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AN EMPIRICAL ANALYSIS TO CONTROL PRODUCT COUNTERFEITING IN THE AUTOMOTIVE INDUSTRY'S SUPPLY CHAINS IN PAKISTAN

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AWARD: PhD

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DECLARATION

I certify that this thesis report which I now submit for Confirmation Examination for the Ph.D. award is entirely my work and has not been taken from the work of others, save to the extent that such work has been cited and acknowledged with the text of my work.

This thesis is prepared according to the regulations for graduate study by the research of the TU Dublin and has not been submitted in whole or in part for another award in any other institution.

The work reported in this thesis report conforms to the principles and requirements of the TU Dublin guidelines for ethics in research.

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ABSTRACT

The counterfeits pose significant health and safety threat to consumers. The quality image of firms is vulnerable to the damage caused by the expanding flow of counterfeit products in today's global supply chains. The counterfeiting markets are swelling due to globalization and customers' willingness to buy counterfeits, fuelling illicit activities to explode further. Buyers look for the original parts are deceived by the false (deceptive) signals' communication. The counterfeiting market has become a multi-billion industry but lacks detailed insights into the supply side of counterfeiting (deceptive side). The study aims to investigate and assess the relationship between the anti-counterfeiting strategies and improvement in the firm's supply performance within the internal and external supply chain quality management context in the auto-parts industry's supply chains in Pakistan.

DESIGN / METHODOLOGIES / APPROACH

This study performs a systematic literature review based on the scholarly contribution made in different disciplinary studies, by different researchers in three decades with diversified strategies, to counter the counterfeiting activities in supply chains. This study shares the comprehensively compiled form of common anti-counterfeiting strategies suggested through scholarly contributions made in three decades, after selecting validated publications and secondary sources of information databases. The structured equation model (SEM) assessment technique is used to formulate and test the hypothesized causal relationships that exist among dimensions and items' measures of the "Anti-Counterfeiting Strategies Initiative" (ANCT-INT) construct, after completing the factor extraction process, along with the extended model. The statistical techniques (SPSS & Smart-PLS applications) were used to ensure constructs' reliability and validity to test antecedent and consequent relationships in the hypothesized model. EFA (Exploratory Factor Analysis) and CFA (Confirmatory Factor Analysis) techniques are used to help the practitioners to confirm the reliability and validity of the hypothesized research model. The interviewee and the survey respondents are practitioners who work in the OEMs and assembler firms which are registered members of the PAMA (Pakistan Automotive Manufacturer Association) and PAAPAM (Pakistan Association of Automobile Parts & Accessories Manufacturers) associations.

FINDINGS

This study verifies that a hypothesized model provides an effective, systematic, and economical way of measurement, about the auto-parts industry's supply chains in Pakistan. The research

hypothesis guides the goals of the research. In this study, the hypothesized model when assessed and evaluated confirms the presence of the direct and indirect relationship among the anti-counterfeiting strategies and supply chain quality management with FSP, in the context of the networked governance model supported environment. This study also ensures the constructs' reliability and validity to test antecedent and consequent relationships in the hypothesized model to observe the impact on the firm's supply performance.

PRACTICAL IMPLICATIONS

After successful implementation of anti-counterfeiting strategies, the practitioners and authorities can take knowledge-based decisions timely in the presence of the networked governance model supported environment to enhance FSP. In the presence of the parts' traceability platform, the empirically tested confirmatory research model would help firms to reduce the occurrences of the counterfeiting phenomenon in their automotive industry's supply chains and from a broader perspective would reduce the number of seizers of the counterfeit goods at European and western borders and ports. This contribution to knowledge would enhance supply chain practitioners' understanding of the clandestine and protective nature of the product counterfeiting phenomenon that can be controlled after the successful implementation of the common anti-counterfeiting strategies in automotive industry's supply chains in Pakistan.

ORIGINALITY / VALUE

This study contributes to the SC knowledge stream and helps researchers to understand the counterfeiting phenomenon. This study develops a theoretical model by integrating the ANCT-INT, SCQM, and FSP constructs. The approach adopted in this study is unique and has not been pursued empirically by managers of automotive firms in Pakistan. The approach adopted is a) measurement model analysis technique to investigate the multi-dimensionality of ANCT-INT; b) statistical analysis to validate the measurement instrument; c) structural model building technique used to examine the antecedent and the consequent relationship among constructs.

KEYWORDS: Deception buying, product counterfeiting, integrating SCM and TQM practices, Supply Chain Quality Management (SCQM), Firm Supply Performance, Technology and Product Counterfeiting, Exploratory and Confirmatory Factor Analysis.

EMPIRICAL ANALYSIS TO CONTROL PRODUCT COUNTERFEITING IN AUTOMOTIVE INDUSTRY'S SUPPLY CHAINS IN PAKISTAN

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GLOSSARY OF TERMS

ACTA	Anti-Counterfeiting Trade Agreement
AIPM	Association Of International Pharmaceutical Manufacturers
ASEAN	Association Of South-East Asian Nations
BASCAP	Business Action To Stop Counterfeiting And Piracy
BIPOS	The Brazilian Institute Of Public Opinion & Statistics)
CEBR	Centre For Economic And Business Research
CFA	Confirmatory Factor Analysis
CIPR	Coalition For Intellectual Property Rights
CRA	Charles River Associates Inc.
ECC	European Commission For Cooperation
EFA	Exploratory Factor Analysis
EUROPOL-EUIPO	European Union Agency For Law Enforcement Cooperation – European Union Intellectual Property Office
GLC	Global Learning Consortium (Instructional Management Systems)
IACC	International Anti-Counterfeiting Coalition
IBOPE	Instituto Brasileiro De Opiniao Publica Estatística
ICC	International Chamber Of Commerce
IDC	International Data Group (Market Intelligence)
IFPI	International Federation Of The Phonographic Industry
IIPI	International Intellectual Property Institute
INTA	Internatonal Trade Association
IPTOC	Intellectual Property Theft And Organized Crime
NAFTA	North American Free Trade Agreement
NTSB	Nation Transportation Safety Board
OECD	Organisation For Economic Cooperation And Development
OECD-EUIPO	Organisation For Economic Cooperation And Development - European Union Intellectual Property Office
PAAPAM	Pakistan Association Of Automotive Parts And Assessories Manufacturers
PAMA	Pakistan Automotive Manufacturers Association
PhRMA	Pharmaceutical Research And Manufacturers Of America
PSQCA	Pakistan Standards Quality Control Authority
SFIIP	Swiss Federal Institute Of Intellectual Property
SJBIPP	Shahid Javed Burki Institute Of Publilc Policy
UNICJR	United Nation International Criminal Justice Review
UNODC	United Nation Office Of Drugs And Crime
USCBP	Us Customs And Border Protection
USITC	The United States International Trade Commission
WCO	World Customs Organisation
WHO	World Health Organisation

CHAPTER-1: INTRODUCTION

1.1 COUNTER PRODUCT COUNTERFEITING IN THE SUPPLY CHAIN

The product counterfeiting issue in supply chains is a threat to parts supply firms (especially upstream trade owners) in terms of revenues and margins. The supply chain complexity raises the cost of the failure analysis due to the lack of parts' traceability. The present counterfeiting knowledge stream shows a research deficit (especially in deceptive counterfeiting) in addressing the counterfeiting issue. To address the product counterfeiting issue in supply chains, this study performs a systematic literature review based on the scholarly contribution made earlier, within three decades, in different disciplinary studies. These scholarly contributions have suggested different anti-counterfeiting strategies according to the different contextual references. This study comprehensively compiles, sorts, and synthesizes the suggested strategies into the common anti-counterfeiting strategies, to address the counterfeiting issue. Therefore, this study generates novel insight into SCM by reviewing studies related to counterfeiting issues, anti-counterfeiting strategies, and an important role of the technology in SCM to counter counterfeiting activities in the automotive industry's supply chains in Pakistan. Moreover, the research study integrates different knowledge streams (Annexure-S-1 to S-3) supported by the empirical studies to reach a reality that the product counterfeiting phenomenon does exist in automotive industry's supply chains in Pakistan. To unfold the reasons for the existing reality, the national cultural context matters where the ethical buying behaviour of the consumers can counter the deceptive buying patterns in the automotive industry's supply chains in Pakistan.

Annexure-S-1 covers TQM, SCM, and SCQM-related knowledge streams. Annexure-S-2 covers the ANCT-INT-related knowledge stream, and Annexure-S-3 covers technology and the SCQM environment-related knowledge stream. The outcome of this study shows the positive relationship among the TQMP, SCMP, and ANCT-INT with FSP, in the networked governance model-supported environment. The importance of the development of the SCQM environment is that it provides a parts traceability platform, from sub-tiers to aftermarket, to the SC practitioners for decision-making to control product counterfeiting in the automotive industry's SCs in Pakistan. This study follows the guideline of Berthon et al.'s (2002) study to develop and extend the research measurement instrument to evaluate the research model that can enhance supply chain practitioners' understanding of how anti-counterfeiting strategies influence a Firm's Supply Performance (FSP) in the automotive industry's supply chains in

Pakistan. Table-1.1 provides information for the reader to follow the research strategy to achieve the present study's aims and objectives.

Table-1.1: RESEARCH STRATEGY

Research Problem	To control the product counterfeiting phenomenon in the automotive industry's supply chains in Pakistan. The main concern is that the buyers look for the original parts are deceived by the false (deceptive) signals' communication.
Research Aims and Objectives	The study aims to investigate and assess the relationship between the anti-counterfeiting strategies and improvement in the firm's supply performance within the internal and external supply chain quality management context in the auto-parts industry's supply chains in Pakistan. The study objectives are: • To explore and synthesize relevant ant-counterfeiting strategies to control product counterfeiting problems. • To develop new insights on how the anti-counterfeiting strategies interact with supply chain quality management to control product counterfeiting. • To evaluate and assess the anti-counterfeiting concept that influences FSP, in the auto-parts industry supply chains in Pakistan
Research Motivation	The importance of the product counterfeiting phenomenon affects international communities in terms of its techno-socio-economic impact at a regional level. Investigative work is required to spread knowledge among practitioners and authorities about the seriousness of counterfeiting crime in business operations. Moreover, limited contributory evidence exists in terms of anti-counterfeiting strategies initiatives and stream of knowledge, especially from the developing countries due to the clandestine and protective nature of the phenomenon. Jinhua et al.'s (2020) study says that the trade-in of counterfeit goods is growing and is affecting the sales and profits of companies affected by this phenomenon. To ensure the identification and traceability of real products throughout the supply chain, Dasko's (2017) study says that the product counterfeiting phenomenon has been increasing, contributing to growing losses of the right holders and increasing threat to consumers health and safety. According to Dasko's study, UN counterfeiting goods generate $250 billion annually for criminal organisations. Spink et al.'s (2014, p.2) study say that "*Product counterfeiting is growing in scope, scale, and threat (FDA, 2010, FDA, 2006, WCO, 2007a, WHO, 2007, OECD, 2007b, Interpol 2007)*". The UN Inter-regional Crime & Justice Research Institute's (2011) report states that counterfeiting deserves more attention as a low level of awareness of the seriousness of this crime by both law enforcers and the public, inadequate response by national governments and the international community are interlinked elements, which need to be tackled in parallel effectively. Moreover, the use of technologies and online buying and selling made the supply chain more vulnerable to product counterfeiting, which requires more scholarly efforts to counter the counterfeiting phenomenon in the supply chain. Firms require the BC-based governance network (Alzahrani & Bukusu's, 2018), which can provide a parts traceability platform, from sub-assemblies to the market, to the SC

	practitioners for decision-making to control the product counterfeiting in the automotive industry's supply chains in Pakistan. This study recognizes important scholarly contributions as the source of motivation (see section-2.2.4a) to investigate and address the research inquiry. It is clear from Staake et al.'s (2009, p.341) study that "*Hardly any related trust-worthy statistics exist. Even the often-cited and now widely accepted numbers provided by the OECD, are highly questionable*". Moreover, Staake et al.'s study says that a challenge of confirmed knowledge deficit lies in estimating the actual statistical numbers behind the extent of the country-wide counterfeits trades taking place in the world. Therefore, relying only on secondary information-based statistical evidence lags in controlling the occurrences of the counterfeiting phenomenon in supply chains, which is an investigative challenge considering its clandestine nature. The present body of the to-date knowledge stream reveals the need to contribute empirical efforts to create autonomous counterfeiting research streams separately instead of building blocks to defend efforts distributed around different strands of the management research. The theoretical evidence-based studies [Vanichchinchai & Igel's (2009, 2011); Vanichchinchai's (2020); Staake et al.'s (2009); Robinson & Malhotra's (2005); Lin, C. et al.'s (2005); Harvey's (1987)] discuss some of the research gaps present in automotive industry's supply chains that motivates the researcher to continue the scientific investigation to address the research problem. The present counterfeit knowledge stream refers to the Counterfeiting Protection Model (CPM), which is the only counterfeiting model introduced by Michael Harvey in the year 1987/88. Vanichchinchai & Igel's (2011) study introduces the structural model with managerial limitations related to model incompleteness, model testing, and model validation in the research study. This study not only introduces the new construct (ANCT-INT) into Vanichchinchai & Igel's model but also follow a model extension and replication research strategy to address the research problem. The verification and integration part of the knowledge generation process is the motivational area of the study.
Grounded Theories	To address the research problem, this study provides a theoretical basis (signalling, resource-based view, deceptive, and crime prevention theories) to serve the purpose of a model verification in the context of the automotive industry's supply chains in Pakistan. According to Watson's (2015) study, supply chain practitioners and procurement specialists need to understand how to detect signals of counterfeits to avoid illicit purchase. Thus, this study not only serves the purpose of the injunction but also serves the purpose of observation to understand the source and supplier selection decision process under deceptive product counterfeiting situations.
Research Model External Verification	To confirm the theoretical evidence, a hypothetical model needs external validation. For that matter, the identification of the theoretical evidence can serve either, as a starting point for the researcher's model development or can add as an extension to the existing model.
Research Questions	What kind of research study the researcher is going to conduct and when?. The following research questions help achieve the research goal.

	RQ-1) What theoretical arguments and relationships (antecedent and consequent) exist in the literature to control the product counterfeiting problem? RQ-2) What concepts contribute to controlling the product counterfeiting problem. RQ-3) What is the impact of the anti-counterfeiting strategies on a firm's supply performance?	
Research Context	Extension	This study explores the counterfeit knowledge stream extension in supply chains in terms of the theory, context, and method. This study follows the theory/context extension method. The empirical research space exists about the product counterfeiting body of knowledge stream to validate a hypothetical model in Pakistan.
	System	A suitable environment is required to implement anti-counterfeiting strategies to control product counterfeiting in the automotive industry's supply chains in Pakistan.
	Country	Pakistan
	Firms	PAAPAM member firms, PAMA member firms (Honda Motors, Toyota Motors, Pak Suzuki Motors)
	Respondents	PAAPAM member firms' employees (Supply Chain practitioners, Procurement specialists, & Managers), etc.
Research Methodology	Research Ethics	The research methodology fulfills the research objectives to develop and evaluate an appropriate model to improve understanding of how anti-counterfeiting strategies influence FSP in the automotive industry's supply chains in Pakistan. Ethics pertain to avoiding harm through the implementation of the ethical principles (codes) in the research process and to protecting participants in the research study.
	Interviews	The purpose of the qualitative studies is to check the presence of the counterfeiting phenomenon, from the participants' point of view, with the help of interviews and observations. The empirical study is conducted to investigate the clandestine nature of the counterfeiting phenomenon in the automotive industry's supply chains in Pakistan (Interviews with the managers of PAMA members Pak-Suzuki Motors, Honda Motors, and Toyota Motors). The section-3.2.7.2.2 discusses the seven phases of the interview guideline for qualitative research (Myer & Newman, 2007) and four phases of systemically developing the interview protocol (Castillo-Montoya, 2016). This section discusses in detail the process of conducting interviews.
	Data Collection	The participants from the PAAPAM member firms are contacted to conduct and administer the Initial survey.

	Data Analysis	Inductive-deductive analysis for the Initial Survey based on exploratory data collection and analysis
		Deductive causal analysis using Structural Equation Modelling (SEM) and Partial Least Square (PLS) tools for the "confirmation survey data"

It is important to mention the limitation of the study here. The progress of the study is against the original intention of the study. The original intention of the study was to conduct a full survey to confirm the theoretical evidence of the study, with the help of a hypothetical model, in the automotive industry in Pakistan. That is, the thesis was set out to undertake CFA using a separate sample of respondents. The pandemic situation impedes the separate survey process to reach to the desired the sample size. So, CFA was performed using the same sample of respondents as used in the EFA. To summarise the introductory discussion about the research study, the readers are recommended to see the thesis presentation structure table in chapter 1 (section-1.5) for more information.

1.1a) PROTECTIVE NATURE OF THE COUNTERFEIT MARKET

Realising the protective nature of the counterfeit market, the scholarly contributions [Green & Smith's (2002); Staake et al.'s (2005, 2009); Bosworth & Yang's (2006); Nill & Shultz's (1996); Grossman & Shapiro's (1988a, 1988b)], introduce anti-counterfeiting strategies to address the product counterfeiting issue. The clandestine nature of the counterfeiting market made the product counterfeiting issue unobservable. That is, limits direct observation accessibility (Staake et al.'s, 2009) to understand the counterfeits' development process. Harvey's (1988, p.20) study also discussed an unobservable & uncontrollable counterfeiting phenomenon and advised practitioners that a corporation does not have an arsenal of personnel and procedures to protect its trademark, it will be more like to fall victim to counterfeiters somewhere in the world. Furthermore, Harvey's study discussions are not only about protecting the patent rights, trademark rights, and copyrights with a legal cover but suggest practitioners create an environment to protect the products at each step of the process of the entire product life cycle. Harvey's study also emphasised enhancing administrative control of operations and forming separate anti-counterfeiting surveillance teams to control the counterfeiting phenomenon.

1.2 CONCEPTUAL JUSTIFICATION AND THEORETICAL CHALLENGES

The research strategy translates ontological and epistemological principles into guidelines to show how the researcher proceeds to continue the process of research data collection by adopting relevant research methodology. Selecting the right research study is important to clarify the purpose and scope of the study. The topic of the study discusses theory, method, and context parameters to explain the nature of the research problem [Walshe et al.'s (2004); Berthon et al.'s (2002)]. Based on the nature of the research problem, the research strategies (replication, generation, and extension) are applied. This study, about the context extension, follows the research guideline of Berthon et al.'s (2002) study to develop and extend the research instrument to address the product counterfeiting issue in the automotive industry's supply chains in Pakistan.

CONCEPTUAL JUSTIFICATION

The conceptual and theoretical justification for further investigation is discussed as follows:

- The literature reviews infer that the present counterfeiting knowledge stream mostly discusses the non-deceptive counterfeiting phenomenon in the supply chain and overlooked the deceptive counterfeiting phenomenon in supply chains (see Section-2.2.4a). The deceptive counterfeiting phenomenon is still new and needs further investigation so that more knowledge should be shared among all stakeholders (researchers, practitioners, and authorities). Knowledge gaps exist worldwide in the product counterfeiting body of knowledge for automotive SCs.

- No publications explicitly found, in the existing counterfeiting body of knowledge stream, that discusses anti-counterfeiting measures for the automotive industry's supply chains. The present counterfeiting knowledge stream reveals that in 1988 Michael Harvey introduced the "Counterfeit Protection Model (CPM)" to counter the counterfeiting activities and to to-date exists a knowledge deficit to fill the gap in this area. Harvey's study limits the discussions to control the counterfeiting problem administratively at the management level, missing the need to emphasize improvements in the operational processes [SCQM, Quality-based performance (Q.M & TQM framework like MBNQA & EFQM)].

- The present counterfeiting knowledge stream reveals that the firms discuss the planned anti-counterfeiting strategies implementation vis-a-vis the firm's management capabilities

loosely, in terms of the production, the technology, and the distribution [embossed stamps, chemical strips, decomposable materials, etc.] in the SC. The existing knowledge gap encourages the researcher to conduct research investigation empirically.

THEORETICAL CHALLENGES

A theoretical challenge exists to understand the unobservable and protective counterfeiting phenomenon in the product counterfeiting body of the knowledge stream. The present knowledge deficit exists in terms of the case studies / empirical studies to support the exemplary evidence (s) to uncover the reality behind the clandestine nature of the counterfeiting phenomenon. This study infers that the existing product counterfeiting issue in the automotive industry's supply chains in Pakistan is influenced by the development of the theory of reliability, the resource-based view (RBV), crime protection theory, signalling theory, and deceptive theory which sometimes society behave both ways deceptively or non-deceptively due to the social motivation and availability of the shopping environment (Wilcox et al.'s, 2009) in the presence of the counterfeiting phenomenon. The firms can successfully implement relevant anti-counterfeiting strategies to reduce occurrences of product counterfeiting activities in the SCs by introducing reliable processes (e.g., providing a parts traceability platform to practitioners for decision making).

1.3 ACADEMIC JUSTIFICATION

This study benefited from the theoretical bases, provided by the findings of Vanichchinchai & Igel's (2011) and Vanichchinchai's (2012) studies that serve the purpose of verification by testing the research-based extended model in Pakistan to address the research problem. In the context of Q.M and counterfeiting, Wilcock & Boys's (2014) study introduces a framework of the standard quality plan (SQP), following an approach of integrating anti-counterfeiting strategies into the plan. The reason is that there exists a substantial interconnection between the reduction of product counterfeiting and quality management. Therefore, it is important to explore and confirm what impact TQM can have on SCM (Gunasekaran & McGaughey's, 2004) to enhance a firm's supply performance (FSP). Therefore, it is expected that the outcome of the study leads to providing information that will enhance the understanding of the impact of the ANCT-INT items' measures on the FSP. The ANCT-INT items' measures construct was added to the hypothesized model to justify its antecedent role in the SCQM environment to enhance FSP.

Based on the theoretical justification, academic justification requires evidence of the empirical support to confirm the presence of anti-counterfeiting strategies in automotive supply chains and the initiatives taken by the OEMs to address the product counterfeiting issue. Also, academic justification requires evidence of the empirical support to confirm the willingness of the practitioners to work under a network governance model supported SCQM environment, from sub-tiers to aftermarket, to control product counterfeiting in automotive supply chains in Pakistan. The literature review reveals that the gaps present in the knowledge stream, to explicitly address the counterfeiting issue, encourage researchers to conduct an empirical investigation. Although, the existing body of knowledge discusses the qualitative research design using case studies with expert interviews. Moreover, product counterfeiting is not free from a culture where the ethical buying behaviour of the consumers may counter the deceptive buying patterns in the automotive industry's supply chains in Pakistan.

1.4 RESEARCH QUESTIONS

The research questions are helpful for researchers to reach the study objectives. To understand how anti-counterfeiting strategies influence firms' supply performance (FSP), a research instrument forms the basis of making an additional contribution to the counterfeiting knowledge stream. The presence of the SCQM environment to provide a parts traceability platform is helpful for the SC practitioners in decision-making to control product counterfeiting in automotive industry's supply chains in Pakistan. The management question takes support from the literature to address the gaps present in the counterfeiting knowledge stream where exploratory study requires information about the effective strategies against product counterfeiting activities (secondary information sources to be used as a unit of analysis, content analysis to counter counterfeiting to be used as a data collection method, Journal articles & reports to be used as a unit of observation). Some observations (from organisations, etc.) about the problem of product counterfeiting (Managers of the firms to be used as a unit of analysis, interviews of decision-makers & content analysis to be used as a data collection method, anti-counterfeiting strategies to be used as a unit of observation). To confirm the observations, sizeable responses are required from the professionals in a domain (e.g., supply chain decision-makers) about controlling product counterfeiting activities in supply chains, under the influence of the SCQM environment, to enhance FSP? (Cohort/group to be used as a unit of analysis, a survey of decision-makers to be used as a data collection method, Managers of the firms to be used as a unit of observation). The management question translates into research questions. Bassioni et al.'s (2008) study cited in Cooper & Emory's (1995) study suggests researchers

adopt a top-down approach to formulate the research study questions. The management question translates into facts-oriented questions so that the information aggregation activities can be performed. The researchers used a judgemental method for information aggregation, according to Ryan et al.'s (2021) study, the model completeness is difficult and may lead to method bias. The information aggregation is important to achieve model completeness. There are three approaches to achieving model completeness that includes triangulation, grounded theory, and data synthesis. The completeness of the models requires data to be reflective of the study model that fits the purpose of the study.

Investigation Level: Investigative questions are more specific, as they give details about the evidence needed to answer the research questions. Investigative questions suggested the way of managing and interpreting the collected evidence. Bassioni et al.'s (2008) study cited in Cooper & Emory's (1995) study discusses that the researchers satisfactorily answer the research questions.

Measurement level: Bassioni et al.'s (2008) study discuss that the measurement questions stood for the fourth level of the research questions hierarchy. The measurement questions that appeared on the research instruments need responses from the respondents. These questions are found after selecting an appropriate strategy and methodology to gather data to answer investigative questions. Measurement questions derive from various activities of the research study.

Table-1.4(a): Summary of Initial Research Question Hierarchy

Research Questions RQ.1: What theoretical arguments and relationships (antecedent and consequent) exist in the literature to control the product counterfeiting problem?	
Investigative Q1.1	How do the theoretical arguments, supply chain complexities, and assumptions underpin the counterfeiting knowledge stream and help SC practitioners to detect counterfeit's signals to avoid illicit purchase?
Research Questions RQ.2: What concepts contribute to controlling the product counterfeiting problem?	
Investigative Q2.1	What variables / theoretical concepts are present in the literature to support the development of the constructs?
Research Questions RQ.3: What is the impact of anti-counterfeiting strategies on a firm's supply performance?	
Investigative Q3.1	How can a structural model-building technique examine the relationships among constructs?
Investigative Q3.2	How reliability and validity of the constructs can be determined?

1.5 THESIS PRESENTATION STRUCTURE

The thesis consists of eight chapters to describe the various activities of the research study. In this section, the summary introduced the contents of each chapter described briefly. The outline of the structure of the thesis commences onwards in a summarized manner.

Table-1.5(a): CHAPTER-WISE SUMMARY ALONG-WITH PURPOSE DETAILS

Chapters	Reviewed Literature and Purpose
Chapter-1	The chapter includes sections (introduction, research strategy table, theoretical and academic justification and challenges, and research questions). The chapter discusses the research study aims and objectives, the readers are advised to see the thesis presentation structure table in chapter-1 (section-1.5) for more chapter-wise information. Chapter 1 provides essential information about the thesis intentions and plans. The details are discussed about the protective nature of counterfeiting activities where observation of the phenomenon is difficult. The conceptual, theoretical, and academic justification of the research study is also discussed. This chapter discusses an approach to developing a research question to reach research objectives. The detail in this chapter serves the purpose of creating awareness, about the counterfeiting phenomenon in the automotive industry's supply chains, among the readers in general and specific to practitioners, researchers, and authorities.
Chapter-2	The chapter-2 (section-2.1 to 2.4) splits into four sections that provide up-to-date information regarding multiple knowledge-based research streams (scholarly contributions and reports publications): a) systematic literature review to present the counterfeiting knowledge streams; b) cultural context supported by Hofstede studies to study consumers' buying behaviour; c) similarities in TQM and SCM practices to create BC supported SCQM-Imp environment to provide parts traceability platform to practitioners for decision making in the automotive industry's supply chains; d) the research model. This chapter provides information about the background information on the impact of the presence of counterfeits worldwide in the SC on consumers' health and safety. The systematic literature review presents the counterfeiting knowledge streams within the context of culture and consumers' buying behaviour; similarities in TQM and SCM practices to create BC-supported SCQM
Chapter-2 Section (2.1)	Chapter-section-2.1 discusses background information about the counterfeiting phenomenon in the automotive industry's supply chains where China and Hong Kong came out as the major source of the production and shipments of the counterfeits. More discussions can be found related to the health safety and worldwide presence of counterfeits in the supply chains in comparison to the Thai and Pakistani automotive industries. This chapter discusses important grounded theories concerning counterfeiting and consumers' ethical purchase intention. Different discussions on Hofstede cultural dimensions according to the Pakistan and Thailand administration system. The detail in this chapter serves the purpose of providing background information of the research study where the region and country-wise supply and demand situation of the counterfeits are discussed. The secondary information considers China with Hong Kong as the biggest source of the counterfeits' supplies to other regions of the world, using re-routing techniques.
Chapter-2 Section (2.2)	The chapter (Section–2.2) provides details about counterfeiting and piracy, the impact of counterfeiters' entry under a weak IPR environment, trade-related aspects of IPR, discussion of Harvey's (1988) study counterfeit protection model (CPM), deceptive and non-deceptive counterfeiting possibilities in automotive supply chains and its driving factors. To analyse the anti-counterfeiting strategies, the systematic literature review procedure is discussed after doing a structured thematic analysis. The literature review reveals four important themes to control counterfeiting activities in the automotive industry's supply chains. This section discusses the Harvey model (CPM), anti-counterfeiting strategies, and possibilities of deceptive and non-deceptive counterfeiting. Important themes develop from the review.
	Chapter (Section– 2.3) provides details about the rising need for research efforts to develop a common framework that can completely integrate the mismatches of the two most critical disciplines (TQM & SCM) for organisational competitiveness to meet a firm's unique requirements [Vanichchinchai

Chapter-2 Section (2.3)	(2019) cited Rashid and Aslam (2012)]. Building strong relationship in these disciplines leads to a new challenge in terms of Supply Chain Quality Management (SCQM). The Section provides detail referencing the Vanichchinchai & Igel (2009) study that says although the TQM & SCM disciplines have different starting points, they have evolved in similar ways to reach the same goal, that is customer satisfaction. Therefore, integrating both disciplines' specific approaches could improve opportunities for SCQM implementation in further research. This section discusses the presence of the network governance model of SCQM and the role of Sharing information in maintaining data security and controlling the multiple access concurrent problems. The section also provides a managerial guideline to avert counterfeits trade. The purpose of this section is to provide information about the possible integration of TQM and SCM practices to introduce an SCQM environment where practitioners can take educated decisions. The theoretical evidence shows that creating networked governance (BC) model supported by the SCQM environment enhances FSP where practitioners can take digital supply chains based right decisions.
Chapter-2 Section (2.4)	Chapter (Section – 2.4) is the fourth section that provides details about the research model. This section discusses the research model of this study, which is the extension of the Thai model with a detailed explanation of the anti-counterfeiting strategies initiative taken by the firms to enhance their supply performance and its relevant constructs' dimensions identification process. The detail in this section serves the purpose to check the completeness of the Thai model to capture the impacts of the ANCT-INT items' measures on FSP. The study assumes the hypothetical assumptions that significantly impact FSP.
Chapter-3 Research Design	This Chapter discusses the epistemology of this study by introducing the three perspectives: positivist, interpretive and critical. This chapter summarizes a research design process to develop a framework for a research study. To conduct the interviews the managers from the PAMA member firms are selected. And, to conduct the survey the managers from the PAAPAM member firms are contacted. This study justified in following the present research methodology by using a mixed-method of research to gather responses from the managers of the automotive industry's supply chains in Pakistan. The chapter introduces the research strategy, covering the Extension and Instrument development stages of the research study. The research strategy looks for theoretical support to apply research methodology in conducting a mixed method of investigation. This chapter discusses the importance of interview protocol, interview guideline (Myers & Newman, 2007), and tasks accomplished before and after conducting the interviews. This chapter also discusses the process of conducting interviews and some considerations during the interview process.
Chapter-4 Exploratory and Explanatory phases	This chapter discusses the need to implement a systematic review procedure to reduce the subjectivity of the contents so that objectivity can be reached after applying four steps of the content analysis. This study considers experts' opinions as the sources of information to continue with the interviewing process. In the first phase, the structured interviews are arranged on a one-to-one basis in Pak-Suzuki Motors. In Honda and Toyota interviews are arranged with their managers. These interviews are video recorded except for Toyota Motors. The transcription is done for later analytical use. The NVivo software application is used for analytical purposes. The interviewee's responses indicate the importance of the research problem to the firms so that they can take strategic decisions to address the research problem. The present research study takes help from managers of the PAMA member companies (PakSuzuki, Honda, and Toyota) to support this study. In section 4A, the video-recorded interviews were arranged to explore the interviewee (managers of the PAMA member firms) responses during the exploratory phase of the study. In section 4 B, the survey methodology is recommended when investigating the relationships between various factors of the large population which can be used at the verification and validation stages. This study while conducting surveys introduces un-structured or semi-structured questions with an open space for respondents' comments. The nature of the open-ended questions allows respondents to address the questions in detail without any influence (biasness). In section-4B.1.1, this study discusses fifteen (15) facets of the survey research process, recommended by Andres's (2012) study, in detail (see Fig-4B.1.1a). The mapping out survey research process discusses a combination of research approaches to address the research problem with the help of the research questions, where research design emphasizes the importance of

	the use of the mixed method to reach the sample of the population for their feedback. This study discusses the survey processes and the mixed method of research design (sequential transformative strategies) in detail (Fig-4B.2b). The discussion covers the survey design, survey instrument development, and survey execution information.
Chapter-5 Descriptive Statistics	The chapter provides a clear understanding of the descriptive data which can either be the representation of the entire or a sample of the population. The descriptive statistics are broken down into measures of central tendency and measure of dispersion so that the readership can observe the presence of skewness in the data. Finally, the data is analysed and normalized according to the classification of the respondents with descriptive statistics details of the survey. The descriptive analysis of the items provides the researcher with a way to verify the normality of the data and to scan the data for any possible outliers. The comparative analysis investigated the differences in the mean scores of the model dimensions for different types of employment cohorts. In general, the findings of the comparative analysis indicated that there are no significant differences among the different groups, except in the case of isolated occasions.
Chapter-6 Exploratory Factor Analysis (EFA) technique	This chapter discusses the procedure to apply the EFA technique after completing the initial survey process. The EFA is a complex and multi-step process used to discover the factor structure of a measure and then examine its internal consistency. Conventional wisdom states that despite many options for executing the steps of EFA, the actual difference between them remains very small, so it doesn't matter what method the practitioners choose. Moreover, this study PCA (Principle Component Analysis) is conducted on the 31 items/anti-counterfeiting strategies (ANCT-INT) using SPSS V.22, and data analysis work is performed: first with Oblique rotation (Direct Oblimin) and then with Orthogonal rotation (Varimax) methods. Thus, this study applies some clear decisions and rules of EFA to emphasize clear decision sequencing and protocols to be used for investigation. Five steps EFA statistical technique was found useful in contemplating the said research requirements. The ANCT-INT construct was found to be a promising candidate for conception as an antecedent to the SCQM.
Chapter-7 Confirmatory Factor Analysis (Literature Reviews–SEM)	This chapter starts with an overview of Structural Equation Modelling (SEM). It discusses a comparison between formative constructs and reflective constructs, to understand their characteristics and the assessment approaches suitable for each construct. The chapter proceeds by exploring the various approaches to SEM, which include the Covariance-Based SEM (CBSEM) and the Component-Based SEM, e.g. Partial Least Squares (PLS). The chapter provides a review of the procedures for assessing Structural Equation Models (SEM), which consists of two steps: assessing measurement models (reflective or formative) and assessing the structural model. The chapter concludes by discussing the application of the various tests for assessing the research model, including the assessment of reflective models, formative models, and the structural model. The chapter provides a brief explanation of the Partial Least Squares (PLS) approach, which is the selected approach for this study. The chapter justifies selecting the PLS approach by showing the suitability of the approach through different phases of the research study. This chapter discusses how the SEM technique used to measure the dimensions and measures of the research model, consists of three (3) constructs: ANCT-INT; SCQM-Imp; FSP. In the research model, ANCT-INT items' measures supported construct is hypothesized as an antecedent to SCQM-Imp environment construct and conceptualized as a reflective dimensional measurement model. FSP, as the consequent, is conceptualized as a reflective measurement model to the hypothesized ANCT-INT items' measures supported construct.
Chapter-8 Conclusion	The final chapter summarizes the findings of the research study. The chapter highlights the academic (theoretical, methodological, & contextual) and managerial contributions of the study. It also mentioned the limitations (theoretical, methodological, & contextual) and future direction of the research study. The chapter suggested potential future research work flowing from this study.

1.6 CHAPTER SUMMARY

The chapter provides introductory information about the research study and a description of a thesis structure. Highlighted product-counterfeiting issue in supply chains at the global level, its effects, consequences, and magnitude of the counterfeiting phenomenon. This study updates the knowledge base with more relevant information to address the product counterfeiting issue and added some unique information about research parameters (theory, methodology, and context). The chapter referred to international reports and publications (OECD, OECD-EUIPO, ICC, BASCAP, UNICJR, EUROPOL-EUIPO, ECC, MIMA, US Chamber of Commerce, UNODC, USCBP, etc.) related to product counterfeiting in the US & Europe to spread scientific knowledge among targeted audience and society. To summarize the introductory discussion about the research study, the readers are advised to see the thesis presentation structure table in chapter 1 (section-1.5) for chapter-wise information. The chapter-1 provides essential information about the thesis intentions, research aims, objectives and plans. The chapter discusses details about the protective nature of the counterfeiting activities where observation of the phenomenon is difficult. The details of conceptual, theoretical, and academic justification of the research study.

CHAPTER-2: LITERATURE REVIEW

(CHAPTER-SECTION-2.1)

2.0 INTRODUCTION

This section discusses the background information of the research study (based on secondary information) where the region and country-wise supply and demand situations of the counterfeits are discussed. Such as China with Hong Kong are considered to be the biggest source of counterfeits' supplies to the other regional countries of the world, using re-routing techniques. OECD (2018) report mentioned that during the years 2014 to 2016, 43.6% of goods were traded worldwide. The OECD report also says that Italy ranked third on the list of economies after the US, and France ahead of Switzerland, Germany, Japan, and Korea, most affected by global counterfeiting and piracy. The ICC (BASCAP) and International Trademark Association (INTA) report (2017) forecast the total value of counterfeit goods trade expected to reach the US $ (1.9 to 2.81) Trillion in the year 2022.

Izogo's (2015) study recognizes the importance of the existing role of the industrial (organisation) and national (social) cultures in a society. Thus, under the influence of contextual environment, Izogo's study discusses industrial & national cultures that impact consumers' purchase intentions and these intentions then transform into consumers' buying behaviour. Different studies such as Shah & Amjad's (2015), Quoquab et al.'s (2017), and Sharma & Chan (2017) emphasis that the presence of a strong causal relationship between Cultural-Moral-Philosophy (CMP) and Self-Consciousness Emotions (SCE), expected to impact strongly on Consumers' Ethical-Behavioural-Intention (EBI) to purchase authentic products, by using licit supply chains, to enhance brand image and customer loyalty. In the product counterfeiting context, the studies highlight the importance of the announcement of the product counterfeiting awareness messages to the target audience. Santos & Ribeiro's (2006) study says that for a realistic strategy formation to counter counterfeiting activities, it is necessary to consider that the counterfeiting phenomenon is not culture-free and the existing counterfeiting knowledge stream lacks empirical evidence to confirm the existing gap between counterfeiting and culture. These studies recommend the promotional activities of message announcement, in line with the cultural-moral-philosophy (CMP) of the consumers, to create awareness about the cons of the counterfeits' usage among the practitioners and the public in general.

2.1 BACKGROUND INFORMATION

2.1a) GLOBAL COUNTERFEITING LANDSCAPE

China's government's "21st-Century Maritime Silk Road" program of developing ports in Southeast Asia, the Indian Ocean, and the Mediterranean is a recent set of development. Growth trends show developing economies [Africa, East Asia, South Asia, Western Asia, and Latin America] are the primary source of counterfeits manufacturing. The OECD-EUIPO (2019) report identifies important transit points for trade in counterfeits, including Hong Kong, Singapore, and UAE handling trade in counterfeit goods. Several Middle Eastern economies (Saudi Arabia, UAE, and Yemen) are important transit points for sending fake goods to Africa. Four Transit points (Albania, Egypt, Morocco, and Ukraine) are of particular significance for redistributing fakes destined for the European Union. Panama is an important transit point for fakes on their way to the United States. The US Chamber of Commerce Global IP centre report (2016) has identified 38 economies' share (the US $40.37 billion) of global physical counterfeiting (the US $461 billion). Which, the share of China is 72%, Hong Kong is 14%, Central and East Asian countries along with some European countries is 8.76% and the rest of the world is 5.24%. Ukraine suffers counterfeiting, produced approx. 35% of known brands in 2014. The report from Frontier Economics, an internationally recognized economics research firm, commissioned by ICC's Business Action to Stop Counterfeiting and Piracy (BASCAP) [ICC (BASCAP)] and International Trademark Association (INTA) report (2017) forecast the total value of counterfeit goods trade expected to reach US $ (1.9 to 2.81) Trillion in 2022, based on the UN trade (2013) data.

The ICC (BASCAP) and International Trademark Association (INTA) report (2017) forecast: The average annual growth rate in domestic production and consumption of counterfeits of 9% estimated, based on the WTO report, global GDP average growth of 2.6%. The EUROPOL-EUIPO (2017) report mentioned that counterfeit goods contributed (during 2011-13) to total external trade (86% of imports and 93% of export) and the GDP (42%) in the EU. The EU Custom enforcement IPR report (2019) says that 27 Mil articles were suspected, and 70,000 detention cases were registered by customs authorities. The OECD-EUIPO (2019) report mentioned that FTZs (the hub of trade) is a strong driver of trade in counterfeit and pirated goods. The report mentioned existing links between FTZs and trade in counterfeit products. The OECD (March 2017) report [GOV/PGC/HLRF/TFCIT/RD (2017)], discussed FTZs utilized as an instrument to augment foreign trade and investment, some countries, such as UAE, South Korea, and China, free zone activities constitute a significant proportion of GDP

and create employment by attracting additional investment (cited in ICC, 2013). The EUROPOL-EUIPO (2017) report mentioned that FTZs continue to be associated with several IPR crimes, and harmonized enforcement standards are still required in certain geographical areas. The world trade share of developing economies increased to 50%, more than 10% since the year 2000. Especially, China's exports have increased by 6% to 8% annually in recent years. The US Chamber of Commerce Global IP centre report (2016) discusses that customs authorities seize billions of dollars of counterfeit goods every year (see Table-2.1a-1).

Table-2.1a-1: COUNTERFEIT GOODS SEIZED

UNITED STATES		EUROPEAN UNION		JAPAN	
Economy of origin	**Est. Value**	**Economy of origin**	**Est. Value**	**Economy of origin**	**Est. Value**
China	$953.2 Mil	China	$467.5 Mil	China	$100 Mil
Hong Kong	$301.4 Mil	Hong Kong	$70.2 Mil	Hong Kong	$14.6 Mil
India	$11.1 Mil	Turkey	$50.6 Mil	South Korea	$6.2 Mil
Canada	$8.3 Mil	Greece	$29.9 Mil	Philippines	$3 Mil
Singapore	$5.6 Mil	Panama	$18.7 Mil	Thailand	$1.2 Mil

Source: The US Chamber of Commerce Global IP centre report (2016)

New York Times report, of October (2011), says that twenty-seven (27) firms representing companies around the world publicly applauded Australia, Canada, Japan, The Republic of Korea, Morocco, New Zealand, Singapore, and the United States, for signing the first Anti-Counterfeiting Trade Agreement (ACTA, 2011), designed to combat counterfeiting and piracy, and making it clear by agreed countries that they will protect their citizens, I PR, and address counterfeiting problems on a top priority basis (Table-2.1a-2).

Table-2.1a-2: List of Associations Involved in Anti-Counterfeiting Activities

International Trademark Association (INTA)	Centre for Economic and Business Research (CEBR)
Intellectual Property Theft and Organized Crime (IPTOC)	Coalition for Intellectual Property Rights (CIPR)
North American Free Trade Agreement (NAFTA)	Charles River Associates Inc. (CRA)
Nation Transportation Safety Board (NTSB)	Entertainment Software Association (ESA)
Organisation for Economic Co-operation and Development (OECD)	Food and Drug Administration (FDA)
Pharmaceutical Research and Manufacturers of America (PhRMA)	International Anti-Counterfeiting Coalition (IACC)
Swiss Federal Institute of Intellectual Property (SFIIP)	Instituto Brasileiro de Opiniao Publica Estatística (IBOPE)
The United States International Trade Commission (USITC)	The Brazilian Institute of Public Opinion & Statistics)
World Customs Organisation (WCO)	International Data Group (IDC) (market intelligence)
Association of International Pharmaceutical Manufacturers (AIPM)	International Federation of the Phonographic Industry (IFPI)
World Health Organisation (WHO)	International Intellectual Property Institute (IIPI)
Association of South-East Asian Nations (ASEAN)	Global Learning Consortium (Instructional Management Systems)

Source: ACTA (2011)

2.1b) THAILAND AND PAKISTAN AUTOMOTIVE INDUSTRY'S

2.1b-1) THAILAND AUTOMOTIVE INDUSTRY'S

In their study, Warr et al. (2017) found that the Thailand automotive industry is largely foreign-owned. Foreign investment was attracted due to two reforms made by the Thai government. Those reforms were (1) allowing foreign ownership and (2) allowing local requirements to settle down according to the market demand and supply. The potential competitors of the Thai automotive industry (Malaysia, Indonesia, Philippines, etc.) were found not as attractive for FDI due to the mentioned two reforms. The Thai automotive industry got financial support and intellectual input from Japanese sources. With the relaxation of restrictions on the foreign entry of input suppliers (1997), multinational enterprise final assemblers often preferred domestically located, but foreign, tier-1 input suppliers. The large, foreign-owned vehicle assemblers are each linked to numerous parts suppliers, that tend to be small to medium-sized and include both foreign and domestically owned firms. New parts supplier plants tend to locate in the area surrounding car assembly plants. For example, the number of part supplier plants located in Samut-Prakan province increased from 56 in 1996 to 122 and 144 plants in 2006 and 2011, respectively. Thailand liberalized input supplies became an export platform and the market is now considered the promising automotive parts supplier market for Asian and European countries. Comparatively in the Southeast Asian market the case of export, Malaysia's automotive exports has grown only marginally as compared to Thailand. Indonesia has performed better than Malaysia in both respects, but still less well than Thailand.

2.1b-2) PAKISTAN AUTOMOTIVE INDUSTRY'S

In their study, Imran et al. (2015) refer to the State Bank of Pakistan (2015) report where it is mentioned that the yearly auto-parts trade in terms of export trade reaches US$ 15 million and import reaches US$ 140 million, a trade deficit of US$ 125 million to the national exchequer. Although, there is growth observed in the automobile sector in Pakistan in both large-scale and small-scale components. Moreover, according to the State Bank of Pakistan report (2015) and the Federal Bureau of Revenue report (2014), the value of the cumulative investment in the automotive sector (passenger cars and commercial vehicles) reaches US$ 3.0 Billion. According to MarketResearch.com, which is the known date database of automotive units' expert insights, published the information on their website, in 2019, the Pakistan Automotive market was estimated at 194 thousand units and is expected to grow to 264 thousand units in 2026 with a growth rate of 14.9% over this period.

The producer associations that exist are the Pakistan Automotive Manufacturers Association (PAMA), the Pakistan Association of Automotive Parts and Accessories Manufacturers (PAAPAM), and the Association of Pakistan Motorcycle Assemblers (APMA). According to PAMA, there are eight (8) active car manufacturers out of which Honda, Suzuki, and Toyota are the dominant ones. There are 68 manufacturers of motorcycles, 65 are members of APMA, and 3 of PAMA. There are 6 units producing trucks/buses, four of which are members of PAMA. According to PAAPAM there are as many as 2200 parts manufacturers' units are Tier 1 units; 425 units are Tier 2 units and in addition as many as 1325 units operate in the unorganized sector. 292 units currently are members of PAAPAM. The biggest share in production is accounted for by large cars with a capacity of 1300 – 1800cc. An international comparison shows that, in 2013, Pakistan has the lowest rate of motorization per 1000 population of 15, as compared to 20 in India, 77 in Indonesia, 61 in Egypt, 208 in Thailand, and 182 in Turkey. Therefore, while the automotive sector has shown impressive growth during the last decade, it is still relatively small and at an early stage of development.

A) AUTO-PARTS VENDORS QUALITY BASED PERFORMANCE IN PAKISTAN

The SJBIPP report published in 2018 referenced the vendors' performance concerning quality control (Q.C). The study was conducted with a sample of 34 vendors of 4 OEMs, out of 220 vendors, where the types of quality control measures and the actual standards used to assure the quality by formal vendors are as follows: 1) the sigma checks: control over measures, particularly of expenditures; 2) the fishbone method; 3) Honda's Supplier Quality Manual; 4) Supplier Quality Assurance Manual of the International Machinists Corporation; 5) Suzuki's Supplier Quality Assurance Manual. The following measures were adopted by the informal vendors: 1) American Society for Material Specifications; 2) Total Quality Measures, International Standards Institutions; 3) Total Inspection Systems. The SJBIPP report published in 2018 reveals that in Pakistan OEMs are mostly owned by MNCs and have access to the latest technologies and costs of production (at world prices) are dependent more on the extent of economies of scale realized in the production process and/or on the extent of competitive pressures. In addition to this, it is observed that a potential 'niche' where Pakistan could be competitive internationally is in relatively labour-intensive parts manufactured with low to intermediate technology. The major Pakistani automotive imports start from Japan, as Japan is traditionally the largest supplier of the range of auto-parts products given the domination of Japanese multinational companies in the domestic market. Emerging sources are Turkey in tractors, Singapore and Thailand for cars and parts, South Korea in trucks, and China in the

case of motorcycles. When describing the major destinations of Pakistan auto-part exports, Pakistan has established a small market 'niche' in the neighbouring country, Afghanistan, and a South Asian Association for Regional Cooperation (SAARC) partner, Bangladesh, for motorcycles; for tractors in African countries like Nigeria and Kenya; and for parts in USA and Italy. Substantial imports in bulk are made by the automotive sector, with almost 90 percent, of CKD units and parts. Imports of parts have risen sharply in 2014-15 from 2011, increasing from $825 million to $1,015 million.

