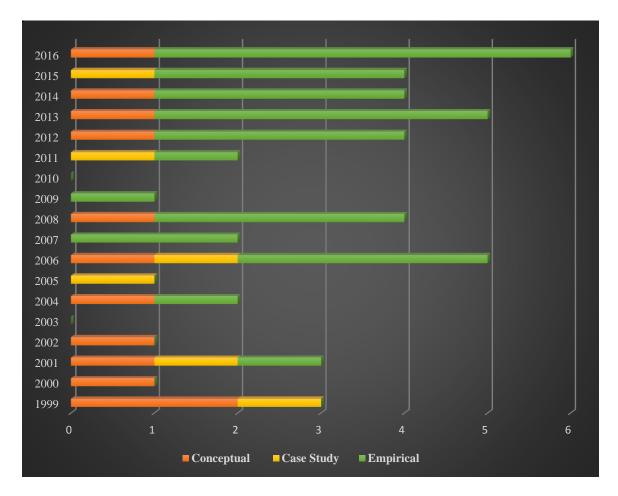
Figure 2. Dispersion of articles over years and methodology

Although it tends to be used consistently over the years of publications, the case study is the least frequently used methodology, accounting for almost 13 per cent of papers. While the conceptual type of research methodology was dominant in the early stages of SCA publications (1999–2006), the empirical type was the most frequently used afterwards and as a whole. This affirms the fact that during the primary years in the development of any new area, conceptual work plays an important role in terms of defining concepts, identifying factors and constructing frameworks, followed by empirical work. More importantly, this may indicate the evolving stage of the theory development process of SCA with an initial emphasis on acquiring more qualitative, rich and descriptive information.

SCA is implemented in a global scenario in different countries such as France (Brusset, 2016), China (Li et al., 2006; Liu, Ke, Wei, & Hua, 2013; Yang, 2014), India (Khan, Bakkappa, Metri, & Sahay, 2009; Vinodh, Prakash, & Selvan, 2011), Hong Kong (Ngai,

Chau, & Chan, 2011), Australia (Fayezi et al., 2015; Power et al., 2001), Taiwan (Lin et al., 2006), Iran (Sangari & Razmi, 2015), UK (Yusuf, Gunasekaran, Adeleye, & Sivayoganathan, 2004; Yusuf et al., 2014), Germany (Blome et al., 2013; Eckstein et al., 2015), USA (Chiang, Kocabasoglu-Hillmer, & Suresh, 2012; DeGroote & Marx, 2013; Gligor & Holcomb, 2014; Gligor et al., 2016; Qrunfleh & Tarafdar, 2013; Swafford et al., 2008; Tarafdar & Qrunfleh, 2016), and in various sectors, for instance, electronics (Tse et al., 2016), oil and gas (Yusuf et al., 2014), fashion and textiles (Ngai et al., 2011) and telecommunications (Collin & Lorenzin, 2006). It seems that due to increased communication and awareness of SCA, it is becoming a cross-cultural and sectorial paradigm.

The data analysis methods employed are varied, namely multiple regressions (DeGroote & Marx, 2013), structural equation modelling (Braunscheidel & Suresh, 2009; Brusset, 2016; Dwayne Whitten et al., 2012; Gligor & Holcomb, 2014; Gligor et al., 2016; Qrunfleh & Tarafdar, 2013; Sangari & Razmi, 2015; Swafford, Ghosh, & Murthy, 2006; Swafford et al., 2008; Tse et al., 2016) and interpretive structural modelling (Agarwal et al., 2007; Tarafdar & Qrunfleh, 2016). Besides, fuzzy methods were quite popular (Jain et al., 2008; Lin et al., 2006; Vinodh et al., 2011) as these methods are useful to tackle the difficulty of quantifying agility since it is inherently intangible in many cases. Generally, the main goal of most empirical studies was to measure agility in the supply chain to extract its enablers or to quantify its impact on overall performance.

Core journals

As evidenced by the analysis of articles according to journals and the Association of Business School (ABS) categories[3], they have been published in a wide range of journals. The selected articles are taken from 17 highly ranked academic journals spread over five different disciplines. While there is a strong emphasis on operations and supply chain management journals as would be expected, this also illustrates the multidisciplinary approach required in a

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[3] The ABS guide can be accessed via http://www.kfs.edu.eg/com/pdf/20820152253917.pdf

systematic review (Tranfield et al., 2003), with journals crossing information management, strategy and marketing. This recognises the need to consider the cross-disciplinary perspective in systematic reviews and shows the different ways the research topic has been approached (Tranfield et al., 2003). Table 4 lists the 17 journals and their corresponding ABS category, the number of articles per journal and the percentage of total articles. This asserts that SCA has wide-ranging relevance across many different backgrounds and that SCA does not operate in an independent environment, but instead is influenced by various fields that interface with the topic. It is the purpose of this study to develop consistency between all the business fields. Generally, 77 per cent of articles come from the field of operations and technology management, with many of these journals focusing on supply chain management and logistics. From this part, it is worth noting that four journals account for about 52 per cent of the reviewed articles. The remaining percentage is spread over sciences, such as information management, general management, operations research and marketing.

Table 4. Distribution of articles per journals and fields

SR	ABS Category	Journals	No. of Articles	% Total Articles
1	**Operations and technology management**	International Journal of Production Economics	8	16.6
2		Supply Chain Management: An International Journal	7	14.6
3		International Journal of Production Research	5	10.4
4		International Journal of Operations & Production Management	5	10.4
5		International Journal of Logistics Management	4	8.3
6		International Journal of Physical Distribution & Logistics Management	3	6.3
7		Journal of Operations Management	3	6.3
8		Journal of Business Logistics	2	4.1
9	**Marketing**	Industrial Marketing Management	2	4.1
10	**Operations research and management science**	European Journal of Operational Research	1	2.1
11		Decision Sciences	1	2.1
12	**Information management**	International Journal of Information Management	2	4.1
13		Decision Support Systems	1	2.1
14		Journal of Strategic Information Systems	1	2.1
15	**General management, ethics and social responsibility**	International Journal of Management Reviews	1	2.1
16		Harvard Business Review	1	2.1
17		California Management Review	1	2.1
		Total	**48**	**100**

Thematic analysis

The second part of phase 9 is in the form of a thematic analysis generated during data synthesis (phase 9), which is split into three components parallel to the research objectives: (1) defining SCA; (2) synthesising SCA enablers; and (3) synthesising outcomes of SCA.

<u>Towards defining 'supply chain agility'</u>

In essence, SCA seeks to describe the capacity for coping with incessant change armed with superior capabilities to maintain competitiveness. The specific concept of SCA has emerged in the literature by drawing on the various perspectives of 'agility' that have been developed within the various disciplines to which the broad concept of agility is relevant. In fact, some researchers have commented on the multidisciplinary nature of SCA (e.g. Braunscheidel & Suresh, 2009; Gligor et al., 2013; Li et al., 2008; Swafford et al., 2006). This disparate nature of the SCA literature, spread across many fields, and the broad notion of what the concept means has led some scholars to echo the problem of a lack of consensus in the literature on the definition of SCA (e.g. Gligor et al., 2013; Li et al., 2008). However, the lack of SCA definition consensus is not surprising given the age of the discipline. SCA is a new field of study, with the first papers appearing in 1999 (e.g. Bal et al., 1999; Mason-Jones & Towill, 1999). The field of SCA seems therefore to be in a formative stage (Chiang et al., 2012) where definitional ambiguity prevails. However, science progresses where common understanding and clear definitions are shared by researchers.

To address this shortcoming, I critically evaluate 24 definitions, listed in Table 5. Bal et al. (1999) is perhaps the first attempt to define SCA as a mere manoeuvrability tool by viewing it from a purely strategic perspective. Yet the most frequently used definitions came from Swafford et al. (2006) and Braunscheidel and Suresh (2009), who emphasised speed of response. A truly giant step in delivering a theoretically grounded definition of SCA was,

however, accomplished by Eckstein et al. (2015) and Fayezi et al. (2015). Within this time span, the definitions were slightly modified. For example, Lee (2004, p. 105) defined it as "the ability to respond to short term changes in demand or supply quickly and handle external disruptions smoothly", while others, like Gligor and Holcomb (2012a, p. 296) defined it as "the supply chain's ability to quickly adjust its tactics and operations".

Table 5. Summary of chronological 'supply chain agility' definitions

SR	Source	Definition
1	Bal et al., 1999	The basis for achieving competitive advantage in changing market conditions.
2	Naylor et al., 1999	Using market knowledge and a virtual corporation to exploit profitable opportunities in a volatile market place.
3	Christopher, 2000	• A business-wide capability that embraces organisational structure, information systems, logistics processes and, in particular, mindsets. • The ability of an organisation to respond rapidly to changes in demand, both in terms of volume and variety.
4	Van Hoek et al., 2001	An emerging management concept centred around response to dynamic and turbulent markets and customer demands.
5	Prater, Biehl, & Smith, 2001	The degree to which a firm's supply chain is agile is determined by how its physical components (i.e. sourcing, manufacturing and delivery) are configured to incorporate speed and flexibility.
6	Lee, 2002	Supply chains that utilise strategies aimed at being responsive and flexible to customer needs.
7	Yusuf et al., 2004	The ability to respond, in real time, to the unique needs of customers and markets.
8	Lee, 2004	The ability to respond to short-term changes in demand or supply quickly and handle external disruptions smoothly.
9	Swafford et al., 2006	The supply chain capability to adapt or respond in a speedy manner to a changing marketplace environment.
10	Lin et al., 2006	A structure under the goals of satisfying customers and employees within which every organisation can design its own business strategies, organisation, processes and information systems.

11	Ismail & Sharifi, 2006	The ability of the supply chain and its members as a whole to rapidly align the network and its operations to dynamic and turbulent requirements of the demand network.
12	Baramichai, Zimmers, & Marangos, 2007	An integration of business partners to enable new competencies in order to respond to rapidly changing, continually fragmenting markets.
13	Jain et al., 2008	- The capability to survive and prosper by reacting quickly and effectively to changing markets. - It concerns change, uncertainty and unpredictability within its business environment and makes appropriate responses to changes.
14	Li et al., 2008	The result of integrating alertness to internal and environmental change (opportunities/challenges) with a capability to use resources in responding (proactively/reactively) to such changes, all in a timely and flexible manner.
15	Braunscheidel & Suresh, 2009	The capability of the firm, both internally and in conjunction with its key suppliers and customers, to adapt or respond in a speedy manner to marketplace changes as well as to potential and actual disruptions, contributing to the agility of the extended supply chain.
16	Ngai et al., 2011	The capability of an organisation to respond to market changes visible to customers using a set of supply chain competencies that enable such capability.
17	Gligor & Holcomb, 2012a	The supply chain's ability to quickly adjust its tactics and operations.
18	Gligor et al., 2013	A firm's supply chain agility is manifested through the firm's cognitive and physical capabilities that enable the firm to quickly detect changes, opportunities and threats (alertness), access relevant data (accessibility), make resolute decisions on how to act (decisiveness), quickly implement decisions (swiftness) and modify its range of supply chain tactics and operations to the extent needed to implement the firm's strategy (flexibility).
19	Yang, 2014	An operational and relational capability in quick response to uncertain and turbulent markets.
20	Eckstein et al., 2015	The ability of the firm to sense short-term, temporary changes in the supply chain and market environment (e.g. demand fluctuations, supply disruptions, changes in suppliers' delivery times) and to rapidly and flexibly respond to those changes with the existing supply chain (e.g. reducing replacement times of materials, reducing manufacturing throughput times, adjusting delivery capacities).
21	Fayezi et al., 2015	A compilation of mindset, intelligence and process across supply chain

		organisations which enables organisations to respond quickly to the environmental uncertainties and changes in a reactive, proactive and, ultimately, predictive manner by relying on their relationship integration in order to fulfil end-customer requirements.
22	Tarafdar & Qrunfleh, 2016	Supply chain strategy that is directed towards quick and effective response to changing customer needs.
23	Fayezi et al., 2016	A strategic ability that assists organisations to rapidly sense and respond to internal and external uncertainties via effective integration of supply chain relationships.
24	Brusset, 2016	An operational capability stemming from the ability to manage across networks demand-side, supply-side processes, systems and routines.

As may seem quite intuitive, SCA incorporates speed and a relative agreement can be recognised in grasping this feature by utilising it in almost 70 per cent (17) of the selected definitions. In fact, agility per se means moving about quickly and easily according to the Cambridge Dictionary[4]. Since the birth of SCA, authors have always envisaged speed through considering 'information lead time' that must constantly be slashed among chain members in order to cope with the rate of the current change. For instance, Mason-Jones and Towill (1999) coin the term "information enriched supply chain" and deem it a prerequisite for a supply chain to be agile. Similar results are found in Li et al. (2006), with a focus on supply information. Given this feature of SCA, we propose speed as a fundamental dimension of the definition of SCA. This speed is managed either proactively or reactively—that is, a capability to adjust a firm's supply chain in anticipation of change or in response to a change. Altogether, SCA can only be defined in terms of its proactive and reactive enablers and subsequent results. In light of this, I define SCA as the supply chain's ability to swiftly sense and respond to market changes proactively or reactively to deliver operational excellence and maintain financial benefits.

