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A COMPARATIVE META EVALUATION OF SUPPLY CHAIN INTEGRATION ON PERFORMANCE: A MODERATOR AND MEDIATOR PERSPECTIVE

MASTER'S THESIS

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Branch : Production Management and Marketing

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FOREWORD

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Augustine CASTRO SINGINE

08/09/2020

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ACRONYMS AND ABBREVIATIONS

SCI : Supply Chain Integration
SCP : Supply Chain Performance
SCA : Supply Chain Agility
SCID : Supply Chain Integration in terms of Dimensions
SCIF : Supply Chain Integration in terms of Facilitators
II : Internal Integration
SI : Suppliers Integration
CI : Customer Integration
InfI : Information Integration
OpI : Operational Integration
RI : Relational Integration
EI: : External Integration
BS : Business Performance
OP : Operational performance
FE : Fixed Effects model
RE : Random Effects model
MU : Market Uncertainty
MO : Market Orientation
RQ : Relationship Quality
RV : Relational View
OC : Organisational Capability
CT : Contingency Theory
RDT : Resource Dependency Theory
RBV : Resource Based View
KBV : Knowledge Based View
IPT : Information Processing Theory
EIO : External Integration Orientation
GSCF : Global Supply Chain Forum
CPER : Collaborative Planning, Forecasting and Replenishment
CIPS : Chartered Institute of Purchasing and Supply
SCOR : Supply Chain Operations Reference

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DEDICATION

This paper is dedicated to My Father, Jesus Christ and my mom Agnes N. Singine who mean everything to me.

Title of Thesis: A Comparative Meta Evaluation of Supply Chain Integration on Performance: Moderation and Mediation Perspective

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In an environment with ever changing customers' needs and intensifying global competition, quality processes and supply chains are critical for organisational success. To satisfy customers, outsmart competition and improve performance, contemporary organisations are trying to improve on their processes through integrated supply chains. Furthermore, with the dynamic and ever-increasing demand by global customers, while scholars and practitioners fail to agree on the performance outcomes of SCI, one important question is raised whether SCI is really a viable solution for improving performance. Furthermore, the conditions under which SCI effectively contribute to improved performance remains unclear.

A comparative meta- analytic evaluation based on Hunter and Schmidt (2004) along with key moderator and mediator analysis was conducted. In the lens of several theories, SCI from two perspectives; SCID (internal, suppliers, customer integration) with 67 studies and SCIF (information, operational, relational integration) with 25 studies was assessed on overall performance as well as on both operational and business performance. Meta-analytic results obtained through Jamovi provided significant correlation coefficients for SCID and SCIF. Therefore, indicating that the association between SCID and performance is medium and positive, while that of SCIF and performance is positive and large. This is a clear indication that SCI from the perspective of SCID and SCIF yields different results, with SCIF having a relatively larger effect. Operational performance was influenced by both SCID and SCIF, although operational and relational integration indicated a significant larger effect on business performance. Thus, individual SCID and SCIF constructs have different effects on business and operational as well as on overall performance. All moderators though with different levels of interactions indicated a significant effect on both SCID and SCIF. With an exception of SC innovation all the tested mediators indicated some form of significant mediation effects.

This study significantly contributes to the SCI body of knowledge in a number of ways. Firstly, it provides a theoretical and conceptual framework that examines the impact of SCI from two perspectives SCID and SCIF which is done both at an aggregate and individual level on performance. It further assesses the effects of moderating variables to understand critical conditions for SCI implementation. The study went further to include standard mediation analysis to explore the nature of nonlinear associations on the topic in order to understand why the inconsistencies and lack of consensus exist. Assessment of the effects of individual SCI constructs on both operational and business as well as on overall performance and its corresponding results might serve as a guide to managers on the individual constructs that best predict a specific type of performance. An understanding of probable condition expressed through moderators and their estimated effects on the SCI- performance association will also help the managers to use them to their advantage. The existence of mediators and moderators suggests that SCI-performance association should not be considered in isolation of these factors both at the academic and practical level.

Keywords: Supply Chain Integration; Moderators; Mediators; Meta-analysis; Performance

Başlık: Tedarik Zinciri Entegrasyonunun Performans Üzerindeki Etkisinin Karşılaştırmalı bir Meta Değerlendirmesi: Düzenleyici ve Arabuluculu Etkisi

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Müşteri ihtiyaçlarının sürekli değiştiği ve küresel rekabetin yoğunlaştığı bir ortamda, kalite süreçlerini ve tedarik zincirini yönetmek örgütsel başarı için kritik öneme sahiptir. Çağdaş kuruluşlar, müşterilerini memnun etmek, rakiplerine karşı üstün gelmek ve performanslarını artırmak için entegre tedarik zincirleri aracılığıyla süreçlerini geliştirmeye çalışmaktadırlar. Küresel müşterilerin dinamik ve sürekli artan talebi karşısında akademisyenlerin ve uygulayıcıların tedarik zinciri entegrasyonunun performans üzerindeki etkisi konusunda fikir birliğine sahip olmadıkları bir ortamda bu entegrasyonun performansı artırmak için gerçekten uygulanabilir bir çözüm olup olmadığı önemli bir konu olarak karşımıza çıkmaktadır.

Bu çalışmada Hunter ve Schmidt (2004) yaklaşımı takip edilerek karşılaştırmalı bir meta-analitik değerlendirme ile düzenleyici ve arabulucu analizi yapılmıştır. Tedarik zinciri entegrasyonu çeşitli teorilerin ışığı altında iki perspektiften incelenmiştir. Bunlardan birisi 67 çalışmayla incelenen entegrasyonun boyutları (içsel, tedarikçi ve müşteri entegrasyonu) diğeri ise 25 çalışma ile incelenen entegrasyonun kolaylaştırıcılarıdır (bilgi, operasyonel, ilişkisel entegrasyon). Hem boyutlar hem de kolaylaştırıcıların genel performansın yanı sıra ayrı ayrı operasyonel ve işletme performansı üzerindeki etkileri değerlendirilmiştir. Jamovi ile elde edilen meta-analiz sonucunda sırasıyla boyutlar ve kolaylaştırıcılar için anlamlı korelasyon katsayıları elde edilmiştir. Korelasyon katsayıları entegrasyon boyutu ve performans arasındaki ilişkinin orta derecede güçlü ve pozitif olduğunu, kolaylaştırıcılar ve performans arasındaki ilişkinin ise güçlü ve pozitif olduğunu göstermiştir. Operasyonel ve ilişkisel entegrasyonun işletme performansı üzerinde önemli bir etkisi bulunmaktadır. Diğer yandan operasyonel performansın hem boyutlardan hem de kolaylaştırıcılardan etkilendiği görülmektedir. Ayrı ayrı olarak boyutların ve kolaylaştırıcıların işletme ve operasyonel performansın yanı sıra genel performans üzerinde de farklı etkileri görülmüştür. Etkileşimleri farklı düzeylerde olsa da tüm düzenleyiciler hem boyutlar ve hem de kolaylaştırıcılar üzerinde önemli bir etki göstermektedirler. Tedarik zinciri yeniliği hariç tüm arabucular için test sonuçları anlamlı değerler vermiştir.

Bu çalışma literatüre birkaç yönden önemli katkılarda bulunmaktadır. İlk olarak, tedarik zinciri entegrasyonunun boyutları ve kolaylaştırıcılarının performansla ilişkisini gösteren kavramsal bir model geliştirilmiştir. Ayrıca tedarik zinciri entegrasyonu için gerekli kritik koşulları anlamak için düzenleyici değişkenlerin etkileri değerlendirilmiştir.

Daha da ileri gidilerek önceki çalışmalardaki tutarsızlıkları anlamak için doğrusal olmayan ilişkilerin doğasını ortaya çıkaracak standard arabulucu analizi yapılmıştır. Tedarik zinciri entegrasyonu faktörlerinin ayrı ayrı hem operasyonel hem de işletme performansı üzerindeki etkileri ve bunun sonuçları bulunarak belirli bir performans çeşidini en iyi tahmin edecek faktörün tespiti konusunda yöneticilere yol göstermesi amaçlanmıştır. Düzenleyici değişkenler aracılığıyla ifade edilen olası durumun ve onların entegrasyon-performans ilişkisi üzerindeki etkilerinin anlaşılması yöneticilerin bunu kendi avantajlarına kullanmalarına yardımcı olacaktır. Düzenleyici ve arabulucu değişkenlerin varlığı entegrasyon ve performans ilişkisinin akademik ve uygulama düzeyinde bu değişkenlerden bağımsız olarak değerlendirilmemesi gerektiği anlamına gelmektedir.

Anahtar Kelimeler: Tedarik Zinciri Entegrasyonu; Düzenleyiciler; Arabulucular; Meta-analiz; Performans

INTRODUCTION

Background of the Study

In an environment with ever changing customers' needs and intensifying global competition, quality processes and supply chain are critical for organisational success. Thus, to satisfy customers, outsmart competition and improve performance, contemporary organisations are trying to improve on their processes through integrated supply chains. Supply chain integration has become popular among supply chains practitioners and supply chain scholars. Supply chain integration (SCI) has received growing attention among scholars and practitioners in recent decades (Stank et al., 2001; Tseng & Liao, 2016; Yuen & Thai, 2016 (Ataseven & Nair, 2017)). It is defined as 'the management of various sets of activities that aims at seamlessly linking relevant business processes within and across firms, and eliminating duplicate or unnecessary parts of the processes for the purpose of building a better functioning supply chain' (Chen et al., 2009) It is one of the most researched topics which spans for over 25 years of research. SCI is field that is still gaining interest by many researchers. For instance, a quick internet search for supply chain integration (SCI) yielded 57000 related articles and reviews for 2019 alone. Though a number of Studies have concluded a positive link between SCI and performance. The impact of SCI on performance is still vague. Moreover, with the dynamic and ever-increasing demand by global customers, while scholars and practitioners fail to agree on the performance outcomes of SCI, one important question is raised. Over two decades of primary research on supply chain integration, researchers are yet to reach conclusive performance outcomes for SCI and theoretical framework. Is supply chain integration really a viable solution for improving performance?

Over 25 years of research on SCI, has seen the adoption and development of many different definitions, theories and concepts by many scholars. A systematic review by Costes et al (2008) pointed out that definitions and measures of both SCI and performance are not only diverse but they make it difficult for a conclusion such as the more SCI the better the performance to reached. Moreover, one cannot easily conclude on what theory or concept SCI hinges upon. Several theories have been adopted by scholars in addressing the relationship between SCI and performance. For instance, the relationship between SCI

and Performance can be approached from different perspectives. Hence, the needed for studies with clear definitions, measures and theoretical basis to aid in providing a good basis for related studies. Identifying and establishing from previous studies which theories are effective in determining the link between SCI and performance will be of great help to both practitioners and researchers. Equally distinguishing between and among the dimensions of SCI would provide a better understanding of the effects of SCI on performance outcomes. For instance, a study by Osei & Kagnicioglu (2018) concluded that supply chain integration has a positive impact on performance. However, it is not clear from their study how supplier and customer integration respectively affect performance. They were simply treated as external integration. Though some studies consider suppliers and customer integration as a single construct, external integration, this may lead to inaccurate conclusions (Flynn et al., 2010). Categorising supply chain integration into internal and external integration lead to impractical implications as it does not reveal whether all the dimensions or part of the dimensions influence performance. Kumar et al., (2017) found empirical evidence which shows that supplier integration has a positive effect on performance, while customer integration revealed a negative one. Though the overall conclusion of the study was that SCI positively affected performance, it still revealed that customer integration has a negative effect. This however, bring us to another question of which dimensions have the most consistent effect on performance. The dimensions that could be used to understand this key relationship.

Integrating supply chain processes across departments and firms is viewed as a means to creating efficiencies, generating value for customers, and gaining a competitive advantage. According to Danese et al., (2013) & Chen et al., (2007) supply chain efficiency could be created by integrating internal organisational processes across departments or functions as well as linking external processes across enterprises. However, the conditions under which SCI effectively contribute to improved performance remains unclear. In literature supply chain integration has been addressed by either what or who is being integrated. What is being integrated is referred to in this study as facilitators of SC while who is being integrated represents the dimensions of SCI. Thus, measures of SCI such as Operational (OpI), Information (InfI), and Relational Integration (RI) are considered as facilitators in this study. On the hand, Internal Integration, Customer Integration, and Suppliers Integration as considered as dimensions.

The distinction between facilitators and dimensions of SCI and how each the impact on performance has not been clearly explained in literature. Could the inconsistencies and lack of consensus be attributed to what or who is being integrated? For instance, Leuschner et al., (2013) conducted a meta review using mainly facilitators and found evidence that SCI has limited impact on financial related performance. On the other hand, Mackelprang et al., (2014) conducted a similar meta review with the same objective using dimensions, yet found evidence that concluded a significant positive impact of SCI on financial performance. This therefore, leads to a significant question of whether the conflicting results in these studies as well as other studies in SCI literature lies in what (Operational, Information, & Relational Integration) and who (II, SI, & CI) is being integrated. Thus, a quest to establish how what is being integrated and who is being integrated becomes essential in determining the effect of SCI on performance outcomes. SCI-performance studies are not only inconsistent on theory and findings. There is equally no consensus on the dimensions of SCI and how they affect performance. However, consistent in SCI-performance association, are the claims that moderators might exist and influence the relation.

Purpose of the Study

Inconsistency of empirical results and practical implications on the impact of Supply Chain Integration (SCI) has compelled researchers to conduct meta analyses on the topic. Unfortunately, available meta reviews provided no consensus on the impact of Supply Chain Integration on performance. This lack of consensus in both primary and earlier meta studies, leaves room for another meta-analysis. This is even more compelling due to the recent increase in the number of primary studies which included both moderators and mediators as previous reviews recommended. For instance, Costes & Jabre (2008) argued that more SCI does not always lead to improved performance. Thus, raising the question of what degree of SCI is necessary for improved performance. Despite two meta analyses by Leuschner et al., (2013) and Mackelprang et al., (2014) conducted with the same objective, they drew contradicting conclusions on the topic. This poses further questions on whether inconsistencies on the impact of SCI and performance could be attributed to varying degrees of SCI, facilitators, dimensions, moderators or mediators. Thus, this research will attempt to address these questions and improve on preceding

reviews by taking into consideration recommendations for better meta analyses highlighted in previous reviews. Leuschner et al., (2013) suggested that when results are contradicting it might be due to organisational factors or timeframe in which the study was conducted. Coupled with these considerations, primary studies from 2010 to 2019 are considered to determine whether new studies provide new insights, consensus and clarity on the topic. Autry et al., (2014) pointed out that a meta-analysis with more and modern empirical studies might provide a better understanding and enrich theory of SCI. This meta-analysis attempts to clarify theory and contribute to the field by adding recent studies with known moderators and mediators. Mackelprang, et al 2014 argued that the inconsistencies in empirical results and unanswered questions for both research and practice could be addressed by further assessing moderating factors. Furthermore, Chang et al., (2015) suggested that the inconsistencies in meta- analyses may be associated with failure to consider mediating and moderating factors. Therefore, identifying and evaluating the effects of relevant moderating and mediating factors are part of the primary the aims of this meta-analysis. Determining the effects of moderators and mediators might improve on the preceding meta studies and the topic as a whole. Therefore, as an attempt to address issues highlighted in previous related work and contribute to the SCI-performance literature, a recent meta research was conducted.

Main Objective

The objective of this study is not only to determine the overall impact of SCI on performance and evaluate moderator variables. It aims at identifying and evaluating effects of key mediating variables between SCI and performance, and establish which dimensions or facilitators of SCI have the most influence on performance which is classified as Operational and Business. It is also in the interest of the study to determine whether facilitators or dimensions of SCI have the most influence on performance. This will provide greater insight on how the two aspects of SCI compare with each other in relation to performance.

Research Questions

The objectives of this study will be addressed by the following corresponding research questions:

i. What kind of relationship exists between aggregate SCI and performance?

ii. To which extent do dimensions of SCI (II, CI, & SI) influence performance?

iii. To which extent do facilitators of SCI (OpI, InfI, & RI) influence performance?

iv. Which key mediators have the most significant impact on the SCI- performance relationship?

v. Which key moderators have the most significant impact on the SCI- performance relationship?

Significance of the study

The study on SCI-performance relationship has many inconsistencies. These inconsistencies range from definitions, measures, facilitators, dimensions, concepts to theories. Clarifying and identifying the reasons for these lies at the heart of this meta evaluation. Attempting to determine and justify which theories are best suited for SCI-performance relationship would contribute to SCI theoretical literature and provide a theoretical basis for further studies. The study will attempt to identify and classify which elements of SCI under facilitators (what is being integrated) and dimensions (who is being integrated) contribute more to performance. Furthermore, the effects of both facilitators and dimensions of SCI on performance were evaluated. This will provide both practitioners and researchers with insight on the distinction and effect of both on either Operational or Business-related performance. Knowledge of which dimensions or facilitators have the most influence on performance will greatly assist decision makers on which key element of integration to take into consideration when implementing SCI. It would also be beneficial in dealing with the inconsistencies that are found in SCI-performance literature. Opposed to the common practice of simply regarding SCI from a single perspective; dimensions or facilitator, the study compares the influence of both individually on performance.

Determining which moderating factors are key and with a significant effect to SCI-performance relationship will reveal under which conditions the impact on the association is strong or weak. This will be an attempt to establish the conditions under which SCI is most effective. Dametew et al., (2016) pointed out that little is known about the contextual conditions under which SCI is effective in supply chain management literature. Thus,

determining the effect of moderating factors between SCI and performance would be an initial step in establishing the condition under which SCI is effective. Moreover, Mackelprang, et al., (2014) argued that the inconsistencies in empirical results and unanswered questions for both research and practice could be addressed by further assessing moderating factors. Therefore, identifying and explaining key moderating factors will not only establish the conditions under which SCI is effective. It would also assist in resolving the inconsistencies and unanswered questions for both researchers and practitioners.

This review will consider primary empirical studies from 2010 to 2019. This period accounts for the most published articles with known mediators and moderator on the SCI-performance relationship. Moreover, it includes studies that might have not been published at the time preceding meta and systematic reviews were done. It is sufficient enough to provide new insights on the advances made on SCI- performance especially after key recommendations from previous meta studies. Many empirical studies were also done around this timeframe. For a primary study to be considered as empirical, it had to meet the criteria for an empirical study justified in the methodology section. This time frame was more precisely selected as more recent empirical studies on SCI and performance with both mediating and moderating factors have been done during this period. Key mediating factors will further explain how SCI and performance are related. In some case attempt to explain why some studies claim no significant relationship between SCI and Financial performance. It will help in addressing the direct and indirect relationships between SCI and performance suggested in primary research.

Limitations and Scope of the Study

The study was limited to a timeframe between 2010 and 2019. This means that studies done in 2020 or before 2010 were not included in the study sample. Furthermore, only English empirical studies were included as sample in this research. A quantitative meta-analysis which requires the use of Pearson correlation coefficients was adopted. Thus, limiting the research to only empirical primary studies with correlation related outputs. Implication of this is that studies which did not include correlations or results which could be converted to correlational equivalent were left out.

Synopsis of the Thesis

The study is divided into four main chapters. Introduction and background section provide a brief overview of the research with the main emphasis on the problem definition, purpose of the study, research objectives, research questions and the significance, scope and limitations of the study. Chapter one provides a detailed discussion on the theoretical and conceptual framework of the study with emphasis on the concept of SCM, SCI and performance. The chapter goes into details to distinguish between facilitators and dimensions of SCI. The association between SCI constructs and performance in relation to theory is discussed.

In short, this chapter provides a detailed literature review leading to hypotheses and research model formulation.

The second chapter provides a detailed methodology and research design adopted for conducting this study. It provides insights into the search for primary studies, the inclusion and exclusion criteria, the coding of studies, the computation and interpretation of effect sizes. The statistical model for analysis of collected data, the correction of statistical artefacts, moderator, and mediator analysis as well as the test for publication bias ae all presented in this section. Chapter three presents the results of the study in which tables and figures were used to effectively communicate the study results. The results were also presented in terms of the research questions and the tested hypothesis. Chapter four as the final chapter provides a summary the whole study, conclusions and implications drawn from the study findings as well as recommendations for future research.

CHAPTER 1: THEORETICAL AND CONCEPTUAL BACKGROUND

1.1. Introduction

A basis for better understanding the background and concepts of supply chain integration (SCI) lies in supply chain management (SCM). Therefore, a short background of SCM was deemed necessary to provide a solid backbone for discussing supply chain integration. Though the concept of SCM is known to have made its earlier appearances in the manufacturing sector in the 1980s, it has gained popularity in almost every sector including the agricultural sector. Despite, SCM being viewed as a single interlinked process which consisted of the flow of goods from the manufacturer to the customer in the late 1980s, the term SCM was not yet adopted around this era. It was not until the mid of 1980 that the term Supply Chain Management (SCM) was used by Keith Oliver, a consultant at Booz and Hamiton. However, the wide adoption or rather the wide use of the term SCM was not until the mid to late 1990s (Pinmanee, 2016). In the late 1990s a number of both articles and books were published on SCM which gave it popularity in Operations Management and Marketing as well as other related fields. SCM has not only grown to influence many areas, it has also been heavily influenced by fields such as Industrial Engineering, procurement, information technology, operations management, logistics, strategic management, systems engineering and marketing. This has made SCM a content free practice where no fixed standards or components are needed to apply SCM. Thus, SCM may mean different things to different people with many different ways of implementation. SCM, is similar to SCI one of its components in terms of complexity especially where implementation and measuring its outcomes are concerned. Nonetheless, unlike SCI, SCM has well defined frameworks upon which it can be based and assessed.

1.2. The Concept and Definitions of Supply Chain Management (SCM)

A summary of a number of important SCM definitions was done to provide a basis for understand SCI. Building upon previous definitions, SCM can be said to be the integration of critical business processes which involves all parties that provide materials, goods, information and services that add value for both stakeholders and customers. Thus, at the heart of SCM is integration, relationships and business processes**.** SCM is a strategic and

systematic integration of business processes which enables the smooth flow of materials, goods, information, and money from suppliers to producers to customers in the value chain with the goal of improving the supply chain and organisational performance as a whole (Mentzer, et al., 2001). Value Chain or network which is simply the sequence involving production and delivery of materials, products or services with the goal of adding value at every level is key to SCM.SCI is an aspect of SCM that facilitates this integration function of supply chain management. A list of summarised SCM definitions below clearly provide the process integrative role of SCM, upon which SCI is built.

1.2.1 Supply Chain Management, Supply Chain Integration, and their Linkage

A list of summarised definitions for Supply Chain Management shows how it is strongly associated with supply chain integration. In fact, SCI could be thought of as a subset of Supply Chain Management. SCI is a more focussed integrative field of SCM.

Table 1: SCM Summarised Definitions and Aspects

Source	SCM Definition	SCM Aspect
Ellram & Cooper (1990)	SCM is an integrative philosophy applied to manage the entire flow of a distribution channel from supplier to ultimate customer.	**Integration of Flows**
Stank et al. (2001)	SCM is generally considered to involve integration, coordination, and collaboration within and across firms belonging to the entire supply chain.	
Wasim Syed et al., (2019)	Supply chain deals with total flow of materials from suppliers to end users as a collaborative and cohesive process. SCM is the management of the flows of products and services which includes all critical processes that convert raw materials into final goods.	
Pinmanee (2016)	SCM is the management of a network of all business processes and activities involving procurement of raw materials, manufacturing and distribution management of Finished Goods. It is the management of material and information flow in the supply chain with the aim of providing a high degree of customer satisfaction.	
Kwamega et al. (2018)	SCM is the management of the flows of products and services which includes all critical processes that convert raw materials into final goods	

Cooper et al. (1997)	SCM is simply the integration of all key business processes involved in the supply or value chain network.	
Lambert et al. (1998)	SCM is the integration of critical and relevant business processes, from key suppliers to end users.	**Process Integration**
Wisner et al. (2005)	supply chain management is the integration of business processes from end user through original supplies that provides products, services and information that add value to customers.	
Sandhu et al. (2013)	SCM is an integrative process of supply chain entities such as suppliers, manufacturers, warehouses, retailers and customers.	
Rouse (2019)	Supply Chain encompasses the integrated planning and execution of processes required to optimize the flow of materials, information and capital in functions that broadly include demand planning, sourcing, manufacturing, management and logistics or transportation.	
Winterstein et al., (2019)	SCM is the integrated process-oriented planning and control of the flow of goods, information and money across the entire value and supply chain from the customer to the raw material supplier.	
CSCMP (2019)	SCM ensures the synchronisation and alignment of supply and demand management within and across organisations.	
Basnet et al. (2003)	Supply chain management involves the close collaboration of all the value-generating elements in supply, manufacturing, and distribution processes. Thus, it is the integration of supply and demand which involves close collaboration with internal and external vendors.	
Elmuti (2002)	SCM is the coordination and collaboration of the entire chain of activities and processes performed by chain members, in order to develop and ensure efficient, effective and cohesive process.	**Integratin of supply & demand**
Naslund & Hulthen (2012)	SCM enables total cooperation of all process or activities (sourcing, manufacturing, warehousing, distribution, and delivering to final customers) and supply chain members involved in the entire supply chain.	
Mentzer et al. (2001)	Supply chain management implies coordination of the traditional business functions and activities or processes within and across all business functions involved in the supply chain.	

Hunt & Davis (2012)	SCM are approaches used in managing integration as well as coordination of supply, demand and relationships in order to effectively satisfy customers and profitably achieve organisational goals.	**Cooperation& coordination**
Attaran & Attaran (2007)	SCM manages the interface relationships among key stakeholders and enterprise functions that occur in the process of maximization of value creation.	
Barney (2012)	SCM is the management of relationships within a firm and between interdependent organisations.	**Stakeholder relationships**
CSCMP (2018)	Supply chain management encompasses the planning and management of all activities involved in sourcing, procuring, conversion, and management of logistics. It also includes coordination and collaboration with supply chain members, which may include supplier, intermediaries, third-party service providers, or simply customers.	
Croxton et al. (2001)	SCM encompasses the planning and management of all activities involved in conversion, sourcing and procurement.	
Ling & Tan (2012)	SCM is a philosophy whose goal is forming an integrated network of upstream linkages (sources of supply), internal linkages inside the organization and downstream linkages (distribution and ultimate customer) to perform critical processes that ultimately create and optimise customer value.	
Pualraj & Chen (2007)	SCM is a management approach that focuses on establishing internal and external links for enabling effective and timely communication channels for cost-effective outsourcing of services.	**Internal & external integration**
Lummus et al. (2001)	SCM involves all activities from handling raw material, through sales and delivery to the customer in the provision and utilisation of information systems necessary for monitoring and performing all relevant chain activities effectively and efficiently.	
Ibrahim et al. (2012)	SCM entails practices that comprise of partnership with the supplier, process of outsourcing, crashing of cycle time, continuous process flow and sharing information and technology.	

Table 1 shows that SCM involves integration, coordination and collaboration of business processes, relationships, and resources. Thus, it is worth pointing out from these definitions that SCI is an essential part for effectively implementing SCM. A summary

review of SCM not only reveals that integration is at the centre of SCM and its related strategies. It also provides insight into the coordination, collaborative, relational, resource sharing and process synchronisation aspects of Supply Chain Integration. The term integration identified in SCM can simply be said to be coordination, collaboration, synchronisation, and alignment of business processes and resources with key partners. Integration also entails relationship building. Though more focused than SCM, SCI is and has always been an integral aspect of SCM. In fact, SC or supply network in and of itself implies integration. Most of the summarised SCM definitions put emphasis on integration of number factors of supply chain (SC) such as: information, business processes, both external and internal stakeholders, technology, supply and demand management. This entails that SCM involves the management of a chain or network of relationships with key stakeholders, which implies synchronisation, co-operation, coordination, collaboration and effective sharing and flow of resources. SCM are approaches applied in managing integration and coordination of supply, demand and relationships in order to effectively satisfy customers and profitably achieve organisational goals.

1.2.2. SCM related Frameworks and their Contributions to SCM and SCI

There are four main SCM based frameworks, which were developed in order to standardise the approach to SCM and related concepts as well as make the access to information and tools easier for all SC members. These frameworks are key to the understanding of SCM and SCI Thus, the Supply Chain Operations Reference (SCOR) model; the Global Supply Chain Forum (GSCF) framework; the Collaborative Planning, Forecasting, and Replenishment (CPER) and the Chartered Institute of Purchasing and Supply (CIPS) as the four main SCM frameworks, were primarily developed for understanding and implementing SCM successfully. It is for this same reason that these frameworks or models are reviewed and summarised with the purpose of gaining an even deeper understanding of SCM and SCI.

1.2.2.1.Supply Chain Operations Reference Model

SCOR which was developed around 1996, seeks to provide a standardised approach to SCM and related concepts. SCOR was developed via a rigorous consultancy work by both Manufacturing/Operations and Supply chain practitioners. It was later endorsed by the then Supply Chain Council (SCC) later. Though it has gone through a number of

revisions with the 11th and latest revision being in 2015, its primary focus has remained the same. The latest version of SCOR identifies five core supply chain performance attributes such as: reliability, responsiveness, agility, costs, and asset management. This provides a basis for analysing supply chain and business process related performance. SCOR describes business processes and activities that are associated with satisfying customer demands, which may include planning, sourcing, making, delivering, returning and enabling as shown in figure 1. This helps supply chain practitioners and researchers in addressing, improving, and communicating SCM practices between and among all stakeholders. By indicating the processes with which sourcing, production, and delivery are associated, the SCOR model provides a unique platform upon which organisations' both internal and external operation/activities could be synchronised, improved and effectively implemented to enhance supply chain performance (SCP) and other types of performance. Lambert et al., (2005) pointed out that the SCOR model proposes a unique planning process which is essential for developing and implementing an action plan that best meets the organisation's requirements, while simultaneously addressing specific aspects of sourcing, manufacturing, and delivery processes.

SCOR model also provides a distinguished and significant framework that links supply chain performance metrics, business processes, SCM best practices, and people into a single joint structure (Kocaoğlu, Gülsün, & Tanyaş, 2013). Thus, promoting effective communication between supply chain partners, enhances the effectiveness of SCM, technology utilisation and sharing, as well as improvement of related supply chain activities. In other words, the SCOR model seeks to improve supply chain operations and performance by integrating well-known concepts, such as business process benchmarking (BPB), business process reengineering (BPR), and process measurement, into a unified cross-functional framework. Thus, through the SCOR integration of SC is proposed.

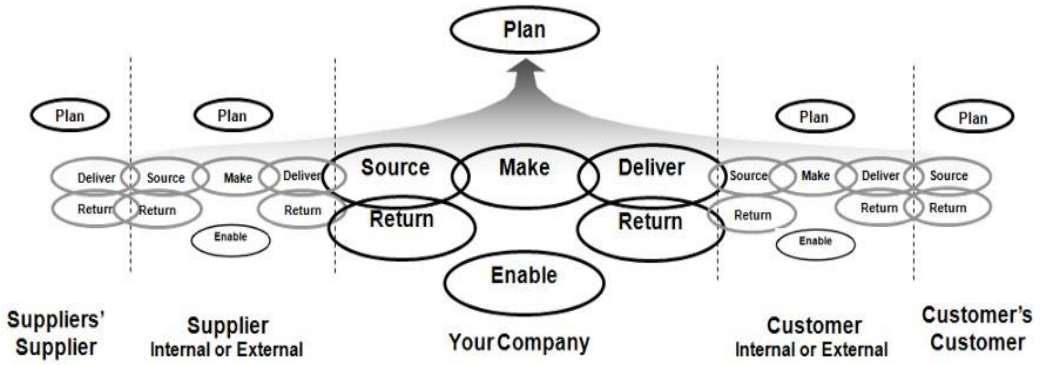

Figure 1: The SCOR Model

Source*:* Pinmanee, S. (2016). *Logistics Integration for Improving Distribution Performance: in the Context of Thai Egg Industry.* Melbourne, Australia: Victoria University.

1.2.2.2. Global Supply Chain Forum

The global supply chain forum (GSCF) framework suggests eight key processes that provide the foundation for SCM (Lambert et al. 1998). Simply put, the GSCF framework views organisations and SCM as eight distinct yet related processes. These processes include customer relationship management, customer service management, demand management, order fulfilment, manufacturing flow management, supplier relationship management, product development and commercialisation, and return management as shown in figure 2. The processes included in GSCF model represents the functions of marketing, research and development, finance, production, purchasing, and logistics which represents the entire supply chain. This further provides insight into the integrative nature of SCM which involves the integration of various business functions. The breakdown of these related functions into a series of strategic sub-processes, provides the blueprint for the implementation of SCM and SCI. Organisations are not obliged however, to implement all the eight processes as the relevance of each process is subject to organisational goals and needs. For instance, some organisations might need to consider only one key process, while others might consider multiple processes or functions in their implementation of SCM or SCI. Nevertheless, it is of paramount importance to identify and critically analyse all the key processes, so as to successfully integrate and manage the value chain (Cooper et al. 1997). Furthermore, Lambert et al. (1998) pointed out under this model that coordinating activities or process within the firm is also an essential prerequisite for successful SCM. Therefore, coordination which one of the components of SCI is equally an important requirement under the GSCF model. In

short, this model views SCM in terms of process management with the main focus on coordination. A key component of SCI.

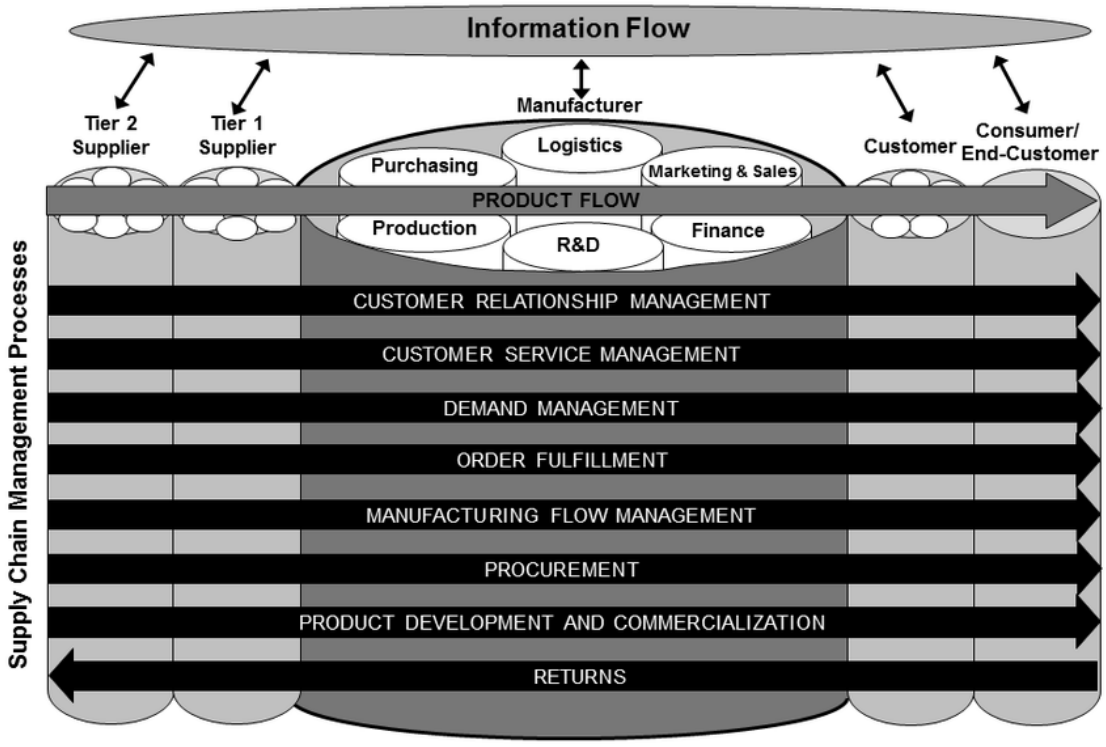

Figure 2: The Global Supply Chain Forum Model

Source*:* Pinmanee, S. (2016). *Logistics Integration for Improving Distribution Performance: in the Context of Thai Egg Industry.* Melbourne, Australia: Victoria University.

1.2.2.3. The Collaborative Planning, Forecasting, and Replenishment Model

The collaborative planning, forecasting, and replenishment (CPFR) model was developed for the purpose of providing a comprehension systematic approach for improving supply chain collaborations. The model helps in understanding the collaborative aspect of SCI similar to the GSCF model which provide insight into the coordination aspect of both SCM and SCI. Particularly CPER assists firms with collaboration of various process/activities among supply chain trading partners, such as production and purchase planning, demand forecasting, and inventory replenishment (Attaran & Attaran 2007). The main purpose of CPFR is facilitation of the exchange of operational information through a shared web server, so as to provide a more reliable and long-term view of demand within the supply chain (Fliedner, 2003). Integrating or collaborating activities of multiple parties in the planning and fulfilment of customer demand throughout the SC, may enable inventories to moved more efficiently in correct quantities to specific

inventory location to meet customer demands. CPER model provides insights and guidelines for clear language, synchronised processes and metrics to help trading partners achieve specified business goals.

This framework benefits all the users, due to its enhanced visibility of all relevant components and processes in the SC, as well as achievements such as; inventory reductions, improved customer service and sales increments by both retailers and manufacturers (Lambert et al. 2005; Croxton et al. 2001). It is worth stating that CPFR is categorised into four main stages, as illustrated in Figure 3 below. The first step is strategy and planning, which basically involves collaborative agreements and the development of a joint business plan between suppliers and customers. The second step is demand and supply management which involves forecasting of demand and supply which also includes the generation of sales and order forecasts. The third stage is mainly focused on the execution and implementation process, where orders are actually generated, products are shipped and delivered, received and stocked on retail. In simple terms this stage involves order fulfilment and generation. The fourth and final stage is analysis which involves trading partners coming together with organisations to share insights and adjust strategies in order to improve planning, execution and performance. At the centre of CPER are consumers or customer which indicates the significance of customers in SCM and SCI. It further illustrates how collaboration is or at least should be done with; manufacturers, retailers, and customers to produce and delivery product or services of high customer value. Thus, a careful evaluation of the CPER framework provides tremendous insights in the collaborative and cooperative aspect of SCI. It clearly suggests collaborative or integrative relations among manufacturers, customers and retailers. In short it points out a collaborative relation among the dimensions of SCI (suppliers, internal & customers integration).