B) THE AUTO-PARTS MANUFACTURING PROCESS

The SJBIPP report published in 2018 discusses that the manufacturing of different auto parts is a mixture of different procedures and processes. The main production (formal/informal) processes involved in the manufacturing of auto parts [Forging, Die stamping, Injection moulding, Production of moulds, Sheet metal fabrication, Electrical engineering, Chemical/flow process, and others] do not necessarily involve identical or all processes. The most used production processes are sheet metal fabrication, die-stamping, and production of moulds. It also appears that while the formal units have reached an intermediate plus level of technology or in some cases relatively high technology, informal units are mostly at an intermediate or low level of technology and producing more labour-intensive light parts. This is the area where quality and QC measures are grossly compromised. The formal sector, which has stronger links with OEMs, has achieved an important level of technology deepening, the informal sector is still using low or intermediate technologies and producing simple parts mostly for the large 'replacement market'. The informal vendors due to their limited means are reluctant to maintain the QA measures according to the QM standards but know the importance of their business expansion and growth. The auto-parts industry is linked to the performance of the automotive sector, its dominant customer. To understand the vendors with the OEM relationship, as practice the auto-part manufacturers produce the auto-parts first and then find the buyers for their products. Mostly formal vendors, identify first the buyers, the automotive manufacturer, and then produce auto parts for them. The OEMs usually have more than one auto-part manufacturer supplying them with the same part. Thus, the vendors' share of the supply of the parts mostly falls between 10 to 40 percent. However, there are extreme cases where an auto-part manufacturer is the sole supplier of that respective part, for example, Ruba Tech Manufacturer is the sole supplier of door seals to Master Motors. Likewise, auto-part manufacturers do not necessarily sell to only one OEM. Formal vendors are those manufacturers whose share of sales to OEMs is more than half. The competition among

informal suppliers to the retail parts market is intense. In the after-market, local vendors face severe competition at the lower end of the market primarily from imported (or smuggled) parts from China and Taiwan. At the upper end of the market, there is more competition from high-quality parts imported from Malaysia and Thailand. On top of domestic competition, sales in the replacement market are not subject to strict quality control standards, so more cases of auto-part counterfeits are observed by auto-part dealers in Lahore.

POLICY AND STANDARDS: Pasha & Ismail's (2012) study says that the quality of manufactured goods, as expected, is set by the Pakistan Standards Quality Control Authority (PSQCA) and the Ministry of Science and Technology, mandated to prove, and monitor adherence to quality standards for commodities manufactured locally. Safety standards are laid out in the Motor Vehicles Rules which unfortunately are not standardized across the country.

CHAPTER-SECTION-2.2

2.2.0 INTRODUCTION

This section discusses the presence of the counterfeiting phenomenon in supply chains, where the FBI labelled the product counterfeiting issue as "*the organized crime of the 21st century*". This section highlights inspirational scholarly contributions [Staake et al.'s (2009); Veloutsou & Bian's (2008); Penz et al.'s (2008); Berman & Swani's (2010); Chaudhry & Stumpy's (2013); Wilcock & Boys's (2014); Chaudhry & Zimmarman's (2005); Stevenson & Busby's (2015)], which becomes the source of motivation to address the research problem. The scholarly contributions made by different scholars in the product counterfeiting body of knowledge stream concerning the subjective importance: a) the consumers buying behaviour about the cultural context (Thailand & Pakistan); b) the presence of the counterfeiting phenomenon in supply chains; c) the networked governance model supported Supply chain quality management (SCQM); d) the development of the research-based conceptual model to address the research problem. The present product counterfeiting body of knowledge stream infers that the existing product counterfeiting issue in the automotive industry's supply chains in Pakistan is influenced by the development theory of deception, crime protection theory, enterprise theory of crime, and signalling theory where society behaves both ways deceptively or non-deceptively sometimes due to the social motivation and sometimes due to the shopping environment. This section also discusses the counterfeit protection model (CPM), introduced by Harvey's (1988) study, which suggests practitioners control their distribution system by linking channels' verification with the quality control system. The channels' verification procedures need to monitor the supply and demand side (in case of deceptive and non-deceptive

buying behaviour) of the channel of the supply chains. Harvey's study suggests management of the organisations form the "counterfeit prevention task force", whose responsibility is to monitor products and trade markets for potential counterfeits. This section provides comparative information about deceptive and non-deceptive buying patterns. This study references the OECD (2008, 2020) reports discussing the presence of unauthorized spare parts trade worldwide (in case of over-runs of the genuine non-branded spare parts, pure counterfeit parts may include the use of spare parts and accessories under the influence of trademark infringements, imported from the Grey market may include licit genuine spare parts diverted from one market of interest to another market without brand owners' knowledge and consent, usage of copycat techniques, diversion possibilities after disposal into licit supply chains.

To serve the desired purpose, this study searches Google Scholar, Science Direct, Scopus (Elsevier, SAGE Informs), and Emerald publications to reach the relevant information (multi-disciplinary approach) with wide area coverage of the journals. This study expands the product counterfeiting body of knowledge stream with up-to-date knowledge, using relevant keywords reaches to the synthesized thirty-one (31) commonly focused anti-counterfeiting strategies and compiled from 220 research papers, suggested by twenty-six contributors, filtered in three decades to reduce occurrences of the counterfeiting phenomenon in the automotive industry's supply chains in Pakistan.

2.2.1) ENGAGING THEORIES IN COUNTERFEITING

Theories draw scholars' attention to various issues prevailing in society. Development theory is a collection of theories about how society behaves against the relevant issue. Some theories may directly or indirectly impact product counterfeiting issue that creates supply chain disruptions. For that matter, firms can develop strategic plans to implement anti-counterfeiting strategies to reduce occurrences of product counterfeiting phenomenon in the automotive industry's supply chains, even in high-risk situations (resource dependence theory-RDT) (Pfeffer & Salancik's, 1978; Swink & Song's, 2007). The firm can develop strategies to mitigate the supply chain disruptions risk by introducing more reliable processes in the supply chain operations (theory of reliability) (Telser's, 1980 cited in Song's, 2021); cross-functional collaborations share competent resources (Theory of Resource-Based View – RBV) (Barney's, 1991; Wernerfelt's, 1984); lack of self-esteem and control leads to the theory of crime at adolescence stage (self-control theory of crime) [(Hirschi & Gottifredson's (1993); Hirschi's (1969, 2010, 2013)]; market economics forces influence motivation to do criminal activity (Enterprise theory of crime) (Gottschalk's, 2010); more chances of crime due to low propensity

of being caught (illegitimate opportunity theory) (Cloward & Ohlin's, 2013); self-enforced agreement (Wang et al.'s, 2018) between parties practiced in its true sprit till that time when either member feel unsatisfied (theory of self-enforced agreement); self-control theory of crime (Peguero et al.'s, 2011; Nasgasawa et al.'s, 2000); illegitimate opportunity theory (Cohen's, 2000); Messner & Rosenfeld's, 1994); high reliability theory (Roth et al.'s (2008)); and social control theory (Peguero et al.'s, 2011). The firms can bring resilience to the supply chain processes by seizing the opportunities of infringements in any form. It may be in the form of intellectual proprietary rights (IPR), trademarks, industrial design, and patent copyrights (crime protection theory-CPT) (Speier et al.'s, 2011). Moreover, the firms can introduce new strategies along with processes (Mavlanova & Benbunan-Fich's, 2010) that can convey recognizable signals to the consumers about the originality of the product (signalling theory or information asymmetries (uncertainties). The firm can also introduce simulations / dis-simulations tactics (Mavlanova & Benbunan-Fich's, 2010) to deceive a target that generates signals about the falsehood of the quality of the product (deception theory). This study infers that the existing product counterfeiting issue in the automotive industry's supply chains in Pakistan is influenced by the development of the theory of reliability, the resource-based view (RBV), crime protection theory, signalling theory, and deceptive theory where sometimes society behave both ways deceptively or non-deceptively due to the social motivation and availability of the shopping environment (Wilcox et al.'s, 2009).

The theory of reliability is the basic theory that perceives that every business activity should be taken place after following a due diligence procedure to determine the reliability factor of the contract details. Telser's (1980) study (cited in Song, 2021) discusses that a prudent person avoids making a transaction with someone who is suspected to be unreliable. Reliability, however, is not an inherent part of the contract but business requirements justification among parties makes it reliable. There is always a chance that the parties do away from the contract until felt beneficial. This section discusses in detail the importance of the RBV, enterprise theory of crime, crime protection theory, and signalling & deception theories, which are influencing the most. Mavlanova & Benbunan-Fich's (2010, p.79) study says that counterfeiters use product presentation to manipulate signals that might otherwise identify a product as a fake and channel trust signals to present themselves as legitimate business entities. The study by Kempen's (2003, p.158) highlighted that the counterfeiters use deceptive status (brands) signalling as a misleading strategy that influences observers to purchase counterfeits. Another aspect of counterfeiting, discussed by Kempen's study, is that the consumption of counterfeits potentially enhances the welfare of low-income consumers. Sovacool et al.'s

(2018) study says that the selection of theories can also flow from a "paradigm", a worldview or way of interpreting reality. This section discusses the RBV, signalling, and deception theory in detail to explain that the decisions may lead to deception in an uncertain situational environment.

A) RESOURCE-BASED VIEW (RBV)

Grant's (2001) study discusses the resource-based approach to strategy formulation by integrating key themes arises from the body of knowledge. Grant's study discusses that the essence of strategy formulation is to design a strategy that makes the most effective use of firm's core resources and capabilities. Grant's study mentioned five stage procedure of strategy formulation (see Fig-2.2.1a): 1) analysing firm's resource base; 2) appraising the firm's capabilities; 3) analysing profit earning potential of firm's resources and capabilities; 4) selecting a strategy; 5) extending ad upgrading the firm's pool of resources and capabilities.

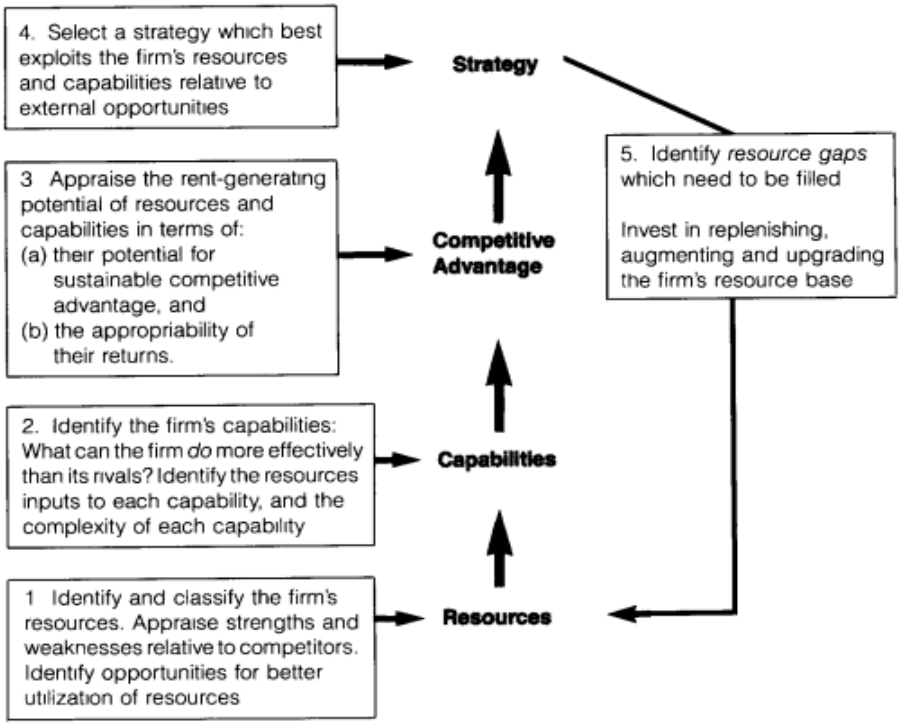


Fig-2.2.1a: A Resource-based approach to strategy formulation analysis (source: Grant (2001))

Lavie's (2006) study contribution rests in the extension of the RBV theory and ability to move to a new perspective of evaluation of a firm's competitiveness in a networked environment. An interconnected firm can extract value from the pool of resources to complete the projected activities. Lavie's study says that the RBV theory lacks in addressing the competitive advantage of interconnected firms and undermines the essential contribution of the resources of alliance partners. McMillan & Chavis (1986) study discuss the sense of community that include

territorial and relational communities (professionals, spirituals, quality circles, and other forums) and introduced four criteria for a definition and theory of sense of community. First, the definition needs to be explicit and clear; second, it should be concrete, its parts identifiable; third, it needs to represent the warmth and intimacy implicit in the term; fourth, it needs to provide a dynamic description of the development and maintenance of the experience. Wade & Hulland's (2004) study discusses that firm's RBV help researchers to focus on three considerations: 1) choice of an appropriate level of specific resources; 2) choice of a performance outcome construct; 3) modifying the RBV framework over time (competitive environment) by introducing dynamic elements into it.

Firm's specific resources

The resource-based view (RBV) of a firm is a robust theory (Wade & Hulland, 2004) that has received wide acceptance in the operations management field. Wade and Hulland's study say that the RBV theory encourages researchers to take advantage of competitive assessment tool to measure firm's performance. Wade and Hulland's study mentioned three key variable attributes: a) it should provide an assessment of performance; b) it should incorporate a competitive assessment element; c) it should address the notion of performance over time. Wade and Hulland's study support the narrow (understanding of specific resource) and wide (understanding of wide resources) definitions of resources to enhance firms' competitive performance (cited in Silverman, 1999). However, it is difficult to generalize narrow resource (use of specific technology or industry) outcome to new context. As a result, narrow resource definitions suffer from reduced relevance to a context as technologies, systems and skills become obsolete over time. Wade and Hulland's study say that RBV can be validated with a narrow resource definition. Wade and Hulland's study also say that a firm can be sorted into three types of process: inside-out, outside-in, and spanning. The inside-out capabilities are deployed from inside the firm in response to market requirements and opportunities, and tend to be internally focused (e.g., technology development, cost controls). In contrast, outside-in capabilities are externally oriented, placing an emphasis on anticipating market requirements, creating durable customer relationships, and understanding competitors (e.g., market responsiveness, managing external relationships). Finally, spanning capabilities, which involve both internal and external analysis, are needed to integrate the firm's inside-out and outside-in capabilities. Grant's (2001) study highlights the stock of the firm's resources that include first thirteen (13) resources (see Table-2.2.1b). Based on the secondary information [Raduan et al., 2009; Gogos et al., 2022], this study not only recognise the fact that counterfeiting activities are not culture free but also re-affirms the Michael Porter's contribution to the theory of the

competitive advantage. Moreover, this study also recognises the fact that the theory of the competitive advantage weakened by neglecting the cultural factors, giving insufficient attention to the process of resource development, and provide less support to empirical evidence of the deployment of capabilities. The secondary information [Raduan et al., 2009; Gogos et al., 2022] provides details about the other resources (14 to 16) in the Table-2.2.1b.

<table>
<tr><th>Sr.</th><th>RESOURCES</th><th colspan="2">PORTER's ENABLERS</th><th>PROFITABILITY</th></tr>
<tr><td>1</td><td>Patent</td><td rowspan="3">Barriers to entry</td><td rowspan="5">Industry attractiveness</td><td rowspan="16">Rate of profit in-excess of the competitive level</td></tr>
<tr><td>2</td><td>Brands</td></tr>
<tr><td>3</td><td>Retaliatory capability</td></tr>
<tr><td>4</td><td>Market share</td><td>Monopoly</td></tr>
<tr><td>5</td><td>Firm size</td><td rowspan="2">Vertical bargain power</td></tr>
<tr><td>6</td><td>Financial resources</td></tr>
<tr><td>7</td><td>Process technology</td><td rowspan="3">Cost advantage</td><td rowspan="10">Competitive advantage</td></tr>
<tr><td>8</td><td>Size of plants</td></tr>
<tr><td>9</td><td>Access to low-cost input</td></tr>
<tr><td>10</td><td>Brands</td><td rowspan="7">Differentiation advantage</td></tr>
<tr><td>11</td><td>Product technology</td></tr>
<tr><td>12</td><td>Marketing, distribution, service capabilities</td></tr>
<tr><td>13</td><td>Cultural context</td></tr>
<tr><td>14</td><td>I.T based systems support (technology)</td></tr>
<tr><td>15</td><td>Process of resource development</td></tr>
<tr><td>16</td><td>Deployment of capabilities</td></tr>
</table>

Table-2.2.1b: Resources as a basis for profitability (source: Grant (2001) and Author)

Product activity requires the cooperation and coordination of teams of resources. Grant's study says that a capability is the capacity for a team of resources to perform some task or activity and the main source of firm's competitive advantage. While resources are the source of a firm's capabilities.

Firm's resources performance outcome

The firm's performance is affected by some broader factors in a broader context. Thus, a firm level dependent variable may not capture the broader context (cited in Ray et al. 2004). A firm should follow best industry performance matrix. The RBV theory indicates that any performance advantage must be sustained over time and must be tracked throughout the project cycle. Wade & Hulland's (2004) study says that a firm's competitive advantage will be sustained for a longer duration as long as its resources are available and its competitors fail to acquire, imitate, or find substitutes for them.

Firm's competitive Environment

The stable environment is important to incorporate the firm's competitiveness into resource-based thinking. Some resources are more useful to the firm in stable environment, while others are more important to use in a dynamic environment. Wade & Hulland's (2004) study says that environmental turbulence and complexity may affect the extent to which a competitive advantage is sustained. Eisenhardt & Martin (2000) study says that the concept of dynamic

resources attempts to bridge the gaps by answering questions regarding arrangement of the relevant resources and then their allocations within a changing business environment. Thus, the dynamic resources help a firm adjust its resource mix and then maintain the firm's competitive advantage sustainability, which otherwise eroded by time. Yang & Fryxell's (2009) study confirms the existing knowledge deficit about the concept of brand positioning and anti-counterfeiting effectiveness. The study says that the concept of the brand's value creation broadly includes resources, which their RBV theory considers as the firms' sustainable competitive advantage. Schneider's (2012) study used the RBV of the firm to explore how counterfeiters conduct their business and how firms' competencies of rights holders intended to protect existing legitimate markets against illegal counterfeiting. Schneider's study highlights elements of ACM in Table-2.2.1c.

Dimensions	Foundation	Sources
	ACM strategy	
- Target: Stakeholder - Time: action, reaction - Behavior: defensive & offensive - Orientation: prevention, sanction, toleration, cooperation	*Theoretical*: Game-Theory, TRIZ, theory of reasoned action, resource based view, market based view *Empirical*: expert interviews, case studies, survey research	Amine/Magnusson 2007; Anand/Galetovic 2004; Berman 2008; Firth 2006; Harvey 1987, 1988; Harvey/Ronkainen 1985; Hung 2003; Jacobs et al. 2000; Kaikati/LaGarce 1980; Keupp et al. 2009, 2010; Lybecker 2007; Olsen/Granzin 1992, 1993; Staake/Fleisch 2008; Schuh et al. 2009; Yang/Fryxell 2009; Yang et al. 2006; Yang et al. 2004
	ACM instruments	
- Source: managerial, legal, technical, political, - Target: group specific	*Theoretical*: resource based view, market based view *Empirical*: Survey research, expert interviews, case studies	Bush et al. 1989; Chaudhry et al. 2005; Chaudhry/Zimmerman 2009; Clark 2006; Hung 2003; Lybecker 2007; Staake/Fleisch 2008; Yang/Fryxell 2009; Yang et al. 2006; Yang et al. 2004
	ACM organization	
- Structure - Process	*Theoretical*: - *Empirical*: expert interviews, case studies	Chaudhry/Zimmerman 2009; Harvey 1988; Jacobs et al. 2000; Staake/Fleisch 2008

Table-2.2.1c: Elements of anti-counterfeiting management (ACM), Schneider (2012)

Schneider's study shows that no typologies or taxonomies were found during the literature review cluster anti-counterfeiters to strengthen their knowledge about counterfeiting. However, anti-counterfeiting capabilities are only loosely mentioned in terms of production, technology, or distribution. Thus, Schneider's study says that it is unclear whether a firm can perform individual strategies or implement certain instruments at all. The study emphasizes that to explore anti-counterfeiting management (ACM) to enhance a firm's performance, an integrated multi-dimensional approach needed. Schneider's (2012) study explains that anti-counterfeiting approaches are based on a process-oriented perspective, starting with intelligence generation,

target definition, strategy formulation, structural and procedural organisation, instrument selection, monitoring, and evaluation. The firm can choose different approaches to counter counterfeiting activities. These approaches include sanctions, prevention, tolerance, and cooperation with competitors. Moreover, the RBV theory introduced by Barney's (1991) study states that cross-functional collaboration can create distinctive and inimitable (unmatched) competencies (Hausman et al.'s, 2002). Moreover, Helfat & Peteraf's (2003) study discusses the concept of "resource" in RBV means operations resources (quality goods, etc.); trademark registration; the reputation attached to the trademark concerning quality goods, which organisation can own, accessed, and controlled. Therefore, the RBV theory becomes important not only for examining the counterfeiting threats but also for resource allocation which legitimate organisations must organize to counter product counterfeiting activities. Forces organisations to bring quality improvements in supply chains (Eisenhardt & Martin, 2000; Barney et al.'s, 2001] with the best anti-counterfeiting initiatives and develop dynamic capabilities to make resources harder to imitate.

B) THE ENTERPRISE THEORY OF CRIME (ETC)

Gottschalk's (2010) study discusses that organized crime exists because legitimate markets leave many potential customers unsatisfied, that high demand for particular goods or services, low levels of risk detection, and high profits lead to a conducive environment for entrepreneurial criminal groups to enter the market and profiteering by supplying those goods and services. The ETC theory explains that economic enterprises involve both legitimacy and criminal activities. The ETC theory further states that organisational crimes discourage competition to ensure criminal monopolies are maintained to sustain profits. Smith's (1980) study states that the counterfeiters observe the market dynamics. The increasing demand for a particular form of goods and services combined with a relatively lower risk of detection with considerably high-profit margins provides the ideal condition for illicit business groups to enter the market. Chow's (2010) study emphasizes the importance of ETC where the study discusses that multinational companies (MNC) adopted short-term enforcement strategies (raids of counterfeiters, seizures of products, and destruction of machinery and equipment) to address the counterfeiting problem in China. Chow's study indicates the basic flaw of enforcement without deterrence strategy is that it ignores the role of local protectionism in supporting the trade in counterfeit goods. Local governments protect counterfeiting because it brings economic benefits to the local economy by generating revenue and creating jobs. The consequences of being caught by counterfeiters are minor. Fines are so low as to be just the

cost of doing business, and imprisonment is rare. Chow's study emphasizes that MNCs should adopt long-term strategies to make meaningful progress against counterfeiting. The enforcement without deterrence strategy has the unintended, even opposite, effect of inciting counterfeiting to new heights in China. The short-term enforcement-based strategy without deterrence is not working.

C) SIGNALLING THEORY (ST) / SIGNALLING ENVIRONMENT

Bird & Smith's (2005) study says that the signalling theory holds a prominent position in the management literature including strategic management, entrepreneurship, and human resource management. Firms work in a dynamic environment where information constantly changing between sender and receiver. Firms' legitimacy to survive signals to customers where signalling theory combines with the institutional theory. Connelly et al.'s (2011) study discusses that the signalling environment, either within a firm or between organizations, can affect to the extent to which signalling reduces information asymmetry. This study concerns communication of the false (deceptive) signals to customer to enhance deceptive buying patterns. Environmental distortion occurs whenever the medium for propagating the signal reduces the observability of the signal (signal deception). Connelly et al.'s study discusses that individuals who are unsure about how to interpret the signal may imitate (whether right or wrong) leading to a bandwagon effect, where signals are interpreted in a certain manner which may or may not be correct. Moreover, Connelly et al.'s study discusses signal's visibility, observability, clarity, intensity, and quality to describe signal's characteristics. Qian's (2014) study defines the signalling process, one party is signaler (choose how to communicate signal) and the other party is receiver (choose how to interpret signal when it is received). Bird & Smith's (205) study discusses that the signal theory is useful for describing behaviour when two parties (individuals or organisations) have access to different information. The secondary information reveals that the companies send pricing and non-pricing signals clearly to consumers so that they can recognise fake products. Qian (2014) study discusses that prices, money-back guarantees, contractual bindings with partners, fixed cost related to display of licenses for business operations, IPR, and marginal cost of holograms and packaging are better signals of product's quality and authenticity than non-price signals (notably campaign-lobbying /advertisements, and programs to counter counterfeiting). For that matter, authentic producers display exclusive licenses obtained from the authorities. Quality differentiation and price signalling are used as strategies against counterfeits. Moreover, company-level enforcement activities reduce the chances of counterfeits' entry in the market. Objects give signals about their authenticity, quality, traceability, organisation, destination, accessibility, demand,

availability, recourse, jurisdiction, and penalty. Thus, a signal has certain strength that can provide correct information to the supply chain members to make the right decision. Otherwise, weak signals provide an opportunity for counterfeiters to obscure information to deceive consumers. As counterfeiters are capable to distort signals, enhances false signals that their products are authentic.

Thomas et al.'s (2021) and Connelly et al.'s (2011) studies say that signalling theory is fundamentally concerned with the deliberate communication of information (signals) to convey unobservable intentions of firms. As it is difficult for firms to ascertain a potential exchange partners' underlying goals and intention. Similarly, in the supply chains "anti-counterfeiting strategies initiative" (ANCT-INT) context, it is difficult for buyers to evaluate which suppliers are genuinely committed to take ANCT-INT initiative. To overcome this limitation, suppliers should take initiative to signal their commitment to buyers. Thomas et al.'s study say that trust in firm's management and perceptions of genuineness & authenticity in processes may signal receivers to make buying decisions. This study builds on signalling theory to develop hypotheses in a specific context of SC exchange relationships. Thomas et al.'s study emphases more on supplier attributes (after sales services, delivery, reliability, cycle time, and quality, etc.) rather than traditional research where decisions were taken based on material cost. Furthermore, Thomas et al.'s study says that these supplier attributes are signals that enable buyers to evaluate exchange relationship alternatives to make suppliers' selection decisions. Wang et al. (2015) study discuss that as buyers became more demanding and SC became increasingly complex, supplier selection became a strategic decision with an expanded list of desirable attributes. Mavlanova & Benbunan-Fich's (2010) study examined customers' abilities to process signals of trust and deception in buying situations and discusses the importance of the ST concept applied in consumers' counterfeiting situations. Thus, consumers need reliable signals to recognize the expected specification of the quality of the product delivered. False signals create "distortion" that refers to as noise introduced by media outlet in uncertain signalling environment. As a result, signals are interpreted in a certain manner that may or may not be accurate. Therefore, deceptive signalers (counterfeiters) decrease signal reliability. Connelly et al.'s study discusses cases where manufacturers executed exclusive distribution contracts with wholesalers to play up the counterfeiting risk and at the same time defend anti-counterfeiting practices to gain customer confidence. Connelly et al.'s (2011) study discuss the feedback mechanism where receiver's behaviour provides signallers ideas to manipulate their messages to gain greater control (Table-2.2.1d). It is important how receivers meaningfully aggregate signals, interpret signal's sequencing, determine, and read pattern to safe themselves

from deception (deceptive buying). Connelly et al.'s study tabulated the key constructs where signilar's observability & reliability of signals, cost of signals & distortion of signals are most relevant to counterfeiting, especially about trademark infringements. Connelly et al.'s study introduced key signalling theory constructs (see Table-2.2.1d).

Key Signaling Theory Constructs

Construct (alternate names)	Definition	Management Journal References
Signaler		
Honesty (genuineness, veracity)	Extent to which the signaler actually has the unobservable quality being signaled	Arthurs, Busenitz, Hoskisson, & Johnson, 2008 Ndofor & Levitas, 2004
Reliability (credibility)	The combination of a signal's honesty and fit	Busenitz, Fiet, & Moesel, 2005 Sanders & Boivie, 2004
Signal		
Signal cost	Transaction costs associated with implementing a signal	Bhattacharya & Dittmar, 2001 Certo, 2003
Observability (intensity, strength, clarity, visibility)	Signal strength, not accounting for distortions and deception	Lampel & Shamsie, 2000 Warner, Fairbank, & Steensma, 2006 Ramaswami, Dreher, Bretz, & Wiethoff, 2010
Fit (value, quality)	Extent to which the signal is correlated with unobservable quality	Busenitz et al., 2005 Zhang & Wiersema, 2009
Frequency (timing)	Number of times the same signal is transmitted	Baum & Korn, 1999 Carter, 2006
Consistency	Agreement between signals from one source	Chung & Kalnins, 2001 Fischer & Reuber, 2007
Receiver		
Receiver attention	Extent to which receivers vigilantly scan the signaling environment	Gulati & Higgins, 2003 Janney & Folta, 2006
Receiver interpretation (calibration)	Amount of distortion introduced by the receiver, and/or weights applied to signals by the receiver	Perkins & Hendry, 2005 Rynes, Bretz, & Gerhart, 1991
Feedback/environment		
Countersignals (feedback)	Responsive signaling from the receiver designed to improve signal interpretation	Gulati & Higgins, 2003 Gupta, Govindarajan, & Malhotra, 1999
Distortion	Noise that can be introduced by the signaling environment, external referents, or other signalers.	Branzei, Ursacki-Bryant, Vertinsky, & Zhang, 2004 Zahra & Filatotchev, 2004

Table-2.2.1d: Source: Connelly et al. (2011)

In a management research, this study recognises the Connelly et al. study strategic signals with suppliers' extended attributes. This study recognises the importance of the suppliers' resources (RBV) and their expanded attributes (cultural factors, I.T based systems support (technology), process of resource development, and deployment of capabilities) to meet suppliers' selection criteria (see Table-2.2.1e). The expansion of supplier selection criteria highlights the increasing need for suppliers to signal their commitment to meet buyers' continued value determination. Thus, a supportive environment to supplier's attributes affects buyers' purchase intensions regardless of any economic viability. This study also recognises the fact that the public–private partnership would be leveraging (private firms' insider knowledge and the government's sanction power) to enforce anti-counterfeiting strategies in the automotive industry's supply chains in Pakistan. Collaboration among auto-parts manufacturers having same interest can coordinate to counter counterfeiting activities.

SIGNALER	STRATEGIC SIGNALS	RECEIVER
Knowledge-based Firms, BOD, teams, Managers, acquisition targets, counterfeiters	Alliance announcement Number of patents in an industry Fortune reputation rank Strategic flexibility & endowments Consultant surveys & qualitative market outcomes Reputation Market actions Press releases Firm ownership and name Inter locks Board prestige, diversity and structure CEO background & shareholding Product aesthetics Advertising and branding Structural embeddedness	Stakeholders, shareholders, competitors, consumers & media, investors, capital & labour markets,
	Cultural factors I.T based systems support (technology) Process of resource development Deployment of capabilities	

Table-2.2.1e: List of extended strategic attributes - Source: Connelly et al. (2014) and author

In their studies, [Wilcock & Boys (2014), Chaudhry et al.'s (2009), and Bird & Smith (2005)] say that the literature reviews showed the most and least effective actions for IPR protection which guides the practitioner to formulate their standard quality plan (SQP) to control counterfeiting phenomenon in their supply chains supported by an essential concept of signal theory. The earlier discussion about the signalling theory supports the theoretical view of counterfeiting and provides a link to the use of a customized standard quality plan (SQP) and the counterfeit prevention model. Harvey's (1988) study proposes the counterfeiting protection model (CPM) and discusses the key relationship among RBV, signalling theory, and deception theories to help develop, maintain and exploit the associated resource value over time (Cohen & Dean's, 2005). Trademarked goods available in the market always emit signals regarding the extent of the OEM's commitment to protecting their trademarks and about products' quality reputation whenever consumer pays attention to it. At a particular time when the counterfeit product becomes available in the market, the consumers receive false signals from the counterfeiter encouraging possible deceptive or non-deceptive purchases. However, the important aspect of signalling theory is that it does not explain clearly about ultimate harm done, because of a counterfeiting phenomenon, to legitimate supply chain or OEM or trademark reputation resources. The contradictory signals affect the value of the OEM trademark and reputation resources.

Mavlanova & Benbunan-Fich's (2010) study discusses that sellers use quality-inducing signals to sell their products. The deceivers misrepresent these signals to selling counterfeit products,

but it is the responsibility of the buyers to correctly interpret and evaluate the credibility and validity of the information provided by the seller to avoid low-quality signals. Kochan & Nowichi's (2018, p.849) study [cited Blackhurst et al. (2011)] suggest that the effect of disruptions on a SC varies depending on the level of supply chain resilience (SCRES). Dias et al.' (2018) study support the comments made by Kochan & Nowichi's study that there is a lack of consensus over a well-grounded definition of SCRES to improve firm's competitiveness. This study highlights the importance of expansion of supplier selection criteria and the increasing need for suppliers to signal their commitment to meet buyers' continued value determination. For that matter, a supportive environment to supplier's attributes affects buyers' purchase intensions regardless of any economic viability. This study recognises the importance of the suppliers' resources (RBV) and their expanded attributes (cultural factors, I.T based systems support (technology), process of resource development, and deployment of capabilities) to meet suppliers' selection criteria.

D) DECEPTIVE THEORY

The deception theory explains how an entity uses a combination of simulative and dissimulative tactics to deceive a target into believing a falsehood. Santos & Johnson's (2004) study discusses that the deceptive theory applied with signalling theory to understand product counterfeiting in consumer purchasing. Santos and Johnson's study discusses that simulative tactics, including mimicking, inventing a false reality, and decoying, are used to attract a victim by showing false information to lure them into believing a falsehood, while dissimulative tactics, such as masking, repackaging, and dazzling, try to make the false goods blend into the normal environment, thus hiding their true nature. Qian et al.'s (2014) study discuss that in the case of deceptive counterfeiting, RBV and signalling theory support the protective nature of the counterfeiting phenomenon, where sizeable counterfeits entered into the market generate deceptive signals to a small number of customers. Forced the authentic brands to invest in innovation to ensure searchable quality of the auto-parts and differentiate itself from counterfeiters Market incentives turn to favours separate equilibrium instead of favouring pooling equilibrium. In this type of separating equilibrium, counterfeiting induces the authentic producer to invest more in the product's searchable quality (e.g., appearance) and less in experiential quality (e.g., the functionality of the auto-parts, not apparent to consumers at the time of purchase). This could be socially wasteful if searchable quality does not contribute to consumer utility as much as experiential quality.

In the case of deceptive products counterfeiting, masking, and repacking are commonly used simulative tactics. In the electronics and automotive industry, there are documented cases where older circuits or spare parts become newer after removing their serial numbers and replacing them with newer ones. The deception theory helps to understand how counterfeiters perform their deceitful activities and guide the practitioners to develop anti-counterfeiting strategies to reduce the occurrence of counterfeiting activities in supply chains. The counterfeiting knowledge stream provides an opportunity for scholars to do more empirical studies to counter the illicit nature of counterfeiting. Ebersberger et al.'s (2021) study discusses the case-based research on counterfeiting, imitation, and reverse engineering from a Chinese perspective, using information from three key informants to provide insights into why firms engage in the non-consensual acquisition of technology. Staake et al.'s (2012) study used cluster analysis of industry experts' assessment of counterfeited items to derive business strategies used by counterfeiters, identifying five strategic groups: dis-aggregates, imitators, fraudsters, desperados, and smugglers. Discussed "how" counterfeiters conduct their activities, thus encouraging supply chain managers to select and implement concerned anti-counterfeiting strategies. Daniel & Herbig's (1982) study defines deception as deliberate misrepresentation of reality to gain a competitive advantage. Deceptions can be divided into three categories: cover, lying, and deception. Cover refers to secret-keeping and camouflage. Lying is subdivided into simple lying and lying with artifice. Lying is more active than covering in that it draws the target away from the truth. Artifice goes beyond straight lying in that it involves manipulating the context surrounding the lie. Deception is not the same as lying; as lying focuses more on the actions of the liar, and deception deals with the effects on the receiver. Daniel & Herbig's (1982) study further classify deceptions as ambiguity-increasing and ambiguity-decreasing: the former deceives by confusing the target, and the latter misleads by building up the attractiveness of one wrong alternative.

E) CRIME PROTECTION THEORY (CPT)

Speier et al.'s (2011) study worked on supply chain security using a combination of NAT and HRT with situational crime prevention theory and disaster management processes to theorize that organisations can prevent, detect, respond, and recover from security incidents that can bring resiliency into the processes and can ensure the sustainability of their supply chains. The study raises the argument that offensive ill acts in legitimate supply chains are a result of an opportunity target and location, lack of sufficient guardianship, and an offender's willingness to seize the opportunity to attack a vulnerable area of the supply chains. Thus, it is very

important to detect and eliminate counterfeiting activities from the supply chain. One way to achieve prevention is to understand how a counterfeiter could operate to sell deceptive counterfeits in a supply chain. Deception theory serves as a lens by which firms can understand how counterfeiters attempt to deceive consumers to purchase counterfeits.

F) How did four theories (RBV, CPT, ST, and DT) contribute to research design and conceptual model construct?

This study discusses the collective contribution of four theories (Resource Based View (RBV), Crime Protection Theory (CPT), Signalling Theory (ST), and Deceptive Theory (DT)) to understand the protective nature of counterfeiting phenomenon. The collective contribution of theories disclose answer to the research questions and help managers to work in an environment where parts' traceability is possible. The RBV focuses on investigating the internal competencies, based on a subset of the company's resources, to gain a competitive advantage. The CPT and S.T theories originate from neo-classical economic theory and help to answer questions regarding how to structure SCs. These theories fall short when comes to considering human behaviour, critical resources, and suppliers' contractual binding relationships (Halldorsson et al.'s, 2007). These factors can be addressed by including RBV and D.T, which help to determine what is needed to manage an organisational SC structure (buyers' propensity of being deceived). The CPT helps to explain how weak governance and lack of sufficient guardianship provide counterfeiters opportunities to infiltrate the licit SC. The S.T focuses on the cost of observability of the signals, quality plan, and strategic relationships. The theoretical arguments, supply chain complexities, and assumptions underpin the counterfeiting knowledge stream and help SC practitioners to detect counterfeit signals to avoid illicit purchases?. Swanson et al. (2017) study say that that adaptation of the collective theories addresses the wide variety of context in SCM research caused by the disruptive technologies. Finally, the D.T provides a rationale for assessing the role of distributed technology that can protect the automotive SC from illicit parts' penetration, after harmonizing the conflicting goals. Taking four theories together represents complementary perspectives for inter/intra organisational attributes that allow product traceability platforms for managers to make decisions. The research questions on existing theory allow for the incremental development of a body of research that makes it easier to replicate or reject previous findings.

Four theories collectively contributed to the research design and explore about how knowledge and phenomenon takes place in supply chains (see below discussion part). These theories provide investigative opportunities to follow a research cycle that involves two main phases:

an exploratory phase and a confirmatory phase. Whether a researcher should pursue interpretive, or positivist research depends on paradigmatic considerations about the nature of the phenomenon under consideration and the best way to study it. These collective theories also link to the conceptual model of the "anti-counterfeiting strategies initiative" construct to the firm's performance. Moreover, these theories are also helpful to develop hypotheses in the product counterfeiting context of supply chains SC exchange relationships.

DISCUSSION: HOW THEORIES IMPACT ON THE MODEL?

SUPPLY CHAIN QUALITY MANAGEMENT (SCQM)

How crime protection theory informed the supply chain quality management?

Crime protection theory, also known as crime prevention through environmental design, is a crime prevention strategy that focuses on designing physical environments to reduce the opportunity for criminal activity. This theory has informed supply chain quality management by highlighting the importance of securing facilities, controlling access to sensitive areas, and implementing surveillance systems to deter theft and other crimes within the supply chain. Additionally, CPT can be applied to logistics and transportation systems to reduce the vulnerability of cargo to theft and damage. Overall, the application of CPT can help ensure the integrity and security of the supply chain, and help to protect against potential losses due to criminal activity. The CPT has informed the TQM (customer focus, supplier quality management) and SCM (lean system, partnership management) that the quality management systems are helpful in improving supply chain operations to control product counterfeiting. The CPT has also informed SCQM that real quality performance requires an equal focus on both intra-firm (purchasing consortia, warehousing, internal operations) and inter-firm relationships (off-shore operations, distribution-DCs). Thus, the CPT supports SCQM practices to deliver quality products as per the delivery schedule within the minimum cost.

How resource-based theory informed the supply chain quality management?

Resource-based theory (RBT) is an organizational theory that argues that a firm's resources and capabilities are key determinants of its performance. RBT has informed supply chain quality management by emphasizing the importance of a firm's resources and capabilities in achieving and maintaining a competitive advantage in the market. Specifically, RBT suggests that a firm's ability to effectively manage its resources and capabilities can lead to improved supply chain

performance, including better quality management. According to RBT, a firm's resources and capabilities can include things like its financial resources, technological capabilities, and human resources. In the context of supply chain quality management, a firm's resources and capabilities can include things like its quality management systems, its ability to track and analyse data, and its access to specialized equipment or technology. By effectively managing these resources and capabilities, a firm can improve its ability to identify and address quality issues, and ultimately improve the overall quality of its products and services. In summary, RBT has informed supply chain quality management by emphasizing the importance of a firm's resources and capabilities in achieving and maintaining high quality standards throughout the supply chain. The RBT has informed the TQM (H.R, information analysis) and SCM (information management) that the quality management systems are helpful in improving SC operations to control product counterfeiting. The RBT has informed SCQM that real quality performance requires an equal focus on both intra-firm (purchasing consortia, warehousing, internal operations) and inter-firm relationships (off-shore operations, distribution-DCs). Thus, the RBT supports SCQM practices to deliver quality products according to the delivery schedule within the minimum cost.

How signalling theory informed the supply chain quality management?

Signalling theory is an economic theory that explains how firms use certain signals to communicate information about their products or services to potential buyers. This theory has informed supply chain quality management by highlighting the importance of signals in communicating information about product quality to customers. The ST has informed the TQM (customer focus, supplier quality management) and SCM (lean system, partnership management) that the quality management systems are helpful in improving supply chain operations to control product counterfeiting. Signalling a quality conscious image to potential customers helpful in retaining current business in the supply chain. The certifications (ISO9001) and awards (Malcolm Baldrige National Quality Award) to communicate information about the quality of their products or services to customers. In summary, signalling theory has informed supply chain quality management by emphasizing the importance of signals in communicating information about product quality to customers, and by providing a framework for understanding how firms can use certifications, awards, and brand reputation to signal quality to customers. The ST has informed SCQM that real quality performance requires an equal focus on both intra-firm (SOPs, regulated operations, inspection and logistics) and inter-firm relationships

(SOPs, agreements of outsourcing, campaign, inspection and logistics). Thus, the ST supports SCQM practices to protect the licit supply chains through regulated procedures.

How deceptive theory informed the supply chain quality management?

Deception theory is a psychological theory that examines how and why individuals and organizations deceive others. This theory has informed supply chain quality management by highlighting the importance of detecting and preventing deception in the supply chain. Deception can occur in the supply chain (SCM-strategy & organization) in a variety of ways, such as by providing false information about the quality or origin of products (TQM-information analysis), by misrepresenting the condition of goods, or by concealing defects or non-compliance with regulations (counterfeits). Such deception can lead to a range of problems for firms in SCM, such as reputational damage, legal liability, and financial losses. Deception theory suggests that in order to detect and prevent deception in the supply chain, firms need to be aware of the various ways in which deception can occur, and have the ability to detect signs of deception. This can include implementing robust quality control processes, monitoring supplier behaviour, and conducting regular audits of suppliers' facilities and practices. Firms can also use technology that can help to increase transparency in the supply chain, and make it more difficult for actors to deceive. In summary, deception theory has informed SCQM by detecting and preventing illicit activities in the supply chain. The DT has informed SCQM that real quality performance requires an equal focus on both intra-firm (purchasing consortia, warehousing, internal operations) and inter-firm relationships (off-shore operations, distribution-DCs). Thus, the DT supports SCQM practices to deliver quality products through licit supply channels within a minimum cost.

ANTI-COUNTERFEITING STRATEGIES INITIATIVE (ANCT-INT)

How crime protection theory informed the-counterfeiting strategies?

Crime protection theory, also known as crime prevention through environmental design (CPT), is a crime prevention strategy that focuses on designing physical environments to reduce the opportunity for criminal activity. This theory has informed anti-counterfeiting strategies by highlighting the importance of securing facilities, controlling access to sensitive areas, and implementing surveillance systems to deter the production and distribution of counterfeit goods. According to CPT, anti-counterfeiting strategies (theme#3 to 4) should focus on reducing the opportunities for counterfeiting by making it more difficult for counterfeiters to access the materials and equipment they need to produce fake goods. This can include things like securing

warehouses and distribution centres, controlling access to printing presses and other equipment, and implementing surveillance systems to monitor for suspicious activity. The CPT suggests that it is important to design the physical environment (Theme#1) in a way that makes it difficult for counterfeiters to move and distribute their goods. This can include things like implementing security gates and barriers, deploying security personnel and cameras, and creating a layout that makes it difficult for vehicles to move around the facility. In addition to physical security measures, CPT suggests (in Theme#4) that it is important to create a culture of security within an organization to make it difficult for employees to engage in counterfeiting or other criminal activities. This can include things like implementing strict security protocols, providing training on security awareness, and conducting background checks on employees.

In summary, crime protection theory has informed anti-counterfeiting strategies (Theme#1 to 4) by highlighting the importance of securing facilities, controlling access to sensitive areas, and implementing surveillance systems to deter the production and distribution of counterfeit goods. It also suggests that it is important to design the physical environment in a way that makes it difficult for counterfeiters to move and distribute their goods, and to create a culture of security within an organization. The CPT has informed ANCT-INT (Theme#1) that real quality performance can be achieved through ISO-supported Q.M standards for standardized reporting, conformance to quality, supplier's commitment to quality, and setting up of performance evaluation criteria. The CPT has informed ANCT-INT (Theme#2) that customers' ethical buying behaviour is important. Awareness can be created by lobbying and advertisement to address the product counterfeiting issue. The CPT has informed ANCT-INT (Theme#3) that techniques like the product technical evaluation, tracking and tracing, data protection, data mining & data visualization are important to address the product counterfeiting issue. The CPT has also informed ANCT-INT (Theme#4) that real quality performance can be achieved by introducing the surveillance program to maintain the product specification according to the product characteristics, to improve the quality of the processes, and to use law enforcement agencies to provide legal cover to a product (crisis management plan).

How resource-based theory informed the anti-counterfeiting strategies?

Resource-based theory (RBT) is an organizational theory that argues that a firm's resources and capabilities are key determinants of its performance. RBT has informed anti-counterfeiting strategies (Theme#2) by emphasizing the importance of a firm's resources and capabilities in achieving and maintaining a competitive advantage in the market by protecting its intellectual

property (IP) rights. According to RBT, a firm's resources and capabilities can include things like its financial resources, technological capabilities, and human resources. In the context of anti-counterfeiting (Theme#3 & 4), a firm's resources and capabilities can include things like its IP rights, its ability to track and analyse data, and its access to specialized technology or equipment. Additionally, a firm can use its technological capabilities such as using digital watermarks, holograms, and RFID tags to protect its products and make it difficult for counterfeiters to replicate them. Firms can also use legal resources such as hiring legal teams and engaging in legal action against counterfeiters to stop their activities. Furthermore, they can use their financial resources to invest in anti-counterfeiting technologies and solutions, and in hiring specialized personnel to conduct investigations and take legal action against counterfeiters.

In summary, RBT has informed anti-counterfeiting strategies (Theme#2 to 4) by emphasizing the importance of a firm's resources and capabilities in protecting its IP rights, and by providing a framework for understanding how firms can leverage their resources such as their IP rights, technological capabilities, legal and financial resources to fight counterfeiting activities and protect their brands and products. The RBT has informed ANCT-INT (Theme#2) that customers' ethical buying behaviour is important. Awareness can be created by lobbying and advertisement to address the product counterfeiting issue. The RBT has informed ANCT-INT (Theme#3) that techniques like the product technical evaluation, tracking and tracing, data protection, data mining & data visualization are important to address the product counterfeiting issue. The RBT has also informed ANCT-INT (Theme#4) that real quality performance can be achieved by introducing the surveillance program to maintain the product specification according to the product characteristics, to improve the quality of the processes, and to use law enforcement agencies to provide legal cover to a product (crisis management plan).

How signalling theory informed the anti-counterfeiting strategies?

Signalling theory is an economic theory that explains how firms use certain signals to communicate information about their products or services to potential buyers. This theory has informed anti-counterfeiting strategies (Theme#1 & 2) by highlighting the importance of signals in communicating information about product authenticity to customers and making it more difficult for counterfeiters to imitate genuine products. Specifically, signalling theory suggests that firms can use certain signals (Theme#3), such as certifications, labels, or holograms, to communicate information about the authenticity of their products or services to customers.

These signals can help customers make more informed decisions about which products or services to purchase, and can also help firms differentiate their genuine products from counterfeit ones. Additionally, companies can use their brand reputation (Theme#2) as a signal for authenticity, signalling to customers that they have a track record of providing genuine products or services. In summary, signalling theory has informed anti-counterfeiting strategies (Theme#1 to 3) by emphasizing the importance of signals in communicating information about product authenticity to customers and making it more difficult for counterfeiters to imitate genuine products. It also provides a framework for understanding how firms can use various types of signals such as certifications, labels, holograms, RFID tags, barcodes, and QR codes, and brand reputation to signal authenticity to customers. The ST has informed ANCT-INT (Theme#1) that real quality performance can be achieved through ISO-supported Q.M standards for standardized reporting, conformance to quality, supplier's commitment to quality, and setting up of performance evaluation criteria. The ST has informed ANCT-INT (Theme#2) that customers' ethical buying behaviour is important. Awareness can be created by lobbying and advertisement to address the product counterfeiting issue. The ST has also informed ANCT-INT (Theme#3) that techniques like the product technical evaluation, tracking and tracing, inspection and logistics, data protection, data mining & data visualization are important to address the product counterfeiting issue.