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[4] http://dictionary.cambridge.org/

In what follows I explore what factors enable this proactive or reactive responsiveness. The analysis of the definitions dataset reveals four major themes that occur repeatedly throughout the definitions: (1) proactiveness; (2) reactiveness; (3) enablers; and (4) outcomes (Figure 3).
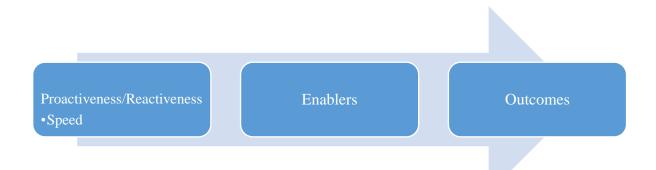

Figure 3. Major themes of a consensus SCA definition

In examining SCA definitions over time, the earliest definitions averaged about two themes and gradually increased. Early definitions only included the reactiveness mode of SCA. Later, both proactiveness and reactiveness were incorporated into SCA definitions. In fact, while almost all definitions that utilise speed aim to describe the reactive perspective to adapt to changes, only three definitions are found that associate the speed characteristic with both proactive and reactive modes (e.g. Fayezi et al., 2016; Gligor et al., 2013; Li et al., 2008). These authors made it clear by utilising terms such as 'alertness' and 'predictive' to refer to the proactive nature of the supply chain. Organisations generally apply their knowledge acquired from previous incidents to reach a proactive state (Fayezi et al., 2015). This process will minimise the threats that might have faced the organisation if not properly confronted. Additionally, firms might exploit profitable opportunities by taking advantage of such disruptions (Naylor et al., 1999). This resembles what Li et al. (2008) term "alertness", describing agility as an opportunity-seeking capability. Similarly, for a supply chain to be agile it should act as a defensive mechanism in responding to unplanned events. Indeed, speed should be embedded into both actions to keep up with the current pace of change; it is a rapid attentiveness to recognise change and explore opportunities and threats, and it is a rapid responsiveness to adapt to changes. While proactiveness is implicitly addressed by the

definition from Naylor et al. (1999), the definition from Eckstein et al. (2015) does not incorporate proactiveness with speed. In total, only five definitions employ the proactiveness mode on which this study greatly depends, a point that is neglected in the most frequently cited definitions.

Another inspection of the definitions reveals that some authors define SCA only in terms of its enablers (e.g. Brusset, 2016; Prater et al., 2001) by implicitly concentrating on supply chain capabilities or strategies that can engender agility. While some scholars blend enablers with the reactive nature of SCA in forming their definitions (e.g. Christopher, 2000; Ismail & Sharifi, 2006; Ngai et al., 2011), Naylor et al. (1999) integrate enablers with proactiveness. Over time, an advancement of the SCA definition is witnessed. More comprehensive definitions came from Eckstein et al. (2015), Fayezi et al. (2015, 2016) and Gligor et al. (2013). SCA is manifested in these definitions through combining the proactive-reactive nature of SCA along with its enablers to clearly shape a thorough and simple understanding of SCA. Different sets of enablers were mentioned in the definitions—e.g. aligned process, mindsets, IS and relationship integration. However, there seems to be no agreement either on the practices that help in achieving SCA. Although I argue that enablers should be included in the unified definition as an extracted theme, broadening the definition to specifically include a wider set of enablers may not be appropriate to reach a high level of consensus.

Finally, outcomes of SCA were the least used theme in definitions. Ultimately, the goal of SCA is to achieve greater profitability to sustain competitiveness (Lee, 2004; Li et al., 2008; Swafford et al., 2006). Although SCA may not necessarily be associated with the lowest cost, especially when comparing it with lean supply chain (Gligor et al., 2015; Jain et al., 2008; Qrunfleh & Tarafdar, 2013; Van Hoek et al., 2001; Yusuf et al., 2004), this study stresses the fact that there would be no room for boosting financial performance and thus maintaining competitiveness if achieving agility were to incur significant expenses. SCA should not be taken merely as the ability to rapidly manage market changes, but also the ability to do so in a

better and more cost-effective way than competitors—and consequently, gain a competitive advantage. Consequently, it is argued here that any definition of SCA without regard to outcomes is incomplete. Nonetheless, different outcomes were identified in the definitions, reflecting inconsistencies—for example, maintaining competitiveness (e.g. Bal et al., 1999), fulfilling customer requirements (e.g. Fayezi et al., 2015; Lin et al., 2006) and satisfying employees (Lin et al., 2006)—and more investigation is hence required in this regard.

Overall, when examining the SCA definitions published through to 2016, it was unusual to find definitions including all four themes (see Table 6). Of the 24 unique definitions identified, only one definition—that belonging to Fayezi et al. (2015)—covers all themes. This definition explicitly mentions the proactive-reactive nature of SCA incorporated with speed along with its selected enablers and outcomes. Nevertheless, whether or not the enablers and consequences mentioned in this definition are accurate and mirror what the literature says is subject to further examination.

Table 6. Published SCA definitions contracted into themes of a consensus definition

Number of themes contained in definitions	Number of definitions
Four	1
Three	4
Two	6
One	13
Total	24

To sum up, an investigation of the selected definitions reveals that a speedy response to market changes forms part of almost all definitions which are, although considered acceptable, more narrowly focused and tend to be more illustrative than comprehensive.

These definitions evidently indicate that there is a lack of agreement in conceptualising enablers of this speedy response and what benefits accrue to firms who succeed at this task.

In the next section, I will compile the most commonly cited enablers and outcomes of SCA to pave the way for developing a relatively comprehensive SCA model that will be depicted in the discussion (phase 10).

<u>Towards identifying enablers of supply chain agility</u>

Considering that agility from a supply chain context means involving more than a single entity, consequently, the mobilisation of an organisation's agile capabilities would not be sufficient to augment agility across members of the supply chain. Therefore, different integrated patterns are required to maintain an acceptable level of supply chain agility to survive and improve performance in the turbulent environment, and thus a different set of enablers has been widely discussed in this arena. In analysing the practices to attain SCA, an inconsistent body of terminologies has been identified. While some scholars call them capabilities (Van Hoek et al., 2001; Yusuf et al., 2004), others refer to enablers (Baramichai et al., 2007; Gligor, 2014; Ngai et al., 2011), antecedents (Braunscheidel & Suresh, 2009; Gligor & Holcomb, 2012a; Swafford et al., 2006), drivers and antecedents together (Chiang et al., 2012), determinants (Sangari & Razmi, 2015) or critical success factors (CSF) (Power et al., 2001). As one purpose of this study is to decipher ambiguity in SCA concepts, adding further synonyms will not advance its understanding, and since all mentioned terms might have various definitions and interpretations in the literature, it is decided to remain neutral in this descriptive analysis and adopt the term 'enablers'.

Moreover, the disparity that surrounds SCA definitions also surrounds SCA enablers. A good example to illustrate this contentious issue is the fact that while researchers refer to IT assimilation (Liu et al., 2013), others speak about IT integration (Jain et al., 2008; Ngai et al., 2011). Likewise, and in discussing virtualisation, some authors refer to virtual enterprise (Vinodh et al., 2011), while others discuss virtual corporation (Naylor et al., 1999), virtual

integration (Christopher, 2000; Van Hoek et al., 2001) or virtual teaming (Bal et al., 1999). Although the terminology differs, it seems the essence is the same. It is thus designated that greater agreement on specific, yet simpler, terms regarding SCA enablers is required, and helpful in designing our comprehensive framework.

After comprehensively synthesising all enablers using the data extraction form, this systematic review clusters SCA enablers into 11 top enablers across various scholars. Consistent with the proactive and reactive nature of SCA agility discussed in the previous section, the enablers have been broadly organised into two categories: proactive and reactive enablers. While proactive enablers act as a preventive mechanism and a risk alleviator (Braunscheidel & Suresh, 2009; Tse et al., 2016) to anticipate possible opportunities or threats, reactive enablers are based on responding to unanticipated events after they have happened (Christopher, 2000; Lee, 2004; Swafford et al., 2008). Within the proactive enablers, four enablers are meant to help recognise change, namely:

a) Market sensitivity

b) Strategic sourcing

c) Culture of change

d) Strategic operational alignment

Reactive enablers are effect-oriented, aimed at countering the consequences of unanticipated incidents. Accordingly, SCA should be designed in a way that the consequences of an incurred event are moderated (Braunscheidel & Suresh, 2009). Thus, four main enablers are proposed for effective SCA within the reactive approach, namely:

a) Flexibility

b) Demand management

c) Contingency planning

d) Strategic orientation

The findings also address three central enablers that might fit in either mode depending on when they are applied, and thus they are needed in both modes:

a) Information technology utilisation

b) Collaborative relationship

c) Dependable logistics and distribution capabilities (see Table 7).

For instance, a collaborative relationship can help alleviate potential threats (Braunscheidel & Suresh, 2009) or anticipate possible opportunities through information sharing. However, it can also be utilised to rapidly reconfigure aligned resources and assets (Ngai et al., 2011; Sangari & Razmi, 2015) by providing a synergetic response. Another noticeable finding is that some particular enablers are interrelated. For example, information technology is a *sine qua non* for almost all other enablers in both modes. It enables capturing accurate market data (Christopher, 2000; Li et al., 2006), streamlines operations and inventory (Brusset, 2016; DeGroote & Marx, 2013), enhances information sharing and connectivity between supply chain members (DeGroote & Marx, 2013; Lin et al., 2006; Liu et al., 2013; Sangari & Razmi, 2015), fosters flexibility (Ngai et al., 2011), coordinates and integrates activities in procurement, manufacturing and logistics and distribution (Swafford et al., 2008) and assists in building effective relationships with suppliers (DeGroote & Marx, 2013; Yang, 2014). Finally, while each article focuses on a specific set of enablers, the findings reveal that proactive and reactive modes share the same number of enablers (four). This critical finding stresses the equal importance of both modes and that supply chain managers should apply equal effort to both approaches to engender agility in the supply chain.

Table 7. Summary of proactive and reactive SCA enablers and supporting references

	SCA enablers	Supporting references
Proactive enablers	**Market sensitivity:** being alert to capture market information immediately	Christopher, 2000; DeGroote & Marx, 2013; Eckstein et al., 2015; Gligor et al., 2013; Gligor, 2016; Li et al., 2008; Lin et al., 2006; Van Hoek et al., 2001; Vinodh et al., 2011
	Strategic sourcing: selecting and involving key suppliers to maintain innovativeness	Chiang et al., 2012; Christopher, 2000; Ismail & Sharifi, 2006; Jain et al., 2008; Power et al., 2001
	Culture of change: embracing change and learning through continuous improvement, top management support and staff empowerment	Braunscheidel & Suresh, 2009; Jain et al., 2008; Ngai et al., 2011; Power et al., 2001; Tse et al., 2016; Vinodh et al., 2011; Yusuf et al., 2014
	Strategic operational alignment: enhancing operational capabilities through production planning, process integration, managing inventory and postponement	Agarwal et al., 2007; Blome et al., 2013; Braunscheidel & Suresh, 2009; Brusset, 2016; Chiang et al., 2012; Christopher, 2000; Collin & Lorenzin, 2006; Ismail & Sharifi, 2006; Khan et al., 2009; Lee, 2002, 2004; Lin et al., 2006; Naylor et al., 1999; Ngai et al., 2011; Prater et al., 2001; Qrunfleh & Tarafdar, 2013; Tarafdar & Qrunfleh, 2016; Van Hoek et al., 2001; Vinodh et al., 2011; Yang, 2014
	Information technology utilisation: adoption of IT and IS tools to boost connectivity amongst members	Bal et al., 1999; Brusset, 2016; Chiang et al., 2012; Christopher, 2000; DeGroote & Marx, Fayezi et al., 2015; Gligor, 2016; 2013; Ismail & Sharifi, 2006; Jain et al., 2008; Khan et al., 2009; Lee, 2002; Li et al., 2006; Liu et al., 2013; Ngai et al., 2011; Power et al., 2001; Sangari & Razmi, 2015; Swafford et al., 2008; Vinodh et al., 2011; White, Daniel, & Mohdzain, 2005; Yang, 2014; Yusuf et al., 2004

	Collaborative relationship: sharing beliefs, information and resources across members	Baramichai et al., 2007; Braunscheidel & Suresh, 2009; Chiang et al., 2012; Christopher, 2000; Gligor & Holcomb, 2012a, 2012b; Gligor et al., 2013; Ismail & Sharifi, 2006; Jain et al., 2008; Lee, 2002, 2004; Li et al., 2006; Lin et al., 2006; Mason-Jones & Towill, 1999; Naylor et al., 1999; Sangari & Razmi, 2015; Tse et al., 2016; Vinodh et al., 2011; Yang, 2014; Yusuf et al., 2004; Yusuf et al., 2014
	Dependable logistics and distribution capabilities: building collaborative distribution practices to minimise vulnerabilities	Gligor & Holcomb, 2012b, 2014; Khan et al., 2009; Lee, 2004
Reactive enablers	**Flexibility:** adapting the SC in face of market changes with minimal penalty	Braunscheidel & Suresh, 2009; Chiang et al., 2012; Eckstein et al., 2015; Fayezi et al., 2016; Gligor et al., 2013; Gligor, 2016; Khan et al., 2009; Prater et al., 2001; Swafford et al., 2006, 2008
	Demand management: manipulating customer demand through pricing and customer service	Blome et al., 2013; Collin & Lorenzin, 2006; Gligor, 2014; Gligor & Holcomb, 2012b, 2014
	Contingency planning: forming back-up teams to tackle disruptions	Lee, 2004
	Strategic orientation: aligning collective capabilities	Braunscheidel & Suresh, 2009; Gligor et al., 2016
	Information technology utilisation: adoption of IT and IS tools to boost connectivity amongst members	Bal et al., 1999; Brusset, 2016; Chiang et al., 2012; Christopher, 2000; DeGroote & Marx, Fayezi et al., 2015; Gligor, 2016; 2013; Ismail & Sharifi, 2006; Jain et al., 2008; Khan et al., 2009; Lee, 2002; Li et al., 2006; Liu et al., 2013; Ngai et al., 2011; Power et al., 2001; Sangari & Razmi, 2015; Swafford et al., 2008; Vinodh et al., 2011;