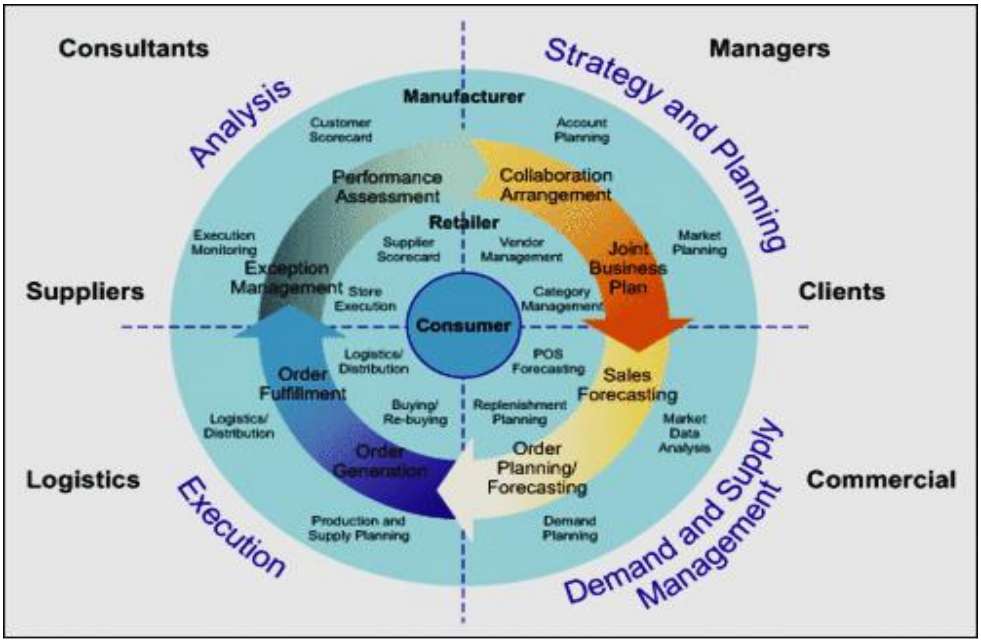

Figure 3: The Collaborative Planning, Forecasting, and Replenishment (CPFR) Model

Source*:* Pinmanee, S. (2016). *Logistics Integration for Improving Distribution Performance: in the Context of Thai Egg Industry.* Melbourne, Australia: Victoria University.

1.2.2.4.Chartered Institute of Purchasing & Supply Framework

Supply chain management is thought of as the continuous management of all processes or activities aimed at satisfying the customer or end user along the supply network. It covers almost all activity within and out of the organisation which are value adding to all stakeholders. The CIPS views SCM as the continuous management and improvement process. This is evident in the way it defines supply chain management. SCM is the continuous planning, developing, controlling, informing and monitoring of actions within and among SC partner, in order to develop an integrated supply chain processes that effectively and efficiently meet overall strategic goals (CIPS, 2017) Moreover, figure 4 below indicates a continuous process from ordering to consumption and returns. Thus, in Figure 4 the process of SCM includes issues that pertain to strategic (i.e. optimising the network of product distribution and collaboration with partners), as well as both operational and tactical issues (i.e. demand forecasting, order promising, materials sourcing, production, distribution planning, scheduling and inventory control) (Eriksson et al. 2006). Effective SCM seeks to increase transparency and synchronisation of the supply chain's coordination and configuration, regardless of functional or corporate boundaries through continuous business process improvement and management.

Under CIPS, SCM is based on the principle that suggests incorporation of a number of critical success factors which include a clear procurement strategy, effective control systems, as well as the development of expertise. CIPS also attempts to draw a distinction between supply and procurement which could be considered as a business management function that ensures identification, sourcing, accessing and management of external resources that are necessary for the fulfilment of organisational strategic objectives. SCM therefore, represents a holistic approach to organisational operations. In short, according to CIPS supply chain management relates to the entire procurement cycle which has a vital role to play in the development of an organisation's sourcing strategy. On the other hand, supply involves relationship building with key SC members. Similar to SCOR, CPER, GCSF, the CIPS suggests synchronisation of resources and key business processes to effectively meet operational, tactical, and strategic goals. The only difference is that production is viewed as a flow under the CIPS framework which is opposed to the transformation or conversion perspective held by many traditional views and other frameworks. Thus, CIPS would best suited to the understanding SCI in terms of facilitators.

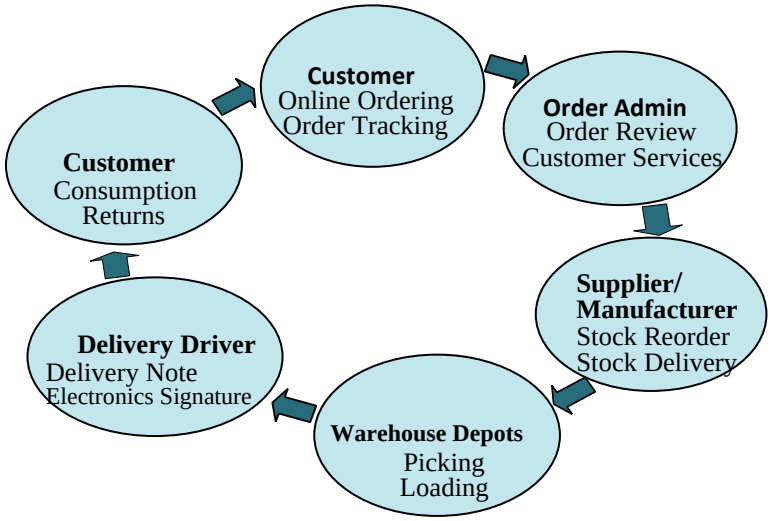

Figure 4: The Chartered Institute of Purchasing & Supply (CIPS)

Source*:* Pinmanee, S. (2016). *Logistics Integration for Improving Distribution Performance: in the Context of Thai Egg Industry.* Melbourne, Australia: Victoria University.

Though there are many studies just as they are a number of definitions for SCM, unlike SCI where there is still lack of consistency and standard frameworks, SCM has standard sets frameworks. The above discussed, four SCM frameworks which were developed to

standardise the approach to SCM and make access to SCM related tools and information easier for all SC practitioners and researchers, are clearly outlined in literature. SCOR, GSCF, CPFR, and CIPS provide an important basis for developing and understanding the concept of supply chain management. Therefore, based on a summary of SCM definitions and the above four frameworks, SCM can be thought of as holistic management of a value network of business processes and activities involving procurement, manufacturing/production and distribution management of goods and services. It is the management of processes, material and information flow in the value network with the aim of providing a high degree of customer satisfaction. From both the definitions and frameworks of SCM, supply chain integration is a critical aspect of SCM which allows for the effective and successful implementation of SCM strategies. SCM is a strategic and systematic integration of business processes within and across organisations which enables the flow of materials, goods, information, and money from suppliers to producers to customers within and along the value chain with the goal of improving supply chain and organisational performance as a whole.

1.3. The Concept of Supply Chain Integration

SCI, though a content free practice with several definitions and no predefined framework, its concepts of connectivity and simplification are indisputably accepted among several researchers. Despite different understanding on what constitutes SCI and how to implement or approach it, supply chain integration revolves around connectivity and simplification. According to Vickery and Dröge, (2010), connectivity could be observed in SCI's aspect of synchronising operations and processes both internally and externally between functional departments, as well as among organisations. It is worth mentioning that connectivity could be attained and maintained through various integrative mechanisms such as sychronisation, cooperation, coordination, and collaboration. Simplification on the other hand, involves identification and elimination of non-valuing adding processes or activities within the supply chain. According to Chen et al., (2009) and Bowersox et al., (2013) SCI could help develop simplification by establishing common operational policies and practices, as well as through synchronised operations and standardisation of key processes. Connectivity is necessary for simplification as partnerships with SC members must be established for synchronised chain operations to

exist. Standardised processes are as a result of cooperation. Connectivity is equally enhanced by simplification. Thus, simplification and connectivity could be thought of as two sides of the same coin. They dependent on each other and their association is a direct one.

1.3.1. Defining Supply Chain Integration

Supply chain integration (SCI) has many definitions which makes it difficult for one to easily adopt a working definition. Supply chain integration can be viewed from many different perspectives, especially those of technology, information technology, business process, logistics and collaboration (Bennett & Klug, 2012). SCI has been viewed widely as either the coordination or co-operation between and among various functions in the entire supply chain. However, SCI goes beyond cooperation and collaboration of functions in the supply chain. Though the term integration may denote cooperation or collaboration, SCI is not only restricted to these terms. Supply chain collaboration may be considered as a relationship among supply chain partners developed over a certain period of time. As pointed out by Stank et al (2001) and Frohlich et al (2001), collaboration begins with customers and extends back through the firms. Thus, supply chain collaboration can be said to be a relationship which develops overtime and exists between organisations and supply chain partners. Integration also involves coordination of the forward physical flows and the backward coordination of information technology. Both collaboration and coordination are key components of SCI. Therefore, studies that focused on the effect of either Supply chain collaboration or coordination are considered as part of SCI in this research.

One of the most comprehensive SCI definitions was by Flynn et al (2010), who considered SCI as the extent to which organisations strategically collaborate with their chain partners and manage intra and inter-organisational processes in order to achieve efficient and effective flows of products, services, information, money and decisions. Though many studies defined SCI differently, it is inarguable that it is strategic move to combine, align, coordinate and collaborate with key supply chain partners as well as resources. For instance, a review of SCI definitions found in studies by (Costes & Jabre , 2008; Flynn et al, 2010; Huo et al, 2012; Mackelprang,et al., 2014; Leuschner et al., 2013; Alfalla- Luque et al.,2013) clearly reveals that Integration or SCI is simply

characterised by coordination, collaboration, information and technology sharing, trust, partnerships, and the management of integrated chains of processes as opposed to single organisational processes. Pinmanee (2016) pointed out that SCI is a strategy that comprise of a sum of both necessary material and product flows within the supply chain, beginning with suppliers, and ending with delivery to the final consumers through a wide network of different organisational bodies, as well as external and internal processes. Therefore, any conclusive definition of SCI must at least include; the degree of strategic collaboration or coordination with supply chain partners, alignment and management of inter and intra-organisational processes, and sharing of information and facilitation of physical flows. Such a definition would be consistent with the SCOR, GSCF, CPER, and CIPS which at least reveals an aspect of SCI. Without these key elements any definition of SCI is insufficient.

It is the goal of any effective SCI to provide maximum customer value at low cost with high speed. (Flynn et al ,2010). SCI seeks to accomplish this goal by building strong and effective relationships with its supply chain partners. According (Rosenzweig, 2009) SCI assists organisations in improving partner-related routines and processes via both coordination and collaboration, which in turn helps firms to respond timely to technological and market changes. Deriving from (Flynn et al, 2010; Liu et al., 2013), SCI is defined in this study as the extent to which organisations can strategically work with their supply chain partners and cooperatively manage intra and inter-organisational business processes to attain effective and efficient flows of products or services, information, money, and decisions in order to provide maximum customer value and attain organisational goals. This definition involves SCI at the tactical, strategic, and operational level, as the goal of this study is to consider SCI at all three levels. Thus, SCI definition can simply be summarised as the degree to which strategic processes within an organisation and those of its suppliers, customers and other supply chain members are effectively and efficiently integrated. Simply put SCI can be said to be a mechanism which seeks to support and improve business processes across the value chain or supply network through synchronisation.

1.3.2. Dimensions of Supply Chain Integration

SCI which is the degree to which the strategic processes and operations within an organisation and those of its suppliers, customers and other supply chain members are effectively and efficiently integrated can be classified under three dimensions. These dimensions according to (Mackelprang et al., 2014; Flynn et al., 2010, Khalid et al., 2017) include: Internal, Customers, and Suppliers integration. SCI aligns organisations with their customers, suppliers and other channel members by integrating their relationships, operations, functions, processes and locations. It is worth mentioning however, that SCI also includes two stages: Internal Integration (II) between functions and External Integration (EI) with trading partners. Several studies have even attempted to assess the effect of SCI on performance using these two stages (Osei & Kagniciogu, 2018). Similar to those who considered the SCI-performance relationship using dimensions of SCI, inconsistencies still exist with II and EI. II attempts to establish close relations among functions such as distribution and inventory or purchasing and raw material management (Zhao L , Huo, Sun, & Xiande, 2013). On the other hand, EI has two directions: forward integration for physical flow of resources among, manufacturers, suppliers and customers and backward coordination of information technology systems and the flow of data from customers, to manufacturers, to suppliers (Frohlich & Westbrook,2001).

1.3.2.1. Internal Integration

Identifying and understanding the SCI dimensions is essential and fundamental for understanding the SCI-performance association. Internal integration (II), for which many studies have argued to be the basis for SCI (Flynn et al., 2010; Wong et al., 2011; Osei & Kagniciogu, 2018) is the synchronising and cooperative responsibility across functions bordering on product design, procurement, manufacturing, sales and distribution to efficiently meet customer needs. II is a precondition to external integration which is usually broken down into supplier and customer integration. For instance, Errassafi et al., (2019) found evidence of mediating effects of II on EI- performance association. Internal integration provides easy access to operational information from the joint databases and decision support systems. It facilitates the linking of integrated processes and information systems to internal departments in an organization. (Phan et al., 2019; Shahbaz et al., 2019; Delic et al., 2019) Thus, providing key departments access to inventory information

throughout the supply chain. Retrieving real time inventory information by utilising integrated computer-based planning systems allows departments such as Productions/Operations and marketing to quickly respond and meet customer demands on time. II, according to (Kwak et al., 2018; Vickery et al., 2003) includes best practices such as cross-functional teams and improved communication practices which break down functional barriers and facilitate sharing of real time information across key functions. When employees effectively communicate and work together, they can easily adapt their team culture and best practices to external supply chain partners. Successful II may provide a platform for external information sources to reach appropriate personnel within the organisations. When different functions within the organisation operate in harmony, organisational performance in terms of quality, costs and flexibility can be enhanced. Effective II may through better coordination of production processes and improved product or process design and product quality, allow for improved production flexibility and delivery in organisations (Wong et al., 2011; Liu et al., 2015). II can thus be thought of as a strategy for enhancing organisational agility by breaking down barriers across functional teams and departments. The main goal of II is to ensure an efficient and effective flows of information, services, products, decisions, and money, as well as providing optimum customer value through high speed and low cost.

1.3.2.2. Customer Integration

Customer Integration (CI) is one of the dimensions of SCI which is usually classified as external integration together with supplier integration. Customer integration is simply the degree to which organisations collaborate with their customers to improve visibility and enable joint planning (Flynn et al., 2010; Wong et al., 2011; Setyadia, 2019). CI is one of the best strategies for obtaining the voice of customers (Huang & Huang, 2018). VOC is critical to any organisation whose goal is providing maximum customer value. Customer integration may help organisations to understand the requirements of customers and work with customers in information exchange and joint product or service design. However, Koufteros et al. (2014) argued that without internal integration, it is difficult for firms to collaborate with customers and meet their requirements in an ever-changing business environment. It reveals what customers really need and helps manufacturers in designing and producing goods according to real time customer needs and specifications. Customer

Integration provides manufacturers with a better understanding of market expectations and the opportunities which helps them in being more sensitive to customer needs and requirement (Swink et al., 2007). Effective CI may provide firms with insights on how to improve on the II. Another significant perspective of customer integration is the development of partnership relationships with customers (Power, 2005) which results in the promotion of cooperation and openness of communication (Danese & Romano, 2011). Thus, CI is the degree to which organisations can partner with their key customers to structure their inter-organizational strategies, practices, procedures and behaviors into collaborative, synchronized and manageable processes with aim of meeting real time customer requirements (Chen et al., 2009; Flynn et al., 2010; Zhao et al., 2011). The goal is to involve customers so as to gain a better understanding of customer needs and expectations.

1.3.2.3. Supplier Integration

Supplier integration (SI) refers to the degree to which organisations collaborate with their suppliers to structure their inter-organizational practices, procedures, strategies and behaviours into synchronized and manageable process in order to fulfil customer's requirements at lowest cost (Flynn et al., 2010; Zhao et al. 2008; Chang et al., 2015). Goffnett & Goswami (2016) pointed out that Supplier integration is a useful way to obtain external resources from suppliers and customers. SI just like integration may reduce uncertainty in the supply chain as well as increase demand control in operations. Song et al., (2017), supplier integration may provide fundamental competencies such as product development with specific attributes that meet both customer requirements and organisational goals. SI involves the collaboration organisation's processes/activities and information sharing with key suppliers in the supply chain. Supplier integration also involves integrating and coordinating the forward physical flow of goods among supply chain partners. (Devaraj et al. ,2007) The ultimate goal of SI which is achieving the optimal coordination of demand and supply is attainable through internal integration. Thus, similarly to (Yu ,2013), Errassafi et al., (2019) suggesting that II is a prerequisite for effective development and implementation of SI as well as CI. Similar to CI, supplier integration is largely attained via synchronisation of data flow and coordination of information technologies. Chienwattanasook & Jermsittiparsert (2018) further suggested

that suppliers' integration requires direct participation of suppliers in terms of decision making and providing information. This participation is anchored on the nature of relationship between suppliers and organisations, which can either be relational or contractual. As Afshan & Motwani (2018), pointed the nature of the cooperation with suppliers can be either relational or contractual. It is worth mentioning however, that SI is characterised by the buyer and upstream supplier having a cooperative relationship. These relations allow for quick ordering systems and lean production. Similar to Koç et al (2018), sharing production schedules between the organisation and its key suppliers allows for consistent procurement and production. Therefore, by sharing information and developing integrated inventory systems throughout the supply chain may improve customer service and allow for quick response to dynamic markets.

1.3.3. Unidimensional and Multi-Dimensional Approach to SCI

Supply chain integration has been treated as both a single and multi-dimensional construct. For instance, (Huang & Huang, 2018; Michalski et al., 2018) considered SCI as a multi-dimensional concept while mostly categorising it into customer, internal, and supplier integration. Other authors have simply classified SCI as the external and internal integration (e.g. Osei & Kagniciogu, 2018). However, classifying SCI in terms of external and internal integration similar to unidimensional perspective makes it difficult to clearly understand how SCI influences performance. Nevertheless, whether a unidimensional or multi-dimensional approach to SCI, the connectivity and simplification aspects of SCI can be observed in different studies. Thus, different dimensional approaches to SCI strengthen the concept of SCI. Despite each dimensional approach strengthening the SCI concepts and revealing different aspects of SCI, they complicate the assessment of the SCI- performance relationship. According to (Chaudhuri et al., 2018; Huo et al., 2019) there is a great deal of overlap among the dimensions or elements of SCI. It was because of this overlap that SCI constructs were grouped into dimensions and facilitators in this study. However, using the SCOR, GSCF, CPER, and CIPS frameworks and the definitions of SCI, the diverse dimensions of SCI could be reduced into three main dimensions and facilitators. The reduced dimensions include II, CI, and SI, while facilitators include informational, relational, and operational integration. Whether as II,

SI and CI or operational, relational, or informational integration, these SCI constructs can either be classified as EI or II.

1.3.4. Facilitators of Supply Chain Integration

SCI, though commonly categorised into internal and external integration, with many studies considering it in terms of three main dimensions (II, CI & SI), it can also be discussed and assessed from the perspective of facilitators. This might perhaps reduce the complexity in determining what to integrate. Many studies that have attempted to assess the relationship between SCI and performance, have either considered facilitators of SCI as dimensions or vice versa. Costes (2008) divided the review of SCI into three categories; facilitators, scopes and degrees (dimensions) of integration. This was one of the earlier reviews that pointed out the distinction between facilitators and dimensions of SCI. Though not clearly discussed as the study's objectives did not include making a distinction between the two aspects of SCI. Autry et al., (2014) in attempting to explain the conflicting meta results by Leuschner et al., (2013) and Mackelprang et al., (2014), pointed out the distinction between dimensions and facilitators of SCI. Many studies however, discussed SCI in terms of Internal, Suppliers, and Customers. Though a distinction exists between facilitators (what is being integrated) and dimensions (who is being integrated) most studies do not draw attention to the distinction between what is being integrated and who is being integrated.

In attempting to examine and understand the lack of consensus in primary empirical studies, this meta evaluation classifies SCI into both dimensions and facilitators. Alfalla-Luque et al (2013), Costes & Jahre (2008) and Leuschner et al., (2013) provide a basis for understanding the facilitators of SCI. For instance, Costes & Jahre (2008), established four intertwined facilitators of integration which includes: Integration of flows (physical, information, financial, and resources); Integration of processes and activities; Integration of technologies and systems; and integration of actors (structure and organisations). Thus, based on his review facilitators of integration can be interwoven into four main categories.

However, based on Alfalla- Luque et al (2012) and Leuschner et al., (2013) these facilitators of supply integration could be summarised into three levels; Informational integration, Coordination and resource sharing, and Organisational relationship linkage. Hence, this study chose to take approach a similar approach to Leuschner et al., (2013),

Allafa- Luque et al., (2013), and Khalid et al., (2017) of categorising SCI into three main elements or facilitators. Drawing upon the studies by costes (2006), Leuschner et al., (2013) and Allafa- Luque et al (2013), three main facilitators or levels of integration are identified. These three elements or facilitators; Informational integration, operational integration, and relational integration are used to determine how the facilitators of SCI influences performance.

1.3.4.1.Information Integration

According to Leuschner et al (2013) and Alfalla-Luque et al., (2015) SCI can occur at the informational, relational, and operational. Information integration (InfI) refers to the sharing of strategic information and information technology systems among supply chain partners, such as demand, for the purpose of forecasting and planning. Leuschner et al (2013) defined information integration as the coordination of information transfer, collaborative communication and supporting technology among business in the value chain. According to Som et al., (2019) information integration, through information sharing among supply chain partners could help to facilitate the coordination of supply chain activities, which consequently leads to, improved SCP. Thus, this meta study argues that organisations are likely to perform better when there is effective information sharing among supply chain partners. Information is not only critical for integrated supply chains and performance it is also one of the main facilitators SCI. It is one of main necessary organisational capabilities and competence needed for gaining a competitive advantage. Furthermore, Alfalla-Luque et al., (2015) pointed that organisations' information systems capabilities have a significant impact on organisation' performance. Thus, it can be claimed that information systems capabilities or integrated information influence supply chain performance as well individual organisational performance.

Information integration may provide supply chain partners with the capability to access shared information on a timely basis which is vital for improving supply chain or operations performance. For instance, Yawar & Seuring (2015) found that supply chain integration through information systems and integration significantly influence supply chain performance. Information integration also involves collaboration of systems needed to ensure the compatibility of intra- and inter-organisational value chain communications and technologies. Thus, information integration an important element of SCI which

facilitates effective and efficient communication and information sharing within the value chain.

1.3.4.2. Operational Integration

Operational integration (OpI) involves synchronisation or linking of business processes/activities and coordinated decision making through integrated decision support systems which enable firms in a supply chain to operate as one with minimum operational barriers. Leuschner et al (2013) defined operational integration as joint activities, business processes, and decisions that are collectively performed by either group of internal departments or organisations in the value chain well managed and integrated business processes or chain operations could provide a number of organisational capabilities which could become key strategic resources. Thus, consistent with resource related theories, properly managed organisational operations may constitute a valuable resource that might contribute to the overall organisational performance. Beheshti et al., (2014) and Wiengarten et al., (2015) noted that operational integration of suppliers and customers have a positive impact on organisational performance. Operational integration is a key facilitator of SCI which could be perceived as both a strategic valuable resource and capability. It facilitates the smooth movement of inventory across the supply chain, which reduces the bullwhip effect as well as shortens lead time. Liu et al. (2013) examined the effect of two SCI facilitators; operational coordination and information sharing, and concluded that operational coordination has a positive association with business performance. Furthermore, Leuschner et al., (2013) noted that operational integration promotes resources, knowledge, and risk sharing across the value chain which in turn improves supply chain performance. Operational integration or coordination reduces the time needed to design new business processes, products or services as well the time needed to deliver the goods to end users. (Sanders, 2008) argued that operational integration facilitates the design and production, as well as the quick and reliable delivery of products/services to the customers or end users. Therefore, operational integration allows firms to make collective decisions on how to adjust business processes and tasks across organisational boundaries to improve performance. Studies have shown that operational integration has a significant positive effect on both operational and business performance.

1.3.4.3. Relational Integration

Relational integration (RI) not only facilitates the relationship between an organisation and its related stakeholders in the value chain, it enhances the implementation of both informational and operational integration. RI can be considered as both a strategic tool and strategic resource with its core activities. Authors like Adams et al., (2014) who considered RI as a resource, found relational integration as a strategic resource had a significant impact on organisational performance. Chang et al (2016) further found evidence that strategic relational integration positively influence performance. Relational integration is the adoption of a strategic association among organisations in the supply chain characterized by trust, commitment and long-term orientation (Leuschner et al., ,2013). It may allow organisations to associate and work with their customers and suppliers and as well as their employees. Supply chain partnerships could provide quality information which may in turn lead to improvement in performance. Yu & Huo (2019) studied the impact of relational capital on supplier quality integration and operational performance. The study revealed that relational capital has a positive effect on operational performance. The authors attributed this outcome to the information quality that accrues from the relationship with customers. Additionally, the authors found that information quality was associated with cost efficiency. Leuschner et al (2013) and Jermsittiparsert et al (2019) also indicated that there is a significant positive correlation between SCI and performance.

1.3.5. Types of Supply Chain Integration

A brief discussion of the types of supply chain integration provides a deeper understanding on the dimensions and facilitators of SCI. Particularly the types of SCI provide insight on the flows, coordination, and relations among partners.

1.3.5.1.Vertical and Horizontal Integration

Vertical integration is the degree to which an organisation owns or controls the chain of processes. Perez-Lara et al., (2018) It involves the coordination of processes or activities among businesses that exist at different stages of the supply chain. Customer integration and supplier integration are some of the typical examples of vertical integration. On the contrary, horizontal integration is the coordination which happens between or amongst

businesses situated at the same level of the supply chain. The main purpose of horizontal integration is to identify key organisational and managerial competencies and synergies which could enhance inter-functional and inter- organizational coordination.

1.3.5.2.Forward and Backward Integration

Forward and backward integration usually occurs at the tactical level of the supply network. According to Adeleke et al., (2019) Forward integration which involves synchronising the forward physical flow of deliveries between suppliers, manufacturers, and customers, could be associated to just in time (JIT) production systems. SCI through forward integration ensures that agility in the supply chain network is enhanced. Agility in delivery or logistics plays a significant role in terms of avoiding product postponement and ensuring a quick response to customer orders. Backward integration on the other hand, involves the backward synchronisation of information technology systems and the flow of information from customers to suppliers. These information technology systems assist independent organisations to acquire relevant information needed to integrate their activities or processes in a supply network in order to enhance performance. Thus, through both forward and backward integration organisation can improve on their operations and logistics.

1.4. The Concept of Performance and Dimensions of Performance

Performance is a dynamic multi-dimensional concept which makes a comparison of an organisation's goals and objectives with its actual outcomes. Though, performance and its dimensions across SCM and SCI studies are complex and vary from study to study, it can still be categories into operational, and business performance. For instance, business performance from three distinct perspectives; financial performance, market or strategic performance, and shareholder value. These three performance dimensions could be used to determine whether an organisations is attaining its intended business goals. Thus, performance in terms of SCI could be said to be a measure of both efficiency and effectiveness. Hence, the reason for classifying different dimensions of performance into operational and business performance. These aspects of performance have been proven to accurately measure efficiency and effectiveness. Thus, to fully understand the SCI - performance association, this meta-analysis identified different yet common performance

measures from literature which could simply be classified into two main categories; operational and business performance.

1.4.1. Operational Performance

A number of studies have measured the performance effects of SCI in terms of operational performance (OP). For instance, (Leuschner et al., 2013; Mackelprang et al.,2014; Flynn et al.,2010; Boonwitt et al., 2011; Swink et al.,2012; Som et al., 2019) all measured the impact or association of SCI with performance using performance outcomes which could be classified as operational. These measures included quality, delivery speed or agility, product development and innovation, cost efficiency, flexibility and so on. Customer service, according to Mackelprang et al., (2014) and Koufteros et al., (2010) could also be considered as a measure of operational performance under SCM and related studies. However, in this study similar to other studies it was considered as a measure of business performance. Operational performance in relation to SCI has been associated with improvements and development of key competitive capabilities which may include; cost, quality, agility, delivery, flexibility, innovation and so on. Different measures of operational performance with regard to SCI have yielded varying results across studies. Some studies (Leuschner et al, 2013; Som et al, 2019; & Flynn, 2010) have found evidence that SCI has significant positive effect or association with different measures of operational performance. On the contrary, other studies have also found evidence that no significant correlation exists between SCI and operational performance. In some studies (e.g. Chang et al., (2015)), still operational performance or at least one of its measures have shown to mediate the relationship between SCI and financial, customer- oriented, and business performance.

1.4.2. Business Performance

Business performance (BS) which could further be broken down into financial and market performance has equally revealed mixed results. The association of business performance with SCI dimensions or facilitators varies across studies in literature. For instance, financial performance which is often measured using metrics such as profitability and return on assets, or purely revenue-based measures, like return on sales and return on investment has also shown mixed results. With studies finding no significant association between financial performance and SCI (e.g. Leuschner et al., 2013) to a positive

significant association (e.g. Mackelprang et al., 2014), financial performance still remains a disputable measure of business performance. On the other hand, market-oriented performance could also be categorised as strategic and relational performance. Relational performance is a relative customer-oriented measurement which include performance outcomes such as customer satisfaction, brand and customer loyalty, and customer retention. Whereas strategic performance involves the improvement of marketing goals such as sales growth, increased market share and return on marketing investment. Opposed to dividing market performance into strategic and relational or customer-oriented performance, it was deemed necessary to put them all under market performance. Moreover, Rosenzweig et al., (2003) and Mbugua & Namada (2019) argued that market performance which considers how well businesses achieves their market-oriented goals also includes relational and/or customer-oriented goals. Thus, it does not make a difference whether separated or not. This was done in order to avoid too many hypotheses based on too many dimensions of performance which could simply be consider as either market or financial in nature. This meta- analysis involves testing a number of hypotheses, hence one of the reasons for putting marketing and financial related measures together under business performance. Moreover, the goal was not to determine how individual business or operational performance outcomes are influenced by SCI.

Analyses and hypotheses testing were conducted on both operational and business performance to determine the aggregate performance effects of SCI. Though performance is usually conceptualised in terms of financial performance (ROA, return on sales, revenue & so on), market or market-oriented performance (customer satisfaction, customer loyalty, sales growth, & market share), cost performance , quality performance (conformance to quality standards, reliability, and defect free), delivery performance (agility and dependability), and flexibility performance (modification and innovation, new product development, and volume adjustments), many other performance measures were also evaluated. However, for the sake of simplicity regardless of the performance measures adopted in the primary study, this meta-analysis classified them as either operational or business performance (i.e financial and market performance). This was done with the goal of determining which aspect of performance is mostly influenced by

SCI. Thus, the question of whether SCI has an impact on business performance or operational performance was addressed through this approach.

1.4.3. Operationalisation of Performance in this Meta Evaluation

This meta- analysis considered performance from two different perspectives. In order to determine the overall effect of SCI dimension and facilitators on aggregate performance, operational and business are used as intermediate performance measures. Thus, different dimensions of performance were amalgamated into either operational or business performance. Doing so would reduce the complexity and ambiguity that is associated with performance. Moreover, this would further clarify which dimension or aspect of performance is mostly influenced by SCI. This was done to determine which specific dimension of business performance has the most influence on performance. Since Leuschner et al., (2013) and Mackelprang et al., (2014) two of the renown meta reviews on the topic did not agree on the performance effects of SCI, it becomes imperative to assess the mediating effect of mediators between SCI and overall performance. Thus, overall performance as opposed to individual dimensions is used to determine mediation effects of key factors.

1.5. Supply Chain Integration- Performance Association

The SCI- Performance association is one of the most researched topics under SCM literature. Thus, discussing or reviewing all there is on this topic is nearly impossible. For this reason, a brief summary of the empirical evidence on this association is provided. This provides insight which together with the above selected theories helped in the development of this study's theoretical framework and hypotheses.

Despite the challenge in the operationalisation of SCI and performance, Som et al., (2019) found evidence that SCI (information integration and sharing) positively influences SCP. SCM literature is not short of studies which claimed a positive association between SCI, collaboration or at least a form of integration and performance. Although, the measures of performance and SCI as well as theory vary across studies, in one way or another some association is suggested. For instance, Huo et al (2014) found evidence that SCI significantly affects firms' financial performance**.** Wong et al (2015) found a positive relationship between information integration and effective IT-enabled collaborative

decision making, which leads to an improvement customer service and organisational performance. Liu et al (2013) further evaluated the effect of SCI on performance found out that operational integration was positively associated with both operational performance and organizational performance. However, the authors indicated that information sharing did not have any effect on organizational performance but influenced firm's operational performance. How SCI and its dimensions or facilitators impact or relate to specific dimensions of performance has always been an issue in SCM literature. For instance, Leuschner (2013) using the facilitators of SCI (informational, operational & relational), noted that SCI has limited and insignificant influence on finance. On the contrary, Mackelprang et al (2014) using the dimensions of SCI (internal, customer & suppliers) found evidence that SCI has a significant positive effect on financial performance.

On the other hand, Flynn et al., (2010) using both the contingency and configuration theory found that supplier integration has a significant yet weak association with performance. These findings contradict the findings of studies such as (Danese & Bortolotti, 2014; Flynn & Lu, 2017; Leuschner et al., 2013) which concluded that a significant positive relationship between SCI and operational performance exists. Studies done both before and after the two renown meta- analyses, Mackelprang et al., (2014) and Leuschner et al., (2013) on the relationship between SCI and Performance have yielded conflicting results. For instance, (Gimenez &Ventura, 2005; Droge et al. 2004; Wong et al. 2011) all found evidence that support a positive influence, while (Vickery et al. 2003; Rosenzweig et al., 2003; Germain& Iyer 2006; Koufteros et al.,(2005) found evidence that does not support a significant positive association between SCI and performance. The relationship between SCI and performance is one that is full of inconsistencies. For example, Rosenzweig et al. (2003) found evidence that integration intensity has both a positive direct and indirect association with ROA, while at the same time finding no significant association between customer satisfaction and sales growth**.** Contrary to most studies, Vickery et al. (2003) an insignificant positive association between SCI and financial performance. A study by Leuschner et al., (2013) found evidence that CI does not support the general hypothesis that customer integration positively impacts on financial performance. On the contrary, Ataseven & Nair (2017) noted that customer

integration had a positive correlation with financial performance. This inconsistency makes statements such as SCI positively influences performance questionable.

Moreover, not only are there mixed results on the SCI-performance association, some studies claimed that a number of factors moderate and mediate are can be attributed to this relationship. Therefore, one would conclude that implementing SCI strategies does not always guarantee superior performance. As it is not clear to what extent mediating and moderating factor influence or explain the SCI-performance association. With mixed results, mediating and moderating factors, the impact of SCI on performance becomes even more complex than it already is. For instance, (prajogo & Olhager ,2012; Swink et al. 2012) investigated this association and found mixed result as well as a number of both mediating and moderating variables. Even more complicated some studies went further and found evidence that the dimensions of SCI could be considered as moderators or mediators to SCI- performance relationship. For example, Rosenzweig et al., (2003), Vickery et al., (2003), Swink et al., (2007), and Flynn et al., (2010) found evidence of moderators in the relationship between SCI and performance. For instance, Afshan & Motwani (2018) found out that SI positively moderates the relationship between CI and efficiency. Huo et al.,(2014) and Dametew et al., (2016) on the other hand, found that internal integration improves external integration which directly and indirectly influence organisational performance. Leuschner et al (2013) and Mackelprang et al (2014) further suggest that future studies should be devoted to understanding these mediating or moderating factors. Thus, the association between SCI and performance is as complex as supply chain integration itself. Furthermore, the concept of SCI, especially when referring to its linkage to performance, could can be approached from different perspectives.

1.6. Theoretical Foundation, Development of Hypotheses, and Research Model

In order develop a theoretical and conceptual framework that encapsulates all the key constructs of SCI, moderators and mediators between the SCI- performance association, a number of well-established and SCI related theories were adopted.

Organisations transform resources into specific desired outputs that conform to their objectives and goals. Resources in and of themselves consists of key competencies and capabilities which may provide organisations with a competitive advantage. Furthermore, organisations are viewed as a sum of resources which include all capabilities and

competencies developed or owned by organisations (Barney, 2012; Som et al, 2019). Thus, all organisations could be deemed as a resource. Since SCI seeks to synchronise organisations, processes and resources, it can also be viewed as an essential resource for gaining competitive advantage. Shared information and materials, relational and operational capabilities involved in SCI could all be viewed as resources. This is true according to Chen et al. (2009) who argued that it is the strategic utilization of these resources that allows for integration of both internal and external functions of organisations, and ultimately attainment of shared objectives. Based on the view that organisations and SCI are resources, the Resource Based View was adopted for this study. However, RBV alone is not sufficient as theoretical framework for SCI. SCI, is a complex phenomenon which cannot be anchored a single theory. Moreover, as Barney et al., (2012) and Som et al., (2019) pointed out that organisations and SCI are resources which include capabilities and competencies, theories such as Organisational Capability, Resource Dependence, Relational view, Contingency and Configuration theory can be adopted. Complementary theories to RBV, were adopted to provide a rich and strong theoretical background. These theories were also selected with regard to the objectives of the study.

One aspect of supply chain integration is connectivity or relationship development and management. The RBV theory on which many SCM, SCI and BPM related studies are based including this one, is not conclusive. It does not provide a sufficient basis for the complex nature of SCI. Consequently, the Relational View Theory which is an extension of the resource-based view theory (Hunt & Davis, 2008; Leuschner et al.,2013) was also adopted. For instance, information sharing within a supply chain is facilitated through chain relationships. Mackelprang et al., (2014) and Som et al., (2019) confirmed that SCI can generate strategic resources that partner organisations could adopt to generate and provide higher customer value.

1.6.1. Main Theories of the Study

This section discusses the main theories adopted for this study. It goes beyond just discussing theories. It discusses how these theories are related or could be associated with supply chain integration and related fields. In short, some theories considered as critical both SCM and SCI are highlighted and their relation to SCI discussed.

1.6.1.1.Resource Dependence Theory

SCI involves synchronisation of operations, information, and relations to facilitate easy sharing resources among supply chain members. Thus, similar to Kozlenkova, et al., (2014) resource development theory (RDT) which states that organisations depends on resources which are provided by others, in order to reach objectives which could involve sustaining growth or exploiting new opportunities. This implies that core competencies and capabilities which are necessary in delivering value in or across the value network cannot be provided by a single organisation. According to Kozlenkova, et al., (2014) no single organisation is likely to possess all the essential qualities, competencies and capabilities that will enable it to sustain a competitive advantage in the long term. Hence, the need for resources resource and dependence generated through SCI to allow organisations exploit their own resources, as well as those of partners in attaining both short term and long-term supply chain objectives. Organisations must develop systems and that will grant them access to key qualities and resources that will enable them sustain a competitive advantage in the long term. RDT is based on the view that organisations are open systems. Based on this theory it is practically impossible for organisations to be entirely independent or self-sufficient. They will always have a need for at least one essential resource, process or service which could only be provided or performed by others in the SC. Thus, according to Heide (1994) organisations need to form strategic alliances with key stakeholders to survive, and ensure sustainable growth and development. This helps in reducing diversifiable risk and uncertainty. These alliances also facilitate the smooth flow of resources and information along the value network. In the context of SCI, RDT suggests that supply chain members should form collaborative relations that will guarantee sustainable growth and continuity through resource integration. According to Mentzer & McCarthy (2011) this collaboration is more beneficial to organisations and chain members than short term benefits which might be gained at the expense of other chain members. RDT theory highly recommends relationships among partners as well as resource sharing and coordination. Therefore, RDT theory could be considered as one of the major theories through which relational and informational integration could be assessed. Since relationship and resource sharing are the focus of RDT theory which are equally the foci of SCI, RDT can be argued to be

one of the most important theoretical lenses on SCI. In short, SCI helps in building a system through which resources could be exchanged among chain partners.