How deception theory informed the anti-counterfeiting strategies?

Deception theory (DT) is a psychological theory that examines how and why individuals and organizations deceive others. This theory has informed anti-counterfeiting strategies (Theme#3 & 4) by highlighting the importance of detecting and preventing deception in the marketplace by identifying and stopping counterfeiters who deceive consumers by selling fake products. Deception can occur in the marketplace in a variety of ways, such as by providing false information about the origin, authenticity or quality of products, by misrepresenting the condition of goods, or by concealing defects or non-compliance with regulations. Such deception can lead to a range of problems for firms, such as reputational damage, legal liability, and financial losses. Deception theory suggests that in order to detect and prevent deception in the marketplace, firms need to be aware of the various ways in which deception can occur, and have the ability to detect signs of deception (Theme#3). Firms can also use technology that can help to increase transparency in the supply chain, and make it more difficult for actors to deceive (Theme#3). Additionally, firms can use legal means such as lawsuits, and work with relevant

authorities to prevent counterfeiters from deceiving consumers, and to protect their brand and IPR (Theme#4).

In summary, deception theory has informed anti-counterfeiting strategies (Theme#3 & 4) by highlighting the importance of detecting and preventing deception in the marketplace by identifying and stopping counterfeiters who deceive consumers by selling fake products, and by providing a framework for understanding the various ways in which deception can occur, and the steps that firms can take to detect and prevent it. It also suggests the use of technology and legal means to prevent deception. The DT has informed ANCT-INT (Theme#3) that techniques like the product technical evaluation, tracking and tracing, data protection, data mining & data visualization are important to address the product counterfeiting issue. The DT has also informed ANCT-INT (Theme#4) that real quality performance can be achieved by introducing the surveillance program to maintain the product specification according to the product characteristics, to improve the quality of the processes, and to use law enforcement agencies to provide legal cover to a product (crisis management plan).

FIRMS SUPPLY PERFORMANCE

How crime protection theory informed the firm supply performance?

Crime protection theory informs the firm's supply performance by providing a framework for understanding how firms can protect themselves from criminal activities within the supply chain. This can include implementing measures such as background checks, supplier audits, and compliance training to ensure that suppliers are following all relevant laws and regulations. According to crime protection theory, firms can also establish internal controls and surveillance systems to detect and prevent fraudulent or illegal activities within the supply chain. This can include using data analytics and other surveillance techniques to detect patterns of suspicious behaviour, such as unusual transactions or unusual spending patterns. By implementing these measures, firms can reduce the risk of supply chain crime, which can improve the overall performance and integrity of the firm's supply operations. Additionally, firms can also consider implementing security measures such as secure transportation, packaging and storage to protect their goods from theft or damage. Furthermore, firms can also consider implementing risk management processes to identify and assess possible risks of crime and fraud in the supply chain, and to develop strategies to mitigate or manage those risks. The CPT has informed FSP that the successful implementation of anti-counterfeiting strategies (Theme#1 to 4) can help firms to

proactively protect themselves from criminal activities, and improve their supply performance and control product counterfeiting issue.

How resource-based view theory informed the firms supply performance?

The resource-based view (RBV) theory informs the firm's supply performance by emphasizing the importance of the firm's resources and capabilities in determining its competitiveness. According to RBV, a firm's unique resources and capabilities can be leveraged to create a competitive advantage. In the context of supply performance, this means that a firm's resources and capabilities such as its financial resources, technology, skilled employees, and reputation can be used to improve supply chain efficiency and effectiveness. For example, a firm with strong financial resources can invest in advanced technology or logistics systems to improve the speed and accuracy of its supply chain operations (FSP-cost, quality, relationship). A firm with a reputation for ethical conduct can use that reputation to attract and retain high-quality suppliers (FSP-quality). By identifying and leveraging its unique resources and capabilities, a firm can improve its supply performance and create a competitive advantage in its industry (FSP-responsiveness). Additionally, RBV theory suggests that a firm's internal resources and capabilities (FSP-cost, quality, flexibility) can be complemented by external resources and capabilities. The RBV theory has informed FSP that the successful implementation of anti-counterfeiting strategies (Theme#2 to 4) can help firms to establish strategic partnerships with other firms to access resources and capabilities that it lacks internally. A flexible firm can utilize their best resources to address cost, quality, and suppliers' relationship issues to enhance FSP and control product counterfeiting problem in the automotive industry's SCs.

How signalling theory informed firm's supply performance?

Signalling theory informs firm's supply performance by providing a framework for understanding how firms communicate information to their suppliers, customers, and other stakeholders. According to signalling theory, firms use various signals (FSP-quality, responsiveness) to convey information about their products or services. In the context of supply performance, signalling theory suggests that firms can use signals such as long-term contracts, advanced payments, or exclusive agreements to signal (FSP-quality, flexibility, responsiveness) to suppliers that they are reliable and trustworthy partners. This can help to attract and retain high-quality suppliers which can improve the firm's overall supply performance. Additionally, signalling theory also suggests that firms can use signals such as certifications and awards signal (FSP-relationship) to customers that they are providing high-quality products or services. This can help to

increase customer loyalty and improve the firm's reputation, which can lead to increased demand for the firm's products or services and improve its supply performance (FSP-quality, flexibility, responsiveness). The ST has informed FSP that the successful implementation of anti-counterfeiting strategies (Theme#1 to 3) can help firms to send the product quality signal to their customers by investing in advanced technologies. A flexible firm can utilize their communication platform (lobbying, advertisement) to address cost, quality, and suppliers' relationship issues to enhance FSP to control product counterfeiting problem in the automotive industry's SCs.

How deceptive theory informed the firm supply performance?

Deceptive theory informs the firm's supply performance by suggesting that firms may engage in deceptive or unethical behaviour in order to gain a competitive advantage. This can include actions such as price fixing, false advertising, or misrepresenting the quality of goods or services. Such behaviour can lead to increased profits for the firm in the short term, but can also lead to negative consequences such as legal penalties and damage to the firm's reputation (FSP-relationship). Therefore, it is important for firms to consider the potential long-term consequences of engaging in deceptive behaviour when making strategic decisions (FSP-quality, flexibility, responsiveness) regarding their supply performance. The DT suggests that in order to detect and prevent deception in the marketplace, firms need to be aware of the various ways in which deception can occur, and have the ability to detect signs of deception (FSP-relationship, responsiveness) to enhance FSP. The DT has informed FSP that the successful implementation of anti-counterfeiting strategies (Theme#3 to 4) can help firms to use the auto parts traceability technology to detect and prevent deception in the marketplace. A flexible firm can utilize their best resources to address cost, quality, and suppliers' relationship issues to enhance FSP and control product counterfeiting problem in the automotive industry's SCs.

2.2.3 PRODUCT COUNTERFEITING ISSUE - AUTOMOTIVE SUPPLY CHAIN

The counterfeit parts get into military systems in different buying situations, as the SMT Magazine (August 2011) report discusses that counterfeit parts get into military systems need components that are most often obsolete and become part of the licit supply chain under distress buying with missing alternatives. An opportunity for brokers solicited by defense contractors when a buyer is desperate enough to be much less careful while buying these parts. Monetarily motivated manufacturers of counterfeit parts and trade agents perform deception activities (changing labels, repackaging, refurbishing scrap, etc.) in which counterfeit products become accepted into military and avionics systems. The automotive supply chains involve the OEM and multi-tier suppliers (Mena et al.'s, 2013). Take an example of a car disc brake with three other components (Disk, caliper, and brake pads). The final assembly of a disk brake is completed at tier-1 (allocate unique serial number) and other components of that disk brake, are individually assembled at various sub-tiers (allocate unique serial number at an individual level). Later at the time of part-assembly, the serial numbers of components paired up with a disk brake serial number to align into the tier-1 tracking system. Next, the tier-1 ships the disk brakes to OEM where it placed into vehicles with unique serial numbers paired up with the vehicle identification number (VIN). All quality management-based processes in the factory are then followed accordingly concerning a particular VIN. The traceability ends when the vehicle leaves the factory. The SJBIPP report published in 2018, mentioned that the referenced knowledge base infers that OEMs do systematically maintain that traceability within their system, but they do not share the cause of the counterfeiting. Thus, the lack of a shared vehicle parts traceability platform from sub-tiers to aftermarket prevents OEMs to implement strategies that can reduce product counterfeiting activities in automotive supply chains. On the other hand, the authorized dealership orders serialized parts through the OEM distribution channel and then updates the car's computer with the new part serial number. Whereas the unauthorized service shops have verification limitations as per their stakes. Some service repair shops choose cheap parts with or without consumer consent to increase their profit margins and may end up servicing counterfeit parts. As a result, vehicle parts quality is directly compromised concerning driver safety measures and indirectly to the firm's brand image.

In another scenario, it is observed that people, in general, adjust the meter reading or replace the Thai model with a copy meter before selling their vehicle without realizing its dangerous consequences. It is related to the timing belt because it is due for replacement after 105km or 105 months, whichever comes first. In case of a longer delay in replacement when a vehicle

goes beyond 100,000 miles without transmission flush, a gear slip or transmission failure occurs. A transmission flush involves connecting a machine to the vehicle's transmission cooler lines and letting the machine pump new transmission fluid into the vehicle while it draws the old fluid out. The problem led to the most common failure of valves. The valve contacting the top of a piston is due to incorrect engine synchronization caused by timing chain/belt breakage and incorrect fitting of new belts and chains. EUIPO (2020) report said that fake parts underperform, lead to an accident, and OEMs face difficulty to justify that accident occurred due to the fake parts.

2.2.4 PRODUCT COUNTERFEITING

Wilcock & Boys (2014, p.279) study define counterfeiting as "*the unauthorized representation of a registered trademark carried on goods similar to goods for which the trademark is registered, to deceive the purchaser into believing that he or she is buying the original goods*". Harvey's (1988) study states that product counterfeiting is the unauthorized copying of potential inventions, copyrighted works, or trademarks. Counterfeiters introduced counterfeits in the market with substandard materials and exploit the original products' reputation without referencing the brand. Ghadge et al.'s (2021, p.89) study mentioned different definitions of counterfeiting concerning deceptive counterfeiting risks in global supply chains. Staake & Fleisch's (2008) study discusses that counterfeiting denotes the unauthorized reproduction of goods, services, or documents concerning which the state confers upon legal entities, a statutory monopoly to prevent their exploitation by others. Staake et al.'s (2009) study says that the trade in goods, be it due to their design, trademark, logo, or company name, bears without authorization a reference to a brand, to a manufacturer, or any organisation that warrants the quality or standard conformity of the goods, in such a way that the counterfeit merchandise could be confused. Staake et al.'s study state that the investigative studies deficit has not helped practitioners and authorities to understand the intricacies involved in the counterfeiting phenomenon in supply chains (due to the protective nature of the phenomenon) and that is one of the major reasons why existing counterfeit prevention measures are found insufficient to confine the recent growth of the counterfeit market. Staake et al.'s study concedes that the academic research related to supply-side investigations is limited, acknowledging few publications dedicated to these issues, despite the importance of understanding how the supply side operates. Quach & Thaichon's (2018) study discusses that counterfeiters exploit the latest technologies to deceive the customers and a wide research gap exists to investigate the supply side of the counterfeits' market and how OEMs protect their brands. The study mentioned four

themes behind selling counterfeits that include: a) Personal characteristics (self-interest priority and sense of adventure); b) Moral justification (denial of responsibility, inequality hypothesis of self-deception process, Social acceptance); c) Operational aspects (low-cost investment, free-riding on luxury brands' marketing efforts, and invisibility from regulators); d) Relationship Management (projecting image using volitional cues and interpersonal relationship with buyers).

COPYRIGHT INFRINGEMENTS AND COUNTERFEITING

Copyright describes the rights given to the authors for their creative works. The kind of works that may be covered by copyright includes literary works, databases, films, music compositions, phonograms, performances, broadcasts, and choreography, artistic works such as paintings, drawings, photographs, and sculpture; architecture; and advertisements, maps, and technical drawings. The rights do not cover ideas, procedures, methods of operations, or mathematical concepts. In the automotive sector the copying of parts and components (trademark infringements, patent & design infringements) ranging from individual components to entire vehicles, are also come under IPR. Spink et al.'s (2010, 2011) studies define different types of counterfeiting, such as a) Adulteration: a component of the legitimate finished product is fraudulent; 2) Tamper: a legitimate product and package are used fraudulently; 3) Over-run: a legitimate product is made more than production agreements; 4) Theft: a legitimate product is stolen and passed off as legitimately procured; 5) Diversion: the sale or distribution of legitimate product outside of intended markets; 6) Simulation: Illegitimate product is designed to look like but not exactly copy the legitimate product. According to internet sources says that Cordell et al.'s (1996) study refers to counterfeiting as the unauthorized use of someone else's legitimately registered trademark while piracy refers to the violation of someone else's copyright.

2.2.4a) INSPIRATIONAL SCHOLARLY CONTRIBUTIONS

This study considers the most inspiring scholarly contributions that have created public awareness against the use of counterfeits (in terms of deceptive and non-deceptive buying) and its impact at a techno-socio-economic level in society. This section highlights scholarly contributions made with respect to deceptive counterfeiting [Abdulbaqi's (2020); Bian & Veloutsou's (2017); Hayder's (2017); Wilcock & Boys's (2014); Staake et al.'s (2009, 2012); Berman's (2008); Khouja & Smith's (2007); Hoe et al.'s (2003); Green & Smith's (2002); Olsen & Granzin's (1992, 1993); Harvey's (1987, 1988); Harvey & Ronkainen's (1985)].

Whereas, contributions made with respect to non-deceptive counterfeiting [Singh et al.'s (2020, 2021); Samaddar & Menon's (2020); Quach & Thaichon's (2018); Bian & Veloutsou's (2017); Xi & Cheng's (2017); Jiang & Cova's (2012); Koklic's (2011); Phau et al.'s (2009); Phau & Teah (2009); Wilcox et al.'s (2009); De Matos et al.'s (2007); Bian & Veloutsou's (2007); Santos & Ribeiro's (2006); Veloutsou & Bian's (2007); Gentry et al.'s (2006); Eisend & Schuchert-Guler's (2006); Wang et al.'s (2005); Penz & Stottinger's (2005); Penz et al.'s (2008); Vida's, (2007); Ben-Shahar & White's (2005); Hoe et al.'s (2003); Hung's (2003); Ang, S.H. et al.'s (2001); Phau et al.'s (2009); Wagner & Sanders's (2001); Grossman & Shapiro's (1988a, 1988b)] highlight the importance of the consumers' buying behaviour and understanding about the culture according to the intended studies.

The scholarly contributions made by Staake et al.'s (2009), D'Amato et al.'s (2012), Wilcock & Boys (2014), and Vanichchinchai & Igel (2011) show attempts to describe licit and illicit supply chains and their immediate relationships. Following the direction of the Vanichchinchai and Igel study, despite the TQM and SCM being large-scale management systems, managers consider them as one system. Both could be implemented together to achieve excellent performance in the firm's supply-related business process system. In TQM and SCM literature, there exist studies [Forker et al.'s (1997); Kannan & Tan's (2005); Kaur et al.'s (2019, 2021); Kaynak & Hartley's (2008); Lin et al.'s (2005)] dedicated to extending theories, models, and strategies to a different context. This study only focuses on the existing deceptive counterfeiting phenomenon in automotive supply chains in Pakistan. For that matter, secondary information and important scholarly contribution became the source of motivation [Vanichchinchai & Igel's (2011); Wilcok & Boys's (2014); Staake et al.'s (2009, 2012); Robinson & Malhotra's (2005); Trott & Hoecht's (2007); Stevenson & Busby's (2015); Stumpf & Chaudhry's (2010); Shultz & Saporito's (1996); Xi & Cheng's (2017); Cheng et al.'s (2017); Chen, S. et al.'s (2017); Schumacker et al.'s (2016)] to investigate the research inquiry. However, the secondary information and scholarly contributions related to the counterfeiting knowledge stream are still young (Staake et al.'s, 2009) to shed light on the clandestine nature of the market mechanism to address the research problem, is to control product counterfeiting in the automotive industry's supply chain in Pakistan.

Staake et al.'s study says that a real challenge lies in estimating the extent of the country-wide counterfeits' trades taking place, as hardly any relevant trustworthy statistics exist to provide complete country-wide counterfeits' presence status. The OECD studies observation is considered highly questionable and deficient to provide industry-wide detailed impact analysis

based on empirical studies. As the OECD studies provide information about the consignment seized at ports only. Hung's (2003) study finds that almost every company wants counterfeit trade to be controlled on a managerial and legal basis, as existing anti-counterfeiting measures (that include firm's level approaches and technological approaches) have not yet confined the recent growth of the counterfeit market. The Staake et al study emphasizes that the performance measures of the anti-counterfeiting activities could help to identify, select, and improve successful practices to counter the counterfeiting phenomenon in supply chains. The speechless contribution on behalf of the present counterfeiting research streams of the body of knowledge shows that companies have no reasonable estimates of the financial implication of counterfeits on brand equity (Staake et al.'s, 2009) and the perception of the quality of the product. Moreover, the unverified estimates of the counterfeits' production and their seizures at the ports and borders at cross countries geographic markets are likely based on "gut feelings" (Staake et al.'s, 2009) rather than on the specific ROI calculations.

Soon & Manning's (2019) study emphasizes that a stand-alone system is not enough to check counterfeits' entry into supply chains. The presence of counterfeits in supply chains needs to be checked in the presence of a reliable physical authentication system at the decoupling points, a more holistic approach of designing required to trace and track the product throughout the supply chains. Thus, individual businesses, supply chains, and regulators need to consider the kinds of "integrated anti-counterfeiting systems" that are required to reduce counterfeiting to protect supply chains. Soon and Manning discusses different anti-counterfeiting measures in supply chain areas related to; communication, distribution, price and product, social value, and management system. Grenoble's (2014) study discusses the detection and deters approaches concerning the supplier and buyer firms. The study says that counterfeiting is an omnipresent, critical, and yet exclusive supply chain issue evolved over the last few years into a global phenomenon (US Customs and Border Protection, 2014). Aside from techno-socio-economic determinants, consumer safety is at risk as counterfeiting activities are encroaching across a wider range of safety-critical products such as medical devices, electronic equipment, pharmaceutical, automotive, and aircraft parts that are critical to their safety operations. The Grenoble study describes the detect-and-deter approaches designed to improve counterfeit parts detection and institute barriers to deter counterfeiters. The study reveals that counterfeiting activities can be categorized as Grey-market activities, re-marked / re-packaged activities, Green-market activities, Surplus production activities, and illegally acquired activities. The study discusses different countermeasures against counterfeiting activities concerning supplier

and buyer firms, such as: focusing on counterfeit part intelligence; risk-based multi-layered approach; identifying trusted/distrusted parties; employing authentication technology applications; strengthening the internal line of Défense; capitalizing on external reinforcement through collaboration and information sharing; achieving internal re-enforcement through organisation-wide culture and policies. Hussein & Kachwamba's (2011) discussed that the availability of low-quality products in developing countries' markets is a critical challenge to practitioners due to its detrimental effects on legitimate manufacturers, final consumers, and the economic development of the country.

2.2.4b) DECEPTIVE AND NON-DECEPTIVE COUNTERFEITING

Samaddar & Menon's (2020, p.3) study mentioned that "*Products which are presented in the marketplace as genuine to deceive the purchaser are known as deceptive counterfeit goods; common examples are counterfeit medicines and cosmetics".* Samaddar & Menon's (2020, p.3) study also mentioned that "*Non-deceptive counterfeit purchase happens when consumers intentionally purchase a copied version of the original product".* Staake et al.'s (2009) study say that with deceptive counterfeiting, the consumer is unaware that the item is a counterfeit, whereas, with non-deceptive counterfeits, the consumer is fully aware of the illicit nature of the product. Zhang & Zhang's (2015) study discusses that in the case of deceptive counterfeiting supply chain structure in the market, the counterfeits lower consumers' perceived quality of the authentic product, which cost less and allows a retailer to charge a lower price to attract more consumers. Thus, a general retailer may simply replace the brand-name product with its counterfeits if the quality of the counterfeits is relatively high, and the penalty of doing so is low. Ghadge et al.'s (2021, p.94) study discusses the types of counterfeits and the deceptive counterfeiting breaches identified in the supply chain in a global SC environment. The findings of Ghadge et al.'s research study, based on the online survey concerning the research objective, say that low-cost spare parts and items supplied by tier-2 suppliers downward are the sources of counterfeits' presence in the markets. As a result of the deceptive buying, the OEM experience delays in lost sales, product recalls events and litigation cases.

Ghadge et al.'s study discusses that to control counterfeiting activities, the parts traceability platform (network transparency), QC/QA checks, and pre-supply evaluation strategies are important. Furthermore, these strategies can be: 1) high levels of specifications; 2) contract performance review and continuous improvement; 3) supplier relationship and contract management/development. Yao, Jen-Te's (2015) study discusses that under the existence of deceptive counterfeiting, the legal producer's pricing strategy is affected by the degree of quality uncertainty. As a result, in the presence of the uniform distribution in quality estimation (log-concavity), various anti-counterfeiting policies have a different impact on legitimate producers' pricing strategies. The study further discusses that under the deceptive counterfeiting with uniform distribution in quality estimation, raising counterfeiters' fines pegged to the product price entails positive effects, which increase consumer surplus and the genuine firm's profits, while imposing counterfeit-purchase penalties on consumers generates negative effects, as they reduce consumer surplus and the genuine firm's profits. Staake et al.'s (2009) study introduces the classification scheme from terms related to counterfeiting. The term

"counterfeiting" is a subset of illicit trade and IPR infringements separate from contraband trade, illicit trade in controlled goods, and stolen goods trading. Counterfeiting can be of a deceptive or non-deceptive nature. Staake et al.'s (2012) study highlight various groups of counterfeiters, investigating their strategic profiles and the main industry in which they operate. The study identifies the Dis-aggregators and Imitators, typical counterfeiters operating in fashion and luxury businesses. Staake et al.'s study further discusses various facets of counterfeiting research along the supply chain. (Fig-2.2.4c):

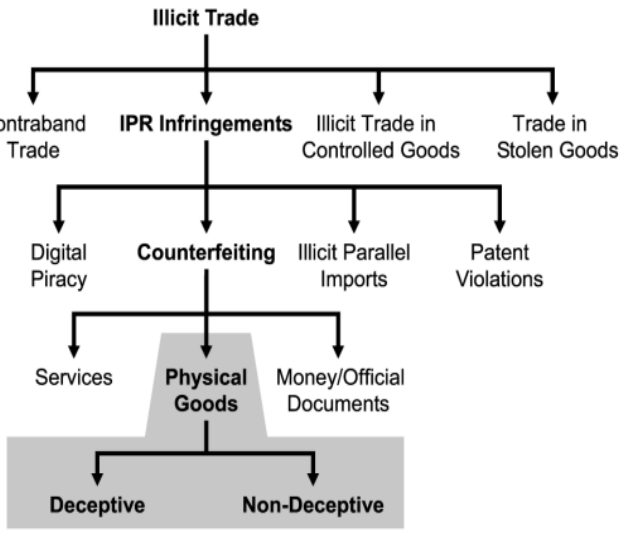


Fig-2.2.4c : Source – Staake et al., 2009

The OECD (2008) report mentioned that sub-markets for counterfeit products are primary and secondary markets. In the primary markets, consumers purchase counterfeits under deception believing that they are purchasing genuine products (deceptive buying, Green & Smith, 2002). The counterfeits are often found non-compliant with quality standards and carry severe health and safety risks. Green and Smith's study says that in the secondary market, customers knowingly purchase counterfeit products (non-deceptive buying).

2.2.4c) DRIVING FACTORS AND EFFECTS OF COUNTERFEITING

Eser et al.'s (2015) study discusses the supply and demand side of counterfeiting, where research on-demand side of the counterfeits is abundant. The counterfeits on the supply-side may have one or more of the characteristics linked with the counterfeits: heavily advertised; widely distributed; limited supply; prestige; strong consumer brand affiliation; and technologically advanced products. Whereas on the demand side, there are reasons for purchasing counterfeits: 1) Brand prestige and attraction for apparel (D' Astous et al.'s, 2005); 2) Material gain, cheapness (Furnham & Valgeirsson's, 2007; De Matos et al.'s, 2007; Ang,

S.H. et al.'s, 2001; Harvey et al.'s, 2003; Prendergast et al.'s, 2002); 3) Self-legitimation and self-justification; 4) None or low criminal risk perceived on consumer end (De Matos et al.'s, 2007); 5) Low social risk perceived (Penz et al.'s, 2005); 6) Ethical diversion (Ang, S.H. et al.'s, 2001); 7) Improving self-image by owning/using brand products (Bloch et al.'s, 1993); 8) Low education and awareness (Prendergast et al.'s, 2002). Thus, low price plays an important role in the purchase of counterfeits. Consumers with low education and low awareness buy such goods mostly for good value for the price paid. Eser et al.'s study discuss that to counter the counterfeiting activities some measures are required: 1) secure supply chains; 2) improve their internal systems and coordinate with other stakeholders including subcontractors and government authorities; 3) improvement in product track and trace activities; 4) monitoring investment in the low-cost country for sourcing; 5) cyber control on the use of the internet-based technology in supply-chain; 6) use of media campaign to create awareness among consumers; 7) make surveillance team to counter organized crime network. OECD (2005) report discussed (Table-2.2.4a) the driving factors of demand and supply of counterfeit goods, such as 1) counterfeits' supply driving factors (deceptive counterfeiting / primary market); market characteristics, production/distribution & technology characteristics; institutional characteristics. 2) Counterfeits' demand driving factors (non-deceptive counterfeiting / secondary market); product and consumer characteristics, institutional characteristics. Considering a significant contribution to the economy, firms sometimes imitate & reverse engineer spare parts, and thus demonstrate technical capabilities in creating copyright issues.

TABLE-2.2.4a: PRODUCT COUNTERFEITING DERIVING FACTORS FOR COUNTERFEITING

Counterfeit Supply driving factors (Deceptive Counterfeiting / Primary Market)	**Counterfeit Demand driving factors (Non-Deceptive Counterfeiting / Secondary Market)**
Market characteristics • High unit profitability • Large potential market size • Genuine brand power	**Product Characteristics** • The huge price difference between the basic and fake products • Acceptable perceived quality • Ability to conceal the status
Production, Distribution & Technology Characteristics • Moderate need for investments • Moderate technology requirements • Unproblematic distribution and sales • High ability to conceal the operation • Easy to deceive consumers	**Consumer Characteristics** • No health concerns • No safety concerns • Personal budget constraint • Personal values: Low regard for IPR
Institutional Characteristics • Low risk of discovery • Legal and Regulatory Framework • Weak enforcement • Penalties – Weak sanctions	**Institutional Characteristics** • Low risk of discovery and prosecution • Weak or no penalties • Availability and ease of acquisition of fake products • Socio-economic factors: Lack of awareness, education

Source (OECD, 2005): Driving factors of Demand and Supply of Counterfeit Goods

Chaudhry et al.'s (2009) study refers to the definition that product counterfeiting involves any unauthorized manufacturing of goods whose special characteristics are protected as IPR or trademarks, patents, and copyrights. Chaudhary et al.'s (2011) study discuss different short-term and long-term effects of counterfeiting on stakeholders. In their studies, Chaudhry & Zimmerman's (2005), Chaudhry et al.'s (2009), and Chaudhary et al.'s (2011) say that sometimes obsolete parts are no longer available in the OEM's inventory reserve pool and that gap could become the biggest risk for the licit supply chain. In a complex system where several subsystems nested within a system and become an integral part within multiple layers, making counterfeits detection is more difficult when only a sub-sub-system is purchased for installation. Following are the details of the effects of counterfeiting at the stakeholders' level. Table-2.2.4b highlights the effects of counterfeiting on stakeholders in the supply chain.

TABLE-2.2.4b: EFFECTS OF COUNTERFEITING ON STAKEHOLDERS

Stakeholders	**Short Term Effects**	**Long Term Effects**	
Manufacturers	* Sales volume & prices * Royalties * Customer Loyalty	*Brand value and firm reputation *Firm-level investment * Cost of combating counterfeiting/piracy * Scope of operations	**Impacts** • Socio-economic • On right holders • On consumers • On governments • On businesses • On brand value • On R&D • On entrepreneurial activities **Risks** • Financial • Operational • Continuity • Strategic • Social, ethical, and environmental
Consumers	* Health and Safety risk	* Consumer utility * Social Status	
Government	* Tax Revenues	* Cost of anti-counterfeiting act * Corruption	
Regulators	* Infringement of IP laws, Patents, Trademarks	* Trust of People	
Exporters	* Revenue per customer	* Loss of International Markets	
Industry Associates	* Domestic & Export Markets	* Tarnishing Industry Image	
Distribution Channel	* Business * License	* Trust from Manufacturer and Consumer	
Socio Economic Status	* Criminal activities *Dull incentives to innovate or invest	* Innovation /growth * Environment * Employment * Foreign D. investment	

Source: Chaudhary et al.'s, 2011

2.2.5 COUNTERFEITS' ENTERING STAGES IN A SUPPLY CHAIN

There are different stages and de-coupling points from where counterfeits enter the value chain. Firms need to differentiate supply chain stages according to their processes that create the product and able to sell and guarantee not only the product but also the whole supply chain process the product had passed through. In their studies, Vanichchinchai & Igel's (2011) and Kuei et al.'s (2001) found that companies with higher supply chain quality management tended to perform better than companies with lower supply chain quality management in the performance of cost saving. Moreover, Vanichchinchai & Igel's (2011) and Wilcock & Boys's (2014) studies found QM significantly correlated with the supply side of the supply chains and supported the integration of two bodies of knowledge SCM and QM perspectives with their philosophies and principles. The referenced study identifies papers presented on the verge of the intersection of quality and supply chain topics so that the reader can understand the Supply Chain Quality Management (SCQM) perspective while investigating the issue. Moreover, Wilcock & Boys's (2014) study states that there is a substantial interconnection between the reduction of product counterfeiting and quality management (QM) and suggested how integrating the anti-counterfeiting initiatives into QM perspective can reduce the risk of product counterfeiting activities in supply chains. More exploratory efforts are required to track the illegitimate side of the upstream and downstream supply chains (both before market and aftermarket journey) under deceptive buying conditions. Therefore, the counterfeiting knowledge stream refers to some contributions that are classified into three just main stages (Table-2.2.5a), to give clarity to the reader, about: the upstream stage, downstream stage, and the customer buying behaviour stage. For licit and illicit trade phenomena, D'Amato & Papadimitriou's (2013) analysed different trades under different supply chain conditions: 1) pure counterfeiting; 2) factory overruns; 3) grey & parallel markets; 4) supply chain infiltration; 5) product diversion; 6) sale of stolen goods. A limited number of studies have investigated the upstream activities of the illegitimate supply chain (OECD, 1998) and described the main characteristics of the possible actors at different stages of product counterfeiting, grey imports (product diversion), illegitimate trade activity (supply chain infiltration), Retail service copycatting (Harvey & Ronkainen's, 1985), shoplifting and factory overruns (OECD, 1998). Robinson & Malhotra's (2005) study discusses the integration of QM and SCM perspectives. The literature found mostly related to the demand side of the supply chain where consumers' buying behaviour patterns (non-deceptive buying) are discussed.

TABLE-2.2.5a: SUMMARY OF CONTRIBUTIONS MADE W.R.T DIFFERENT SUPPLY CHAIN STAGES

SUPPLY CHAIN STAGES					
Pure Counterfeiting	**Grey market & parallel import**	**Supply chain Infiltration**	**Retail Service**	**Factory Overrun**	**Disposals**
Upstream operations in the supply chain (Design and Factory)					
Harvey & Ronkainen, 1985; Ben-Shahar & White's, 2005; Trott & Hoecht, 2007; Staake et al.'s, 2011	D'amato & Papadimitriou (2013); Raff & Schmitt, 2007; Duhan & Sheffet's (1988); Kim et al.'s (2009); Boyd et al.'s (2007)	Green & Smith, 2002; Berman, 2008; Cooper & Eckstein (2008); Eser et al.'s (2015); CACP's (2006)		Mc Donald & Roberts (1994); Simone et al.'s, 2009; Song et al.'s (2007) ; D'Amato & Papadimitriou (2015)	Shen et al.'s (2022); Boyd et al.'s (2007); Stevenson & Busby (2015);
Downstream operations in supply chain (Warehouse & Retailer)					
Simone (1999, 2006); Mavlanova & Benbunan-Fich (2010); Danese et al.'s (2021); Machado et al.'s (2018)	Boyd et al.'s (2007); Beh, L.S. et al.'s (2016) ; Danese et al.'s (2021)	Green & Smith (2002); Liu et al.'s, (2005); Li & Yi (2017); Li et al.'s (2017); Karjanen (2011); Olsen & Granzin (1992, 1993); Kaikati & LaGarce (1980)	Harvey & Ronkainen (1985); Kaikati & LaGarce (1980); Branigan (2012); Beh, L.S. et al.'s, 2016	D'Amato & Papadimitriou (2015) ; Beh, L.S. et al.'s (2016)	DiMase et al.'s (2016); Hoffmann et al.'s (2008)
Customers buying behaviour in supply chain (Trust)					
Bloch et al.'s, 1993; Green & Smith, 2002; Chapa et al.'s, 2006; Han et al.'s, 2008; Teah & Phau (2008); Phau et al.'s (2009); Romani et al.'s (2012); Commuri (2009); Wilcox et al.'s (2009); Yoo & Lee (2011); Poddar et al.'s (2011); Turunen & Laaksonen (2011); Bian & Moutinho (2011); Jiang & Cova (2012); Hieke (2010)	Zhang & Feng (2017) ; Chen (2007); Chen et al.'s (2012); Carrigan (1998)	Wang et al.'s, 2010; Kshetri & Voas (2019); Cho et al.'s (2015); Stevenson & Busby (2015); D'amato & Papadimitriou (2013)	Mavlanova & Benbunan-Fich, 2010	Parker et al.'s (2003); Beh, L.S. et al.'s (2016); Albers et al.'s (2008); Prendergast et al.'s (2002).	

A) PURE COUNTERFEITING STAGE:

Counterfeiting under deception in SCM: The study conceptualizes the relationship of deceptive product counterfeiting to the field of supply chain management. Three elements emerged that constitute a core definition of deceptive product counterfeiting: a) unauthorized manufacturing or production of tangible goods; b) violating/infringing on another's intellectual property

rights; c) misrepresenting the nature of the product to deceive the buyer into believing that the counterfeits are authentic products. To ensure a comprehensive and parsimonious conceptualization of this construct, there is a need to discuss these concepts one after the other. Unauthorized Manufacturing: The manufacturing or distribution refers to either producing or distributing goods without the consent of the IP owner. Includes, different types of counterfeiting activities, such as reversed engineered "knock-offs", refurbished parts or items, scrap parts sold a new one, disposed-off parts, factory overruns, etc. Staake & Fleisch (2009) discussed that factory overruns occur when a contractor with a license from an IP owner produces goods more than the limit of the licensing or distribution contract granted by the IP holder. A breach of contract takes place that may intern affects a firm's profits, losses related to sales, and brand value. [SASC, 2012; SAE Aerospace, 2009] report discussed the refurbished parts sold as new, are considered counterfeit items, because industry and government entities incorporate this into their working definitions of counterfeiting. Fleischmann et al.'s (2000) discussed the situation of product recovery activities in supply chains that allow additional source nodes of materials converted into counterfeit parts. As SCs are complex and involve many stages where manufacturing, sourcing, distribution, and disposal occur, counterfeits may enter the SC at any point in these activities.

Violate Owner's IPR: The studies of Minagawa et al.'s (2007) and Parloff et al.'s (2006) suggest that the possible counterfeits' entry points into supply chains may be through scrap, disposal, and reclamation activities. Inferior goods are disposed-off by IP owners or upstream and downstream participants in the supply chain and then re-packaged by counterfeiters and sold as the basic quality item. Minagawa et al.'s (2007) study discusses that reverse engineering as a source of counterfeits. However, it is important to distinguish it from reverse engineering to make a competitive product as a part of how other firms learn and compete in markets. Producing an item through reverse engineering, coupled with a claim as a genuine article protected as IP, results in a counterfeit deceptive product.

Intent To Deceive: Staak et al.'s (2009) study discusses that the final dimension of deceptive product counterfeiting is that the counterfeiter intends to defraud the purchaser of the counterfeit product into believing that the goods are the genuine article that is someone else IP. This intent to deceive is what differentiates a deceptive product counterfeit from a non-deceptive counterfeit. Deceptive product counterfeiting exists when the buyer is unaware that the product is a counterfeit good, while a non-deceptive counterfeiting situation occurs when the buyer is

aware that the item procured is a counterfeit product. The studies of Grossman & Shapiro (1988a & b), Wee et al.'s (1995), and Tom et al.'s (1998) discuss that non-deceptive counterfeit situation are often linked with luxury brand name goods, iPhones, Rolex watches, leather goods, etc. The ISO 9000 standards focus on controlling and eliminating such non-conformities. Krzemińska's (2017) study refers APICS (2015) report where the study addresses non-conformance by defining nonconforming materials as any raw material, part, component, or product with one or more characteristics that depart from the specifications, drawing, or other approved product description. A defective product is another term used with non-conformity that comes under product liability law. A defective product is defined as a product that has the tendency or propensity to harm its normal user, meaning an item manufactured to the expected standards/specifications may still be a defective product in the legal sense.

B) GREY MARKETS STAGE AND PARALLEL IMPORTS

The literature discussed three strong reasonable conditions of the existence of the upstream side of parallel imports: a) source of supply; b) easy access from one market to another; c) price differentials. However, any form of the grey market can create confusion in the distribution channel and the conditions under which counterfeiters infiltrate their products. In their studies, Chen's (2007), Chen et al.'s (2007), and Thomas & Okleshen's (2006) discuss the issues of unfair competition, conflicts with trademark laws, free riding, price discrimination, and market characteristics, although parallel imports and the grey markets are legal. Raff & Schmitt's (2007) study explains why manufacturers might be interested in allowing parallel trade for categories of products, including clothes, cosmetics, and perfumes. On-demand side, Ang, S. et al.'s (2001) study underlines how emerging markets and parallel imports can be confused with counterfeiting and how the perceived legality of a parallel imported product is a critical decision factor in purchasing intention. Finally, Chen's (2007) study demonstrates that the source channel (grey goods vs. authorized goods) had a significant impact on brand equity. Thomas & Okleshen's (2006) study discusses that the "underground mall"; a specific grey market retail format that emerged in the USA, underlines consumer preferences not only for price reasons but also for socialization benefits.

C) SUPPLY CHAIN INFILTRATIONS STAGE

Cooper & Eckstein's (2008) study discusses supply chain infiltrations, describe strategies to secure the end-to-end legitimate supply chain, to eliminate the possibility of counterfeiters' infiltration from the design stage till the final part sale when it is bought by the customer.

Deceptive counterfeiting and the problem of supply chain infiltrations at a retail level study by Olsen & Granzin's (1992) stresses the importance of controlling and gaining retailers' collaboration. The study introduces a model that would help manufacturers to establish a relationship with their distributors and gain support to fight against product counterfeiting. Wang et al.'s (2010) study discuss the main reason why Chinese people prefer to shop in western countries to avoid the potential risk of buying counterfeit products in Chinese marketplaces. Green & Smith's (2002) study discusses that smaller retailers and bars are especially attracted by the higher profits that they could gain from selling counterfeits, which could be obtained for a mere fraction of the basic price from local criminals. The study discussed the SC counterfeiting risk, presented a case of "Supply Chain infiltrations," and underlined how collusion between counterfeiters and channel members became the main cause of counterfeiting problems w.r.t a major brand owner in Thailand.

D) RETAIL SERVICE COPYCATTING STAGE

The studies of Green & Smith's (2002) and Simone's (2006) discuss that in the case of pure counterfeiting, the wholesalers are often linked to a criminal firm while the retailers are usually street vendors, or the sale takes place on street markets. Mavlanova & Benbunan-Fich's (2010) study says that both "retailer level" and "point of sale" perspectives are crucial for customers who wish to assess the legitimacy of the point of sale, especially when the customer is not able to assess the product's authenticity. The studies of Branigan's (2012) discuss some counterfeiting activities related to IKEA and Apple stores detected in China. The studies of Kaikati & LaGarce's (1980) and Harvey & Ronkainen's (1985) discuss the retail services copycatting phenomenon and the customers' side of things. Mavlanova & Benbunan-Fich's (2010) study explores the possibilities to prevent sellers from deceiving buyers with counterfeited products in the online sale. The study also seeks the role of information at the seller-level and product level to counter counterfeiting activities.

E) FACTORY OVERRUNS STAGE

The studies of Simone et al.'s (2009) and Song et al.'s (2007) suggest strategies for ways to deal with the suspicion of backdoor production in a manufacturing factory and emphasized that both counterfeiting, and factory overruns are the risks that should be considered while evaluating counterfeiting. The studies of McDonald & Roberts's (1994) and Hilton et al.'s (2004) discuss that the activities at the factory overruns stage are performed descriptively.

F) DISPOSALS STAGE

Regarding the counterfeiting issue where material disposals are considered as one a grey area, Robotis et al.'s (2005) study suggested strategies to address the issue of cut-off quality level products to be remanufactured instead of being disposed of. However, Melo et al.'s (2009) study considers a layer of disposal facilities that receive returned products, otherwise not recovered. Geyer et al.'s (2017) study discusses that in Europe, North America, and Japan, governments have introduced take-back legislation. Even though such laws are primarily aimed at recycling and proper disposal of end-of-life products, they could also considerably change the economics of Product remanufacturing.

2.2.6 LEGITIMATE SUPPLY CHAIN AND COUNTERFEITERS' INTENTION

Staake et al.'s (2012) study discusses the group of disaggregates focuses on products with average functional quality, based on brand name/trademark-related earnings with minimal investment in production facilities. A low to average complexity of the counterfeit parts supports this conjecture. The imitators copy the products of high value and fulfill the user's needs. However, the functional quality is somewhat below that of the corresponding genuine products. They primarily serve the domestic markets and flourish in those economies where IPR is compromised. Foreign patents and designs, and brands of high value can help imitators, to reduce their product development & launching costs. Imitators are vulnerable to raids & seizures. Whereas trademark infringements can gain the quick benefit of product sales and can accelerate experience curve effects. Counterfeiters within this group are more likely to become licit competitors. The Fraudsters group has a higher aim to sell products as deceptive counterfeits. These products have high visuals with lower functionality attributes and buyer who is unaware of the fake product allows fraudsters to place product price near to those of genuine products.

The desperados' group bears similar characteristics as fraudsters, but the difference is that they are involved in more lethal activities concerning the wellbeing of the users. They target expensive but easily copied products whose quality hardly be judged until used after the purchase, such as pharmaceuticals, electronics, and automotive spare parts. Therefore, quick, and high profits are incentives for desperados. They work on a small scale and can easily change their business model in case their fakes are confiscated. Experts believe that they are the most difficult group to fight. Severe penalties and punishments restrict desperados from doing such activities. The members of the desperados' group are well connected with organized crime, and higher levels of investment, from production until distribution, are the protection of their operations. A more controlled business environment might be a promising measure to limit illicit supplies. The smugglers realize their profits by evading taxes not by getting brand-related profits. They bring fake products into the country (deceiving authorities) by using illegal means (see Table-2.2.6a).

TABLE-2.2.6a: GROUP OF DISAGGREGATES FOCUSES ON PRODUCTS COUNTERFEITING

Characteristics	Dis-Aggregators	Imitators	Fraudster	Desperados	Smugglers
Capabilities	*Establish production network and develop own production skills	*Solid engineering or reengineering skills	*Some production capabilities	*Ability to conceal illicit activities	*Manage networks of criminal actors *Money laundering *Insulating individual steps within a value chain from each other

	*Flexibility to follow new trends quickly	*Extended production capabilities			
Business Model	*Brand imitation as a dominant source of income *Serves customers' desire to signal wealth and status	*Brand imitation as an accelerator *Compatible products at low prices	*Brand imitation as an enabler for goods *Deceit of customers	*Brand imitation as an enabler for selling dangerous products *Deceit of customers	*Brand imitation to improve market access *Evading taxes *Low production cost
Strategic Focus	*Flexibility *Focus on goods with high demand *Reaping short-term benefits	*Competitive advantage *Entrepreneurship *Learning & Growth	*Profit orientation *Opportunism	*Maximum profit orientation with an absence of ethics standards	*Extend power in a criminal network *Established structures & long-term orientation
Typical Products	*Reaping short-term benefits *Clothing and Accessories *Watches and Jewellery"	*Learning and growth *Clothing/Accessories *FMCG products *Automotive /Electronic Components and parts	*Perfume and cosmetics	*Pharmaceutical products *Automotive/ Electronic Components and parts	*Cigarettes

Source: Profiles of Strategic Groups (Staake et al.'s, 2012)

Chaudhry et al.'s (2009) study discuss the possibilities to improve the relationship with network distributors and channel members. That is, introduced the concept of Licit and Illicit supply chain under deceptive and non-deceptive buying behaviour of consumers. Stevenson & Busby's (2015) study discusses the possibility of the occurrence of some adverse events in the supply chain, where disposed-off parts/products after expiry are re-injected into the legitimate supply chain and sold as genuine products. The study discussed possibilities of theft, stealing genuine parts from legitimate supply chains, and later trading in grey or aftermarket. In this way, procurement takes place from unsuspected upstream supply chain members. As far as the production activities are concerned, few manufacturers used the final assembly delay technique to use their mollified trademarks to avoid detection and raid from law enforcement agencies. In subcontracting, production overruns issue, with licit manufacturer's trademark, may arise that can lead to some unscrupulous activities diluting genuine products. Those bundled mollified spare parts/products shipped via multiple free trade ports to several potential and less risky destinations and further infiltrated into the parallel market to obtain anonymity. The study provides a selective view of product counterfeiting and supplier selection in operations

management literature. The study discussed important themes under the reflection of conceived and observed threats. The themes worked out as: selection of suppliers, integration of suppliers, traceability of products, and issues related to product offshoring & end-of-life. Therefore, the social and economic impact is quite considerable while the size of the problem is difficult to gauge because much of the counterfeiting activities go undetected or unreported. The study intentions say that counterfeiters acquire basic products from legitimate supply chains and then change the product (see Table-2.2.6b).

Table-2.2.6b: INTENTIONS OF COUNTERFEITERS

Goals of Counterfeiters is to acquire basic products from legitimate supply chain	**non-mutually exclusive strategies**
"Recovery and overhauling of disposed of genuine products" "Theft and repacking of components (e.g.: from repair operations)" "Acquisition of parts/products from an un-suspecting legitimate source"	Extraction Strategies
"Produce for the early market entry" "postpone assembly for product and trademark" "Production overrun by sub-contractors" "Parallel production of near copies by sub-contractors" "Illicit sub-contracting of a product to a cheaper product producer" "Dilution of genuine products"	Production Strategies
"Ship via multiple ports and addresses" "Obscure trademark until closer to the customer" "Overproduction and accept high attrition rates from seizures" "Bundle counterfeit and genuine products together" "Using a legitimate distributor or credible location"	Distribution Strategies
"Infiltration of parallel markets" OR "Retail via informal markets" "Using impersonal media, e.g.: via the internet" "Recruiting an otherwise legitimate retailer or wholesaler" "Injection into less controlled maintenance and repair after markets" "Passing off a legitimate supplier's product as the OEM's"	Infiltration Strategies

Source: Stevenson & Busby (2015)

Stevenson & Busby's (2015) study discusses the authorities' work in developing countries following two-pronged support programs: one is to seek foreign award firms on one end to accelerate the supplier development process so that the first two strategic goals (extraction & production) can be achieved and on the other hand encouraging domestically leading firms to achieve the third strategic (distribution) goal. The third goal is infiltration where counterfeiters look for opportunities to exploit parallel marks. The study identifies the following four sets of strategies:

A. EXTRACTION STRATEGIES

Different ways in which counterfeiters procure materials from the legitimate economy deal with the inadvertent supply of genuine materials into counterfeiting operations. Extracting genuine parts from disposed-of products, after the expiry of products, repacked, remarked, re-injected, overhauled, and other dubious items from legitimate channels and then resell those

items or products to unsuspecting customers. The other aspect of extraction in the market is extraction by stealing genuine parts or products from the supply chain or aftermarket.

B. PRODUCTION STRATEGIES

Counterfeit production involved upstream and downstream supply chain members diluting a genuine product. Counterfeiting as an internal phenomenon is especially problematic insofar as supply chain members have privileged access to production technology and distribution channels, but it is potentially more controllable with suitable governance arrangements. Here, timing may be an important element to exploit the chance of product counterfeiting, such as Time for early market entry simultaneous or ahead of the genuine product; Time to postpone the final assembly of a product with its counterfeited trademark until close to the final sale, thereby avoiding detection and action by the authorities. The other aspects related to cases of production over-runs by a sub-contractor to the genuine manufacturer. The ordered quantity was supplied to the genuine manufacturer but, without authorization, the subcontractor produced and sold extra output under the manufacturer's trademark. Furthermore, the subcontractors produced cheaper, near-copies of the basic, which they passed off as the genuine article. The producer illicitly subcontracted to a cheaper unauthorized producer, before using false paperwork to pass the items off as its own.

C. DISTRIBUTION STRATEGIES

Counterfeiting is mostly observed by bundling counterfeit products with genuine items. Counterfeits are shipped from free zones to several addresses in target countries in low volumes to limit traceability. Risk is also minimized by being mobile. Another strategy for coping with seizures is simply to over-produce. The other strategy may be to involve legitimate service providers to camouflage activities. This included shipping products via FedEx services, using trusted online services such as Paypal, and shipping counterfeits from established ports.