		White, Daniel, & Mohdzain, 2005; Yang, 2014; Yusuf et al., 2004
46	**Dependable logistics and distribution capabilities:** building collaborative distribution practices to minimise vulnerabilities	Gligor & Holcomb, 2012b, 2014; Khan et al., 2009; Lee, 2004
	Collaborative relationship: sharing beliefs, information and resources across members	Baramichai et al., 2007; Braunscheidel & Suresh, 2009; Chiang et al., 2012; Christopher, 2000; Gligor & Holcomb, 2012a, 2012b; Gligor et al., 2013; Ismail & Sharifi, 2006; Jain et al., 2008; Lee, 2002, 2004; Li et al., 2006; Lin et al., 2006; Mason-Jones & Towill, 1999; Naylor et al., 1999; Sangari & Razmi, 2015; Tse et al., 2016; Vinodh et al., 2011; Yang, 2014; Yusuf et al., 2004; Yusuf et al., 2014

Figure 4 shows SCA enablers classified into proactive and reactive. This illustration provides a reference guide for practitioners considering SCA capitalisation. It differs from other frameworks in terms of its scope as it is exclusively centred on SCA and thus companies can blend elements by utilising each enabler where appropriate.
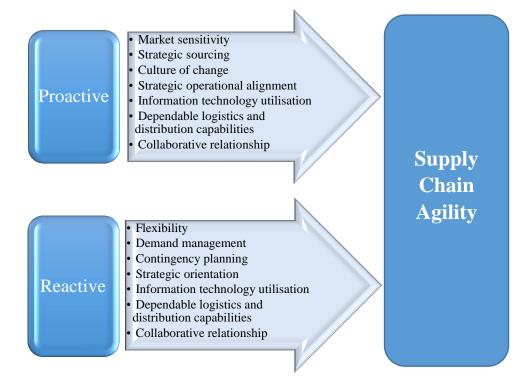
Figure 4. SCA enablers grouping

This guide is comprehensive as it reflects what the literature has so far tackled and thus no single firm would possess all (Lin et al., 2006). The choice of which combination of enablers to utilise and to what extent, will depend on the type and characteristics of changes faced by organisations (Baramichai et al., 2007) and the scale of organisations (Ngai et al., 2011). For instance, large companies that operate in a unpredictable business environment characterised by a reduced product lifecycle that forces them to constantly develop diversified and innovative products (Eckstein et al., 2015; Swafford et al., 2006) may equally and heavily depend on maintaining strong relationships with key suppliers (Christopher, 2000; Lee, 2004; Tse et al., 2016) and applying robust demand and distribution management tools (Gligor, 2014; Khan et al., 2009), utilising sophisticated IT tools (Ngai et al., 2011) and credible and automated logistics (Gligor & Holcomb, 2012b) simultaneously to sustain SCA. In contrast, while small scale firms that work in more stable environments should not invest heavily in such enablers (Ngai et al., 2011), it is of great importance to keep in mind the balanced approach when utilising their mixture.

Towards identifying outcomes of supply chain agility

While I aimed in this section to synthesise the various outcomes of SCA in terms of how it can affect performance, I have noticed that even the measures used to confirm this relationship are scattered. Therefore, I have decided to present the published contributions that address both the performance measures and performance outcomes of SCA. It is the premise of this paper that investigating the performance of SCA will advance its understanding and will contribute to forming SCA framework.

Needless to say, one reason to embrace an agile supply chain is to maintain competitiveness and improve profitability. Only a few studies have qualitatively addressed the link between SCA and the firm's competitiveness. For instance, Li et al. (2008) conceptually investigate the relationship between SCA and firm competitiveness from a work-design perspective. They conclude that a firm's agile performance is positively related to its competitiveness. Likewise, Lee (2004), with the aid of diversified examples from international companies, posits that agile supply chains equip companies with competitive advantages. Similar results are found by Ngai et al. (2011) based on case studies in Hong Kong.

Only 15 (31.2%) of the selected articles have conducted empirical research to quantify the impact of SCA on a wide variety of performance measures. The allocation of these studies across years is illustrated in Figure 5, which demonstrates that only recently have the consequences of SCA been empirically investigated. Swafford et al. (2008) presented the first research of its kind that tested the impact of SCA on competitive business performance.
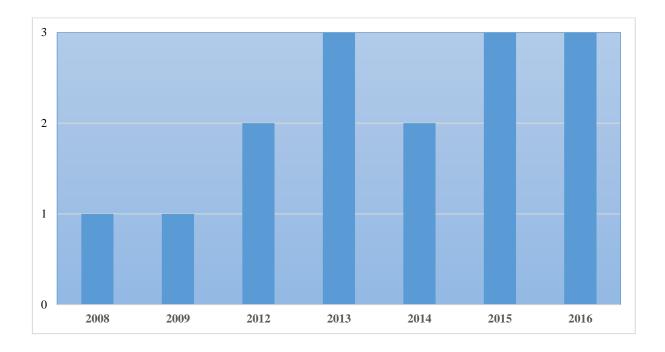
Figure 5. Dispersion of empirical articles tackling SCA consequences over years

The papers that do offer definitions of performance and assume it to be improved by SCA take different types of performance indicator into account, from pure operational performance references (e.g. product innovation, lead time reduction, service and quality) to broad strategic performance (e.g. overall competitiveness, profitability and growth). They also look at performance for differing units of analysis such as the whole supply chain or the organisational level. In regard to how performance is measured (see overview in Table 8), the majority include items related to logistics and SCM performance, with approximately 50 per cent also including financial performance measures. Two papers use only financial performance, one uses only operational performance, and one uses both operational and financial performance. The number of items used for measuring performance varies from one (Gligor, 2016; Gligor et al., 2015) to thirteen (Sangari & Razmi, 2015), with a mean of 5.7. Moreover, a closer investigation of the constructs reveals diversity of performance, with some authors focusing on operational performance (Blome et al., 2013) while others (Tse et al., 2016) do not take such indicators into account.

Table 8. Types of performance indicators and constructs included in the empirical studies

SR	Author	Performance Indicators	Items/Constructs
1	Swafford et al., 2008	Competitive business performance	• Return on global assets • Global market share • Profit margins • Sales/number of employees
2	Khan et al., 2009	Organisational performance	• Reduced returns • On-time delivery • Customer service • Time to market • ROA • Market share • Reduced make time • Overall competitiveness
3	Gligor & Holcomb, 2012a	1. Operational performance 2. Relational performance	• Meets promised deadlines to SC partners; ensures dependability and accuracy of a service • Identifies partners well and establishes formal relationships; exchanges recommendations for continuous improvements
4	Dwayne Whitten et al., 2012	1. Financial performance 2. Marketing performance	• AROI, average profit, profit growth, average return on sales • Average market share growth, average sales volume growth, average sales (in dollars) growth
5	DeGroote & Marx, 2013	1. Financial performance 2. Operational performance	• Sales, market share and profitability • Speed to market and customer satisfaction
6	Liu et al., 2013	Firm performance	• ROI • Percentage profit of sales • Shrinking delivery cycle time • Rapid response to demand change • Rapid confirmation of customer orders • Increase in customer satisfaction
7	Blome et al., 2013	Operational performance	• Customer service • SC cost performance • SC service level performance • SCF
8	Yang, 2014	Performance	• Market share • ROA • Average selling price • Product quality • Customer service

9	Yusuf et al., 2014	1. Business performance 2. Competitive objectives	• Turnover, net profit, market share, customer loyalty, performance relative to competitors • Proactivity, dependability, quality, flexibility, cost, innovation, delivery and speed
10	Eckstein et al., 2015	1. Cost performance 2. Operational performance	• Manufacturing costs, inventory costs, transportation and handling costs, costs of purchased goods and services • Product quality, service level, on-time delivery
11	Sangari & Razmi, 2015	SCA performance	• Customer satisfaction • Average process changeover time • Productivity improvement • Delivery in full on time • Technological competitiveness • Average sales to total stock • Cost reduction • Quality improvement • Lead time reduction • Process technology • Ability to develop new products • Product innovation
12	Gligor et al., 2015	Financial performance	• ROA
13	Tse et al., 2016	Firm performance	• ROS • ROA • ROI • Sales growth • Overall profitability
14	Tarafdar & Qrunfleh, 2016	Supply chain performance	• Rapid introduction of product improvements • Rapid product adjustment • Products variety • Handling difficult nonstandard orders
15	Gligor, 2016	Financial performance	• ROA

With respect to performance outcomes, with the exception of two (Tarafdar & Qrunfleh, 2016; Yusuf et al., 2014), all papers explicitly take the starting hypothesis that SCA positively, or directly, impacts performance. Table 9 extends Table 8 and complements it by providing a summary of the relationship between SCA and performance in the identified

articles. Among the 15 papers providing empirical evidence of the link between SCA and performance, ten affirm a positive relationship, while five provide more ambivalent results. For example, Gligor (2016) and Gligor et al. (2015) find that there is no direct relationship between SCA and a firm's financial performance measured by ROA, a relationship that showed contradicting results in other studies (e.g. Khan et al., 2009; Swafford et al., 2008; Tse et al., 2016). The other ambivalent results confirmed the positive relationship through different mediating variables. Ambivalent results generally suggest a complex relationship between SCA and different types of performance.

Table 9. Relationship between SCA and performance identified in the empirical studies

SR	Author	Relationship
1	Swafford et al., 2008	Direct relationship is supported
2	Khan et al., 2009	Significant impact is supported
3	Gligor & Holcomb, 2012a	Positive impact is supported for both types of performance
4	Dwayne Whitten et al., 2012	- Positive impact is supported for marketing performance - Financial performance is mediated through marketing performance (Combined impact with adaptable and aligned SC)
5	DeGroote & Marx, 2013	Significant and positive impact is supported for both types of performance
6	Liu et al., 2013	Positive relationship is supported
7	Blome et al., 2013	Positive impact is supported
8	Yang, 2014	Performance is mediated through cost efficiency
9	Yusuf et al., 2014	- Positive correlations are supported for business performance - Strong positive correlations are supported only for quality, proactivity, innovation, delivery and speed
10	Eckstein et al., 2015	Significant impact is supported for both types of performance
11	Sangari & Razmi, 2015	Positive effect is supported
12	Gligor et al., 2015	No direct relationship. Positive impact through cost efficiency and customer effectiveness
13	Tse et al., 2016	Significant positive effect is supported
14	Tarafdar & Qrunfleh, 2016	- Full mediation through strategic supplier partnership - partial mediation through postponement
15	Gligor, 2016	No direct relationship. Fully mediated through SC fit

The review regarding the consequences of SCA reveals that a great deal of research seeks to examine the benefits of SCA by quantifying financially oriented measures. However, while increasing financial performance is the organisation's ultimate goal, of great importance is maintaining operational performance, since SCA is originally linked to many operational issues—manufacturing, flexibility, lead time, quality, inventory, cost, logistics, etc. It is therefore believed that developing a better understanding of SCA can be accomplished if both operational and financial performance are well scrutinised. In fact, even though authors have broadly discussed the benefits of SCA across numerous operational constructs, only two rigorous empirical studies exist (Blome et al., 2013; Eckstein et al., 2015). Similarly, a plethora of research has widely tackled the financial benefits of SCA while few robust testing exist (Gligor, 2016; Gligor et al., 2015). This leads us to conclude that there is a fractional confirmation that SCA and both operational and financial performance are linked and that only a few studies have tackled this issue. However, the inconsistencies in performance indicators and constructs, along with failing to represent a set of financial and non-financial measures in a balanced framework, added to the slightly contradictory findings, all indicate that there is no universal consensus regarding suitable measures of supply chain agility performance outcomes, and commonly implemented SCA measurements are fragmented. The surrounding conceptual ambiguity of SCA might have hampered the development of an established link to performance and thus only a few robust studies have attempted to address this issue. This argument is the foundation stone for the next part of the thesis. The final phase of the review summarises its critical findings and presents its comprehensive framework.

PHASE 10: DISCUSSION

Having carried out the review, the final phase of the reporting and dissemination stage is to discuss the entire systematic process, highlighting major findings. Limitations of the findings and the identification of future research are provided in at the end of the thesis.

Overall, this review process has shown the development of research on SCA across several scientific arenas. Authors seem to be communicating with one another by frequently citing each other, and there is a somewhat delineated stream of research. However, as Table 5 shows, there is a relatively high proportion of authors proposing new definitions or modifications to existing definitions. This suggests that definitional consensus does not exist, a point previously acknowledged by some authors (Gligor et al., 2013; Li et al., 2008). In fact, capturing a total of 24 SCA definitions pinpoints two issues: firstly, it indicates the accelerated awareness of the concept; secondly, it points to the fact that SCA is still in its development stage.