1.6.1.2.Resources Based View

One of the particularities of RBV theory is that it considers intangible resources integrated resources, processes and relationships as critical factors in achieving competitive advantage. The RBV portrays organisations as resource collections, and that resources are not homogenous. Thus, implying that competencies and capabilities required in delivering value in or across a value network are essential intangible strategic resources. However, it is important to point out that RBV may include both intangible and tangible resources. Integrated organisations can have easy access to available resources in the value chain or network (Liu, Ke, Weiling, Wei, & Hua, 2013). These integrated resources could be exploited for competitive advantage and ultimately the attainment of value network goals. SCI via information, relations, and operations cooperation ensures the unhindered flow of information, materials, products, services which finally ensure higher customer satisfaction and service (Liu & Liang, 2015). Thus, enhanced and strategically managed integrated supply chains make it difficult for competitors to imitate, or substitute thereby providing a competitive advantage. Quality SCI may provide a longer sustainable competitive advantage, which could allow for harmonious value delivery to customers throughout the value network. This according to Barney (2012) may consequently lead to superior or improved performance. According to (Chen et al., 2009, Barney, 2012; Leuschner et al., 2013; Som et al., 2019) and the RBV theory, SCI could be regarded as a strategic resource for gaining competitive advantage, and improving performance. Though usually in conjunction with other theories, the RBV is so far the most adopted theory in BPM, SCM and SCI related studies. Equally in this study the dimensions and facilitators of SCI in relation to performance will be evaluated in light of this theory.

Moreover, via the lens of RBV, it is possible to achieve synergistic gains in both production and operations by using common and shared key resources in production units. Since the RBV argues that organisations can be considered as a sum of strategic resources, synergistic gains as well as low production costs could achieved through effective SCI. According to Barney (2012) and Som et al., (2019) strategic resources are valuable, rare and difficult to imitate or substitute. Thus, well integrated supply chains

are not only a valuable resource that can help in generating higher customer value, they are a unique resource that can provide synergistic gains which in turn could lead to competitive advantages. SCI integrates information, relations, and operations which facilitates the smooth flow of products and services within and across the value chain. The smooth flow of products and services which is facilitated by integration across firms, may result in a competitive advantage. SCI can be perceived as either a strategic or critical resource that could result in a competitive advantage and improved organisational performance (Barney, 2012). Therefore, based on the RBV theory SCI is a unique and strategic resource that may help organisations in gaining competitive advantage and improve performance, through information, relational, and operational integration.

1.6.1.3.Resource-Advantage (R-A) Theory

R-A theory, is a similar yet different theory to the RBV which does not only focus on resources, but specifically advantageous resources. Advantageous resources which are rare, unique and inimitable will provide organisations with an opportunity to survive and influence external environment. R-A theory claims that integrations should be concentrated around those specific advantageous resources which provide competitive advantage. Resource advantage theory focuses not just on resources per se, but more specifically on advantageous resources, which provide organisations with a competitive advantage (Hunt & Davis, 2008). Thus, under R-A theory resources are integrated or synchronized based on their contribution to creating competitive advantage and customer value creation. Hunt & Davis, (2012) further argued that resources are to be viewed with regard to their advantageous contribution in producing a market offering that has high perceived customer value and the degree to which they can used to create a competitive advantage. Thus, customers, suppliers, and resource integration could be viewed from the perspective of R-A theory. Since value creation revolves around organisations, customers, and suppliers as well as key resources, SCI with the help of R-A could be thought of a means to value creation and competitive advantage.

1.6.1.4.Relational View

The RV theory could be thought of as a complementary theory to RBV and its extended version extended RBV. However, RV draws attention to the relational nature of SCI as opposed to strategic resources. Competitive advantage could be derived from SCI through

both relational and strategic resources. While the RBV is necessary for understanding strategic resource management, RV is essential for understanding and assessing the relations or partnerships involved in SCI. Simply put, RV provides a platform for understanding the nature of relationships among chain partners and how these relationships influence overall performance. RV theory could be used to understand relationship among chain members in relation to performance. According to Zhang & Wang (2018) the relational view theory was first proposed by Dyer & Singh, (1998) to assess how inter-organisational linkages could result in sustainable competitive advantage. Thus, RV provides insights on how the relational aspect of SCI could be exploited to gain a competitive advantage. According to Miguel & Brito (2011), there are four main relational rents or benefits which could be highlighted in the RV. Namely, relation- specific asset investments, substantial knowledge sharing, complementary capabilities and effective governance which could be exploited by chain partners to gain competitive advantage. Relational rents could be thought of as, the benefits or returns generated in an exchange relationship that cannot be generated by an independent organisation. The stronger the supply chain partnerships in terms of relation- specific asset investments, substantial knowledge sharing, complementary capabilities and effective governance, the greater the potential for relational rent. Generally, the RV theory provides insight on how organisations could develop value partnerships with stakeholders to gain a competitive advantage and achieve higher relational rents or benefits. Therefore, SCI in the theoretical lens of RV could result in mutual benefits among chain members or partners where the overall chain benefits are increased as a result of the use of unique or imitate specialised assets, skills and information.

1.6.1.5.Organisational Capability Theory

Organizational capabilities (OC) involves collaboration, talent management which links all the parts of the organisations together. Grant, (1996) defined an OC as the as the ability to repeatedly perform a productive task or activity which is either directly or indirectly associated to an organisation's capacity to create value through effective transformation of inputs into outputs. On other hand, Leuschner et al., (2013) viewed OC as the organisation's ability to perform a set of integrated or coordinated set of tasks via the utilisation of organisational resources, for the purpose of achieving a particular desired

outcome. SCI may be thought of as a strategy which leads to integrated chain capabilities which are fundamental for gaining competitive advantage. Hall et al., (2011) citing Kusunoki et al. (1998), pointed out that there are three main types of OCs: local, architectural and process capabilities. From the perspective of SCI, local capabilities could be associated to technological and informational system synchronisation within an organisation such as Enterprise Resource Planning (ERP), Integrative inventory management and so on. According to (Hall et al., 2011; Lu et al., 2017) architectural capabilities may represent joint product/process design, cross-functional teams and coordinations among all internal functions. Process capabilities on the other hand, could be based on information sharing, collaboration and communication within the organisation. Thus, SCI from the perspective of OC, might be viewed as an intra and inter-organisational capability. Informational, operational and relational integration as well their effects on performance could be assessed in light of OC. The role of inter-organisational capabilities and competencies (e.g. information sharing, system and process alignment, collaborative awareness, etc.) may act as catalysts in facilitating strategic partnerships within a supply chain. Thus, competencies and capabilities may strengthen both internal and external logistic and supply chain integration.

1.6.1.6.Contingency Theory

In the lens of Contingency theory, the impact of SCI on performance can be said to dependent on contextual factors, which could simply be classified into firm-specific and environmental factors. Regarding firm-specific factors, Kim (2006) argued that firm size moderates the relationship between SCI and performance. It was further discovered that smaller firms experience greater performance improvement from their integrated supply chains. While in other studies Shou et al., (2017) and Germain et al., (2006), contingency of production system and the effect of II on performance where either moderated by the level of suppliers or customers integration. Contingency theory asserts that in a dynamic environment with high uncertainties and complexity, organisations usually tend to develop external-oriented strategies to effectively cope with these factors (Leuschner et al., 2013; Lu et al.,2017). In other words, under the contingency theory, organisations with strong external integrative capabilities are able to obtain quality information and resources from external sources at a faster rate as a result of synchronised inter-

organisational information technology. Integrative supply chain capabilities are vital in very complex and dynamic environment with ever changing customer demands and quality expectations. Through coordinated operations or business activities with chain member or partners, organisations can also respond quickly and adapt to changes induced by external factors.

Performance is influenced by how SCI practices and the individual dimensions of SCI are aligned to the environment. Organisational structures and processes are determined by the environments within which organisations operate. The contingency theory, according to (Petersen et al., 2005; Flynn et al ,2010; Uwamahoro, 2018) organisations should align their structures and processes with the environment in order to improve performance. This implies that organisational performance is equally affected by factor external to the organisation. In the case of SCI, suppliers and customers could be considered an important part of a production firm's environment. Moderators and mediator could equally be thought of a significant part of external or contextual factors which may affect the SCI- performance linkage. Flynn (2010) argued that organisations should match their structures and processes to their environment, in order to maximize performance. He further, noted that customers and suppliers are a critical part of a manufacturer's environment. Thus, according to Flynn et al., (2010), dimensions of SCI should be aligned in such a way that they best achieve desired performance outcomes. Wong et al., (2011) and Lu (2017) further argued that a high level of environmental uncertainty and complexity influences the association between SCI and performance. Contingency theory was adopted to explain why many studies on SCI- Performance relationship apparently yield conflicting results. The contingency theory can be perceived as an appropriate theory for assessing moderating or mediating factors associated with the SCI- performance relationship.

1.6.1.7.Configuration Theory

Configuration theory perceives organisations as a set of interlinked and interrelated processes or activities. According to Flynn et al. (2010) and Cao & Zhang (2011) via the lens configuration theory, argue that SCI patterns are associated to performance, especially to the operational performance in different configurations. Flynn et al. (2010), citing (Drazin et al, 1985; Ward et al, 1996; and Sinha et al, 2005) argues that

organisations usually perform better when they develop better configurations of interconnected elements. This therefore suggests that a well and highly integrated supply chain is most likely to have better performance in the market place. Thus, configuration theory points out the necessity for well- integrated supply chains needed in order to deliver high performance. It can therefore, be argued that configuration theory is essential in providing a theoretical basis for understanding the linkage between SCI and performance. Flynn (2010) further argues that configuration theory is useful when understanding and explaining SCI patterns and tendencies which are complex in nature. The SCI- performance is not short of mediating and moderating factors. Some studies have even gone further to suggest that besides mediating factors between SCI and performance, SCI dimensions mediate each other. For instance, Khamis al Naqbi et al., (2018) concluded that CI and SI mediate the relationship between Internal Integration and Sustainable Supply Chain Performance. Though focussing on the integration of flows or facilitators, Sacristán-Díaz et al (2018) pointed out that the degree of external informational integration positively mediates the relationships between II and financial flow integration as well as the physical flow integration. In other words, external integration, especially one that involves flows mediates the association between II and performance This suggests that additional mediation analysis, based on a configuration theory, is necessary in analysing the relationship between SCI and performance. Therefore, based on the configuration theory and previous SCI- performance literature association, a number of mediating and moderating hypotheses are proposed.

1.6.2. Other Important Related Theories

Although, RDT, RBV, RV, OC, Contingency and configuration theory were adopted to address the objectives of this study as well as formulate and test the hypotheses, SCI could also be viewed in the light of other related theories. SCI and SCM related studies have shown that no single theory alone would suffice when dealing with SCI-performance. Hence, many theories found in SCM and SCI literature. Therefore, besides the six main theories adopted for this meta research, a number of other relevant and related, additional to the main for study theories are briefly discussed. These secondary theories were identified in sample articles to supplement the main theories and build a stronger theoretical and conceptual framework.

1.6.2.1.Knowledge Based View

Some have evaluated SCM and SCI in the light knowledge based (KBV). According to Leuschner et al (2013), SCI helps in facilitating knowledge resources via valuable information (operational and strategic information) exchange across the organisational boundary with supply chain partners. This is consistent with the KBV which asserts that firms use knowledge resources such as strategic and operational information to gain a competitive advantage and improve performance.

1.6.2.2. Information Processing Theory

IPT argues that information processing capabilities, which are an internal aspect of SCI, are cardinal for organisations operating in dynamic environments with high uncertainty and complexity. This capability to process both internal and external information assists decision makers to make apt and accurate decisions. According to Zhao et al. (2013), apt supply chain related information may help firms make decisions that will provide them with a better survival position in a dynamic environment. SCI provides organisations with effective and efficient information processing capabilities. Based on Boonwitt & Wong,(2011) and Leuschner et al. (2013), Information processing theory (IPT) contributes to theoretical development of SCI, especially information integration. This is simply because the connectivity aspect of SCI allows increased flow of quality information which can assist organisations to respond quickly to changes in the environment and customer demands which in turn may lead to improved supply chain performance.

1.6.2.3. Transaction Cost Theory

Lu (2017) citing Lee et al (2007) on transaction cost, pointed out that existing studies suggest that SCI mechanisms such as investments in transaction-specific assets may lead to stable long-term relationships with higher switching cost. These switching high costs lessen the threat of opportunism exhibited by supply chain partners as well increase dependence. According to Lu (2017) the presence of transaction-specific assets such as dedicated terminals, dedicated warehouse, joint ventures, or any other pooled resources ties supply chain partners in a long-term relationship may increase commitment and trust among supply chain partners. This could consequently reduce transaction costs that are

associated with outsourcing resources, negotiating, and monitoring a product or service for every single transaction.

1.6.3. Research Hypotheses Based on SCI constructs, Theories and Performance

Presented in this section are the SCI constructs in relation to theory and performance dimensions. Based on these key relations appropriate hypotheses were developed as well as the research model of the study. These hypotheses and research model provide a basis for addressing the research questions and objectives of this research.

1.6.3.1. Internal Integration, Performance and Related Theories

Internal integration as a dimension of SCI among many other functions, it is involved with breaking down barriers across departments. It also involves collaboration and sharing of critical information among departments or to satisfy customers demand and needs. II through information sharing, joint planning, brainstorming and collaboration with different departments in making decisions provides organisations with important competencies that allow them to gain a competitive advantage**.** According to Flynn et al (2010), II may be viewed as intra-organizational capabilities, specifically the manufacturing organisation's ability to integrate or synchronise its processes or activities within and across both departments and functions. II like SI and CI can be said to be both a set of organisational capabilities and strategic resource which may present manufacturing organisations with a competitive advantage. Thus, similarly it will be through RBV, RDT, OC and Configuration theory. Though many authors claimed a positive relationship between internal integration and operational performance (Alfalla-Luque et al., 2013; Flynn et al., 2010; Chang et al., 2016; Wong et al., 2015), others found no direct relationship between internal integration and performance (Koufteros et al., 2005; Giménez et al., 2005). Empirical results on SCI- performance association vary across studies depending on the dimension of the performance selected, facilitators or dimensions of integration, and nature of the linkage. In terms of business performance, some studies find that internal integration is positively associated with performance (e.g., Droge et al. 2004; Flynn et al. 2010; Chang et al, 2015), while others failed to confirm this association (e.g., Germain and Iyer 2006; Swink et al. 2007). Those who concluded a positive linkage between the two constructs, used different measures of operational performance such as: cost of quality, innovation, delivery, agility, flexibility, process

efficiency, product development, and other related measures. Thus, II has many benefits such as improved flexibility and agility in which are essential in meeting dynamic customer demands, reducing throughput and delivery times, reducing logistics and material purchasing costs. It also helps in ensuring a stable and optimal level of inventories, increased workforce efficiency and market share. With regard to the mentioned theories and previous study findings or claims, the following hypotheses were proposed:

$\mathbf{H_{2a1i}}$: Internal Integration positively influences Operational performance.

$\mathbf{H_{2a1ii}}$: Internal Integration positively influences Business performance.

1.6.3.2. Customer Integration, Performance and Related Theories

Customer integration may provide organisations with essential capabilities necessary to produce and deliver customer satisfying services or products. Just like II, CI has been argued to improve performance by many studies. For instance, (Droge et al., 2004; Frohlich and Westbrook, 2001; Flynn et al., 2010; Wong et al., 2015, Huo et al., 2014; Kumar et al., 2017; Ataseven & Nair,2017; Jermsittiparsert et al., 2019; Errassafi et al., 2019; Mackelprang et al., 2014) found that CI has a significant positive influence on performance. On the contrary, studies like (Flynn et al.,2010; Leuschner et al., 2013; Koufteros et al., 2005) found that CI has no significant impact on financial performance. Though the impact of CI on financial performance is inconsistent, many studies concluded a significant positive association between CI and operational performance. Customer integrations may provide organisations with relevant information and insight on customer needs and preferences. It enables organisation to gain a better understanding of customers' preferences, as well as to build relationships with customers (Swink et al., 2007). From the view point of strategic brand management, strong and advantageous relationships increase customer switching cost which may lead to brand loyalty. Manufacturing organisations from the perspective of resource dependency theory (RDT), rely or depend on customer information to design processes, products and responses that best meet customer needs. Close interactions between customers and organisations if well harnessed through customer integration, may become an important resource for improving performance. Using RDT, RBV, OC, and the CI- performance empirical existing literature, the following hypotheses were suggested:

H_{2a2i}: Customer Integration positively influences operational performance.

H_{2a2ii}: Customer integration positively influences Business Performance.

1.6.3.3. Suppliers Integration, Performance and Related Theories

SI can be viewed as both a resource and external integrative capability that may directly or indirectly influence performance. Similar to II, scholars found inconsistent results regarding the association between SI and performance. Frohlich (2001), Rosenzweig et al., (2003) and Narasimhan & Kim, 2002 found that SI may improve performance**.** On the contrary, some studies have claimed no significant linkage between SI and performance (Stank et al. 2001), while others even a negative association (Koufteros et al. 2005; Swink et al. 2007). SI is usually associated with the coordination and sharing of information with critical suppliers that provide insights into suppliers' processes, capabilities, and constraints. SI has also been related to new product introduction processes and product development performance (Koufteros et al. 2005). This would help in ensuring that the manufacturing organisations have a stable flow of inventory. SI may help firms develop materials or an inventory plan needed to prevent stockout and the bullwhip effect. Similarly, Chen et al., (2009) claimed that manufacturing organisations implement SI in order to have capabilities that enable more effective planning and forecasting, product/ process design, and inventory management. Developing a health partnership with suppliers, especially one based on operations and processes, may provide manufacturing organisations with the capabilities, competencies and strategic resources needed to achieve a higher customer service level, which may in turn, improve performance. Thus, the propose hypotheses:

H_{2a3i}: Suppliers Integration positively influences Operational Performance.

H_{2a3ii}: Suppliers integration positively influences Business Performance.

1.6.3.4. Information Integration, Performance, and Related Theories

Information sharing or integration is a very important for improving both value chain and performance. Leuschner et al., (2013) defined information integration as the coordination of information transfer, collaborative communication and supporting technology among business in the value chain. Sharing information among supply chain partners could help

in facilitating the coordination of supply chain activities, which consequently leads to, improved performance. Thus, this study argues that an organization will perform better where there is efficient and effective information sharing between various supply chain partners. Information is not only critical for integrated supply chains and performance it is one of the main facilitators SCI. It is one of main necessary organisational capabilities needed for gaining a competitive advantage. Organisational information systems capabilities have an impact on organisations performance. Thus, it can be claimed that information systems capabilities or integrated information influence supply chain performance as well individual organisational performance.

According to Som et al., (2019), information integration provides supply chain partners with the capability to access shared information on a timely basis is vital for improving supply chain performance. Thus, it can be argued that supply chain integration through information systems and integration may significantly influence supply chain performance. Didonet et al., (2014) citing (Liu et al., 2013), further pointed out information sharing has a significant positive effect on operational performance. Thus, information integration is critical for both operational and business performance. Information integration also facilitates product delivery, new process/product design, new market development exploration, and new product/services promotion (Deveraj, Krajewski, & Wei, 2007). Real-time information provides organisations with capabilities to respond quickly to change and meet customers' needs which consequently improves performance.

With the help of information integration particularly via information sharing in the supply chain, an organisation may easily detect problems related to customer demands, special needs and interest at any time. This information may help organisations to make appropriate adjustments needed to respond to such demand changes and needs, which is essential for performance. According to Jermsittiparsert et al., (2019), information sharing reduces the "bullwhip effect" which is simply increasing demand variability and demand uncertainty in a supply chain. Information sharing may assist organisations increase their financial performance by providing them with necessary information needed to optimise and reduce inventory costs. Since information integration presents organisations with organisational capabilities (OC) and it can be perceived as a strategic resource from the perspective of RBV, thus the following hypotheses could be drawn:

H_{2b1i}: Information Integration positively influences operational performance.

H_{2b1ii}: Information Integration positively influences Business Performance.

1.6.3.5. Operational Integration, Performance, and Related Theories

Operational integration involves synchronisation of business processes/activities and coordinated decision making through integrated decision support systems which enable firms in a supply chain to operate as one with minimum operational barriers. Well managed and integrated business or chain operations could provide a number of organisational capabilities which could become key strategic resources. (Beheshti & Hultman, 2014) from (RBV) perspective, pointed out that well managed organisational operations may constitute a valuable resource that might contribute to the overall organisational performance. Wiengarten al., (2014) noted that operational integration of suppliers and customers have a positive impact on organisational performance. Since operational integration, a facilitator of SCI could be perceived as both a valuable resource and capability, evaluating it from the perspective of OC and RBV is more reasonable.

Operational coordination facilitates the smooth movement of inventory across the supply chain, which reduces the bullwhip effect as well as shortens lead time. Liu et al. (2013) who examined two facilitators of SCI in relation to performance; operational coordination and information sharing, found that the operational coordination has a positive association with business performance. Furthermore, Som et al., (2019) noted that operational coordination promotes resources, knowledge, and risk sharing across the value chain which in turn improves supply chain performance. Operational integration or coordination reduces the time needed to design new business processes, products or services as well the time needed to deliver the goods to the customer. Sanders et al., (2013) argued that operational integration facilitates the design and production of goods, as well as the quick and reliable delivery of products/services to the customers or end users. Therefore, operational integration allows firms to make collective decisions on how to adjust business processes and tasks across organisational boundaries to improve performance. Studies have shown that operational integration has a significant positive effect on both operational and business performance. Hence, the hypotheses below:

H_{2b2i}: Operational Integration positively influences operational performance.

H_{2b2ii}: Operational integration positively influences Business Performance.

1.6.3.6. Relational Integration, Performance, and Related Theories

Relational integration (RI) facilitates the relationship between the firm and its related stakeholders in the value chain. RI can be considered as both a strategic tool and strategic resource with its core activities. Authors such as Adams et al., (2014) who considered RI as a resource, found that relational integration as a strategic resource had a significant impact on organisational performance. Leuschner et al., (2013) further found evidence that not just relational integration, but strategic relational integration positively influence performance. Relational integration refers to the adoption of a strategic to association among organisations in the supply chain characterized by trust, commitment and long-term orientation (Leuschner 2013). RI may enable organisations to associate and work with their customers and suppliers and as well as their employees. Supply chain partnerships could provide quality information which may in turn lead to improvement in performance. The RV theory might be best suited for relational integration which involve association there are either internal or external. In the context of this study, the researcher opined that, relational integration will contribute significantly to the performance of the firm. Yu & Huo (2019) studied the impact of relational capital on supplier quality integration and operational performance. The study revealed that relational capital has a positive effect on operational performance. The positive association between SCI and performance outcome which is usually attributed to the information quality, might be as a result of the relationship among chain partners. Additionally, the authors found that information quality is associated with cost efficiency. Leuschner et al (2013) and Jermsittiparsert et al (2019) also indicated that there is a positive and significant correlation between SCI and organizational performance. Therefore, it can be hypothesised that:

H_{2b3i}: Relational Integration positively influences operational performance.

H_{2b3ii}: Relational integration positively influences business performance.

1.6.4. Moderating Factors and Their Supposed Effects

Many studies both primary and meta reviews claimed that the SCI- performance linkage involves the presence of many moderators. Lu (2017) pointed out that the pattern of

association between SCI and performance tend to usually be nonlinear. This simply means that SCI and performance are not always directly associated. The nonlinearity nature of the relationships between SCI and performance could be attributed to the influence of a number of moderator factors. For instance, Leuschner et al., (2013), Sofyalıoğlu & Öztürk, (2012)**,** Wu et al., (2014) and Mackelprang et al (2014) in their meta reviews not only identified but also suggested that future studies should be done with consideration to moderator factors. Though later primary studies were conducted with regard to moderator factors as Leuschner (2013) and Mackelprang et al., (2014) recommended, meta reviews have not assessed the effect of these moderators. Most reviews on SCI- performance association, including a much later study by Ataseven & Nair (2017) which similarly to preceding meta reviews only concluded that moderators exist. As Liu (2013) pointed out that the influence of moderators can bring clarity on the topic. Therefore, there is no doubt whether there are moderators which could shed more light on the SCI-performance association exist. However, which specific groups of moderators are critical or more influential to this association, remains unanswered. For this reason, it remains one of the primary goals of this study to identify and assess the effect of these moderating factors on both SCID and SCIF.

Opposed to previous studies which limited themselves to at least one moderator, based on primary studies this meta research developed and tested multiple categorical and continuous moderators. Moreover, literature has a number of primary studies with moderating factors. Developing and testing all moderating hypotheses individually would be practically impossible. Consequently, this meta-analysis put these individual moderators into appropriate groups and assessed them accordingly. These groups were used to develop hypotheses in order to determine which key moderates have the most influence of the SCI- performance relationship. The moderating hypotheses are tested with overall performance which combines all types of organisational performance (i.e., operational, relational, strategic, and financial performance). All moderation hypotheses are based on the claims that the relationship between SCI and performance is influenced or strengthened by moderators.

1.6.4.1. Time and Relationship Quality

A number of primary studies identified different types of moderator factors beside the dimensions of SCI. For instance, time and relationship quality have been found to moderate the impact of SCI on performance. Good relationship quality which is characterized by mutual trust, commitment, and long-term partnership (Lahiri & Kedia, 2011; Srinivasan et al, 2011, & Chang, 2015) is known to have an influence on the SCI-performance linkage. Good relationship quality consists of the strength and closeness of partnerships among supply chain members which could be a strategic resource for gaining a competitive advantage. This closeness among partners strengthens over time which may also moderate the relationship between SCI and performance. According to Srinivasan et al., (2011) strong relations among supply chain partners may become both a strategic and valuable relational resource which could have an effect on the SCI- performance association. Thus, the quality of relationships among supply chain partners could influence certain patterns of SCI which would in turn affect performance. Thus, the following hypotheses:

H_{3a}: The association between SCI and performance strengthens over time.

H_{3b}: Relationship quality strengthens the association between SCI and performance.

1.6.4.2. Culture and Organisational Structure

Good culture and organisational structure are critical factors in strategy development, improvement or implementation. The culture and structure of an organisation play a significant role in decision making as well as overall in the organisation's overall performance. According to Makhdoom et al., (2016), organisational culture which shows the way organisations conduct their businesses, might be considered as a key moderator on SCI- performance association. Flat and flexible organisational structures may help organisations to make decision quickly and timely decisions which would allow them to respond in real time. The more bureaucracy the organizational structure the longer it takes to make supply chain related decisions or respond to external changes. According to Khan & Wisner, (2019) organisations need to develop a culture that will allow them to make quick decisions and solve problems with both higher flexibility and agility. In other word,

organisational structures and culture which are designed for lean management might make SCI effective and successful. Lean oriented organisational culture and structure may reduce waste during the manufacturing process as well as improve performance. They may also help in improving the entire value chain. Organisational culture might also encourage employee and customer involvement in decision making which would in turn improve on chain performance. An organisational culture which supports innovation and innovativeness may facilitate and improve the implementation of SCI which may in turn influences performance. Based on OC, contingency and configuration theory and these claims, the researcher assumes that organizational culture and structure moderate the relationship between SCI and performance. It is worth mentioning that culture includes both organisational and national as well as culture attributes such as lean and TQM, innovativeness, oriented and agility. While organisational structure includes: management system and ownership, industry, firm size, production system, IT level, and flexibility in the following proposed hypotheses.

H_{3ci}: Organisational Culture influences the association between SCI and performance.

H_{3cii}: Organisational structure influences the association between SCI and performance.

1.6.4.3. Geographical region

Similar to organisational culture and structure, geographical location might go a long way to influence SCI implementation for certain organisations. For instance, certain regions may not have a certain culture that supports integration. Some regions might lack or have technologies that support innovation which is needed to facilitate SCI. Geographical location may give certain organisations a relatively better positional advantage compared to others. For instance, Doering et al., (2019) found evidence that geographical location in terms of national culture has moderating effects on SCI- performance relationship. Hence the following hypothesis based on Geographical region:

H_{3d}: Geographical region influences the association between SCI and performance.

1.6.4.4. Market Uncertainty

Besides time and quality of relationship, other moderating factors have been identified in primary empirical studies. Among these factors is supply chain risk (SCR) which could be mitigated by internal and external integration. Though perceived risk and uncertainty could encourage and strengthen SCI, it can also hinder effective SCI implementation (Zhao et al., 2013)**.** Moreover, Boonwitt and Wong (2011) also found evidence that uncertainty moderates the relationship between SCI and operational performance. Risk could compel organisations to develop supply chain risk management mechanism (SCRM) to help them manage both organisational and supply chain risks. Thus, risk could strengthen the relationship between SCI- performance. Market uncertainty (MU) and complexity similar to SCR may increase the level of supply chain integration among organisations. This is simply because organisations operating in markets with high uncertainty and complexity will seek to minimize risk through SCI. Thus, MU could influence the relationship between SCI and performance. Hence, the following hypotheses:

H_{3e}: Market uncertainty influence the association between SCI and performance.

1.6.4.5. Market Orientation

Several scholars have claimed that market orientation may acts as a moderating factor in the relationship between innovation and organisational performance. Not only does innovation influence performance it also moderates the correlation between SCI and performance. Innovation and Technology or information technology could be considered to moderate the SCI-performance linkage. For instance, Xu et al., (2014) found evidence that information technology, Top management system, and innovation all moderate the SCI- performance relationship. Liu 2013 found further evidence that market orientation as a contingency factor moderates the relationship between SCI and performance. MO consists of both competitor and customer orientation. Thus, market orientation can be said to influence the SCI-performance association. According to Lu et al., (2017) market orientation could help organisations sense market place requirements and leverage their capabilities that are connected to external networks to respond appropriately to market changes. For instance, customer- oriented organisations through SCI may respond quickly

to changes in customer demands on the market. This would in turn affect organisational performance. Hence the following hypothesis:

H_{3f}: Stronger Market Orientation strengthens the association between SCI and performance.

It is worth noting that the moderation effects of these factors with an exception of time, are performed on both aggregate and individual constructs of SCID and SCIF. This is done in order to explore and understand how each moderator influence aggregate and individual constructs of SCI.

1.6.5. Mediating Factors and their Supposed Effects

Mediating effect occurs when a third variable intervenes in the relationship between two associated constructs. The inconsistencies in the results on the association between SCI and dimensions of performance might be attributed to the existence mediators. Hence, the reason this study opted to identify and evaluate relevant mediators in the existing literature the topic.

Some dimensions of SC integration were found to mediate the relationship between performance and other dimensions of SCI. For instance, Lu et al., (2013**)** and Alfalla-Luque et al., (2015) found evidence that mediations among SCI constructs influence operational performance. Some studies have even claimed that operational and other intermediate performance outcomes have mediating effects between the relationship of SCI and performance. Operational performance, an amalgamation of many operations related outcomes is a key contributor to the overall organisational and supply chain performance (Lu, Ding, Sobhan, & Sanjoy, 2018). It is worth pointing out that most of those studies which included mediating and moderating factors, evaluated or identified moderating factors in the light of contingency and configuration theory.

Similarly, contingency and configuration theory as well as claims on the SCI-performance linkage were used to develop appropriate moderation hypotheses. Organisational efforts in terms of external suppliers and customers integration may allow it take advantage of its internal integration, in order to achieve better performance outcomes. Some studies even suggest that individual dimensions of facilitators of SCI interact among themselves to affect performance. Germain et al., (2006) found that an

association exist between II and CI. This association was found to have an influence on logistics/operations related performance, which in turn had an effect financial performance. This suggests that operational performance may have mediating effects to financial and business performance. It can be therefore argued the dimensions or facilitators of SCI have mediating effects among themselves which in turn influences performance. For instance, Droge et al. (2012) found empirical evidence that internal integration has mediation effect on external integration (CI and SI) and vice versa. Thus, suggesting that mediating effects between customer and supplier integration. Devaraj et al. (2007) concluded that customer integration had moderating effects on the relationship between supplier integration and performance. Since in one way or another a dimension is believed to have mediated the SCI- performance, the following hypotheses were suggested:

H_{4a}: CI acts as a mediator in the relationship between SI and performance.

1.6.5.1. External Integration and External Integration Orientation

II which involves integrating flows and processes internally can be assessed in terms of many forms of integration capabilities such as; information sharing, information systems integration, process or activity coordination, and cross functional team cooperation. Internal integration does not only provide organisations with capabilities, it also provides inter- organisational competencies which are essential for building strategic supply chain partnerships. As it can be argued for internal and external integration, inter-organisational competencies and capabilities may have mediating effects on the SCI- performance impact. Thus, it can be argued that without II effective internal integration, CI and SI would be difficult and ineffective. Though, II is essential for external integration, its relationship with performance could also be mediated by external integration. According to Errassafi et al., (2019), II has a significant positive association with external integration which in turn influences performance. This is supported by Alfalla-Luque et al (2015) who found that higher level of internal integration, made CI and SI significant in the association between SCI and performance. Thus, the more organisations improve on their internal integration, the more likely their external integration is likely to influence performance

Furthermore, Alfalla-Luque et al (2015) concluded that external integration orientation (EIO) acts as a mediating factor in the correlation between SI or CI and operational performance. That is to say that, the inclusion of EIO generates mediating effects between external integration (SI & CI) and operational performance. Further evidence was obtained which indicated both full and partial mediation of EI between Internal Integration and operational performance and customer satisfaction. Additionally, Khamis al Naqbi et al., (2018) concluded that CI and SI mediate the relationship between Internal Integration and Sustainable Supply Chain Performance. Though focussing on the integration of flows, Sacristán-Díaz et al (2018) pointed out that the degree of external information flow integration positively mediates the relationships between II and financial flow integration as well as the physical flow integration. In other words, external integration, especially one that involves flows mediates the association between II and performance. These claims provide insights which goes beyond knowledge of the mediating effects of EI. They also suggest that both EI and II must interact to improve performance outcomes. Thus, EI and EIO could be said to mediate each other in the SCI-performance relationship. Based on these arguments, the following hypotheses were derived:

H_{4bi}: EI acts as a mediator in the relationship between II and performance.

H_{4bii}: EIO acts as a mediator in the relationship between SCI and performance.

1.6.5.2. Supply Chain Agility, Supply Innovation, and Flexibility

Supply chain agility, similar to a number of other factors such as operational, relational and market related (strategic) performance has shown to have a mediating role to the relationship between SCI and performance. Furthermore, Tseng et al., (2016) revealed that SCI and external learning are indirectly associated to performance with agility as a mediating factor**.** He further argued that SCI cannot influence performance without the mediating effects of supply chain agility. Additionally, Uman & Sommanawat, (2019) and Kumar et al., (2017) found that flexibility (strategic and manufacturing) is associated with the relationship between integration and performance can be mediated by supply chain agility (SCA). Thus, flexibility similar to supply chain agility could play a mediating role between SCI and performance. Supply chain risk (SCR) is equally known to affect the relationship between SCI and operational performance. Krisada &

Jermsittiparsert, (2018) found that SCR affects the association between SCI and performance (innovation and cost). Innovation could also be included among the mediators of SCI. For instance, Goffnett & Goswami, (2016) found that supply chain innovation performance (SCIP) has mediation effects to the relationship between SCI and performance (customer satisfaction). Available literature, indeed has many of mediators regarding the SCI- performance linkage. However, to address the inconsistencies in the SCI- performance relationship findings, determining which mediators have the most effect is necessary through a meta- analysis. Thus, mediators from available relevant primary studies were identified for analysis. Corresponding hypotheses were derived as follows:

H_{4c}: Supply chain agility mediates the relationship between SCI and performance.

H_{4d}: SC innovation performance mediates the relationship between SCI and performance.

H_{4e}: Flexibility mediates the relationship between SCI and performance.

1.6.6. Research Model

Based on the hypothesised associations which are based on corresponding theories, the research model as shown in figure 5 was developed to summary the proposed relationships.

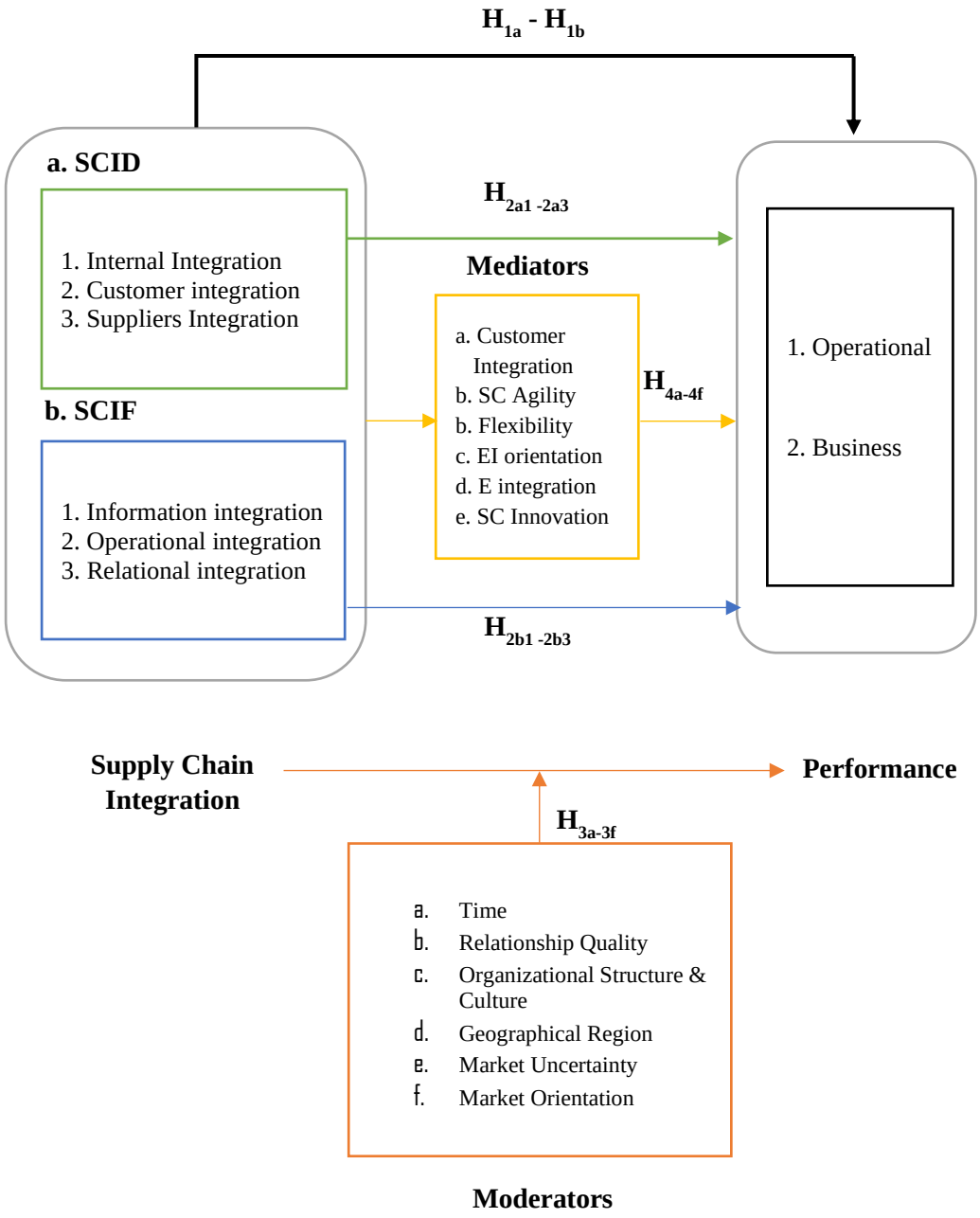

Figure 5: Research Model

CHAPTER 2: RESEARCH METHODOLOGY

2.1. Introduction

This quantitative research was carried out with the main aim of evaluating the effect of Supply Chain Integration (SCI) on performance (Operations and Business) between the period 2010 to 2019. The period was equally significant as one of primary goals of this study was to investigate the effects of moderators and mediators within this period. A Meta-analytic approach was adopted to explore the effect of SCI implementation on the performance of organisations. Presented in this chapter are discussions of the methodology and research design, detailed explanation of sampling and sampling procedures as well as data analysis procedures and the meta- analysis software used.