D. INFILTRATION STRATEGIES

The strategy is to maintain anonymity in some cases by infiltrating informal, loosely regulated channels such as flea markets. Using infiltrating parallel markets strategies to gain or maintain anonymity. Parallel cheaper foreign sales are re-imported and re-packaged with local language instructions. Dealers use multiple transactions in anonymity and infiltrate the aftermarket, which has fewer procurement controls due to its size, dispersed nature, and informal institutions. Cases involved independent counterfeiters selling into the automotive aftermarket,

often to unlicensed mechanics who are presumably much less likely to report counterfeits to the authorities. The major component of the firms' competitive strategy is therefore to build a strong framework of supply chain management (SCM) (Gunasekaran et al.'s, 2004) to enhance firms' productivity. The theoretical outcome of the study is to develop an understanding of the product counterfeiting phenomenon. Therefore, by combing [Staake et al.'s (2012); Stevenson & Busby's (2015)] investigative studies, this study provides information about the conceptual model (Fig-2.2.6c) with the support of the grounded theories to address the product-counterfeiting issue.

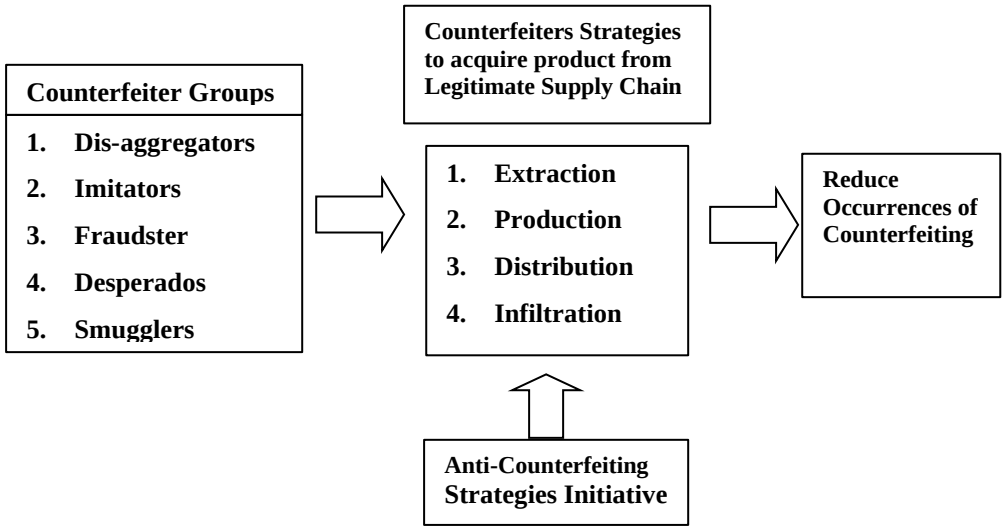


Fig # 2.2.6c: Supply chain conceptual model

The referenced model shows the strategic groups among counterfeiters, as per Staake et al.'s (2012) study, tries to reach a better position in connection to the counterfeits' market by implementing different counterfeiting strategies to exploit possibilities of extraction, production, distribution, and infiltration and re-injecting shady parts and products into legitimate supply chain operations. Introducing potential anti-counterfeiting strategies at this stage in a well-governed automotive supply chain context would reduce occurrences of the counterfeiting phenomenon.

2.2.7 ANALYSING ANTI-COUNTERFEITING STRATEGIES

To explore and analyse the recent contributions to observe the impact of product counterfeiting in the supply chain under deceptive buying patterns, efforts are made to perform a systematic literature search. In this regard, the studies from Durach et al.'s (2017), Thorpe et al.'s (2005), Gundolf & Filser (2013), Kraus et al.'s (2020, 2014), and Xi, J.M. et al.'s (2013) are important contributions. During the initial stages of the study, particular keywords were used which are common in the relevant field of research and for that matter, the search was made in selecting journal articles published since 1985 (Cornelius et al.'s, 2006). To develop a comprehensive

understanding of the subject, selected papers' abstracts were read by the researcher to ensure that the paper analyses the counterfeiting phenomenon in supply chains. In case of any relevancy doubt, the whole paper is re-read for confirmation. The 100 articles were found about the counterfeiting phenomenon but focused on different topics in a supply chain where they holistically addressed the counterfeiting activities. A further selection of the articles was made addressing the deceptive counterfeiting issue only, neglecting those which are addressing non-deceptive counterfeiting aspects. The analytical review procedure brought some 54 papers in limelight for the referenced study. This study considers the Scopus databases important as they provide wider coverage of journals. This study highlights the inclusion and exclusion criteria for SLR (see Table-2.27).

TABLE-2.2.7: INCLUSION AND EXCLUSION CRITERIA OF S.L.R

Criteria	**Inclusion**	**Rationale**	**Exclusion**
Journal quality	Scientific periodic peer-review	Consider to be of higher quality	Business magazines, books and notes
Access	Full content written in English	Dominant English reading audience	Content not written in English
Objective alignment	Counterfeiting concepts, deceptive buying within scope of Operations Management (supply side)	To review, analyse and map anti-counterfeiting strategies	Resilience and/or Counterfeiting concepts with reference to aftermarket supply chains (demand side)
SLR Unit of analysis	Employees, Firms, supply chains	Basis of analysis	Communities
Focus and clarity	Deal directly with clearly defined enablers in firms or supply chains and/or Anti-counterfeiting strategies	To improve conceptual clarity and understanding	No deal directly with not clearly defined enablers in firms or supply chains and/or Anti-counterfeiting strategies
Article's Practices	Theoretical & empirical studies, authentication practices regarding counterfeiting, SCQM & technologies	To evaluate and synthesize different approaches, develop understanding about technology-based support to concepts SCQM &ANCT-INT	Consumer role and articles discussing demand side of supply chains

Source: Author

STEPS FOLLOWED IN SYSTEMATIC LITERATURE REVIEWS (SLR)

In the SCM context, SLR needs to develop an understanding of the conditions under which theories on a real-life phenomenon do or do not work. So SLR should start by taking a theoretical lens on the phenomenon of interest to develop an initial theoretical framework that reflects the relationship between concepts of the phenomenon. The initial theoretical framework reveals the scope of the SLR by addressing the "what", "how", and "why" questions relating to the research phenomenon. Durach et al.'s (2017) study suggests six steps and guidelines conduct a systematic literature review. The steps are: 1) define the purpose and research question; 2) determine the required characteristics of primary studies; 3) retrieve a sample of potentially relevant literature; 4) select the pertinent literature; 5) synthesize the literature; 6) report the results.

A) CRITERIA FOR PAPERS' INCLUSION:

a.1) Papers published from 1985 till 2021. Focus on relevant publications related to the impact of product counterfeiting in the supply chain under deceptive buying patterns. Building on previous contributions made by scholars in suggesting measures to counter counterfeiting activities to protect licit supply chains from any infiltration on decoupling areas. The scholarly contribution made within three decades proposed some non-mutually exclusive anti-counterfeiting strategies are selected for further compilation to present clustered based strategic anti-counterfeiting strategies chart that helps the SC practitioners to focus their attention on some specific themes to address the product counterfeiting issue in the automotive industry's supply chains in Pakistan.

a.2) Papers explicitly referred to conducting SLR: The studies from Durach et al.'s (2017), Gundolf & Filser's (2013), Kraus et al.'s (2020, 2014), and Xi, J.M. et al.'s (2013) contribution to developing a narrative of the study.

a.3) Papers demonstrate a focus on the impact of product counterfeiting in SCM: To address the purpose of the research study, the focus remains on SCM studies to address counterfeits' tracing issue.

a.4) Keywords used for selecting relevant papers: Multiple search combinations for Anti-counterfeiting strategies, Counterfeits, and TQM practices, Counterfeiting and SCM practices, counterfeits, and SCQM, BC supported SCQM and anti-counterfeiting, TQM and SCM into SCQM.

a.5) Papers written in English: English is the dominant research language in the SCM discipline; ensuring accessibility and comparability of results.

B) DATA SEARCH

b.1) Keywords in combination [deception buying, product counterfeiting, integrating SCM and TQM practices, supply chain quality management (SCQM), firm supply performance, technology, and product counterfeiting] are used to search articles. Google Scholar, Science Direct & Scopus databases are used. Articles selected are published by Wiley, Springer, Taylor & Francis, Elsevier, Emerald, and Research Gate.

b.2) Scopus core collection: Fig-2.2.7 (b to e) displayed as example.

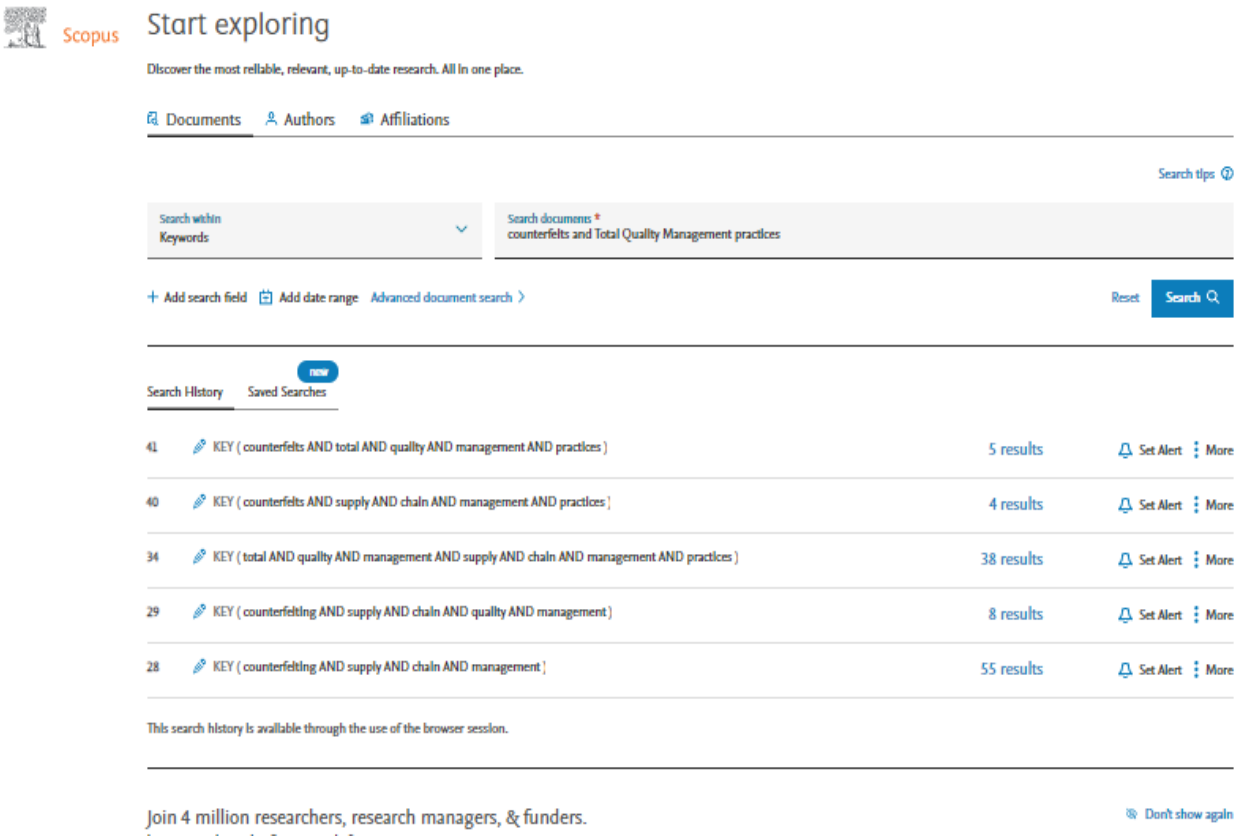


Fig-2.2.7b; Searching keywords

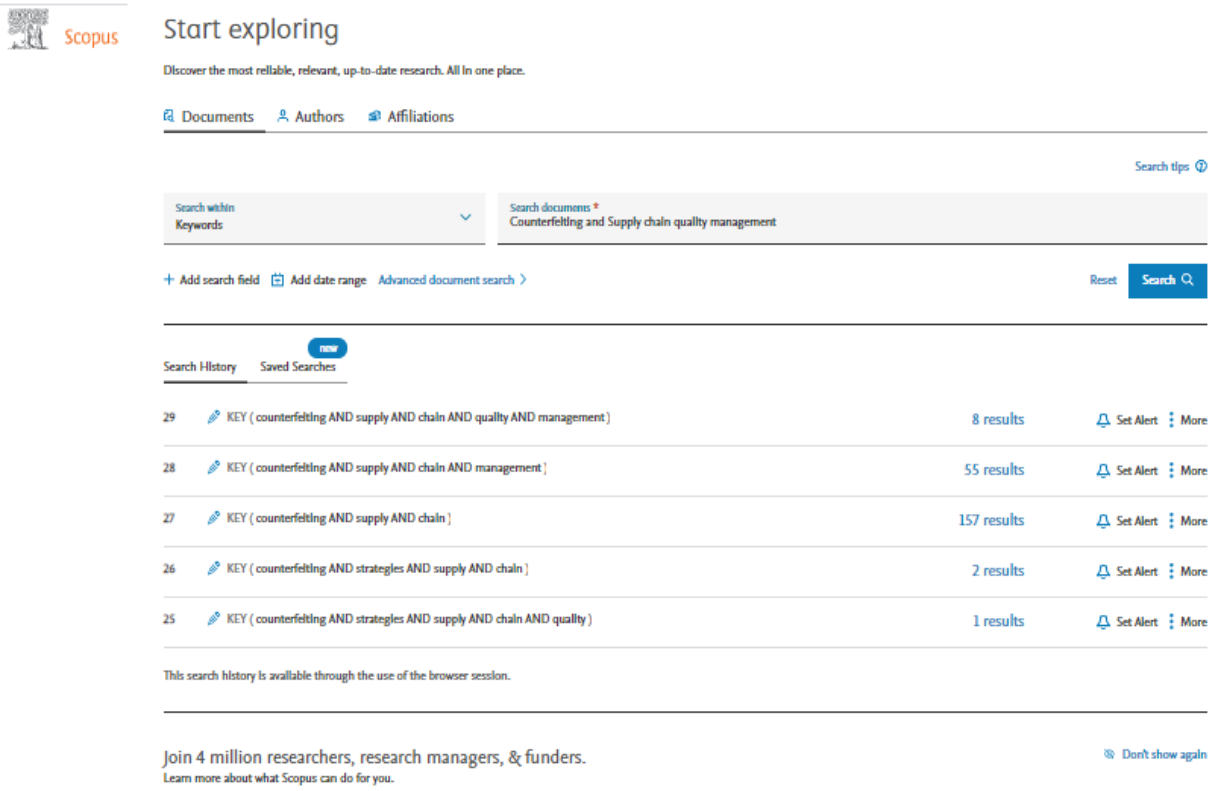


Fig-2.2.7c; Searching keywords

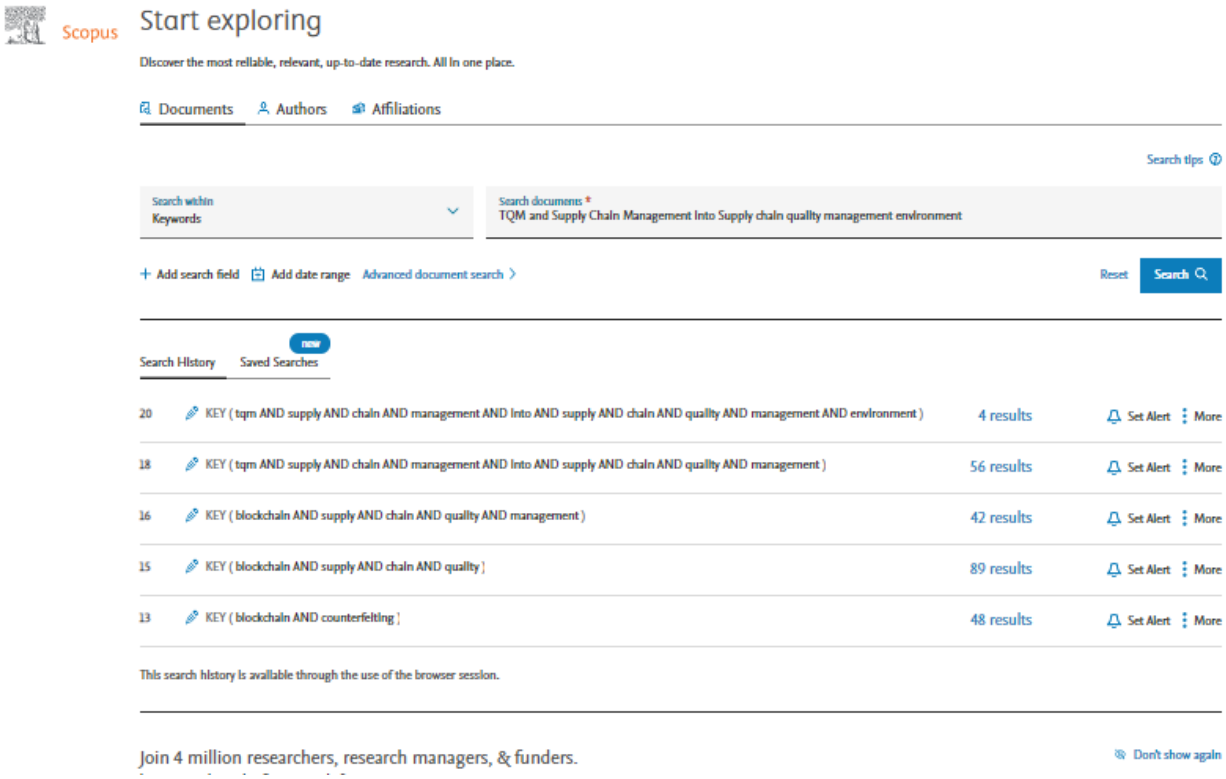


Fig-2.2.7d; Searching keywords

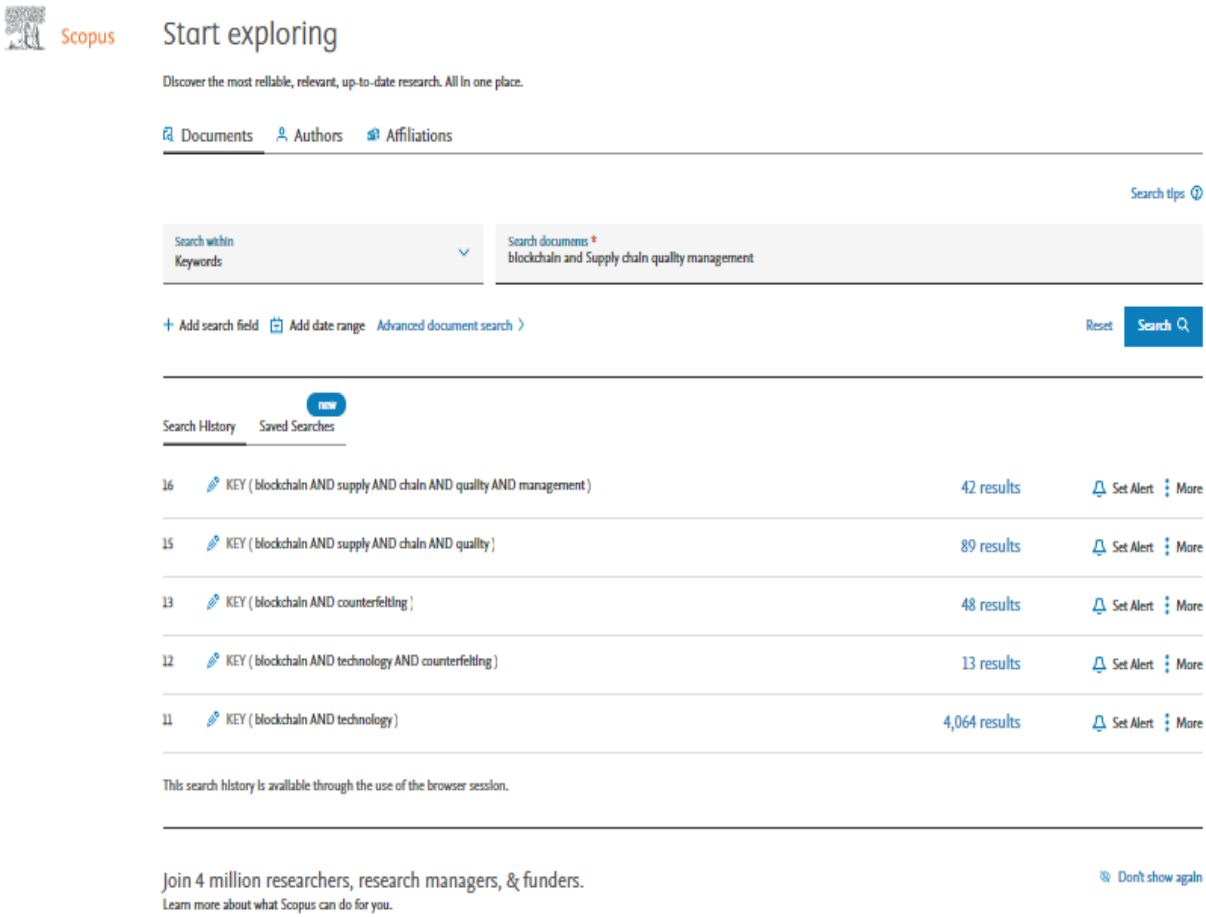


Fig-2.2.7e; Searching keywords

c) DATA SELECTION

c.1) Total articles from databases search: (searched 356 papers according to keywords used with different combinations (Fig-2.2.7 (b to e)), after initial screening process left with papers equal to 220 from the year 1980 onwards. With different keywords combination [1= (TQM, QM, SCM, SCQM), 2= (Anti-counterfeiting strategies), 3= (BCT, SCQM)], the literature review highlighted three knowledge streams. The first knowledge stream covers 90 papers, the second knowledge stream covers 100 papers, and the third knowledge stream covers 75 papers. Following the focused approach of paper selection according to the relevance criteria, the publications from the year 2000 are selected, especially for the 3rd knowledge stream which is considered young (details are in section D). The 2nd counterfeiting knowledge stream, after screening, left with 100 papers that are initially considered relevant, and after the third screening left with the most relevant 54 papers, suggesting anti-counterfeiting strategies (401 mutually / non-mutually exclusive) according to different industry contexts, which are later filtered, sort and mapped into thirty-one (31) common anti-counterfeiting strategies. Four themes are extracted from these strategies. This study follows the Tribis et al. (2018) study

guideline where a systematic mapping study (SMS) method used to examine extracted primary studies from scientific databases. As guideline, papers are screened after reading abstracts and conclusions of the papers. Most papers provide information about the protective and clandestine nature of the counterfeiting phenomenon in supply chains and its broader socio-techno-economic impact, creating awareness among readers rather than discussing empirical analysis-based findings to counter the counterfeiting phenomenon in the supply chain. The purpose of the review-based investigation is to explore the possibility to bring a common platform for the readers, after the strategies mapping process (see Fig.2.2.7x), to observe the approximate commonality among anti-counterfeiting strategies so that possible themes can be extracted.

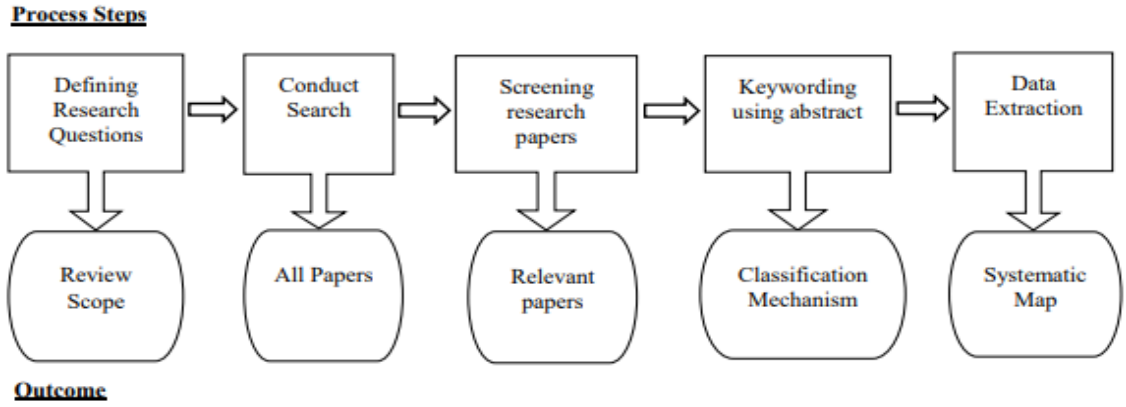


Fig-2.2.7x: Ref, Tribis et al.'s (2018) Mapping paper searching process

All abstracts with conclusions of the articles read during research investigation, regarding the impact of product counterfeiting phenomenon in supply chains, to ensure that relevant papers are analysed. As a result of the confirmation process, 100 papers were found addressing different areas of supply chains like medicine, defence, luxury items, agriculture, automotive, mobiles, technical items, etc. Also, other selection criteria are applied to select the paper that should address deceptive counterfeiting issues and reject those addressing only non-deceptive counterfeiting issues. In the process of literature review three most dominant knowledge streams are observed (see example Fig.2.2.7 (c to g)) to address the relevant issue context, the first knowledge stream is "Supply chain quality management (SCQM) interaction with QM and SCM practices" (especially during 1997 and 2021), the second knowledge stream is "BC supported SCQM environment" (especially during 2017 and 2021) and the third is "Anti-counterfeiting strategies to control product counterfeiting in supply chains" (especially after the year 2000) (see in Appendix-Table-S1, S2, and S3 respectively).

D) INDEXING THE PAPERS

The referenced Annexures (S1, S2, and S3) highlight details about the author's name of the paper, brief title, and purpose of the paper, dimensions discussed, key terms extracted, citations, and publications in journals. Annexure-S1 refers to the contributions made (50 papers, during 1997-2021) about QM, SCM, and the SCQM knowledge streams. Annexure-S2 refers to the contributions made (44 papers, during 2000-2021) about counterfeiting knowledge streams (anti-counterfeiting strategies). Annexure-S3 refers to the contributions made (36 papers, during 2017-2021) about SCQM and BC knowledge streams. The papers selected after the year 2000 are indexed for an explanation after review (see an example, Table-2.2.7a, and Fig.2.2.7 (f to h)).

	Annexure-S-1		**Annexure-S-2**		**Annexure-S-3**	
Publications	**papers#**	**Period**	**papers#**	**Period**	**papers#**	**Period**
Elsevier	8	2000-2020	11	2006-2020	5	2016-2020
Emerald	17	2000-2020	8	2006-2020	1	2016-2020
Taylor & Francis	11	2000-2021	6	2006-2021	3	2016-2020
IEEE	2	2006-2010	1	2016-2020	5	2016-2021
Springer	2	2011-2015	3	2006-2020	5	2016-2020
Misc. Publications	8	2006-2015	9	2006-2020	13	2016-2021
Wiley	0	0	2	2016-2020	3	2016-2020
Research Gate	1	2011-2015	2	2006-2015	0	0
Total	**49**		**42**		**35**	

Table-2.2.7a: Summary of the papers indexed

According to Annexure S-1 knowledge stream (TQM, SCM integrated SCQM environment), a total number of 49 papers published in different journals are selected (see Fig-2.2.7f) for review. In 2021, one (1) publication made by Taylor & Francis, one (1) publication by Research gate (during the year 2011 to 2015), eight (8) publications by Elsevier (during the year 2000 to 2020), Seventeen (17) from Emerald (during the year 2000 to 2020), eleven (11) publications by Taylor & Frances (during the year 2000 to 2021), two (2) publication by IEEE (during the year 2006 to 2010), two (2) publications by Springer (during the year 2011 to 2015), and eight (8) by Miscellaneous publications (during the year 2006 to 2015). Fig-(2.2.7f.1) shows a journal-wise citations graph indicating the importance of the journals in the area of relevant contributions. The scholarly contributions show that the contributors see similarities in the characteristics of the TQM and SCM research streams (internally in QM and externally in SCM perspective) and consider the integrated approach of SCQM important to enhance FSP.

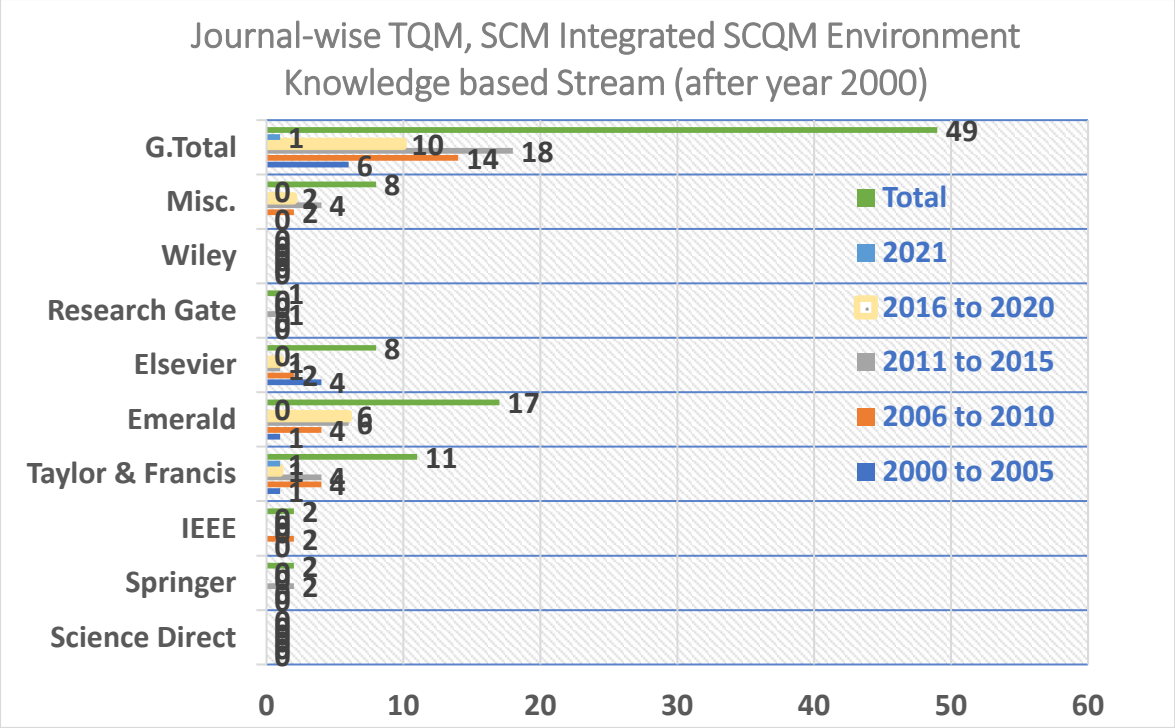
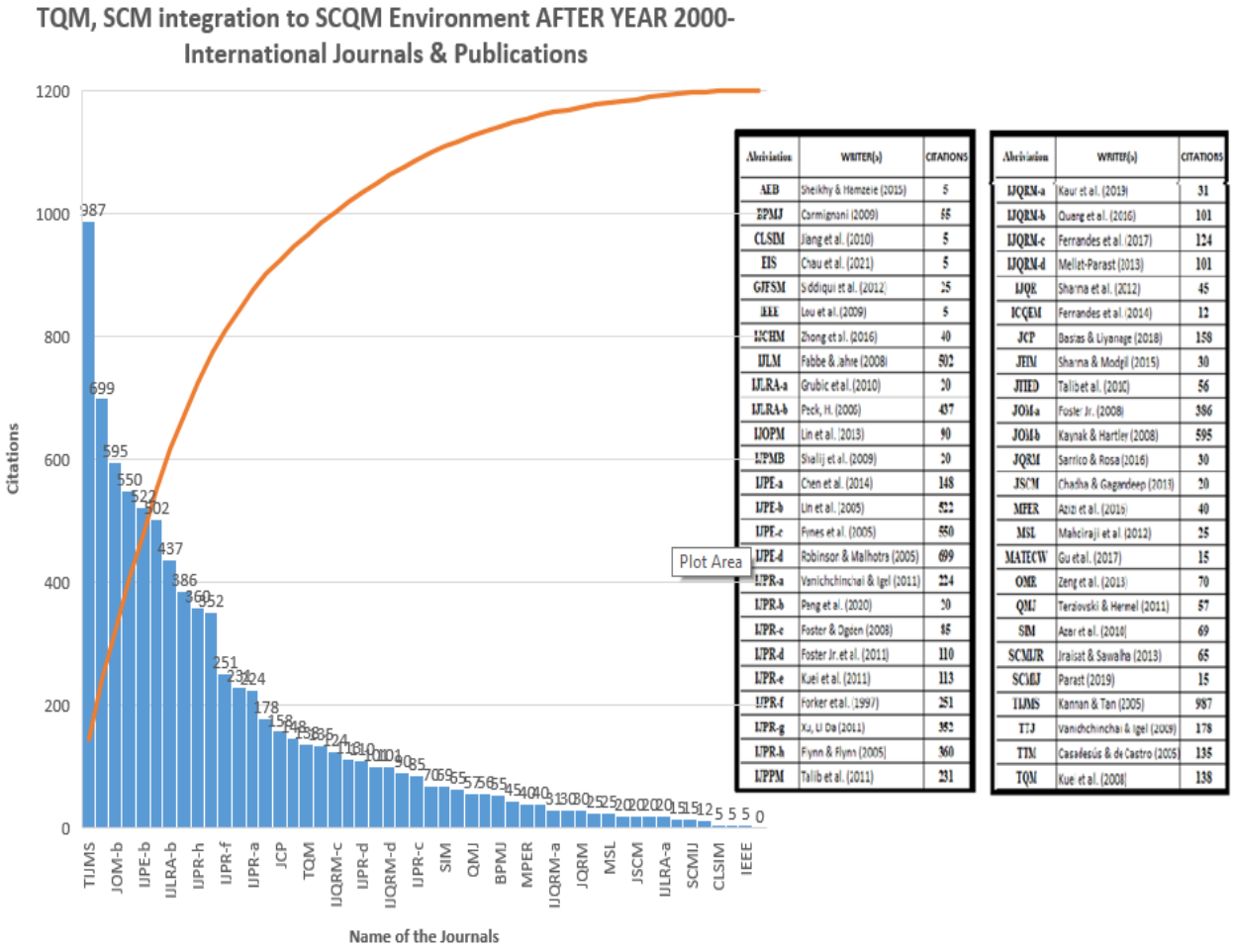


Fig-2.2.7f; Journal-wise total yearly publications



Abbriviation	WRITER(s)	CITATIONS
AEB	Sheikhy & Hemzeie (2015)	5
EPMJ	Carmignani (2009)	55
CLSIM	Jiang et al. (2010)	5
EIS	Chau et al. (2021)	5
GJFSM	Siddiqui et al. (2012)	25
IEEE	Lou et al. (2009)	5
IJCHM	Zhong et al. (2016)	40
IJLM	Fabbe & Jahre (2008)	502
IJLRA-a	Grubic et al. (2010)	20
IJLRA-b	Peck, H. (2006)	437
IJOPM	Lin et al. (2013)	90
IJPMB	Shalij et al. (2009)	20
IJPE-a	Chen et al. (2014)	148
IJPE-b	Lin et al. (2005)	522
IJPE-c	Fynes et al. (2005)	550
IJPE-d	Robinson & Malhotra (2005)	699
IJPR-a	Vanichchinchai & Igel (2011)	224
IJPR-b	Peng et al. (2020)	20
IJPR-c	Foster & Ogden (2008)	85
IJPR-d	Foster Jr. et al. (2011)	110
IJPR-e	Kuei et al. (2011)	113
IJPR-f	Forker et al. (1997)	251
IJPR-g	Xu, Li Da (2011)	352
IJPR-h	Flynn & Flynn (2005)	360
IJPPM	Talib et al. (2011)	231

Abbriviation	WRITER(s)	CITATIONS
IJQRM-a	Kaur et al. (2013)	31
IJQRM-b	Quang et al. (2016)	101
IJQRM-c	Ferrandes et al. (2017)	124
IJQRM-d	Mellat-Parast (2013)	101
IJQE	Sharma et al. (2012)	45
ICQEM	Ferrandes et al. (2014)	12
JCP	Dasias & Liyanage (2018)	158
JHM	Sharma & Modgil (2015)	30
JITED	Talibet al. (2010)	56
JOMa	Foster Jr. (2008)	386
JOMb	Kaynak & Hartley (2008)	595
JQRM	Sarrico & Rosa (2016)	30
JSCM	Chatha & Gagandeep (2011)	20
MPER	Azizi et al. (2015)	40
MSL	Malchiraji et al. (2012)	25
MATECW	Gu et al. (2017)	15
OME	Zeng et al. (2013)	70
QMJ	Terziovski & Hermel (2011)	57
SIM	Azar et al. (2010)	69
SCMJR	Jraisat & Sawalha (2013)	65
SCMIJ	Parast (2019)	15
TIJMS	Kannan & Tan (2005)	987
TTJ	Vanichchinchai & Igel (2009)	178
TTM	Casadesús & de Castro (2005)	135
TQM	Kue et al. (2008)	138

Fig-2.2.7f.1; Journal-wise citations

According to Annexure S-2 knowledge stream (Anti-counterfeiting knowledge stream), a total number of 42 papers published in different journals are selected (see Fig-2.4h) for review. In 2021, one (1) publication by Taylor & Francis, eleven (11) publications by Elsevier (during the year 2006 to 2020), eight (8) from Emerald (during the year 2006 to 2020), six (6) publications by Taylor & Frances (during the year 2006 to 2021), one (1) publication by IEEE (during the year 2016 to 2020), three (3) publications by Springer (during the year 2006 to 2020), two (2) publications by Wiley (during the year 2016 to 2020), two (2) publications by Research gate (during the year 2006 to 2015), and nine (9) by Miscellaneous publications (during the year 2006 to 2020). Fig-(2.2.7h.1) shows a journal-wise citations graph indicating the importance of the journals in the area of relevant contributions. The scholarly contributions show that the contributors suggest different anti-counterfeiting strategies to control the product counterfeiting phenomenon in supply chains to enhance FSP. The occurrences of the counterfeiting phenomenon can be reduced with the possibility of the parts, and traceability platform to benefit decision-makers to counter counterfeiting activities in the automotive SCs in any system.

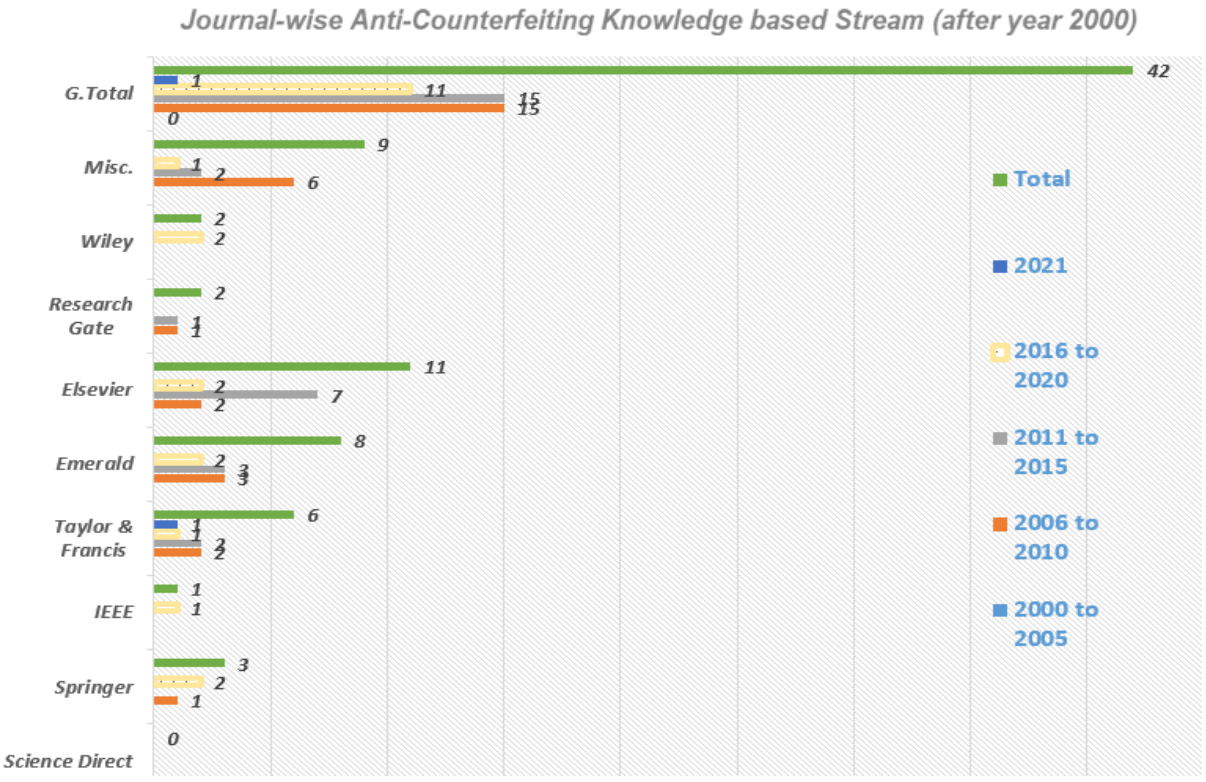
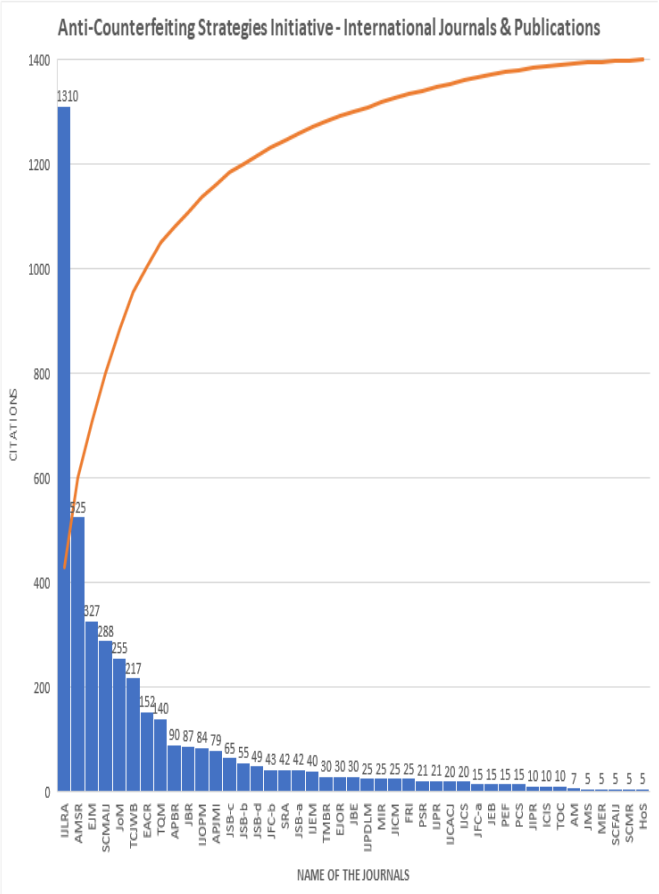


Fig-2.2.7h; Journal-wise total yearly publications



Abriviation	WRITER(s)	CITATIONS
AMSR	Eisend & Schuchert-Guler (2006)	525
AM	Zhou et al. 2020	7
APBR	Hung (2010)	90
APJMI	Quoquab et al. (2017)	79
EACR	Hoe et al. (2003)	152
EJM	Staake et al. (2009)	327
EJOR	Zhang & Zhang (2015)	30
FRI	Soon & Manning (2019)	25
HoS	Barnier (2014)	5
ICIS	Mavlanova et al. (2008)	10
IJCS	Souiden et al. (2018)	20
IJCACJ	Heinonen & Wilson (2012)	20
IJEM	Hoecht & Trott (2014)	40
IJLRA	Tang (2006)	1310
IJOPM	Stevenson & Busby (2015)	84
IJPDLM	Machado and Paiva (2018)	25
JBE	Chen et al. (2018)	30
JBR	Staake et al. (2012)	87
JEB	Yao (2015)	15
JFC-a	Reynolds (2011)	15
JFC-b	Lowe (2006)	43
JIPR	Bosworth & Yang (2006)	10

Abriviation	WRITER(s)	CITATIONS
JICM	Hussain et al. (2017)	25
JMS	Peterson (2012)	5
JoM	Commuri (2009)	255
JSB-a	Zimmerman (2013)	42
JSB-b	Berman & Swani (2010)	55
JSB-c	Chaudhry et al. (2009)	65
JSB-d	Wilcock & Boys (2014)	49
MIR	Yang & Fryxell (2009)	25
MER	Mura (2018)	5
PSR	Santos & Ribeiro (2006)	21
PCS	Bodner (2014)	15
PEF	Eser et al. (2015)	15
SRA	DiMaze et al. (2016)	42
SCFAIJ	Ghadge, A. et al. (2021)	5
SCMR	Grenoble et al. (2014)	5
SCMAIJ	Blos et al. (2009)	288
IJPR	Ting & Tsang (2014)	21
TCJWB	Shultz & Saporito (1996)	217
TMBR	Amine & Magnusson (2007)	30
TQM	Kuei et al. (2008)	140
TOC	Sullivan et al. (2016)	10

Fig-2.2.7h.1; Journal-wise citations

According to Annexure S-3 knowledge stream (BC supported the SCQM and Anti-counterfeiting knowledge stream), a total number of 35 papers published in different journals are selected (see Fig-2.2.7g) for review. In 2021, two (2) publications made by IEEE and one (1) publication by Miscellaneous channel, five (5) publications by Elsevier (during the year 2016 to 2020), three (3) from Emerald (during the year 2016 to 2020), one (1) publications by Taylor & Frances (during the year 2016 to 2020), five (5) publication by IEEE (during the year 2016 to 2021), five (5) publications by Springer (during the year 2016 to 2020), three (3) publications by Wiley (during the year 2016 to 2020), and thirteen (13) by Miscellaneous publications (during the year 2016 to 2021). Fig-(2.2.7g.1) shows a journal-wise citations graph indicating the importance of the journals in the area of relevant contributions. The scholarly contributions show that the contributors see technology as the single source of the network that can provide sharing information functionality to save transactions from mutability. The concept of a parts traceability platform is possible to benefit decision makers to enhance FSP. In this

connection, a networked controlled model supported the SCQM environment is necessary for practitioners so that they can take decisions timely to address the product counterfeiting issue.