The proposed definition is more encompassing because many of the previously published definitions have included only a few themes. To that end, the definition is not simply another addition to the SCA literature, but rather it serves to synthesise SCA thoughts, yielding a consensus definition of SCA generated from previously published research. So, is this consensus definition the 'ideal definition'? Probably no ideal definition may ever be determined because SCA is still developing and is evolving continuously. Nonetheless, we believe the proposed definition is better than those previously published because it encompasses themes that have been widely agreed upon in the SCA literature: proactiveness, reactiveness, enablers and outcomes. Given the fact that these themes might be developing, they will remain a vital part of SCA as the area continues to grow and develop.

The analysis also clearly demonstrates a lack of consistency among different enablers that may hinder the ability to capture SCA effectively. Therefore, a greater consensus on particular

notions and terms in respect to SCA enablers is undoubtedly required. Accordingly, the different terms were synthesised and grouped into proactive and reactive modes with each carrying the same number of enablers (four), along with identifying three mutual enablers. It is believed that by combining an appropriate set of the two modes, organisations can better engender SCA. The findings also reveal that, until now, SCA has experienced the absence of reasonable and sufficient SCA measures and that the outcomes of SCA are somewhat ambivalent. The analysis highlights that SCA can be better measured through examining the firm's operational and financial performance.

Based on this argument, this review develops a state-of-the-art schematic model of SCA that addresses the review's core objectives and aids in better capturing SCA, as seen in Figure 6.
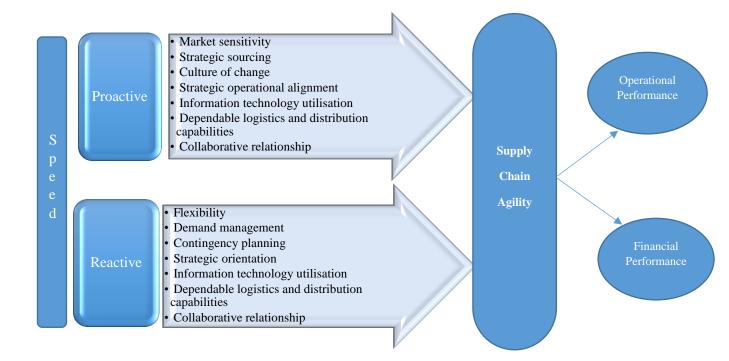
Figure 6. State-of-the-art schematic model of SCA

This framework provides the groundwork for an emerging theory of supply chain agility through synthesising many hitherto disconnected studies published in multiple research outlets. It seeks to assert the distinct quality—speed—that allows organisations to predict and

respond to market changes through well-grouped enablers which, if blended effectively, will progress the firm's operational and financial situation.

3. PART TWO: AN EMPIRICAL INVESITIGATION OF THE RELATIONSHIP BETWEEN SUPPLY CHAIN AGILITY AND A FIRM'S PERFORMANCE

Having surveyed the literature on the outcomes (consequences) of SCA, and in order to consolidate the confirmation that SCA positively affects a firm's performance, this analytical part statistically investigates this relationship based on secondary data. It is believed that this empirical work will enrich the review in advancing the understanding of SCA and thus providing a rigorous literature review supplemented by empirical confirmation.

3.1 THEORETICAL BACKGROUND: SCA AND THE FIRM'S PERFORMANCE

The performance of a firm indicates how effectively it runs its business. Firm performance is one of the most relevant constructs in the field of business studies (Rumelt & Teece, 1994) and is regularly considered the final result of a business model (Richard, Devinney, Yip, & Johnson, 2009). Accordingly, a clear definition of a firm's performance is required in clarifying the multidimensional relationship between SCA and a firm's performance. The notion of a firm's performance has many levels and aspects. Each aspect has been operationalised in various ways in previous SCA studies. In particular, SCA literature has increasingly focused on testing the financial and operation-related benefits of SCA separately or simultaneously.

Selecting the most appropriate performance indicators and measures is challenging to operations management researchers (Melnyk, Stewart, & Swink, 2004). This might be due to the complexity of the supply chain (Beamon, 1999; Flynn, Huo, & Zhao, 2010). Although financial performance has been argued to be the dominant indicator (Kennerley & Neely, 2003; Nadkarni & Narayanan, 2007; Neely, 2002), it is a limited indicator of the firm's improvement in such highly competitive markets (Kennerley & Neely, 2003; Santos & Brito, 2012) that might not exactly reflect the SCA's dynamism. Consequently, including operational performance indicators along with financial indicators would provide a wider performance conceptualisation (Venkatraman & Ramanujam, 1986). Composite performance measures generate more precise results about an organisation's improvement (Panayides, 2007). Additionally, composite measures allow the examination of all aspects of SCA, consider the effect of uncertainty, and take into account the strategic goals of the organisation (Beamon, 1999). As such, the present part considers operational performance and financial performance as two key aspects of a firm's performance. This extended understanding of firm performance helps provide a more inclusive model of a firm's performance and hence allows us to draw a more encompassing conclusion.

There is no doubt that managers embrace agile supply chains due to their efficacy in capitalising profits (Agarwal et al., 2007). There are some studies that conceptually address this contention (e.g. Li et al., 2008; Ngai et al., 2011). These studies postulate that SCA arms organisations with competitive privileges. Through their comprehensive study, Yusuf et al. (2014) reveal that SCA has a significant influence on competitive objectives and business performance in the oil and gas industry. Eckstein et al. (2015) empirically demonstrated that supply chain agility significantly impacts both cost performance and operational performance. This is consistent with Liu et al. (2013), who measured firms' performance via multiple constructs: operational, marketing and financial. Utilising structural equation modelling, Tse et al. (2016) claim that SCA has significant influence over a firm's performance in the electronics industry in terms of turnover, net profit, market share and customer loyalty. Gligor and Holcomb (2012a) extended the analysis scope and stated that agility is a broad and multidimensional concept. They empirically addressed the association between supply chain agility and the firm's operational and relational performance. They conclude that supply chain agility is a key factor in improving organisational performance, especially in the case of meeting promised deadlines to supply chain partners, as well as dependability and accuracy of a service. Likewise, Blome et al. (2013) claimed, from a dynamic capabilities perspective, the positive influence of supply chain agility on operational performance. Further, DeGroote and Marx (2013) empirically contended that supply chain agility, combined with an adaptable and aligned supply chain, improves the firm's financial and operational performance with significant impact on all measures. In contrast, although Dwayne Whitten et al. (2012) find a positive relationship between supply chain agility and marketing performance through supply chain performance, the relationship between supply chain agility and financial performance is found to be weak. In an attempt to demonstrate how SCA can assist organisations to attain a competitive advantage, Wu, Tseng, Chiu, and Lim (2016) have recently argued, utilising a closed loop decision making structure along with fuzzy set theory and Delphi method, that the

information integration aspect of SCA is the major aspect influencing competitiveness, effectiveness and efficiency.

Other authors have confirmed conflicting results. For example, although Gligor (2016) and Gligor et al. (2015) find that there is no direct relationship between SCA and a firm's financial performance measured by ROA, other studies proved this link to be direct (e.g. Khan et al., 2009; Swafford et al., 2008; Tse et al., 2016).

The other ambivalent results confirmed the positive relationship through different mediating variables which proposes complex relationship between SCA and different types of performance. For example, Tarafdar and Qrunfleh (2016) found a complementary relationship between agile supply chain strategy and particular supply chain practices such as strategic supplier partnership, customer relationship, postponement and lean practices that can enhance the supply chain performance through the mediating effect of such practices. Similarly, Yang (2014) found no direct relationship between SCA and a firm's performance measured by multiple constructs. Deploying path analysis, the study posits that cost efficiency mediates this relationship.

In summary, we can say that, based on the above argument, the positive and direct effect of SCA on financial performance is not assertive.

3.2 HYPOTHESIS DEVELOPMENT

SUPPLY CHAIN AGILITY AND FIRM'S OPERATIONAL PERFORMANCE

In this study, the firm's performance is based on both operational performance and financial performance. Figure 7 shows the theorised performance model. SCA is hypothesised as positively influencing both the operational and the financial performance of the firm. Additionally, operational performance is hypothesised as positively influencing the firm's financial performance.
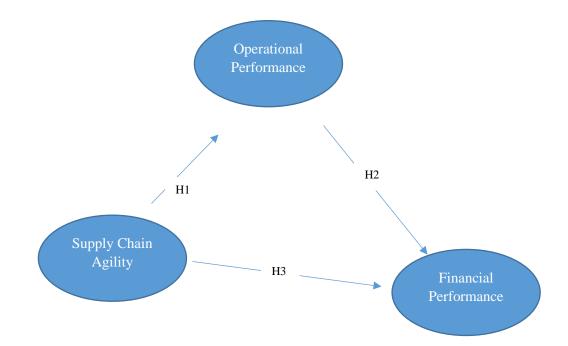
Figure 7. Supply chain agility performance model with hypotheses

The discussion below seeks to demonstrate how SCA can contribute to operational performance. SCA has been always associated with operational aspects of creating capability through flexible operations (Braunscheidel & Suresh, 2009; Fayezi et al., 2015; Swafford et al., 2006). Naylor et al. (1999) postulate that agility provides firms with the flexibility to cope with changing technologies, uncertain demand and short product lifecycle. Brusset (2016) conceptualises SCA as an operational capability focusing on timely and cost-effective product

delivery. Lee (2004) argues that SCA can also help to support the overall cost leadership strategy by reducing market mediation costs. Postponement or delayed configuration can accurately and quickly capture demand fluctuations and thus enhance flexibility (Prater et al., 2001; Qrunfleh & Tarafdar, 2013; Tarafdar & Qrunfleh, 2016). This will lead to enhanced customer service through delivering the right quantity while maintaining the requested level of quality. Moreover, postponement can result in reduced cost of inventory, production and transportation through fewer stock-keeping variants and volume-oriented economies of scale (Christopher, 2000; Lee, 2004). SCA enables firms to meet delivery deadlines and to ensure the dependability and accuracy of a service (Gligor & Holcomb, 2012a), all of which are product quality characteristics. Building inventory buffers and safety stocks helps execute design and engineering rapidly and accurately (Blome et al., 2013; Lee, 2004; Van Hoek et al., 2001), which will result in exactly delivering tailored products. Collaborative operation planning reduces SC uncertainty while it improves lead times and handling of customer deliveries (Agarwal et al., 2007; Yang, 2014). Thus, SCA can quickly assess markets that assist the firm in swiftly reconfiguring its operations and tactics, which leads to launching innovative and desired products to gain competitive advantage in a constantly changing environment. Having developed this argument, this study hypothesises the positive impact of supply chain agility on operational performance:

H1: Supply chain agility positively influences the firm's operational performance.

FIRM'S OPERATIONAL PERFORMANCE AND FINANCIAL PERFORMANCE

Generally, managers work to improve operational performance in terms of cost, flexibility and quality. Such operation-related improvements should impact financial performance through improved revenue numbers. Liu et al. (2013) posit that partnership integration within the supply chain incorporated with speed will result in improving daily operations and reducing costs, along with maximising profitability. Restructuring supply chain operations may lead to reduced costs and increased profitability (Eckstein et al., 2015). IBM was able to respond rapidly to customer needs through reconfiguring its internal processes by directly transmitting customers' orders to suppliers, which has led to cost reduction and eventually an increase in profit and competitiveness (White et al., 2005). Hence, this study proposes the following hypothesis:

H2: The firm's operational performance positively influences the firm's financial performance.

SUPPLY CHAIN AGILITY AND FIRM'S FINANCIAL PERFORMANCE

Supply chain agility can also positively affect financial performance in myriad ways. While the supply chain agility aims to chase the customers' needs, it sometimes convert markets' threats into opportunities. This will eventually increase the overall sales and maintain market share. Customers tend to repeat purchase if they feel looked after and comfortable towards a specific company. Swafford et al. (2008) found that supply chain agility improves return on assets, market share and profit margins. Similar results are found in many related studies (e.g. Khan et al., 2009; Liu et al., 2013; Tse et al., 2016). Cisco was able to secure profits and gain market share by tailoring its supply chain structural configuration to different target markets and customers (Lee, 2004). Using archival data, Gligor et al. (2015) found that SCA affects the firm's financial results by positively impacting its customer effectiveness and cost efficiency. Agarwal et al. (2007) argue that the ability of SCA to introduce a new product into

the market can lead to a greater market share and higher price premiums, which will accordingly result in higher profitability. Moreover, the collaborative relationship among supply chain members enhances the capacity for low cost, quality, speed and product innovation, which in turn might lead to greater revenue and profit (Yusuf et al., 2004). Agile supply chains are market-sensitive and will profit by exploiting their supply chains to swiftly and cost-effectively respond to unanticipated changes (Baramichai et al., 2007). All these arguments lead to the third hypothesis:

H3: Supply chain agility positively influences the firm's financial performance.