2.2. Research Design and Rationale

A quantitative comprehensive meta- analysis was adopted in order to determine the impact of SCI on performance. A meta-analysis becomes necessary especially where a topic with complex constructs and contradictory results is involved. The SCI-performance association has been conducted from different perspectives through different theoretical lenses. Conflicting conclusions were drawn on this association by many studies both primary and meta reviews. Furthermore, many studies have pointed out that this association is surrounded by many moderating and mediating factors. A quantitative meta-analytic design has the ability to address these issues and test for the effects of both moderating and mediating variables. However, in order to effectively address the above highlighted objectives, hypotheses and contribute to the SCI- performance literature, a mixed approached was adopted. Additionally, mediation analysis was included to this meta analytic design. Meta-analysis is not only an objective and quantitative technique through which empirical studies on a topic with inconsistent or vague results could be statistically integrated or aggregated to assess their effects size. It has also proven effective even in supply chain management and related studies. For instance, though with conflicting results two earlier meta analyses in SCI literature, Leuschner et al., (2013) and Mackelprang et al., (2014) successfully used meta analytic approaches to address the SCI-performance argument.

Critical to any meta analytic review are the inclusion and exclusion criteria. Equally, this study adopted specific inclusion criteria to include and combine only relevant and useful studies. The chosen criterion is consistent with meta- analytic procedures for a thorough assessment of scale items suggested by Hunter & Schmidt (2004) and Ellis (2010). Thus, the following steps and questions were observed to develop the criteria in the next section:

i. Was the scale used consistent the study's constructs and definitions of SCI?

ii. Are the constructs consistent with any of study's dimensions of performance?

iii. Are there any moderators in the studies?

iv. Are 75 percent of the items closely related to the studies definitions of constructs?

Thus, every selected study was assessed in light of these conditions. Though a detailed inclusion and exclusion criteria is provided under section 2.3.2.

2.3. Sample and Sampling Procedure

A thorough literature search was conducted both electronically and manually to obtain a relevant sample for this study. Search terms "integration, logistics, process integration, collaboration, and coordination" were used to identify studies done between 2011 and 2019 in supply chain management literature to include in the study. Subsequently, each article was carefully examined to identify the SCI dimension (i.e. internal, supplier, and customer integration) or facilitator (i.e. Operational, informational, and relational) it focused on. A slight deviation from most SCI- performance relationship studies, lies in the fact that this study has opted to address SCI from two perspectives. Opposed to simply classifying SCI as II, CI, and SI which in this study is referred to as dimensions, SCI is also viewed in terms of facilitators; operational, relational, and informational integration. Thus, SCI was considered in terms of dimensions if and when it was thus treated in the study. This was done to address the argument raised by Autry et al (2014) regarding the conflicting results of meta studies by Leuschner et al (2013) and Mackelprang et al (2014). This would provide insight on how SCI from two perspectives would influence performance. However, the same sampling procedure is used for both samples.

2.3.1. Computerized Database Search

Studies were obtained through electronic databases with the help of E-Library resources. Thus, for a comprehensive and reliable sample the researcher used popular e- databases such as Emerald Insight, ScienceDirect, $EBSCO_{host}$, Researchers Gate, Academia, ProQuest, SAGE Journals, Wiley, Springer and Google scholar. The search yield studies whose publications were included in the following journals: Journal of Operations Management, Production and Operations Management, Decision Sciences Journal, Management Science, Manufacturing and Service Operations Management, International Journal of Production Research, International Journal of Operations and Production Management, International Journal of Production Economics, Journal of Business Logistics, Journal of Supply Chain Management, International Journal of Logistics Management, International Journal of Physical Distribution and Logistics Management, Management Information Sciences Quarterly, Information Systems Research and Journal of Management Information Systems. These journals happen to be the major outlets for empirical studies in SCI and SCM related.

2.3.2. Manual Search

The researcher searched for some studies which could not be identified through electronic databases. This was done as an attempt to avoid the file drawer problem (publication bias) which is commonly associated with meta studies especially where a number of important unpublished studies are ignored or unaccounted for. As suggested by Lipsey & Wilson(2001) and Ellis (2010) a thorough search for relevant unpublished studies was conducted on ProQuest and EBSCO search engines. However, detailed diagnostic analyses such as the Rosenthal Fail-safe N were conducted to address the file drawer or publication bias problems. Nonetheless, for the purpose of a thorough meta-analytical study, a 3-stage literature review was conducted to obtain the sample.

2.3.3. Inclusion and Exclusion Criteria

Inclusion and exclusion criteria were developed with the guidance of Hunter & Schmidt (2004) and Ellis (2010) highlighted above as well as with the help of successful meta studies such as Leuschner et al., (2013), Mackelprang et al., (2014), Chang et al., (2015) and Ataseven et al., (2017). This was done in order to ensure that only relevant studies

are sought for and included. Retaining only those studies which have specific and relevant attributes would ensure that the file- drawer effect as well as the orange- apple meta-analysis problem is reduced. Thus, whenever a study used constructs measures or labels that are different from the ones considered in this study for SCI and performance, the items underlying these constructs in that paper were carefully evaluated to determine whether they are consistent with this study's conceptualisation or at least were easily convertible to conform to the study's conceptualisation based on the inclusion guidelines above and the criteria below .

A meta study obtains and combines primary studies as sample or input data for analysis. The process of gathering studies requires a rigorous and systematic procedure. Therefore, in order to ensure that only relevant primary studies were selected and included in the analysis the following criteria were used:

- Only English papers across the globe (any country)
- Empirical studies on the topic
- At least one measure of performance
- At least one facilitator or dimension of SCI
- Articles that at least assessed the SCI- performance linkage
- Provides the effects size which can be converted to r correlations
- Published within the time frame 2010- 2019

The above criteria were followed as both an inclusion and exclusion criteria for obtaining a relevant and representative sample of empirical primary studies from literature. This was done in order to help in avoiding the problem of mixing apples with oranges which yields spurious results. A common problem that may occur when dissimilar studies are combined for a meta-analysis.

With the help of the stated inclusion and exclusion criteria, primary studies were sought from well-known and reliable databases. These sources included but not limited to Emerald Insight, ScienceDirect, EBSCO, ProQuest, Wiley, ResearchersGate etc. for both published and unpublished studies. Snowballing method was also used to obtain more studies on SCI-performance topic.

The above stated criteria were strictly followed in determining studies that should be included or excluded in this study.

2.3.2.1. Results of Searches and Primary Sample Selection

The primary stage of the literature search on key terms such as "*Supply Chain Integration*", "*Supply Chain Collaboration, Cooperation or Coordination*", "*Logistic Integration*", "*operational performance", and "Business performance"* in databases such as Emerald Insight, ScienceDirect, EBSCO, ProQuest, ResearchersGate etc. produced a total of 300 published and unpublished articles which could be considered as empirical for the period 2010 to 2019. In order to determine whether the collected 300 studies examined the relationship between SCI dimensions, facilitators and performance dimension selected for study, the abstracts of all the retrieved studies were reviewed. In some case study methodologies, results and/or conclusion section were examined to ensure that they measured key and relevant constructs as well as the relationship between SCI and performance. Where necessary the hypotheses of some primary studies were critically reviewed to determine if in some way, they assessed the relationship in question. This process coupled with the time frame allowed for the elimination of 180 studies which failed to meet the inclusion criteria. Leaving a total of 120 studies to be considered for further evaluation. See appendix 5 for sampling process.

2.3.4. Final Sample Selection

The full details of the remaining 120 studies were carefully reviewed on a one by one case with the inclusion criteria strictly applied to determine their suitability for meta-analysis. This process resulted in the final exclusion of 28 studies, thereby retaining 92 studies for the meta-analysis. A total of 92 sample studies consisted of 25 studies which measured the relationship between SCI and performance from the perspective of facilitators (SCIF), while the remaining 67 measured dimensions of SCI (SCID). The 28 excluded studies were discarded mainly due to their inability to report effects that could be easily converted to Pearson correlation as well their inability to satisfactorily meet the inclusion criteria. Descriptive summaries of the included sample studies are provided in table 18 and table 19 in appendix 1;

2.4. Coding of the Studies

A critical part of meta-analysis beside sample selection is coding of sample studies. In a typical meta-analysis, coding depicts the extraction and recording of important attributes or characteristics from individual empirical sample studies that have in the meta-analysis. Though tedious, coding provides an opportunity for the researcher to present underlining characteristics of the studies that meet the inclusion criteria. The coding of SCI-performance (Operational & Business) studies was carried out through a three (3) step procedure; designing of coding form, establishment of coding instructions and the determination of coder reliability.

2.4.1. Coding Form

Similar to questionnaires, coding forms in meta studies are instruments used by researchers to extract all the necessary information from every single sample study. The coding form was designed to capture key information such as the author's last name, year of publication, and the name of the journal, sample size, method, dimensions or facilitators and different dimensions of performance. The coding form contains all the relevant data extracted for this meta evaluation. Thus, appendix 6 contains the coding form used for this meta evaluation.

2.4.2. Coding Information

A total of 15 items of information were obtained through the coding form. The collected information was classified into main three categories; identification of the study, sample and outcome characteristics. Identification of the study provides individual study's basic descriptives such as the author's name, method, publication year and the journal it was published in. Sample characteristics highlights the nature of the included study such as the geographical region, type of analysis design used, and the sample size used in the selected study. On other hand, the outcome characteristics includes detailed information such as the operationalisations of both SCI and performance dimensions. The type of effect sizes in sample studies were also classified under outcome characteristics.

2.4.3. Coding Instructions

A set of instructions were established based on the coding information to facilitate the coding process. In this set of instructions lies a detailed description of how all the required

data for the meta-analysis was sought. Not only did these coding instructions guidelines but they also acted as a means to reduce sample ambiguity. See attached appendix 7 for these coding instructions.

2.4.4. Coding Reliability

Primary studies were coded and analysed with the help of Jamovi and Meta essentials, meta- analysis software specially built for the purpose of systematic and meta reviews. All the necessary coding reliability test as well as the coding for this study were done with the help of Excel and Jamovi. The coding process was done a number of times with the help of these software to ensure coding reliability. About 15 items were coded in two software until no differences were observed. This done to ensure that no relevant item was let out during the coding process. The output obtained through this application were used to conduct heterogeneity test and moderator effect tests. The random effects model was used for analysis and interpretation of findings as the primary studies were not collected from a homogeneous source.

2.5. Effect Size Conversion and Estimation

A correlational meta-analysis, as recommended by Schmidt and Hunter (2004), and adopted by Mackelprang et al., (2014), Leuschner et al (2013), and Ataseven & Nair, (2017) requires that effect sizes in the sample be in Pearson's correlation, r. Thus, effect sizes used in the study were all converted into the Pearson correlation using Hunter and Schmidt's (2004) formula and Wilson effect size calculator. Psychometrica (2018) and the Wilson (2016) effect-size calculators provide meta-analysts with the opportunity to compute effect sizes from a variety of statistical data as well as convert them from one effect size to a desired metric (r). After the study characteristics were properly coded and effect sizes converted to r (the common metric), the final meta-analysis was carried out on deattenuated correlations.

The correlation between SCI and performance in the sample was computed by weighting the correlations between SCI dimensions or facilitators and performance dimensions. Cronbach's alpha was used to record average reliability scores of SCI dimensions or facilitators in each study that was included in the sample. Similarly, Cronbach's alpha represented the weight of reliability scores of performance dimensions which were used

as the performance reliability in this evaluation. In this study, performance is an aggregate or amalgamation of different performance outcomes which could simply be classified as Business and operational measures. However, in order to assess the specific effect of SCI on individual performance outcomes or measures, overall performance was broken down into individual specific measures (business and operational performance) in the analysis.

2.6. Interpretation of Effect Sizes

Similar to any quantitative research interpretation of effect size is very essential. Thus, standards for interpreting meta effect sizes were adopted to provide a logic and meaningful understanding. Specifically, Cohens (1992)'s effect size standards were found to be appropriate for interpreting effect sizes. For instance, he classified effect sizes (r) into small (i.e. below 0.10), medium (i.e. between 0.3 & 0.50), and large (i.e. above 0.5). Thus, the interpretation of the magnitude of every effect size in this evaluation was based on Cohens standards.

2.7. Data Analysis

Similar to most meta-analytical reviews, this evaluation began with selection of appropriate sample, coding and the conversion of effect sizes into a desired statistic. Model selection is one of the most important steps of the meta-analysis process. Basically, there are two main categories of models for meta-analysis, the fixed effect (FE) model and the random-effect (RE) or mixed effects model. The nature of the SCI- performance association contains a variety of studies with different constructs and measures. For a sample that contains studies with diverse measures and constructs, a fixed model would not suffice. Therefore, the random-effect model was adopted for this meta evaluation. Moreover, Schmidt and Hunter (2014) recommended that the random-effect model should be used when all the studies under analysis are not homogeneous across population effect sizes. Thus, the random-effect model was used to conduct significance tests and confidence intervals for the study.

According to Hunter & Schmidt (2004) one of the main advantages of a meta-analytical approach is that it enables the researcher to evaluate relevant construct measurement characteristics as well as sampling errors which may explain or account for the variability in effect sizes. The operationalisation of SCI construct and inter-construct correlations as

well as scales in literature vary across studies. Using a meta-analytic approach, the constructs of each included study were put into priori groups. These categories were used to test the study's hypotheses stated in the previous chapter. This was done by splitting these studies into specific sub-groups based on their construct operationalisation. There are various scales used in the of supply chain integration literature. Meta-analysis is very helpful in aggregating various constructs and measurement efforts to test and formulate theory. Thus, this study focuses on three main dimensions and three facilitators of SCI to contribute to the theoretical development and generalized understanding of the SCI-performance association. In an attempt to address the inconsistencies and contradictions on the topic, the study goes beyond identifying moderating and mediating factors like some studies have done. The effects of identified mediators and moderators are assessed to determine the extent to which they influence SCI- performance association. These moderators may allow for an evaluation of a specific and more detailed view of SCI-performance association which may provide insight on the conditions that affect the association. Categorical moderators in this study were evaluated by developing specific subgroups which were compared against the main effects to determine the impact of some specific moderator factors. Continuous moderators were evaluated using mixed random in Jamovi.

Furthermore, the study used two statistical applications for data analysis. Meta essentials, and Jamovi were used to analyse data. The two applications were very effective and complementary in dealing with the SCI- performance, moderators and mediating factors. All the two were chosen because no single applications could provide all the tools needed for analysis.

2.8. Statistical Artefacts

Although Schmidt and Hunter (2014) identified 11 distinct artefacts that must considered in a meta-analytic study, not all could be covered in a single study. The number and type of artefacts to consider depends on the nature of the sample and the study being pursued. In a meta-Analysis, artefacts refer to errors in the primary studies that may arise from study imperfections which must be corrected using statistical techniques and information. This study however, considered, two major artefacts of interest; sampling error and measurement error.

2.8.1. Sampling Error

Sampling error arises from primary studies sample characteristics. Usually larger samples are known to accurately represent the population of interest, while the opposite could be said regarding smaller sample sizes. Schmidt and Hunter (2014) pointed out sampling error is one of the most damaging artefacts in review studies. Therefore, sampling error was corrected by weighing the study findings against their sample sizes. According to Hunter and Schmidt (2004) aggregation of multiple studies through meta-analysis, offsets the sampling errors associated the studies included in the sample such that the average sampling error becomes effectively zero. This involved computing weighted effect sizes for every study based on their corresponding sample sizes. Meta essentials and Jamovi simplified this process of weighting effect sizes needed to correct sampling error in this study.

2.8.2. Measurement Error

Measurement error as the second artefact that needed covering in the study, was done through the help of a reliability formula below. Measurement error is inversely proportional to reliability. This simply means that the higher the reliability coefficient the less measurement error and vice versa. Variations in terms of measurement and the corresponding measurement errors usually affect the size of the correlations in primary studies**.** This may lead to the attenuation for the relationship between SCI and performance. Thus, as an attempt to correct for this attenuation, reliability information from individual primary studies regard both SCI and performance constructs or variable was used. The Schmidt and Hunter's reliability formula which is especially suited for Pearson product-moment correlation effect size was adopted to obtain reliability measure were where the study did not provide for them. The formula is stated as;

$$\mathbf{r'}_{xy} = \frac{\mathbf{rxy}}{\sqrt{r_{xx}.r_{yy}}}$$

Where; $r_{xy}{}'$ is the corrected, weighted correlation coefficient; r_{xy} is the uncorrected, unweighted correlation coefficient; r_{xx} is the reliability for SCI; and r_{yy} is the reliability for performance.

2.9. Heterogeneity Analysis

Effect size vvariations which could be associated with systematic and cross-sample variability was assessed in this study. The model random-effect model, held under the assumption that the true effects are normally distributed, requires testing for heterogeneity. Thus, to test for the presence of heterogeneity in the study as well as assess the effects of moderators and mediators, heterogeneity analysis was deemed necessary. From the many available methods for testing heterogeneity, the Q statistic and the I^2 index were found suitable for this review. A significant Q statistic, according to Borenstein et al. (2009), may indicate the presence of moderators. On the other hand, the I^2 index according to Higgins et al. (2002) reveals the strength or degree of heterogeneity. Unless, coupled with the I^2, a significant Q statistic does not tell us much about the size of heterogeneity. It is I^2 which could be classified as low, moderate, and high that tells a lot about heterogeneity. For instance, I^2 of 25 percent could be said to represent low heterogeneity. Whereas that of 50 percent could represent a moderate. However, this depends on the interpretation standards adopted in the study in question.

2.10. Moderator Analysis

One unique advantage of meta-analytical evaluations over narrative reviews such as systematic reviews is their ability to assess the effects of moderators on the association under scrutiny. Moderators, though not entirely may account for variability in effect size estimates across studies. The relationship between SCI and performance in literature as see in the hypotheses development section above may contain a number of moderators. It is in the interest of this study to assess effects of these moderators as well as determine their significance to the SCI-performance association. However, a detailed discussion on how moderators are assessed is provided in the analysis chapter, under the meta analytic procedure section.

2.11. Mediation Analysis

One of the reasons for conducting a mixed meta research from 2010 to 2019 was to determine the effects of different mediators between SCI and performance. Primary studies on SCI- performance association, especially around this time have shown interest in identifying mediators. Since a number of previous meta studies have not done likewise.

This review acts as one of the few studies to assess the effects of mediators and determine whether this could add clarity to the SCI- performance association. Mediation is the kind of relationship that may occur when a third construct Z or mediator is involved in the analysis between two other constructs X and Y. X denotes the independent construct and Y the dependent construct. The relationship exists in such a way that X is the cause of Z which, in turn, is the cause of Y. For instance, if SC agility really is the mediator between internal integration and customer satisfaction, then it means that a direct significant relationship exists between internal integration and agility where agility in turn influences customer satisfaction. This also implies that if any direct relationship exists between internal integration and customer satisfaction, it must be weak and only strengthened through agility.

Mediation effects can either be full or partial. Under full mediation the direct effect between X and Y is no longer significant when the mediating variable (Z) is introduced. On the contrary, in partial mediation the direct effect does not completely disappear altogether though it decreases and a direct effect (between X and Y) and an indirect effect (X-->Z-->Y) exist alongside each other with the full effect being the sum of the direct and indirect effects. According to Hair et al., (2018) mediation can be said to be non-existent if the indirect effect is insignificant and the confidence interval equal to zero. In order to test various mediators identified in hypotheses section, Jamovi software was used.

2.12. Summary

The chapter provides information on various meta analytical processes through which the inclusion and exclusion criteria needed for final sample collection was based. A meta-analytical evaluation has been argued to be one of the most effective techniques for correcting a number of artifacts such as measurement and sampling errors. The Pearson's correlation coefficient (r) was adopted as the effect size measure for this meta evaluation. Included also are the methods or techniques used to obtain and were necessary convert some study findings into r. Whenever a study used constructs measures or labels that are different from the ones considered in this study for SCI and performance, the items underlying those constructs in that paper were carefully examined to ensure whether they are consistent with this study's conceptualisation or at least were easily convertible to

conform to the study's conceptualisation. Estimation and interpretation standards were equally outlined in this section. The study used Jamovi, and Meta essential as statistical software for computing and analysing data.

Furthermore, this chapter discusses how individual studies were corrected for statistical artefacts; sampling error and measurement error to mitigate errors in their findings that could have resulted from their samples, sampling techniques and statistical analysis of empirical data. The random-effect model adopted for the analysis presents a higher possibility of heterogeneity even after the correction of the statistical artefacts. Thus, efforts were made to assess the degree to which heterogeneity could influence the SCI-performance through moderation and mediation analysis.

The next chapter therefore presents the meta-analytic procedure and the heuristics leading to the quantitative synthesis of effect size data as well as the detailed analysis and presentation of the research findings. Research findings have been arranged carefully and presented in terms of the hypothesis and research questions for easy discussion and understanding of the SCI- performance in relation to theory. Tables and figures were also employed as a means for presenting and communicating research results.

Despite these differences, as long as the main hypothesized relationships between independent and dependent variables are the same, meta-analysis methodology allows these distinct conceptualizations to be used for analyzing the broad concept (Hunter & Schmidt, 2004). This idea, referred to as multiple operationism (Webb et al., 1981), suggests that the same concept can be evaluated by multiple measures that have some imperfections and irrelevancy to them. Nevertheless, at a higher level of abstraction the core idea remains the same. If the latent construct can be measured with these multiple realizations and can still reveal associational patterns between variables, the uncertainties regarding the relationships are greatly reduced of supply chain integration that can be found in the literature.

The remainder of the study is organized as follows. The theoretical background and research hypotheses are developed in the following section. Following that section, the research methodology is described and results of the meta-analysis are reported. Last, conclusions are presented, including theoretical implications, managerial implications, limitations and recommendations for future research.

CHAPTER 3: FINDINGS AND DATA ANALYSIS

3.1 Introduction

This section presents the findings and analysis of data as well as interpretation of the study findings. The section begins with a summary of studies included for the meta-analysis after a thorough inclusion and exclusion process in appendix 1. A total of 92 studies were obtained and coded as the final sample, see appendix 2 and 3. The sample consisted of 67 studies which were classified under SCI dimensions while the remaining 25 were categorised as facilitators. Studies were classified in terms of dimensions or facilitators, if they explicitly did so. A description of study characteristics is equally provided as well as all the necessary procedures and discussion leading to actual hypotheses testing. Ultimately research questions and objectives are addressed in this chapter. The primary research objective, mediator and moderator analyses are carefully addressed in this section. The primary question being, is there a significant association or effect between SCI and performance? If any, which aspect/perspective or operationalisation of SCI (e.g. dimensions or facilitators) has a higher significant influence on performance?

3.2 Characteristics of Study sample

For the purpose of obtaining a single correlation coefficient, multiple correlations were averaged where necessary. Thus, mean correlations were derived from studies with more than one dimension or facilitator. However, where SCI was treated as a unidimensional construct the correlations were acquired without any averaging. Correlations ranging from .117 to .872 with a sample population (N) of 16812 were extracted from 67 SCID primary studies. Asia- Pacific region accounted for the majority of studies whose details are provided below. Correlations for SCIF which were composed of 25 primary studies, ranging from .150 to .873 with a sample population of 5600.

Table 2 and Table 3 provides a summary of the effect size profile for SCID and SCIF respectively. The profile includes among other many attributes, geographical region and journals in which the studies where published. The distribution of these articles with regard to year and the methods used are provided below the study profiles.

Profile of Sample Studies

Table 2 as pointed out above shows the profile of studies which considered SCI in terms of internal, customers, and suppliers' integration. Such studies as earlier noted are regarded as SCID or dimensions SCI. In the table r represents mean correlations with 0.117 as the smallest and 0.872 as the largest. Note that full journal names are provided in the appendix section.

Table 2: SCID Study Profile

ID	Authors	Year	Method	Journal	Sample	r	Region
1	Pakurár et al	2019	Regression	JIS	112	0.324	Middle East
2	Jermsittiparsert et al	2019	PLS- SEM	IJSCM	80	0.531	Asia Pacific
3	Xu et al	2014	Factor Analysis	IMDS	176	0.355	Asia Pacific
4	Evans Maroko Mose	2015	Correlation analysis	EAJ	52	0.805	Africa
5	Zhao et al	2013	SEM	SCMAI J	317	0.417	Various
6	Suntichai et al	2012	SEM		261	0.117	Asia Pacific
7	Geoff Willis & Chen	2016	SEM- Factor Analysis	IJLM	92	0.175	Asia Pacific
8	W. Ni & Hongyi Sun	2019	PLS-SEM	SJ	162	0.796	Asia Pacific
9	D Ying	2016	SEM & Hierarchical regression	RP	385	0.398	Asia Pacific
10	Osei &Kagnicioglu	2018	SEM	JMML	208	0.440	Asia Pacific
11	Muntaka et al	2017	Correlation analysis & SEM	IJBM	255	0.282	Africa
12	Alfalla-Luque	2015	SEM	IJPE	266	0.336	Various
13	Annan, J, Boso et al	2016	Factor Analysis	IJSCM	199	0.477	Africa
14	Antonius Setyadia	2018	PLS- SEM	USCM	300	0.173	Asia Pacific
15	Chaudhuri	2018	Factor Analysis	IJOPM	343	0.498	Asia Pacific
16	Baofeng Huo	2012			617	0.290	Asia Pacific
17	Huo et al	2014	Hierarchical regression	SCM	607	0.450	Asia Pacific
18	A. Subburaja et al	2019		USCM	250	0.307	Asia Pacific
19	Abdallah et al	2014	Hierarchical regression	IBR	104	0.300	Middle East
20	Chatzoudes et al	2011	SEM	OSCM	132	0.324	Europe
21	Delic et al	2019	PLS-SEM	SCMIJ	124	0.233	Europe
22	Uwamahoro	2018	SEM	EARP	250	0.407	Africa
23	Errassafi et al	2019	PLS-SEM	JIEM	75	0.420	Africa
24	Kumar, V. et al	2017	Correlation analysis	FAIM	60	0.236	Europe

							Asia
25	Hung Bae	2011		AJSL	208	0.395	Pacific
26	Beheshti et al	2015	Regression Analysis	JGC	271	0.393	Europe
							Asia
27	Lu et al	2018		GJFSM	357	0.378	Pacific
28	Ibrahim & Hamid	2012	Hierarchical regression	IJSR	110	0.231	Africa
29	Kwamega et al	2018		SAJBM	162	0.713	Africa
							Asia
30	Erdinç Koç et al	2018	Factor Analysis	IJSCM	390	0.236	Pacific
							Asia
31	Habibullah Khan	2019	SEM	JOSCM	257	0.468	Pacific
							Asia
32	Sutduean et al	2019	Factor Analysis	IJICC	278	0.557	Pacific
33	Ralston et al	2014	SEM	JSCM	220	0.457	N America
	Sacristán-Diaz et			JTQMB			Asia
34	al	2017	SEM	E	308	0.432	Pacific
35	Mofokeng et al	2019	PLS-SEM	SAJBM	271	0.652	Africa
							Asia
36	Wasim Syed et al	2019		SJ	296	0.526	Pacific
	Afshan &						Asia
37	Motwani	2018	SEM	BIJ	214	0.299	Pacific
38	Odongo	2017	Regression Analysis	RP	25	0.247	Africa
	Danese &			SCMAI			
39	Romano	2011	Hierarchical regression	J	200	0.425	Various
							Middle
40	al Naqbi et al	2018	PLS-SEM	IJET	225	0.207	East
	Saeed Shahbaz et						Asia
41	al	2019	SEM- Regression Analysis	RCSH	362	0.333	Pacific
							Asia
42	Chul-hwan Han	2018	Hierarchical regression	AJSL	47	0.264	Pacific
							Asia
43	M. Huang et al	2019	Factor Analysis	APMR	84	0.160	Pacific
							Asia
44	Koçoglu et al	2011	SEM Factor Analysis	PSBS	158	0.608	Pacific
				SCMAI			Asia
45	Liu et al	2018	SEM	J	216	0.363	Pacific
				EJLPSC			
46	Atnafu & Hussen	2017	Correlation Analysis	M	35	0.425	Africa
							Asia
47	Sriyakul et al	2019	PLS-SEM	HSSR	319	0.125	Pacific
							Asia
48	de Vass et al	2018	SEM	AJIS	227	0.343	Pacific
							Asia
49	Hien Phana et al	2019	SEM	USCM	1000	0.533	Pacific
	Thoo Ai Chin et						Asia
50	al	2014	SEM Factor Analysis	PSBS	201	0.483	Pacific
							Asia
51	Özdemir & Aslan	2011	Hierarchical regression	AJBM	181	0.526	Pacific
	Torsten Doering						
52	et al	2019	Hierarchical Linear Model	CBM	1017	0.233	Various
							Asia
53	Vanpoucke et al	2014	SEM	JOM	719	0.593	Pacific
				IJARBS			Asia
54	Makhdoom et al	2016	Regression Analysis	S	150	0.545	Pacific

55	Yaw Agyabeng et al	2019	PLS-SEM	JSCM	275	0.259	Africa
56	E. N. Yunus et al	2016	Factor Analysis- SEM	BPMJ	446	0.391	Asia Pacific
57	S M Ebrahimi	2015	SEM-Factor Analysis	RP	181	0.205	Various
58	Wantao Yu et al	2013	SEM	IJPE	214	0.394	Asia Pacific
59	Yongtao Song et al	2017	Hierarchical Regression	SJ	214	0.378	Asia Pacific
60	Veera Pandiyan et al	2016	PLS Analysis	BAIJ	156	0.872	Asia Pacific
61	Didia &. Nwokah	2015	Correlation analysis	IJSCM	28	0.301	Africa
62	Wantao Yu	2014	Confirmatory Factor Analysis	SCMAIJ	126	0.222	Asia Pacific
63	Hamza Saleh	2015	correlation and regression	RP	135	0.519	Middle East
64	Himanshu Shee et al	2018	PLS-SEM	SCMAIJ	105	0.391	Asia Pacific
65	He & Lai	2012	Factor analysis	IJPE	229	0.207	Asia Pacific
66	Flynn et al	2010	Hierarchical regression	JOPM	617	0.374	Asia Pacific
67	Boon & Wong	2011	Hierarchical Analysis	IJPDLM	151	0.183	Asia Pacific

Table 3 as noted earlier shows the profile of studies which considered SCI in terms of Informational (InfI) Operational (OpI), and Relational Integration (RI). Such studies as earlier noted are regarded as SCIF or Supply Chain Integration facilitators. In table 3 below, **r** represents mean correlations with .150 as the smallest and .873 as the largest. Though, with a smaller sample of 25 primary compared to SCID with 67, SCIF has a slightly wide range of mean correlations.

Table 3: SCIF Study Profile

ID	Authors	Year	Method	Journal	Samp	r	Region
1	Jermsittiparsert et al	2019	PLS- SEM	SJ	80	0.750	Asia Pacific
2	Xu et al	2014	Factor Analysis	IMDS	176	0.340	Asia Pacific
3	Suntichai et al	2012	SEM		261	0.327	Asia Pacific
4	Antonius Setyadia	2018	PLS-SEM	USCM	300	0.236	Asia Pacific
5	Huo et al	2014	Hierarchical regression	SCM	607	0.340	Asia Pacific
6	Abdallah et al	2014	Hierarchical regression	IBR	104	0.247	Middle East
7	Nimeh et al	2018	Factor Analysis	IJSCM	308	0.238	Middle East
8	Liu et al	2013	Hierarchical regression		246	0.405	Asia Pacific

9	Naway & Rahmat	2019	PLS-SEM	USCM	197	0.221	Asia Pacific
10	Panahifar et al	2018	PLS-SEM	JIEM	189	0.794	Asia Pacific
11	Ince et al	2013	SEM	PSBS	138	0.560	Asia Pacific
12	Som et al	2019	Regression Analysis		400	0.307	Africa
13	Ibrahim & Hamid	2012	Hierarchical regression	IJSR	110	0.150	Africa
14	Kumar, V. et al	2017	Correlation analysis	FAIM	60	0.873	Europe
15	Yuen & Vinh V. Tha	2016	Regression Analysis	TJ	172	0.380	Asia Pacific
16	Khalid H. M. et al	2017	Factor Analysis	SCM	182	0.387	Africa
17	Sutduean et al	2019	Factor Analysis	IJICC	278	0.346	Asia Pacific
18	Prajogo & Olhager	2011	SEM	IJPE	232	0.310	Asia Pacific
19	Saichon Pinmanee	2016	SEM	RP	429	0.550	Asia Pacific
20	Koçoglu et al	2011	SEM Factor Analysis	PSBS	158	0.362	Asia Pacific
21	Thoo Ai Chin et al	2014	SEM factor Analysis	PSBS	201	0.396	Asia Pacific
22	Veera Pandiyan et al	2016	PLS Analysis	BAIJ	156	0.570	Asia Pacific
23	Francis Admire	2019	Correlation & regression	R paper	235	0.705	Africa
24	He & Lai	2012	Factor analysis	IJPE	229	0.418	Asia Pacific
25	Wiengarten et al.	2010	Factor Analysis	SCMAIJ	152	0.323	Europe

Publication Year of Sample studies

Figure 6, indicates the distribution of the year publication for primary studies under SCID. It can be seen from the figure that 2019 had the highest number of articles. 16 articles were published in 2019 which makes up 23.9% of the total sample. Following 2019 was 2018 with 13 studies (19.4 %), and 2014 with 7 studies (10.4%). 2011, 2015, 2016, and 2017 have the same frequency of 6 studies (9.0%). Only 1 study was included from 2010 which accounted for 1.5%. This also shows that about 80.7% of the studies included were recent and published after the publication of previous meta studies.

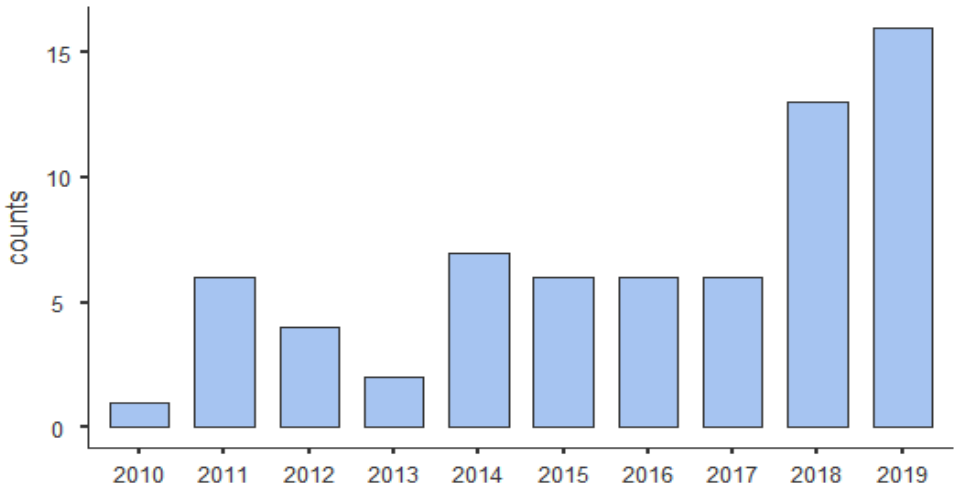

Figure 6: Distribution of Publication Year for SCID Sample Studies

Method Used in the Sample

Table 4, indicates the distribution of methods used by sample studies. SEM was the highest with 16 studies which make 23.9% of the total sample. The lowest being Hierarchical Linear Model. Thus, in terms of ranking by frequency, SEM is first, second PLS-SEM, third Factor Analysis, fourth Hierarchical regression, fifth Correlation Analysis, sixth SEM-Factor Analysis, and the last one being Hierarchical Linear Model. This can be seen from the counts and percentage totals provided in table 4 below.

Table 4: Methods Used in SCID Sample

Method	Count	% of Total	Cumulative %
Factor Analysis	12	17.9 %	17.9 %
SEM	16	23.9 %	41.8 %
PLS-SEM	14	20.9 %	62.7 %
Hierarchical regression	11	16.4 %	79.1 %
Regression Analysis	4	6.0 %	85.1 %
SEM Factor Analysis	3	4.5 %	89.6 %
Correlation Analysis	6	9.0 %	98.5 %
Hierarchical Linear Model	1	1.5 %	100.0 %

Geographical Region of the Sample

Table 5 show the frequency of sample studies by region. Asia-Pacific region had by far the largest number of studies compared to other regions. 61.2% of the studies which is a total of 41 were based in this geographical region. The second was Africa with only 12 studies. Ironically only one study was included from North America and a few studies from Europe. Various were studies based on multiple regions.

Table 5: Geographical Region Distribution of SCID sample

Region	Counts	% of Total	Cumulative %
Middle East	4	6.0 %	6.0 %
Asia Pacific	41	61.2 %	67.2 %
Africa	12	17.9 %	85.1 %
Various	5	7.5 %	92.5 %
Europe	4	6.0 %	98.5 %
N America	1	1.5 %	100%

Distribution of Sample by Journal

Table 6 is an illustration of the distribution of sample studies by journal which is very important for assessing publication quality. Journals such as International Journal of Supply Chain Management (IJSCM), Supply Chain Management an Internal Journal (SCMAIJ), Journal of Operations Supply Chain Management (JOSCM), Journal of Supply Chain Management (JSCM) and Uncertain Supply Chain Management (USCM) are known to produce quality studies on Supply chain articles. SCMAIJ had the highest number of published articles with 7 studies, followed by both IJSCM and JSCM with 4 studies, and USCM with 3. Though, distributed across many journals as seen in table 6, the majority of articles are published in supply chain, production and operations management journals. It is worth noting that out of the 67 articles, 4 were research papers (RP) as seen in the table below.