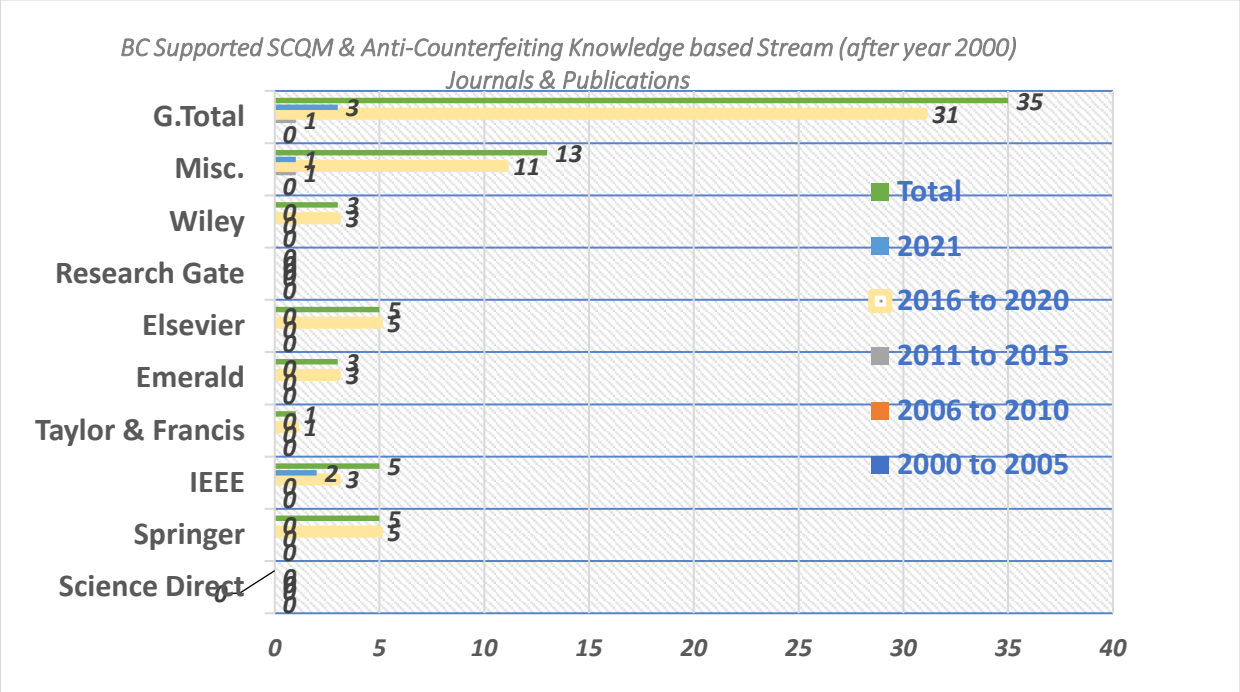
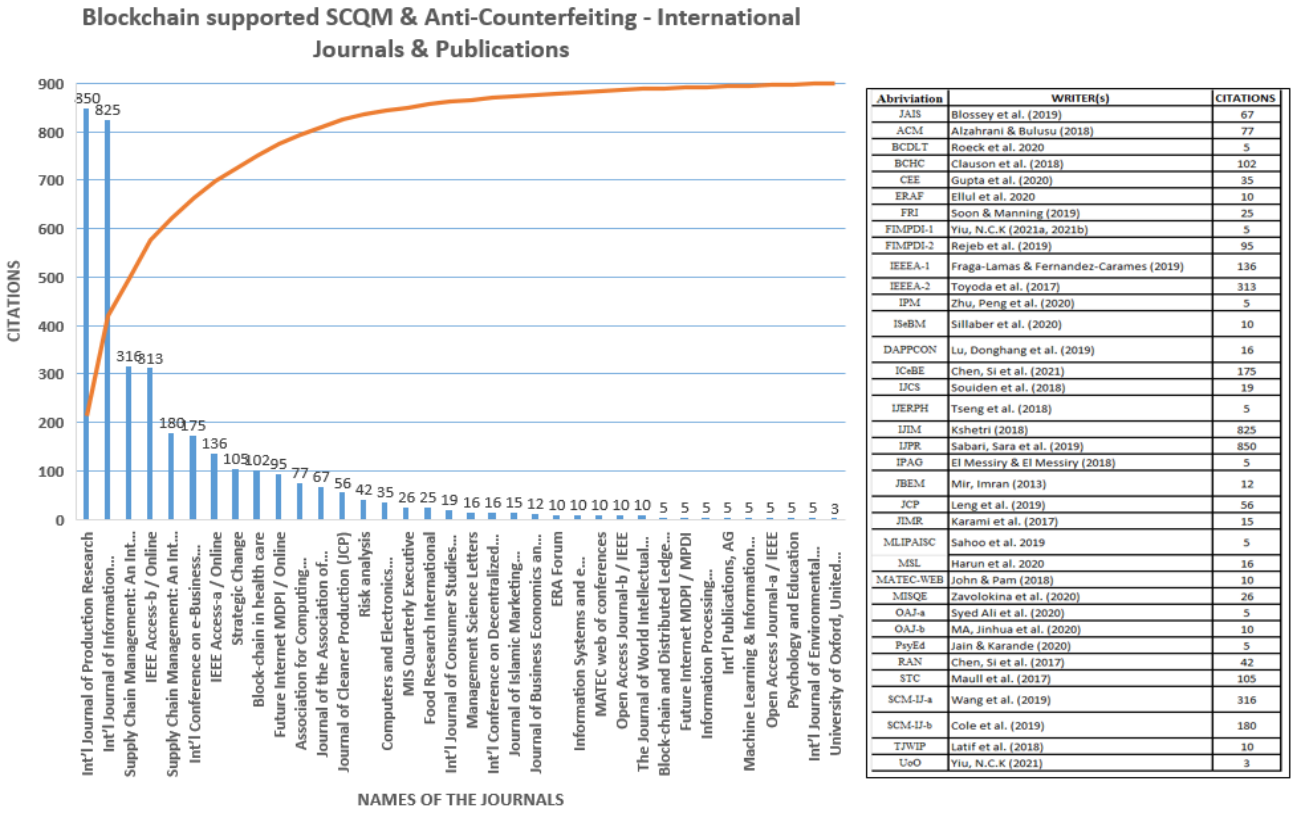


Fig-2.2.7g; Journal-wise total yearly publications



Abriviation	WRITER(s)	CITATIONS
JAIS	Blossey et al. (2019)	67
ACM	Alzahrani & Bulusu (2018)	77
BCDLT	Roeck et al. 2020	5
BCHC	Clauson et al. (2018)	102
CEE	Gupta et al. (2020)	35
ERAF	Ellul et al. 2020	10
FRI	Soon & Manning (2019)	25
FIMPDI-1	Yiu, N.C.K (2021a, 2021b)	5
FIMPDI-2	Rejeb et al. (2019)	95
IEEEA-1	Fraga-Lamas & Fernandez-Carames (2019)	136
IEEEA-2	Toyoda et al. (2017)	313
IPM	Zhu, Peng et al. (2020)	5
ISeBM	Sillaber et al. (2020)	10
DAPPCON	Lu, Donghang et al. (2019)	16
ICeBE	Chen, Si et al. (2021)	175
IJCS	Souiden et al. (2018)	19
IJERPH	Tseng et al. (2018)	5
IJIM	Kshetri (2018)	825
IJPR	Sabari, Sara et al. (2019)	850
IPAG	El Messiry & El Messiry (2018)	5
JBEM	Mir, Imran (2013)	12
JCP	Leng et al. (2019)	56
JIMR	Karami et al. (2017)	15
MLIPAISC	Sahoo et al. 2019	5
MSL	Harun et al. 2020	16
MATEC-WEB	John & Pam (2018)	10
MISQE	Zavolokina et al. (2020)	26
OAJ-a	Syed Ali et al. (2020)	5
OAJ-b	MA, Jinhua et al. (2020)	10
PsyEd	Jain & Karande (2020)	5
RAN	Chen, Si et al. (2017)	42
STC	Maull et al. (2017)	105
SCM-IJ-a	Wang et al. (2019)	316
SCM-IJ-b	Cole et al. (2019)	180
TJWIP	Latif et al. (2018)	10
UoO	Yiu, N.C.K (2021)	3

Fig-2.2.7g.1; Journal-wise citations

E) BIAS IN THE SLR PROCESS

The SLR provides an opportunity to critically reflect, compare, and discuss prior study findings from different perspectives by applying triangulation techniques to bring more objectivity to the research context. According to Durach et al.'s (2017) study, the particular concern of the researcher is the possibility of biasness remains in the processes of paper selection, retrieval of information, and synthesis of the study data. The selection and retrieval biases bring incompleteness in the review process that impacts the synthesis process. To reduce biasness in the said processes this study followed the second opinion strategy to follow a consultative approach where opinions from experts (industry, academia) became important. The disagreements where possible are resolved by conducting parallel working. Maybe an independent coding strategy would be a good approach to resolve the disagreements but stands limitation for this study due to the Covid-19 situation and independent coder unavailability.

F) COMPILATION OF THE ANTI-COUNTERFEITING STRATEGIES PROCESS

This study considers the number of strategies and citations as the important selection criteria for scholarly contributions for further evaluation. The citation establishes the causal relationship (interconnection) at the conceptual level by connecting different scientific conceptions with the researchers' observations [Kraus et al.'s (2020, 2014)]. The regularly cited publications consider important indicatives for conveying essential scientific knowledge necessary for foundation-building activities [see studies from Acedo & Casillas (2005) and Casillas & Acedo (2007)]. However, the debatable issue in academia is how several citations can be an indicator of any academic article being considered influential. Alternatively, more recent relevant publication information may be considered as scholarly important, which is yet to gain sizeable citations. Therefore, to pick the true picture of contributory evidence, the abstract and conclusion of the papers are thoroughly read and analysed by the researcher to reach a common consensus by using peer review and expert opinion techniques. Table-2.2.7b shows relevant scholarly work with varied citations linked to anti-counterfeiting strategies from the year 1996 onwards. According to the number of strategies and citations, important forty-seven (47) scholarly contributions were made from the year 2000 onwards, whereas five (5) scholarly contributions were made before the year 2000 concerning the anti-counterfeiting strategies. The referenced literature conveys essential scientific knowledge for foundation-building activities to serve a separate anti-counterfeiting knowledge stream for further research investigation and the development of the theoretical construct of the model. However, some contributions are showing less than ten (10) citations, which is considered a paper's selection criterion for further analysis as per the readers' importance. Furthermore, the papers less than ten (10) are not completely ignored and keep them intact, as per their contents' importance, for further investigation to address the counterfeiting issue comprehensively. This literature review reveals that all anti-counterfeiting strategies are recommended as important to counter counterfeiting activities: Extraction; Production; Distribution; Infiltration, found important according to their relevance. The summary of the number of anti-counterfeiting strategies with citations (Table-2.2.7a) conveys essential scientific knowledge necessary for a foundation building block to address possible infiltration & product counterfeiting issue in SC.

TABLE-2.2.7b: SUMMARY OF ANTI-COUNTERFEITING STRATEGIES

AUTHOR'S NAME	Strategies	Citations	Publication / Journal
Ghadge, A. et al.'s (2021)	5	5	Taylor & Francis / Supply Chain Forum: An International Journal
Zhou et al.'s 2020	1	7	ACS Publication/ Applied Material
Soon & Manning (2019)	6	25	Elsevier / Food Research International
Mura (2018)	3	5	Elsevier / Micro-electronics Reliability
Souiden et al.'s (2018)	1	20	Wiley / Int'l Journal of Consumer Studies
Machado et al.'s (2018)	8	25	Emerald / Int'l Journal of Physical Distribution & Logistics Management
Chen et al.'s (2017)	2	30	Springer / Journal of Business Ethics
Sullivan et al.'s (2017)	2	10	Springer / Trend Organized Criminology
Hussain et al.'s (2017)	3	25	Taylor & Francis / Journal of International Consumer marketing
Quoquab et al.'s (2017)	2	79	Emerald / Asia Pacific Journal of Marketing Intelligence
DiMase et al.'s (2016)	5	42	Wiley / Society for Risk Analysis
Eser et al.'s (2015)	6	15	Elsevier / Procedia Economics and Finance
Yao, Jen-Te (2015)	1	15	Elsevier / Journal of Economics and Business
Zhang & Zhang (2015)	3	35	Elsevier / European Journal of Operational research
Stevenson & Busby (2015)	29	120	Emerald / Int'l Journal of Operations & Production Management
Barnier (2014)	1	5	Research Gate /Handbook of Security
Grenoble et al.'s (2014)	7	5	online / Supply Chain Management Review
Bodner (2014)	8	15	Elsevier / Procedia Computer Science
Ting & Tsang (2014)	3	21	Taylor & Francis / Int'l Journal of Production Research
Hoecht & Trott (2014) *	11	40	Emerald / Int'l Journal of Emerging Markets
Wilcock & Boys (2014)	26	49	Elsevier / Kelly School of Business, Indiana University
Zimmerman (2014)	7	42	Elsevier / Kelley School of Business
Peterson (2012)	4	5	Canadian Centre for Science and Education / Journal of Management & Sustainability
Heinonen & Wilson (2012)	5	20	Taylor & Francis / Int'l Journal of cooperative and Applied Criminal Justice
Staake & Fleisch (2008, 2012)	33	87	Elsevier / Journal of Business Research
Reynolds (2011)	5	15	Emerald / Journal of Financial Crime
Mavlanova & Benbunan-Fich, (2010)	1	10	online / Int'l Conference on Information Systems (ICIS)
Berman & Swani (2010)	6	55	Elsevier / Kelley School of Business
Hung (2003) *	11	90	Frank Cass / Asia Pacific Business Review
Yang & Fryxell (2009)	4	25	Springer / Management International Review
Chaudhry et al.'s (2009)	17	65	Elsevier / Kelley School of Business
Commuri (2009)	1	255	online / Journal of Marketing
Blos et al.'s (2009)	1	288	Emerald / Supply Chain Management: An International Journal
Staake et al.'s (2009)	4	327	Emerald / European Journal of Marketing
Berman (2008)	25	110	Online / Business Horizon
Kwok et al.'s (2008)	2	30	The Int'l Federation of Automatic Control
Amine & Magnusson (2007)	4	30	online / The Multinational Business Review
Lehtonen et al.'s (2007)	2	78	Online / IEEE Systems Journal
Minagawa et al.'s (2007)	5	70	Online / R&D Management
Bosworth & Yang (2006)	12	10	online / Journal of Intellectual Property Rights
Santos & Ribeiro (2006)	3	21	Research Gate / Polytechnical Studies Review
Lowe (2006)	1	43	Emerald / Journal of Financial Crime
Eisend & Schuchert-Guler (2006)	2	525	online / Academy of Marketing Science Review
Tang (2006a, 2006b)	5	1681, 1423	Elsevier / International journal of production economics, Taylor & Francis/ Int'l Journal of Logistics Research and Applications

Staake et al.'s (2005)	2	58	Online / ACM Symposium on applied computing
Chaudhry & Zimmerman (2005)	37	85	Online / Business Horizon
Hoe et al.'s (2003)	2	152	online / European Advances in Consumer Research
Bush et al.'s (1989) **	14	185	Online / Business Horizon
Harvey (1988) **	14	67	Online / The Columbia Journal of World Business
Harvey & Ronkainen (1985) **	14	123	Online / The Columbia Journal of World Business
Chaudhry & Walsh (1996) **	14	182	Online / The Columbia Journal of World Business
Shultz & Saporito (1996) *	11	217	Elsevier / The Columbia Journal of World Business

The study reveals that some suggestive strategies have strong shades of similarities in addressing the counterfeiting issue directly or indirectly according to the aims of their scope of studies. However, some dissimilarities do exist in their suggested anti-counterfeiting strategies where contributors' aim (s) and objective (s) are different. Moreover, the study reveals that strategies are mostly focused on production and distribution areas in which counterfeiters' goal is to acquire basic products from a legitimate supply chain (at decoupling points). Whereas extraction and infiltration areas are no less a menial opportunity as far as the counterfeiters' interest is concerned. Therefore, the firm should work out common anti-counterfeiting strategies keeping in mind the areas of counterfeiters' interest so to counter the product counterfeiting issue in the firm's supply chain. This study considers some scholarly contributions, with greater than seven (7) strategies, as strongly relevant to the study objectives, with several proposed strategies and citations, to address the product counterfeiting issue in the automotive supply chains in Pakistan. These scholarly contributions with respect to the anti-counterfeiting strategies proposed to counter counterfeiting in supply chains are from [Chaudhry & Zimmerman's (2005); Bosworth & Yang's (2006); Sood et al.'s (2011); Staake & Fleisch's (2008), Wilcock & Boys's (2014); Stevenson & Busby's (2015); Chaudhry et al.'s (2009); Berman's (2008); Harvey & Ronkainen's (1985); Harvey's (1988); Bush et al.'s (1989); Shultz & Saporito's (1996); Hoecht & Trott's (2014); Bodner's (2014, 2015); and Machado et al.'s (2018)]. The consistency in publications and scholars' concerns shown in the reviews reveals that the international community is now aware of the protective and clandestine nature of the existing product counterfeiting phenomenon in the supply chains and is now more concerned about consumers' health and safety than ever before. The moderately increasing yearly frequency of scholarly publications before and after the year 2000, shows the convincing presence of contributors' interest worldwide according to its theoretical importance. The study reveals the five (5) publications made during the years 1985 and 1996, ten (10) publications during the year 1997 and 2007, and thirty-eight (38) publications during the years 2008 and 2021. The study reveals that during the last decade the contributors' interest worldwide

increases the most, as consignments confiscated at Western and European ports and borders were reported the most as well (OECD & international organisations study reports), thus requires empirical testing to validate the claimed knowledge.

G) THEMATIC ANALYSIS

According to Ryan & Bernard's (2003) study, the themes consider representative indicators of the fundamental concepts that describe the subject intent in terms of relevant context in every article. Depicting from these principles, themes are inductively derived from the holistic understanding of the referenced article (Jones et al., 2011). Thus, themes and sub-themes are intended to stand for the core ideas, conceptual linkages & arguments (Thorpe et al., 2005) leading to specific expressions defining research questions, upon which constructs, concepts & measurements are based. Papers in reference (54 in number) are independently classified / themes addressing product counterfeiting issues in the automotive industry's supply chains in Pakistan.

G.1) THE PROCESS MODEL OF A THEORY-BASED CONTENT ANALYSIS

McMillan & Chavis's (1986) study focused on the literature on group cohesiveness in the definition matching. A sense of community where identified elements work together to produce the community experience. McMillan and Chavis's study propose four criteria for a definition and theory of a sense of community. First, the definition needs to be explicit and clear; second, it should be concrete, its parts identifiable; third, it needs to represent the warmth and intimacy implicit in the term; and, finally, it needs to provide a dynamic description of the development and maintenance of the experience. This study fulfils the first two criteria of the McMillan & Chavis's study and follows the theory-definition matching criteria in theory-based content analysis. Referring to the methodology, this study began by addressing the approach to systematic literature reviews (described by Ortiz-Avram et al., 2018) to investigate what highlighted themes and dimensions present concerning anti-counterfeiting strategies within the counterfeiting knowledge stream. The process model of theory-based content analysis (Fig-2.2.7j-1) is discussed where stepwise procedures are followed where each strategy is processed one after the other. To categorize anti-counterfeiting strategies, the first criteria applied is to find a theory-based definition that matches of dimensions the concerning themes. The process of content analysis supplements the process of categorization. The theory-definition matching criteria is applied in support of the counterfeiting knowledge stream. The selected dimensions are then bundled and linked to the themes. These qualitative steps of analysis are then followed till all

the anti-counterfeiting strategies are processed. The literature reviews reveal that scholarly contributions about the counterfeiting knowledge stream found speechless to present the systematization and categorization criteria to follow, to extract some cluster-based dimensions to formulate a new construct. However, the qualitative content analysis of the fifty-four (54 reviewed papers identify four-hundred-nineteen (419) anti-counterfeiting strategies (see Appendix Tabel-A), which when filtered out and analysed further reach the thirty-one (31) strategies. Here, Mayring's (2004, 2015) method is applied for qualitative content analysis to identify main themes after coding the definitions used in the relevant articles, as the first filter criteria of the first content analysis step. The sorted and condensed version of the anti-counterfeiting strategies, according to the specified theory definition matching criteria, are clustered to reach four (4) mutually exclusive themes to uncover dominant directions present in the literature and to support a theoretical discussion. These themes are: 1) Contractual binding with partners (28 anti-counterfeiting strategies); 2) Campaign against product counterfeiting (69 anti-counterfeiting strategies); 3) Following best industry techniques to counter counterfeiting activities (115 anti-counterfeiting strategies); 4) Formulate programs to counter counterfeiting activities (130 anti-counterfeiting strategies). The discussion about the definitions and details of the themes is available in section (G-2).

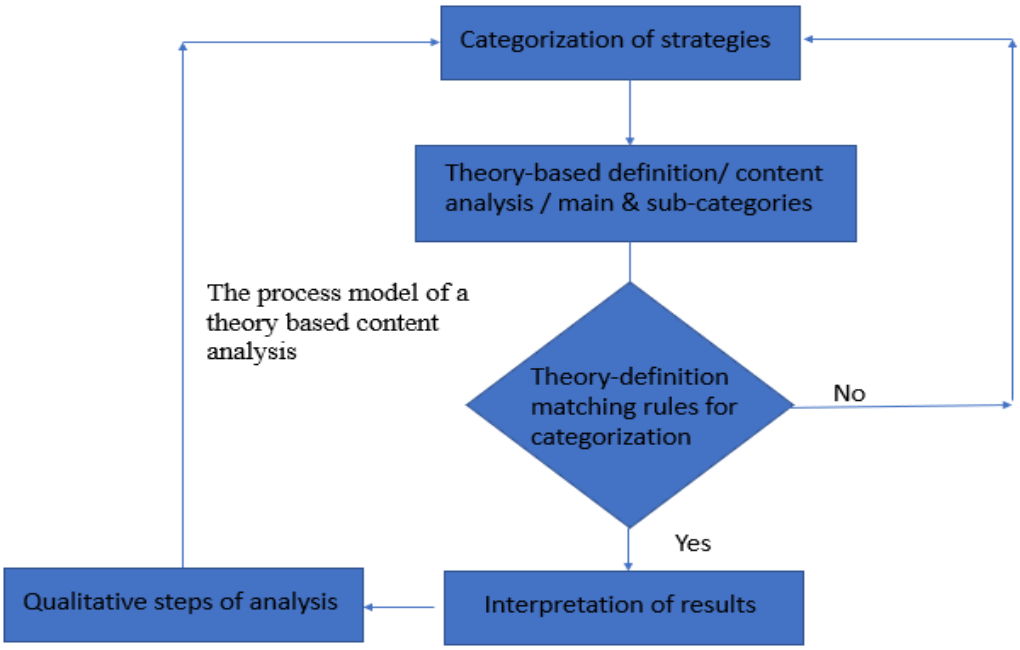


Fig-2.2.7j-1: Source - Ortiz-Avram et al., 2018

In the second step of content analysis, the similarities and differences among sub-dimensions are identified (see Annexure Table-2.2.7a-2 to Table-2.2.7a-5). The similar sub-dimensions are bundled up to form a new level of categorization, which is termed dimensions. The thirty-one

(31) dimensions after applying theme definition matching criteria are identified from the literature review, within the selected anti-counterfeiting strategies, are linked to them. The seventy-four (74) dimensions after applying theme definition matching criteria identified from the literature review, within the selected anti-counterfeiting strategies, are linked to theme #2. The sixty-two (62) dimensions after applying theme definition matching criteria identified from the literature review, within the selected anti-counterfeiting strategies, are linked to theme #3. Moreover, the sixty-six (66) dimensions after applying theme definition matching criteria identified from the literature review, within the selected anti-counterfeiting strategies, are linked to theme #4.

G-2) DISCUSSIONS ABOUT THE THEMES

A) CONTRACTUAL BINDING WITH PARTNERS (THEME #1)

Theme #1 helps decision-makers to formulate parts supply contracts, which brings continuous improvements in the operational processes. Supplier qualification and selection criteria should be applied to receive quality parts. Wang's (2002) study says that the supply chain contract is a coordination mechanism that provides incentives to all its members so that the decentralized supply chain behaves nearly or the same as the integrated one. Wang's study focuses on a group of closely related SC contractual binding. A supply chain contract is an agreement among the partners to maintain information confidentiality, accept strict liability to deliver quality items (Wilcock & Boys's, 2014; Soon & Manning's, 2019), to maintain industry standards and compliances (Staake & Fleisch's, 2008; Sood et al., 2011; DiMase et al.'s, 2016), to work for continuous improvement (Staake & Fleisch's, 2008; Mura's, 2018), to conduct supplier audit (Wilcock & Boys's, 2014), to improve communication among different department to discourage counterfeits (Stevenson & Busby's, 2015;), to follow early checking steps and conduct test to check fake items (Berman's, 2008; Wilcock & Boys's, 2014; Stevenson & Busby's, 2015), to maintain trust and control in SC, to maintain industry standards for suppliers and sub-contractors qualification and selection for performance evaluation (Wilcock & Boys, 2014; Bodner, 2014; Stevenson & Busby, 2015). Applying the theory definition matching criteria, Hofstetter's (2018) and DuHadway et al.'s (2021) studies support theme #1 where power and dependence among the contractual partners through legally binding agreements lead to the relationship mechanism that supports norms (trust, flexibility, solidarity, exchange of information) and business collaboration (see Annexure-Table-2.2.7a-2).

B) CAMPAIGN AGAINST PRODUCT COUNTERFEITING (THEME #2)

Theme #2 helps decision-makers to use different lobbying techniques, by introducing new product attributes & packaging styles, for more rigorous counterfeits control. Walsh's (2019) study says that advertising campaign informs consumers about, or seek to manipulate them into, making choices about whether or what to buy even before consumer enter a retail outlet. Campaign for the masses is short-term and narrow, as Sung et al.'s (2019) study say that the strategic emphasis on advertising campaign facilitates a firm's capability to prolong profitability by establishing barriers to imitation, and by lowering product buying risks. Goločorbin-Kon & Mikov's (2011) study mentioned that the WHO estimate shows that 50% of medicines available via the internet are counterfeit. The study further says that the most important players in the campaign against counterfeit medicines are health professionals. Pharmacists and doctors should stay vigilant and report suspicious products and consider counterfeits as a possible cause of adverse reactions or therapeutic failure. Goločorbin-Kon & Mikov's study mentioned that the crucial step in the prevention of counterfeit medicines is to purchase from licensed pharmacies. De Jesus, D.S.V.'s (2021) study mentioned that the concept of advertising has fractionalized into short-term activities rather than long-term communication, which created obstacles to a widely accepted definition of the concept (cited in Shultz (2016). Philip. & Hellstrom's (2011) study discusses that in response to the risks of counterfeiting the sildenafil (Pfizer medicine), Pfizer has implemented a successful campaign consisting of patient education, the use of novel technology, and collaboration with law enforcement to prevent these counterfeits from reaching patients.

Applying the theory definition matching criteria, Theme #2 is linked with the campaign, lobbying, and advertisement to address the product counterfeiting issue [Berman's (2008); Yang & Fryxell's (2009); Hoecht & Trott's (2014); Hung's (2003); Shultz & Saporito's (1996); Yoo & Lee's (2009); Nakkash & Yoo's (2009); Zhang & Zhang's (2015); Stevenson & Busby's (2015); Quoquab et al.'s (2017); Hussain et al.'s (2017); Ghadge, A. et al.'s (2021)]; Information sharing among partners to encourage customers' ethical buying behaviour [Stevenson & Busby's (2015); Wilcock & Boys's (2014)]; Campaign announces incentives for suppliers and distributors who are supportive to work assignments [DiMase et al.'s (2016); Chaudhry et al.'s (2009); Mura's (2018); Chaudhry & Zimmerman's (2005); Chaudhry & Walsh's (1996); Harvey & Ronkainen's (1985); Harvey's (1988); Bush et al.'s (1989)]. The counterfeit knowledge stream [Nneka & Olivia's (2020); Chauhan et al.'s (2021)] support theme #2 that product quality is a challenging task to mobilize communities to follow ethical buying patterns. Campaigns & alliances are formed to discourage counterfeiting activities, like spreading alerts

about safety, new financial incentives for channel members to reject counterfeits, and the risk of introducing counterfeits into the market can be effective (see Annexure -Table-2.2.7a-3).

C) FOLLOWING THE BEST INDUSTRY TECHNIQUES TO COUNTER COUNTERFEITING ACTIVITIES (THEME #3)

To make a control strategy successful, fair access to technology for managers is important. Theme #3 emphasizes that the development of sophisticated technologies has made product duplication possible. This study encourages managers to gain knowledge about innovative technologies that can easily trace counterfeits in the supply chains. Bhandari's (2018) study [cited in Hussain's (2020)] emphasizes that BC along with smart contracts and IoT can improve the product traceability possibilities in the SC and can save contingency and other costs. To follow best industry practices to protect brands, Theme #3 is linked with the use of data protection, data mining, and data visualization techniques to gain market knowledge [Eser et al.'s (2015); Wilcock & Boys's (2014); Ting & Tsang's (2014); Bodner's (2014, 15); Stevenson & Busby's (2015); Kwok et al.'s (2008); Chaudhry & Walsh's (1996); Harvey & Ronkainen's (1985); Harvey's (1988); Bush et al.'s (1989)]. Moreover, technical evaluation, product & package inspections, and use of the supply chain risk assessment technique to follow the best industry practices to seek reliability in the processes [Staake & Fleisch's (2008, 2012); Sood et al.'s (2011); Grenoble's (2014); Syed T.A. et al.'s (2020); D'Amato & Papadimitriou's (2013); Berman's (2008); Cooper & Eckstein's (2008); Blos et al.'s (2009)]. Applying the theory definition matching criteria, theme #3 links where Kotusev's (2018, 2019) studies emphasize following the best industry techniques, the managers deployed technologies via color-coding reference models (TRMs). Wu & Zhao's (2021) study emphasizes to use of un-imitative patterns with signs and codes to protect the intellectual rights of the product. Modgil & Sonwaney's (2019) study says that the Sharing information technologies required to combat the counterfeiting problem within a legal framework to pass transactions safely (see Annexure -Table-2.2.7a-4).

D) FORMULATE PROGRAMS TO COUNTER COUNTERFEITING ACTIVITIES (THEME #4)

Machado et al.'s (2018, p.139) study cited the argument raised by the study of Grenoble et al. (2014) where companies have not systematically collected or evaluated information about incidents of counterfeiting, they are forced to develop programs for combating it in one-off, reactive ways, based on fragmented data. Wicock & Boys (2014) study supported the efforts of

countering counterfeiting say that top management must be committed to implement control program and set up dedicated team to coordinate this program to minimise the resources. Moreover, Machado et al.'s study says that managers should recognise the importance of allocating the relevant resources needed for putting anti-counterfeiting strategies into place. Machado et al.'s (2018, p.150) study discussed five (5) case studies where the study emphasised important capabilities needed to counter counterfeiting activities, like collaboration within SC, traceability, control and trust. Machado et al.'s (2018, p.150) study say that companies closer to the suppliers can control product counterfeiting. Therefore, Theme #4 is to formulate long-term programs to counter counterfeiting activities so that decision-makers are encouraged to start the investigation process to address the product counterfeiting issue.

Applying the theory definition matching criteria, theme #4 links to the managers' initiatives to formulate surveillance teams to perform anti-counterfeiting activities with the help of law enforcement agencies and use protection technologies (see Table-2.2.7g-4). Formulate a standard quality program to strengthen quality processes with feedback mechanism [Wilcock & Boys's (2014); Staake & Fleisch's (2008); Stumpf & Chaudhry's (2010); Chaudhry et al.'s (2009); Berman's (2008); Amine & Magnusson's (2007); Chaudhry & Zimmerman's (2005); Harvey's (1988); Grenoble's (2014); Bodner's (2014, 15); D'Amato & Papadimitriou's (2013); Nunes & Donnelly's (2010); Lybecker's (2007, 2008); Bosworth & Yang's (2006)]. Theme #4 emphasizes that the procedures should be developed to periodically monitor the disposal process in supply chain activities (rejected or spilled or disposed of products), and warning issuance details [Stevenson & Busby's (2015); D'Amato & Papadimitriou's (2013); Wilcock & Boys's (2014)]; for protection of the product, back out procedures are formulated (outsourcers' agreement) after collecting technical documents; and the acquisitions & joint ventures and introduce incentivize pricing policy to reduce the business-related counterfeiting activities [Bodner's (2014, 2015); Chaudhry et al.'s (2009); Chaudhry & Zimmerman's (2005); Minagawa et al.'s (2007); Bosworth & Yang's (2006)]. The counterfeit knowledge stream supports theme #4, where [Wilson & Grammich's (2022); Wu & Zhao's (2021); Heinonen & Wilson's (2012] studies recognize the risk of counterfeiting has to the brands. [Chaudhry et al.'s (2009, 2011); Chaudhry & Zimmerman's (2005)] studies also recognize risks and discuss the use of counterfeits at the sub-assembly level makes detection difficult in the licit supply chain. (see Annexure -Table-2.2.7a-5).

The managerial approach to meet the criteria is to first list all anti-counterfeiting strategies (Appendix Table-A), then summarize, filter, and compile strategies with a clear structure of

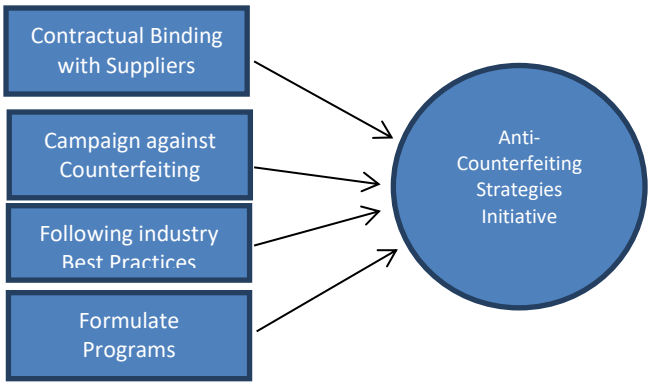
commonality to formulate a new construct (Appendix Table-B). The themes/categories based on the common anti-counterfeiting strategies (Table-C) encourage managers to limit their liabilities specific to their role in the trade through practicing legal contracts with their customers (suppliers/distributors, etc.) and concentrate on specifics to get better time value of money. A mixed-method is used to analyse the themes-based model. Thomas's (2006) study discusses that inductive research allows theory to emerge from raw data to drive concepts, themes, or a model through interpretations. The deductive analysis tests the consistency of the data with prior assumptions, theories, or hypotheses. This study follows Thomas's study that mentioned three inductive analysis approach: 1) to condense extensive and varied raw text data into a brief, summary format; 2) to establish clear links between the research objectives and the summary findings derived from the raw data and to ensure that these links are both transparent and defensible (justifiable with the objectives of the research); 3) to develop a model or theory based on data showing the evidence about the presence of the relationship that exists among ANCT-INT, SCQM, and FSP in the supply chains. This study helps a researcher to adopt the general inductive approach to evaluate the model (Thomas, 2006), as being a convenient and efficient way of analysing qualitative data, as compared to other approaches (Grounded Theory, Discourse Analysis, & Phenomenology). For the deductive analysis test, this study follows Harlow's (2006) study. The Harlow study discusses that the statistical methods are more reliable and generalizable to the extent that they can encompass multiple considerations (e.g., theories, hypotheses, measures, samples, time points, and controls). In this regard, structural equation modelling allows more rigorous and correct conclusions. The Harlow study also says that the multivariate methods (correlational, linear combination prediction, or group difference model) analyse the ratio of variances and/or covariance between and within the variables or groups. The multivariate methods can be assessed at a macro level by a significance test and show effect size and whether the magnitude of the shared variance between independent and dependent variables is significantly different by chance. Therefore, this study not only evaluates the research model but also seeks the possibility to address research inquiry as to how anti-counterfeiting strategies influence FSP in the context of the automotive industry supply chains in Pakistan.

Table-C: COMMON THEMES FOR ANTI-COUNTERFEITING STRATEGIES

	Theme-1: Contractual Binding with Partners
1	Preparation of early steps of checking required. Possibilities of reverse engineering / obsolete items to be checked.
2	Processes are designed to follow ISO-supported Q.M standards for standardized reporting
3	Relationship stability and supplier's commitment to quality
4	Supplier certification and conformance to quality
5	Formation of supplier's selection and performance evaluation criteria
	Theme-2: Campaign against Product Counterfeiting
1	Develop customers' ethical buying behaviour
2	Campaign with lobbying and advertisement to address the product counterfeiting issue
3	Campaign announces incentives for cooperative suppliers and distributors to counter counterfeiting
4	Create awareness regarding the adverse impact of counterfeits on health and safety
5	Information sharing among partners to support anti-counterfeiting activities
	Theme-3: Following best industry techniques to counter counterfeiting activities
1	Product and package inspection with technical evaluation as per standard
2	Data mining and visualization techniques are used to gain market knowledge. Training given.
3	Collaboration and coordination among all stakeholders to formulate anti-counterfeiting strategies
4	Knowledge about using protection technologies to track and trace items
5	Use data protection techniques to support brand protection strategies with law enforcement agencies
6	Apply supply chain risk assessment technique to seek process reliability
	Theme-4: Formulate Programs to counter counterfeiting activities
1	Follow feedback mechanism to improve processes
2	A program to facilitate acquisitions or form joint ventures to reduce counterfeiting activities
3	Program to develop internal resources and invest in protective countries
4	The product specification is maintained along-with product characteristics
5	Loss prevention and audit programs help take back the design documents of the product
6	Monitor disposal activities regarding rejected, spoiled, and disposed of items
7	A program that focuses to improve the quality of the processes
8	Formulate crisis management plan and surveillance program
9	Program development to influence the government to formulate legislation against counterfeiting (as a joint plan)
10	Formulate a surveillance team to track counterfeiting activities
11	Program protection plans to focus on parts / sub-assemblies of sub-systems are critical to the mission
12	Monitor SC activities periodically and issue warnings to distributors, suppliers, and agents
13	Use law enforcement agencies to provide legal cover to a product
14	Certified retailer program to protect partners and products
15	Activities as per cost-benefit analysis

H) THEORETICAL ASSUMPTIONS BASED ON ANCT-INT MEASURES

Based on the systematic literature review (Appendix Table-A, A-1 & B), new dimensions (themes) are introduced to form a construct (ANCT-INT), according to the theoretical concept to support the present counterfeiting knowledge stream in the context of the automotive industry's supply chains in Pakistan. According to Table C, four dimensions (themes) of the mutually exclusive anti-counterfeiting strategies are identified based on the theoretical assumptions of the mixed research study (see Fig.2.2.7k).



Ref: Fig. 2.2.7k- Theoretical assumptions for ANCT-INT measures

CHAPTER-SECTION-2.3

2.3.0 INTRODUCTION

This section conceptualizes the practices of the SCM and the TQM philosophical approaches and discusses in detail the possibilities of its integration into SCQM practices according to the present body of knowledge. The theoretical evidence shows that creating networked governance (BC) model supported by the SCQM environment enhances FSP where practitioners can make knowledge-based decisions at the right time. This section discusses the quality component of the services and products. Promoting the TQM philosophy encourages managers to bring improvement in the product quality and to achieve organisations' objectives at a regional and national level. The organisational culture is the driving force of TQM implementation that influence business performance. TQM helps organisations in building human capital in a knowledge-based age of governance and administration and it should be used as a strategic innovation in capacity building, managing global challenges, and promoting quality assurance. On the other hand, the supply chain talks about the collaboration of firms in chains of relationships to leverage strategic positions to improve operating efficiency. Kim's (2006) study examines the causal linkages among SCM practices, competition capability, the level of SC integration, and firm performance. Shah et al.'s (2002) study discussed that much of the current research in SCM focuses on an upstream or downstream side of the supply chain. Tan et al.'s (2002) identify six aspects of SCM practices.

Vanichchinchai & Igel's (2009) study states that the TQM & SCM studies are essential for organisation competitiveness and evolved in similar ways to reach the goal, of customer satisfaction. TQM emphasizes internal participation (employee) and SCM focuses on external (business partners) partnership but there is a need to emphasize both internal and external partnerships to further strengthen the emphasis on "total" TQM and the entire supply chain in SCM. So, better quality and faster delivery services lead to lower costs. Thus, emerge a new operational concept of SCQM from the integration of the operational functions of the TQM and SCM studies. This section mentioned the scholarly contribution made towards integrating the TQM & SCM practices extending benefits to the SCQM studies. Bastas & Livanage's (2018) study reveals some integration benefits like a) Supply chain integration (increased supply chain collaboration); b) Improved customer satisfaction; c) Improved firm performance; d) Improved supply chain performance. This section discusses the networked governance model of SCQM and recognizes the existing knowledge gap for practitioners concerning the availability of the

parts traceability platform so that they can make the right decision timely to control product counterfeiting in the automotive industry's supply chains in Pakistan. Queiroz et al.'s (2020) study discuss BC-based SCM integration that provides firms the opportunity to credibly make and verify claims for record safety and data security services. Roeck et al.'s (2020) study emphasises the presence of sharing information technology in supply chains, which provides record traceability surety. The study claims that technology solves the issue of distrust among partners, based on unchanged information. This section discusses the BC-based SCQM model introduced by Chen, S. et al.'s (2017) study, which explains four existing layers in the model. The first layer of the model is the IoT sensors layer, the second is the Data layer, the third is the Contract layer, and the fourth is the Business layer. Moreover, this section discusses the importance of technology to avert counterfeits trade and managerial guidelines for that matter.

2.3.1 LINKING TOTAL QUALITY MANAGEMENT AND COUNTERFEITING

Kros et al.'s (2020) study emphasises that the use of quality management systems (QMS) and tools can be instrumental in achieving the formalization of risk mitigation in an SC context. Friedli et al.'s (2010) study analyses the operational effectiveness and efficiency of the pharma industry where the study emphasizes that the industry did make continuous improvements throughout the systems TPM, TQM, and JIT. The literature review reveals that many research studies have attempted to adopt RBV to provide a better understanding of competitive advantage in different operational management areas. So, under the RBV perspective, the quality philosophy, strategies, and approaches towards bringing inimitability vary according to the organisational objectives. Friedli et al.'s study says that companies are still working on the effectiveness side (TPM and TQM) rather than focusing on the efficiency side (JIT). However, Farazmand's (2005) study says that promoting TQM is a means to address strategic issues and achieve strategic national goals in the global environment. Farazmand's study sees the TQM as a movement, as a philosophy, and as a tool of improvement in quality governance and a management measure for quality assurance in private and public sector organisations. Poor quality products and services create dissatisfaction and give the wrong signal to the local and international community. The study says that the successful implementation of TQM practices is an important factor that influences business performance. Kujala's (2002) study discusses that the organisation that intends to implement TQM successfully needs to develop a culture where internal processes can be improved to meet external demand. Forker et al.'s (1997) study encourage manufacturers to continue promoting TQM practices throughout the supply chain. The strong TQM problem-solving Kaizen approach addresses the product counterfeiting issue

by delaying the parts obsolescence process, Brondoni's (2018) study discusses that product design management focuses on planned obsolescence, which is linked to many types of counterfeiting, as it includes used components presented as a new and claimed as supplied form an approved source. The present counterfeiting knowledge stream reveals that in 1988 Michael Harvey introduced the "Counterfeit Protection Model (CPM)" to counter the counterfeiting activities with limitations to focus on improvement of the quality systems, as the study seeks to establish administrative control on the management level to counter counterfeiting phenomenon (see Fig-2.3.1a).

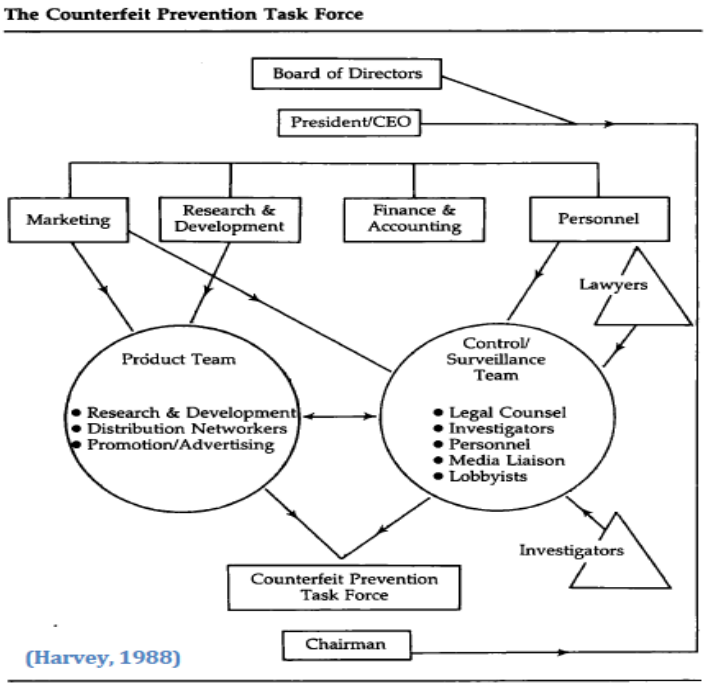


Fig-23.1a: Control of distribution against product counterfeiting

Harvey's (1988) study introduced CPM with an argument that different departments within the organisation, like research & development and distribution & promotion marketing, work closely around the product. They form the "product team" which is considered the backbone of the company and is supported by a "controlled surveillance team" in the process of developing anti-counterfeiting strategies. The study recommended that internal protection systems and track & trace capability are necessary to detect the genuine product. The study discussed the control of distribution systems and channels' verification support is linked to quality control. Harvey's study emphasized, in the R&D section, that the susceptibility of the product to counterfeiting should be analysed by the R&D team in coordination with the marketers, based on the level of technology, the types of distribution channels used, the degree of brand loyalty associated with the product, and the intensity of advertising. The study supports the need that

R&D should investigate certain internal control systems that are applied to products to aid in counterfeiting detection. In a “control team” there exist important players such as the “legal council”, “investigators”, “personnel” and “public relations/lobbyists”. The study claims that when it comes to education, is an important step in prevention since middlemen need to be aware of what legal action, obligations, and penalties they might face when doing business with counterfeit goods. The study also claims that when counterfeit products are detected it may have serious implications for the brand image and customer loyalty. Every functional area within the organisation should form both the “product team” and the “controlled surveillance team” in the process of the development of anti-counterfeiting strategies. These teams then form a “counterfeit prevention task force” with a responsibility to monitor products and trade markets for potential counterfeiters. The Harvey study limits the discussions at the firms’ level to administratively control the counterfeiting problem, missing the need to emphasize improvements in the operational processes (Quality based performance (Q.M & TQM framework like MBNQA & EFQM) in the organisational culture perspective, especially due to time-pressed and parts un-availability / non-availability of alternates.

Wilcock & Boys’s (2014) study discusses that there is a substantial interconnection between the reduction of product counterfeiting and quality management. The study tried to address in brief how integrating anti-counterfeiting initiatives into QM strategies can reduce risk in the supply chain. The study says that the anti-counterfeiting approaches can be used to limit legitimate product replication, secure production, and distribution channels, and to better educate consumers. They are 1) Quality implications of counterfeiting [Consumer purchase (demand) perspective; Product production (supply) perspective]; 2) Efforts to counter counterfeiting; 3) Anti-counterfeiting efforts within the supply chain [Limiting counterfeiting production, securing distribution channel, Informing consumers about counterfeiting, Industry-specific considerations]. The study discusses the approach that offers a framework to the management for integrating anti-counterfeiting strategies into standard quality management (SQM) plans. The elements of the SQM plan consist of Quality Policy, Quality Objectives, Leadership, Strategic Planning, Customer Focus, Employee & Partner, Responsibilities / Training, Process Management, Performance Improvement, Protection of Brand Name/ Identity, Identification of IP Infringement, Anti-Counterfeiting Strategy Coordination, and Litigation Strategy (see Table-2.3.1a).

Table-2.3.1a) Integration of anti-counterfeiting and elements of a standard quality plan

Quality Plan Element	**Anti-Counterfeiting/Piracy Consideration**
Quality Policy	Recognize that counterfeiting affects consumer perceptions of the quality of a firm's brand and products.
Quality Objectives	✓ Develop an anti-counterfeiting and/or anti-piracy policy. ✓ Introduce and integrate anti-counterfeiting considerations into the organisation's quality objectives and goals (see below). ✓ Include categorized risk assessments and codes of conduct into corporate objectives (KPMG, 2006).
Leadership/ Management	**External Leadership** ✓ Establish contacts with, become active members of, and consider taking leadership roles in trade and industry associations that support anti-counterfeiting: International Anti-Counterfeiting Coalition (IACC), National Association of Manufacturers (U.S.), U.S. Chamber of Commerce, Canadian Anti-Counterfeiting Network (CACN), and industry-specific groups. ✓ Demonstrate commitment, provide resources, and support public awareness and consumer education regarding the negative effects of counterfeiting at the micro (firm-level) and macro (societal) levels. ✓ Establish relationships with law enforcement, customs officials, etc. so such groups are made aware of, and remain vigilant for, the firm's counterfeit products (T. Johnson, personal communication, 2011). **Internal Leadership** ✓ Create and foster an anti-counterfeiting culture: ✓ Demonstrate respect for IP in business practices and policies, explicitly forbidding employees to engage in piracy and counterfeiting. ✓ Train employees to identify counterfeit products/reward ongoing vigilance. ✓ Develop whistle-blower reporting mechanisms and protections.
Strategic Planning	Incorporate anti-counterfeiting technologies and security considerations into new product development and product evolution programs. Consider the potential for counterfeiting/piracy of products and/or technologies in decision-making concerning raw material suppliers, manufacturing locations, distribution N/W, etc. ✓ Consider locating overseas production in countries where foreign governments have a demonstrated interest and capacity to enforce laws about counterfeiting and infringement. ✓ Consider centralizing distribution networks (i.e., ship from a centralized address to assist in product identification). Develop joint anti-counterfeiting action plans with key strategic business partners. ✓ Establish agreements and mechanisms to ensure confidentiality & share information that would help combat counterfeiting.
Customer Focus	Develop an official counterfeit crisis management plan. The plan should include: ✓ A process to forward counterfeit item inquiries/complaints to a designated and centralized brand protection specialist/department (to facilitate tracing counterfeit cases and sources). ✓ A process to address complaints from individuals who purchased a product that they believed to be authentic, returned it, and then discovered it wasn't the real product (T. Johnson, personal communication, 2011). ✓ Formulate plans to address media issues, customer complaints, and related issues (Cooper & Eckstein, 2008).

Employee and Partner Responsibilities/ Training	Develop employee training programs that: ✓ Emphasize the importance of IP rights, the value of IP to the business, and the need to respect those rights for other companies. ✓ Teach how to identify counterfeit products of your firm and those of strategic business partners. ✓ Develop and participate in training for employees of company partners to help them to identify the firm's counterfeit products (i.e., training for law enforcement, customs officials, and employees of partner firms). ✓ Ensure contact information for those responsible for anti-counterfeiting programs is readily and publicly available
Process Management	✓ Introduce traceability into the supply chain. ✓ Develop a loss prevention program; establish an auditing program for all components of the supply chain to identify and help prevent counterfeiting. ✓ Develop an efficient supplier audit program: Consider developing/expanding the supplier qualification process to include behavioural assessments, detailed verification of record-keeping & comprehensive site audits (Grocery Manufacturers Association & A.T. Kearney, 2010). ✓ Develop a product disposal program to ensure that defective, expired/outdated, and spoiled products are permanently removed from the supply chain.
Performance/ Improvement	✓ Consider product/service features that are difficult to replicate and/or easy to distinguish from those of non-legitimate producers during product development/ improvement. ✓ Remain vigilant and continually enhance the technologies and processes used to protect IP. ✓ Track the effectiveness of counterfeiting programs to enable firms to adjust quickly and improve results when appropriate (Grocery Manufacturers Association & A.T. Kearney, 2010).
Protection of Brand Name / Identity	Ensure that the organisation is the actual holder of the rights to the brands, marks, and/ or other IP in its portfolio. Firms must ensure that registration is in existence and updated in each of the countries in which they conduct business. Firms should inform law enforcement and customs agencies in each country to protect their authentic products against infringement by imported counterfeit/pirated products.
Identification of IP Infringement	Document how a firm will monitor the marketplace for counterfeit products under its brand or trademark and assign responsibility for market surveillance.
Anti-Counterfeiting Strategy Coordination	Define a procedure to ensure internal coordination of activities to implement the company's anti-counterfeiting strategy.
Litigation Strategy	Determine which (types of) cases to pursue legally; be prepared to litigate by identifying 'the right' contacts and resources proactively (Cooper & Eckstein, 2008). Litigation against the manufacturer, distributors, or retailer will serve as a deterrent in favor of the legitimate business and against the counterfeit community in general.