3.3 METHODS AND DESIGN

DATA COLLECTION AND SOURCE

To test our research hypotheses, a segment of a large custom-built dataset was extracted on the performance of SMEs in Asia-Pacific. This dataset was accumulated over four years (2012–2016) by a team of scholars form different universities in Australia, Hong Kong, Malaysia and Iran.[5] The dataset contains information on supply chain agility and the performance dimensions of 222 manufacturing SMEs in Australia. Dr. Arash Najmaei, one of the mentors who directed in the review, was a member of the data collecting team and has provided the author with access to this dataset.[6]

Sample firms were distributed across six states [NSW = 70 (32%), VIC = 65 (29%), SA = 40 (18%), QLD = 30 (14%) and WA = 17(8%)]. No firms from ACT, Northern Territory and Tasmania were in the sample. Sample firms have between 31 and 147 employees (mean = 45 employees) and are aged between five and 28 years (mean = 13 years). The distribution of sample firms according to the Australia and New Zealand Standard Industrial Classification Codes (ANZSIC) is as follows: 52 firms (23%) were in food processing, 58 firms (26%) in beverage manufacturing, 48 (22%) in wood product manufacturing, 34 firms (15%) in basic chemicals manufacturing and the remaining 30 firms (14%) were in the fabricated metal manufacturing sector. This heterogeneity suggests that the sample represents a relatively complete picture of the Australian manufacturing sector.

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[5] Team members include Dr Arash Najmaei from MGSM, Dr Shafique Raghman from MGSM, Dr Zahra Sadeghinejad from MGSM, Mr Tm Yang, PhD student at the Hong Kong University of Science and Technology, Mr Brenda Lin from Hong Kong University of Science and Technology, Miss Saphia Rasul from the International College of Management, Sydney, Mr Pejman Zaidani from Isfahan University of Science and Technology, Dr Nezal Aghajari from the University of Technology Malaya (UTM), and Dr Mehdi Poorangi from the University of Malaya.

[6] Appendix I explains the process of building and developing this dataset.

Data robustness checks

For checking robustness of data, several measures were performed. Firstly, anonymity and confidentiality of data was ensured and explicitly mentioned that the data was collected solely for research purposes and would not be used in any competitive benchmarking or evaluative activity. Secondly, two rounds of ad-hoc ANOVA tests to assess the bias inherent in the sampling process were conducted. These tests revealed no significant difference between early, late and non-responding firms, ruling out the effect of sampling bias (Armstrong & Overton, 1977). Finally, since data was collected from a single respondent from each firm, common method bias was tested using Harman's single factor test. The test did not show any single factor carrying more than 50 per cent of the variance in the model (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Therefore, we concluded that common method bias was not a threat to the quality of data.

MEASURES

Previously validated scales were selected to measure the constructs. Supply chain agility was measured by the scale developed by Qrunfleh and Tarafdar (2014). This scale is composed of five items, each with five anchors ranging from strongly disagree to strongly agree. A sample item is "our supply chain responds effectively to changing requirements of design". The measure has shown high reliability in past research (CA = 0.81).

The firm's operational performance was measured by five items taken from the Blome et al. (2013). This measure captures the performance of the firm in terms of its ability to deliver the right quantity and quality at the right time relative to its main competitors. The measure uses five anchors ranging from much worse to much better and has achieved high reliability in prior studies (CA = 0.79).

Finally, the firm's financial performance was measured using the scale developed by Qrunfleh and Tarafdar (2014). This scale asks participants to rate the performance of their firm in terms of return on investment (ROI), profit margin on sales, growth in return on investment and the growth of market share. The scale also has high reliability in prior studies (CA = 0.92).

3.4 VALIDITY AND RELIABILITY

Before proceeding with testing of the hypothesised relationships, the measures from the dataset underwent a refining process by assessing their unidimensionality and reliability through examining the convergent validity, internal consistency and discriminant validity of the constructs.

Convergent validity

First, due to potential conceptual and statistical overlap, an attempt was made to produce a parsimonious set of distinct non-overlapping variables from the full set of items underlying each construct. An exploratory factor analysis (EFA) was performed to ensure a reliable scale. EFA provides evidence for the validity of the constructs and the measurement model. With this evidence, there is more confidence in the results of the hypothesised model. Principle component analysis (PCA) as a means of extraction and Varimax with Kaiser's normalisation as a method of orthogonal rotation was performed. An examination of the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy suggested that the sample was factorable (KMO = 0.924), as a minimum KMO score of 0.70 is considered necessary to reliably use factor analysis for data analysis. Similarly, Bartlett's test of sphericity (the higher the better) was 2006.816 with significant level of $P < 0.005$.

Table 10 shows the results of EFA. When loadings less than 0.40 were excluded, the analysis yielded a three-factor solution which explained cumulatively 70.8 per cent of total variance, lending preliminary support to a claim for constructs' unidimensionality. Convergent validity assessment involves examining the factor loadings of each item measuring a construct. The items in question should converge on the same construct. Results in Table 10 indicate that all items loaded into their respective factors with loadings greater than 0.50, which means that the convergent validity is supported (Bollen, 2014). To further assess the convergent validity, the average variance extracted (AVE) and the composite reliability (CR) were calculated.

AVE and CR were all above the cut-off values of 0.5 and 0.7, respectively (Hair et al., 2010), implying good convergent validity of the measurement model.

Reliability testing

The reliability of each construct was further analysed. To be retained in a scale, items had to exceed the recommended 0.70 cut-off for Cronbach's alpha (Nunnally, 1978). The reliability of the scale of all measures exceeds 0.843, as Table 10 depicts, which indicates adequate internal consistency.

Table 10. Reliability and convergent validity test results

Scale/item	Item loading, min ≥ 0.50	Cronbach's α, min ≥ 0.70	Average Variance Extracted (AVE) min ≥ 0.50	Composite Reliability (CR) min ≥ 0.70
Supply chain agility		0.90	AVE = 0.64	CR = 0.88
SCA 3	0.841			
SCA 2	0.811			
SCA 1	0.810			
SCA 5	0.765			
SCA 4	0.757			
Operational performance		0.88	AVE = 0.54	CR = 0.85
OP 2	0.798			
OP 4	0.796			
OP 3	0.760			
OP 1	0.682			
OP 5	0.628			
Financial performance		0.84	AVE = 0.55	CR = 0.89
FP 1	0.803			
FP 2	0.802			
FP 4	0.679			
FP 3	0.669			

Discriminant validity

Before conducting discriminant validity, linear composites of the component variables were created using the summative method. Discriminant validity can be inferred when the measure of each construct converges on its respective true score, which is uniquely distinct from those of the others (Churchill, 1979). Discriminant validity was assessed by examining factor correlations (Kline, 2005) and whether the square root of the average variance extracted (AVE) for each construct was larger than its correlation with other factors (Henseler, Ringle, & Sarstedt, 2015). As shown in Table 11, all construct correlations were less than 0.80 and the square root of the AVE for each construct is significantly higher than the correlation between any pair of factors. This indicates that none of the constructs shared more variance with another construct than with its own indicators, thus exhibiting sufficient levels of discriminant validity. Moreover, none of the correlations was higher than 0.90, suggesting that there was no problem of multicollinearity (Hair et al., 2010).

Table 11. Discriminant validity test results

Item	SCA	OP	FP
SCA	**0.95**		
OP	0.60	**0.94**	
FP	0.55	0.70	**0.92**

Note: Diagonal elements are the square roots for AVE

3.5 HYPOTHESIS TESTING

TEST OF DIRECT LINK

Hypothesis testing was conducted using a series of regressions. The first regression examined the association between SCA and operational performance (OP). The results show a positive relationship between SCA and OP (β = 0.6, t = 11.2, $P \leq 0.001$, R^2 = 0.362). This finding provides full support for H1, indicating that supply chain agility positively influences the operational performance of the firm. Next, OP was regressed on financial performance (FP), providing full support for H2, showing a positive relationship between OP and FP (β = 0.70, t = 14.6, $P \leq 0.001$, R^2 = 0.492.) Finally, the relationship between SCA and FP was analysed. The results suggest a positive relationship between SCA and FP (β = 0.54, t = 9.6, $P \leq 0.001$, R^2 = 0.297). This finding provides support for H3, specifically that supply chain agility positively influences the firm's financial performance. A summary of the multiple regression results is presented in Table 12.

Table 12. Multiple regression analysis results
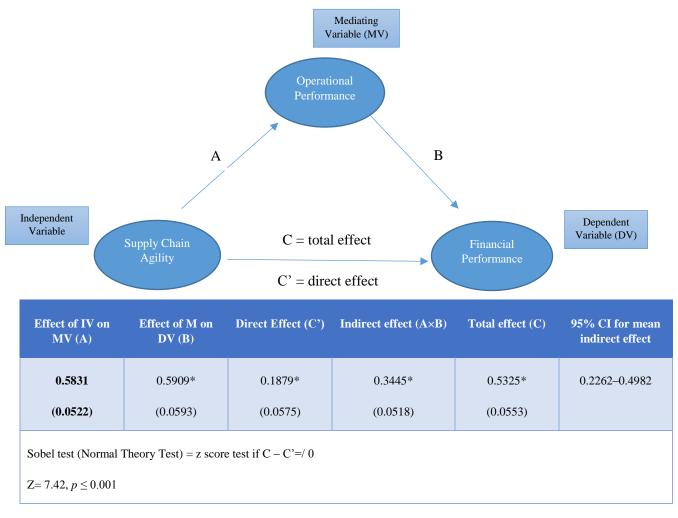
Independent Variable	Dependent Variable		
	OP	FP	FP
SCA	0.6	0.54	-
OP	-	-	0.70
(*P*-value)	.000	.000	.000
R²	0.362	0.297	0.492

MEDIATION ANALYSIS

In order to examine the mediating role of operation performance in the link between SCA and financial performance, we used the method proposed by Baron and Kenny (1986). Then the Sobel test value (Sobel, 1982) was calculated using the bootstrapping approach. The results are shown in Figure 8. The mediating effect of OM in the relationship between SCA and FP was statistically significant ($Z = 7.42$, $P<0.00$). Note that the total effect ($C = 0.5325$) is equal to the direct effect ($C' = 0.1879$) plus the indirect effect ($A \times B = 0.3445$). However, while all paths were shown to be significant, as the figure shows, full mediation occurs when there is no direct effect (path C') but an indirect effect (the path going through A and B).

As such, supply chain agility shows direct and indirect effect on financial performance. The results suggest that OP partially mediates the link between SCA and financial performance.

Effect of IV on MV (A)	Effect of M on DV (B)	Direct Effect (C')	Indirect effect (A×B)	Total effect (C)	95% CI for mean indirect effect
0.5831	0.5909*	0.1879*	0.3445*	0.5325*	0.2262–0.4982
(0.0522)	(0.0593)	(0.0575)	(0.0518)	(0.0553)	

Sobel test (Normal Theory Test) = z score test if C − C'=/ 0

Z= 7.42, $p \leq 0.001$

Note: Standard errors are shown in parentheses; *significant at $P \leq 0.001$

Figure 8. Mediation results

3.6 DISCUSSION

The results of the second part of the thesis also provide an important theoretical contribution to better conceive the SCA benefits. It mainly conceptualises SCA as an operational capability stemming from the ability to manage across the demand and supply network (Brusset, 2016).

The SCA literature, with its theoretical and empirical studies, indicates the presence of a positive relationship between SCA and performance. Previous studies, however, have not been conclusive about this positive relationship, nor have they considered operational performance as a mediator. Our results support the notion that supply chain agility plays an instrumental role in enhancing the firm's financial performance and that this relationship is also mediated through operational performance (fully supporting hypotheses 1–3). This finding extends the SCA literature by delivering a unique direction in the relationship between SCA and the firm's performance that has not been tested before, to the best of our knowledge. Research on the impact of SCA on operational performance has been conducted previously (e.g. Blome et al., 2013; DeGroote & Marx, 2013; Eckstein et al., 2015; Gligor & Holcomb, 2012a). Likewise, the relationship between SCA and financial performance has previously been investigated (e.g. DeGroote & Marx, 2013; Dwayne Whitten et al., 2012; Gligor, 2016; Gligor et al., 2015). However, our performance model validated a different perspective on the direct influence of SCA on financial performance via operational performance. Additionally, the effect of SCA on firm performance has not been empirically performed before in Australia, to our knowledge, which confirms previous results and increases the study's generalisability.

4. IMPLICATIONS

The first part of the thesis culminates in a state-of-the-art framework that is expected to be valuable for both academia and professionals. The former may find it useful because it provides theoretical insight into SCA and gives, in addition to themes extracted, a possible explanation considering the multidisciplinary and multidimensionality of the concept. The review represents the funnel bottom of the highly impacted SCA literature. The latter may appreciate it in different decision making processes that should be designed while keeping in mind the SCA delineated definition and both approaches of enablers synthesised in this review. Therefore, it supports practitioners during management processes related, for instance, to predicting any threat or opportunity by deploying the appropriate proactive enablers and associating them with the reasonable reactive enablers in coordination with other members in the supply chain. It is hoped that the current review provides an impetus for further examination of the important domain of SCA.

The empirical testing presented in the second part shifts our understanding of the relationship between SCA and firm financial performance a step forward. It conveys important guidelines for managers to maintain financial performance and thus satisfy shareholders by maintaining operational excellence. Besides, the definitions and measures provided for SCA can help managers define specific actions to be taken to engender SCA—i.e. customised products, maintaining a buffer, quick response to markets. Likewise, the measurements provided for operational performance can serve as a powerful tool for managers to squeeze the financial benefits of SCA—i.e. flexibility, cost, quality, delivery. They can also help firms to minimise the chance of financial failure by addressing these key operational dimensions.