Table 6: Frequency Distribution of SCID Sample of by Journal

Journal	Counts	% of Total	Cumulative %
JIS	1	1.5 %	1.5 %
IJSCM	4	6.0 %	7.5 %
IMDS	1	1.5 %	9.0 %
EAJ	1	1.5 %	10.4 %
SCMAIJ	7	10.4 %	20.9 %
IJLM	1	1.5 %	22.4 %
SJ	3	4.5 %	26.9 %
Research Paper	4	6.0 %	32.8 %
JMML	1	1.5 %	34.3 %
IJBM	1	1.5 %	35.8 %
IJPE	3	4.5 %	40.3 %
USCM	3	4.5 %	44.8 %
IJOPM	1	1.5 %	46.3 %
IBR	1	1.5 %	47.8 %
EARP	1	1.5 %	49.3 %
JIEM	1	1.5 %	50.7 %
FAIM	1	1.5 %	52.2 %
AJSL	2	3.0 %	55.2 %
JGC	1	1.5 %	56.7 %
GJFSM	1	1.5 %	58.2 %
IJSR	1	1.5 %	59.7 %
SAJBM	2	3.0 %	62.7 %
JOSCM	2	3.0 %	65.7 %

IJICC	1	1.5 %	67.2 %
JSCM	4	6.0 %	73.1 %
JTQMBE	1	1.5 %	74.6 %
BIJ	1	1.5 %	76.1 %
IJET	1	1.5 %	77.6 %
RCSH	1	1.5 %	79.1 %
APMR	1	1.5 %	80.6 %
PSBS	2	3.0 %	83.6 %
EJLPSCM	1	1.5 %	85.1 %
HSSR	1	1.5 %	86.6 %
AJIS	1	1.5 %	88.1 %
AJBM	1	1.5 %	89.6 %
CBM	1	1.5 %	91.0 %
JOM	1	1.5 %	92.5 %
IJARBSS	1	1.5 %	94.0 %
BPMJ	1	1.5 %	95.5 %
BAIJ	1	1.5 %	97.0 %
JOPM	1	1.5 %	98.5 %
IJPDLM	1	1.5 %	100.0 %

Figure 7, indicates the distribution of the publication year for samples under SCIF. It can be seen from the figure that 2019 had the highest number of articles. 5 articles were published in 2019 which makes up 20% of the total sample. Following 2019 was 2014 with 4 studies (16 %), and 2011, 2013 and 2017 with 2 studies (8.0%) each. 2012, 2016, and 2018 had the same frequency of 3 studies (9.0%). Only 1 study was included from 2010 which accounted for 1.5%. This also shows that 68% of the studies included were recent and published after the publication of previous meta studies.

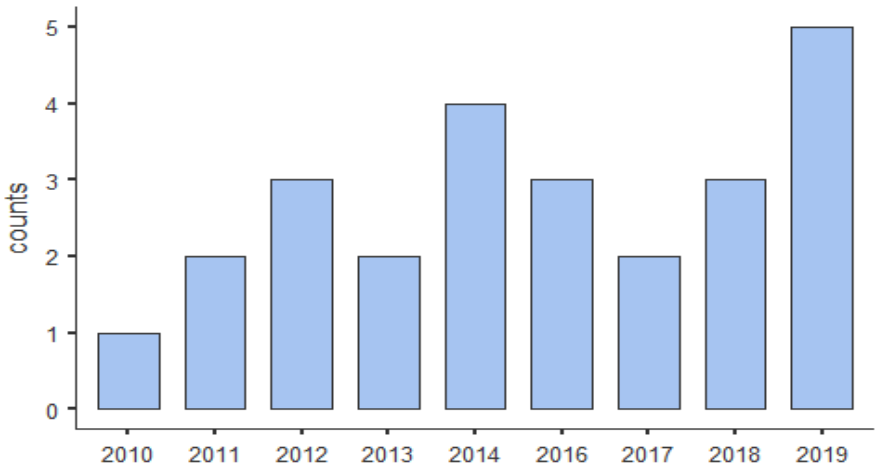

Figure 7: SCIF Sample distribution by Publication Year

Methods Used in SCIF Sample

Table 7 below, indicates the distribution of statistical methods used by sample studies to analyse data. Factor Analysis was the highest with 6 studies which make 24 % of the total

sample. The least being PLS Analysis, Confirmatory Factor Analysis, and correlation analysis with 1 study and a percentage of 4. Thus, in terms of ranking by frequency, Factor Analysis had the majority seconded by PLS-SEM and Hierarchical regression with 4 studies and a percentage distribution of 16%, SEM and Regression Analysis could be ranked as third with 2 studies. All these methods have the ability to provide correlational effect sizes as well as quantitative effects sizes which could be easily converted to correlational outputs.

Table 7: Methods used in SCIF sample

Method	Counts	% of Total	Cumulative %
Factor Analysis	6	24.0 %	24.0 %
SEM	2	8.0 %	32.0 %
PLS-SEM	4	16.0 %	48.0 %
Hierarchical regression	4	16.0 %	64.0 %
Regression Analysis	2	8.0 %	72.0 %
Correlation analysis	1	4.0 %	76.0 %
SEM Factor Analysis	3	12.0 %	88.0 %
PLS Analysis	1	4.0 %	92.0 %
Correlation & regression	1	4.0 %	96.0 %
Confirmatory Factor analysis	1	4.0 %	100.0 %

Sample Distribution by Geographical Region

Table 8 shows the frequency of sample studies by region. Similar to SCID under geographical region Asia-Pacific had by far the largest number of studies compared to other regions under SCIF. A total of 68% which is 17 studies were based on this geographical region. The second largest region was Africa with 4 studies. Middle east and Europe each had 2 studies as seen below.

Table 8: Sample Distribution by Geographical Region

Region	Counts	% of Total	Cumulative %
Asia Pacific	17	68.0 %	68.0 %
Middle East	2	8.0 %	76.0 %
Africa	4	16.0 %	92.0 %
Europe	2	8.0 %	100.0 %

Sample Distribution by Journal

Table 9 is an illustration of the distribution of sample studies by journal which is very important for assessing publication as well as study quality. Journal such as International Journal of Supply Chain Management (IJSCM), Supply Chain Management an Internal Journal (SCMAIJ), International Journal of Production Economics (IJPE), Transportation

Journal (TJ), Journal of Supply Chain Management (JSCM) and Uncertain Supply Chain Management (USCM) are known to produce quality studies on Supply chain related articles. IJSCM had the largest number of published articles with 4 studies, followed by USCM with 3 studies. IJPE and SCMAIJ had the same number of studies and percentage, 2 and 8% respectively. Though, distributed across many journals as seen in table 9, the majority of articles are published in supply chain, production and operations management, Decision Science journals. Included in the sample is a research paper as seen in the table below.

Table 9: Frequency Distribution of SCIF Sample by Journal

Journal	Counts	% of Total	Cumulative %
SJ	1	4.0 %	4.0 %
IMDS	1	4.0 %	8.0 %
USCM	3	12.0 %	20.0 %
IBR	1	4.0 %	24.0 %
IJSCM	4	16.0 %	40.0 %
JIEM	1	4.0 %	44.0 %
PSBS	1	4.0 %	48.0 %
IJSR	1	4.0 %	52.0 %
FAIM	1	4.0 %	56.0 %
TJ	1	4.0 %	60.0 %
IJICC	1	4.0 %	64.0 %
IJPE	2	8.0 %	72.0 %
Research paper	2	8.0 %	80.0 %
PSBS	2	8.0 %	88.0 %
BAIJ	1	4.0 %	92.0 %
SCMAIJ	2	8.0 %	100.0 %

3.3. Meta-Analysis Procedure

Hunter and Schmidt's (2004) meta-analytic procedure was adopted and implemented in an attempt to evaluate the impact of SCI on performance. The purpose for employing this meta- analytic procedure and criteria was to facilitate the amalgamation or aggregation of SCI – performance effect sizes across empirical sample studies. According to Ellis (2010), Hunter & Schmidt (2004) and Raudenbush et al., (1991) a meta- analytic evaluation is a more reliable way for drawing generalisable conclusions. Hence, the reason for the adoption of a quantitative meta- analytic approach to address the topic.

The heuristic nature of the Hunter and Schmidt's (2004) meta- analytic approach is specially, suited for dealing with the difficulties of significance tests and statistical

power especially when a smaller number of studies is involved. It also makes provision for the correction of many artefacts that might affect the effect sizes included in a meta evaluation. As pointed out in chapter two, corrections were made for two main artifacts; measurement and sampling errors in this study.

Weighted correlations (ř) of sample studies are used as effect size estimates for the analysis. Primary studies that reported correlations for multiple indicators of operational performance were averaged to obtain a single effect size for the study. The same was true for studies that reported different business performance outcomes. In an attempt to correct for measurement errors, reliability coefficients for both dependent and independent variables for each sample study were obtained. In cases where a few studies did not provide reliability estimates, mean reliabilities of the available reliabilities were regarded as the reliabilities of the few studies. This idea was borrowed from (Demirbag et al., 2006; Lakhal et al., 2006; Awoku, 2002; and Panuwatwanich & Nguyen, 2017) who justified the use of average reliabilities for that did not report reliability coefficients. Doing this not enabled this study to correct measurement errors for each study based on the Hunter and Schmidt's (2004) formula described in chapter 2, section 2.9.2, it also helped in retaining studies which did not include reliabilities.

Similar to measurement error, corrections for sampling error were done for included studies. This done to ensure that included studies contribute effectively based on an appropriate sample weight. Thus, studies with large sample sizes are expected to be weighted higher than those with small sample sizes. Therefore, to derive appropriate study weights the compound attenuation factor (A) for each study was multiplied by the study's sample (N). This approach was proposed by Hunter and Schmidt (1990), and was highly recommended by many meta studies. A is simply the square root of the product of SCI reliabilities and performance reliabilities ($\sqrt{\boldsymbol{r_{xx}}.\boldsymbol{r_{yy}}}$) in this study and the weights; $W = N \times A^2$. On the other hand, error variance (e) which is based on the weighted or corrected mean correlation (ř) across sample studies was finally obtained using this formula: $e = (1 - \check{r}^2)/(N - 1)\, A^2$.

Additional to deliberate efforts made to minimise the effects of the "file – drawer problem" during the literature search process which ensured that unpublished studies were included in the meta-analysis, the possibility of publication bias was equally

explored for both aggregate and individual constructs. Publication Bias Assessment was done using the Fail-safe N. Rosenthal approach was adopted to obtain the Fail-safe N and corresponding p-value needed to perform the Publication Bias Assessment in this study. Despite, the existence of several, even more robust techniques, the Rosenthal Fail-safe approach was chosen for its simplicity and popularity. Its simplicity makes it easier to understand and interpret, while its popularity across meta reviews makes it more reliable.

Based on the research questions, objectives and hypotheses the analysis was done in five main stages. However, prior to hypotheses testing, heterogeneity tests were conducted for all the proposed associations to evaluate the significance and the degree of variation in effect sizes that is attributable to systematic cross-sample variability. The most frequently employed method for heterogeneity analysis being Q-test and the I^2 index (Higgins and Thompson, 2002). The existence of heterogeneity is determined by Q-test while the I^2 index reveals the extent or degree of heterogeneity (Huedo-Medina et al., 2006). Thus, both statistics were computed via Jamovi and reported in the analysis. A detailed description of the five stages as well as the heuristics of analysis is presented as follows;

3.3.1. Stage I: Aggregate SCI and Performance

Stage one deals with the impact of aggregate SCI dimensions and facilitators on performance ($H_{1a} - H_{1b}$). It is aimed at determining the effect and significance of the association between the study's dependent and independent variables. It also seeks to find out the aggregate effect of SCI on overall performance (H_1). It equally seeks to determine which perspective of SCI aggregately has a higher effect on performance.

Presented in Table 20 and table 21 in appendix 2 are statistical data used to test hypotheses H_{1a} and H_{1b} respectively. The tables contain all the sample sizes (N), correlation coefficients, reliabilities and the weights of every study required to test the hypotheses for both SCID and SCIF. The sample sizes (N) for SCID range from 25 to 1017, the corrected effect sizes (ŕ) range from 0.140 to 0.985 and the weights (W) which largely depends on the sample sizes (N), also range from 17.878 to 752.611. On the other hand, the sample sizes (N) for SCIF range from 60 to 607, corrected effect sizes (ŕ) range from 0.180 to 0.998 and study weights range from 37.380 to 393.336.

Therefore, shown in tables 20 and table 21 are data sets for stage one (Kindly see appendix 2). The splitting of SCI into SCID and SCIF was deemed necessary to determine how each influence performance. It was done with the hope of gaining a better understanding of SCI from both perspectives. This is opposed to preceding meta studies which chose only one approach or simply treated SCID and SCIF as one and the same.

3.3.2. Stage II: Individual SCI Dimensions and Facilitators

Stage II considered the separate associations between all the individual SCI (Internal, Customer, Suppliers Integration, Information, Operational, & Relational Integration) constructs and aggregate performance. H_{2a1}–H_{2a3} denotes the linkage between SCI dimensions (SCID); II, CI, SI with aggregate performance, while H_{2b1}–H_{2b3} is a hypothetical representation of the proposed association between SCI facilitators (SCIF); Information, operational, and relational integration with aggregate performance. This stage is specifically implemented to address research questions ii and iii. The research questions ask as to which extent do dimensions and facilitators of SCI influence performance. This was done to understand how individual dimensions and facilitators influence overall performance. Therefore, sample data was grouped in term of II, CI, SI for SCID, and OpI, InfI, & RI for SCIF. The tables equally provide all relevant data such as; sample sizes (N), deattenuated correlation coefficients (**ř**), reliabilities (**α)** and the weights (**W**) of every study required to evaluate the effect of the individual SCI constructs on performance. Each SCI construct whether under SCID or SCIF is accompanied by a number of studies that investigated its impact on performance. The number of studies for each individual dimension and facilitators are also provided in the tables (kindly see appendix 3).

3.3.3. Stage III: Individual SCID & SCIF with Dimensions of Performance (OP & BS)

Stage III considered the separate associations between all the individual SCI (II, CI, SI, InfI, OpI, &RI)) constructs and dimensions performance. H_{2a1i}– H_{2a3} which is split into two sub hypotheses (H_{2ai} & H_{2aii}) as seen in section 1.5.3 above, which denotes the linkage between SCI dimensions; II, CI, SI with Operational and Business performance, while H_{2b1}–H_{2b3} is a hypothetical representation of the proposed association between SCI facilitators; InfI, OpI, and RI with Operational and Business performance. This stage is

specifically implemented to address research questions iv and v. The research questions ask what individual dimensions and facilitators of SCI have most significant influence on individual performance dimension (Operational and Business). This was done to understand how individual dimensions and facilitators separately influence Operational and Business performance. Doing this will provide insight on which individual SCI dimensions and facilitators have the most significant effect on Operational and Business. Therefore, sample data was grouped in term of II, CI, SI for SCID, and OpI, InfI, & RI for SCIF. Tables 6.1 to 6.3 in appendix 4, provide all relevant data such as; sample sizes (N), deattenuated correlation coefficients (**ř**), reliabilities (**α**) and the weights (**W**) of every study required to evaluate the effect of the individual SCI constructs on individual dimensions of performance. Each SCI construct whether under SCID or SCIF is accompanied by a number of studies that investigated its impact on performance.

3.3.4. Stage VI: Moderator Analysis

This stage was specifically implemented to provide probable explanations to the variations (heterogeneity) identified in the proposed relationships through heterogeneity tests. This was inspired by previous meta studies which argued that SCI- performance associations involve a number of moderators. However, it is in the interest of this study to go beyond identifying moderators. It aims at determining which key moderators have significant effects on the association. The period 2010 to 2019 was particularly selected because in it are many studies with identifiable moderators. Thus, through continuous and categorical moderator analysis models and techniques the effects of proposed moderation factors were assessed. The moderator analysis was used as the means to determining the extent to which the results of proposed associations in stage 1 and 2 were affected by external conditions or factors. Six main moderators were identified from sample studies which could provide insight on how they influence the SCI-performance association (H_{3a} – H_{3f}). These moderators included; time, market uncertainty, relationship quality, organisational structure and culture, market orientation, and geographical region. Apart from time which was assessed using mixed or random effects (RE) model, the remaining moderators were evaluated using fixed effect model (FE). Thus, this stage was deemed necessary to address question vi. The question asks which key moderators have the most influence on the interaction between SCI and performance.

3.3.5. Stage V: Mediator Analysis

The fifth stage was adopted to assess mediation effects associated with SCI and performance (H_{4a} – H_{4f}). Through this analysis insights will be drawn on how SCI and some key mediating factors interact with each other to influence performance. This stage addresses research objective vii which seeks to determine how mediators influence the SCI- performance relationship as well as which key mediators have the most effect on this association. Six mediators were identified through sample studies. The study examined the mediating effects of flexibility, SC agility, SC innovation, External Integration Orientation (EIO), External Integration, and Customer Integration. Mediation analysis for these factors was done with the help of medmod a Jamovi add-in which is specifically designed to handle standard mediation analysis. Correlation coefficients associated with these factors were obtained and used to generated the required data for mediation analysis. This mediation analysis will not only shade more-light on the nature of the SCI- performance linkage. It is also an attempt to account for some inconsistencies in previous meta studies.

3.5. Results of the Meta-Analysis

This section of the chapter presents the meta-analysis results based on the meta-analytic procedure, stage 1 to 3 data set, and the five heuristics discussed above. Results were obtained using Jamovi and excel. Discussion of results is guided by hypotheses which were developed in relation to theory and empirical results in earlier studies discussed in section 1.6. This is also true for moderation and mediation analysis included in this study.

3.5.1. Heterogeneity Test

The heterogeneity test results for all the proposed association are presented in this section. The standard error (se) and Tau^2 were based on Hunter and Schmidt's estimation method in Jamovi. Table 10 indicates that all SCID-performance associations have a significant high level of heterogeneity. This is shown by their significant Q and I^2 with their corresponding p-value less than 0.01 level of significance. Heterogeneity in the proposed associations below range from (I^2 = 96.46%, Q =1018.136, df =32, se = 0.018, $p < 0.001$) to (I^2 = 98.41%, Q = 6909.776, df = 66 se = 0.013, $p < 0.001$). 98.41%, which shows that aggregate association between SCID and performance has the highest heterogeneity

statistic while the association between II and Operational had the lowest heterogeneity statistic I^2 with 96.46%. Overall, all the associations indicate high heterogeneity as shown in the table below. Thus, justifying the adoption of random or mixed effect model and the moderator analysis in this study

Table 10: Heterogeneity Analysis for SCID

Proposed Association	I^2	Q	df	se	Tau^2	p- value
H_{1a}: SCID→Performance	98.41%	6909.776	66	0.013	0.021	< .001
$H2_{a3}$: SI→ AG Performance	96.98%	1255.981	35	0.019	0.055	< .001
$H2_{a2}$: CI→ AG Performance	98.36%	3123.825	41	0.019	0.040	< .001
$H2_{a1}$: II→ AG Performance	97.11%	3570.591	37	0.008	0.032	< .001
$H2_{a2}$: CI→ BS Performance	97.99%	1259.781	21	0.031	0.067	< .001
$H2_{a2}$: CI→ OP Performance	97.97%	3065.673	35	0.015	0.038	< .001
$H2_{a1}$: II→BS Performance	97.25%	882.092	22	0.023	0.059	< .001
$H2_{a1}$: II→OP Performance	96.46%	1018.136	32	0.018	0.048	< .001
$H2_{a3}$: SI→ BS Performance	96.53%	594.681	19	0.022	0.057	< .001
$H2_{a3}$: SI→ OP Performance	97.43%	1291.494	30	0.024	0.063	< .001

NB: SCID represents Aggregate SCI based on dimensions, AG is overall performance, df represents degree of freedom, BS is Business Performance, and OP is Operational performance

Table 11 indicates that all associations (SCIF-performance) have a high level of heterogeneity. This is shown by their significant Q and I^2 with their corresponding p-value less than 0.05 level of significance. Heterogeneity in the proposed associations below range from (I^2 = 88.43%, Q = 849.74, df =9, se = 0.001, $p < 0.001$) to (I^2 = 98.49%, Q = 1009.295, df = 16 se = 0.017, $p < 0.001$). 98.49%, which represents the association between aggregate information integration and performance with the highest heterogeneity statistic while the association between Information integration and Operational performance had the lowest heterogeneity statistic I^2 with 88.43%. Overall, all the associations indicate high heterogeneity (i.e $I^2 > 75\%$) as shown in the table below. Thus, justifying the adoption of random or mixed effect model (RE) and the moderator analysis for SCIF based associations in this study.

Table 11: Heterogeneity Analysis for SCIF

Proposed Association	I^2	Q	df	se	Tau^2	p- value
H_{1b}: SCIF→Performance	97.92%	1451.898	24	0.022	0.046	< .001
$H2_{b1}$: AG InfI→Performance	98.49%	1009.295	16	0.017	0.046	< .001
$H2_{b2}$: AG OpI→Performance	96.63%	443.892	13	0.019	0.040	< .002
$H2_{b3}$: AG RI→Performance	96.08%	347.909	11	0.023	0.045	< .001
$H2_{b1}$: InfI→BS Performance	97.10%	374.963	7	0.020	0.035	< .002
$H2_{b1}$: InfI→OP Performance	88.43%	849.74	9	0.001	0.008	< .001
$H2_{b2}$: OpI→ BS Performance	97.04%	265.425	6	0.021	0.038	< .001
$H2_{b2}$: OpI→ OP Performance	95.92%	284.685	10	0.017	0.035	< .001
$H2_{b2}$: RI→ BS Performance	96.71%	236.081	4	0.026	0.059	< .001
$H2_{b2}$: RI→ BS Performance	95.08%	159.247	6	0.021	0.038	< .001

NB: SCIF represents Aggregate SCI based on facilitators, AG is aggregate, df represents degree of freedom, BS is Business performance, and OP is Operational performance

3.5.2. Relationship between Aggregate SCI & overall Performance

Hypothesis (H_1) was specifically developed to address the question, what kind of association exist between SCI and overall performance. However, this question was evaluated from two aspects of SCI; SCID and SCIF as earlier discussed. Thus, the sub hypotheses were derived from the main research question and overall hypothesis (H_1). The results provided in this section are based on H_{1a} and H_{1b}. Since the ultimate goal involved comparing how SCI using two different perspectives influence performance, their results are compared.

Meta analytic results in Table 12 shows the association between SCID (II, CI, SI)) and performance which is denoted by H_{1a}. Provided also in the table below is Fail-safe N for each association. However, their discussion is presented separate. A total of 67 studies, sample population (N) of 16812, standard error (se) of 0.019, a 95% confidence interval (L bound= 0.439 & U bound= 0.514) which does not include zero, and p-value < .002, all these results together with an effect size (ř) of 0.476 indicate that SCID has a positive influence on performance. Based on Cohen's (1992) guidelines discussed earlier, an effect size (ř) of 0.476, confidence interval between, 0.439 and 0.514, with a p-value less than 0.05, it can be confidently argued that SCID has a medium effect on performance. These results confirm H_{1a} which agrees with the findings of (Mackelprang et al., 2014; Ataseven & Nair, 2017).

Table 13 shows meta analytic results which were based on the associations between SCIF (SCI in terms of facilitators) and performance which is represented by H_{1b}. A total of 25 studies, sample population (N) of 5600, standard error (se) of 0.044, a confidence interval (L = 0.421 & U= 0.594) which does not include zero either, and p-value < .001, all these results together with an effect size (ř) of 0.508 shows that there is a positive association between SCIF and performance. Thus, based on Cohen's guidelines, it can be argued that SCIF has a statistically large significant positive effect on performance (ř =0 .508, CI = 0.421– 0.594, & p < 0.001). Thus, we fail to reject H_{1b} which agree with the findings of Leuschner et al., (2013) and Som et al (2019).

Meta analytic results in table 12 confirmed that aggregate SCID has a medium significant influence on performance (ř = .476, CI = 0.439; 0.514, p <.002). Aggregate SCIF on the other hand as seen in table 13 had a large significant influence on performance (ř = .508,

CI = 0.421;0.594, & p <.001). Thus, based on these findings it can be claimed that SCIF using constructs or measures such as information, operational and relational has a slightly higher influence on aggregate performance than SCID using II, CI, and SI. Aggregate SCI has a positive significant effect on overall performance based on the acceptance of H_{1a} & H_{1b}.

3.5.3. Individual SCI Dimensions (SCID) and Performance

This section presents meta-analytic results on the impact of the individual SCID dimensions (II, CI, SI) on overall performance (H_{2a}). The objective was to determine how each individual dimension influence performance as well as establish which dimensions have more influence on overall performance. Assessment of these associations is based on hypotheses H_{2a1}, H_{2a2}, and H_{2a3} (sub- hypotheses for H_{2a}) as seen in table 12. The proposed association H_{2a1} which represents the relationship between II and performance shows a significant medium effect (N= 8598, ř = 0.465, p < .001). Thus, II positively influences overall performance. This is similar to the results of (Naqbi et al., 2018; Goffnett & Goswami, 2016; Flynn et al., 2010).Proposed associations H_{2a2}, and H_{2a3} equally indicate medium significant effects on overall performance as clearly seen by the respective results (N= 9220, ř = 0.493, p< .001) and (N= 8217, ř = 0.474, p < .001). Based on these findings which are supported by Errassafi et al., (2019), Sacristán-Díaz et al (2018), it can be said that customer and supplier integration influence overall performance. Despite all the dimensions of SCI having a significant medium effect on overall performance, CI which accounted for 63% (ř = 0.493, p < 0.001) of the total had a slightly higher influence than II and SI. Therefore, based on their effect size (ř), CI (ř = 0.493, p < 0.001) was the largest, followed by SI (ř = 0.474, p < 0.001), and II (ř = 0.465, p < 0.001) as shown in the table 12 below.

The influence of II, CI, and SI were also evaluated based on separate performance dimensions (Operational and Business). All their corresponding hypotheses with regard to performance were accepted based on p-values which are less than 5%. This was done in order to determine which performance outcome was mostly influenced by individual SCI dimensions. Table 12 reveals that operational performance was the most impacted by these dimensions than business performance. The influence of SCI dimensions on operational performance based on the magnitude of their effect sizes (ř) are as follows:

CI (ř = 0.481, p < 0.001), SI (ř = 0.452, p < 0.001), and II (ř = 0.449, p < 0.001) respectively. On the other hand, though still significant with a medium effect yet slightly lower than operational performance, the impact of SCI dimensions on business performance is as follows: SI (ř = 0.446, p < 0.001), CI (ř = 0.442, p < 0.001), and II (ř = 0.437, p < 0.001). Though, CI has a slightly higher effect under both overall and operational performance, on the contrary under business performance SI had a slightly higher effect. Contrary to most studies CI had the highest significant effect on both overall and individual performance dimensions than II.

Table 12: Meta- Analytic Results for SCID

Proposed Association	N	k	Effect	SE	p-value	CI L Bound	CI U Bound	Fail-Safe N
H_{1a}: SCID→Performance	16812	67	0.476	0.019	< .002	0.439	0.514	795478
$H2_{a3}$: SI→ AG Performance	8217	36	0.474	0.040	< .001	0.395	0.553	70961
$H2_{a2}$: CI→ AG Performance	9220	42	0.493	0.032	< .001	0.429	0.556	244793
$H2_{a1}$: II→ AG Performance	8598	38	0.465	0.031	< .001	0.405	0.524	179571
$H2_{a2}$: CI→ BS Performance	5124	22	0.442	0.057	< .001	0.330	0.554	32010
$H2_{a2}$: CI→ OP Performance	8159	36	0.481	0.034	< .001	0.414	0.547	170961
$H2_{a1}$: II→BS Performance	6146	23	0.437	0.052	< .001	0.334	0.539	26175
$H2_{a1}$: II→OP Performance	7990	33	0.449	0.040	< .001	0.372	0.527	49923
$H2_{a3}$: SI→ BS Performance	4883	20	0.446	0.055	< .001	0.338	0.555	15330
$H2_{a3}$: SI→ OP Performance	7105	31	0.452	0.046	< .001	0.360	0.543	50682

Note: AG represents overall performance, k is number of samples, N is population sample, effect is ř, se is standard error, CIL lower confidence interval, and CIU is upper confidence interval.

3.5.4. Individual SCI Dimensions (SCIF) and Performance

This section presents meta-analysis results on the impact of the individual SCI facilitators (Information, Operational, Relational Integration) on overall performance. The objective was to determine how each facilitator (OpI, InfI, RI) influence performance as well as establish which facilitators have more influence on overall performance. Evaluation of these associations is based on hypotheses H_{2b1}, H_{2b2}, and H_{2b3} as seen in table 13. The proposed association H_{2b1} which represents the relationship between InfI and overall performance shows a significant large effect (N= 3476, ř = 0.560, p < .001). Thus, information integration positively influences overall performance which agrees with Leuschner et al (2013) and Som et al., (2019).

On the other hand, proposed associations for H_{2b2}, and H_{2b3} indicate a significant medium effect on overall performance as clearly seen by the respective results (N= 3741, ř = 0.493, p < .001) and (N= 2632, ř = 0.485, p < .001). Based on these findings which are supported

by Leuschner et al (2013), it can be said that similar to information integration, operational and relational integration significantly influence overall performance. Despite all the facilitators of SCI having a significant effect on overall performance, information integration which accounted for 68% (ř = 0.560, p < 0.001) of the total had a slightly higher influence than operational and relational integration on overall performance. Thus, based on their effect size (ř), InfI (ř = 0.560, p < 0.001) was the largest, followed by OpI (ř = 0.493, p < 0.001), and RI (ř = 0.485, p < 0.001) as shown in the table 13 below.

The influence of InfI, OpI, and RI were also evaluated separately based on individual performance dimensions, Operational (OP) and Business (BS). This was done in order to determine which performance outcomes was mostly influenced by SCI facilitators. Table 13 reveals that business performance was the most impacted by these facilitators than operational performance. The influence of SCI facilitators on business performance based on their effect size (ř) are as follows: OpI (ř = 0.575, p < 0.001), InfI (ř = 0.534, p < 0.001), and RI (ř = 0.461, p < 0.001). On the other hand, the impact of SCI facilitators on operational performance is as follows: InfI (ř = 0.585, p < 0.001), OpI (ř = 0.496, p < 0.001), and RI (ř = 0.450, p < 0.001). Though, InfI has a slightly higher effect under both overall and operational performance, on the contrary under business performance it had a slightly lower effect than OpI. Nevertheless, Info Int has an overall significant large effect on all outcomes of performance. Based on these results it can be confidently said that SCI facilitators influence both Operational and Business performance.

Table 13: Meta- Analytic Results for SCIF

Proposed Association	N	k	Effect	se	p-value	CIL Bound	CIU Bound	Fail- safe N
H_{1b}: SCIF→Performance	5600	25	0.508	0.044	< .001	0.421	0.594	70272
$H2_{b1}$:AG InfI→Performance	3476	17	0.560	0.054	< .001	0.454	0.665	61103
$H2_{b2}$: AG OpI→Performance	3741	14	0.493	0.055	< .001	0.385	0.600	14989
$H2_{b3}$: AG RI→Performance	2632	12	0.485	0.063	< .001	0.361	0.609	7933
$H2_{b1}$: InfI→BS Performance	1743	8	0.534	0.068	< .001	0.399	0.668	9251
$H2_{b1}$: InfI→OP Performance	2138	10	0.585	0.032	< .001	0.523	0.647	65754
$H2_{b2}$: OpI→ BS Performance	2138	7	0.575	0.076	< .001	0.427	0.723	6159
$H2_{b2}$: OpI→ OP Performance	1743	11	0.496	0.058	< .001	0.382	0.610	8550
$H2_{b2}$: RI→ BS Performance	1124	5	0.461	0.111	< .001	0.244	0.679	1761
$H2_{b2}$: RI→ OP Performance	1878	7	0.450	0.076	< .001	0.300	0.600	2198

3.5.5 Publication Bias Assessment

One of the critical issues beside the apple and orange mixture problem, is publication bias also known as the file- drawer problem. Thus, in order to address this issue, publication bias assessment was also conducted. The guidelines and procedures discussed above were used to address and interpret publication bias results. This analysis was done for all proposed associations in this meta analytic evaluation in order to known how many studies need to be included in order to nullify or change the claims made through this evaluation.

The Rosenthal Fail-safe N approach to publications bias assessment adopted in this study assumes that, meta-analytic results usually have missing or exclude studies. To the extent that if all the excluded or missing studies were to be retrieved and included in the analysis, the p-value of the summary effects would no longer be significant (Borenstein et al. 2009). This approach follows the assumption that, the mean effect of the missing studies is zero. Thus, a Fail-safe N result which indicates that only a few studies are required to make the effect non-significant raises some serious concern that the true effect might have indeed been zero. The opposite is true, where a large number of studies is required to nullify the effect. According to Borenstein et al., (2009) where a large number of studies are required to nullify the effect, there would be no reason to be concerned with publication bias. In short, a large significant Fail-safe N indicates that the missing number of studies have to be equally large to influence the results otherwise.

The Rosenthal Fail-safe N was obtained for all associations as indicated by the meta-analytic results in table 12 and table 13 above. A significant Fail-safe N of 795478 (p-value < 0.001) for the aggregate association between SCID (SCI dimensions) and overall performance (H_{1a}) was obtained as seen in table 12. Equally a significant Fail-safe N of 70272 for SCIF (H_{1b}) was obtained as illustrated in table 13. Among the individual dimensions of SCI (SCID), CI on overall performance had the highest Fail-safe N of 244793 whereas SI on business performance had the lowest Fail-safe N of 15330. On the other hand, among the facilitators of SCI (SCIF) information integration on overall performance had the largest Fail-safe No of 61103, while relational integration on business performance had the smallest with 1761. All the Fail-safe N values were significant even at 1% level of significance. Thus, making it highly unlikely that such

large numbers of studies were missing, though the results of the study might have been overstated. For instance, for aggregate SCID and SCIF it implies that at least 700,000 and 70,000 studies respectively have to be introduced to nullify the results. Based on these results it can be said that publication bias or the true effect being zero is highly improbable.

3.5.6. Moderator Analysis

Heterogeneity tests conducted in table 10 and table11 revealed that all of the proposed associations represented by respective hypotheses had high heterogeneity which could be accounted for by moderators. Thus, this led to the analysis of 6 probable moderator factors identified through the study sample. This analysis is performed on both SCID and SCIF. These moderator factors include: time, market uncertainty, organisational structure and culture, market orientation, relation quality, and geographical region. Time being an exception, all the other moderators which are categorical in nature were addressed using the subgroup method and the fixed effects (FE) model. For instance, under geographical region, studies were grouped into Africa, Asia-Pacific, Middle East, Europe, America. However, the majority of studies were based on Asia-Pacific and Africa. Thus, Africa and Asia-Pacific were evaluated as moderators under geographical region. Asia-Pacific had more studies than Africa. Similarly, organisational structure and culture, studies were grouped as organisational structure and organisational culture. There were more studies under organisational culture than organisational structure. The same was done for Market orientation, Market Uncertainty and relationship quality. The only difference is that for these three variables they grouped as present and none.

3.5.6.1. Potential Moderator Factors for SCID

Table 14 provides results for potential moderators under SCID. The goal is to determine which key moderators have the most significant effect on SCID- performance associations. This also involves exploring how each moderator variable influences both aggregate and individual SCID associations. Overall performance is used instead of individual performance dimensions. The assessments are done with the help of proposed hypotheses for both associations and moderators.

3.5.6.1.1. Market orientation as a Moderator

Market orientation (MO) using fixed effects (FE) model revealed a significant large interaction with H_{1a} (the association between SCID and overall performance) as seen from table 14. This, provides evidence that MO may indeed be considered as a significant moderating factor on the association between SCID and performance (ř=0.518, $p < .001$). Market orientation (MO) had a significant medium influence on all the individual dimensions of SCID; H_{2a1}, H_{2a2}, and H_{2a3} respectively (ř = 0.450, ř = 0.367, ř =0.395, $p< .001$). Thus, MO as a potential moderator significantly influences the relationship between SCID and performance both at an individual and aggregate level. This confirms hypothesis H_{3f} which agrees with Lu et al., (2017).

3.5.6.1.2. Relationship Quality as Moderator

Table 14 reveals that relationship quality (RQ) has a large significant interaction with H_{1a} (ř = 0.562, $p < 0.001$). However, RQ has a significant medium interaction with individual dimensions of SCID; H_{2a1}, H_{2a2}, and H_{2a3} respectively (ř = 0.482, ř = 0.413, ř =0.420, $p< .001$). Thus, RQ as a potential moderator has a significant large influence on the aggregate SCID- performance association and a significant medium influence on individual SCID dimensions as revealed by the results from table 14. These results tarry with the findings of (Lahiri & Kedia, 2011; Srinivasan et al, 2011, & Chang, 2015) upon which hypothesis H_{3b} was based.

3.5.6.1.3. Market Uncertainty as a Moderator

A large significant interaction between Market uncertainty (MU) and H_{1a} can be deduced from table 3.6.4. (ř = 0.591, $p < 0.001$). MU has a significant influence on both; H_{2a1} and H_{2a3} (ř = 0.687; ř = 0.692, $p < 0.001$). On the other hand, MU had a significant medium effect on H_{2a3} (ř = 0.462, $p < 0.001$). Thus, on MU has a significant large influence on SCID associations. This perfectly confirms the findings of Xu et al., (2014) upon whose claims hypothesis H_{3d} was developed.

3.5.6.1.4. Organisational Structure and Culture as a Moderator

3.5.6.1.4.1. Organisational Structure

Organisational structure and culture as a moderator was split into two subgroups Structure and culture. Organisational structure had a significant large influence on H_{1a} (ř = 0.591, $p < 0.001$) as seen in table 14 below. However, it has a significant medium interaction with individual dimensions of SCID; H_{2a1}, H_{2a2}, and H_{2a3} respectively (ř = 0.308, ř = 0.330, ř =0.339, $p < .001$). Nonetheless, organisational structure has a statistically influence on SCID associations as a moderator. These results support hypothesis (H_{3cii}) and confirm the findings of Khan & Wisner, (2019).

3.5.6.1.4.2. Organisational Culture

Unlike organisational structure, organisational culture has a significant medium interaction with both H_{1a} (ř = 0.435, $p < 0.001$) and with individual dimensions of SCID; H_{2a1}, H_{2a2}, and H_{2a3} respectively (ř = 0.379, ř = 0.358, ř =0.378, $p < .001$). Therefore, overall organisational culture has a significant medium influence with all associations of SCID. These results confirm hypothesis H_{3ci} as well as the claims of Khan & Wisner, (2019).