Source: Wilcock & Boys (2014)

2.3.2 CONCEPTUALIZE TOTAL QUALITY MANAGEMENT (TQM)

In their studies, Bhandari's (2014) and Kaur et al.'s (2021) discuss that in conventional systems, quality only depends upon final product quality control testing. Its implementation increases cost and time consumption in detecting the problem. Quality checks at every step in the process if any problem arrives. Bhaskar's (2020) study discusses the requirements for implementation of TQM: 1) Support from the management; 2) Employee Training and motivation; 3) Thorough

knowledge about the cause and effects of the process. TQM efforts depend mainly on the previously developed techniques of quality control. Whyte & Witcher's (1992) study [cited in Yusuf, Y, et al.'s (2007)] discusses that TQM is more than a program; it is a way of business management for the whole organisation. Its holistic corporate philosophy includes three fundamental principles: total (participation of every person and every department); quality (meeting customer needs and expectations exactly); management (enabling conditions for total quality.

Chaudhuri & Holbrook's (2001) study discusses TQM with various concepts of brand loyalty (purchase loyalty and attitudinal loyalty) and firm-level brand outcomes (market share and relative prices), brand trust, and brand affect on the overall structure of brand equity improvement. Bhandari & Baldi's (2014) study discusses that TQM implementation is desirable in the industry as it increases the quality of the product. ISO 9000 series of quality standards developed in the early 1990s for supplier quality audits. Evans's (2010) study contended that there are as many different approaches to TQM as there are businesses, but that most share the basic elements of (1) customer focus, (2) strategic planning and leadership, (3) continuous improvement and learning, and (4) empowerment and teamwork. Traditional quality programs focus on approaches such as TQM, EFQM, and the MBNQA awards.

2.3.2a) TOTAL QUALITY MANAGEMENT PRACTICES

Arumugam et al.'s (2008) study explores the relationship between TQM practices and quality performance in ISO 9001-certified manufacturing organisations in Malaysia. The main finding revealed that TQM practices were found partially correlated with quality performance. They further found that customer focus and continuous improvement are perceived as dominant TQM practices in quality performance. Keng-Boon et al.'s (2012) study has undergone an empirical study that examines the association of TQM practices (i.e, leadership, customer focus, strategic planning, people management, informational analysis, and process management) with innovation. Based on MBNQA criteria, six hypotheses were formulated and tested by multiple regressions. The results of the study show that TQM has a significant positive relationship with innovation performance. Where process management, strategic planning, people management, and customer focus have positive relationships with the innovation performance of Malaysian firms. Table-2.3.2a-1 shows the list of the important scholarly contribution made in the knowledge area of TQM.

Table-2.3.2a-1: IMPORTANT DIMENSIONS OF TQM PRACTICES

Saraph et al.'s, 1989	Flynn et al.'s, 1994	Ahire et al.'s, 1996	Dow et al.'s, 1999

The role of top management leadership The role of the quality department Quality data and reporting Training Employee Relations Product / Service design Process Management Supplier quality management	Top Management Support Customer involvement Quality Information Workforce management Product design Process Management Supplier involvement	Top management commitment Customer focus Internal quality info usage Benchmarking Employee Training Employee empowerment Employee involvement Design quality management SPC usage Supplier quality management Product quality Supplier performance	Shared vision Customer focus Use of benchmarking Workforce commitment Use of team Personnel training Cooperative supplier relation
Rao et al.'s, 1999	**Wilson & Collier, 2000**	**Sila & Ebrahimpour (2005)**	**Bandyopadhyay & Sprague, 2000**
Top Management commitment Quality citizenship Strategic quality management Customer orientation Quality information available Quality information use Benchmarking Employee training Employee involvement Product / Process design Supplier quality Internal / External quality results	Leadership Strategic Planning Information & Analysis Human resource management Process Management Customer focus Customer satisfaction Financial results	Leadership Strategic planning Customer focus Information and analysis Human Resource Management Process Management Supplier Management Organisational effectiveness Customer results Financial and Market results Human Resource Results	Top management commitment Customer satisfaction Product design Manufacturing for quality Continuous improvement Education & training of employees Employees involvement Employee empowerment Effective In-house QA system, Supplier quality management

Mehra et al.'s (2001) compiled an extensive review of TQM research and suggested that at least 45 elements affect TQM implementation, categorizing five key areas of (1) human resource focus, (2) management structure, (3) quality tools, (4) supplier support and (5) customer orientation. Table-2.3.2a-2 highlight TQM dimensions and conceive summaries.

Table-2.3.2a-2: Conceptualize common dimensions of TQM practices

SUMMARY OF OVERALL TQM PRACTICES	CONCEIVED TQM PRACTICES
Customer focus; Customer involvement; Customer orientation; Benchmarking; Design quality management; Manufacturing for quality; Product quality; Product / Process design; Product design; Quality assurance system; Quality citizenship	Customer focus T1)
Employee empowerment; Employee involvement; Employee Relations; Employee training; Education & training employees; Human resource management; Personnel training; Teamwork	Human resource management (T3)
Information and analysis; Internal quality information usage; Quality data and reporting; Quality Information; Quality information use; Statistical process control usage	Information & Analysis (T4)
Leadership; Top management commitment; The role of quality department; The role of top management leadership; Top Management Support; Organisational effectiveness; Workforce commitment; Workforce management; Shared vision; Process Management; Strategic Planning; Strategic quality management	Commitment and Strategy (T2)
Continuous improvement; Cooperative supplier relation; Customer results; Customer satisfaction; External quality results; Financial and Market results; Financial results; Human Resource Results; Internal quality results; Supplier quality management; Supplier performance; Supplier involvement; Supplier Management; Supplier quality	Firm's Supply Performance (F1=Cost, F2=Flexibility, F3=Relationship, F4=Responsiveness) F5=Supplier Quality

2.3.3 CONCEPTUALIZE SUPPLY CHAIN MANAGEMENT

The supply chain talks about the collaboration of firms in chains of relationship to leverage strategic positions to improve operating efficiency. In that context, Christopher's (1999, 2006) studies, as a value-based variation in the theme define a supply chain as a network of organisations that are linked through upstream and downstream relationships in different processes and activities that produce value in the form of products and services in the hands of the ultimate customers. Peck's (2006) study states that there is an unclear understanding of the term "supply chain" with confusion over the scope of "supply chain management (SCM)". Thus, supply chains comprise flows of materials, goods, and information linked by a range of tangible and intangible facilitators, including relationship processes, activities, and integrated information systems. In practice, functional legacies remain, and the term supply chain continues to mean different things to different people. Therefore, important SCM practice studies are illustrated in (Table-2.3.3a-2).

Table-2.3.3a-2: Important SCM practices across different studies

Li S. et al.'s (2006)	**Lo & Yeung (2004)**	**Robinson & Malhotra (2003)**	**Kaynak & Hartley (2005)**	**Vanichchinchai & Igel (2011)**
Strategic supplier partnership Customer Relationship Information sharing Quality of Information sharing Postponement	Supplier integration (strategic planning, buyer-supplier relations, operational improvement, alliance) Supplier development (supplier development management, strategic purchasing) Supplier selection (supplier quality system, Supplier quality culture)	Inventory Management Supplier Management Production Management Information Management Technology Management Quality Management	Customer focus Employee relations Quality data reporting Supplier Quality Management Product & service design Process Management Effective Inventory Management	Information Management Lean System Partnership Management Strategy Organisation Cost Flexibility Relationship Responsiveness
CONCEPTUALIZE COMMON DIMENSIONS OF SCM PRACTICES (S1=Information Management, S2=Lean Systems, S3=Partnership Management, S4=Strategy, and Organisation)				

Giannakis et al.'s (2004) study discussed that the term SCM was first introduced by Oliver and Webber in the year 1992, when SCM term described as an amalgamation and relabelling of established business activities, notably: "logistics" (integrated transportation, warehousing, and distribution) and operations management (manufacturing, purchasing, order & inventory management, Production Planning, and control, and customer services). Gunasekaran & McGaughey's (2004) study discusses that QM could play a key role in improving supply chain management. Bandyopadhyay & Sprague (2003) study mentioned that TQM could be

implemented in the supply chain to enhance competitiveness. Thus, deliver quality products to customers in time and at competitive costs (see Fig-2.3.3-1).

Fig-2.3.3-1: TQMP relating to SCM

Perez & Sanchez's (2001) study discusses that in the automotive sector, parts or components are mostly manufactured and supplied by a network of specialized vendors. Therefore, the price, quality, and delivery of an automobile depend significantly on those components, which in turn are influenced by the quality and efficiency of all partners along the supply chain. Kuei & Madu's (2001) study discusses that supplier participation is needed to ensure supply chain excellence that continues to focus on customers, IT systems quality, and the trust relationship. Therefore, the entire supply chain needs to utilize the TQM approach to maintain an external focus on customers and make use of the Supply chain quality management (SCQM) approach to ensure best practices in SCM to enhance the firm's supply performance (FSP). The goals of SCQM then to achieve customer satisfaction, a trusted relationship between customers and suppliers, and a high level of supply chain information system. According to Ross et al.'s (1997), the SCQM is the formal coordination and integration of business processes involving all partner organisations in the supply channel to measure, analyse and continually improve products, services, and processes to enhance FSP (see Fig-2.3.3-2).

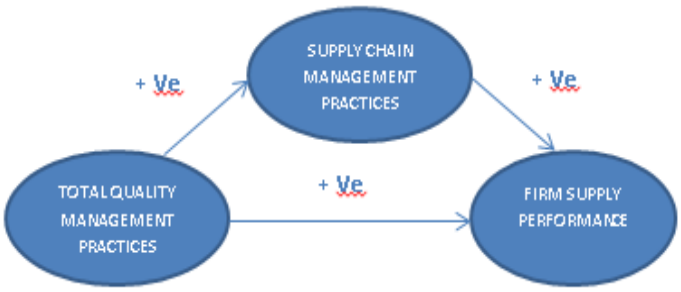


Fig-2.3.3-2: TQMP, SCM directly or indirectly relating to FSP

Counterfeiting continues to be a sensitive issue and the literature review reveals that brand manufacturers trying to develop risk mitigation capabilities in their supply chains to reduce the negative impacts of counterfeiting. Machado et al.'s (2018) study address risk mitigation and resilience in supply chains. Risk-averse companies are more proactive and have a broad number

of mitigation capabilities to control counterfeiting activities in SC. Soares et al.'s (2017) study said that effective management of quality across the entire SC is maintained when a firm maintains a smooth supply of high-quality products to customers. Wagner & Bode's (2006) study reviews the existing strong relationship between vulnerabilities and risk in a supply chain with the help of theoretical groundwork and a developed understanding of antecedents of supply chain vulnerabilities (see Fig-2.3.3-3).

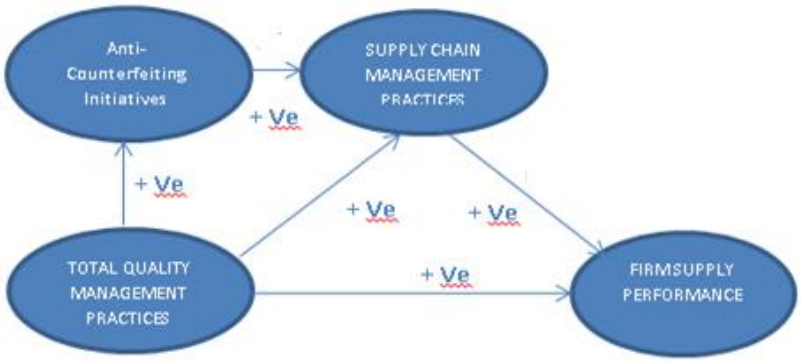


Fig-2.3.3-3: TQMP, SCM directly or indirectly relating to FSP

2.3.3a) SUPPLY CHAIN MANAGEMENT PRACTICES

Kim's (2006) study examines the causal linkages among SCM practices, competition capability, the level of SC integration, and firm performance. Where researcher emphasized that once supply chain integration has been implemented it is advisable to focus on SCM practices and competition capability. Shah et al.'s (2002) study discussed that much of the current research in SCM focuses on an upstream or downstream side of the supply chain. Tan et al.'s (2002) study identifies six aspects of SCM practices: supply chain integration, information sharing, supply chain characteristics, customer services management, geographical proximity, and JIT capability. Chen & Paulraj's (2004) study uses supplier base reduction, long-term relationships, communication, cross-functional teams, and supplier involvement to measure buyer-supplier relationships. Lee, S.M. et al.'s (2011) study proposed a research model that describes the impact of SC innovation, supplier cooperation, SC efficiency, and QM practices on firms' performance. Wathne & Heide's (2004) study discusses two key implications for managers; 1) identify specific strategies that are used to manage SC relationships; 2) described the effects of these strategies across all levels in the overall chains. The SC literature supported different supply chain factors like QM practices, organisational performance, Supplier development practices, Buyer-supplier performance, and Integration approaches (suppliers, internal supply chains, and distributions). Lo & Yeung's (2004) study

emphasizes critical elements of strategic alliance practices [supplier integration (strategic planning, buyer-supplier relations, operational improvement, alliance), supplier development (supplier development management, strategic purchasing), supplier selection (supplier quality system, supplier quality culture)] and total quality philosophies [customer focus, continuous improvement, total involvement] could enhance global SC performance. Li S. et al.'s (2005, 2006) studies discuss five dimensions of SCM practices (strategic supplier partnership, customer relationship, level of information sharing, quality of information sharing, and postponement of internal supply chain processes) and test the relationships among SCM practices, competitive advantage, and organisational performance.

2.3.3a.1) LARGE SCALE (LS) SYSTEM MODEL (THAI MODEL)

Vanichchinchai & Igel's (2011) study investigates the relationships among total quality management practices (TQMP), supply chain management practices (SCMP), and firm's supply performance (FSP) in the automotive industry in Thailand. The measurement instruments for SCMP, TQMP, and FSP were developed based on an extensive literature review and verified by experts, pilot tests, and various statistical techniques to ensure reliability and validity in structural equation modeling (SEM) constructs. The hypothesized model was tested through a path analysis. Qualitative case studies of large first-tier of automotive suppliers conducted to obtain more in-depth information. The findings of the study were the set of SCMP, TQMP, and FSP measures which were found reliable and valid for Thailand's automotive industry (see Fig-2.3.3a).

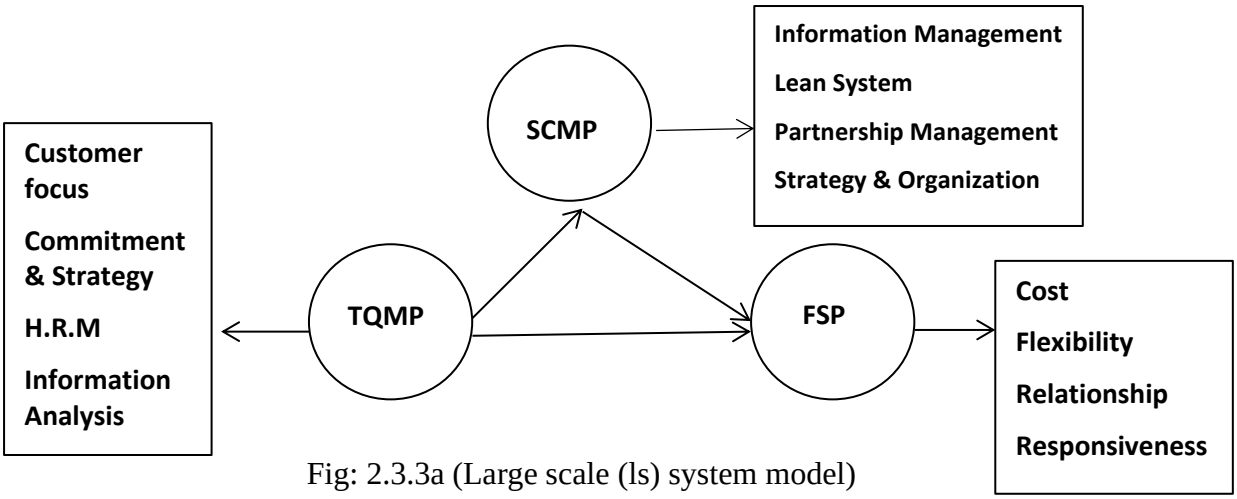


Fig: 2.3.3a (Large scale (ls) system model)

The original model indicated that the TQMP not only had a significant direct positive impact on SCMP and FSP but also had a significant indirect positive impact on FSP through SCMP. Vanichchinchai & Igel's (2011) study introduces reliable and multiple indexes of sub-

constructs (SCM practices, TQM practices, and FSP) where SCM practices sub-constructs are: information management, lean system, partnership management, and strategy and organisation. The results indicate that higher levels of SCM practices can lead to enhanced competitive advantage which has a positive impact on organisational performance. The other factors like geographical proximity, JIT / lean capability (Tan et al.'s, 2002), cross-functional teams, logistics integration (Chen & Paulraj, 2004), agreed-on vision and goals, and supply chain leadership (Min & Mentzer, 2004) are also identified in the literature.

A. INFORMATION MANAGEMENT

Li S. et al.'s (2005) study discusses that "Information sharing" refers to the extent to which critical and proprietary information is communicated to one's supply chain partner. Organisations need to view their information as a strategic asset and ensure that it flows with minimum delay and distortion. Kanji & Wong's (1999) study discusses that the order completion process for shipped orders wholly encompasses many functional areas, as opposed to a compilation of fragmented departmental information. Principles and concepts include leadership, customer focus, cooperative relationship, integrated process and information management, continuous improvement, and business excellence. Sharing information timely with the supply chain partners regularly as a single entity is advantageous. Li S. et al.'s (2005) study discusses that "Information quality" includes such aspects as the accuracy, timeliness, adequacy, and credibility of information exchanged.

B. LEAN SYSTEM

The term ''lean'' is used to refer to a system that uses less input to produce at a mass-production speed while offering more variety to the end customers. Vanichchinchai & Igel's (2011) discussed that streamlining business processes (e.g. Ordering, receiving, shipping, and other related paperwork) with trade partners is necessary to bring excellence to FSP. Study regarding the implementation of lean management in the organisation, Berger et al.'s (2018) study discusses three aspects of lean implementation in the supply chain area comprise: a) Lean supply (upstream activities), including supply and production; b) Lean distribution (downstream activities), including warehousing, transportation, retailing and customer service; c) Lean supply chains representing the integration of end-to-end supply chains; d) SC members comprise suppliers, manufacturers, distributors, healthcare service providers, customers, prescribers, and pharmacists. Nimeh et al.'s (2018) study identifies five lean SCM practices based on an extensive literature review, namely, just-in-time system, the flow of information, supplier relationship, customer relationship, and waste reduction.

Li S. et al.'s (2005) study refers to "Internal Lean practices" and is defined as the practices of eliminating waste (cost, time, etc.) in a manufacturing system, characterized by reduced setup time, small lot sizes, and pull production. The "Supplier relationship" is another very important factor that does matter to ensure cost-effective supply for the organisation. As the ISO 9000:2008 revisions put more emphasis on business results, customer relationship management, customer satisfaction, and long-term, mutually beneficial supplier relationships, indicating efforts to look beyond the enterprise. Oakland's (1989) suggested a two-stage process: 1) establish foundations; 2) introduce core techniques. Establishing foundations means the company must be organized and managed to achieve quality, low cost, minimum lead times, and high flexibility.

C. PARTNERSHIP MANAGEMENT

Vanichchinchai & Igel's (2011) study says that supply chain effectiveness & efficiency depend significantly on the degree of integration across the supply chain. Although SCM emphasizes external integration, the actual implementation must begin by integrating internal functions & then moving to external integration among business partners. Vanichchinchai and Igel's study cited Lockamy & McCormack's (2004) identifies four stages of SCM maturity, comprising ad hoc, defined, linked, integrated & extended. The stages within these maturity levels begin with weak coordination among the internal functions & then mature into integration with external business partners. Ideally, the entire supply chain should be viewed as a single system, called a "seamless supply chain." Li S. et al.'s (2005) study discusses that a "Strategic Supplier Partnership" is defined as a long-term relationship between an organisation and its suppliers. It is designed to leverage the strategic and operational capabilities of individual participating organisations to help them achieve significant ongoing benefits. Vanichchinchai & Igel's (2011) study cited Waterson et al.'s (1999) says that the current use and effectiveness of modern manufacturing practices and found the most common practices to be supply chain partnering, TQM, team-based working, and integrated computer-based technology.

D. STRATEGY AND ORGANISATION

Heist's (2011) study analyses the lack of strategic planning for information technology management in the U.S and research work proved that there exists a significant relationship between information technology management effectiveness and strategic planning. Soni & Kodali's (2011) investigated the mediating role of supply chain strategy between competitive strategy and supply chain performance in the Indian manufacturing industry. The result of this study revealed that choices of competitive strategy and supply chain strategy affect business

and supply chain performance. Karim's (2011) examined the extent to which management information system was implemented in strategic and tactical planning for decision-making. Results from the study revealed that management information system was primarily used in banks to enhance strategic planning. Forker et al.'s (1997) study demonstrates the relationship strategies between the performance of the supply chain and the adoption of TQM practices. Employing a rigorous study in the electronic components industry, spells out four aspects strongly related to quality management policies: (1) maintain and improve the quality control department; (2) provide the suppliers (and the suppliers of the suppliers) with incentives to encourage quality; (3) collect data on defects and get this information to all company employees; and (4) give employees training, recognition, and incentives for their full cooperation in quality improvement.

2.3.3a2) <u>RESEARCH GAPS PRESENT IN THE THAI MODEL</u>

- The Thai study lacks model testing for external validity. Verification is possible only after checking the repeatability of the findings by confirming the completeness of the model's dimensions and measures.
- The study introduced the measurement instrument for TQMP, SCMP, and FSP for the automotive industry. The motivation behind this study is to explore the research methodology and to use the referenced measurement instrument (from the original model) with certain amendments to address the product-counterfeiting issue in supply chains, under a deceptive environment, for the automotive industry in Pakistan.
- The original model missed the combined concept of SCQM (TQM + SCM) at the industrial level. The writer suggested going for further investigation for SCQM. Thus, created space for researchers to explore conceptual philosophical integration (miss-specification issue OR model incompleteness).
- No publication found linking cultures, ethical buying behaviour, governance model supported SCQM environment and product counterfeiting in SC.
- The study requires external validation through empirical testing of the model. Exploratory and explanatory work is required, as Vanichchinchai & Igel's (2011) study tests the model in the automotive industry in Thailand, and lacks observation and verification steps for external validity in the new context.

- The study showed a possibility of response biasness due to convenience samples and require random samples for generalization.
- The theory-based concepts require confirmation that the Thai model is complete and able to capture the impact of the Anti-Counterfeiting measures (model appropriateness) on the FSP in the automotive industry's supply chains in Pakistan. Furthermore, the theory-based concepts also require confirmation that the Thai model is statistically valid.
- Theory lacks reasoning about over-dependence on the suppliers, categorizing the counterfeiting activity signals, determining a relationship between time pressure and workload pressure, in purchasing decisions that may create problems for decision-makers to make the right purchase decisions timely.
- No publications explicitly found, in the existing counterfeiting body of knowledge stream, addressing RDT, RBV, Deception and Signalling theory, Self-control theory of Crime, and the Crime preventions theories about deceptive buying counterfeiting phenomenon in automotive supply chains.

2.3.4 SIMILARITIES AND DIFFERENCES BETWEEN TQM & SCM

Vanichchinchai & Igel's (2009) study refers to the studies [Sila et al.'s, 2006; Chin et al.'s, 2004; Robinson & Malhotra, 2005; Li et al.'s, 2006; Kuei et al.'s, 2001] state that the TQM & SCM studies are essential for organisation competitiveness and evolved in similar ways to reach the goal, customer satisfaction. TQM emphasizes internal participation (employee) and SCM focuses on external (business partners) partnership but there is a need to emphasize both internal and external partnerships to further strengthen the emphasis on "total" TQM and the entire supply chain in SCM. Vanichchinchai & Igel's (2009) study develop a comparative understanding of the philosophies, goals, evolution, and integration of both approaches therefore could improve opportunities for integrated implementation and further research. However, there is a need for a new combined standard framework for SCM for practical implementation. The study cited [Prajogo & Sohal's (2004); Casadesus & Castro's (2005); Lambert et al.'s (2005); Croom et al.'s (2000)] that TQM focuses more on quality conformance by aiming to deliver error-free quality product and services. Whereas SCM satisfies customers in terms of time-based delivery performance by using cost-effective supply chain efforts. Thus, both studies emerged in response to the need to develop tactical strategies for operational functions (inspection and logistics). So better quality and a faster delivery always lead to lower

costs. Thus, emerge a new operational management concept of SCQM from the integration of the operational functions of the TQM and SCM studies [see Appendix- Table (S-1)].

2.3.4a) INTEGRATE SCM & TQM KNOWLEDGE STREAMS WITH SCQM: BENEFITS

In the Int'l JOURNAL OF QUALITY & RELIABILITY MANAGEMENT (Emerald Publication) Mellat-Parast's (2013) study discusses that the buyer/supplier quality practices are the first step to developing SC-level quality products. The study discusses inter-organisational competitive advantage and buyer/supplier performance outcome, where the study extends concepts of quality to SC relationships. The study reveals evidence related to the understanding of QM practices within an SC environment from an inter-organisational perspective. The study enhances SC satisfaction and performance, and support provides propositions: P1) SCQM practices have a positive effect on firms' SC satisfaction; P2) SCQM practices have a positive effect on firms' SC performance; P3) Suppliers' QM practices have a positive effect on inter-organisational learning in SC; P4) Buyers' QM practices have a positive effect on inter-organisational learning in SC.

The study combines conceptual aspects of SC quality practices [trust, governance, information integration, process integration, cooperative learning], SCQM practices [buyer-supplier satisfaction and performance], Firm-level quality practices [top management support, information system, employee involvement, process improvements, product/service design, customer satisfaction]. In the Journal of operations management (Elsevier publication) Kaynak & Hartley's (2008) study, in continuation to Kaynak's (2003) contribution towards the development of the SCQM theory (including SQM and customer focus in the QM model) to improve quality performance after integrating SC members. The study suggests that SCM consists of internal & external practices which connect all parties within SC. Two QM practices (SQM + Customer focus) lie within the SCM domain, which supports the importance of internal/external integration for quality performance. QM practices covers [(management leadership, training, employee relations, customer focus, quality data & reporting, SQM, product/service design, process management)]. In the Int'l Journal of Logistics: Research & Applications (Taylor & Francis publication) Peck's (2006) study argues that attitudes to risk and approaches to risk management vary greatly within SCM and between related SCM disciplines. The study says that SCM is an integrative, cross-functional discipline where SC cross-disciplines vulnerabilities are considered a concern for practitioners and academics, and securing SC malign interventions (counterfeiting, etc.) is an important task. For that matter, a

contingency plan is needed to mitigate the impact where preventive measures fail. In the Int'l JOURNAL OF LOGISTICS: RESEARCH & APPLICATIONS (Taylor & Francis publication) Grubic et al.'s (2010) study emphasizes that there is some generic set of SC processes, which support material and information follow in a dyadic relationship. Two SC process frameworks a) SC operation reference; b) Global SC forum, are identified together with nine evaluation criteria. In the Int'l Conference on Quality Engineering & Management (literature review on QM & SCM: a perspective of integration publication) Fernandes, A.C. et al.'s (2014) study reviews the literature and cited Talib et al.'s (2011) as QM considers as important strategies management tool, which involves the application of principles & practices of quality at all levels of an organisation. Lin & Gibson's (2011) study introduces the concept of SCQM. From the perspective of QM, SCM could be recognized as providing quality products and services involving partners in SC to address customers' expectations. Bastas & Liyanage's (2018) study cited some scholarly contributions in terms of SCQM benefits (Table-2.3.4a).

SCQM Benefits	**Scholarly contributions**
1. Supply chain integration (increased by SC collaboration)	[Carmignani, 2009; Casadesús and de Castro, 2005; Chadha & Gagandeep, 2013; Chen et al.'s, 2013; Flynn & Flynn, 2005; Fynes et al.'s, 2005; Jiang et al.'s, 2010; Kannan & Tan, 2005; Kaynak & Hartley, 2008; Kuei et al.'s, 2011; Lou et al.'s, 2009; Mahdiraji et al.'s, 2012; Mellat-Parast, 2013; Quang et al.'s, 2016; Robinson & Malhotra, 2005; Shalij et al.'s, 2009; Sharma et al.'s, 2012; Talib et al.'s, 2011; Terziovski and Hermel, 2011; Vanichchinchai and Igel, 2009; Wang et al.'s, 2010; Zhong et al.'s, 2016]
2. Improved customer satisfaction	[Casadesús and de Castro, 2005; Chadha & Gagandeep, 2013; Fynes et al.'s, 2005; Jiang et al.'s, 2010; Kannan & Tan, 2005; Lin et al.'s, 2013; Mahdiraji et al.'s, 2012; Mellat-Parast, 2013; Quang et al.'s, 2016; Robinson and Malhotra, 2005; Talib et al.'s, 2011, 2010; Vanichchinchai & Igel, 2009; Zeng et al.'s, 2013]
3. Improved firm performance	[Azar et al.'s, 2010; Azizi et al.'s, 2016; Foster & Ogden, 2008; Lin et al.'s, 2013; Mahdiraji et al.'s, 2012; Mellat-Parast, 2013; Quang et al.'s, 2016; Sarrico & Rosa, 2016; Shalij et al.'s, 2009; Sharma & Modgil, 2015; Talib et al.'s, 2011, 2010; Zhong et al.'s, 2016]
4. Improved supply chain performance	[Flynn & Flynn, 2005; Jraisat & Sawalha, 2013; Lin et al.'s, 2005; Mahdiraji et al.'s, 2012; Mellat-Parast, 2013; Sarrico & Rosa, 2016; Terziovski & Hermel, 2011; Vanichchinchai & Igel, 2010; Zhong et al.'s, 2016]

Table-2.3.4a - Source: Bastas & Liyanage (2018)

Kochan & Nowichi's (2018, p.848-850) study discuss taxonomies of supply chain vulnerabilities (internal, external, and structural) and capabilities (anticipative, responsive, recovery, adaptive, learning) in the SCQM perspective, where relevant counter measures can control counterfeiting. Robinson & Malhotra's (2005) study says that SCQM is the formal coordinating & integration of business processes among all partners in the SC to measure, analyse, and continually improve products, services & processes to create value and achieve customer satisfaction. In the Int'l JOURNAL OF LOGISTICS MANAGEMENT (Emerald Publication) [Fabbe-Costes & Jahre's (2009); Fabbe-Costes et al.'s (2009); Fabbe-Costes &

Roussat (2011)] studies review evidence of the SC integration and explains its importance concerning firms' performance. The study says that it is possible to differentiate SC integration concerning layers, scope, and degree. The possible trade-off between integration and flexibility to what suitable approach (modularization & standardization) in terms of plug-in and plug-out scenarios. In the Int'l JOURNAL OF MANAGEMENT SCIENCES (Elsevier publication) Kannan & Tan's (2005) study discusses the linkages that exist among JIT, TQM, and SCM regarding the impact and business performance. The study helps researchers in understanding how the organisation sees these linkages as operations strategies. The study outcome shows that a "commitment to quality" and understanding of "SC dynamics" have the greatest effect on performance.

Lim, Ai-Fen et al.'s (2021) study says that the empirical studies on the connections between SCQM practices and sustainability performance (SP) are gaining popularity not only in academic circles but also in the industrial world. The study introduces a research model that extends the current QM and SCM literature by investigating the selected SCQM practices to enhance the SP. Lim, Ai-Fen et al.'s study says that the theoretical contribution of SCQM is connected to the philosophy of QM and SCM. Vanichchinchai's (2019) study says that the QM and SCM are the two most critical disciplines for business competitiveness that are rarely examined together in the SCQM environment. There are various QM and SCM implementation frameworks that are effective when used to cater to problems related to different industries. Vanichchinchai's study found that QM and SCM frameworks can be determined by generality (generic or specific) and scopes (wide or narrow) into four categories (Qualifier, Improver, Extender, and Winner). Moreover, Vanichchinchai's study says that a generic framework is applicable in any organisation and in any industry. The narrow scope focuses on operational issues and internal functions. The wide scope emphasizes strategic issues and extends to cover more external partners. The QM and SCM frameworks enhance managerial understanding of implementing the SCQM practices.

Table-2.3.4a: QM and SCM Frameworks Characteristics

Scope	**Narrow Scope (Specific=Improver, Generic=Qualifier)**	**Wide Scope (Specific=Winner, Generic=Extender)**
Focused level	Operational	Strategic
Focused Functions	Generic = Conventional QM/SCM functions, ISO-9001, SCOR Specific = JIT, QR, ECR, TS-16949, HACCP	Internal/External functions Generic = MBNQA, GSCF Specific = MBNQA, SCM (CPT, S.T, RBV, D.T, N.T)

New concepts / Empirical contribution	TQM, SQP	SCQM, BC
SC complexity	Low	High
Performance	Conventional QM (quality) / SCM (Delivery and cost) performance	FSP, Business, and operational performance
Implementation	Less difficult	More difficult
Investment	Less	More

Source: Vanichchinchai (2019) and author

The Table-2.3.4a refers that the narrow scope of the generic QM and SCM frameworks emphasises more on operational issues or functions according to their primary goals. The narrow scope of the generic QM and SCM frameworks emphasises less on strategic issues and supportive functions. Vanichchnchai's (2019) study mentioned that the QM and SCM frameworks although easier to introduce and manage, cannot achieve ultimate integration among interrelated internal and external partners' activities. These frameworks lack concentration due to their narrow scope and generality. This framework can be considered as a Qualifier for SCM or QM for doing business. The QM and SCM frameworks' wider scope of both (generic/specific) is more strategic and extends to cover more partners. These frameworks have strength in enhancing the opportunities to add value through total integration.

2.3.5 NETWORKED GOVERNANCE MODEL OF SCQM

Queiroz et al.'s (2020) study discuss BC-based SCM integration as a hot topic, requiring the support of the top SCM / logistics journals. In this connection, there are subject matter limitations related to the knowledge base scarcity in the networked governance model of the SCQM. Wang, Y. et al.'s (2018) study refers to the BC sharing information which verifies and manages the blocks by using a model governance protocol. Chen, S. et al.'s (2017) study discusses that enhancing traceability in the supply chain provides firms an opportunity to credibly make and verify claims. The lack of a shared traceability platform (networked governance model) from sub-tiers to aftermarket prevents OEMs to implement anti-counterfeiting strategies that can reduce the counterfeiting phenomenon in automotive supply chains [OECD (2016); Alhassan I. et al.'s (2016)]. Queiroz et al.'s (2020) study reveal findings that BC supply chain application uses Industry 4.0 with IoT technologies. BC represents a cutting-edge technology that promises to transform established business models [see Appendix-Table (S-3)]. Therefore, BC SCM relationships within the networked governance model of SCQM support well-established SCM areas (distribution, product traceability, intelligent transportation system, CRM, procurement, quality, and anti-counterfeiting efforts). Kochan & Nowichi's (2018, p.850) study discusses the taxonomies of supply chain capabilities

(anticipative, responsive, recovery, adaptive, learning) from the SCQM perspective, where relevant countermeasures can control counterfeiting (SC disruption). Kochan & Nowichi's study [cited Blackhurst et al. (2011)] suggests that the effect of disruptions on SC varies depending on the level of supply chain resilience (SCRES), which extends RBV theory to S.T theory. Gogos et al.'s (2022) study discusses that BC is an emerging and promising technology that offers advantages like data privacy & security, distribution & sharing of information, traceability of products through the whole SC, immutable data anonymity, and anti-counterfeiting character. Gogos et al., the study also discusses four features (visibility, integrity, orchestration, and virtualization) of technology that enhance the core objective of SCM to meet the global economic challenges (track and trace, anti-counterfeiting, and compliance).

2.3.5(a) SHARING INFORMATION TECHNOLOGY: SCQM ENVIRONMENT

Roeck et al.'s (2020) study emphasize that in the supply chain, SIT introduces Transparency, Trust, and Disintermediation as a key value proposition. Transparency improves visibility in the supply chain, whereas Traceability is enabled by the ability of a SIT solution to trace back every transaction. Trust is operationalized by ability, magnanimity, and integrity. Disintermediation is the elimination of the role of intermediaries in a supply chain which ultimately enhances the trust level in the firm processes. Chen, S. et al.'s (2017) study discusses how to use BC to solve the problems caused by distrust in the SCQM environment to enhance the management of product qualities. The study claims that technology solves the issue of distrust based on unchanged information and traceable records through standardized norms and agreements. The auto-run intelligent system executes quality management smart contracts for that matter. The technology-based applications extended from financial services (Bitcoin) to SCM practices, supported by intelligent manufacturing and the internet of things (IoT). Cheng et al.'s (2017) study discusses that in BC no single party controls the data, which is verified & visible to all parties. The decentralized storage of data reduces the risk of single-point access failure associated with centralized databases. Chen, S. et al.'s (2017) study system architecture and discusses the framework and the system architecture composed of four layers based on different functions. The bottom layer is the IoT sensors layer, GPS is used to locate the products in the logistics process. Quality information, assets, and transaction information are recorded with RFID technology. Considering the relatively higher cost of RFID, barcodes are used alternatively in some processes when the standard of accuracy is not an immediate requirement. Considering that numerically controlled devices have their information systems, it is more efficient to develop some interfaces for acquiring information from these devices. The second

layer is the Data layer, including BC. The third layer is the Contract layer. Data gathering and sharing assist quality control, whereas smart contracts help in executing real-time quality monitoring and control activities. The fourth layer is the business layer where business-related activities take place at the enterprise level, in firms' supply chains. In turn, enhances FSP. The sharing information technology supported the Industry 4.0 maturity model to determine the maturity level of the firm through a self-assessment method to validate the product development process. Schumacher et al.'s (2016) study discuss that enterprises are currently facing substantial challenges to disruptive concepts such as the Internet of Things, Cyber-Physical Systems, or Cloud-based Manufacturing (Industry 4.0). The study also discussed that most companies at the time do not possess the required knowledge about industry 4.0 to self-assess the maturity level of their own company. Additionally, the study discussed the self-assessment procedure which determines the maturity level of the company.

2.3.5(a-1) Theorisation of technology-supported SCQM

Theories from different areas-benefit disciplines (Halldorsson et al.'s, 2007) and their adaptations are applied successfully in a wide variety of technological contexts in the SCM research [Defee et al.'s (2010); Kembro et al.'s (2014); Haldorsson et al.'s (2015); Swanson et al.'s (2017); Treiblmaier et el. (2018a)]. This study provides a socio-techno-economic perspective to answer the question of how do the theoretical arguments, supply chain complexities, and assumptions underpin the counterfeiting knowledge stream and help SC practitioners to detect counterfeit signals to avoid illicit purchases? The implications of the technology from different theoretical perspectives consider a promising starting point for further theory development and empirical research. Table-2.3.5a shows how different technology attributes can be integrated into the four theories. The literature review reveals that smart contracts have the potential to solve or alleviate the problem of information asymmetry. The RBV focuses on investigating the internal competencies, based on a subset of the company's resources, to gain a competitive advantage. The use of technology can provide strategic opportunities. The CPT can help to explain how weak governance and lack of sufficient guardianship provide counterfeiters opportunities to infiltrate the licit SC. And, how effective use of technology will impact firm's supply performance (FSP). The problem of information asymmetry where deceptive buying takes place is from the S.T perspective. The customers' ability to recognize signals of trust. Firms should recognize the cost of observability of the signals. For that matter, a quality plan with technology helps firms to take complete advantage. Finally, the technology promises to create smart contracts to improve transparency in the transactions and remove process

ambiguities. Thus, the technology helps the firms to control product counterfeiting activities in SC and enhance FSP.

Table-2.3.5a: Theoretical framework applied to technology-based SCQM research

Characteristics	CPT	ST	RBV	DT
Behavioural assumptions (Bounded relationship)	Opportunism	Deception in buying situations	Trust in transactions, knowledge transfer	Increased info transparency to reduce ambiguities
Problem orientation, (Internal competence development)	lack of sufficient guardianship	customers' abilities to process signals of trust	Resource allocations/ development	Supervision and contract execution
Key questions, Why & how do firms differ? If they use technology.	Why & how effective technology governance structure provides control?	Why strong signal of trust is important? How use of technology helps?	Why & how do technology-related resource generates competitive advantage?	Why & how does technology impact contract efficiency?
The primary focus of the analysis	Willingness to seize the opportunity	Cost of observability of the signals	Resource attributes and competitive allocations	Smart contracts can enhance control
Nature of relationship	Access to heterogeneous resources, Firms' cooperation	Quality plan, Strategic relationships	Access complementary resources, technology is a new competence	Harmonize conflicting goals
Primary domain of interest	Resiliency in processes	Easy market access to counterfeits, transmitting false signals	Firm's resources and capabilities, identify & develop competencies	Align conflicting goals with smart contracts

Source: Treiblmaier (2018a) and Author

Theoretical implications: Original theory-building efforts in the SCQM are scarce (Touboulic & Walker, 2015), and the refinement and adaptation of existing theories encourage researchers to perform investigative studies. This study takes help from the collective knowledge streams within a particular domain to support the formulation of the theoretical framework. The literature review reveals those four complementary theories (CPT, S.T, RBV, D.T) provide support to the use of technology in SC to restructure processes. The CPT and S.T theories originate from neo-classical economic theory and help to answer questions regarding how to structure SCs. These theories fall short when comes to taking into account human behaviour, critical resources, and suppliers' contractual binding relationships (Halldorsson et al.'s, 2007). These factors can be addressed by including RBV and D.T, which help to determine what is needed to manage an organisational SC structure. Taking four theories together represents

complementary perspectives for inter/intra organisational attributes (SCQM) that allow product traceability platforms for managers to make decisions. The research questions on existing theory allow for the incremental development of a body of research that makes it easier to replicate or reject previous findings. Applying characteristics of the theoretical framework applied to technology-based SCQM research helps researchers to identify potential research areas.

Managerial implications: The four complementary theories (CPT, S.T, RBV, D.T) that serve as a starting point in the study are general theories requiring further refinement, validation, and testing. Academically sound research results that are based on empirical findings and well-founded reasoning will benefit decision-makers. Combining theories to disclose answer to the research questions (by analysing, explaining, predicting, designing, and acting) help managers to better understand the implications of the use of technology in SC to control product counterfeiting problem. The SC structural issues are addressed by CPT and S.T where CPT explains how complex inter/intra-organisational dependencies increase the importance of information transparency. The S.T focuses on the cost of observability of the signals, quality plan, and strategic relationships. To understand how attributes of the technology can lead to an adjustment in organisational size and design of the contractual agreements. The managerial issues are addressed by the RBV to critically assess the role, importance, and growth potential of the existing organisational resources. How do the attributes of the technology impact organisational processes and how changes can improve competitive power?. Finally, the D.T provides a rationale for assessing the role of smart contracts that can enhance control on processes offered by technology, after harmonizing the conflicting goals. The methodological knowledge needed to address research questions is derived systematically. This study benefits managers to understand how the theoretical framework applied to BC-based SCQM research would impact organisations in any domain.

Methodological approach: The collective knowledge streams within a particular domain support the formulation of the theoretical framework. The theoretical framework applied to technology based SCQM research concerns possibilities to answer the explanatory questions. The methodological approach is discussed in the chapter-3 and can be classified into the four theoretical perspectives, which can analyse (what?), explain (Why?/How?/When?/Where), predict (testable proposition but lacks justifiable causal explanation), and explain plus predict or prescribe. While design and action research give prescriptions for constructing artifacts (Gregor, 2006).

2.3.7 REASONS FOR SELECTING THE THAI MODEL FOR INVESTIGATION

Counterfeiting continues to be a sensitive issue that brand manufacturers do not want their customers to be exposed to. The literature review reveals that brand manufacturers trying to develop risk mitigation capabilities in their supply chains to reduce the negative impacts of counterfeiting. The secondary information shows that counterfeiting is rapidly extending (OECD, 2005:2018). The nature of universality of the product counterfeiting issue in the supply chain is prevalent. The review also shows that counterfeiting deserves more attention (UN Interregional Crime & Justice Research Institute, 2011) as the low level of awareness of the seriousness of this crime by both law enforcers and the public, inadequate response by national governments and the international community are strictly interlinked elements, which need to be tackled in parallel effectively. Wilcock & Boys's (2014) study discusses that there is a substantial interconnection between the reduction of product counterfeiting & QM. The study also says that integrating anti-counterfeiting initiatives with Q.M strategies can reduce counterfeits penetration risk in SC. Xu, D. L. (2011) study says that the quality requirements play a crucial role in SCM, firms require information technology-based architecture for SCQM. Lin & Gibson's (2011) study introduces the concept of SCQM. From the perspective of QM, SCM could be recognized as providing quality products and services involving cross-partners in SC to address customers' expectations. Robinson & Malhotra's (2005) study says that SCQM is the formal coordinating & integration of business processes among all partners in the SC to measure, analyse, and continually improve products, services & processes to create value and achieve customer satisfaction. Lin, C. et al.'s (2013) study says that the SCQM practices help organisations in managing resources and achieving collective performance outcomes. Soares et al.'s (2017) study said that effective management of quality across the entire SC is maintained when a firm smoothly supplies high-quality products and services to the customers. Soares et al.'s study further say that real quality performance requires an equal focus on both inter-firm and intra-firm relationships among SC partners. More understanding needs to be developed about SCQM with empirical support and validation for the conceptualization and measurement of SCQM practices. So, this gap needs to be filled to examine the impact of SCQM practices on quality performance. Okoth & Ochieng's (2016) study says that the SCQM practices improve organisational markets & financial performance without sacrificing customer satisfaction and can face industry challenges (influx of counterfeits & vulnerabilities). Singh, R. et al.'s (2020) study addresses the BC system for IoT-based SCM to counter counterfeiting. In this study, the primary focus is on improving classic BC systems to make them suitable for

IoT-based supply chain management, and as a secondary focus, applying these new promising technologies to enable a viable smart healthcare ecosystem through a drug supply chain. Table-2.3.7 refers to different conceptual models, system designs, and frameworks that provide linkages to different counterfeiting and SCQM-based knowledge streams, that can integrate the concepts of anti-counterfeiting and SCQM to enhance a firm's supply performance (FSP).