This study has found that SCA enhances a firm's operational performance and consequently enhances firm financial performance. This relationship alerts managers to conceive the dynamism conceptualisation of SCA and act quickly internally and externally with each

partner across the supply chain, which will eventually aid in creating and sustaining their competitive advantage.

5. LIMITATIONS AND FUTURE RESEARCH ENDEAVOR

As is the case in any research, typical limitations to research (or to human choices in general) include time, imperfect or incomplete knowledge, and scarce resources. Aside from these more 'typical' and catholic limitations, there are a few others applicable to this thesis.

In regard to the systematic review, while some relevant articles were found unsystematically through backward snowballing which were valuable due to the relevance and quality in presenting the review objectives, this study might have missed out on other, more relevant, articles, especially as only two online repositories were probed (Web of Science, ABI/INFORM). Whilst they are widely regarded as excellent data sources, other databases could have been reviewed for completeness. Nevertheless, as a result of considering only those articles published in the highly impacted journals, suggesting that most relevant and high quality research has been taken into account, the author is assured that any other paper would be unlikely to change the output of this thesis. Furthermore, although the enablers of SCA were grouped and synthesised, the author believes that the interaction between the enablers is only briefly discussed and could be an area for further research.

Based on the sound foundation of the research findings described in both parts of this study, some issues are highlighted that warrant further investigation. SCA is a relatively emerging phenomenon and developing theories in this area will be an important contribution to advance a better understanding of the SCA field. Some areas that may require attention from academics and researchers in the future are:

Systematic review extension. Further research should strive to extend the analysis to a more comprehensive coverage of the field of operations and supply chain management, so it could be possible to go further and select more keywords that would allow for the literature review to sufficiently represent the range of key topics in the field in a broader way. Finally, it would be of great importance to conduct a systematic review based on a bibliometric analysis to

reveal the intellectual influences that have helped shaped the SCA research. This can be applied by means of citation and co-citation techniques.

Constant investigation of SC via multiple methodologies. Given the relatively recent emergence of SCA as a discipline and the dynamic nature of the field (Tse et al., 2016), scholars should continue to perform research that examines what SCA is and what it is not. This may require constant investigations via case studies that examine SCA enablers, field interviews that tap the richness of what practitioners believe is involved in SCA, and surveys that supply a wider verification of the conclusions reached in the first two types of study. Through this systematic examination of what is and is not included in SCA, scholars should continue to publish different theoretical models of SCA.

Examining SCA enablers' relationships. While the stream of empirical work on SCA has grown steadily over the past years, it remains insufficiently developed (Eckstein et al., 2015; Gligor & Holcomb, 2012a). So, the next phase may be a validation of our proposed framework by conducting further research and in different industrial sectors in order to collect evidence from companies to examine the importance and causal relationships of SCA enablers. More interestingly, the door is open to benchmark our synthesised enablers in order to comprehensively select the most appropriate enablers and the best scenario under which they function, as well as the joint impact of these enablers on supply chain agility.

Testing new performance models. In line with this, we suggest exploiting and empirically testing new models that prove the significant impact of SCA on firm's performance, given the dearth of research from this angle. Our proposed framework allows the incorporation of performance quantification. Therefore, we propose exploiting additional methodological tools such as case studies in combination with quantitative methods to validate and prove theoretical concepts. Additionally, the size and nature of the sample addressed in the empirical analysis is considered a major limitation. Supply chains vary from industry to industry. Hence collecting more data from a wider range of firms is an important direction to

validate the findings of this study. In the same vein, researchers may apply a multiple case study approach to analyse and benchmark the payoffs—or losses—between those organisations incorporating SCA and non-SCA adopters in the same sector while exposed to homogenous market circumstances. We believe that such studies would attract more companies focusing on SCA, and shed light on effective enablers for implementing SCA to receive the maximum benefits.

New theoretical lenses. Another opportunity emanates from contingency theory and points to the importance of expanding this model using other mediators and moderators. Our empirical part is just an early step in this direction and it is hoped that researchers will use this model and these findings as a guiding point to expand the body of knowledge on how, when and through what processes practising supply chain agility yields financial and non-financial results.

Robustness of empirical results. More rigorous studies are needed of areas remaining uninvestigated. For instance, what is the role of SCA in different macroeconomic climates? Are different groups of enablers—or a specific mixture—needed during an economic recession? And are the benefits of SCA enhanced or weakened during such circumstances? Quantitative approaches can lead to new sources of data to produce important knowledge and acquire new insights.

Global SCA analysis. The area of global supply chain agility can inspire many opportunities and extend the seminal work of Prater et al. (2001). Will the proactive-reactive nature of SCA be valid under and across different national cultures? Do the enablers change in different global regions and across different types of company? Are there any regional differences regarding the financial benefits of SCA? More empirical studies from different regions and cultures may be conducted in this area to confirm the general findings presented in this study. There is a dearth of SCA research in respect to an international focus. Nonetheless, globalisation is nowadays arguably one of the most critical concepts for industry practitioners.

Moreover, it could be possible to investigate how companies in the same or in different sectors capture the topic of agility in the supply chain. This may answer the question as to how prevalent SCA is. In fact, this may yield benchmarking information on both companies and regions. Yet, the review is in itself a noteworthy contribution by laying the theoretical foundation for future SCA studies.

Integrating traditional OM topics. Many traditional OM topics may be revisited and refreshed in the light of SCA. For example, the philosophy of quality management can be examined jointly with SCA. Can speed and quality be interrelated? Can quality management be an SCA enabler? How can quality be improved across firm boundaries in order to improve the performance of the supply chain?

SCA in the service sector. The lack of studies dealing with SCA in services SC is perhaps one of the main gaps in the current SCA literature. Still, a great majority of the existing literature on SCA corresponds to the manufacturing SC. In view of the crucial role of the service industry (e.g. education, healthcare, banking, hospitality and so on) in the current economy, the literature related to service-based SCA must be enriched. Accordingly, there is a clear need to package and interpret lessons from the SCA research and test it in the services SC, considering the differences between manufacturing and service operations and the implications these differences may have in capturing SCA. In comparison to manufacturing, service operations: (a) have greater customer involvement; (b) are more sensitive to quality errors; (c) have tight delivery times; and (d) are more dependent on information reliability (Brandon-Jones, Lewis, Verma, & Walsman, 2016). All these elements might pose challenges to SCA implementation—for example, how to deliver services that precisely match the customer requirements, or how to promise short delivery times considering highly customised services. Research on SCA in the service sector could be either theoretical (e.g. matching themes, if applicable, of manufacturing versus service industries), exploratory (e.g. survey of service industry to identify practices) or descriptive (e.g. case studies of service companies).

Under-researched topics. While a great deal of research has investigated the enablers of SCA, none, to our knowledge, has explored the inhibitors. This might be of significant interest for further studies.

Methodological upgrading. Finally, it is worth mentioning that most reviewed articles represent a single moment in time, while in many cases a longitudinal approach would be far more informative. Although such studies require considerably longer timeframes and are difficult to collect, they provide an effective tool and deliver useful findings.

6. CONCLUSION

We have reviewed research in SCA since its emergence with a focus on articles published in highly ranked journals. After providing descriptive results, we presented the analysis in response to the review objectives. Accordingly, we have constructed an encompassing definition, scrutinised SCA enablers and outcomes, and thus developed an original framework for supply chain agility, providing a unique methodological contribution. Recognising the importance of consistent and reliable performance measures and outcomes for SCA, the research study makes another original contribution in the direction of linking SCA to the company's financial performance through focusing on empirically studying the relationships between SCA and financial performance by utilising a dataset from Australian manufacturing SMEs. This statistical investigation, by means of multiple regressions, shows the positive relationship between SCA and financial performance, addressing evidentiary value and knowledge as a fundamental basis to further explore more models.

We hope that this study adds some granularity to the SCA construct. Still, SCA is relatively a new concept within the supply chain literature. There will be a need to delve further into what constitutes SCA and what other performance indicators might be affected by SCA. These issues will be left hopefully for the PhD program.

REFERENCES

Agarwal, A., Shankar, R., & Tiwari, M. K. (2007). Modeling agility of supply chain. *Industrial Marketing Management, 36*(4), 443–457. doi:10.1016/j.indmarman.2005.12.004

Armstrong, J. S., & Overton, T. S. (1977). Estimating nonresponse bias in mail surveys. *Journal of Marketing Research, 14*(3), 396–402. doi:10.2307/3150783

Bal, J., Wilding, R., & Gundry, J. (1999). Virtual teaming in the agile supply chain. *The International Journal of Logistics Management, 10*(2), 71–82. doi:10.1108/09574099910806003

Baramichai, M., Zimmers Jr., E. W., & Marangos, C. A. (2007). Agile supply chain transformation matrix: An integrated tool for creating an agile enterprise. *Supply Chain Management: An International Journal, 12*(5), 334–348. doi:10.1108/13598540710776917

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*(6), 1173.

Beamon, B. M. (1999). Measuring supply chain performance. *International Journal of Operations & Production Management, 19*(3), 275–292.

Bettany-Saltikov, J. (2010). Learning how to undertake a systematic review: Part 2. *Nursing Standard, 24*(51), 47–56.

Blome, C., Schoenherr, T., & Rexhausen, D. (2013). Antecedents and enablers of supply chain agility and its effect on performance: A dynamic capabilities perspective. *International Journal of Production Research, 51*(4), 1295–1318. doi:10.1080/00207543.2012.728011

Bollen, K. A. (2014). *Structural equations with latent variables*. New York, NY: John Wiley & Sons.

Booth, A., Sutton, A., & Papaioannou, D. (2016). *Systematic approaches to a successful literature review*. London: Sage.

Brandon-Jones, A., Lewis, M., Verma, R., & Walsman, M. C. (2016). Examining the characteristics and managerial challenges of professional services: An empirical study of management consultancy in the travel, tourism, and hospitality sector. *Journal of Operations Management, 42*, 9–24.

Braunscheidel, M. J., & Suresh, N. C. (2009). The organizational antecedents of a firm's supply chain agility for risk mitigation and response. *Journal of Operations Management, 27*(2), 119–140. doi:10.1016/j.jom.2008.09.006

Brusset, X. (2016). Does supply chain visibility enhance agility? *International Journal of Production Economics, 171*, 46–59.

Chiang, C.-Y., Kocabasoglu-Hillmer, C., & Suresh, N. (2012). An empirical investigation of the impact of strategic sourcing and flexibility on firm's supply chain agility. *International Journal of Operations & Production Management, 32*(1–2), 49–78. doi:10.1108/01443571211195736

Christopher, M. (2000). The agile supply chain: Competing in volatile markets. *Industrial Marketing Management, 29*(1), 37–44.

Churchill Jr, G. A. (1979). A paradigm for developing better measures of marketing constructs. *Journal of Marketing Resea*rch , *16*(1), 64-73. doi:10.2307/3150876

Collin, J., & Lorenzin, D. (2006). Plan for supply chain agility at Nokia: Lessons from the mobile infrastructure industry. *International Journal of Physical Distribution & Logistics Management, 36*(6), 418–430. doi:10.1108/09600030610677375

David, R. J., & Han, S. K. (2004). A systematic assessment of the empirical support for transaction cost economics. *Strategic Management Journal, 25*(1), 39–58.

DeGroote, S. E., & Marx, T. G. (2013). The impact of IT on supply chain agility and firm performance: An empirical investigation. *International Journal of Information Management, 33*(6), 909–916.

Denyer, D., & Tranfield, D. (2009). Producing a systematic review. The Sage handbook of organizational research methods , (pp. 671-689). Thousand Oaks, CA: Sage Publications Ltd, xxxvi, 738 pp.

Dwayne Whitten, G., Green Jr, K. W., & Zelbst, P. J. (2012). Triple-A supply chain performance. *International Journal of Operations & Production Management, 32*(1), 28–48.

Eckstein, D., Goellner, M., Blome, C., & Henke, M. (2015). The performance impact of supply chain agility and supply chain adaptability: The moderating effect of product complexity. *International Journal of Production Research, 53*(10), 3028–3046. doi:10.1080/00207543.2014.970707

Fayezi, S., Zutshi, A., & O'Loughlin, A. (2015). How Australian manufacturing firms perceive and understand the concepts of agility and flexibility in the supply chain. *International Journal of Operations & Production Management, 35*(2), 246–281. doi:10.1108/ijopm-12-2012-0546

Fayezi, S., Zutshi, A., & O'Loughlin, A. (2016). Understanding and development of supply chain agility and flexibility: A structured literature review. *International Journal of Management Reviews*. 00, 1–30. doi: 10.1111/ijmr.12096

Flynn, B. B., Huo, B., & Zhao, X. (2010). The impact of supply chain integration on performance: A contingency and configuration approach. *Journal of Operations Management, 28*(1), 58–71.