3.5.6.1.5. Geographical Region as a Potential Moderator

Geographical region moderation analysis was performed only on Asia-Pacific and Africa. The other regions were left out as they did not contain a substantial number of studies. Since they account for 54 studies (81%), it makes sense to only base the geographical moderator analysis on these two regions.

3.5.6.1.5.1. Asia-Pacific as a Potential Moderator

Asia-Pacific as a moderator had a significant large influence on H_{1a} (ř = 0.502, $p < 0.001$) as seen in table 14 below. However, a significant medium interaction with individual dimensions of SCID; H_{2a1}, H_{2a2}, and H_{2a3} respectively (ř = 0.428, ř = 0.373, ř =0.385, $p < .001$) could also be observed. Nonetheless, Asia-Pacific has a statistically influence on SCID associations as a moderator.

3.5.6.1.5.2. Africa as a Potential Moderator

Surprising Africa with few sample studies compared to Asia-Pacific had a relative larger significant influence on H_{1a} (ř = 0.543, p < 0.001). Even more surprising is that Africa has a significant large influence on H_{1a2}, and H_{2a3} respectively (ř = 0.500, ř = 0.504, p< .001). It also has a significant medium influence on H_{2a2} (ř = 0.474, p < 0.001). Thus, on average Africa has a significant large influence of on all SCID -performance associations. It also has a higher moderating effect on SCID than Asia- Pacific.

Out of all the proposed potential moderators of SCID, market uncertainty (MU) has the largest significant effects estimate (ř = 0.591, p < 0.001). Thus, MU has the highest significant effect on SCID-performance associations. This can be seen from the results above and in the table below. The implication is that in the presence of high uncertainty or risk, strengthens SCI (precisely II and SI) among partners which in turn positively influence performance.

Table 14: Moderation Analysis of Factors Associated with SCID Under Fixed Effects model

Potential Moderator	k	Estimate	SE	Z Value	p-value	CIL Bound	CIU Bound
MARKET ORIENTATION							
H_{1a}: SCID→Performance	33	0.518	0.008	64.100	< .001	0.502	0.533
$H2_{a1}$: II→Performance	18	0.450	0.011	40.500	< .001	0.428	0.472
$H2_{a2}$: CI→Performance	22	0.367	0.030	12.300	< .001	0.309	0.425
$H2_{a3}$: SI→Performance	19	0.395	0.012	32.300	< .001	0.371	0.419
RELATIONSHIP QUALITY							
H_{1a}: SCID→Performance	31	0.562	0.008	71.200	< .001	0.547	0.578
$H2_{a1}$: II→Performance	16	0.482	0.012	39.500	< .001	0.458	0.506
$H2_{a2}$: CI→Performance	18	0.413	0.027	15.500	< .001	0.360	0.465
$H2_{a3}$: SI→Performance	15	0.420	0.013	31.400	< .001	0.394	0.446
MARKET UNCERTAINTY							
H_{1a}: SCID→Performance	16	0.591	0.009	63.100	< .001	0.572	0.609
$H2_{a1}$: II→Performance	8	0.687	0.011	61.300	< .001	0.665	0.709
$H2_{a2}$: CI→Performance	8	0.462	0.075	6.130	< .001	0.314	0.609
$H2_{a3}$: SI→Performance	7	0.692	0.011	60.500	< .001	0.669	0.714
ORGANISATIONAL STRUCTURE & CULTURE							
a. STRUCTURE							
H_{1a}: SCID→Performance	19	0.556	0.011	52.800	< .001	0.536	0.577
$H2_{a1}$: II→Performance	11	0.308	0.018	16.700	< .001	0.272	0.344
$H2_{a2}$: CI→Performance	11	0.330	0.020	16.300	< .001	0.290	0.370
$H2_{a3}$: SI→Performance	10	0.339	0.020	16.900	< .001	0.300	0.378
b. CULTURE							
H_{1a}: SCID→Performance	19	0.435	0.010	41.900	< .001	0.415	0.456
$H2_{a1}$: II→Performance	10	0.379	0.017	23.000	< .001	0.346	0.411
$H2_{a2}$: CI→Performance	9	0.358	0.025	14.600	< .001	0.310	0.406
$H2_{a3}$: SI→Performance	6	0.378	0.022	17.200	< .001	0.335	0.421
GEOGRAPHICAL REGION							
a. ASIA- PACIFIC							

H_{1a}: SCID→Performance	42	0.502	0.007	73.100	< .001	0.488	0.515
$H2_{a1}$: II→Performance	23	0.428	0.011	40.900	< .001	0.408	0.449
$H2_{a2}$: CI→Performance	24	0.373	0.024	15.300	< .001	0.325	0.420
$H2_{a3}$: SI→Performance	19	0.385	0.012	31.700	< .001	0.361	0.409
b. AFRICA							
H_{1a}: SCID→Performance	12	0.543	0.017	32.300	< .001	0.510	0.576
$H2_{a1}$: II→Performance	7	0.500	0.025	19.900	< .001	0.451	0.549
$H2_{a3}$: CI→Performance	6	0.474	0.080	5.930	< .001	0.318	0.631
$H2_{a3}$: SI→Performance	6	0.504	0.025	19.900	< .001	0.455	0.554

Note: k is number of samples with moderator, estimate is corrected correlation (ř), se is standard error, CIL and CIU lower and upper 95% confidence interval

3.5.6.2. Potential Moderator Factors for SCIF

Table 15 provides results for potential moderators under SCIF. The goal is to determine which key moderators have the most significant effect on SCIF-performance associations. This also involves exploring how each moderator variable influences both aggregate and individual SCIF-performance associations. These assessments are done with the help of proposed hypotheses for both associations and moderators.

3.5.6.2.1. Market orientation as a Moderator

Market orientation (MO) using fixed effects (FE) model revealed a significant large interaction with H_{1a} (the association between SCIF and overall performance) as seen from table 15. This, provides evidence that MO may indeed be considered as a significant moderating factor on the association between SCID and performance (ř =0.836, p < .001). Market orientation (MO) had a significant large influence on all the individual dimensions of SCIF; H_{2b1}, H_{2b2}, and H_{2b3} respectively (ř = 0.693, ř = 0.658, ř =0.723, p < .001). Thus, MO as a potential moderator significantly influences the relationship between SCIF and performance both at an individual and aggregate level. Furthermore, MO has large interaction with all SCIF associations. This confirms hypothesis H_{3f} which is accepted and is in agreement with Lu et al., (2017).

3.5.6.2.2. Relationship Quality as Moderator

Table 15 reveals that relationship quality (RQ) has a large significant interaction with H_{1b} (ř = 0.728, p < 0.001). However, RQ has a significant medium interaction with individual dimensions of SCIF; H_{2b1}, H_{2b2}, and H_{2b3} respectively (ř = 0.904, ř = 0.661, ř =0.696, p< .001). Thus, relationship quality as a potential has a significant large influence on the aggregate SCIF- performance association and a significant medium influence on

individual SCIF dimensions as revealed by the results from table 15. These results tarry with the findings of (Srinivasan et al, 2011, & Chang, 2015) upon which hypothesis H_{3b} was based. Furthermore, all the hypotheses that corresponds to H_{3b} were all accepted.

3.5.6.2.3. Market Uncertainty as a Moderator

A large significant interaction between Market uncertainty (MU) and H_{1b} can be deduced from table 15 (ř = 0.607, $p < 0.001$). MU has a large significant influence on both; H_{2b1} and H_{2b2} (ř = 0.648; ř = 0.646, $p < 0.001$). On the other hand, MU had a significant medium effect on H_{2a3} (ř = 0.440, $p < 0.001$). Thus, on average MU has a significant large influence on SCI associations. This supports H_{3d} and perfectly confirms the findings of Xu et al., (2014).

3.5.6.2.4. Organisational Structure and Culture as a Potential Moderator

Organisational structure and culture as a moderator were split into two subgroups Structure and culture.

3.5.6.2.4.1. Organisational Structure

Organisational structure had a significant large influence on H_{1b} (ř = 0.676, $p < 0.001$) as seen in table 15 below. Organisational structure has a significant large interaction with individual facilitators of SCIF; H_{2b1}, H_{2b2}, and H_{2b3} respectively (ř = 0.623, ř = 0.713, ř = 0.600, $p < .001$). Organisational structure has a large statistically significant influence on SCIF associations as a moderator. These results support hypothesis (H_{3cii}) which is accepted and confirm the findings of Khan & Wisner, (2019).

3.5.6.2.4.2. Organisational Culture

Unlike organisational structure, organisational culture has a significant medium interaction with both H_{1b} (ř = 0.435, $p < 0.001$) and with individual dimensions of SCIF; H_{2b1}, H_{2b2}, and H_{2b3} respectively (ř = 0.379, ř = 0.358, ř =0.378, $p < .001$). Therefore, overall organisational culture has a significant medium influence with all associations of SCIF. Thus, supporting hypothesis (H_{3cii}) which was accepted and confirms the findings of Khan & Wisner, (2019) and Jermsittiparsert et al., (2019).

3.5.6.2.5. Geographical Region as a Potential Moderator

Geographical region moderation analysis was performed only on Asia-Pacific and Africa for SCIF. The other regions were left out as they did not contain a substantial number of studies. Since they account for 21 studies (84%), it makes sense to only base the geographical moderator analysis on these two regions.

3.5.6.2.5.1. Asia-Pacific Region

Asia-Pacific as a moderator had a significant large influence on H_{1a} (ř = 0.502, p < 0.001) as seen in table 15 below. However, a significant large interaction with individual facilitators of SCIF; H_{2b1}, H_{2b2}, and H_{2b3} respectively (ř = 0.701, ř = 0.907, ř =0.601, p < .001) could also be observed. Asia-Pacific has a large statistically significant influence on both aggregate and individual SCIF associations as a potential moderator.

3.5.6.2.5. 2. Africa Region

Similar to SCID, Africa with fewer sample studies compared to Asia-Pacific had a relatively higher significant influence on H_{1b} (ř = 0.730, p < 0.001). Even more interesting is that Africa has a significant larger influence on H_{2b2}, and H_{2b3} respectively (ř = 0.6530, ř = 0.773, p < .001) than Asia-Pacific (ř = 0.907, ř =0.601, p < .001). It also has a significant large influence on H_{2b1} (ř =.807, p < 0.001). Thus, on average Africa has a significant large influence of on all associations of SCIF. It also has a higher moderating effect on SCI than Asia- Pacific.

Out of all the proposed moderators of SCIF, market orientation (MO) has the largest significant effect on aggregate SCIF-performance association (ř = 0.838, p < 0.001). Thus, MO has the highest significant effect on aggregate SCIF associations. This can be seen from the results above and in the table below. On other hand, information integration among other individual facilitators had the largest significant interactions with MO as seen from table 15.

Table 15: Moderation Analysis of Factors Associated with SCIF Under Fixed Effects Model

Moderator	k	Estimate	se	Z-value	p-value	CI L Bound	CI U bound
MARKET ORIENTATION							
H_{1b}: SCIF→Performance	12	0.838	0.007	120.00	< .001	0.824	0.852
$H2_{b1}$: InfI Int→Performance	10	0.693	0.011	61.500	< .001	0.671	0.715
$H2_{b1}$: OP Int→Performance	8	0.658	0.012	54.900	< .001	0.635	0.682
$H2_{b3}$: Rel Int→Performance	6	0.723	0.014	52.600	< .001	0.696	0.750
RELATIONSHIP QUALITY							
H_{1b}: SCIF→Performance	16	0.728	0.009	81.300	< .001	0.711	0.746
$H2_{b1}$: InfI Int→Performance	11	0.904	0.006	162.00	< .001	0.893	0.915
$H2_{b1}$: OP Int→Performance	7	0.661	0.015	44.200	< .001	0.632	0.691
$H2_{b3}$: Rel Int→Performance	8	0.696	0.014	49.400	< .001	0.669	0.724
MARKET UNCERTAINTY							
H_{1b}: SCIF→Performance	4	0.607	0.019	31.500	< .001	0.570	0.645
$H2_{b1}$: InfI Int→Performance	3	0.648	0.021	30.900	< .001	0.607	0.689
$H2_{b1}$: OP Int→Performance	2	0.646	0.022	30.000	< .001	0.603	0.688
$H2_{b3}$: Rel Int→Performance	3	0.440	0.028	16.000	< .001	0.386	0.494
ORGANISATIONAL STRUCTURE & CULTURE							
a. STRUCTURE							
H_{1b}: SCIF→Performance	7	0.676	0.014	49.800	< .001	0.649	0.702
$H2_{b1}$: InfI Int→Performance	4	0.623	0.021	30.400	< .001	0.583	0.663
$H2_{b1}$: OP Int→Performance	5	0.713	0.014	51.800	< .001	0.686	0.740
$H2_{b3}$: Rel Int→Performance	3	0.600	0.023	25.800	< .001	0.554	0.646
b. CULTURE							
H_{1b}: SCIF→Performance	9	0.743	0.012	64.600	< .001	0.721	0.766
$H2_{b1}$: InfI Int→Performance	5	0.948	0.006	152.00	< .001	0.936	0.960
$H2_{b1}$: OP Int→Performance	3	0.720	0.017	42.100	< .001	0.686	0.753
$H2_{b3}$: Rel Int→Performance	4	0.562	0.026	22.000	< .001	0.512	0.613
GEOGRAPHICAL REGION							
a. ASIA- PACIFIC							
H_{1b}: SCIF→Performance	17	0.701	0.009	82.300	< .001	0.684	0.718
$H2_{b1}$: InfI Int→Performance	11	0.907	0.005	167.00	< .001	0.897	0.918
$H2_{b1}$: OP Int→Performance	11	0.601	0.012	50.400	< .001	0.578	0.625
$H2_{b3}$: Rel Int→Performance	6	0.596	0.017	36.000	< .001	0.563	0.628
b. AFRICA							
H_{1b}: SCIF→Performance	4	0.730	0.016	45.200	< .001	0.698	0.761
$H2_{b1}$: InfI Int→Performance	3	0.807	0.017	49.000	< .001	0.775	0.840
$H2_{b1}$: OP Int→Performance	2	0.773	0.017	46.300	< .001	0.740	0.805
$H2_{b3}$: Rel Int→Performance	3	0.653	0.013	51.300	< .001	0.628	0.677

3.5.6.3 Time as a Continuous Moderator

Unlike the categorical moderators assessed above whose results are presented in table 16, Time as a moderator was assessed using the mixed effect model in Jamovi. This is due to its continuous nature as shown in Table 16. Time has a significant positive impact of the association between SCID and overall performance (B = 1.173, p < 0.001). It equally indicated a significant impact on the association between SCID and overall performance (B= 1.032, p < 0.001). This indicates that time influences both SCID and SCIF as a moderator. However, time can be seen as a higher moderating factor on SCID with (B = 1.173, p < 0.001) than SCIF (B= 1.032, p < 0.001). Nevertheless, time impact both types of SCI. In other words, with time the impact of SCID and SCIF on overall performance increases and becomes stronger. Thus, supporting hypothesis H_{3a} which agrees with the finding of Chang et al (2015) and is accepted.

Table 16: Time as a Moderator for both SCID and SCIF under RE model

Proposed Association	Estimate	se	Z-value	p-value	CI L Bound	CI U bound
H_{1a}: SCID→Performance						
Intercept	0.009	0.019	0.480	0.631	-0.029	0.047
Time	1.173	0.039	29.955	< .001	1.096	1.250
H_{1b}: SCIF→Performance						
Intercept	0.077	0.020	3.870	< .001	0.038	0.116
Time	1.032	0.027	37.850	< .001	0.979	1.085

3.5.7. Mediator Analysis

The study assessed the mediation effects of some key mediators identified through literature to gain further insights into the SCI- performance association. Literature has shown that the findings on SCI- performance association or impact varies across studies. Some have found that SCI affects both operational and business performance, while others have claim that it only affects one dimension of performance. Others have even claimed that the interaction or mediation effects among SCI constructs influence performance. A detailed discussion was provided in literature. However, presented in table 17 below are the mediation results including mediation percentage for 6 key mediator factors. Data on path estimates is provided in appendix 8.

3.5.7. 1. Flexibility as a Mediator between SCI & Performance

Flexibility mediates the SCI- performance association as shown in the table 17. The results show that there is a significant indirect effect between SCI and performance which is mediated by flexibility (B= 0.427, p = 0.04). Furthermore, this indirect effect accounts for 53% of the total effect while the remaining 47% is for the direct effect between SCI and performance. The total effect is equally significant (B = 0.806, p < 0.001). This show that flexibility has a strong and high partial mediation effect on the SCI- performance relationship. Thus, accepting hypothesis (H_{4e}). Since a 53% significant partial indirect effect exists, hypothesis (H_{4e}) is justified as well as the claims of (Kumar et al., 2017; Goffnett & Goswami, 2016)

3.5.7.2. Customer as a Mediator between SI & Performance

Customer integration has a negative indirect effect on the SI- performance association with a significant total effect (B =2.600, p < 0.001). Though negative, the indirect effect of 32% is still significant (B= -2.490, p = 0.022). Thus, based on a 32% significant indirect effect as shown in table 17, it can be confidently stated that CI has a partial mediation effect on the SI- performance relationship. This supports hypothesis (H_{4a}) which accepted as true and confirms (Alfalla-Luque et al., 2015;Sacristán-Díaz et al., 2018), though implying that SI and CI are negatively associated.

3.5.7.3. External Integration (EI) as a Mediator between II & Performance

A positive significant total effect (B = 1.027, p < 0.001) based on the interactions of external integration as mediator and the direct effects of II can be observed from table 17. II has an 81.4% significant direct effect on performance (B = 1.331, p < 0.001). On the other hand, a significant negative indirect effect of 18.6% (B = -0.304, p = 0.020) can also be observed below. Though the indirect effect based on percentage mediation is quite low, it can still be observed that EI has a partial negative mediation effect on the II-performance association. This implies that the mediation effect of EI suppresses the performance. Nonetheless, even with suppression mediation, the total effect is significant due to a high significant direct effect between II and performance. Despite being negative, a partial mediation of 18.4% still supports hypothesis (H_{4b}) which is accepted. This confirms the findings of (Alfalla-Luque et al., (2015); Errassafi et al., (2019).

3.5.7.4. SC Innovation as a Mediator between SCI and Performance

A significant total effect (B = 0.727, p < 0.001) based on the interactions of SC innovation as mediator and the direct effects of II can be observed from table 17. However, the indirect effect was found to be statistically insignificant (B = -101, p = 0.622). A significant positive total effect is thus, attributed to a significant direct effect between SCI and performance (B = 0.829, p < 0.001). Therefore, based on these results SC innovation does not have a significant mediation effect on the association between SCI and performance. Thus, hypothesis H_{4d} is rejected and statistically not supported.

3.5.7.5. SC Agility as a Mediator between SCI and Performance

A significant total effect based on the interactions of SC agility as mediator and the direct effects of SCI can be observed from table 17. However, the direct effect between SCI and performance was found to be statistically insignificant (B = 0.067, p = 0.698). On the contrary, a significant indirect effect of 89.1% (B = 0.547, p < 0.044) was obtained. This shows that SC agility might have a full mediation on SCI- performance association. In other words, SCI affects performance through SC agility without which there would be no significant association between SCI and performance. The presence of a full mediation confirms (accepts) hypothesis H_{4c} and the claims of (Tseng et al., 2016; Krisada & Jermsittiparsert, 2018; Uman & Sommanawat,2019)

3.5.7.6. EIO as a Mediator between External Integration and Performance

A negative significant total effect (B = -0.320, p < 0.001) based on the interactions of EIO as mediator and the direct effects of external integration (EI) can be observed from table 17. Equally there is a negative significant direct effect between EI and performance (B = -0.448, p < 0.001). On the contrary, a 22.8% positive significant indirect effect exists (B = 0.128, p < 0.001). A significant positive indirect effect indicates that EIO might indeed be regarded as mediator between EI and performance. Thus, confirming (accepting) hypothesis H_{4bii} and the claims of (Droge et al., 2012; Alfalla-Luque et al., (2015).

Out of the six mediators tested, SC innovation did not have a significant mediation effect on performance. CI and EI were found to have partial negative mediation effects. Flexibility and EIO had a positive partial mediation effect. SC agility had a full mediation effect on SCI- performance association. Out of all the significant mediators, SC agility

had the strongest significant mediation effect (B = 0.547, p < 0.044). It was also the only factor that had an 89.1% full mediation effect. Flexibility could be classified as the second strongest mediator with a significant partial mediation effect of 53% (B= 0.427, p = 0.04). CI was the third with a negative significant partial mediation effect of 32% (B= -2.490, p = 0.022). External Integration Orientation (EIO) was the fourth mediator with a partial significant mediation effect of 22.8%. External Integration was the fifth and lowest with a mediation effect of 18.6%.

Table 17: Mediation results obtained through Jamovi's Medmod

3.6. Summary

Mediation Estimates							
			95% Confidence Interval				%
Effect	Estimate (B)	SE	Lower	Upper	Z	p	Med
FLEXIBILITY AS A MEDIATOR BETWEEN SCI & PERFORMANCE							
Indirect	0.427	0.208	0.020	0.834	2.050	0.040	53.0
Direct	0.379	0.179	0.029	0.730	2.120	0.034	47.0
Total	0.806	0.191	0.432	1.181	4.220	< .001	100.0
CUSTOMER INTEGRATION AS A MEDIATOR BETWEEN SI & PERFORMANCE							
Indirect	-2.490	1.082	-4.607	-0.364	-2.300	0.022	32.8
Direct	5.080	0.221	4.648	5.514	23.010	< .001	67.2
Total	2.600	1.076	0.487	4.704	2.410	0.016	100.0
EXTERNAL INTEGRATION AS A MEDIATOR BETWEEN II & PERFORMANCE							
Indirect	-0.304	0.131	-0.561	-0.048	-2.320	0.020	18.6
Direct	1.331	0.149	1.038	1.624	8.910	< .001	81.4
Total	1.027	0.109	0.813	1.241	9.420	< .001	100.0
SC INNOVATIVENESS AS A MEDIATOR BETWEEN SCI & PERFORMANCE							
Indirect	-0.101	0.205	-0.503	0.301	-0.493	0.622	16.8
Direct	0.829	0.014	0.800	0.857	57.787	< .001	83.2
Total	0.727	0.205	0.325	1.130	3.541	< .001	100.0
SC AGILITY AS A MEDIATOR BETWEEN SCI & PERFORMANCE							
Indirect	0.547	0.271	0.015	1.078	2.015	0.044	89.1
Direct	0.067	0.173	-0.272	0.406	0.388	0.698	10.9
Total	0.614	0.276	0.072	1.155	2.220	0.026	100.0
EIO AS A MEDIATOR BETWEEN EXTERNAL INT & PERFORMANCE							
Indirect	0.128	0.031	0.068	0.189	4.140	< .001	22.3
Direct	-0.448	0.003	-0.454	-0.442	-144.11	< .001	77.7
Total	-0.320	0.031	-0.380	-0.259	-0.360	< .001	100.0

This research study was conducted with the primary goal of evaluating the impact of SCI from two different perspectives on overall performance. This was done to determine how SCI from two perspectives influence both business and operational performance. Moderator and mediator analyses were conducted to provide further insights on the SCI-performance association. The period 2010 to 2019 was selected as it included a number of studies with known moderators and mediators. In order to address the research question and objective a number of hypotheses were developed based on primary study claims and theories. The analysis of these hypotheses was based on data obtained from relevant

empirical primary studies published within the selected time frame. Through strict implementation of inclusion criteria, a sample of 92 studies was obtained. Out of 92 the included studies, 67 studies belonged to SCID while 25 studies represented SCIF. Over 81% of the studies were conducted within Asia-Pacific and Africa. Sample studies were published in high ranking journals with the majority published in supply chain management related journals. Factor Analysis, SEM, and Hierarchical regression were among the most used statistical methods in the obtain sample studies.

Consistent with the Hunter and Schmidt (2004)'s meta- analytic procedure applied through Jamovi, SCI under both SCID and SCIF revealed a significant effect on both overall and individual performance dimensions respectively (ř = 0.476, CI = 0.439 – 0.514, p <.002) and (ř = 0.508, CI = 0.421 – 0.594, p <.001). Publication bias assessment via Rosenthal Fail-safe N, revealed high significant values (794,478, p < 0.001, & 70,272, p < 0.001) which indicates that publication bias is highly unlikely. All moderators though having varying magnitude of effects, they indicated significant interactions with the SCI-performance association. With the exception of SC innovation whose mediation hypotheses was rejected, all mediators had significant mediation effects. The next chapter which happens to be chapter 4 presents a detailed summary of the study, conclusions and implications which might be drawn based on the results, and recommendations for future research.

CHAPTER 4: SUMMARY, CONCLUSION AND RECOMMENDATIONS

4.1. Introduction

This research was conducted specifically to evaluate the impact of SCI on both overall and two dimensions of performance (operational and business). SCI was evaluated from the perspective of SCID and SCIF. SCID represents studies which measured SCI in terms of Internal, Supplier, and Customer Integration, while SCIF represents studies which measured SCI in terms information, operational, and relational integration. A meta-analytic approach was adopted to assess the association between SCI and performance based on sample studies published between 2010 and 2019. This approach and research design were specifically adopted and implemented for the sole purpose of addressing research questions and testing hypotheses which were based on relevant theories. Thus, this chapter presents a summary of the thesis, conclusions and implications drawn from the study results as well as recommendations for future research.

4.2. Summary

A systematic review by Costes et al (2008) pointed out that definitions and measures of SCI are not only diverse but they make it difficult for a conclusion such as the more SCI the better the performance to reached. Moreover, one cannot easily conclude on what theory or concept SCI hinges upon. Several theories have been adopted by scholars in addressing the relationship between SCI and performance. Furthermore, studies indicate that the relationship between SCI and performance can be approached from different perspectives. Hence, the need for a meta research which combined recent empirical primary studies with clear definitions, measures and theoretical basis to aid in providing a good basis for future related studies. Identifying and establishing via previous studies which theories are effective in determining the link between SCI and performance will be of great help to both practitioners and researchers. Equally distinguishing between and among the dimensions or facilitators of SCI would provide a better understanding of the effects of SCI on operational and business performance outcomes.

Integrating supply chain processes across departments and firms is viewed as a means to creating efficiencies, generating value for customers, and gaining a competitive

advantage. However, the conditions under which SCI effectively contribute to improved performance remains unclear. In literature supply chain integration has been addressed by either what (SCIF) or who (SCID) is being integrated. What is being integrated is referred to in this study as facilitators of SC while who is being integrated represents the dimensions of SCI. Thus, measures of SCI such as operational, information, and relational integration are considered as facilitators (SCIF) in this study. On the hand, internal, customer, and supplier integration are considered as dimensions. The distinction between facilitators and dimensions of SCI and how each the impact on performance has not been clearly in literature. This raised the question as to whether the inconsistencies and lack of consensus could be attributed to these two distinct perspectives of SCI. For instance, Leuschner et al., (2013) conducted a meta review using mainly facilitators (SCIF) and found evidence that SCI has limited impact on financial related performance. On the other hand, Mackelprang et al., (2014) conducted a similar meta review with the same objective using SCI dimensions (SCID), yet found evidence that concluded a significant positive impact of SCI on financial performance. This therefore, led to the investigation of a significant question of whether the conflicting results in these studies as well as other studies in SCI literature lies in what (Operational, Information, & Relational Integration) and who (II, SI, & CI) is being integrated. Thus, a quest to establish how what is being integrated and who is being integrated becomes essential in determining the effect of SCI on performance outcomes. SCI-performance studies are not only inconsistent on theory and findings. There is equally no consensus on the dimensions of SCI and how they affect performance. However, consistent in SCI-performance association, are the claims that moderators might exist and influence the relation.

Inconsistency of empirical results and practical implications on the impact of Supply Chain Integration (SCI) has made researchers to conduct meta analyses on the topic. Unfortunately, even available meta reviews provided no consensus on the impact of Supply Chain Integration on performance. This lack of consensus in both primary and earlier meta studies, leaves room for another meta-analysis. It was even more compelling to conduct a recent meta- analytic evaluation due to the recent increase in the number of primary studies which included both moderators and mediators as previous reviews recommended. For instance, Costes & Jabre (2008) argued that more SCI does not always lead to improved performance. Thus, raising the question of what degree of SCI is

necessary for improved performance. Despite two meta analyses by Leuschner et al., (2013) and Mackelprang et al., (2014) conducted with the same objective, they drew contradicting conclusions on the topic. This poses further questions on whether inconsistencies on the impact of SCI and performance could be attributed to varying degrees of SCI, facilitators, dimensions, moderators or mediators. Thus, this research attempted to address these questions and improve on preceding reviews by taking into consideration recommendations for better meta analyses highlighted in previous reviews. Coupled with these considerations, primary studies from 2010 to 2019 were included to determine whether new studies provide new insights, consensus and clarity on the topic. This meta-analysis attempts to clarify theory and contribute to the field by adding recent studies with known moderators and mediators. As an attempt to address these issues, the following specific research questions and objectives were developed:

Research objectives

These objectives are tied to the above research questions respectively.

- To determine kind of relationship exists between Supply Chain Integration and performance.
- To find out the extent to which dimensions of SCI (II, CI, & SI) influence performance.
- To find out the extent to which facilitators of SCI (OpI, InfI, & RI) influence performance.
- To determine what dimensions of SCI (II, SI, & CI) have the most significant impact on performance.
- To determine what dimensions of SCI (OpI, InfI, & RI) have the most significant impact on performance.
- To determine which key mediators, have a significant impact on the SCI-performance relationship.
- To determine which key moderators, have a significant impact on the SCI-performance relationship.

Attempts to answers the above research questions, and their corresponding research objectives, began with an extensive review of the SCI. Two renown meta reviews by Mackelprang et al., (2014) and Leuschner et al., (2013) were used to draw a clear

distinction between SCID and SCIF. For clearer definitions and understanding of SCI, a brief review of SCM was done as presented in table 1. Some of the clearer definitions of SCI include those provided by (Flynn et al., 2010; Narasimhan et al.,2010; Chaudhuri et al., 2018; Huo et al., 2019)

The literature review also reveals the various performance indicators that organisations attached much importance to, which includes customer satisfaction, quality performance, operational performance, inventory management performance, employee satisfaction, financial performance and market performance. The study based on previous studies found it necessary to reduce these performance measures to two main performance dimensions; operational and business performance. Operational performance was measured based on performance constructs such as product quality, agility, flexibility, cost of scrap and rework, productivity, inventory management, delivery lead-time for finished products, and the level of customer complaints. Business performance on the other hand included measures such as customer satisfaction, financial, strategic, relational and market performance.

Six moderating variables (market orientation, relationship quality, market uncertainty, time, geographical location, organisation structure and culture) were also identified to have potential interactions or influence on the SCI- performance relationship. Six mediating factors (SC agility, flexibility, EIO, CI, external integration, and SC innovation) were also identified and evaluated. Thus, a research model for SCI-performance association included SCI from two perspectives (SCID & SCIF), two dimensions of performance (operational & business), potential moderators variable and mediators. Specific hypotheses corresponding with these interactions are also included in the research model.

Extensive search for relevant primary studies (articles, theses, conference papers etc.) published between 2010 and 2019 was conducted both manually and on online databases in order to obtain a sample that is necessary answer research questions and test the stated hypotheses. Specific inclusion/exclusion criteria based on Hunter and Schmidt (2004)'s guideline was designed to help determine the relevancy of the collected studies for this meta-analysis. Out of 300 studies gathered through the data search, only 92 studies were retained as sample for the analysis. Guided by the Hunter and Schmidt (2004) meta-

analysis of correlation approach, this meta-analysis was conducted using the Jamovi software after the correction of sampling and measurement errors. The Jamovi software was chosen over other meta-analysis software because of its simplicity and its ability to provide all the necessary meta results. A sample of 92 included 67 for SCID and 25 for SCIF whose population or aggregate samples (N) were 16812 and 5600 respectively. Sample descriptives indicate the majority of studies were based in Africa and Asia-Pacific region. For instance, 81% of sample studies under SCID were based on Africa and Asia-Pacific. On the other hand, 85% of SCIF studies were based on Africa and Asia-Pacific. SEM, Factor analysis, Hierarchical regression, PLS- SEM, and regression analysis were among the most used analysis method in primary studies. The heterogeneity test conducted before the meta-analysis indicated that all the proposed relationships were heterogeneously significant. Thus, justifying the choice of the random-effect (RE) model as well as the need to conduct moderator and mediator analysis on the affected associations. The meta-analytic results revealed that SCI implementation generally was positively associated with both business and operational performance. However, SCI had a slightly higher influence on operational performance. It was also evident from the results of the moderation analysis that, all analysed relationships were strongly influenced by all the potential moderating variables. On the other hand, out of all the six mediator variables analysed, only SC innovation had no significant mediation effect. Having all the research questions answered is an indication that the research objectives were successfully achieved.

Furthermore, having failed to reject all hypotheses except for that of SC innovation, it can be suggested that all theories adopted in this study are relevant for exploring the SCI-performance associations. Thus, the accepted hypotheses provide insight on the relevant theoretical framework for assessing the impact of SCI and related fields on performance.

4.3. Conclusion and Implications

Based on extensive literature review and the results of the meta-analysis, a number of conclusions could be derived. Firstly, inconsistencies and lack of consensus on the impact of SCI on performance, could be attributed to the measures as well as the different perspectives of SCI. The results of this study revealed that SCI from two perspectives or operationalisations (SCID & SCIF) yields slightly different results. The same is true with

performance where on average operational performance yielded higher results with both SCID and SCIF than business performance. Thus, looking at overall performance or a single dimension of performance might not reveal the actual effect SCI on performance or which aspect of performance is mostly affect SCI constructs. Research designs in primary studies might also increase the inconsistencies and lack of consensus on the SCI-performance association. Nonetheless, this is where a meta- analytic research on the impact of SCI on performance thrives by quantitatively combining sample studies regardless of their inconsistencies to draw accurate and reliable judgement.

Secondly, further insight and conclusions can also be derived from the results of the research model specifically from key hypotheses tested. Thus, based on the research objectives, five main categories of conclusions can be drawn; (1) based on aggregate SCI (SCID & SCIF)-performance association (2) based on individual SCI constructs (SCID &SCIF) - performance associations (3) based on individual SCI constructs (SCID &SCIF) – operational and business performance associations (4) based on the effects of moderators on all the relationships and (5) based on the effects of mediators on specific SCI- performance associations.

4.3.1. Conclusions and Implications Based on SCI - Performance Relationships

The first category, involves conclusions that can be made from the test of hypotheses (H_{1a}) and (H_{1b}) which states that aggregate SCI constructs have significant positive effects on the overall performance of organizations. The meta-analysis results specifically provided significant correlation coefficients for (H_{1a}) and (H_{1b}) respectively (ř = .476, p <.002) and (ř =.508, p <.001). Therefore, indicating that the association between SCID and performance is medium and positive, while that of SCIF and performance is positive and large. This is a clear indication that SCI from the perspective of SCID and SCIF yields different results, with SCIF having a relatively large effect. The second category involves determining the effects individual SCID and SCIF on overall performance which are based on hypotheses (H_{2a}) and (H_{2b}) respectively, the following conclusions can be obtained;

Hypothesis (H_{2a}) represents associations between individual SCI dimensions (H_{2a1}, H_{2a2}, H_{2a3}) and overall performance as presented below;

- H_{2a1} states that internal integration (II) has an influence on overall performance. II has a medium significant effect on overall performance (ř = 0.465, p< .001).
- (H_{2a2}) states that customer integration (CI) has an influence on overall performance. CI has a medium significant effect on overall performance (ř = 0.493, p< .001).
- (H_{2a3}) states that suppliers' integration (SI) has an influence on overall performance. SI has a medium significant effect on overall performance (ř = 0.474, p< .001).
- CI has a slightly higher effect on overall performance compared to II and SI.

Since all hypotheses (H_{2a1}, H_{2a2}, H_{2a3}) were positive and significant, hypothesis (H_{2a}) is accepted. Thus, concluding that all SCI dimensions influence performance at both overall and individual levels.

Hypothesis (H_{2b}) represented associations between individual SCI facilitators (H_{2b1}, H_{2b2}, H_{2b3}) and overall performance as presented below;

- (H_{2b1}) states that information integration (InfI) has an influence on overall performance. Info Int has a large significant effect on overall performance (ř = 0.560, p < .001).
- (H_{2b2}) states that operational integration (OpI) has an influence on overall performance. Info Int has a medium significant effect on overall performance (ř = 0.493, p < .001).
- (H_{2b3}) states that relational integration (RI) has an influence on overall performance. Rel Int has a medium significant effect on overall performance (ř = 0.485, p < .001).
- InfI has the highest effect on overall performance.

Since all hypotheses (H_{2b1}, H_{2b2}, H_{2b3}) were positive and significant, hypothesis (H_{2b}) is accepted. Thus, concluding that all SCI facilitators influence performance at both overall and individual levels.

The third category involves determining the effects individual SCID and SCIF on operational and business performance which are based on hypotheses (H_{2a}) and (H_{2b}) respectively, the following conclusions can be obtained;

a. Hypothesis (H_{2a}) represented associations between individual SCI dimensions (H_{2a1}, H_{2a2}, H_{2a3}) and operational & business performance. For the purpose of distinguishing between operational and business, these hypotheses are split into two sub- hypotheses. This was done to determine which SCI (SCID) dimensions have the most influence or effect on business and operational performance as presented below;
   - H_{2a1} which is separated into two hypotheses (H_{2a1i} & H_{2a1ii}), states that internal integration (II) has a positive influence on both operational and business performance. II has a higher medium significant effect on operational performance (ř = 0.449, p < .001) than on business performance (ř = 0.437, p< .001).
   - H_{2a2} (H_{2a1i} & H_{2a1ii}), states that customer integration (CI) has an influence on both operational and business performance. CI has a higher medium significant effect on operational performance (ř = 0.481 p < .001) than on business performance denoted by H_{2a1ii} (ř = 0.442, p< .001).
   - H_{2a3} (H_{2a1i} & H_{2a1ii}), states that supplier integration (SI) has an influence on both operational and business performance. SI has a higher medium significant effect on operational performance (ř = 0.452, p < .001) than on business performance indicated H_{2a1ii} (ř = 0.446, p < .001)

   All SCI dimensions have a significant effect on both operational and business performance. However, they have a slightly higher influence on operational performance compared to business performance. CI influenced operational performance more than the other two dimensions, while SI had the highest medium effect on business performance.

b. Hypothesis (H_{2b}) represented associations between individual SCI facilitators (H_{2b1}, H_{2b2}, H_{2b3}) and operational & business performance. For the purpose of distinguishing between operational and business, these hypotheses were also split into two sub- hypotheses. This was done to determine which SCI (SCIF) facilitators have the most influence or effect on business and operational performance as presented below;
   - H_{2b1} which is divided into two hypotheses (H_{2b1i} & H_{2b1ii}), states that information integration (InfI) has a positive effect on both operational and business

performance. InfI has a large significant effect on operational performance (ř = 0.585, p < 0.001) which is higher than H_{2b1ii} which also indicates a large significant effect between InfI and business performance (ř = 0.534, p < 0.001).