Table-2.3.7: Knowledge contribution link counterfeiting & technology-supported SCQM

Contributions	Conceptual model and research framework	The outcome of the investigation linking Counterfeiting and SCQM support practices
Harvey (1988)	Counterfeit Protection Model (CPM) (A)	The study emphasizes that the economic harm is not the only ill of the counterfeiting, other damages done by counterfeits indicate the severity of the issue. The CPM explains that different departments within the firm, like R&D, distribution & promotion, and marketing departments, should work closely around the product. The collaborative efforts should form the "Product team" to support the firm's "Surveillance Team" in the process of implementing anti-counterfeiting strategies in supply chains to improve FSP.
Kros et al.'s (2020)	SC risk management integration and counterfeiting model (B)	The study findings suggest that firms with greater SCRM integration have a strong orientation toward counterfeit risks, greater maturity in CRM, more consistent SC metrics, and better SC performance outcomes. Thus, SC counterfeit risk orientation (CRO) alone is not able to bring higher improvement in SC metric consistency (MC). The firm-level QM framework leads to a theoretical model to counter counterfeiting. Research has shown relationships among risk-based thinking, SC integration, TQM maturity, and structured quality systems (specifically quality culture and risk management). The theoretical model helps to demonstrate the formal counterfeit management system that integrates across the SC and brings a positive impact on SC metrics (variability control in product quality).
Friedli et al.'s (2010)	Integrated operational excellence model (C)	The integrated operational excellence model emphasizes smooth production scheduling to support make-to-order manufacturing. Companies are trying to build stable running machines and stable processes (operational processes effectiveness) before targeting the objective of maintaining low inventory (operational process efficiencies). Total production maintenance, TQM, JIT, and management systems are important approaches to establishing an integrated operational excellence model. The end-to-end value chain support leads to a higher quality level. Companies need to redesign their existing management systems to facilitate lean understanding to leverage the potential of high education levels among employees.
DiMase et al.'s (2016)	Conceptual model of the electronics SC	There are risk-based informed decisions support strategies, such as priorities high-risk parts, moving beyond the certificate of

	(D)	conformance, incentives for best SCM practices, adopting industry standards, and management for SC resilience. Counterfeiting risk is difficult to mitigate, and limited attempts are made to implement risk-based approaches to test and SCM. Traceability shows the chain of custody but does not assure quality & performance, once the component leaves authorized SC custody. Effective material control requires trusted sources to ensure appropriate material handling and storage to establish coordinated efforts.
Chen, S. et al.'s (2017)	System architecture program model (E)	The framework for BC-based SCQI provides theoretical bases to apply intelligent QM in SC. The framework provides a foundation to develop theories about information resource management in SCQM environment. The SCQM and technologies knowledge streams discuss the problem of lack of trust in SC. BC is a promising technology that can address three challenges in centralized trust mechanism: 1) self-interest of SC members; 2) information asymmetry in production processes; 3) costs & limitations of quality inspection.
Sahoo et al.'s (2020)	A model of the SC BC framework work against counterfeiting with BC-based distributed architecture (F)	BC can prevent the issues transparently and securely. BC can be used to add traceability and visibility to the drug SC to counter counterfeiting activities. A model of BC architecture is presented with a shared information system, which not only prevents drug counterfeiting but also makes supply more robust, transparent, and trustworthy. The model of BC not only controls counterfeiting activities but is also useful in real-time tracking to support product deliveries.
Liu, A. et al.'s (2020)	BC tracing anti-counterfeiting platforms (BTAP) to counter counterfeiting (G)	This study assesses supplier selection at the beginning of project management to establish an evaluation system corresponding to BC tracing anti-counterfeiting platforms (BTAP). The study determines 20 evaluation criteria from the four dimensions of platform overview, core technology, application support, and operations management. To satisfy the customer needs, multi-criteria decision-making (MCDM) follows three main steps. First, quality function deployment (QFD) and the best and worst method (BWM) is used to evaluate the four dimensions of the BTAP and specific evaluation criteria from the perspective of customers to obtain the criteria weight. Second, this method uses the extended Vlse Kriterjumska Optimizacija I Kompromisno Resenje (VIKOR) approach to sort the alternatives. Finally, the improved decision-making trial and evaluation laboratory (DEMATEL) method is

		used to analyse the relationships between the 20 criteria in the four dimensions
Singh, R. et al.'s (2020)	A BC system for IoT-based SCM to counter counterfeiting (H)	In this study, the primary focus is on improving classic BC systems to make them suitable for IoT-based supply chain management, and as a secondary focus, applying these new promising technologies to enable a viable smart healthcare ecosystem through a drug supply chain. The biggest challenge associated with the pharma supply chain is temperature monitoring as well as counterfeit drug prevention. Many drugs and vaccines remain viable within a specific range of temperatures. If exposed beyond this temperature range, the medicine no longer works as intended.
Gupta, N. et al.'s (2017)	Embed special features in CAD model to be used against counterfeiting (J)	The special features interfere with the integrity of the design and effectively restrict high-quality manufacturing to only a unique set of process settings and conditions. This model is printed in a high-quality environment only under a specific set of process flow conditions.
Choi, J.B. et al.'s (2015)	Third-party centralized integrated system (TPCIS) against counterfeiting (K)	The TPCIS overcomes the barriers of the existing solutions with comparative simulation models. The simulation models show how TPCIS improves the situation in the public health system. It improves the main issues including counterfeiting, diverted drugs, and drug shortages in the pharma SCs. It shares not only inventory data but also tracking information with other trading partners, like suppliers, customers, and governments.
Lau et al.'s (2021)	Supply chain regulatory compliance against counterfeiting (L)	The generic design architecture of the BC-based SCM system follows logistic behavioural patterns. The system supports QM, multi-hop routing, and tracing without a unique identifier to counter counterfeiting activities.
Miyamoto et al.'s (2017)	Counterfeit risk management framework (M)	The framework analyses the reason for how vulnerabilities increase the risk of compromised SC integrity. One finding shows the important vulnerability of SC, which is a malicious insider. The other finding is increasing the risk of counterfeit chips entry into the SC, due to the counterfeit-avoidance strategy. The counterfeit-avoidance strategy creates a false sense of security, leading to neglecting common security controls. The study says that the framework complements the existing counterfeit-risk program.
Staake, T. et al.'s (2008)	Electronic product code technology-based model to counter counterfeiting (N)	The "Anti-counterfeiting and RFID" introduces EPC networks and the theory of security and authentication. The EPC Network can be separated into six primary modules, some physical, some logical: (1) RFID tags; (2) RFID tag readers; (3) EPC; (4) middleware; (5)

		Object Name Service (ONS); and (6) EPC Information Service (EPCIS).
Machado et al.'s (2018)	Counterfeit risk mitigation capabilities (O)	Mitigation capabilities enable companies to minimize the negative impact of counterfeiting and make companies more resilient to counterfeiting activities. The findings indicate that when managers allocate resources in earlier phases of counterfeiting, losses are lower. Companies presented different levels of proactivity for counterfeiting resilience. This study analyses how companies developing mitigation capabilities in their supply chains can reduce the negative impacts of counterfeiting. The mitigating capabilities include traceability, collaboration in SC, trust, and control, IPR, preparedness, redundancy, visibility, predictive capability, agility, and flexibility.
Abbas, K. et al.'s (2020)	Drug SCM recommendation (DSCMR) system against counterfeiting (P)	The DSCCMR system consists of two main modules: BC-based drug supply chain management and a machine learning-based drug recommendation system for consumers. The drug supply chain management system is deployed using Hyperledger fabrics which are capable of continuously monitoring and tracking the drug delivery process in the smart pharmaceutical industry. BC technology has changed the traditional supply chain method to a new robust, automated, secure, audible, and transparent way. It ensures that the entire supply chain process is fool-proof and prevents fake drugs from entering the system completely
Quang et al.'s (2016)	SCQM conceptual framework for firm performance (Q)	The study introduces a conceptual framework that provides a comprehensive picture covering core dimensions of SCQM with different aspects of firm performance. This conceptual framework can be used as "a guideline" for theory building and measurement instrument development of SCQM and firm performance. An extensive structural model identifies direct and indirect relationships between SCQM and firm performance. Practitioners/managers can apply this model as "a road map" for implementing SCQM practices. This study concentrates on the practices which improve QM aspects of the supply chain, known as SCQM practices.
Zhong et al.'s (2016)	SCQM conceptual framework for hotel performance (R)	This study focuses on supply chain quality (SCQ) in the hospitality industry in China and the importance of the synergy of quality management (QM) and supply chain management (SCM). The study also sees the significant co-relationship among QM practices, SCM practices, SCQ, and hotel performance, and examined the effect of contextual variables. The study sees QM practices / SCM

		practices are positively related to SCQ and consequently influence hotel performance. The SCQ has a mediating effect between QM/SCM practices and hotel performance. Contextual variables truly play a moderator between QM/SCM practices and SCQ.
Fernandes, C.F. et al.'s (2017)	Integrated supply chain management and quality management conceptual model for organisational performance (S)	The study develops a theoretical basis with some common practices for integration of quality management (QM) and supply chain management (SCM). The findings suggest that the synergies of QM and SCM can promote the integration of the approaches which will promote a set of significant organisational benefits. This study contributes to the understanding of the critical factors for effective integration of supply chain QM.
Vanichchinchai & Igel's (2011)	SCQM practices enhance FSP (T)	The study model discusses the need to implement integrated practices of TQM and SCM to improve FSP with the help of the hypothesized model. This study's qualitative results suggest that the broader role of the TQM practices can, directly and indirectly, facilitate the implementation of SCM practices to improve FSP. Vanichchinchai & Igel's study says that TQM and SCM are large-scale management systems and managers have not considered them different. Both could be implemented together to improve FSP.
Robinson & Malhotra (2005)	SCOR model linkages to SCQM practices for organisation supply performance (Quality-SCM framework) (U)	SCOR model supports the SCQM practices with linkages among Intra and inter-organisational activities. The study findings are based on case study workings in the domain of QM and ISO 9001 certification processes. The study proposes a Quality-SCM framework that identifies three opportunities for future SCQM research.
Malmir et al.'s (2016)	Interpretive systems modeling (ISM) for SCQM (V)	The study discusses the importance of the reward and penalty system implemented in supply chain quality management (SCQM) of medical equipment for hospitals by analyzing the behaviour of the simulated model and calculating the revenues. The study says that Gupta and Ramshba adopted the approach to the supply chain through interpretive systems modeling (ISM) for interacting factors contributing to the health care supply chain. The study recommends that the government should adopt a complete and accurate reward mechanism to realize domestically high-quality production and prevent illegal trafficking of poor-quality equipment.
Zu & Kaynak (2012)	Outcome-based & behavioural-based approaches and their operationalization to	The outcome-based and behavioural-based approaches provide managers with a guideline about critical conditions, managing supplier quality, to build the firm's efficient SCQM.

	enhance organisation performance (W)	Apply agency theory to study SCQM to manage supplier quality that covers interactions between buyers & suppliers. Resource dependence theory helps researchers to investigate how firms manage quality when they are forced to rely on certain suppliers in product and service delivery. Five types of agency-based factors (information asymmetry, gaol conflict, risk aversion of suppliers, length of relationship, and task characteristics) impact on firm's design and QMS activities for SC. The study findings show that to achieve desired performance from suppliers, different management mechanisms used for different suppliers with attributes as per the buyers' relationship. are applied
Kumar, A. et al.'s (2020)	Data-driven SCQM on organisational performance (X)	The objective of the study is to test a conceptual model based on the interrelation between data-driven supply chain quality management practices (DDSCQMP) and the performance of organized retailing firms in India. The study provides empirical justification for a structural model that identifies a positive and significant relationship between DDSCQMP and organisational performance within the context of the organized retail sector of India. The research findings confirm hypotheses and reveal the statistically significant relationship between DDSCQMP and retailers' performance at an aggregate level. However, the results of the individual-level analysis of DDSCQMP appear to vary from practice to practice. Among various DDSCQMP, "customer focus" with the highest beta (ß) value was found to have the greatest impact on performance followed by "employee relations".
Madu & Kuei (2014)	Integrating the SCQM and the Context Intervention Mechanism Outcome (CIMO) logic on Lean Six Sigma principles (Y)	The organisation operates with limited resources (RBV) and often has limited communication capabilities. To apply context-intervention-mechanism-outcome (CIMO) logic in the SCQM environment, the context, intervention, mechanism, and outcome conditions are important. The CIMO logic provides a guideline to facilitate lean six sigma to eliminate waste and improve SCQM performance. PDCA cycle helps organisations assess their maturity level of operational excellence and lead the organisation in the desired direction. A team of diverse specialists is required to improve the efficiency and effectiveness of SC activities.
Mellat-Parast (2013)	A conceptual SCQM model linkage between firm-level and supply	A review of the literature on quality management, supply chain management, and strategic management is conducted to develop key practices associated with quality management in a supply chain environment. This study extends the concept of quality to the

	chain-level quality practices (Z)	supply chain by focusing on key practices that influence the quality of supply chain relationships. This study also develops a theoretical base for supply chain quality from the learning perspective. By utilizing the relational view of inter-organisational competitive advantage. The study identifies learning-driven practices that influence buyer-supplier performance outcomes. The findings suggest that quality management facilitates cooperative learning and improves inter-organisational learning processes. At the supply chain level, it enhances supply chain satisfaction and supply chain performance.
Li, L. et al.'s (2011)	Integrating the SCOR model with ISO 9000 standards and SCQM for business performance (AA)	The study says that the ISO 9000 series helps companies develop and maintain supply chain processes that meet certain performance metrics, such as those provided by the Supply Chain Operations Reference model (SCOR). Based on the survey data, this study extends five decision areas (Plan, Source, Make, Deliver, and Return) of the SCOR model by integrating quality assurance measures in the supply chain process. The results show that individually, each decision area has a positive impact on both customer-facing supply chain quality performance and internal-facing firm-level business performance. Collectively, 'Plan' and 'Source' decisions are more important to customer-facing supply chain performance (reliability, response, and flexibility), and 'Make' decisions positively affect internal-facing performance metrics (cost and asset).
Hong et al.'s (2018)	Mapping the relationship between SCQM practices and Knowledge transfer (KT) for organisational performance (AB)	The study findings contribute to theory as well as practice by increasing understanding of how to improve the operational and innovation performance through enhancing SCQMP and KT. This study provides insights for improving performance by mapping the relationship between SCQMP and KT. The structural equation modelling, based on survey data, reveals that internal QMP has a significantly positive effect on internal KT, while QMP at the supply chain level has a highly positive effect on cross-organisational KT.
Xu, L.D. (2011)	Information architecture for SCQM to counter counterfeiting (AC)	This study analyses the current state of the art in information management for supply chain quality management, reviewing the current research and development in information architecture for supply chain quality management, and highlighting some of the key technologies that have the potential to significantly improve the performance of SCQM. Recent research explores the role of service-oriented architecture (SOA), RFID, agent, workflow

		management, and the Internet of Things (IoT) as an enabler of real-time quality management and control in the supply chain.
Soares et al.'s (2017)	SCQM practices affect product quality performance (AD)	The purpose of this study is to redress this imbalance in the literature through an empirical examination of the relationship between SCQM practices and quality performance outcomes. The literature review highlights the notable lack of a consensus among operations and supply chain management scholars regarding the theoretical underpinnings and associated empirical evidence for the performance impact of supply chain quality management (SCQM) practices on quality. As fewer research studies are devoted to understanding the conceptual underpinnings of SCQM as well as empirical support and validation for the conceptualization and measurement of SCQM practices. The findings encourage managers to place a high priority on both inter-firm and intra-firm relationships and see guidelines about effective management of upstream, midstream, and downstream SC networks. Create awareness about the potential synergies arising from the combined effects of SCQM practices that could bring about desired quality performance outcomes across the entire supply chain network.
Lin, C. et al.'s (2013)	SCQM structure and abductive model (AE)	The study findings are based on the abductive model real numerous strategic and tactical enablers, key sequences to move firms from their current situation to their preferred one, and critical opportunities for SC-wide quality system design. The study refers to two approaches (compliance, and voluntary) where the compliance approach includes strategic content variables such as training programs, ISO, and supplier quality audit programs. The voluntary approach looks for motivation in the SCQ system.

This study referenced contributions made by research scholars (Table-2.3.7) concerning the conceptual framework, system design, and model introduction that link counterfeiting and technology-supported SCQM practices. Mostly, the contributors justify their research work and system design subjectively that is based on literature reviews and encourage future researchers to work further for its empirical evaluation and confirmation (like A, D, E, F, G, H, J, K, L, M, N, P, Q, S, U, V, W, Y, Z, AC, AE). Few contributions justify their research work empirically after testing the conceptual model (B, C, O, T, R, X, AA, AB, and AD). The Table-2.3.7 when further analysed indicates found more aligned contributions (like A, D, E, G, Q, T, U, X, Y, Z, AC, AD, AE) concerning the intention of integrating the concepts of anti-counterfeiting and

SCQM to enhance firm's supply performance (FSP). Especially two contributions (A and T), which discuss the importance of administrative and operational (SCQM) control. Moreover, the counterfeit knowledge stream also reveals that the problem of counterfeiting in SC can be addressed strategically by implementing anti-counterfeiting strategies. These strategies not only focus on administrative control but also focus on operational process efficiencies. The basic flaw of enforcement without deterrence strategy (Chow, 2010) ignores the role of local protectionism in supporting the trade in counterfeit goods. Local governments protect counterfeiting because it brings economic benefits to the local economy by generating revenue and creating jobs. Chow's study emphasizes that companies should adopt long-term strategies to make meaningful progress against counterfeiting. The enforcement without deterrence strategy has the unintended, even opposite, effect of inciting counterfeiting to new heights. The short-term enforcement-based strategy without deterrence is not working.

Michael Harvey's study, in 1988, discusses with the help of the Counterfeit Protection Model (CPM) that different departments within the firm, like R&D, distribution & promotion, and marketing department, should work closely around the product. The collaborative efforts should form the "Product team" to support the firm's "Surveillance Team" in the process of implementing anti-counterfeiting strategies in supply chains to improve FSP. The study emphasizes that the economic harm is not the only ill of the counterfeiting, other damages done by counterfeits indicate the severity of the issue. Harvey's study limitation is to focus only on administrative control at the management level to check the counterfeiting problem, missing the need to emphasize improving the operational processes (Quality based performance (Q.M & TQM framework like MBNQA & EFQM) in the organisational culture perspective, especially situations of parts un-availability / non-availability of alternates under time-pressed condition. Whereas Vanichchinchai & Igel's (2011) study model discusses the need to implement integrated practices of TQM and SCM to improve FSP with the help of the hypothesized model. Vanichchinchai & Igel's study qualitative results suggest that the broader role of the TQM practices can, directly and indirectly, facilitate the implementation of SCM practices to improve FSP. According to Vanichchinchai & Igel's study, TQM and SCM are large-scale management systems and managers have not considered them different. Both could be implemented together to improve FSP. Vanichchinchai & Igel's study also encourages future researchers to explore the SCQM research area (in the parts' traceability perspective) for practitioners' knowledge so that they can make educated decisions timely. Vanichchinchai & Igel's (2011) study introduces the Thai model for the automotive industry's supply chains in Thailand. The Thai model completed the first two steps of knowledge generation but lack the

final steps of verification. The study started with an a priori model (hypothetical model) and tested against data collected from the automotive sector in Thailand (context of the study). The hypothesized model was tested through path analysis (used qualitative case studies of the first-tier automotive suppliers to obtain in-depth information). However, the Thai study lacks replication evidence to test the model for external validity. The test for the external validity of the model can only be done through verification by checking the repeatability of the study findings and by confirming the completeness of the models' dimensions and measures. This had been the major limitation of the Thai study.

The reason why the Thai model is selected why not others, as the Thai model was already tested initially (using a selective, qualitative method) for the Thailand automotive industry's supply chains. Where twelve (12) companies were selected from the DB of the Thailand Automotive Part Manufacturer Association (TAPMA) and the director of the Thai Automotive Business. The key informants were executives in SCM & TQM systems in their companies. Another important factor that encourages the researcher to select the Thai model is the continuation of the inter-related extension of the studies [Vanichchinchai & Igel's (2009, 2011) and Vanichchinchai's (2012, 2020)] towards TQM and SCM practices integrated system approach, although TQM and SCM have different starting points, they have evolved in similar ways to reach a common goal, that is customer satisfaction. To enhance FSP, customer satisfaction requires an understanding of the relevant suppliers' context (nationality of the suppliers, ethical buying behaviour, financial & operational strength of suppliers, etc.). The other important factor is the readiness of the research model for testing its reliability and validity in the new context (Pakistan) after relevant addition and modification.

2.3.8 FIRM's SUPPLY PERFORMANCE (FSP)

Beamon (1999) study discusses different performance measures in supply chain modelling, which are cost (inventory, operating, obsolescence, etc.), flexibility (meeting customer requirements) and combination of cost and customer responsiveness (lead time, stockout possibilities, and rate). [Min & Mentzer (2004); Li et al. (2006); Gun-asekaran et al. (2001)] study discussed different performance measures used to develop a measurement scale for a firm's supply performance. Sheel & Nath (2019) study reveals that there is not a single study which shed light on how disruptive technologies will affect supply chain adaptability, alignment, agility and firm performance. Traditional manufacturing firms are looking for modern information technology solutions to improve firm performance and improve collaboration and coordination between supply chain members. Technology based application

that can be used in the supply chain. Sheel and Nath (2019) study discusses how technology can improve supply adaptability, alignment and agility which collectively enhance competitive advantage which in turn influences firm performance. The study also says that supply chain practitioners are confident that technology will help improve supply chain parameters. This creates competitive advantage and increase firms' performance. Internet-based technology that provides better visibility and transparency in transactions among supply chain members [cited in Pilkington (2016)]. Traditional and modern purchasing has problem in goods delivery timing and invoice generation which lead to delay in payments (cited in Kamble et al., 2018). The study (Sheel and Nath, 2019) emphasised that B.C is able to reduce or eliminate (yet not disclose due to paucity of knowledge (cited in Mihathwa, 2016) like payment delay issue with digital contract (through distributed ledger) with logistics and appointed banks. This integration not only simplifies finance operations but reduce working capital requirements. The smart contracts act as an agreed rule book and assist payment related decisions. [Vinichchinchai and Igel (2011)] study discusses the measurement practices (SCM & TQM) for automotive industry in Thailand was developed based on the scholarly efforts made by researchers [Li et al. (2006); Min & Mentzer (2004); Tan et al. (2002); Lee & Kincade (2003)] and Global Supply Chain Forum (GSCF) [Lambert et al. (2005)]. Executives from twelve companies selected from the database of the Thai Auto Part Manufacturer Association (TAPMA) & the Thailand Automotive Industry Directory as informants. From the survey, it is evident that SCM practices together with TQM practices enhanced FSP. [Vinichchinchai and Igel (2011)] study discusses performance measures to improve content validity of the measurement items assessed by four academic experts in SCM, & by three experts in the automotive industry in Thailand. The resulting SCM practices and TQM practices measures the firm's supply performance having four sub-constructs:

- FSP Cost: the degree with which the organization can operate cost effectively
- FSP Flexibility: the degree with which the organization can adopt the changes or customer demand
- FSP Relationship: the degree with which the organization can develop business relationship with partners
- FSP Responsiveness: the degree with which organization can respond to customer requirements

The overall in-depth literature review infers that problem of maintaining product qualities in automotive supply chains is considered as a bigger challenge that leads to the trust deficit and compromised brand value in the existing limited traditional supply chain mechanism. This research study creates awareness among stakeholders about availability of different knowledge based supported studies like Berman (2008), Stevenson & Busby (2015) and Chaudhry et al. (2005) emphasising need to detect and reduce counterfeiting activities (anti-counterfeiting initiatives) via a networked governance model of SCQM so that the firms' supply performance (FSP) can be improved. The counterfeiting activities (performed by counterfeit groups using extraction, production distribution, and infiltration strategies) affects stakeholders and legitimate firms directly and indirectly. Therefore, company level approach to planning, monitoring, and responding to the product counterfeiting issue [counterfeit protection model introduced by Harvey (1988) and discussed by Chaudhry et al. (2005)] is essential. Firms can take initiative to protect their IPR through continuously updating products and packaging, maintaining anti-counterfeiting investigation teams, and developing consumer education programs. The present research study precisely encourages scholars to explore the opportunities to link networked governance model of SCQM with supply chain parameters in order to enhance firm supply performance (FSP). Hong et al. (2020) study investigates the relationships between the SCQM and Firms performance (that include "quality safety performance" and "sales performance"), where SCQM practices enhance firm's management quality performance in reference to "supplier quality management", "internal quality management", and "customer quality management". Thus, SCQM practices have significant positive effects on firm's "quality safety performance" and "sales performance".

CHAPTER-SECTION-2.4

2.4.0 INTRODUCTION

The study aims to investigate and assess the relationship between the anti-counterfeiting strategies and improvement in the firm's supply performance within the internal and external supply chain quality management context in the auto-parts industry's supply chains in Pakistan. This study enhances the understanding of the supply chain practitioners about the presence of a positive relationship among the TQMP, SCMP, and ANCT-INT with FSP The study sets different study objectives to achieve the aim of the study. The study objectives are: a) To explore and synthesize relevant ant-counterfeiting strategies to control product counterfeiting problems; b) To develop new insights on how the anti-counterfeiting strategies interact with supply chain quality management to control product counterfeiting; c) To evaluate and assess the anti-counterfeiting concept that influences FSP, in the auto-parts industry supply chains in Pakistan

This section discusses the research model details (Fig-2.4.0a), where the research study not only develops new insights on how the anti-counterfeiting strategies interact with the SCQM and control product counterfeiting problems but synthesize relevant anti-counterfeiting strategies to control product counterfeiting problems. The higher the level of successful implementation of ANCT-INT items' measures, the higher would be the FSP. Indirectly, the higher the level of successful implementation of ANCT-INT items' measures in the presence of the networked governance model supported SCQM environment, the higher would be the FSP. The knowledge-based decision-making is possible in the presence of the networked governance model supported SCQM environment that provides parts' traceability platform to supply chain practitioners for decision making, controlling product counterfeiting problems, and enhancing the FSP in the automotive industry's supply chains in Pakistan. For empirical research, the hypothesized causal relationships among relevant model constructs can be generalized and become more predictable for decision-making. Moreover, hypothetically the TQM and SCM practices have a positive relationship with the SCQM environment and FSP. Thus, the TQM practices facilitate SCM practices implementation. As Flynn & Flynn's (2005) study says that synergies between QM and SCM in the machinery, electronics, and transportation components industry in the US, Germany, Italy, Japan, and England showed that QM and SCM can be implemented together. Vanichchinchai & Igel's (2011) study reveals that the TQMP significantly and positively impacts its FSP. Vanichchinchai and Igel's study is cited

in several empirical research studies [Rahman (2001), Sun (2000), George & Shery (1998), Hendricks & Singhal (1997), Prabhu et al.'s (2000), and Hsu et al.'s (2009)] that confirm that the QM/TQM can improve not only quality performance but also overall organisational performance.

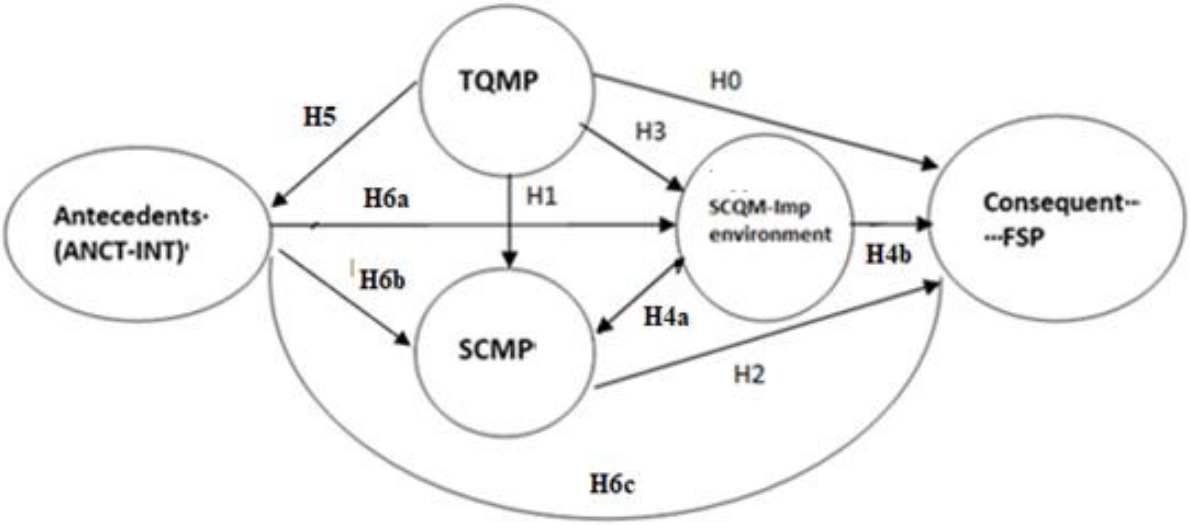


Fig-2.4.0a: Conceptual Extended LS System Model

H0: TQM practices have a positive relationship with the FSP.

H1: TQM practices have a positive relationship with SCM practices.

H2: SCM practices have a positive relationship with the FSP.

H3: TQM practices have a positive relationship with the SCQM environment.

H4a: The presence of the SCQM environment has a positive relationship with SCM practices.

H4b: The presence of the SCQM environment has a positive relationship with FSP.

H5: TQM practices have a positive relationship with the ANCT-INT initiative.

H6a: ANCT-INT initiative has a positive relationship with the SCQM environment.

H6b: ANCT-INT initiative has a positive relationship with the SCM practices

H6c: ANCT-INT initiative has a positive relationship with the FSP.

H0: TQM practices have a positive relationship with the FSP.

THEORETICAL MODEL

The theoretical model incorporates ten individual links representing relationships among the study constructs. The scholarly contributory evidence is hypothesized as directly/in-directly and positively associated with ANCT-INT, TQMP, SCMP, SCQMP, and FSP. The ANCT-INT

is hypothesized as directly and positively associated with TQMP, SCMP, SCQMP, and FSP. The TQMP is hypothesized as directly and positively associated with FSP and indirectly associated with SCMP. Thus, the ANCT-INT measures supported model is conceptualized as an antecedent to the networked governance model supported SCQM environment and plays mediating role between TQMP and FSP through SCMP to enhance FSP.

2.5 CHAPTER SUMMARY (CHAPTER SECTION-2.1 TO 2.4)

Section 2.1 addresses the presence of counterfeiting activities at the global level which China and Hong Kong consider the biggest source of the counterfeits' supplies. The FTZs continue to be associated with several IPR crimes. This section discusses Thailand and Pakistan's automotive industry's performance, discusses the presence of the auto-parts vendor associations, and the overall automotive industry's performance. Moreover, this section discusses the auto-parts manufacturing processes. Section 2.2 discusses the importance of theoretical engagement to provide the reasoning for the exponential growth of the development of product counterfeiting and the consumers' intention to purchase counterfeits. This section discusses in detail the counterfeiting phenomenon, the contributions made concerning counterfeiting knowledge streams, driving factors and effects of counterfeiting, deceptive and non-deceptive counterfeiting, and product counterfeiting issues in automotive supply chains. Furthermore, this section discusses the intention of the counterfeiters to enter the counterfeits into the legitimate SC, the stages of the counterfeits' entry, the supply chain conceptual framework, and the systematic review to analyse anti-counterfeiting strategies. Section 2.3 discusses the importance of the TQM and SCM practices implementation in the automotive industry's supply chains, the relationship of counterfeiting with TQM, Harvey counterfeiting protection model, standard quality plan, conceptualizing TQM and SCM, Thai model details and identified research gaps, Integrating the knowledge streams considering the similarities and differences in TQM & SCM approaches, network governance model of SCQM, the sharing information technology to support SCQM environment, and the managerial guideline to use technology to avert product counterfeiting activities. This section also discusses the reason for selecting the Thai model for investigation as the Harvey model has some limitations and finds contributory gaps to address the issue. Section 2.4 discusses the research model and hypothesized supportive questions.

This chapter stresses the need to develop an independent counterfeiting knowledge stream to address the product counterfeiting issue. The counterfeiting knowledge stream provides researchers an opportunity to address the knowledge gap regarding the structure and

mechanism of the illicit market, the counterfeiting producers' tactics, consumer behaviour concerning product imitation, and the financial impact on individual companies. Further literature review reveals that sizeable contributions are made after the year 2000 in the counterfeiting knowledge stream as compared to the earlier publications. The reviews also infer that more contributions are needed in the counterfeiting knowledge stream to reflect the practitioners' requirements, as the use of technologies with online buying and selling activities made supply chains more vulnerable to the product counterfeiting phenomenon. The referenced studies [Chaudhry & Zimmerman (2005); Chaudhry et al.'s (2009); Chaudhary et al.'s (2011)] reveal that sometimes obsolete parts are no longer available in the OEM's inventory reserve pool and that gap could become the biggest risk for the licit supply chain. In a complex system where several subsystems nested within a system and become an integral part within multiple layers, making counterfeits detection is more difficult when only a sub-sub-system is purchased for installation. Therefore, performance and failure characteristics of counterfeit parts show variation against genuine parts performances and can produce a serious adverse impact on product or service availability, reliability, performance, and safety issues. For scholarly purposes, firms should integrate "anti-counterfeiting practices" into their "standard quality plans". It requires "top management commitment" and "organisational structure" that encourages "active anti-counterfeiting vigilance", as well as "commitment of resources" to this initiative. What is important here is to explore the "right approach" with which anti-counterfeiting practices can be successfully integrated into firms' quality plans. Researchers and practitioners must understand the counterfeiting phenomenon in the supply chain and support potential anti-counterfeiting strategies proposed by practitioners to prevent product counterfeiting in supply chains.

Vanichchinchai & Igel's (2011), "Large Scale (LS) system", Thai model description provides model extension information to the Pakistani context. The explanation given about the model development, gaps, and limitations of previous studies identified and discussed as a basis for study focus. However, the chapter review part is an ongoing phase and can be embedded in other phases of the study. The review can be used for selecting and justifying the research objective and research methodologies of the study. This study explores two new TQM dimensions (Supplier quality management (SQM) & Process Management) to support the leading concept of SCQM. The review provides a basis for interpreting the study findings by emphasizing their significance. Vanichchinchai & Igel's (2011) study introduces reliable multiple indexes of the sub-constructs (SCM practices, TQM practices, and FSP). Where

Vanichchinchai & Igel's (2011) study confirms the absence of standard and complete measurement models that could readily use other than in the Thai automotive industry in Thailand under different context settings. The study strongly emphasizes that the model still needs further extensions to justify and validate the efforts undertaken in the study. Moreover, the review highlighted the importance of extension studies that help in understanding the rationale for adopting the Thai model. There exist some gaps in the Thai model, tested through a path analysis (qualitative case studies) of two large automotive suppliers (first tier) to obtain in-depth information about FSP. The other gap that exists in the study is the model testing for external validity. Verification is possible only after checking the repeatability of the findings by confirming the completeness of the model's dimensions and measures. As the technological need at the industrial level is evident in support of the contributory evidence discussed the Thai model missed the combined concept of SCQM (TQM + SCM) in the study which requires further investigative studies in the future. The technological need at the industrial level requires awareness about details regarding networked governance model SCQM concepts. This opportunity creates space for researchers to explore the conceptual philosophical integration possibilities of TQM and SCM philosophies and highlight the missing concepts behind further constructs' construction due to the miss-specification issue (model incompleteness). For that matter, face validity limitations require empirical testing of the model in a different context.

This study can act as a bridge in implementing anti-counterfeiting strategies in supply chains of the automotive industry to enhance the FSP directly or indirectly through the networked governance model of the SCQM environment. The study provides an opportunity to add new conceptual constructs at the consequent and antecedent level. Like, ANCT-INT constructs at an antecedent stage and Firm Supply Performance (FSP) at a consequent stage. Furthermore, the Thai model fulfils the psychometric assessment requirements of the construct validation (by gathering evidence about the meaning of the counterfeiting phenomenon of interest by schematizing the processes within) of the extended model to confirm the existing links among observable and unobservable theoretical measurements. Therefore, to initiate the process of the formation of the (ANCT-INT measures) model (construct validation) and to discuss the contextual need for the extension of the (ANCT-INT measures) model, the constructs' nomological relationship network tool is used. The extended model, with the help of nomological validity and the existing body of knowledge, confirms that there exists a causal relationship among constructs in the model. In their studies, Diamantopoulos & Winklofer (2001) and Jarvis et al.'s (2003) suggest that the formative validity test is consistent with the

findings of this research and consistent with the research model. The ANCT-INT measures supported model is conceptualized as an antecedent to the networked governance model supported SCQM-Imp environment, and plays mediating role between TQMP and FSP through SCMP to enhance FSP.

CHAPTER-3 RESEARCH DESIGN

3.0 INTRODUCTION

In the research design process, it is important to discuss the choice of the "research approach" to determine how relevant information can be obtained to address the research problem. Gregor's (2002) study discusses that a good research design should justify the study rigor to answer research questions, the research findings, and the impact of future research & practices. Pittman & Bakas's (2010) study discusses the research design, which suggests that a research cycle involves two main phases: an exploratory phase and a confirmatory phase. The chapter follows the theoretical foundation of the philosophies under the classification of theories (Gregor, 2006) and research strategies (Berthon et al.'s, 2002). The ontology philosophy refers to what sorts of phenomena/things exist in the social world and what sort of understanding the researcher should establish (knowledge) about that phenomenon/thing. The epistemology philosophy refers to an assumption of how knowledge is created that refers to existing possibilities to gain understanding (knowledge) about phenomena/things that exist in the social world. Whether a researcher should pursue interpretive, or positivist research depends on paradigmatic considerations about the nature of the phenomenon under consideration and the best way to study it. Orlikowski & Baroudi's (1991) study discusses that the interpretive approach in social sciences avoids examining the externally controlled conditions, like in natural sciences, which justify by providing certain explanations (constructivism) but does not explain the potentially unintended paradigms to address the research question. A cross-sectional level research approach is required to influence the research methodology (operational plan) to support a tracing process in the protocol analysis. This study follows the cross-sectional study approach, which is a predominant form of research in the supply chain (Orlikowski and Baroudi, 1991) with the following positivist research study reasonings:

The positivist paradigm studies offer a clear guideline on how to address research problems reliably and to follow the explanatory aspect of a theory to generalize results. It supports the derived research question, such as Can the hypothetical model confirms the presence of the direct and indirect relationship among the TQMP, SCMP, and ANCT-INT with FSP, in the networked governance model supported SCQM environment? OR Can the hypothetical model in the relevant context provides a systematic, effective & economical measurement that can capture the impact of ANCT-INT items' measures on the Firm Supply Performance (FSP) for

an automotive industry's supply chain in Pakistan?. This chapter summarizes a research design process to develop a framework for a research study. Sileyew's (2019) study discusses that the research design process purposefully provides an appropriate framework for a research study. Andres's (2012) study says that the conceptualization of the process of conducting a research study is important. Also, the decision about the research methodology, including details about the overall research design, steps in conducting interviews, and survey in the automotive industry's supply chains in Pakistan, is important. This study follows the mixed method of research where convenience sampling is used for qualitative analysis and probability sampling is used for quantitative analysis. To conduct the interviews the managers from the PAMA member firms are selected. And, to conduct the survey the managers from the PAAPAM member firms are contacted. This study justified in following the present research methodology by using a mixed method of research to gather responses from the managers of the automotive industry's supply chains in Pakistan.

3.1 PRAGMATIC APPROACH TO RESEARCH STUDY

Researchers explore chains of reasoning to craft coherent epistemologies well matched to the ontological conditions. The ontology-epistemology mismatch may undermine interpretive social science reality (in interpreting reality, understanding global issues, and bringing resolve to standardize the issue). Therefore, the pragmatic approach to research study covers A) Ontological conditions, epistemological implications, and in-depth-Interview; B) Conceptualization, Operationalization of the Survey Research; C) Pragmatic Approach (Mixed, Exploratory and Deductive Methods).

A) Ontological Conditions, Epistemological Implications, and In-Depth Interview Research

Goldkuhl's (2012) study mentioned three epistemologies (interpretive, positivist, and critical) and emphasises the possibility of irreconcilable differences between two paradigms (positivism, interpretivism). That is objectivity disregards contextual factors as a major philosophical limitation to positivism. By ignoring contextual factors, some unexplained gaps (situation of research model incompleteness) may arise in the research findings. Therefore, positivism philosophy explains the investigative phenomenon to measure "single reality" to discover the causal relationship among variables, considered the basis of generalized knowledge. For that matter, well-defined variables/constructs and research instruments are used to justify hypothesized causal relationships. The research outcome could be judged on the bases of the possible presence of the knowledge rigor, its validity, and its generalization. The

contributory evidence from Orlikowski & Baroudi's (1991) and Goldkuhl's (2012) studies support the argument that the product-counterfeiting phenomenon does exist in the automotive industry's supply chains from a broader perspective. Moreover, generalizability is determined by the sampling process and not the sample size. According to Lucas's (2014) study the interviewers may adopt one of three strategies: select everyone (i.e., census-taking), select respondents using probability sampling, or recruit respondents using non-probability sampling.

B) Conceptualization, Operationalization of the Survey Research

Andres's (2012) study says that the conceptualization process begins by engaging with multiple sources (theory, methods, data collection strategies, analytical techniques) to help identify and clarify the key concepts in a research project. Moreover, Andres's study says that it is a useful exercise for all researchers to consider in advance how concepts and related variables (in a quantitative sense) or codes (in a qualitative sense) are related or interrelated. To specify a clear and precise definition of each concept in the research study, the researchers need to specify the dimensions of the concepts, create concrete measures of the concepts, and measure the measures of the concept by introducing close-ended and open-ended questions to the respondents, as survey items. These concepts are further refined after adding more knowledge into the referenced body of knowledge to bring improvement in research questions and relevant concepts. The respondents are asked to give their responses so that research questions can be addressed. Based on the data of the respondents' responses, the educated guesses (hypothesis) are evaluated (H0; Ha). As discussed earlier, the survey process is an iterative process where researchers must decide the pragmatic approach of the research (inductive or deductive).

C) Mixed, Exploratory and Deductive Methods

In their studies, Morgan's (2007) and Tashakkori & Teddlie's (2010) discuss that the pragmatic approach has been the philosophical foundation (underpinned assumptions/hypothesis) for a mixed method of research, especially in no single reality of social sciences context. The pragmatic approach paves the way to multiple methods, and multiple assumptions and use different data collection and analysis methods. Morgan's (2007) study insights that pragmatism portrays reality as volatile and ever-changing experimental nature of knowledge, as a research instrument, for adapting to reality (single reality or no single reality). Creswell et al.'s (2011) study discussed that the mixed method of research provides a link that bridges post-positivist views and social constructivist views, pragmatic perspectives, and transformative perspectives. Creswell et al.'s (2011, p.9) study provides guidelines to design the mixed method of research

study: 1) Preliminary considerations (consider philosophy and theory, consider if the resources (e.g., time, financial resources, skills) are available, consider the research problem and the reasons for using mixed methods); 2) State study aims and research questions that call for qualitative, quantitative, and mixed methods, and that incorporate the reasons for conducting a mixed-methods study; 3) Determine methods of quantitative and qualitative data collection and analysis (when it will be collected, what emphasis will be given to each, and how they will be integrated or mixed); 4) Select a mixed-methods design that helps address the research questions and the data collection/analysis/integration procedures; 5) Collect and analyse the data; 6) Interpret how the combined quantitative and qualitative approaches contribute to addressing the research problem and questions; g) Write the final report making explicit the contribution of the mixed methods approach. The Creswell et al.'s study recognizes designs (see Table-3.1.1c).

Table-3.1.1c: Recognizing the Mixed Method Design

Convergent (or parallel or concurrent) designs:	When the intent is to merge concurrent quantitative and qualitative data to address study aims, the investigator combines both quantitative and qualitative research. This design is known as a convergent design. For example, an investigator might collect both quantitative correlational data as well as qualitative individual or group interview data and combine the two for the best approach.
Sequential (or explanatory sequential or exploratory sequential) designs:	Another design possibility is to have one dataset build on the results from the other. These are known as sequential designs, and they may begin with a qualitative exploration followed by a quantitative follow-up or by a quantitative analysis explained through a qualitative follow-up. Another popular approach is to first explore with qualitative data collection followed by using the resulting qualitative findings to design a quantitative instrument and then administer the instrument to a sample from a population.
Embedded (or nested) designs:	To use quantitative and qualitative approaches in tandem and embed one in the other to provide new insights or more refined thinking. These designs are called embedded or nested designs. There may be a variation of a convergent or sequential design. Qualitative data may be used before the intervention to inform strategies to best recruit individuals or to develop the intervention, during the experiment to examine the process being experienced by participants, or after the experiment to follow up and better understand the quantitative outcomes.
Multiphase designs:	A multiphase design emerges from multiple projects conducted over time linked together by a common purpose. They commonly involve convergent and sequential elements. For example, the overall purpose might be to develop, test, implement, and evaluate a health prevention program for adolescents.

Source: Creswell et al.'s (2011) Mixed Method Design

Creswell et al.'s study discusses that the mixed approach involves a combination of close-ended measures and open-ended observations. The mixed research strategies are based on sequential procedures (explanatory, exploratory, transformative strategies), where sequential explanatory study begins with a quantitative method in which theories and concepts are tested, followed by a qualitative method involving detailed explanation (explanatory study) with few cases or individuals. Whereas the purpose of sequential exploratory strategy is to explore the

phenomenon (single reality) by using quantitative data & results to assist in the interpretation of qualitative findings (not a reality).

The mixed-method is especially advantageous when a researcher is creating a new instrument. On the other hand, the transformative strategy is to employ either method that will best serve the theoretical perspective of the research. According to the Creswell et al.'s study, the "transformative" strategy supports a specific theoretical perspective based on certain ideologies (critical theory, advocacy, participatory, conceptual, theoretical framework). The "sequential" strategy goal is to complete one phase of the research to perform the next phase when the completion time of conducting phased activities is not critical. Whereas, when time is important the researchers can apply a "concurrent" strategy. The concurrent (triangulation / nested/transformative) procedures, where both qualitative and quantitative data are collected at the same time during the study, will integrate information during the interpretation of overall results to provide a comprehensive analysis to address the research problem. The "concurrent triangulation" strategy can be used as a model for cross-validation or corroborative findings, in a single research study, to more accurately defined relationships among variables. Whereas the "concurrent nested" strategy helps in model formation that supports one data collection phase giving it more weightage over another database, during which both qualitative and quantitative data are collected simultaneously. The "concurrent nested" model is applied when a researcher chooses to utilize different methods to study different groups or levels. The "concurrent transformative" strategy is theoretically driven and used to initiate social change or advocacy to support different research perspectives.

3.1.1 RESEARCH DESIGN

The research design is a framework of research methods and techniques used to collect data. Research design has a significant impact on the reliability of the resulting outcome of survey research and is needed to facilitate various research operations thereby making this study (by using a mixed-method of research) feasible. To support fifteen (15) facets of the survey research process as discussed earlier, this study introduces the overall high-level research design (Fig-3.1.1a) to cover different phases of the research project, represented by ovals, information flow symbols, and their directions depicted by arrows, where the rectangles depict the outputs derived from the various activities of the research study.

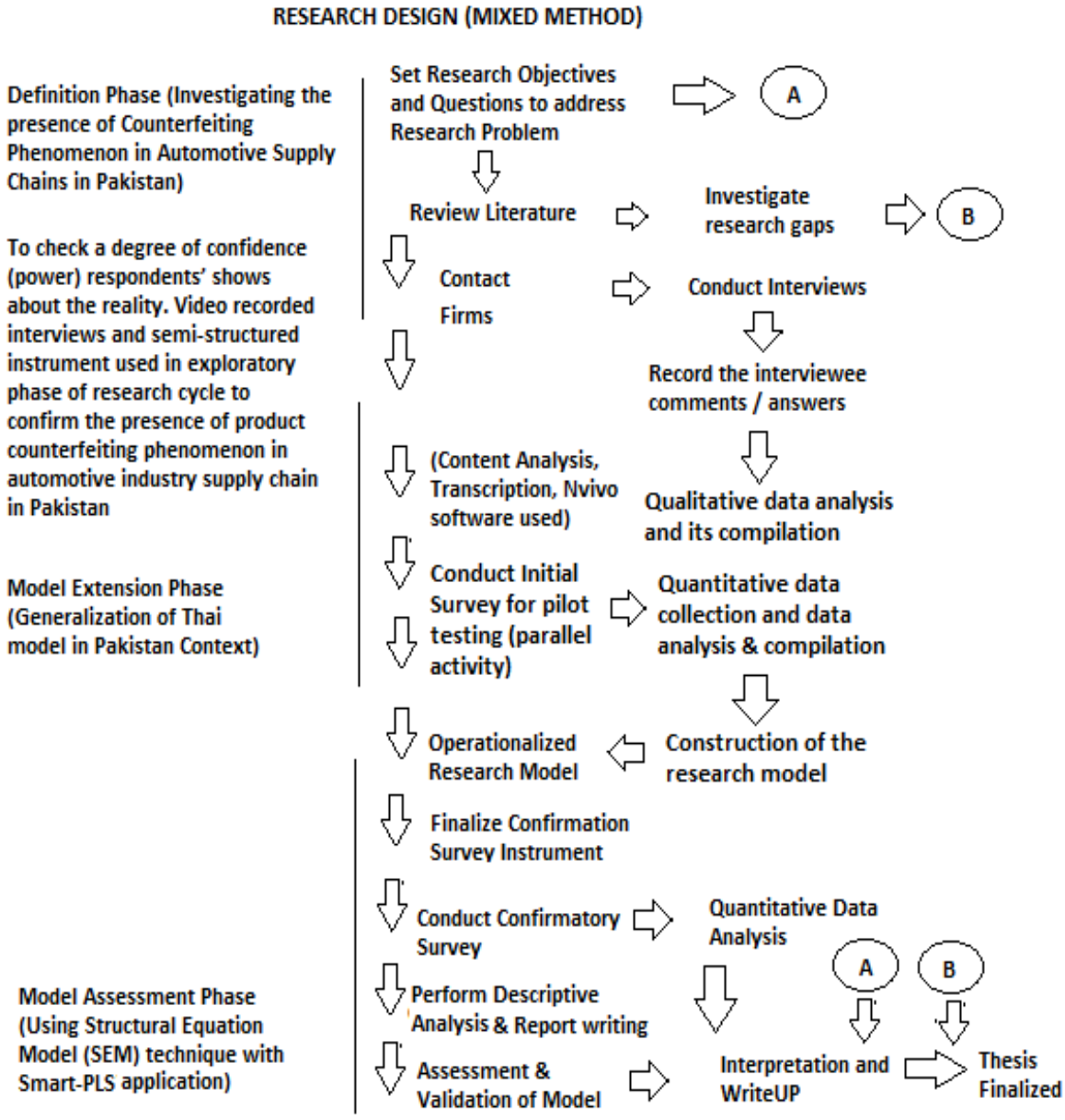


Fig-3.1.1a: Overall Research Design

The research design (Fig-3.1.1a) explains different phases of a mixed research study to confirm the reality concerning the research problem. The definition phase explains the phenomenon because of the research problem. This study investigates the presence of the counterfeiting phenomenon in automotive industry's supply chains in Pakistan. First stage process, researchers need to set up the objectives of the research study so that the research problem could be addressed. According to the title of the research study, keywords are searched in different relevant databases to find out existing research gaps in the literature reviews, which future and present research tries to explore. And, work out the solution to bring resolve to the research problems. To confirm, whether the problem exists or not, the researcher follows

chosen research methodology to use different methods of research to reach the sample of the representative population to gather the respondents' information. To gather the respondents' information, the researcher design a questionnaire so that respondents could answer questions (especially mandatory questions). The research methods could be interviews, focus group discussions, questionnaires, experts' opinions, etc.). The interviews are video recorded, and the survey is paper-based. The questions can be open and sometimes closed. The research can be exploratory or explanatory. Based on the recorded information and comments, the data was collected and analysed (content analysis, themes development, transcriptions, etc.) for further processing. Different tools can be used to gather the data.

This study works for the extension of the Thai model which is already introduced in the automotive industry's supply chains in Thailand. The extension model introduces an additional anti-counterfeiting construct (ANCT-INT) to address the research problem. For generalization of the model, under the influence of the networked governance supported SCQM-Imp environment where practitioners can make educated decisions, it is necessary to confirm the level of operationalization of the model. For that matter, EFA and CFA are required. The model assessment phase, after data collection because of the confirmatory survey, uses the SEM technique with the help of the application called Smart-PLS to analyse the hypothesized assumptions against the completeness of the model so that the extended model can be externally validated.

3.2 RESEARCH STRATEGY (THEORETICAL SUPPORT)

The research strategy translates ontological and epistemological principles into guidelines to show how the researcher can perform the research study to continue the process of research data collection by adopting relevant research methodology. To select an appropriate research strategy to ensure that research questions are addressed, Walshe et al.'s (2004) study discuss that the research strategy should be congruent with the overall topic, questions, and purpose of the research. Berthon et al.'s (2002) study not only discusses theory, method, and context parameters to specify and explain the nature of the research problem but also provides special emphasis on the explanation of the applied research strategies. The Berthon et al.'s study explains the major research strategies, which include replication, generation, and extension strategies (refer to Table-3.2).