Gligor, D. M. (2014). The role of demand management in achieving supply chain agility. *Supply Chain Management, 19*, 577–591. doi:10.1108/SCM-10-2013-0363

Gligor, D. M. (2016). The role of supply chain agility in achieving supply chain fit. *Decision Sciences, 47*(3), 524–553. doi:10.1111/deci.12205

Gligor, D. M., Esmark, C. L., & Holcomb, M. C. (2015). Performance outcomes of supply chain agility: When should you be agile? *Journal of Operations Management, 33*, 71–82. doi:10.1016/j.jom.2014.10.008

Gligor, D. M., & Holcomb, M. (2014). The road to supply chain agility: An RBV perspective on the role of logistics capabilities. *International Journal of Logistics Management, 25*(1), 160–179. doi:10.1108/IJLM-07-2012-0062

Gligor, D. M., & Holcomb, M. C. (2012a). Antecedents and consequences of supply chain agility: Establishing the link to firm performance. *Journal of Business Logistics, 33*(4), 295–308. doi:10.1111/jbl.12003

Gligor, D. M., & Holcomb, M. C. (2012b). Understanding the role of logistics capabilities in achieving supply chain agility: A systematic literature review. *Supply Chain Management: An International Journal, 17*(4), 438–453. doi:10.1108/13598541211246594

Gligor, D. M., Holcomb, M. C., & Feizabadi, J. (2016). An exploration of the strategic antecedents of firm supply chain agility: The role of a firm's orientations. *International Journal of Production Economics, 179*, 24–34. doi:10.1016/j.ijpe.2016.05.008

Gligor, D. M., Holcomb, M. C., & Stank, T. P. (2013). A multidisciplinary approach to supply chain agility: Conceptualization and scale development. *Journal of Business Logistics, 34*(2), 94–108. doi:10.1111/jbl.12012

Hair, J. F., Anderson, R. E., Babin, B. J., & Black, W. C. (2010). *Multivariate data analysis: A global perspective* (Vol. 7). Upper Saddle River, NJ: Pearson.

Hart, C. (2001). *Doing a literature search: A comprehensive guide for the social sciences*. London: Sage.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science, 43*(1), 115–135.

Ismail, H. S., & Sharifi, H. (2006). A balanced approach to building agile supply chains. *International Journal of Physical Distribution & Logistics Management, 36*(6), 431–444. doi:10.1108/09600030610677384

Jain, V., Benyoucef, L., & Deshmukh, S. (2008). What's the buzz about moving from 'lean'to 'agile'integrated supply chains? A fuzzy intelligent agent-based approach. *International Journal of Production Research, 46*(23), 6649–6677.

Jalali, S., & Wohlin, C. (2012). *Systematic literature studies: Database searches vs. backward snowballing.* Paper presented at the Proceedings of the ACM-IEEE International Symposium on Empirical Software Engineering and Measurement.

Kaynak, H. (2003). The relationship between total quality management practices and their effects on firm performance. *Journal of Operations Management, 21*(4), 405–435.

Kennerley, M., & Neely, A. (2003). Measuring performance in a changing business environment. *International Journal of Operations & Production Management, 23*(2), 213–229.

Khan, A. K., Bakkappa, B., Metri, B. A., & Sahay, B. S. (2009). Impact of agile supply chains' delivery practices on firms' performance: Cluster analysis and validation. *Supply Chain Management-an International Journal, 14*(1), 41–48. doi:10.1108/13598540910927296

Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd ed.). New York, NY: Guilford Press.

Lee, H. L. (2002). Aligning supply chain strategies with product uncertainties. *California Management Review, 44*(3), 105–119.

Lee, H. L. (2004). The triple-A supply chain. *Harvard Business Review, 82*(10), 102–113.

Li, G., Lin, Y., Wang, S., & Yan, H. (2006). Enhancing agility by timely sharing of supply information. *Supply Chain Management: An International Journal, 11*(5), 425–435. doi:10.1108/13598540610682444

Li, X., Chung, C., Goldsby, T. J., & Holsapple, C. W. (2008). A unified model of supply chain agility: The work-design perspective. *The International Journal of Logistics Management, 19*(3), 408–435. doi:10.1108/09574090810919224

Lin, C.-T., Chiu, H., & Chu, P.-Y. (2006). Agility index in the supply chain. *International Journal of Production Economics, 100*(2), 285–299. doi:10.1016/j.ijpe.2004.11.013

Liu, H., Ke, W., Wei, K. K., & Hua, Z. (2013). The impact of IT capabilities on firm performance: The mediating roles of absorptive capacity and supply chain agility. *Decision Support Systems, 54*(3), 1452–1462. doi:10.1016/j.dss.2012.12.016

Mason-Jones, R., & Towill, D. R. (1999). Total cycle time compression and the agile supply chain. *International Journal of Production Economics, 62*(1–2), 61–73. doi:http://dx.doi.org/10.1016/S0925-5273(98)00221-7

Melnyk, S. A., Stewart, D. M., & Swink, M. (2004). Metrics and performance measurement in operations management: Dealing with the metrics maze. *Journal of Operations Management, 22*(3), 209–218.

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Annals of Internal Medicine, 151*(4), 264–269.

Nadkarni, S., & Narayanan, V. K. (2007). Strategic schemas, strategic flexibility, and firm performance: The moderating role of industry clockspeed. *Strategic Management Journal, 28*(3), 243–270.

Naylor, J. B., Naim, M. M., & Berry, D. (1999). Leagility: Integrating the lean and agile manufacturing paradigms in the total supply chain. *International Journal of Production Economics, 62*(1), 107–118.

Neely, A. (2002). *Business performance measurement: Theory and practice*. Cambridge, England: Cambridge University Press.

Ngai, E. W. T., Chau, D. C. K., & Chan, T. L. A. (2011). Information technology, operational, and management competencies for supply chain agility: Findings from case studies. *Journal of Strategic Information Systems, 20*(3), 232–249. doi:10.1016/j.jsis.2010.11.002

Nunnally, J. C. (1978). *Psychometric theory* (2d ed.). New York, NY: McGraw-Hill.

Panayides, P. M. (2007). The impact of organizational learning on relationship orientation, logistics service effectiveness and performance. *Industrial Marketing Management, 36*(1), 68–80.

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*(5), 879.

Popay, J., Roberts, H., Sowden, A., Petticrew, M., Arai, L., Rodgers, M., . . . Duffy, S. (2006). Guidance on the conduct of narrative synthesis in systematic reviews. *A Product from the ESRC Methods Programme Version, 1*, b92.

Power, D. J., Sohal, A. S., & Rahman, S. U. (2001). Critical success factors in agile supply chain management an empirical study. *International Journal of Physical Distribution and Logistics Management, 31*(4), 247–265. doi:10.1108/09600030110394923

Prater, E., Biehl, M., & Smith, M. A. (2001). International supply chain agility: Tradeoffs between flexibility and uncertainty. *International Journal of Operations & Production Management, 21*(5–6), 823–839. doi:10.1108/01443570110390507

Qrunfleh, S., & Tarafdar, M. (2013). Lean and agile supply chain strategies and supply chain responsiveness: The role of strategic supplier partnership and postponement. *Supply Chain Management, 18*(6), 571–582. doi:10.1108/SCM-01-2013-0015

Qrunfleh, S., & Tarafdar, M. (2014). Supply chain information systems strategy: Impacts on supply chain performance and firm performance. *International Journal of Production Economics, 147*, 340–350.

Richard, P. J., Devinney, T. M., Yip, G. S., & Johnson, G. (2009). Measuring organizational performance: Towards methodological best practice. *Journal of Management, 35*(3), 718–804.

Rousseau, D. M., Manning, J., & Denyer, D. (2008). Evidence in management and organizational science: Assembling the field's full weight of scientific knowledge through syntheses. *The Academy of Management Annals, 2*(1), 475–515.

Rumelt, R. P., & Teece, D. J. (1994). *Fundamental issues in strategy: A research agenda*. Boston, Massachusetts: Harvard Business Press.

Sangari, M. S., & Razmi, J. (2015). Business intelligence competence, agile capabilities, and agile performance in supply chain. *International Journal of Logistics Management, 26*(2), 356–380. doi:10.1108/IJLM-01-2013-0012

Santos, J. B., & Brito, L. A. L. (2012). Toward a subjective measurement model for firm performance. *BAR-Brazilian Administration Review, 9*(SPE), 95–117.

Sobel, M. E. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. *Sociological Methodology, 13*(1982), 290–312.

Swafford, P. M., Ghosh, S., & Murthy, N. (2006). The antecedents of supply chain agility of a firm: Scale development and model testing. *Journal of Operations Management, 24*(2), 170–188. doi:10.1016/j.jom.2005.05.002

Swafford, P. M., Ghosh, S., & Murthy, N. (2008). Achieving supply chain agility through IT integration and flexibility. *International Journal of Production Economics, 116*(2), 288–297. doi:10.1016/j.ijpe.2008.09.002

Tarafdar, M., & Qrunfleh, S. (2016). Agile supply chain strategy and supply chain performance: Complementary roles of supply chain practices and information systems capability for agility. *International Journal of Production Research*, 1–14. doi.org/10.1080/00207543.2016.1203079

Thomas, D. R. (2006). A general inductive approach for analyzing qualitative evaluation data. *American Journal of Evaluation, 27*(2), 237–246.

Thomé, A. M. T., Scavarda, L. F., & Scavarda, A. J. (2016). Conducting systematic literature review in operations management. *Production Planning & Control, 27*(5), 408–420.

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management, 14*(3), 207–222.

Tse, Y. K., Zhang, M., Akhtar, P., & MacBryde, J. (2016). Embracing supply chain agility: An investigation in the electronics industry. *Supply Chain Management: An International Journal, 21*(1), 140–156. doi:10.1108/scm-06-2015-0237

Van Hoek, R. I., Harrison, A., & Christopher, M. (2001). Measuring agile capabilities in the supply chain. *International Journal of Operations and Production Management, 21*(1-2), 126–147. doi:10.1108/01443570110358495

Venkatraman, N., & Ramanujam, V. (1986). Measurement of business performance in strategy research: A comparison of approaches. *Academy of Management Review, 11*(4), 801–814.

Vinodh, S., Prakash, N. H., & Selvan, K. E. (2011). Evaluation of agility in supply chains using fuzzy association rules mining. *International Journal of Production Research, 49*(22), 6651–6661. doi:10.1080/00207543.2010.535044

White, A., Daniel, E. M., & Mohdzain, M. (2005). The role of emergent information technologies and systems in enabling supply chain agility. *International Journal of Information Management, 25*(5), 396–410.

Wu, K.-J., Tseng, M.-L., Chiu, A. S., & Lim, M. K. (2016). Achieving competitive advantage through supply chain agility under uncertainty: A novel multi-criteria decision-making structure. *International Journal of Production Economics*. doi.org/10.1016/j.ijpe.2016.08.027

Yang, J. (2014). Supply chain agility: Securing performance for Chinese manufacturers. *International Journal of Production Economics, 150*, 104–113. doi:10.1016/j.ijpe.2013.12.018

Yusuf, Y. Y., Gunasekaran, A., Adeleye, E. O., & Sivayoganathan, K. (2004). Agile supply chain capabilities: Determinants of competitive objectives. *European Journal of Operational Research, 159*(2), 379–392. doi:10.1016/j.ejor.2003.08.022

Yusuf, Y. Y., Gunasekaran, A., Musa, A., Dauda, M., El-Berishy, N. M., & Cang, S. (2014). A relational study of supply chain agility, competitiveness and business performance

in the oil and gas industry. *International Journal of Production Economics,*

147(PART B), 531–543. do-i:10.1016/j.ijpe.2012.10.009

APPENDICES

Appendix I

To collect data on Australian firms, the contact information of 1,200 Australian manufacturing SMEs was randomly drawn from the Dun and Bradstreet Database (D&B Hoovers) portal. An invitation to participate in a general survey about operations, logistics and supply chain management was addressed to the managing director or CEO of the firms and was sent to each firm's head office. After two weeks, phone calls were made to find out how many firms were interested in the research. Executives of 850 firms (71%) expressed an interest in the survey. Then copies of the research questionnaire, along with a postage paid return envelope, were sent to these firms. After two follow-ups, 260 questionnaires were collected. The initial screening procedure excluded seven incomplete questionnaires, resulting in a calibrated set of 253 workable questionnaires.

To collect time-lagged financial performance data, executives in the first round were contacted one year after the first wave of data collection. Twenty-two executives had been changed or did not respond to the research team. Also, five firms were not reached, due mainly to changes in their contact information. Executives from 226 firms provided the time-lagged data. After screening, four firms were dropped. Data from the remaining 222 firms were used for the analysis.[7]

Appendix II: Measures

Supply Chain Agility – adopted from Qrunfleh and Tarafdar (2014)
This scale asks participants: Our supply chain:
Responds effectively to changing requirements of design
Responds quickly to customisation requirements
Can handle changes in product design
Customises our products by adding feature models as per our requirements
Maintains a higher capacity buffer to respond to volatile market
Operational Performance – adopted from Blome et al. (2013)
How would you rank your customer service, in terms of delivering the right *quantity* and *quality* at the right time, relative to that of your best competitors? (split into two items)
How would you rank your supply chain cost performance relative to your best competitors?
How would you rank your supply chain service level performance relative to your best competitors?
How would you rank your supply chain flexibility relative to your best competitors?
Financial Performance – adopted from Qrunfleh and Tarafdar (2014)
Return on investment
Profit margin on sales
Growth in return on investment
The growth of market share

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[7] Data are now securely stored and used by members of the team for research purposes. There is no conflict of interest in using the data and members have an equal right to use of the data. Ethical sides of data collection were assessed by the Macquarie University Ethics Committee in 2012.