- H_{2b2} (H_{2b1i} & H_{2b1ii}), states that operation integration (OpI) has an influence on both operational and business performance. OpI has a medium significant effect on operational performance (ř = 0.496, p< 0.001). H_{2b1ii} also indicates a large significant effect of OpI on business performance (ř = 0.575, p < .001) which is higher than H_{2b1i}.
- H_{2b3} (H_{3b1i} & H_{3b1ii}), states that relation integration (RI) has an influence on both operational and business performance. RI has a medium significant effect on operational performance (ř = 0.450, p< 0.001). H_{3b1ii} also indicates a medium significant effect of RI on business performance (ř = 0.461, p < .001).

Besides H_{2b1i} & H_{2b1ii} for information, operational and relational integration being accepted, information integration (H_{2b1}) has the highest large significant effect on both operational and business performance. However, among the facilitators of SCI, Operational integration (H_{2b2}) has the highest large significant effect on business performance. Overall individual SCI facilitators have a slightly large influence on business performance compared to operational performance.

4.3.2. Moderator Based Conclusions

The fourth category involves conclusions which were derived from moderation analysis performed for this study. Both SCID and SCIF including their individual constructs revealed high a degree of heterogeneity which necessitated this moderation analysis. With an exception of time, a continuous moderating variable which was assessed using RE model, all the other categorical moderator variables were assessed via FE model. The results indicated that though with varying degrees, all potential moderators have significant moderation effects on both aggregate and individual SCI constructs with overall performance. For instance, out of all the proposed potential moderators of SCID, market uncertainty had the highest large significant effects (ř = 0.591, p < 0.001). This implies that the higher the market uncertainty, the stronger the integration of II, SI, and CI and their impact on performance. Surprisingly Africa with few sample studies

compared to Asia-Pacific had a relative larger significant influence on H_{1a} (ř = 0.543, p < 0.001) than Asia- Pacific region. This implies that though studies in these regions are likely to yield higher SCI- performance based outcomes, Africa would yield relatively higher outcomes than Asia- Pacific region. Overall organisational culture has a relatively higher significant medium influence on all associations of SCID compared to organisational structure. This suggests that from the perspective of SCID, a good organisational culture would likely improve the SCI- performance association a lot more than organisational structure would. Quality of relationship among partners and the high level of market orientation also affects the SCI-performance associations both at an aggregate and individual.

On the other hand, out of all the proposed moderators of SCIF, market orientation has the largest significant effect on aggregate SCIF-performance association (ř = 0.838, p < 0.001). This reveals that market orientation such as customer and competitive orientation would compel firms to integrate information, operations and relations in order to improve performance and probably gain a competitive edge over their competitors. Similar to SCID, Africa with fewer sample studies compared to Asia-Pacific region had a relatively higher significant influence on H_{1b} (ř = 0.730, p < 0.001). This implies that though studies in these regions are likely to yield higher SCI- performance based outcomes, Africa would yield relatively higher outcomes than Asia- Pacific region. Unlike with SCID, organisational structure had a significant larger influence on SCIF denoted by H_{1b} (ř = 0.676, p < 0.001) than organisational culture. The implication of this is that a flexible organisational structure would be better poised to support the relationship between SCI and performance, especially from the perspective of SCIF. However, organisational culture which may include agility and TQM and leanness equally goes a long way to influence the SCI- performance association. Results also indicate that market uncertainty and relationship quality are equally significant SCIF- performance moderators. This implies that high level of market uncertainty encourages relational and operational integration which is necessary for building strong and quality relationships which are necessary for improved performance and long- term organisational survival. In other words, firms within the SC are compelled to develop good and quality relationships with their partners to meet organisational goals.

Time as a continuous moderating variable has significant interactions with both aggregate SCID and SCIF. Though time has a higher moderation effect on H_{1a} (B = 1.173, p < 0.001) than H_{1b} (B= 1.032, p < 0.001), it has a direct influence on both. This implies that the association or effects of SCI on performance improves overtime. In other words, over time both aspects of SCI strengthen which in turn positively influence performance. This may also imply that SCI may not seem to yield long-term benefits or returns such as profitability which is usually measured in financial terms in the short run. This might also be one of the reasons why some studies did not find direct effects between financial performance and SCI.

4.3.3. Mediator Based Conclusions and Implications

The fifth and last category of conclusions are those based on mediation results. Mediation effects based on mediator variables; flexibility, customer integration, external integration, SC agility, SC innovation, and EIO identified through previous studies were assessed. Flexibility had a 53% significant partial mediation effect on the association between SCI and performance (B= 0.427, p = 0.04). This implies that flexibility which is a measure of operational performance accounts for 53% of the total effect or association between SCI and performance. In other words, without flexibility mediating the SCI- performance association, the impact is only 47%. Flexibility therefore, increases the total effect of SCI on performance. Customer and external integration had negative significant mediation effects (B= -2.490, p = 0.022) and (B = -0.304, p = 0.020). The implication of a 32% negative mediation effect of customer integration (CI) on the SI- performance association is that increased CI as a mediator reduces the total effect or association of SI on performance. Equally an 18.6% negative mediation effect of external integration between II and performance, implies that the individual total effect of internal integration on performance reduces with the introduction and increase of external integration.

SC agility on the other hand, had an 89.1% full mediation effect between SCI and performance (B = 0.547, p < 0.044). This implies that without the inclusion of agility which is a measure of operational performance, overall performance is almost none existent. In other words, the association between SCI and overall performance exists due to the existence of agility. SC innovation had no significant mediation effect between SCI and performance (B = -101, p = 0.622). External Integration Orientation (EIO) indicated

that a 22.8% positive significant mediation effect exists between external integration and performance (B = 0.128, p < 0.001). Thus, suggesting that the association between external integration and performance is improved by EIO as a mediator.

The results of SC agility coupled with the mediation effects of flexibility which together give an average percentage total of 71%, provide insights on why some inconsistencies and lack of consensus highlighted earlier in the background exist on the topic. Operational performance seems to be the most influenced by SCI either directly as seen in the third category of conclusions from the perspective of individual constructs of SCI or indirectly as seen through flexibility and SC agility as mediators. The lack of consensus between Leuschner et al., (2013) and Mackelprang et al., (2014) regarding the impact of SCI on financial (business) performance could be explained using the mediation effects of operational performance (SC agility and flexibility). For instance, focusing on agility only it might be concluded that there is no significant association between SCI and financial (business) performance. However, the mediation effects of flexibility show that about 47% might be attributed to Business performance which might include financial performance. Moreover, a combination of the two operational performance mediators (SC agility & flexibility) shows that 29% might be accounted for by business performance. Since SC agility and flexibility have revealed both a partial (flexibility) and full (SC agility) mediation, both Leuschner et al., (2013) and Mackelprang et al., (2014)'s claims are justifiable. Therefore, with regard to specific operational performance outcomes, the effect of certain business performance outcomes might be claimed to be non-significant or indirect. Thus, assessment of both direct and indirect effects which are done through mediation analysis are essential.

4.4. Contributions to the body of Knowledge and Implications for Practitioners

This meta-analytic evaluation significantly contributes to the SCM and SCI body of knowledge in a number of ways. However, these contributions could be classified in terms of theoretical and empirical contributions.

4.4.1. Theoretical Contributions

Firstly, the study provides a theoretical and conceptual framework that examines the impact of SCI (SCID & SCIF) which is done both at an aggregate and individual level on

performance which is also considered at an overall and individual level. Accepted hypotheses which were based on relevant theories such as RDT, RBV, RV, OC, contingency and configuration view, indicate which theories are relevant and worth considering when dealing with SCI or related studies. The study further assesses the effects of moderating variables; market orientation, relationship quality, geographical location, market uncertainty, time, organisational culture and structure, on the SCI-performance association which provide necessary conditions for implementing SCI. The study went further to include standard mediation analysis for six variables; flexibility, customer integration, external integration, SC agility, SC innovation, and EIO to the topic which provide further insight into the nature of the SCI- performance association. This suggests also why there may be inconsistencies on the SCI- performance outcomes. The presence of both mediators and moderators suggests that configuration and contingency theories are relevant for assessing moderation and mediation analysis on SCM related studies.

4.4.2. Empirical Contributions

The study findings equally have some significant implications for managers and SCI practitioners. Since the main findings of the study is that SCI significantly and positively affects organisational performance, managers, researchers and SCI practitioners will understand the benefits that come with the implementation of SCI and related fields. The assessment of the effects of individual SCI constructs on both operational and business as well as on overall performance and its corresponding results might serve as a guide to managers on the individual constructs (SCID & SCIF) that best predicts or influence a specific type of performance. Results for moderator analysis provide further insight on probable conditions and the magnitude of effect that factors such as their market uncertainty, geographical location, relationship quality, time, market orientation, organisational culture and structure have on their operational or business as well as overall performance goals. An understanding of probable condition expressed through the above stated moderating variables and their estimated effects on the SCI- performance association will also help the managers to uses them to their advantage. Mediations results explain the non- linearity nature of the association. This further provides insight why there are different conclusions on the association.

4.5. Recommendation for Future Research

A number of recommendations for similar future research are also provided to give guidance on however to address the limitations of the study. First and foremost, this study quantitively aggregated the findings of 92 primary empirical sample studies separately as SCID (67) and SCIF (25) to arrive at its results. It is presumed that a larger sample size especially for SCIF would have produced more generalizable results. A comparative meta-analysis of SCID and SCIF with financial performance would provide further insight on the topic. It is therefore recommended that the study be replicated with inclusion/exclusion criteria that allow for the inclusion of a large number of primary studies with more moderators and mediators in the study. High heterogeneity test results observed in the study indicates that more relevant potential moderators both categorical and continuous should be added to future SCI-performance studies. A slight departure from the traditional meta- analytic approach must be adopted in order to include even more robust mediation analysis. A wider language criterion or at least a translation of studies published in other languages like Chinese, French, Arabic and Turkish should be considered to improve the sample size. Additionally, the coding reliability of the replicated study should be improved through the involvement of other researchers, most preferably specialist, in the coding process. This would ensure that no relevant data is left out.

Lastly, a mixed approach would even provide further insight on the topic. For instance, the quantitative nature of this meant that only quantitatively conducted empirical studies were included in the sample. This implies that relevant qualitative studies on the topic might have been left out. Thus, a mixed approach might avoid such cases. A Research approach that that accounts for both qualitative and quantitative study sample is highly recommended.

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APPENDICES

Appendix 1: Summaries of Sample Studies

Table 18: Summary of SCID studies

ID	Authors	Yr	Method	Journal	Sample	Dimension	Perf.	Results
1	Pakurár et al	2019	Regression	JIS	112	Customer	Bs	II influences both OP & BS performance
						Internal	Op	CI only influences customer related BS performance
2	Jermsittiparsert et al	2019	PLS- SEM	IJCM	80	Supplier	Bs	overall SCI influences performance
						Customer	Bs	
3	Xu et al	2014	Factor	IMDS	176	Supplier	Bs	SI is positively associated with performance
						Customer	Bs	CI has weak association with performance
4	Maroko Mose	2015	Correlation	EAJ	52	Customer	Bs	overall SCI influences performance
						Suppliers	Bs	
						Internal		
5	Zhao et al	2013	SEM	SCMIJ	317	Customer	Op.	SCI improves operational & business
						Suppliers	Bs	
						Internal		
6	Suntichai et al	2012	SEM		261	Customer	Op	CI & II together and individually influence performance
						internal	Bs	
7	Willis & Chen	2016	SEM- Factor	IJLM	92	Internal	Op	overall SCI influences performance
						External	Op l	
8	Ni & Hongyi Sun	2019	PLS-SEM	SJ	162	Internal	Bs	II & CI have stronger influence BS performance
						External	Bs	
9	D Ying	2016	SEM Hierarchical	RP	385	Customer	Op	Overall SCI influences performance
						Suppliers	Op	
						Internal	Op	
10	Osei &Kagnicioglu	2018	SEM	JMML	208	Internal	Bs	EI & II influence performance
						External	Bs	
11	Muntaka et al	2017	Correlation-SEM	IJBM	255	Customer	Bs	SCI has a strong correlation with both Op & BS performance
						Suppliers	Bs	
						Internal	Op	
12	Alfalla-Luque	2015	SEM	IJPE	266	Customer	Op	SCI directly and indirect influences OP and BS performance
						Suppliers	Bs	
						Internal		
13	Boso et al	2016	Factor	IJSCM	199	Customer	Op	SCI boosts Op performance
						Suppliers	Bs	SCI affects performance
						Internal	Bs	
14	Antonius Setyadia	2018	PLS- SEM	USCM	300	Customer	Bs	CI & SI improves Business performances
						Suppliers	Bs	
15	Chaudhuri	2018	Factor	IJOPM	343	Internal	Op	II has a direct influence on Op

						External	Op	EI has an indirect influence on OP performance
16	Baofeng Huo	2012	Factor	IJSCM	617	Customer	Op	SCI directly and indirect influences OP & Bs performance
						Suppliers	Op	
						Internal	Op	
17	Huo et al	2014	Hierarchical	SCM	607	Internal	Op	II significantly influences Op & B performance
							Bs	
18	A. Subburaja et al	2019	Factor Analysis	USCM	250	Customer	Op	overall SCI influences performance
						Suppliers		
						Internal		
19	Abdallah et al	2014	Hierarchical	IBR	104	Customer	Op	overall SCI influences performance
						Suppliers		
						Internal		
20	Chatzoudes et al	2011	SEM	OSCM	132	Customer	Op	SCI influences both Op & Bs performance
						Suppliers	Bs	
						Internal		
21	Delic et al	2019	PLS-SEM	SCMIJ	124	Customer	Op	SCI influences both Op & Bs performance
						Suppliers	Bs	
						Internal		
22	Uwamahoro	2018	SEM	EARP	250	Internal	Bs	overall SCI influences performance
						Supplier	Op	II & CI have stronger influence than SI
						Customer		
23	Errassafi et al	2019	PLS-SEM	JIEM	75	Internal	Op	II, SI & CI significantly influences Op performance
						Supplier		
						Customer		
24	Kumar, V. et al	2017	Correlation	FAIM	60	Internal	Op	overall SCI influences performance
						Supplier		
						Customer		
25	Hung Bae	2011	Factor	AJSL	208	Internal	Op	overall SCI influences performance
						External	Bs	
26	Beheshti et al	2015	Regression	JGC	271	Internal	Bs	At all level SCI has a positive influence on financial performance
						Supplier		
						Customer		
27	Lu et al	2018	SEM	GJFSM	357	SCI	Op	significant non-linear effect
28	Ibrahim & Hamid	2012	Hierarchical	IJSR	110	SCI	Op	SCI affects performance
29	Kwamega et al	2018	SEM	SAJBM		SCI	Bs	SCI improves operational & business
						SCI	Op	
30	Erdinç Koç et al	2018	Factor	IJSCM	390	Internal	Op	overall SCI influences performance
						Supplier		
						Customer		
31	Habibullah Khan	2019	SEM	JOSCM	257	SCI	Bs	overall SCI influences performance
32	Sutduean et al	2019	Factor	IJICC	278	SCI	Op	overall SCI influences performance
33	Ralston et al	2014	Factor	JSCM	220	Internal	Op	overall SCI influences performance

						Supplier		
						Customer		
34	Sacristán-Díaz et	2017	SEM	JTQM BE	308	Supplier	Op	overall SCI influences performance
						Customer	Op	
35	Mofokeng et al	2019	PLS-SEM	SAJB M	271	SCI	Op	overall SCI influences performance
36	Wasim Syed et al	2019	Factor Analysis		296	Internal	Bs	overall SCI influences performance
						Supplier	Bs	
						Customer	Bs	
37	Afshan & Motwani	2018	SEM	BIJ	214	Customer	Bs	
38	Odongo	2017	Regression	Resear ch	25	Internal	Bs	overall SCI influences performance
						Supplier	Bs	
						Customer	Bs	
39	Danese et al	2011	Hierarchical regression	SCMA IJ	200	Supplier	Op	CI influences Op performance with SI as a mediator
						Customer	Op	CI negatively affects performance without SI, while influences OP
40	Liu et al	2018	SEM	SCMA IJ	216	Internal	Bs	EI & II influence OP performance
						External	Op	A weak influence exists with Bs performance
41	al Naqbi et al	2018	PLS-SEM	IJET	225	Internal	Op	SCI affects supply chain performance
						Supplier		
						Customer		
42	Shahbaz et al	2019	SEM-Regression	RCSH	362	Internal	Op	overall SCI influences performance
						Supplier	Op	
						Customer		
43	Chul-hwan Han	2018	Hierarchical	AJSL	47	Supplier	Op	overall SCI influences performance
						Customer		
44	Huang & Huang	2019		APMR	84	SCI	Bs	
45	Koçoglu et al	2011	SEM Factor	PSBS	158	Internal	Op	overall SCI influences performance
						Supplier	Op	
						Customer	Op	
46	Atnafu & Hussen	2017	Correlation	EJLPS CM	35	Internal	Op	overall SCI influences performance
						Supplier	Op	
						Customer	Op	
47	Sriyakul et al	2019	PLS-SEM	HSSR	319	External	Op	Both EI & II influence performance
						Internal	Op	
48	de Vass et al	2018	SEM	AJIS	227	Internal	Op	SCI influences both Op & Bs performance
						Supplier	Bs	
						Customer		
49	Hien Phana et al	2019	SEM	USCM	1000	SCI	Op	overall SCI influences performance
50	Chin et al	2014	SEM Factor	PSBS	201	SCI	Op	overall SCI influences performance
51	Özdemir & Aslan	2011	Hierarchical	AJBM	181	SCI	Op	there is a weak association between SCI and performance
52	Torsten et al	2019	H Linear l	CBM	1017	SCI	Op	SCI has positive effect on delivery performance
53	Vanpoucke et al	2014	SEM	JOM	719	SCI	Op	overall SCI influences performance

						SCI	Bs	
54	Makhdoom et al	2016	Regression	IJARBSS	150	Suppliers	Op	overall SCI influences performance
						Internal		
						Customer		
55	Song et al	2017	Hierarchical	SJ	214	Suppliers	Op	SCI influences OP performance
						Internal	Bs	II has negative influence on F performance
						Customer		
56	Wantao Yu et al	2013	SEM	IJPE	214	Suppliers	Bs	overall SCI influences performance
						Internal		
						Customer		
57	Pandiyan et al	2016	PLS	BAIJ	156	SCI	Op	overall SCI influences performance
58	Didia & Nwokah	2015	Correlation	IJSCM	28	SCI	Bs	SCI is associated with performance
59	Agyabeng et al	2019	PLS-SEM	JSCM	275	SCI	Bs	SCI improves operational & business
						SCI	Op	SCI develops SC capabilities
60	S M Ebrahimi	2015	SEM-Factor	Research	181	Suppliers	Op	overall SCI influences performance
						Internal		
						Customer		
61	E. N. Yunus et al	2016	Factor-SEM	BPMJ	446	Suppliers	Op	overall SCI influences performance
						Internal	Bs	
						Customer		
62	Shee et al	2018	PLS-SEM	SCMAIJ	105	Suppliers	Op	overall SCI influences performance
						Internal	Bs	
						Customer		
63	Hamza Saleh	2015	correlation	Research paper	135	Suppliers	Op	II has the most influence on Performance
						Internal		overall SCI influences performance
						Customer		
64	Wantao Yu	2014	C Factor	SCMAIJ	126	Suppliers	Op	II significantly influences CI & SI which influence performance
						Internal		
						Customer		
65	He & Lai	2012	Factor	IJPE	229	SCI (strategic)	Op	Direct significant relationship
						SCI (strategic)	Bs	
66	Boon & Wong	2011	Hierarchical	IJPDLM	151	Suppliers	Opl	SI & II positively associated with performance
						Internal		CI has no significant association
						Customer		
67	Flynn et al	2010	Hierarchical	JOPM	617	Suppliers	Op	SI and CI influence
						Internal	Bs	overall SCI influences performance
						Customer		

Table 19: Summary of SCIF

Id	Study	Year	Method	Journal	Sample	SCIF	Perf.	Results
1	Jermsittiparsert	2019	PLS- SEM		80	Operational	Bs	Op Int influences BS performance
2	Xu et al	2014	Factor Analysis	IMDS	176	Informational	Bs	Info Int has association with performance
3	Suntichai et al	2012	SEM		261	Informational	Op	Info Int, Rel Int, Op Int all significantly influence OP & BS performance
						Informational	Bs	
						Relational	Op	
4	Antonius Setyadia	2018	PLS-SEM	USCM	300	Operational	Op	Op Int influence SC operational capabilities
5	Huo et al	2014	Hierarchical regression	SCM	607	Operational	Op	Op Int influences both OP & BS performance
						Operational	Bs	
6	Abdallah et al	2014	Hierarchical regression	IBR	104	Informational	Op	Info Int improves SC efficiency and effectiveness
7	Nimeh et al	2018	Factor Analysis	IJSCM	308	Information	Op	Info Int and Rel Int significantly improves Market & SC performance
						relational	Bs	
8	Liu et al	2013	Hierarchical			Informational	Op	Info Int and Op Int are directly related to Op & BS performance
						Operational	Bs	
9	Naway & Rahmat	2019	PLS-SEM	USCM	197	Operational	Op	Op Int significantly influences SC performance
10	Panahifar et al	2018	PLS-SEM	JIEM	189	informational	Bs	Info influences BS performance
11	Ince et al	2013	SEM	Procedia SBS	138	relational	Bs	Rel Int & Info Int influences competitive & financial performance
						relational	Bs	
12	Som et al	2019	Regression		400	Informational	Op	Op Int, Info Int & Rel Int significantly influence Op performance
						Operational Integration	Op	
						Relational Integration	Opl	
13	Ibrahim & Hamid	2012	Hierarchical	IJSR	110	Informational	Op	Info Int & Rel Int correlates with OP performance
						relational	Op	
14	Kumar. et al	2017	Correlation	FAIM	60	Informational	Op	Info Int strongly correlates with SC performance
15	Yuen & Thai	2016	Regression	TJ	172	Relational Integration	Op	
						Information Integration	Op	Op Int, Info Int & Rel Int significantly influence Op performance
						Operational Integration	Op	
16	Khalid et al	2017	Factor Analysis		182	relational	Bs	Op Int, Info Int & Rel Int significantly influence BS performance
						relational	Bs	
						Operational	Bs	

17	Prajogo & Olhager	2011	SEM	IJPE	232	Operations integration	Op	Op Int significantly influences SC performance
18	Saichon Pinmanee	2016	SEM	RP	429	Information Integration	Op	Op Int, Info Int & Rel Int positively affects responsiveness and delivery reliability
						Operations integration	Op	
						Relational	Op	
19	Koçoglu et al	2011	SEM Factor	PSBS	158	Informational	Op	Info Int significantly influences SC performance
20	Chin et al	2014	SEM Factor	PSBS	201	operational	Op	Op Int & Rel Int an impact on Operational capability
						relational	Op	
21	Pandiyan et al	2016	PLS Analysis	BAIJ	156	relational	Op	Info Int and Rel Int significantly improves SC performance
						Informational	Op	
22	Francis Admire	2019	Correlation regression	RP	235	relational	Bs	Rel Int, Info Int & Op Int have a significant positive effect BS performance
						Informational	Bs	
						Operational	Bs	
23	He & Lai	2012	Factor analysis	IJPE	229	Operational Integration	Op	Op Int have a significant correlation with both OP and Financial Performance
						Operational Integration	Bs	
24	Wiengarten et al.	2010	Factor Analysis	SCMAIJ	152	informational	Op	Info Int, Rel Int, Op Int all significantly influence OP performance
						Relational	Op	
						Operational Integration	Op	

Appendix 2: Stage I Data Set

Table 20: SCID Data for Stage I

ID	Study Name	Year	N	r	SCID α	Apα	A factor	ř	W
1	Pakurár et al	2019	112	0.324	0.869	0.804	0.836	0.388	78.252
2	Jermsittiparsert et al	2019	80	0.531	0.820	0.912	0.865	0.614	59.827
3	Xu et al	2014	176	0.355	0.935	0.92	0.927	0.383	151.395
4	Evans Maroko Mose	2015	52	0.805	0.878	0.804	0.840	0.958	36.687
5	Zhao et al	2013	317	0.417	0.845	0.855	0.850	0.491	229.023
6	Suntichai et al	2012	261	0.117	0.869	0.804	0.836	0.140	182.416
7	Geoff Willis & Chen	2016	92	0.175	0.882	0.804	0.842	0.208	65.211
8	W. Ni & Hongyi Sun	2019	162	0.796	0.764	0.862	0.812	0.981	106.688
9	D Ying	2016	385	0.398	0.867	0.843	0.855	0.465	281.497
10	Osei &Kagnicioglu	2018	208	0.440	0.828	0.872	0.850	0.518	150.179
11	Muntaka et al	2017	255	0.282	0.670	0.715	0.692	0.407	122.127
12	Alfalla-Luque	2015	266	0.336	0.872	0.861	0.866	0.388	199.671
13	Annan, J, Boso et al	2016	199	0.477	0.810	0.865	0.837	0.570	139.429
14	Antonius Setyadia	2018	300	0.173	0.755	0.705	0.730	0.236	159.683
15	Chaudhuri	2018	343	0.498	0.780	0.793	0.786	0.633	212.025
16	Baofeng Huo	2012	617	0.290	0.887	0.828	0.857	0.338	452.734
17	Huo et al	2014	607	0.450	0.797	0.904	0.849	0.530	437.336
18	A. Subburaja et al	2019	250	0.307	0.773	0.727	0.749	0.409	140.336
19	Abdallah et al	2014	104	0.300	0.923	0.896	0.909	0.330	86.010
20	Chatzoudes et al	2011	132	0.324	0.871	0.913	0.891	0.364	104.891
21	Delic et al	2019	124	0.233	0.849	0.847	0.848	0.275	89.122
22	Uwamahoro	2018	250	0.407	0.816	0.799	0.808	0.504	163.117
23	Errassafi et al	2019	75	0.420	0.830	0.884	0.856	0.490	55.007
24	Kumar, V. et al	2017	60	0.236	0.869	0.804	0.836	0.282	41.921
25	Hung Bae	2011	208	0.395	0.884	0.881	0.882	0.448	161.991
26	Beheshti et al	2015	271	0.393	0.855	0.830	0.842	0.467	192.240
27	Lu et al	2018	357	0.378	0.921	0.840	0.880	0.430	276.189
28	Ibrahim & Hamid	2012	110	0.231	0.810	0.886	0.847	0.273	78.943
9	Kwamega et al	2018	162	0.713	0.887	0.828	0.857	0.831	118.979
0	Erdinç Koç et al	2018	390	0.236	0.881	0.883	0.882	0.268	303.390
1	Habibullah Khan	2019	257	0.468	0.964	0.816	0.887	0.528	202.162
2	Sutduean et al	2019	278	0.557	0.818	0.841	0.829	0.672	191.247
3	Ralston et al	2014	220	0.457	0.869	0.843	0.855	0.534	161.007
4	Sacristán-Díaz et al	2017	308	0.432	0.885	0.753	0.816	0.530	205.059
35	Mofokeng &Chinomona	2019	271	0.652	0.814	0.714	0.762	0.855	157.504
36	Wasim Syed et al	2019	296	0.526	0.842	0.820	0.831	0.633	204.372
37	Afshan & Motwani	2018	214	0.299	0.880	0.900	0.890	0.336	169.488
38	Odongo	2017	25	0.247	0.871	0.821	0.846	0.292	17.878
39	Danese & Romano	2011	200	0.425	0.961	0.944	0.952	0.446	181.342
40	Khamis al Naqbi et al	2018	225	0.207	0.927	0.913	0.920	0.225	190.430
41	Saeed Shahbaz et al	2019	362	0.333	0.495	0.821	0.638	0.523	147.191
42	Chul-hwan Han	2018	47	0.264	0.811	0.872	0.841	0.314	33.224
43	M. Huang & H. Huang	2019	84	0.160	0.710	0.910	0.804	0.199	54.272
44	Koçoglu et al	2011	158	0.608	0.876	0.830	0.853	0.714	114.833
45	Liu et al	2018	216	0.363	0.854	0.870	0.862	0.421	160.484
46	Atnafu & Hussen	2017	35	0.425	0.813	0.870	0.841	0.505	24.746
47	Sriyakul et al	2019	319	0.125	0.848	0.870	0.859	0.146	235.222
48	de Vass, Shee & Miah	2018	227	0.343	0.723	0.780	0.751	0.457	128.073
49	Hien Phana et al	2019	1000	0.533	0.920	0.949	0.934	0.570	873.080
50	Thoo Ai Chin et al	2014	201	0.483	0.780	0.740	0.760	0.636	116.017
51	Özdemir & Aslan	2011	181	0.526	0.808	0.823	0.815	0.645	120.329
52	Torsten Doering et al	2019	1017	0.233	0.841	0.880	0.860	0.271	752.661
53	Vanpoucke et al	2014	719	0.593	0.918	0.908	0.913	0.650	599.186
54	Makhdoom et al	2016	150	0.545	0.871	0.866	0.869	0.628	113.160
55	Yaw Agyabeng et al	2019	275	0.259	0.901	0.922	0.911	0.284	228.322
56	E. N. Yunus et al	2016	446	0.391	0.847	0.854	0.850	0.460	322.356
57	S M Ebrahimi	2015	181	0.205	0.868	0.843	0.855	0.240	132.339
58	Wantao Yu et al	2013	214	0.394	0.762	0.797	0.779	0.505	130.006
59	Yongtao Song et al	2017	214	0.378	0.868	0.817	0.842	0.449	151.722
60	Veera Pandiyan et al	2016	156	0.872	0.828	0.947	0.886	0.985	122.322
61	Didia J. U & G. Nwokah	2015	28	0.301	0.938	0.912	0.925	0.325	23.953
62	Wantao Yu	2014	126	0.222	0.856	0.845	0.850	0.261	91.138
63	Hamza Saleh	2015	135	0.519	0.768	0.810	0.789	0.657	84.052
64	Himanshu Shee et al	2018	105	0.391	0.847	0.854	0.850	0.460	75.891
65	He & Lai	2012	229	0.207	0.905	0.900	0.902	0.229	186.521

66	Flynn et al	2010	617	0.374	0.792	0.811	0.802	0.467	396.636
67	Boon & Wong	2011	151	0.183	0.840	0.840	0.840	0.217	106.546

NB: N represents sample sizes, **r** is unadjusted correlation, **W** is study weight, **SCIDα** represents the reliability estimate for SCID, **APα** is reliability estimate for aggregate performance, **ř** is the adjusted correlation, and **A** is the attenuation factor.

Table 21: SCIF Data for Stage I

ID	Study	Year	N	r	SCIFα	Apα	A factor	ř	W
1	Jermsittiparsert et al	2019	80	0.750	0.790	0.912	0.849	0.884	57.638
2	Xu et al	2014	176	0.340	0.940	0.920	0.930	0.366	152.205
3	Suntichai et al	2012	261	0.327	0.847	0.853	0.850	0.385	188.570
4	Antonius Setyadia	2018	300	0.236	0.781	0.748	0.764	0.309	175.256
5	Huo et al	2014	607	0.340	0.720	0.900	0.805	0.422	393.336
6	Abdallah et al	2014	104	0.247	0.786	0.819	0.802	0.307	66.948
7	Nimeh et al	2018	308	0.238	0.834	0.902	0.867	0.274	231.606
8	Liu et al	2013	246	0.405	0.810	0.825	0.817	0.495	164.390
9	Naway & Rahmat	2019	197	0.221	0.876	0.919	0.897	0.246	158.594
10	Panahifar et al	2018	189	0.794	0.914	0.852	0.882	0.900	147.180
11	Ince et al	2013	138	0.560	0.937	0.890	0.913	0.613	115.041
12	Som et al	2019	400	0.307	0.792	0.687	0.738	0.416	217.733
13	Ibrahim & Hamid	2012	110	0.150	0.780	0.886	0.831	0.180	75.986
14	Kumar, V. et al	2017	60	0.873	0.700	0.890	0.789	1.106	37.380
15	Yuen & Vinh V. Thai	2016	172	0.380	0.823	0.927	0.873	0.435	131.222
16	Khalid H. M. et al	2017	182	0.387	0.844	0.852	0.848	0.457	130.822
17	Sutduean et al	2019	278	0.346	0.911	0.834	0.872	0.397	211.217
18	Prajogo & Olhager	2011	232	0.310	0.930	0.640	0.771	0.402	138.086
19	Saichon Pinmanee	2016	429	0.550	0.788	0.788	0.788	0.698	266.610
20	Koçoglu et al	2011	158	0.362	0.770	0.770	0.770	0.470	93.678
21	Thoo Ai Chin et al	2014	201	0.396	0.798	0.740	0.768	0.515	118.620
22	Veera Pandiyan et al	2016	156	0.570	0.822	0.947	0.882	0.646	121.386
23	Francis Admire	2019	235	0.705	0.820	0.850	0.835	0.844	163.795
24	He & Lai	2012	229	0.418	0.840	0.860	0.850	0.491	165.430
25	Wiengarten et al.	2010	152	0.323	0.814	0.766	0.790	0.409	94.776

Appendix 3: Stage II Data for SCID and SCIF (Individual SCI dimensions with overall performance)

Table 22: Stage II Data for Internal Integration

ID	Study	Year	N	r	IIα	Apα	A factor	ř	W
1	W. Ni & Hongyi Sun	2019	162	0.244	0.707	0.862	0.781	0.313	98.728
2	Zhao et al	2013	317	0.397	0.878	0.822	0.850	0.468	228.784
3	Evans Maroko Mose	2015	52	0.822	0.700	0.700	0.700	1.174	25.480
4	Geoff Willis & Chen	2016	92	0.202	0.854	0.861	0.857	0.236	67.647
5	D Ying	2016	385	0.186	0.904	0.843	0.873	0.213	293.398
6	Muntaka et al	2017	255	0.472	0.810	0.865	0.837	0.564	178.666
7	Osei &Kagnicioglu	2018	208	0.641	0.908	0.886	0.897	0.715	167.334
8	Alfalla-Luque	2015	266	0.431	0.790	0.793	0.791	0.544	166.536
9	Annan, J, Boso et al	2016	199	0.125	0.900	0.865	0.882	0.142	154.922
10	Errassafi et al	2019	75	0.255	0.932	0.890	0.911	0.280	62.211
11	Delic et al	2019	124	0.373	0.834	0.864	0.849	0.439	89.317
12	Abdallah et al	2014	104	0.210	0.910	0.819	0.863	0.243	77.510
13	Baofeng Huo	2012	617	0.337	0.924	0.888	0.906	0.372	506.066
14	Chatzoudes et al	2011	132	0.375	0.813	0.756	0.784	0.478	81.131
15	Hung Bae	2011	208	0.290	0.884	0.881	0.882	0.328	161.991
16	Uwamahoro	2018	250	0.535	0.710	0.710	0.710	0.754	126.025
17	Beheshti et al	2015	271	0.501	0.847	0.841	0.844	0.594	193.041
18	Erdinç Koç et al	2018	390	0.540	0.860	0.660	0.753	0.717	221.364
19	Ralston et al	2014	220	0.535	0.860	0.830	0.845	0.633	157.036
20	Koçoglu et al	2011	158	0.345	0.720	0.760	0.740	0.467	86.458
21	Sriyakul et al	2019	319	0.261	0.885	0.893	0.889	0.294	252.107
22	de Vass, Shee & Miah	2018	227	0.605	0.930	0.885	0.907	0.667	186.832
23	Wasim Syed et al	2019	296	0.020	0.940	0.920	0.930	0.022	255.981
24	Khamis al Naqbi et al	2018	225	0.481	0.919	0.868	0.893	0.539	179.481
25	Saeed Shahbaz et al	2019	362	0.690	0.834	0.753	0.792	0.871	227.337
26	Makhdoom et al	2016	150	0.450	0.826	0.765	0.795	0.566	94.722
27	Wantao Yu et al	2013	214	0.246	0.869	0.836	0.852	0.289	155.468
28	Yongtao Song et al	2017	214	0.308	0.863	0.917	0.890	0.346	169.353
29	Hamza Saleh	2015	135	0.670	0.907	0.844	0.875	0.766	103.344
30	E. N. Yunus et al	2016	446	0.222	0.930	0.875	0.902	0.246	362.933
31	Wantao Yu	2014	126	0.414	0.846	0.833	0.839	0.493	88.794
32	Himanshu Shee et al	2018	105	0.141	0.850	0.800	0.825	0.170	71.400
33	Boon & Wong	2011	151	0.410	0.830	0.900	0.864	0.474	112.797
34	Flynn et al	2010	617	0.375	0.920	0.900	0.910	0.412	510.876
35	A. Subburaja et al	2019	250	0.248	0.910	0.921	0.915	0.271	209.528
36	Odongo	2017	25	0.270	0.857	0.837	0.847	0.319	17.933
37	Atnafu & Hussen	2017	35	0.648	0.857	0.837	0.847	0.765	25.106
38	Liu et al	2018	216	0.209	0.854	0.837	0.845	0.247	154.306

Table 23: Stage II Data for Customer Integration

ID	Study	Year	N	r	CIα	Apα	A factor	ř	W
1	Delic et al	2019	124	0.408	0.807	0.864	0.835	0.489	86.390
2	Abdallah et al	2014	104	0.214	0.757	0.819	0.787	0.272	64.478
3	Chatzoudes et al	2011	132	0.345	0.749	0.756	0.752	0.458	74.744
4	A. Subburaja et al	2019	250	0.429	0.880	0.899	0.889	0.482	197.780
5	Annan, J, Boso et al	2016	199	0.016	0.870	0.865	0.867	0.018	149.757
6	Baofeng Huo	2012	617	0.347	0.900	0.882	0.891	0.389	489.590
7	Antonius Setyadia	2018	300	0.153	0.814	0.748	0.780	0.196	182.662
8	Muntaka et al	2017	255	0.440	0.810	0.865	0.837	0.525	178.666
9	Alfalla-Luque	2015	266	0.445	0.770	0.793	0.781	0.570	162.320
10	D Ying	2016	385	0.131	0.841	0.843	0.842	0.156	272.951
11	Uwamahoro	2018	250	0.555	0.710	0.710	0.710	0.782	126.025
12	Errassafi et al	2019	75	0.365	0.922	0.890	0.906	0.403	61.544
13	Kumar, V. et al	2017	60	0.843	0.700	0.764	0.731	1.153	32.091
14	Suntichai et al	2012	261	0.404	0.850	0.853	0.851	0.474	189.238
15	Zhao et al	2013	317	0.442	0.817	0.902	0.858	0.514	233.608
16	Evans Maroko Mose	2015	52	0.808	0.700	0.700	0.700	1.154	25.480
17	Xu et al	2014	176	0.350	0.940	0.920	0.930	0.376	152.205

18	Jermsittiparsert et al	2019	80	0.650	0.830	0.912	0.870	0.747	60.557
19	Beheshti et al	2015	271	0.527	0.811	0.841	0.826	0.638	184.836
20	Erdinç Koç et al	2018	390	0.460	0.830	0.660	0.740	0.622	213.642
21	Ralston et al	2014	220	0.315	0.780	0.830	0.805	0.391	142.428
22	Sacristán-Díaz, Zhang et al	2017	308	0.365	0.962	0.940	0.951	0.384	278.518
23	Wasim Syed et al	2019	296	0.123	0.950	0.920	0.935	0.132	258.704
24	Afshan & Motwani	2018	214	0.299	0.880	0.900	0.890	0.336	169.488
25	Odongo	2017	25	0.200	0.828	0.853	0.840	0.238	17.654
26	Danese & Romano	2011	200	0.244	0.720	0.700	0.710	0.344	100.800
27	Khamis al Naqbi et al	2018	225	0.631	0.720	0.868	0.791	0.798	140.616
28	Saeed Shahbaz et al	2019	362	0.694	0.720	0.753	0.736	0.943	196.262
29	Chul-hwan Han	2018	47	0.213	0.720	0.790	0.754	0.283	26.734
30	Koçoglu et al	2011	158	0.396	0.720	0.760	0.740	0.535	86.458
31	Atnafu & Hussen	2017	35	0.719	0.720	0.774	0.747	0.963	19.510
32	de Vass, Shee & Miah	2018	227	0.610	0.910	0.885	0.897	0.680	182.814
33	Makhdoom et al	2016	150	0.414	0.779	0.765	0.772	0.536	89.332
34	Yongtao Song et al	2017	214	0.289	0.938	0.917	0.927	0.312	184.071
35	Wantao Yu et al	2013	214	0.192	0.779	0.836	0.807	0.237	139.366
36	S M Ebrahimi	2015	181	0.655	0.982	0.987	0.984	0.665	175.431
37	E. N. Yunus et al	2016	446	0.169	0.880	0.875	0.877	0.192	343.420
38	Hamza Saleh	2015	135	0.668	0.882	0.844	0.863	0.774	100.495
39	Flynn et al	2010	617	0.355	0.900	0.900	0.900	0.394	499.770
40	Wantao Yu	2014	126	0.330	0.720	0.833	0.774	0.426	75.570
41	Boon & Wong	2011	151	0.170	0.790	0.900	0.843	0.202	107.361
42	Himanshu Shee et al	2018	105	0.307	0.680	0.800	0.738	0.416	57.120

Table 24: Stage II Data for Suppliers Integration

ID	Study	Year	N	r	SIα	Apα	A factor	ř	W
1	Evans Maroko Mose	2015	52	0.784	0.890	0.855	0.872	0.899	39.569
2	D Ying	2016	385	0.142	0.857	0.843	0.850	0.167	278.144
3	Muntaka et al	2017	255	0.521	0.810	0.865	0.837	0.622	178.666
4	Zhao et al	2013	317	0.413	0.839	0.842	0.840	0.491	223.941
5	Alfalla-Luque	2015	266	0.348	0.740	0.793	0.766	0.454	155.996
6	Xu et al	2014	176	0.360	0.930	0.920	0.925	0.389	150.586
7	Jermsittiparsert et al	2019	80	0.412	0.810	0.912	0.859	0.479	59.098
8	Annan, J, Boso et al	2016	199	0.373	0.920	0.865	0.892	0.418	158.364
9	Antonius Setyadia	2018	300	0.186	0.810	0.748	0.778	0.239	181.764
10	Baofeng Huo	2012	617	0.313	0.944	0.882	0.912	0.343	513.525
11	A. Subburaja et al	2019	250	0.309	0.910	0.921	0.915	0.337	209.528
12	Abdallah et al	2014	104	-0.325	0.798	0.819	0.808	-0.402	67.970
13	Chatzoudes et al	2011	132	0.373	0.880	0.756	0.816	0.457	87.817
14	Delic et al	2019	124	0.389	0.844	0.864	0.854	0.456	90.388
15	Uwamahoro	2018	250	0.510	0.710	0.710	0.710	0.718	126.025
16	Kumar, V. et al	2017	60	0.649	0.700	0.855	0.774	0.839	35.910
17	Errassafi et al	2019	75	0.237	0.929	0.890	0.909	0.261	62.011
18	Beheshti et al	2015	271	0.552	0.791	0.841	0.816	0.677	180.278
19	Erdinç Koç et al	2018	390	0.290	0.820	0.660	0.736	0.394	211.068
20	Ralston et al	2014	220	0.320	0.750	0.830	0.789	0.406	136.950
21	Sacristán-Díaz, Zhang et al	2017	308	0.450	0.959	0.948	0.953	0.472	280.013
22	Wasim Syed et al	2019	296	0.198	0.950	0.920	0.935	0.212	258.704
23	Danese & Romano	2011	200	0.455	0.730	0.700	0.715	0.637	102.200
24	Khamis al Naqbi et al	2018	225	0.470	0.865	0.868	0.866	0.542	168.935

25	Saeed Shahbaz et al	2019	362	0.713	0.922	0.753	0.833	0.856	251.324
26	Chul-hwan Han	2018	47	0.173	0.770	0.790	0.780	0.222	28.590
27	Koçoglu et al	2011	158	0.482	0.650	0.760	0.703	0.686	78.052
28	Atnafu & Hussen	2017	35	0.779	0.833	0.855	0.844	0.923	24.928
29	Makhdoom et al	2016	150	0.380	0.747	0.765	0.756	0.502	85.662
30	Yongtao Song et al	2017	214	0.290	0.938	0.917	0.927	0.312	184.071
31	Wantao Yu et al	2013	214	0.204	0.886	0.836	0.861	0.236	158.509
32	de Vass, Shee & Miah	2018	227	0.615	0.920	0.885	0.902	0.682	184.823
33	Yunus et al	2016	446	0.153	0.880	0.875	0.877	0.174	343.420
34	Himanshu Shee et al	2018	105	0.207	0.790	0.800	0.795	0.260	66.360
35	Yunus et al	2016	446	0.307	0.680	0.800	0.738	0.416	242.624
36	Hamza Saleh	2015	135	0.649	0.847	0.844	0.845	0.768	96.507
37	Wantao Yu	2014	126	0.357	0.791	0.833	0.812	0.439	83.022

Individual SCI Facilitators (H_{2b1} – H_{2b3}) with overall performance

Table 25: Stage II Data for Information Integration

ID	Study	Year	N	r	Inflα	Apα	A factor	ř	W
1	Xu et al	2014	176	0.340	0.940	0.920	0.930	0.366	152.205
2	Suntichai et al	2012	261	0.310	0.878	0.853	0.865	0.358	195.472
3	Abdallah et al	2014	104	0.247	0.786	0.819	0.802	0.307	66.948
4	Nimeh et al	2018	308	0.387	0.811	0.902	0.855	0.452	225.309
5	Liu et al	2013	246	0.370	0.830	0.780	0.805	0.460	159.260
6	Panahifar et al	2018	189	0.794	0.914	0.852	0.882	0.900	147.180
7	Ince et al	2013	138	0.575	0.920	0.890	0.905	0.635	112.994
8	Som et al	2019	400	0.369	0.820	0.687	0.751	0.492	225.336
9	Ibrahim & Hamid	2012	110	0.096	0.793	0.886	0.838	0.115	77.286
10	Koçoglu et al	2011	158	0.362	0.770	0.770	0.770	0.470	93.678
11	Veera Pandiyan et al	2016	156	0.572	0.788	0.947	0.864	0.662	116.413
12	Francis Admire	2019	235	0.720	0.830	0.850	0.840	0.857	165.793
13	Wiengarten et al.	2010	152	0.501	0.881	0.766	0.821	0.610	102.577
14	Kumar, V. et al	2017	60	0.873	0.900	0.890	0.895	0.975	48.060
15	Yuen &Vinh V. Thai	2016	172	0.500	0.823	0.927	0.873	0.572	131.222
16	Khalid H. M. et al	2017	182	0.383	0.840	0.843	0.841	0.455	128.801
17	Saichon Pinmanee	2016	429	0.557	0.818	0.818	0.818	0.681	287.054

Table 26: Stage II Data for Operational Integration

ID	Study	Year	N	r	OpIα	Apα	A factor	ř	W
1	Nimeh et al	2018	308	0.1633	0.845	0.902	0.873	0.187	234.755
2	Suntichai et al	2012	261	0.2905	0.865	0.853	0.859	0.338	192.578
3	Ince et al	2013	138	0.553	0.945	0.890	0.9171	0.602	116.065
4	Saichon Pinmanee	2016	429	0.585	0.834	0.834	0.834	0.701	298.394
5	Kumar, V. et al	2017	60	0.370	0.823	0.927	0.8735	0.424	45.775
6	Ibrahim & Hamid	2012	110	0.353	0.773	0.886	0.8276	0.427	75.337
7	Som et al	2019	400	0.108	0.768	0.687	0.7264	0.149	211.046
8	Khalid H. M. et al	2017	182	0.384	0.884	0.852	0.8679	0.442	137.077
9	Thoo Ai Chin et al	2014	201	0.506	0.745	0.740	0.7425	0.681	110.811
10	Francis Admire	2019	235	0.705	0.830	0.850	0.8399	0.839	165.793
11	Veera Pandiyan et al	2016	156	0.470	0.786	0.947	0.8628	0.545	116.117
12	Wiengarten et al.	2010	152	0.317	0.697	0.766	0.7307	0.434	81.153

Table 27: Stage II Data for Relational Integration

ID	Study	Year	N	r	RIα	Apα	A factor	ř	W
1	Som et al	2019	400	0.444	0.789	0.687	0.7362	0.603	216.817
2	Naway & Rahmat	2019	197	0.221	0.876	0.919	0.8972	0.246	158.593
3	Liu et al	2013	246	0.440	0.790	0.870	0.829	0.531	169.075
4	Huo et al	2014	607	0.34	0.72	0.9	0.805	0.422	393.336
5	Antonius Setyadia	2018	300	0.236	0.781	0.748	0.7643	0.309	175.256
6	Suntichai et al	2012	261	0.381	0.797	0.853	0.8245	0.462	177.438
7	Jermsittiparsert et al	2019	80	0.750	0.79	0.912	0.8488	0.884	57.6384
8	Yuen & Vinh V. Tha	2016	172	0.309	0.880	0.865	0.8725	0.355	130.926
9	Prajogo & Olhager	2011	232	0.310	0.930	0.640	0.7715	0.402	138.086
10	Saichon Pinmanee	2016	429	0.5095	0.713	0.713	0.713	0.715	218.090
11	Thoo Ai Chin et al	2014	201	0.286	0.850	0.740	0.7931	0.361	126.429
12	Francis Admire	2019	235	0.690	0.800	0.850	0.8246	0.837	159.8
13	He & Lai	2012	229	0.418	0.840	0.860	0.8499	0.491	165.429
14	Wiengarten et al.	2010	152	0.150	0.864	0.766	0.8135	0.184	100.597

Appendix 4: Stage III data Set (Stage III: Individual SCI dimensions with Business Performance)

Table 28: Stage III for Internal Integration with Business performance

ID	Study	Year	N	r	IIα	BPα	A factor	ř	W
1	Zhao et al	2013	317	0.414	0.828	0.872	0.850	0.487	228.879
2	Evans Maroko Mose	2015	52	0.822	0.891	0.863	0.877	0.937	39.985
3	W. Ni & Hongyi Sun	2019	162	0.244	0.707	0.862	0.781	0.313	98.728
4	Osei &Kagnicioglu	2018	208	0.641	0.908	0.886	0.897	0.715	167.334
5	Muntaka et al	2017	255	0.476	0.810	0.830	0.820	0.581	171.437
6	Annan, J, Boso et al	2016	199	0.278	0.900	0.830	0.864	0.322	148.653
7	Alfalla-Luque	2015	266	0.566	0.790	0.880	0.834	0.679	184.923
8	Baofeng Huo	2012	617	0.350	0.924	0.905	0.914	0.383	515.948
9	Huo et al	2014	607	0.430	0.797	0.904	0.849	0.507	437.336
10	Hung Bae	2011	208	0.252	0.892	0.876	0.884	0.285	162.530
11	Beheshti et al	2015	271	0.501	0.847	0.841	0.844	0.594	193.041
12	Delic et al	2019	124	0.399	0.857	0.893	0.875	0.456	94.844
13	Subburaja et al	2019	250	0.251	0.910	0.921	0.915	0.274	209.528
14	Uwamahoro	2018	250	0.530	0.710	0.710	0.710	0.746	126.025
15	Flynn et al	2010	617	0.350	0.920	0.940	0.930	0.376	533.582
16	Yongtao Song et al	2017	214	0.242	0.863	0.922	0.892	0.271	170.277
17	de Vass, Shee & Miah	2018	227	0.580	0.930	0.910	0.920	0.630	192.110
18	Wasim Syed et al	2019	296	0.020	0.940	0.920	0.930	0.022	255.981
19	Odongo	2017	25	0.270	0.891	0.863	0.877	0.308	19.223
20	Liu et al	2018	216	0.249	0.828	0.863	0.845	0.295	154.346
21	Wantao Yu et al	2013	214	0.246	0.869	0.836	0.852	0.289	155.468
22	Yunus et al	2016	446	0.240	0.930	0.900	0.915	0.262	373.302
23	Himanshu Shee et al	2018	105	0.141	0.850	0.790	0.819	0.172	70.508

Table 29: Stage III for Customer Integration with Business performance

ID	Study	Year	N	r	CIα	BPα	A factor	ř	W
1	Xu et al	2014	176	0.350	0.940	0.920	0.930	0.376	152.205
2	Zhao et al	2013	317	0.442	0.839	0.842	0.840	0.525	223.941
3	Geoff Willis & Chen	2016	92	0.261	0.850	0.829	0.839	0.311	64.828
4	Evans Maroko Mose	2015	52	0.808	0.840	0.854	0.847	0.954	37.303
5	Muntaka et al	2017	255	0.420	0.810	0.830	0.820	0.512	171.437
6	Alfalla-Luque	2015	266	0.700	0.770	0.880	0.823	0.850	180.242
7	Annan, J, Boso et al	2016	199	0.185	0.870	0.830	0.850	0.218	143.698
8	Antonius Setyadia	2018	300	0.153	0.814	0.748	0.780	0.196	182.662
9	Huo et al	2014	607	0.250	0.900	0.905	0.902	0.277	494.402
10	Subburaja et al	2019	250	0.311	0.910	0.921	0.915	0.340	209.528
11	Chatzoudes & Chatzoglou	2011	132	0.446	0.749	0.711	0.730	0.611	70.295
12	Delic et al	2019	124	0.437	0.788	0.893	0.839	0.521	87.208
13	Uwamahoro	2018	250	0.560	0.710	0.710	0.710	0.789	126.025
14	Beheshti et al	2015	271	0.527	0.811	0.841	0.826	0.638	184.836

15	Wasim Syed et al	2019	296	0.123	0.950	0.920	0.935	0.132	258.704
16	Odongo	2017	25	0.200	0.840	0.854	0.847	0.236	17.934
17	de Vass, Shee & Miah	2018	227	0.620	0.910	0.910	0.910	0.681	187.979
18	Yongtao Song et al	2017	214	0.276	0.938	0.922	0.930	0.297	185.075
19	Wantao Yu et al	2013	214	0.192	0.779	0.836	0.807	0.237	139.366
20	Himanshu Shee et al	2018	105	0.167	0.880	0.900	0.890	0.188	83.160
21	Hamza Saleh	2015	135	0.290	0.680	0.790	0.733	0.396	72.522
22	Flynn et al	2010	617	0.250	0.900	0.940	0.920	0.272	521.982

Table 30: Stage III for Suppliers Integration with Business performance

ID	Study	Year	N	r	SIα	BPα	A factor	ř	W
1	Wasim Syed et al	2019	296	0.198	0.950	0.920	0.935	0.212	258.704
2	Odongo	2017	25	0.530	0.866	0.862	0.864	0.613	18.662
3	de Vass, Shee & Miah	2018	227	0.600	0.920	0.910	0.915	0.656	190.044
4	Yongtao Song et al	2017	214	0.280	0.938	0.922	0.930	0.301	185.075
5	Wantao Yu et al	2013	214	0.204	0.886	0.836	0.861	0.236	158.509
6	Yunus et al	2016	446	0.173	0.880	0.900	0.890	0.194	353.232
7	Himanshu Shee et al	2018	105	0.172	0.790	0.790	0.790	0.218	65.531
8	Flynn et al	2010	617	0.220	0.940	0.940	0.940	0.234	545.181
9	Beheshti et al	2015	271	0.552	0.791	0.841	0.816	0.677	180.278
10	Delic et al	2019	124	0.408	0.844	0.893	0.868	0.470	93.405
11	A. Subburaja et al	2019	250	0.319	0.910	0.921	0.915	0.348	209.528
12	Baofeng Huo	2012	617	0.220	0.944	0.905	0.924	0.238	527.115
13	Xu et al	2014	176	0.360	0.930	0.920	0.925	0.389	150.586
14	Zhao et al	2013	317	0.413	0.878	0.822	0.850	0.486	228.784
15	Evans Maroko Mose	2015	52	0.784	0.866	0.862	0.864	0.907	38.818
16	Muntaka et al	2017	255	0.595	0.810	0.830	0.820	0.726	171.437
17	Jermsittiparsert et al	2019	80	0.412	0.810	0.912	0.859	0.479	59.098
18	Alfalla-Luque	2015	266	0.541	0.740	0.880	0.807	0.670	173.219
19	Annan, J, Boso et al	2016	199	0.390	0.920	0.830	0.874	0.446	151.956
20	Chatzoudes & Chatzoglou	2011	132	0.314	0.880	0.711	0.791	0.397	82.590

Stage III: Individual SCI facilitators (H2b1 – H2b3) with Business Performance

Table 31: Stage III: Information Integration with Business Performance

ID	Study	Year	N	r	Inflα	BPα	A factor	ř	W
1	Xu et al	2014	176	0.340	0.940	0.920	0.930	0.366	152.205
2	Suntichai et al	2012	261	0.225	0.878	0.829	0.853	0.264	189.972
3	Nimeh et al	2018	308	0.326	0.811	0.935	0.871	0.374	233.552
4	Liu et al	2013	246	0.290	0.830	0.780	0.805	0.360	159.260
5	Naway & Rahmat	2019	197	0.794	0.914	0.852	0.882	0.900	153.409
6	Khalid H. M. et al	2017	182	0.383	0.840	0.843	0.841	0.455	128.801
7	Francis Admire	2019	235	0.720	0.830	0.860	0.845	0.852	167.710
8	Ince et al	2013	138	0.575	0.920	0.890	0.905	0.635	112.994

Table 32: Stage III: Operational Integration with Business Performance

ID	Study	Year	N	r	Opα	BPα	A factor	ř	W
1	Suntichai et al	2012	261	0.262	0.865	0.829	0.847	0.309	187.159
2	Nimeh et al	2018	308	0.085	0.845	0.935	0.889	0.096	243.343
3	Ince et al	2013	138	0.553	0.945	0.890	0.917	0.602	116.065
4	Khalid H. M. et al	2017	182	0.384	0.884	0.852	0.868	0.442	137.077

5	Francis Admire	2019	235	0.705	0.830	0.850	0.840	0.839	165.793

Table 33: Stage III: Relation Integration with Business Performance

ID	Study	Year	N	r	RIα	BPα	A factor	ř	W
1	Suntichai et al	2012	261	0.262	0.865	0.829	0.847	0.309	187.159
2	Nimeh et al	2018	308	0.085	0.845	0.935	0.889	0.096	243.343
3	Ince et al	2013	138	0.553	0.945	0.890	0.917	0.602	116.065
4	Khalid H. M. et al	2017	182	0.384	0.884	0.852	0.868	0.442	137.077
5	Francis Admire	2019	235	0.705	0.830	0.850	0.840	0.839	165.793

Stage III: Individual SCID (H2a1 – H2a3) with Operation Performance (OP)

Table 34: Stage III: Internal Integration with Operation Performance

ID	Study	Year	N	r	IIα	OPα	A factor	ř	W
1	Annan, J, Boso et al	2016	199	-0.028	0.900	0.900	0.900	-0.031	161.190
2	Chaudhuri	2018	343	0.530	0.915	0.831	0.872	0.608	260.805
3	Baofeng Huo	2012	617	0.423	0.923	0.867	0.894	0.473	493.570
4	Huo et al	2014	607	0.470	0.797	0.904	0.849	0.554	437.336
5	Subburaja et al	2019	250	0.245	0.910	0.921	0.915	0.268	209.528
6	Abdallah et al	2014	104	0.210	0.910	0.819	0.863	0.243	77.510
7	Chatzoudes et al	2011	132	0.444	0.813	0.801	0.807	0.550	85.960
8	Delic et al	2019	124	0.292	0.857	0.806	0.831	0.352	85.652
9	Uwamahoro	2018	250	0.540	0.710	0.710	0.710	0.761	126.025
10	Errassafi et al	2019	75	0.255	0.932	0.890	0.911	0.280	62.211
11	Kumar, V. et al	2017	60	0.255	0.700	0.840	0.767	0.333	35.280
12	Hung Bae	2011	208	0.327	0.876	0.886	0.881	0.371	161.436
13	Muntaka et al	2017	255	0.468	0.810	0.900	0.854	0.548	185.895
14	Zhao et al	2013	317	0.370	0.878	0.822	0.850	0.436	228.784
15	Geoff Willis & Chen	2016	92	0.202	0.854	0.861	0.857	0.236	67.647
16	Alfalla-Luque	2015	266	0.295	0.790	0.705	0.746	0.395	148.149
17	Ying	2016	385	0.186	0.904	0.843	0.873	0.213	293.398
18	Ralston et al	2014	220	0.535	0.860	0.830	0.845	0.633	157.036
19	Flynn et al	2010	617	0.400	0.920	0.860	0.889	0.450	488.170
20	Makhdoom et al	2016	150	0.450	0.826	0.765	0.795	0.566	94.722
21	Yongtao Song et al	2017	214	0.373	0.863	0.912	0.887	0.420	168.430
22	Saeed Shahbaz et al	2019	362	0.690	0.834	0.753	0.792	0.871	227.337
23	Khamis al Naqbi et al	2018	225	0.481	0.919	0.868	0.893	0.539	179.481
24	Liu et al	2018	216	0.169	0.879	0.840	0.859	0.197	159.486
25	Koçoglu et al	2011	158	0.345	0.720	0.760	0.740	0.467	86.458
26	Sriyakul et al	2019	319	0.261	0.885	0.893	0.889	0.294	252.107
27	Atnafu & Hussen	2017	35	0.648	0.859	0.840	0.849	0.763	25.255
28	de Vass, Shee & Miah	2018	227	0.630	0.930	0.860	0.894	0.704	181.555
29	E. N. Yunus et al	2016	446	0.204	0.930	0.850	0.889	0.229	352.563
30	Himanshu Shee et al	2018	105	0.140	0.850	0.810	0.830	0.169	72.293
31	Hamza Saleh	2015	135	0.670	0.907	0.844	0.875	0.766	103.344
32	Wantao Yu	2014	126	0.414	0.846	0.833	0.839	0.493	88.794
33	Boon & Wong	2011	151	0.410	0.830	0.900	0.864	0.474	112.797

Table 35: Stage III: Internal Integration with Operation Performance

ID	Study	Year	N	r	CIα	OPα	A factor	ř	W
1	Ralston et al	2014	220	0.315	0.780	0.830	0.805	0.391	142.428
2	Sacristán-Díaz, et al	2017	308	0.365	0.962	0.940	0.951	0.384	278.518
3	Danese & Romano	2011	200	0.244	0.720	0.700	0.710	0.344	100.800
4	Khamis al Naqbi et al	2018	225	0.631	0.787	0.868	0.827	0.763	153.701
5	Saeed Shahbaz et al	2019	362	0.694	0.808	0.753	0.780	0.890	220.249
6	Chul-hwan Han	2018	47	0.180	0.740	0.840	0.788	0.228	29.215
7	Koçoglu et al	2011	158	0.396	0.730	0.760	0.745	0.532	87.658
8	Atnafu & Hussen	2017	35	0.719	0.808	0.706	0.755	0.952	19.966
9	de Vass, Shee & Miah	2018	227	0.600	0.910	0.860	0.885	0.678	177.650
10	Makhdoom et al	2016	150	0.414	0.779	0.765	0.772	0.536	89.332
11	Yongtao Song et al	2017	214	0.302	0.938	0.912	0.925	0.327	183.068
12	Errassafi et al	2019	75	0.255	0.932	0.890	0.911	0.280	62.211
13	Kumar, V. et al	2017	60	0.843	0.806	0.912	0.857	0.983	44.104
14	Baofeng Huo	2012	617	0.200	0.462	0.431	0.446	0.448	122.716
15	Subburaja et al	2019	250	0.253	0.910	0.921	0.915	0.276	209.528
16	Chatzoudes & Chatzoglou	2011	132	0.243	0.749	0.801	0.775	0.314	79.193
17	Abdallah et al	2014	104	0.214	0.757	0.819	0.787	0.272	64.478
18	Delic et al	2019	124	0.424	0.788	0.806	0.797	0.532	78.756
19	Muntaka et al	2017	255	0.459	0.810	0.900	0.854	0.538	185.895
20	Suntichai el at	2012	261	0.546	0.850	0.877	0.863	0.632	194.562
21	Ying	2016	385	0.131	0.841	0.843	0.842	0.156	272.951
22	Alfalla-Luque	2015	266	0.190	0.770	0.705	0.737	0.258	144.398
23	Annan, J, Boso et al	2016	199	-0.154	0.870	0.900	0.885	-0.174	155.817
24	Erdinç Koç et al	2018	390	0.460	0.830	0.660	0.740	0.622	213.642
25	S M Ebrahimi	2015	181	0.655	0.982	0.987	0.984	0.665	175.431
26	E. N. Yunus et al	2016	446	0.170	0.880	0.850	0.865	0.197	333.608
27	Himanshu Shee et al	2018	105	0.323	0.680	0.810	0.742	0.435	57.834
28	Wantao Yu	2014	126	0.479	0.781	0.817	0.799	0.600	80.398
29	Boon & Wong	2011	151	0.170	0.790	0.900	0.843	0.202	107.361
30	Flynn et al	2010	617	0.460	0.900	0.860	0.880	0.523	477.558
31	Hamza Saleh	2015	135	0.668	0.882	0.844	0.863	0.774	100.495
32	Himanshu Shee et al	2018	105	0.323	0.680	0.810	0.742	0.435	57.834
33	Wantao Yu	2014	126	0.330	0.720	0.833	0.774	0.426	75.570
34	Boon & Wong	2011	151	0.170	0.790	0.900	0.843	0.202	107.361
35	Flynn et al	2010	617	0.460	0.900	0.860	0.880	0.523	477.558
36	Hamza Saleh	2015	135	0.668	0.882	0.844	0.863	0.774	100.495

Table: 36: Stage III: Suppliers Integration with Operation Performance

ID	Study	Year	N	r	SIα	OPα	A factor	ř	W
1	Errassafi et al	2019	75	0.237	0.929	0.890	0.909	0.261	62.011
2	Uwamahoro	2018	250	0.510	0.710	0.710	0.710	0.718	126.025
3	Kumar, V. et al	2017	60	0.649	0.700	0.828	0.761	0.852	34.776
4	Erdinç Koç et al	2018	390	0.290	0.820	0.660	0.736	0.394	211.068
5	Ralston et al	2014	220	0.320	0.750	0.830	0.789	0.406	136.950
6	Danese & Romano	2011	200	0.455	0.730	0.700	0.715	0.637	102.200
7	Khamis al Naqbi et al	2018	225	0.470	0.865	0.868	0.866	0.542	168.935
8	Saeed Shahbaz et al	2019	362	0.713	0.922	0.753	0.833	0.856	251.324
9	Chul-hwan Han	2018	47	0.173	0.770	0.790	0.780	0.222	28.590
10	Koçoglu et al	2011	158	0.482	0.650	0.760	0.703	0.686	78.052
11	Atnafu & Hussen	2017	35	0.779	0.835	0.828	0.831	0.937	24.198
12	de Vass, Shee & Miah	2018	227	0.600	0.920	0.910	0.915	0.656	190.044
13	Makhdoom et al	2016	150	0.380	0.747	0.765	0.756	0.502	85.662
14	Yongtao Song et al	2017	214	0.299	0.938	0.912	0.925	0.323	183.068
15	Wantao Yu et al	2013	214	0.129	0.886	0.803	0.843	0.153	152.252
16	Ebrahimi	2015	181	0.638	0.986	0.987	0.986	0.647	176.146
17	Yunus et al	2016	446	0.133	0.880	0.850	0.865	0.154	333.608
18	Himanshu Shee et al	2018	105	0.241	0.790	0.810	0.800	0.301	67.190
19	Hamza Saleh	2015	135	0.649	0.847	0.844	0.845	0.768	96.507
20	Wantao Yu	2014	126	0.357	0.791	0.833	0.812	0.439	83.022
21	Boon & Wong	2011	151	0.370	0.790	0.900	0.843	0.439	107.361
22	Flynn et al	2010	617	0.310	0.940	0.860	0.899	0.345	498.783
23	Ying	2016	385	0.142	0.857	0.843	0.850	0.167	278.144
24	Zhao et al	2013	317	0.431	0.878	0.822	0.850	0.507	228.784
25	Muntaka et al	2017	255	0.446	0.810	0.900	0.854	0.522	185.895
26	Alfalla-Luque	2015	266	0.155	0.740	0.705	0.722	0.215	138.772
27	Annan, J, Boso et al	2016	199	0.355	0.920	0.900	0.910	0.390	164.772
28	Baofeng Huo	2012	617	0.360	0.944	0.870	0.906	0.397	506.730
29	Subburaja et al	2019	250	0.298	0.910	0.921	0.915	0.326	209.528
30	Abdallah et al	2014	104	-0.325	0.798	0.819	0.808	-0.402	67.970
31	Delic et al	2019	124	0.353	0.844	0.806	0.825	0.428	84.353

Stage III: Individual SCIF with Operational Performance

Table: 37 Stage III: Information Integration with Operational Performance

ID	Study	Year	N	r	InfIα	OPα	A factor	ř	W
1	Suntichai et al	2012	261	0.395	0.878	0.877	0.877	0.450	200.972
2	Abdallah et al	2014	104	0.247	0.786	0.819	0.802	0.307	66.948
3	Liu et al	2013	246	0.450	0.830	0.780	0.805	0.559	159.260
4	Som et al	2019	400	0.233	0.807	0.787	0.797	0.292	254.044
5	Kumar, V. et al	2017	60	0.873	0.700	0.890	0.789	1.106	37.380
6	Yuen & Vinh V. Tha	2016	172	0.510	0.823	0.927	0.873	0.584	131.222
7	saichon Pinmanee	2016	429	0.557	0.818	0.818	0.818	0.681	287.054
8	Koçoglu et al	2011	158	0.362	0.770	0.770	0.770	0.470	93.678
9	Veera Pandiyan et al	2016	156	0.572	0.788	0.947	0.864	0.662	116.413
10	Wiengarten et al.	2010	152	0.501	0.881	0.766	0.821	0.610	102.577

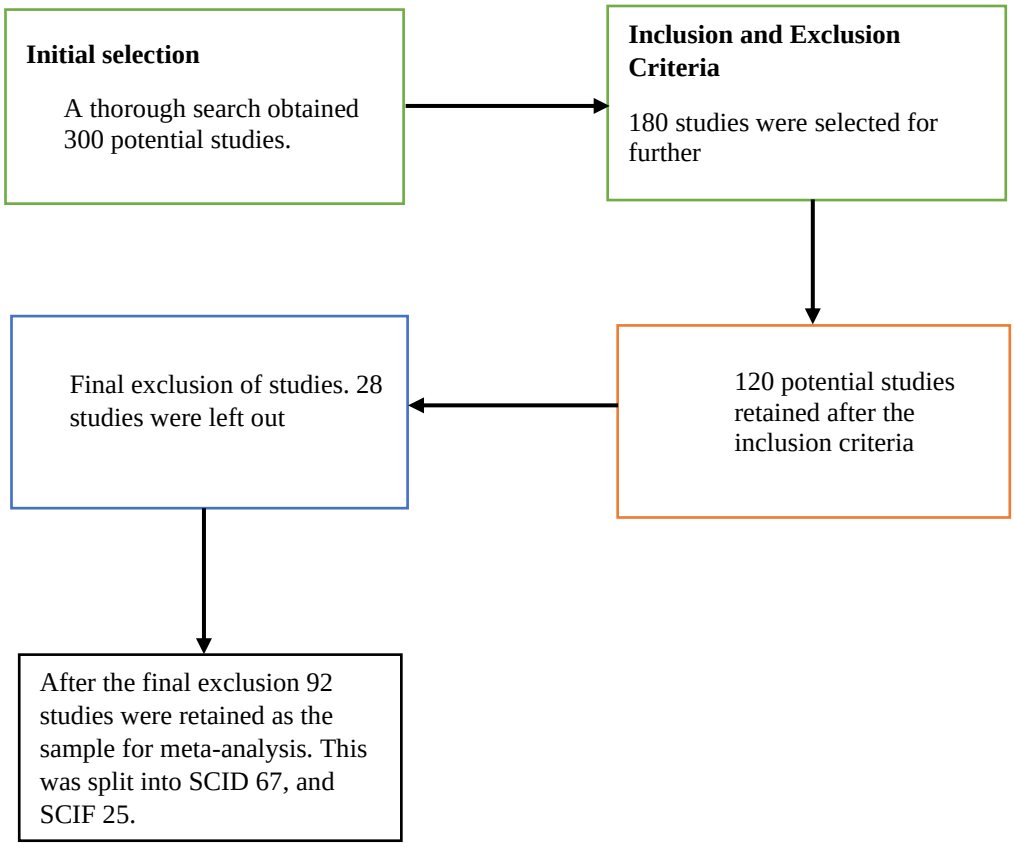
Table: 38 Stage III: Operational Integration with Operational Performance

ID	Study	Year	N	r	OpIα	OPα	A factor	ř	W
1	Som et al	2019	400	0.444	0.789	0.687	0.736	0.603	216.817
2	Prajogo & Olhager	2011	232	0.310	0.930	0.640	0.771	0.402	138.086
3	Saichon Pinmanee	2016	429	0.510	0.713	0.713	0.713	0.715	218.090
4	Thoo Ai Chin et al	2014	201	0.286	0.850	0.740	0.793	0.361	126.429
5	He & Lai	2012	229	0.295	0.840	0.840	0.840	0.351	161.582
6	Wiengarten et al.	2010	152	0.150	0.864	0.766	0.814	0.184	100.597
7	Suntichai et al	2012	261	0.480	0.797	0.877	0.836	0.574	182.431
8	Jermsittiparsert et al	2019	80	0.750	0.790	0.912	0.849	0.884	57.638
9	Antonius Setyadia	2018	300	0.236	0.781	0.748	0.764	0.309	175.256
10	Huo et al	2014	607	0.355	0.720	0.904	0.807	0.440	395.084
11	Liu et al	2013	246	0.460	0.790	0.870	0.829	0.555	169.076

Table: 39 Stage III: Relational Integration with Operational Performance

ID	Study	Year	N	r	RIα	OPα	A factor	ř	W
1	Suntichai et al	2012	261	0.319	0.865	0.877	0.871	0.366	197.996
2	Nimeh et al	2018	308	0.242	0.845	0.869	0.857	0.282	226.166
3	Som et al	2019	400	0.154	0.771	0.820	0.795	0.193	252.894
4	Yuen & Vinh V. Tha	2016	172	0.370	0.823	0.927	0.873	0.424	131.222
5	Saichon Pinmanee	2016	429	0.585	0.834	0.834	0.834	0.701	298.394
6	Veera Pandiyan et al	2016	156	0.668	0.891	0.947	0.919	0.727	131.629
7	Wiengarten et al.	2010	152	0.317	0.697	0.766	0.731	0.434	81.153

Appendix 5: Summary of Sampling Process



Appendix 6: Coding Form

The coding form for the meta-analytical review of the relationship between SCI constructs and performance is given below;

1. Study Identification
   a) Study ID: …….
   b) Author(s): …….....
   c) Year of Publication: …….
   d) Journal: …….
   e) Region Conducted: ……..…
2. Sample Characteristics
   a) Sample Size (N): ……...
   b) Organisational Culture/ Structure: …….
   c) Market Orientation/ Uncertainty: …….
   d) Relationship Quality: ……
3. Outcome Characteristics
   a) Data Analysis Technique(s): …….
   b)

Effect Size Calculation			
	SCI Reliability	Performance Reliability	Effect Size
SCI constructs:			
Performance:			

Appendix 7: Coding Instructions

This is a summary of the coding instructions used.

Study Identification	
Study ID	Assign a unique number to the study
Author(s)	Indication of authors' the last name(s).
Year	Indicate the year the study was published
Journal	Indicate the journal in which the study was published.
Region	Indicate the geographical region where the study was done
Sample Characteristics	
Sample Size	Indicate the sample size (N) of the study
Moderator	Indicate the type moderator factor in each sample
Mediator	Indicate the proposed mediator in the sample
Outcome Characteristics	
Method	Indicate the statistical method used to in sample study
SCI (SCID and SCIF)	Indicate constructs identified in the study with their r.
SCI reliability	Indicate reliabilities for SCID and SCIF constructs.
Performance reliability	Indicate reliabilities for operational business performance

Appendix 8: Mediation Path Estimation

Path Estimates				95% Confidence Interval			
Path	**Label**	**Estimate**	**se**	**Lower**	**Upper**	**Z**	**p- value**
SCI →Flexibility	a	0.801	0.29	0.2331	1.369	2.76	0.006
Flexibility →Performance	b	0.533	0.174	0.1928	0.873	3.07	0.002
SCI →Performance	c	0.379	0.179	0.0287	0.73	2.12	0.034
CI →SI	a	-2.06	0.8849	-3.79	-0.325	-2.33	0.02
SI →Performance	b	1.21	0.086	1.04	1.375	14.03	< .001
CI →Performance	c	5.08	0.2209	4.65	5.514	23.01	< .001
II →External Integration	a	0.576	0.11	0.361	0.791	5.25	< .001
External Integration →Performance	b	-0.528	0.204	-0.928	-0.129	-2.59	0.01
Internal Integration →Performance	c	1.331	0.149	1.038	1.624	8.91	< .001
SCI → SC Innovativeness	a	0.265	0.538	-0.789	1.32	0.493	0.622
SC Innovativeness →Performance	b	-0.381	0.0148	-0.41	-0.352	-25.743	< .001
SCI →Performance	c	0.829	0.0143	0.8	0.857	57.787	< .001

AUTOBIOGRAPHY

Augustine Castro Singine is a Zambian citizen who gradated as the best male graduating student in Business at the Zambia Catholic University. Upon graduation he was offered a job as a tutor in quantitative and research related- businesses courses such as: Production and Operations management, Business Mathematics, Business Statistics and Operations Research for 3 years at the Zambia Catholic University.