APPENDIX III: DATA EXTRACTION FORM AND DATA SYNTHESIS (🟠 : Definition 🟦 : Enablers 🔺 : Outcomes)

SR	AUTHOR	SIGNIFICANCE	COMMENTS	CODE
1	Agarwal et al., 2007	Employing interpretative structural modelling, it examines the interrelationships between different variables affecting SCA.	Provides seven key SCA enablers: customer satisfaction, quality improvement, cost minimisation, delivery speed, new product development, service level improvement and lead-time reduction.	🟦
2	Bal et al., 1999	It addresses the importance of embodying knowledge and expertise to engender SCA.	Provides a definition and introduces 'virtual teaming' as a key enabler of SCA that reduces non-value-adding activities.	🟠 🟦
3	Baramichai et al., 2007	It proposes the agile supply chain transformation matrix and the implementation methodology necessary to achieve agility in the supplier-buyer supply chain.	Provides a definition and stresses the role of collaborative relationships agile suppliers to create SCA. It argues that the dynamic of structures and relationship configuration, information visibility, event-driven and event-based management are key SCA enablers.	🟠 🟦
4	Blome et al., 2013	Based on RBV and the dynamic capability view, and employing PLS, it investigates two key enablers and one mediator of SCA and their impact on performance.	Claims that demand-side and supply-side competencies (focusing on their intangible aspects) along with process compliance are key SCA enablers and that they positively affect operational performance.	🔺 🟦

5	Braunscheidel & Suresh, 2009	Using SEM and PLS, it explains cultural aspects and the impact of organisational practices on SCA by extending the unit of analysis.	A highly-cited paper provides a formal definition and key enablers of SCA (market & learning orientation, internal and external integration, and external flexibility).	🟠 🟦
6	Brusset, 2016	Based on strategic management views, it investigates whether managerial processes related to visibility enhance SCA using SEM.	Provides a definition and pinpoints that internal capabilities (forecasting and sales and operations planning) and external capabilities (efficient customer response) are key SCA enablers, showing the latter as an operational capability.	🟠 🟦
7	Chiang et al., 2012	Using PLS and based on the competency-capability framework and the dynamic capability view, it investigates two key enablers of SCA.	Argues that strategic sourcing and flexibility are key SCA enablers regardless of business-specific conditions or characteristics (firm size, production processes used, seasonality or perishability product features).	🟦
8	Christopher, 2000	It conceptually develops the SCA model and differentiates it from leanness.	A highly-cited article that formed a base for many further works by providing a definition and enablers of SCA (virtual, market sensitive, process integration, network-based).	🟠 🟦
9	Collin & Lorenzin, 2006	Building on Nokia networks as a case study, it argues how demand planning and forecasting can augment SCA.	Postulates 'customer-driven planning' as a key enabler of SCA.	🟦
10	DeGroote & Marx, 2013	Using multiple linear regression analysis, it investigates the role of IT in SCA and the impact of SCA on a firm's performance.	Demonstrates that IT increases SCA measured by the ability to sense and respond to market changes and SCA improves a firm's financial and operating performance.	🟦 🔺

11	Dwayne Whitten et al., 2012	Using SEM, it investigates the Triple A SC performance (agile, adaptable and aligned).	Postulates a positive and direct relationship with marketing performance and indirect relationship with financial performance.	🔺
12	Eckstein et al., 2015	Based on the dynamic capability view and contingency theory, it examines the impact of SC agility and SC adaptability on cost and operational performance in German firms using hierarchical regression analysis.	Indicates that SCA has a positive impact on cost and operational performance under both low and high product complexity.	🔴 🟦 🔺
13	Fayezi et al., 2015	Based on Australian case studies, it mitigates the conceptual and contextual ambiguity between SCA and SC flexibility.	Provides a formal definition of SCA and claims that supplier agility is more important than customer agility.	🔴 🟦
14	Fayezi et al., 2016	Based on a structured literature review, it conceptually, textually and methodologically contrasts the gaps between SCA and SC flexibility.	Provides a definition and conceptualises SCA as a strategic ability and as a paradigm of change, and SC flexibility as operational ability focusing on micro elements—i.e. operations elements.	🔴 🟦
15	Gligor & Holcomb, 2012a	Based on the relational view and utilising regression analysis, it investigates key enablers of SCA and tests the association between SCA and a firm's performance.	Provides a definition and addresses SC communication, coordination and cooperation as key SCA enablers. Besides, it shows a positive association between SCA and operational and relational performance.	🔴 🟦 🔺
16	Gligor & Holcomb, 2012b	Utilising a multidisciplinary systematic review, it develops a framework that addresses the role of firms' specific logistics capabilities in achieving SCA.	Claims that integrated SC logistics capabilities, comprising demand, supply and information management capabilities, are key SCA enablers.	🟦

17	Gligor et al., 2013	Using a multidisciplinary literature review, it develops a comprehensive definition and dimensions of SCA. Besides, it empirically develops a measurement instrument using CFA.	Provides formal definitions of SCA based on five dimensions (alertness, accessibility, decisiveness, swiftness and flexibility).	🟠 🟦
18	Gligor, 2014	Utilising a multidisciplinary systematic review, it develops a framework to examine the impact of demand management on SCA.	Argues that demand and supply integration, along with demand flexibility, is a key SCA enabler.	🟦
19	Gligor & Holcomb, 2014	Based on RBV, it empirically complements a previous study (Gligor & Holcomb, 2012b) utilising SEM to address the role of logistics capabilities in SCA.	Tackles a demand-side perspective by addressing two key SCA enablers (logistics demand-management interface capabilities and logistics information-management interface capabilities).	🟦
20	Gligor et al., 2015	Using secondary data, it investigates the relationship between SCA and customer effectiveness and cost efficiency, and their association across various environmental situations. Besides, it examines the impact of SCA on a firm's financial performance.	Shows indirect impact between SCA and the firm's financial performance measured by ROA by positively impacting its cost efficiency and customer effectiveness.	🔺
21	Gligor, 2016	It develops a theoretical framework and empirically investigates the role of SCA in achieving SC fit.	Shows an indirect impact of SCA on financial performance measured by ROA. This relationship is mediated through SC fit.	🟦 🔺
22	Gligor et al., 2016	Based on RBV and the strategy-structure performance paradigm, it develops a measurement scale that captures both SC orientation's strategic and structural elements utilising SEM.	Addresses market orientation and SC orientation as key SCA enablers.	🟦

#	Reference	Description	Contribution	●	■	▲
23	Ismail & Sharifi, 2006	It conceptually presents a structured conceptual framework for implementing new ideas in the development of SCA.	Provides a formal definition of SCA and key enablers (supplier collaboration, member integration, technology agile manufacturing, and strategic and operational alignment of product features).	●	■	
24	Jain et al., 2008	Utilising a multi-grade fuzzy approach, it develops a conceptual model to evaluate SCA.	Provides a definition and enablers of SCA (information flow, culture of change, relationship with partners, employee satisfaction, team building, IT adoption and quality).	●	■	
25	Khan et al., 2009	Using cluster analysis and ANOVA, it examines the role of distribution practices in achieving SCA and their impact on firms' performance.	Reveals key critical distribution SCA enablers: collaborative distribution, order commitment, distribution flexibility, inventory management and their significant impact on firms' performance.		■	▲
26	Lee, 2002	It theoretically addresses four SC strategies according to supply uncertainties and product characteristics.	Provides a definition and enablers—i.e. information sharing, coordination and postponement.	●	■	
27	Lee, 2004	It conceptually, with the aid of international examples, addresses three types of SC: agile, adaptable and aligned.	Provides a definition and six enablers of SCA (information flow, collaborative relationship with suppliers, postponement, inventory buffers, dependable logistics system and contingency plans).	●	■	▲
28	Li et al., 2006	It empirically investigates the impact of timely supply information sharing on firm's agility and SC performance based on a giant manufacturer in China.	Introduces information sharing as a key SCA enabler.		■	
29	Li et al., 2008	Based on knowledge-based view, dynamic capability	The first article to develop a research framework linking SCA	●	■	▲

		and social learning theory, it conceptually develops the SCA conceptual model and links to firm competitiveness based on the work-design perspective.	and firm competitiveness. It provides a formal definition and two key enablers of SCA (alertness and response capability) at three levels (strategic, operational and episodic).	
30	Lin et al., 2006	Utilising a fuzzy set theory, it develops a framework to measure and improve SCA based on Taiwanese context.	Provides a definition and key enablers of SCA: collaborative relationships, process integration, information integration and customer market sensitivity.	🟠 🟦
31	Liu et al., 2013	Based on the dynamic and the hierarchy capabilities views, it empirically investigates the IT effect on firm performance through absorptive capacity and SCA.	Addresses association between IT and SCA through absorptive capacity, and that both absorptive capacity and SCA mediate the relationship between IT capabilities and a firm's performance.	🟦 🔺
32	Mason-Jones & Towill, 1999	Building on the total cycle time approach, it conceptually reckons on decreasing information and materials flow lead times to achieve SCA.	Introduces the concept of 'information-enriched SC', addressing information flow as a key enabler of SCA.	🟦
33	Naylor et al., 1999	With the aid of a case study, it postulates that adopting agile or lean SC is based on the total SC strategy.	Provides a definition and enablers of SCA (market knowledge, virtual corporation, lead time compression, rapid configuration and robustness). It tackles related issues—e.g. decoupling point.	🟠 🟦
34	Ngai et al., 2011	Based on case studies, it develops a framework of SC competencies for SCA and firm performance, addressing SCA as a competitive capability.	Provides formal definition and key SC competencies as enablers of SCA (IT, operational and management) and argues that the degree of these competencies is based on the organisation scale. Besides, it claims that SCA is directly associated with competitive advantage and firm performance.	🟠 🟦 🔺
35	Power et al., 2001	Empirically provides factors differentiating more agile	Provides key enablers of SCA (supplier involvement, IT	🟦

		companies from less agile organisations.	utilisation, participative management style and continuous improvement).		
36	Prater et al., 2001	A unique study that investigates SCA from an international perspective with the aid of case studies. It claims that complexity and vulnerability may limit SCA realisation.	Provides a definition of SCA, incorporating speed and flexibility as the main dimensions and other related issues—e.g. postponement.	🟠 🟦	
37	Qrunfleh & Tarafdar, 2013	Based on strategic choice theory and RBV and by utilising SEM and covariance-based analysis, it empirically claims that SC responsiveness is enhanced through deploying SC practices in parallel with SC strategies	Highlights the positive effect of SCA on SC responsiveness, having postponement as a key enabler of SCA.	🟦	
38	Sangari & Razmi, 2015	Utilising strategic views, it investigates the impact of business intelligence on SCA and the agile performance of SC using SEM.	Addresses three SC business intelligence competences (managerial, technical, cultural) as key enablers of agility in SC and highlights their positive impact on SCA performance.	🟦 🔺	
39	Swafford et al., 2006	It addresses the role of SC flexibilities in SCA. Besides, it develops a measurement model utilising SEM.	A highly-cited paper, it argues that procurement/sourcing flexibility, manufacturing flexibility and distribution/logistics flexibility are key SCA enablers.	🟠 🟦	
40	Swafford et al., 2008	Using SEM, it examines how IT integration and SC flexibility achieve SCA. Besides, it investigates the impact of SCA on business performance.	The first article to empirically test the consequences of SCA. It argues that investing first in IT enhances SC flexibility and thus SCA which, in turn, positively affects competitive business performance.	🟦 🔺	
41	Tarafdar & Qrunfleh,	Based on complementarity and the information	Indicates SCA's significant impact on SC performance. Also,	🟠 🟦 🔺	

	2016	processing view of the firm, it examines the impact of SCA on SC performance using SEM.	this relationship is mediated through SC practices (strategic partnership and postponement) and the information system capability for agility boosts this mediating effect.	
42	Tse et al., 2016	Using SEM, it addresses SCA antecedents and the role of SCA on firms' performance	Addresses external learning and SC integration as key SCA enablers. Besides, it shows a positive association between SCA and firms' performance.	🟦 🔺
43	Van Hoek et al., 2001	It conceptually develops an audit of agile capabilities addressed by a previous study (Christopher, 2000) based on European companies.	Provides a definition and assesses capabilities of SCA. Overall, it addresses customer sensitivity as a major concern.	🟠 🟦
44	Vinodh et al., 2011	It develops a conceptual model to evaluate agility in SC utilising a multi-grade fuzzy approach.	Addresses six key SCA enablers and sub-enablers: virtual enterprise, collaborative relationship, strategic management, knowledge and IT management, and customer and market sensitivity.	🟦
45	White et al., 2005	Employing IBM as a case study, it investigates the role of IT in capitalising SCA.	Addresses IT and IS as key SCA enablers.	🟦
46	Yang, 2014	Utilising path analysis, it examines the effect of technical and relational factors on SCA and the connection of their agility with performance based on China's guanxi-oriented culture (socially embedded relationship).	Postulates that IT capability and operational collaboration are key SCA enablers and the mediating r ole of cost efficiency between SCA and performance measured by (market share, return on assets, average selling price, overall product quality, overall customer service)	🟠 🟦 🔺
47	Yusuf et al., 2004	It empirically examines SCA capabilities and competitive objectives	Provides an SCA definition and tackles its enablers through addressing how diverse SC capabilities relate to each other and	🟠 🟦

competitive priorities.

| 48 | Yusuf et al., 2014 | It empirically investigates the connection between SCA dimensions, competitive objectives and business performance based on the oil and gas industry in the UK. | It shows a positive relationship between SCA dimensions (customer enrichment, cooperating to compete, mastering change, leveraging the impact of people and information) and competitive objectives and business performance. | |