The problem specification parameters to specify as "what" is being investigated?	
Theory parameter	It explains the cause of the problem

Method parameter	It is concerned with generating knowledge about the problem through data collection and analysis
Context parameter	It is concerned with what, who, and where – the phonological context and content of the problem.
Major research strategies	
Replication	Studies where, theory, method, and context are held constant. In other words, the new study employs the same theoretical framework and methodology in the same context.
Generation	Generation research strategies are considered as challenging and risky compared to other strategies. Here, studies generate a new theory and new methodology applied in a new context.
Extension	It is a combination of replication and generation, where one or more parameters are altered. This means that certain parameters held constant and others changed from the Thai model-based study. When the theory and method are constant and the context is changed, the strategy is called the context extension.

Table-3.2: Source :-(Berthon et al.'s, 2002)

This research strategy (see Table-1 in chapter-1), about the context extension, follows the research guideline of Berthon et al.'s (2002) to develop and extend the research instrument to address the product counterfeiting issue for the automotive industry's supply chains in Pakistan.

3.2.1 RESEARCH METHODOLOGY

The methodology refers to how the researcher reaches the truth about the reality or no reality to what the investigator believes can be known. Antwi & Hamza's (2015, p.220) study emphasizes that "*In terms of methodology, truth in positivist inquiry is achieved through the verification and replication of observable findings".* Antwi & Hamza's (2015, p.220) study also emphasizes that "*Positivists therefore, emphasise the use of valid and reliable methods in order to describe and explain the events*". Therefore, the study explains that the epistemology (interpretivism) and ontology (constructionist) paradigms require experts' opinions from the experienced participants about the research problem and taking help from a mediator to conduct focus group discussions. Antwi and Hamza's study emphasizes that the widely used research methodologies are an experiment, case study, survey, archival analysis, and the analysis of historical data. This study follows the "concurrent transformative" sequential exploratory strategy to support a theoretically driven perspective (Thai model validation for the automotive industry's SC in Pakistan).

Table-3.2.1a: Methodological Challenges in Conducting Mixed Methods of Investigations

Resources	Because multiple forms of data are being collected and analysed, mixed methods research requires extensive time and resources to carry out the multiple steps involved in mixed methods research, including the time required for data collection and analysis.
Teamwork	In multidisciplinary, interdisciplinary, and transdisciplinary teamwork, different approaches might emerge to an investigation as well as different writing styles. Team leaders need to anticipate the challenges and benefits of a team approach to mixed methods research

Page and word limitations	Investigators need to justify their procedures in a high-quality mixed methods study. Organizing information into a table or presenting a figure of the mixed methods procedures can aid in conserving space. Page and word limitations also affect the publication of mixed methods studies in scholarly journals and call for creative ways to present material (see Stange, Crabtree, & Miller, 2006).
Sampling issues	Although discussions (Creswell et al.'s, 2011; Teddlie & Yu, 2007) are available to bring resolve to the sampling issue, however, some challenges specific to concurrent designs (i.e., merging quantitative and qualitative research) include having adequate sample sizes for analyses, using comparable samples, and employing a consistent unit of analysis across the databases. For sequential designs (i.e., one phase of qualitative research builds on the quantitative phase or vice versa), the issues related to deciding what results from the first phase to use in the follow-up phase, choosing samples, and estimating reasonable sample sizes for both phases, and interpreting results from both phases.
Analytic and interpretive issues	Issues arise during data analysis and interpretation when using specific designs. When the investigator merges the data during a concurrent design, the findings may conflict or be contradictory. A strategy for resolving differences needs to be considered, such as gathering more data or revisiting the databases. For designs involving a sequential design with one phase following the other, the key issues surround the "point of interface" in which the investigator needs to decide what results from the first phase will be the focus of attention for the follow-up data collection. Making an interpretation based on integrated results may be challenging because of the unequal emphasis placed on each dataset.

Ref: Creswell et al.'s (2011) Methodological Challenges in Conducting Mixed Methods

Why Pakistan as a case study? [Taraba, P. et al.'s (2020); OECD-EUIPO (2017)] studies mentioned that several East-Asian economies including India, Turkey, Thailand, Pakistan, and VietNam are essential producers of counterfeits in different sectors. Nawaz, M. et al.'s (2021) study identifies grey channel markets of spare parts, metal recycling, and counterfeit products. The study says that the informal and unregulated waste recycling chains co-exist to offset the challenges posed by the lack of formal recycling mechanisms in Lahore, Pakistan. Alarmingly, the sale of sub-standard counterfeits, and replicas of illegal spare parts of machinery, cars, and other items exist. The study found strong evidence that a second-hand auto market is present in Pakistan. The informal waste assemblers, recyclers, and counterfeiters support smuggling activities and for that matter get support from Afghanistan. In terms of international treaties, the transit trade from Karachi to Kabul offers grey channels for the return of counterfeits to neighboring countries instead of their own countries. In Pakistan, three auto-manufacturer associations work with the name as the Automotive Manufacturers Association (PAMA), Pakistan Association of Automotive Parts and Accessories Manufacturers (PAAPAM), and the Association of Pakistan Motorcycle Assemblers (APMA). This study develops a conceptual model by conducting an extensive literature review [Shumacker et al.'s (2016); Sheel & Nath's (2019)] and conducting exploratory research work, which includes arranging and conducting expert interviews with managers of the PAMA member companies. The management level employees (Pak-Suzuki Motors, Honda Motors, & Toyota Motors) are contracted to carry out one-to-one interviews (using the convenience research method) and focus group discussions with a preliminary purpose to gather expert opinions (taking help from interviews) about the

existing product counterfeiting phenomenon for the automotive industry's supply chains in Pakistan. The results of the qualitative findings are then analysed (content analysis, thematic analysis), patterns (themes) developed from the analysis, and themes transformed quantitatively into codes, according to the coding guideline with the help of a quantitative method.

3.2.1.1 GENERALIZATION (EXPLORATORY/EXPLANATORY STUDIES)

A. <u>Exploratory study</u>

This research is exploratory and seeks to provide new knowledge on how the anti-counterfeiting strategies interact with SCQM and FSP to control product counterfeiting activities in the auto-parts industry's SCs in Pakistan. As this study is limited to automotive supply chains in Pakistan, the study results are therefore difficult to generalize to the other countries (populations). Thus, a broader and higher level of analysis (national/regional, cross-cultural) is needed in future research studies. The exploratory study makes analytical generalization (Stuart et al., 2002) where generalization is from each case to a broader theory rather than from samples to the population as in statistical generalization. Naslundy & Dag's (2010) study considers generalization controversial (difficult to draw deterministic inference) if done (Flyvbjerg's, 2006) from a single case. However, a single industry case approach may produce results that are grounded theoretically to increase its generalisability. The limitation can be addressed by using a large sample size and the analysis of the data from multiple sites can help support the generalisability of results. To ensure high-quality results that qualify for theory building, the four criteria are highlighted, such as construct validity, internal validity, external validity, and reliability (see Table-3.2.1.1a). Arlbjorn & Luthje's (2012) study says that external validity is concerned with establishing the relevant domain in terms of generalizing a study's findings analytically, and it is not a question of statistical generalization. The construct reliability is important after checking the internal and external validity of the construct. For that matter, the industry selection criteria for the target group are limited to a) The manufacturing auto-parts industry's SC; b) The manufacturing and selling activities; c) Industry digital capabilities with the use of IoT-enabled BC technologies in SCs; d) To identify industry potential to implement anti-counterfeiting strategies.

Table-3.2.1.1a: Validity and reliability issues addressed throughout the research phases

Criteria	Research design phases	Case selection	Data collection	Data analysis
Construct validity	Adaption of questionnaire based on extensive literature review	N/A	Multiple data sources & journals, multiple interviewees' responses	Review of interviews protocols by participants to eliminate misunderstandings and ambiguities

Internal validity	Analysis and synthesis of existing literature review	N/A	Informants, expert opinion	Triangulation of multiple data sources, Pattern matching explanations, experts' discussions
External validity	Requires multiple industry case studies (firm-wise)	Description of industry/firms' case context	Interviews conducted	Analytical generalization based on industry specifics
Reliability	Development of industry/firms' case protocol	Predefined Selection criteria of Search strings	Questionnaire shared with all interviewees, industry/firms case development and utilization	Triangulation approach to the data collection process, taking external researcher views

Source: Adapted from Yin (2014);Gibbert et al. (2008)

As mentioned earlier, this study not only explores new knowledge qualitatively but also tests it empirically (Table-3.2.1.1b). For that matter, the purposive samples are used to include key stakeholders with a strong understanding of digital technologies and SCQM. The interviews with industry experts served as the primary and valuable data source. In the data collection process, ten (10) managers of three manufacturing firms are invited for interviews. The specific questions are asked regarding anti-counterfeiting strategies, and details of the firms are collected. Emphases are given to the areas of SCQM, the level of digitization in a firm, and the FSP. To ensure high construct validity and to allow for triangulation, the interview information covers secondary data (corporate publications, internet sources, and company websites). In addition to business focus, the competencies of the interviewees are presented in Table-3.2.1.1b.

Table-3.2.1.1b: Overview of samples descriptive by the firms (cases)

Cases	**Job title of the contact person**	**Company name**	**Company Sector**	**SC Experience**	**ISO standards**	**Number of Employees**	**Net Profit (Pak Rs.)**
a)	Deputy Manager SC coordination	Pak-Suzuki Motors	Manufacturing automotive	More than 6 years	9001, 14001, 18001	More than 1500	More than 2.68 billion (the year 2021)
b)	Deputy Manager spare parts & sales	Pak-Suzuki Motors	Manufacturing automotive	More than 6 years	----do----	----do----	----do----
c)	Deputy Manager after-sales services	Pak-Suzuki Motors	Manufacturing automotive	More than 6 years	----do----	----do----	----do----
d)	Executive Parts procurement	Honda Motors	Manufacturing automotive	More than 6 years	9001, 14001, 18001	More than 1500	More than 682 million (the year 2020)
e)	Executive Import, purchase & logistics	Honda Motors	Manufacturing automotive	More than 6 years	----do----	----do----	----do----
f)	Executive Product control supply division	Honda Motors	Manufacturing automotive	More than 6 years	----do----	----do----	----do----
g)	Executive production control division	Honda Motors	Manufacturing Automotive	More than 6 years	----do----	----do----	----do----

h)	Executive Production, Planning, and Marketing	Honda Motors	Manufacturing automotive	More than 6 years	----do----	----do----	----do----
I)	Manager Sales	Honda Motors	Manufacturing automotive	More than 6 years	----do----	----do----	----do----
J)	Assistant Manager parts sales	Toyota Motors	Manufacturing automotive	More than 6 years	9001, 14001, 18001	More than 1500	More than 12 billion (the year 2021)

Source: Author

B. Explanatory study

This study is limited to automotive supply chains in Pakistan and the results are therefore difficult to generalize to other countries (populations). The objective of the survey is to collect samples of the population for statistical generalization. Of the total of 305 survey forms distributed at the PAAPAM forum, forty-eight (48) survey forms were rejected as an un-qualified inquiry due to entry error or participants skipping some of the required information. Therefore, the remaining responses that are considered qualified reach two hundred and fifty-seven (257) only. The respondents are analysed on an individual level in a functional group (employment cohort) to get an estimate of the size of the effect of their (perception) interests. The respondents are not analysed on a firm level. The multiple respondents of a functional group (collective wisdom) can remedy some of the barriers-to-understanding of FSP and can answer the research questions. This study uses collective wisdom of a functional group instead of relying on a single informed (or potentially not much informed) source to answer the research question. The individuals are SC decision-makers representing the auto-parts manufacturing industry and perform their role (employment cohort) at the workplace (PAAPAM member firm). The descriptive information of the survey includes a type of firms' business & operations, yearly turnover, employees' strength, QMS standards implemented, management practices, experience, employment cohort, gender, and education (see Table-3.2.1.1c).

Table-3.2.1.1c : Overview samples descriptive of the Survey details		**Responses**
Type of Firms' businesses -	Services	0
	Manufacturing	305
	Trading	0
Firms' Operations -	Domestic	155
	International	60
	Both	90
Firms' Yearly Turnover	Less than Rs. 20 Mill	40
	Rs. 20 Mill to Rs. 100 Mill	90
	Rs. 101 Mill to Rs. 200 Mill	70
	More than Rs.200 Mill	105
Employees Strength in Firms	Up to 200 in No.	100
	201 to 600 in No.	110
	601 to 1000 in No.	95

QMS Implemented	ISO 9001	305
	ISO 14001	85
	OHSAS 18001	95
	Others	24
Management Practices in Firms	TQM	305
	SCM	98
	Others	35
Experience in Management Practices		
	Less than 1 Year	0
	1 - 3 Years	0
	4 - 6 Years	140
	More than 6 Years	165
Employment Cohort		
Top level Management (CEO / Managing Director / Director) - Strategic Category		22
Mid-Level Management (G. Manager / Factory Manager) - Operational Category		232
Lower Level Management (Manager / Assistant Manager) - Technical Category		51
	Others	0
Gender	Male	305
	Female	0
Your Education	Intermediate	38
	Graduation	136
	Masters	56
	Others	75
Your Experience in Procurement under TQM & SCM Environment		
	Less than 1 Year	0
	1 - 3 Years	45
	4 - 6 Years	77
	More than 6 years	183
Name of the Department		
Finance & Accounts		65
Human Resource		17
Purchase		128
Stores & Inventory Control		15
Manufacturing & Warehousing		20
Managerial Coordination		60
Total Participants - From PAAPAM Member Firms		305

Source: Author

The research knowledge stream reveals that mostly in survey research, there are concerns about response biasness, common method variance, obtaining valid responses, and the generalization of results to other populations. Common method variance is likely to present the results' similarity across populations and should be taken as suggestive rather than confirmatory. As the confirmatory factor analysis (CFA) results with less biasness help discriminate and generalize the information to the population.

3.2.2 RESEARCH ETHICS

In qualitative studies, researchers rely heavily on collecting data through interviews, observations, and written and audio-visual materials. When in the field, researchers negotiate access to participants to collect data, thus, the quality of social interaction between researchers and the participants may facilitate or inhibit access to the required information. Orb, A. et al.'s (2001) study discusses that when preparing research protocols, it is the researchers' responsibility to anticipate potential ethical issues, such as informed consent, the confidentiality of the proceedings and data, generation, and analysis of the data, reporting and sharing final research outcome with participants. One of the ethical problems is the degree of participants' willingness to share their experiences during the interview or to respond to a survey. It depends on how powerful relationships develop among the researcher and participants at the time of the interview or at the time of a survey. Respondents must be psychologically comfortable with the interviewer as a person to go through the mental effort and emotional distress of responding to the interview questions' related details. Myers & Newman's (2007) study discusses seven (7) guideline steps such: Situating the researchers; Minimizing social dissonance; Representing a variety of voices, Every-one being an interpreter; Using mirroring, etc. Q&A; Flexibility; Confidentiality of disclosures.

The research methodology issues the research warrants inferences (insight assessment) to evaluate the logical strength of the argument to justify and support the belief that the research conclusion is probably (H0) but not necessarily (Ha) true to address hypothesized or proposition-based research inquiries. The purpose of the research design is to lead to describe, explain, and interpret research methodology-supported arguments. Such as how and how far, the relevant research methodology issues the research warrants inferences from prescribed data to conclude. This means how strongly (statistical power ratio) the prescribed data logically support the research arguments (inquiries). The research warrant in research terminology is a degree of confidence (power) that researcher has in the capability of inferences to confirm truths about the reality (single or no reality) that researcher cannot observe the product counterfeiting phenomenon directly for automotive industry's supply chains in Pakistan, as per the present body of knowledge. Therefore, research warrants require to set relevant statistical standards according to the mixed research approach.

3.2.3 INTERVIEW METHODOLOGY

Young et al.'s (2018) study discusses that the interview is the most suitable methodology to use based on the question, of whether the interview should be supplemented with other interview methods. Qu, S.Q. & Dumay's (2011) study discusses that in qualitative research the interviews are done primarily, and occur when researchers ask participants close-ended and open-ended questions and record their answers. Often audio tapes are utilized to allow for more consistent transcription (cited in Creswell, 2012). The purpose of the interview is to follow the main themes within a context and whereas the interviewees' responsibility is to give their impartial responses after understanding the questions, willingly and honestly. On the other hand, the interviewer's responsibility is to bring clarity to the questionnaire, not only the question itself but the relevant question's topic as well. Qu, S.Q., and Dumay's study discuss that interviews are particularly useful for uncovering the story behind a participant's experiences and pursuing in-depth information around a topic. Interviews may be useful to follow up with individual respondents after questionnaires to investigate their responses

In the open-ended questionnaire, the participants were asked to give their independent comments willingly against a topic. Whereas the close-ended questionnaire (dichotomic questions, etc.) binds the respondents to give selected responses in close and open environments. As discussed earlier, the purpose of the research design is to lead, describe, explain, and interpret research arguments with the help of research methodology. The arguments, such as how and how far the relevant research methodology issues the research warrants, based on the inferences from prescribed data, to reach a particular conclusion. This means how strongly (statistical power ratio) the prescribed data support research-based arguments (questions) logically. The warrants in research terminology show the degree of confidence (power) that researcher has in the inferences' capability to confirm truths about the reality (single or no reality) that researcher cannot observe directly about the product counterfeiting phenomenon in the automotive industry's supply chains in Pakistan. Therefore, research warrants require to set valid statistical standards according to the mixed research approach. As far as the research inference is a concerned, it is the process of making claims about a phenomenon that cannot be directly observed (like the product counterfeiting phenomenon) based on existing anti-counterfeiting strategies supported body of knowledge (what anyone knows) in the legitimate supply chains of automobile industry in Pakistan.

3.2.3.1 IMPORTANCE OT INTERVIEW PROTOCOL

Qualitative interviewing is a flexible and powerful tool to capture the voices and the ways people make meaning of their experienced learning. The present body of knowledge is considered the best-concerned resource to develop the draft of an interview protocol. With the help of experts' opinions, feedback, and guidance, the draft version of the interview protocol can be refined. Rabionet's (2011, p.563) study says that the interviews require the six stages; a) selecting the type of interview; b) establishing ethical guidelines; c) crafting interview protocol; d) conducting and recording the interview; e) crafting the interview protocol; f) reporting the findings. There are some important components of the interview protocol, one is the rapport-building stage where the interviewer introduces the topic to the interviewee and explains the purpose of the interview and the reason why the interviewee is chosen for this purpose. The other component of the interview protocol explains the type of questions the interviewer is going to ask. Gugiu & Rodriguez-Campos's (2007) study says that one reason for interview protocol popularity may be that by focusing the data collection activities, interview protocols have the potential to standardize data collection and reduce the tendency of premature closure of data collection (deciding based on incomplete data), anchoring (focusing too heavily on specific information), primacy and recency effects (recalling the first and last items of information, respectively with greater frequency), or confirmatory (searching for information, interpreting new and existing information, or avoiding contradictory information to confirm one's preconceptions) biases.

3.2.3.2 INTERVIEW GUIDELINE

The interview guideline (Myers & Newman, 2007) is helpful to all participants to understand terms and definitions before inquiring about the interview questions. This study follows an interview guideline that provides a sequence of close-ended questions. Myers and Newman's study discusses the interview guidelines, such as 1) Situating the researcher as an actor; 2) Minimize social dissonance; 3) Represent various "voices"; 4) Everyone is an interpreter; 5) Uses mirroring in questions and answers; 6) Flexibility; 7) Confidentiality of disclosures. The study can be depicted graphically (Fig-3.2.2.2.2), as follows.

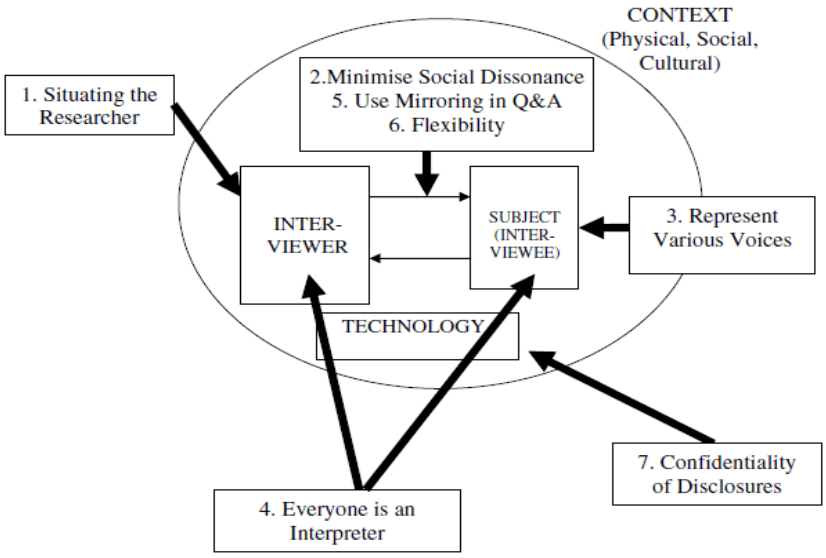


Fig-3.2.2.2.2: Ref. Myers & Newman (2007): "Guideline for qualitative research interview"

Boyce & Neale's (2006) study discusses an example of an interview guide, an initiative for interview participants, and relevant staff members of the program. To strengthen the reliability of interview protocols used for qualitative research and thereby contribute to improving the quality of data obtained from research interviews, Castillo-Montoya's (2016) study discusses four phases process for systematically developing and refining an interview protocol. The four-phased process includes: (1) ensuring interview questions align with research questions, (2) constructing an inquiry-based conversation, (3) receiving feedback on interview protocols, and (4) piloting the interview protocol. This study follows the referenced steps one after the other to discuss the interview protocol framework.

PHASE-1 OF INTERVIEW PROTOCOL: ENSURE INTERVIEW QUESTIONS ALIGN WITH RESEARCH QUESTIONS

The first phase focuses on the alignment between interview questions and research questions. Castillo-Montoya's (2016) study emphasizes that checking the alignment of questions helps map the interview questions. The present research interview protocol (Annexure-I-1, I-2) provides the details of the relevant terminologies, with the consent of the supervisor and subject specialists during topic-brain-storming sessions. One of the investigative points in the present research-based interview guideline is the use of the easily understood language in the question so that research instrument requirements can be met, so to capture the impact of ANCT-INT items' measures on the Firm Supply Performance (FSP), under the influence of networked governance model supported SCQM-Imp environment, in the automotive industry's supply chains in Pakistan. In this phase, the interview questions (IQ) are mapped with the research

questions (RQ) column and row-wise respectively to address the research question. The TABLE-3.2.2.2.2 (a, b, c) is used to present summary in the Table-3.2.2.2.2 (SUM & SUM-1).

TABLE-3.2.2.2.2 (SUM): SUMMARY OF COMMON RESPONSES BY COMPANIES

Interview Questions (IQ) – ALL COMPANIES **Q1. Research questions (RQ)**	IQ-1	IQ-2	IQ-3	IQ-4	IQ-5	IQ-6	IQ-7	IQ-8	IQ-9	IQ-10	IQ-11	IQ-12	IQ-13	IQ-14
Is the "Large Scale (LS) system" Thai model complete and able to capture contributory evidence, supported by the knowledge base, in the context of the networked governance model supported SCQM-Imp environment by combining TQM and SCM practices and their impact on the firm's supply performance (FSP), to address product counterfeiting issue in automotive industry's supply chains?	X													
1.1) All parties installed integrated management system	X													
1.2) All parties maintain lead time and meet supply targets	X													
1.3) Organize meetings, seminars, and conferences for vendors / suppliers	X													
1.3.2) Firms follow multiple vendor development policy	X													
1.4) Monitor and control supplier activities		X												
1.5) Inspection and quality test performed while handling spare parts		X												
1.6) In case of non-conformance, parts are rejected and returned to the supplier		X												
1.7) Firms maintain multiple vendor policies to meet the lead time requirement			X											
1.8) Two teams (department and quality assurance) work together to				X										

ensure spare parts availability														
1.9) Firms follow industry best practices (TQM & SCM practices) to maintain their performance factors					X									
1.10) Buyers are price conscious and fake parts are a serious threat to health and safety						X								
1.10.2) Local parts are used and chances of counterfeiting may occur in the after-market situation.						X								
1.11) Firms uses social media and other platforms to advertise and educate customers about product counterfeiting issue.							X							
1.12) Counterfeit parts disturb the firms' supply performance								X						
1.13) Customers satisfaction enhances firm supply performance									X					
1.14) SCQM environment positively affects the Firm's Supply Performance										X				
1.15) Firms' policy to localize expensive imported spare parts to control counterfeiting activities											X			
1.16) Safety stocks are maintained at supplier's and dealers' levels as contractual binding to satisfy customers' needs												X		
1.17) Firms time to time review policies concerning dealers, distributors, and suppliers to maintain stocks levels													X	
Q2. Research questions (RQ)														
Is the "Large Scale (LS) system" model valid as a hierarchical multidimensional formative measurement model for evaluating the impact of ANCT-														X

INT measures on FSP for the automotive industry's supply chains in Pakistan?														
1) Dealing with Customs and law enforcement agencies with the use of track & trace technologies by: Lobbying for more rigorous counterfeit controls, e.g.; Products attributes and Packaging														X
2) Dealing with market institutions and industry groups by Lobbying for more rigorous counterfeit controls, e.g. forming alliances and networks & Joint advertisements														X
5) Advertise about the safety, performance, and financial risks associated with counterfeits and financial incentives for channel members to reject counterfeits														X
6) Introduce Public Awareness Program about the product counterfeiting phenomenon														X
12) Introduce Cooperation across the supply chain, Supplier qualification, and Supplier penalties for counterfeits and pass-through, Making product replication difficult and costly														X
13) Introduce strategies to prohibit counterfeit products, Introduce a Strict Liability concept, Return outsourced technology and product, Ensure the authenticity of material and components, Use of track & trace technologies, Vigilant to control supply chain risk, Lean management, Share information with suppliers, dealers, and retailers														X

19) Educate all Stakeholders regarding the product counterfeit phenomenon and serious issues related to it, especially employees, customers, authorities, law enforcement agencies, and others														X
21) Formulate Crisis Management plans and Surveillance Programs for firms														X

TABLE-3.2.2.2.2 (SUM-1): COMPANIES (1 to 3) COMMON RESPONSES AGAINST INTERVIEW QUESTIONS (IQ) (IQ-1, Q.1), (IQ-1, 1.1), (IQ-1, 1.2), (IQ-1, 1.3), (IQ-1, 1.3.2), (IQ-2, 1.4), (IQ-2, 1.5), (IQ-2, 1.6), (IQ-3, 1.7), (IQ-4, 1.8), (IQ-5, 1.9), (IQ-6, 1.10), (IQ-6, 1.10.2), (IQ-7, 1.11), (IQ-8, 1.12), (IQ-9, 1.13), (IQ-10, 1.14), (IQ-11, 1.15), (IQ-12, 1.16), (IQ-13, 1.17), (IQ-14, Q.2), (IQ-14, 1), (IQ-14, 2), (IQ-14, 3), (IQ-14, 4), (IQ-14, 5), (IQ-14, 6), (IQ-14, 12); (IQ-14, 13), (IQ-14, 19), (IQ-14, 21		
Company-1 Responses	Company-2 Responses	Company-3 Responses
(IQ-1, Q.1), (IQ-1, 1.1), (IQ-1, 1.2), (IQ-1, 1.3), (IQ-1, 1.3.2), (IQ-2, 1.4), (IQ-2, 1.5), (IQ-2, 1.6), (IQ-3, 1.7), (IQ-4, 1.8), (IQ-5, 1.9), (IQ-6, 1.10), (IQ-6, 1.10.2), (IQ-7, 1.11), (IQ-8, 1.12), (IQ-9, 1.13), (IQ-10, 1.14), (IQ-11, 1.15), (IQ-12, 1.16), (IQ-13, 1.17), (IQ-14, Q.2), (IQ-14, 1), (IQ-14, 2), (IQ-14, 3), (IQ-14, 4), (IQ-14, 5), (IQ-14, 6), (IQ-14, 12); (IQ-14, 13), (IQ-14, 19), (IQ-14, 21)	(IQ-1, Q.1), (IQ-1, 1.2), (IQ-1, 1.3), (IQ-2, 1.4), (IQ-2, 1.4.1), (IQ-2, 1.5), (IQ-2, 1.6), (IQ-3, 1.7.1), (IQ-5, 1.9), (IQ-6, 1.10), (IQ-6, 1.10.1), (IQ-7, 1.11), (IQ-8, 1.12), (IQ-9, 1.13), (IQ-10, 1.14), (IQ-11, 1.15), (IQ-12, 1.16), (IQ-12, 1.16.1), (IQ-13, 1.17), (IQ-13, 1.18), (IQ-14, Q.2), (IQ-14, 1), (IQ-14, 2), (IQ-14, 3), (IQ-14, 4), (IQ-14, 5), (IQ-14, 6), (IQ-14, 6), (IQ-14, 7), (IQ-14, 8), (IQ-14, 12); (IQ-14, 13), (IQ-14, 19), (IQ-14, 21)	(IQ-1, Q.1), (IQ-1, 1.1), (IQ-1, 1.2), (IQ-1, 1.3), (IQ-1, 1.3.2), (IQ-2, 1.4), (IQ-2, 1.5), (IQ-2, 1.6), (IQ-3, 1.7), (IQ-4, 1.8), (IQ-5, 1.9), (IQ-6, 1.10), (IQ-6, 1.10.2), (IQ-7, 1.11), (IQ-8, 1.12), (IQ-9, 1.13), (IQ-10, 1.14), (IQ-11, 1.15), (IQ-12, 1.16), (IQ-13, 1.17), (IQ-14, Q.2), (IQ-14, 1), (IQ-14, 2), (IQ-14, 3), (IQ-14, 4), (IQ-14, 5), (IQ-14, 6), (IQ-14, 12); (IQ-14, 13), (IQ-14, 19), (IQ-14, 21)

PHASE-2 OF INTERVIEW PROTOCOL: CONSTRUCTING AN INQUIRY-BASED CONVERSATION

Castillo-Montoya's (2016) study discusses that researchers should develop inquiry-based conversation through an interview protocol with a) interview questions written differently from the research questions; b) an organisation following social rules of ordinary conversation; c) a variety of questions; d) a script with likely follow-up and prompt questions. This study introduces an interview protocol that covers knowledge of contexts, important terminologies with explanations, and interview questions that are understandable and accessible to

participants. Castillo-Montoya's study states that the researcher's questions are usually formulated in a theoretical language, whereas the interview questions should be expressed in the everyday language of the interviewees (See Interview Transcripts in Annexure-IT-1 (a, b, c); (Annexure-IP-1). Moreover, Castillo-Montoya's study advises researchers to ask only one question at a time, try not to interrupt participants when they are speaking, indicate understanding through nodding or other gestures, and ask to clarify intentions to follow up before the interview ends. Furthermore, the interviewer's responsibility is to gain further information relative to the study at hand by raising four types of questions: 1) introductory questions, (2) transition questions, (3) key questions, and (4) closing questions [Creswell, 2003; Krueger & Casey, 2009].

PHASE-3 OF INTERVIEW PROTOCOL: RECEIVING FEEDBACK ON THE INTERVIEW PROTOCOL

In this phase, the researcher receives feedback on the developed interview protocol. Castillo-Montoya's study emphasizes that research instruments' reliability and trustworthiness are very important so is the feedback on the interview protocol. Feedback can provide the researcher with information about how well participants understand the interview questions and whether their understanding is close to what the researcher intends or expects. Castillo-Montoya's study emphasizes that the process of getting feedback from multiple sources aligns with the iterative nature of qualitative research.

PHASE-4 OF INTERVIEW PROTOCOL: PRE-TESTING THE INTERVIEW PROTOCOL

The researcher after examining the questions in the interview protocol (for clarity, simplicity, and answerability) is now ready to go for the initial investigation. According to the Myers & Newman's (2007) study says that the refined interview protocol facilitates the researcher to gather qualified responses clearly and the order of the questions matters here. The Abd-Gani et al.'s (2020) study emphasizes the importance of the relevant interview questions designed and formulated to achieve the research objectives. The pre-test exercise provides the opportunity to assist the researcher to clarify some questions to improve the interview protocol. Modifications were made because of the pre-test results regarding the quality of wording of the questions. Pre-arranged time, location, and duration of the interview are very important. Hence, pre-test preparation confirms that the measurement instrument should satisfy the recommended time frame and procedure for an interview.

TASKS ACCOMPLISHED BEFORE CONDUCTING INTERVIEW

At this stage, the pre-test interview is carried out before conducting the actual standardized interview research (Abd-Gani et al.'s, 2020). The most important key is this pre-test interview allows the researcher to practice beforehand on the interview techniques according to the three stages of the interview session. The results obtained are adequate to conduct the actual interview.

1) Crafting an introduction to inform the interviewee about the interview process, explaining the purpose of conducting the interview, time duration, how the information will be used to address the research problem, and how the research outcome will impact the health and safety of the consumers.

2) Discussion with the interviewee (telephone/email), before an upcoming interview session, about any clarification needed. Explaining the confidentiality aspect of the data collection process. Express appreciation for the respondents' efforts and their contributions to the research work.

3) Forwarding in advance some important details about the related topic so that trust can be developed with the interviewee.

4) Maintain a good relationship with the interviewee. The interviewer in this case maintains a good relationship (direct/indirect) with all the interviewees. Some interviewees were colleagues of the interviewer in the university, some had a working relationship, and some were friends of the interviewees. Thus, the comfort level is already there before conducting an interview.

5) Deciding about the location and time of the interviews. In this case, all the interviews/group discussions are held in the company (Pak-Suzuki, Honda, and Toyota) offices.

3.2.3.3 COMMUNICATION

Communication between interviewers and interviewee is important before the start of the research interview sessions to get a qualified response, from the respondents, to research interview questions according to the research interview guideline. To obtain qualified responses, Fisher & Geiselman's (1992) study discusses that the Interviewers must communicate their professional, and investigative needs to the respondent, and, in turn, a respondent must communicate their knowledge of the situation to the interviewer. Fisher and Geiselman's study further discuss that the response format should be compatible with the

witness's mental record of the event, thereby minimizing the need to transform the mental record into an overt response. The responsibility of the interviewers is to explain investigative needs in the research interview guideline along with specific details about the questions asked, according to the specified sequence, in the research interview guideline. The responsibility of the respondents is to listen to the instructions of the interviewer (depending upon the availability of the interviewer) or otherwise, first read the research interview guideline carefully and follow the instructions written in the research interview guideline professionally. In case of a non-conformance, according to the standardized instruction set specified in the research interview guideline, ineffective communication results withhold valuable information to mislead the answers to the research questions.

3.2.3.4 CONDUCTING THE INTERVIEW

Behind every story formation in qualitative research, an interview is a form of communication that addresses certain queries so that research problems can be addressed, in a specified order. The context around the topic in the interview can help a researcher to uncover the contextual part of the research themes, within the research study, which requires experience-based responses to address the research problem by answering the research questions. Myers & Newman‘s (2007) study says that there are different types of interviews, such as the structured interview; unstructured or semi-structured interviews; and group interviews. The structured interview is a well-defined script prepared beforehand, where there is no need for improvisation, and it is close-ended. These types of interviews are often used for surveys. The unstructured or semi-structured interviews are open-ended with an incomplete script. The nature of the open-ended questions allows respondents to address the questions in detail without any influence (biasness). In the group or cohort interview, two or more people are involved at one time. This type of interview can be structured or unstructured. This study asks open and closed-ended questions to address the research problem.

PROCESS OF CONDUCTING INTERVIEW

Myers & Newman’s (2007) study discusses the whole process of conducting qualitative research, where, the process of interviewing starts with the planning, instrument development, training of the data collectors & data collection process, analysis of data, and dissemination of the findings. Furthermore, the study presents a stand-alone report with the outline details that include, introduction & justification; methodology; results; conclusion and recommendations; and appendices (including the interview guide). Following the Myers and Newman study to

reach potential sources of information, managers of the PAMA member companies (Pak-Suzuki, Honda, and Toyota) are contacted to support this study. This study considers experts' opinions as the sources of information to continue with the interviewing process. The conversational face-to-face interview, where respondents are allowed to talk uninterrupted without any passing comments or judgments from the interviewer would maintain the flow of the interview process (Ryan et al.'s, 2009). Thus, to maintain a correct comfortable environment and positive rapport during the interview, the roles of the interviewer and interviewee are very important in conducting a face-to-face interview. Ryan et al.'s (2009) study discuss in detail the interview process, the first step is to develop an interview guide/schedule. The interview guide is determined by the structure of the interview, the nature of the research, aims, and objectives of the research study. Interviewers pose the same exactly worded questions (Standardized interview) in the same order to interviewees. This study employs the use of an interview schedule that contains structured and explicit questions that do not allow room for veering off the topic questions (cited in Trochim, 2005). This study prefers to do the pre-test exercise before conducting the final interview. For that matter, a brief overview of the interview guideline with an explanation of the terminologies given to the interviewee before conducting the interview. To maintain rigor (trustworthiness concepts of credibility, transferability, and dependability), a clear interview guideline would help to enhance the understanding of the interviewee. Ryan et al (2009) study say that "Clear accurate interview schedules and documentation will help to address these issues (Tod, 2006)".

CONSIDERATION HAVING A PRIOR RELATIONSHIP WITH INTERVIEWEES

Ryan et al.'s (2009) study say that undertaking interviews with vulnerable populations can be challenging both for the interviewer and the interviewee. An interviewer must form a trust relationship, already developed/formed, with interviewees before conducting the final interview, where pre-testing can be a good option. Establishing a comfortable environment and positive rapport during the face-to-face interview is very important. Ethically, the interviewees should be explained the nature of the research, the use of information, their consent, and the format that the interview will take. It is important to ensure that the interviewee understands the nature of the study, their anonymity status, and the confidentiality of the information. Moreover, the study discusses that in a general situation where an interview is conducted, some factors are important: the place of the interview; time of the interview; persons present; sequence of an interview; experiences of the subjects; emergency characteristics of the

interview; direction is given subject preceding the interview; voluntary vs non-voluntary nature of an interview.

RAPPING-UP THE INTERVIEW

Abd-Gani et al.'s (2020) study say that a good seating arrangement makes the respondents feel at ease and comfortable during the interview session. Following are the steps are taken before the start of the proceedings.

1) The decision about the seating arrangement, briefing, and explanation of the interview session, process of interviewing the respondents, and recording of the data until the closing of the interview session.

2) The interviewer started by having an informal conversation (greetings, self-introduction (previous relationship and earlier discussions made about contents), and appropriate non-verbal communication such as a firm handshake, smile, and eye contact) before asking the interview questions.

3) The interviewer explains the research nature, purpose, and length of the interview session.

4) The interviewer asks the interviewee about any of his concerns related to conducting an interview. If no, then ask permission from the interviewee to start the interview.

5) The interviewer followed the interview protocol sequentially (see Annexures IP-1), with the use of probing techniques to elicit rich information, recording is done, and note-taking is also done. The entire interview takes 45 minutes to complete.

6) English is the medium of conversation as the approach to continue the discussion, but the national language of Pakistan (Urdu) can be used where necessary.

7) According to the interview protocol, the open-ended standardized questions are asked one after the other in sequence.

8) An extended question (what, why, how, etc.) is asked after every discussion so that interviewee can elaborate his explanation.

9) Upon the closing stage of the interview, the researcher summarized the interview session and ask for any suggestions from the interviewees.

10) The interviewer asks closing questions, such as, “Is there anything else that you would like to add before we close the session?” and “Do you have any final thoughts to add about this interview or any further comments to make?”.

11) Finally, the researcher expressed his appreciation and pleasure to the interviewees for their goodwill, and a token of appreciation is given to each of the interviewees.

SOME CONSIDERATIONS DURING INTERVIEW SESSIONS

1) The demographic information is gathered to start the interview
2) Essential questions, which are the focus of the study, are included.
3) Poorly worded questions are refined and ask relevant questions that answer the research questions.
4) The recording arrangement was checked.
5) Good eye contact and silence during the interview allow the interviewee to pause and reflect. Similarly, echoing and repeating the interviewee’s wordings conveys the indication that the interviewer is attentive and listening to the answers.
6) Open-ended questions are asked to explore answers more widely from the respondents (see Annexure-IT-1 & 2)
7) Probing questions are raised to draw out more information by asking to elaborate on the issue

POST-INTERVIEW STAGE

The recording is checked concerning interruption and noise, which is the requirement of the transcribing process. The researcher also paid attention to the duration of time taken to conduct each interview. As each interview session’s period time averaged approximately 45 minutes. At this stage, the interviewee responses are recorded on the sheet (Annexure-IT-1) and then make it available to the summarized form of table [Table-3.2.7.2.2 (SUM) & (SUM-1)]. The data collected from the interview is transcribed verbatim, coded, and themed according to the research objectives (see Chapter-4, Section-4A.1, p.141).

3.2.8 SUMMARY OF THE CHAPTER

The chapter discusses the survey strategy and the survey research process to answer the research questions, the research findings, and the impact on future research practices. The

importance of the ontological observations about the phenomenon and epistemological assumptions to gain an understanding of the phenomenon in the research process. This chapter discusses the paradigm studies (positivist and interpretive) to seek to answer the question of how to address the research problem. This chapter discusses the pragmatic approach of the mixed method, where Creswell et al.'s (2011) study provides guidelines to design the mixed method of research study and support transformative research strategies to understand specific theoretical perspectives. Moreover, the contributory evidence from the knowledge base streams is also part of the discussion. The discussion includes the study work plan with the approach to applying a mixed method of research to gather qualified responses. This chapter discusses a high-level research design to cover different phases of the research project. In research methodology, different methods are used to gather responses from the managers of the PAMA and PAAPAM member firms. The interview is used as a powerful tool to capture the learning of the respondents. This interview protocol is prepared to help build rapport with the interviewee, where an explanation of the purpose of the interview, type of the questions to be asked, and the procedure of conducting the interview are explained. For that matter, a guideline is helpful for the interviewee is helpful for the participants in the interview to understand terms and definitions. The chapter discusses Myers & Newman's (2007) study guidelines for the qualitative research interview. To strengthen the reliability of the interview, four phases of developing and refining (Castillo-Montoya, 2016) interview protocol are discussed. This chapter also discusses the process of interviewing in detail. Further details of the analytical part (use of NVivo application for thematic analysis) of the exploratory phase of conducting an interview are discussed in chapter 4 (section-4a).

CHAPTER 4: EXPLORATORY AND EXPLANATORY PHASES

4.0 INTRODUCTION

This chapter discusses the need to implement a systematic review procedure to reduce the subjectivity of the contents so that objectivity can be reached after applying four steps of the content analysis. This study considers experts' opinions as the sources of information to continue with the interviewing process. The purpose of academic research is to gather information [Exploratory work (discovering, uncovering, exploring), Explanatory work (theory testing, understanding causal relationship), and Descriptive work (illustrating, describing, summarizing)] to address the research problem.

- In the first phase, the structured interviews are arranged on a one-to-one basis in Pak-Suzuki Motors. In Honda and Toyota interviews are arranged with their managers. These interviews are video recorded except for Toyota Motors. The transcription is done for later analytical use. The NVivo software application is used for analytical purposes.
- The interviewee's responses indicate the importance of the research problem to the firms so that they can take strategic decisions to address the research problem. The present research study takes help from managers of the PAMA member companies (PakSuzuki, Honda, and Toyota) to support this study.
- In section 4.1, the video-recorded interviews were arranged to explore the interviewee (managers of the PAMA member firms) responses during the exploratory phase of the study.
- The interviewee showed concerns about the existence of product counterfeiting activities in the automotive industry's supply chains in Pakistan, mostly in the after-market supply chains. They believe that OEMs have no control over the open market. Fort that matter, the firms need to establish their surveillance programs to monitor the activities in the automotive industry's supply chains.
- In section 4.2, the survey methodology is recommended when investigating the relationships between various factors of the large population which can be used at the verification and validation stages. This study while conducting surveys introduces un-structured or semi-structured questions with an open space for respondents' comments. The nature of the open-ended questions allows respondents to address the questions in detail without any influence (biasness).
- In section-4.2.1.1, this study discusses fifteen (15) facets of the survey research process, recommended by Andres's (2012) study, in detail (see Fig-4.2.1.1a). The mapping out survey research process discusses a combination of research approaches to address the research problem with the help of the research questions, where research design emphasizes the importance of the use of the mixed method to reach the sample of the population for their feedback.
- This study discusses the survey processes and the mixed method of research design (sequential transformative strategies) in detail (Fig-4.2.2b). The discussion covers the survey design, survey instrument development, and survey execution information.
- The initial survey helps to investigate the applicability and suitability of the Thai model in the Pakistani context. This chapter discusses in detail the administration of the initial survey process, which include the distribution of the instrument, data description, data analysis, and content analysis (qualitative and quantitative) along with the coding agenda.

4.1 EXPLORATORY STUDY PHASE

4.1.1 INTERVIEWS CONDUCTED

The video recorded interviews arranged to explore the reachable practitioners' confirmation about the presence of product counterfeiting phenomenon in the automotive industry's supply chains in Pakistan, which is one of the research objectives of the study. The desired help sought for to convince the supply chain practitioners in the firms (Pak Suzuki Motors, Honda Motors, and Toyota Motors) to arrange group meetings and to organize one-to-one interview sessions (see Table-4.1.1a). Thus, confirm a reality on an empirical bases that the product counterfeiting does exist in automotive industry's supply chains in Pakistan. For this purpose, this study conducted ten (10) interviews and taken expert opinions from managers of the automotive firms (PAMA members). The supply chain practitioners are assured with a commitment that privacy and confidentiality of the interview's outcome should be maintained. The open-ended questions were asked during video-recorded interviews, according to the interview guideline. The participants from Toyota Motors responded but without recorded interviews. The data are then collected, organized, \and made available for interview transcriptions and readability [Table-IT-1 (a- e)]. The collected data was then explored further with the help of N-Vivo software for analysis (thematically coded & clustered). The reference work highlighted (Fig-4.1.1a and 4.1.1b) where recorded interview files, word frequency (TreeMap), and cluster analysis results were shown by using N-Vivo software. The cluster analysis highlighted some very important keywords, like Counterfeiting, collaboration, coordination, intermediaries, high-level strategies, quality, monitoring, enforcement, control, penalties, inspection, solicitors, surveillance, patents, copyright, local laws, distributors, suppliers, customers, relationship, performance, etc.

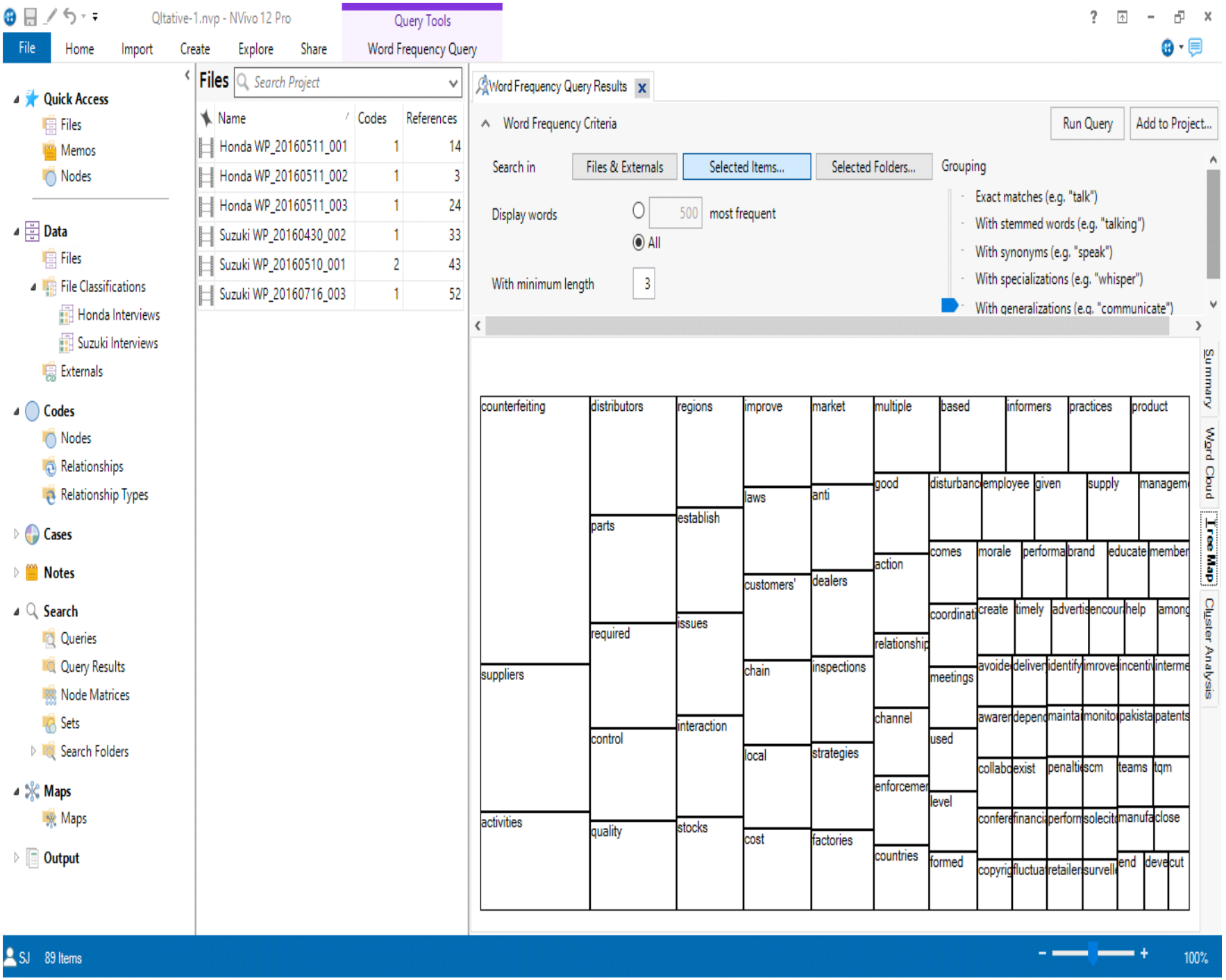


Fig-4.1.1a: Interview files and Word frequency results using N-Vivo software

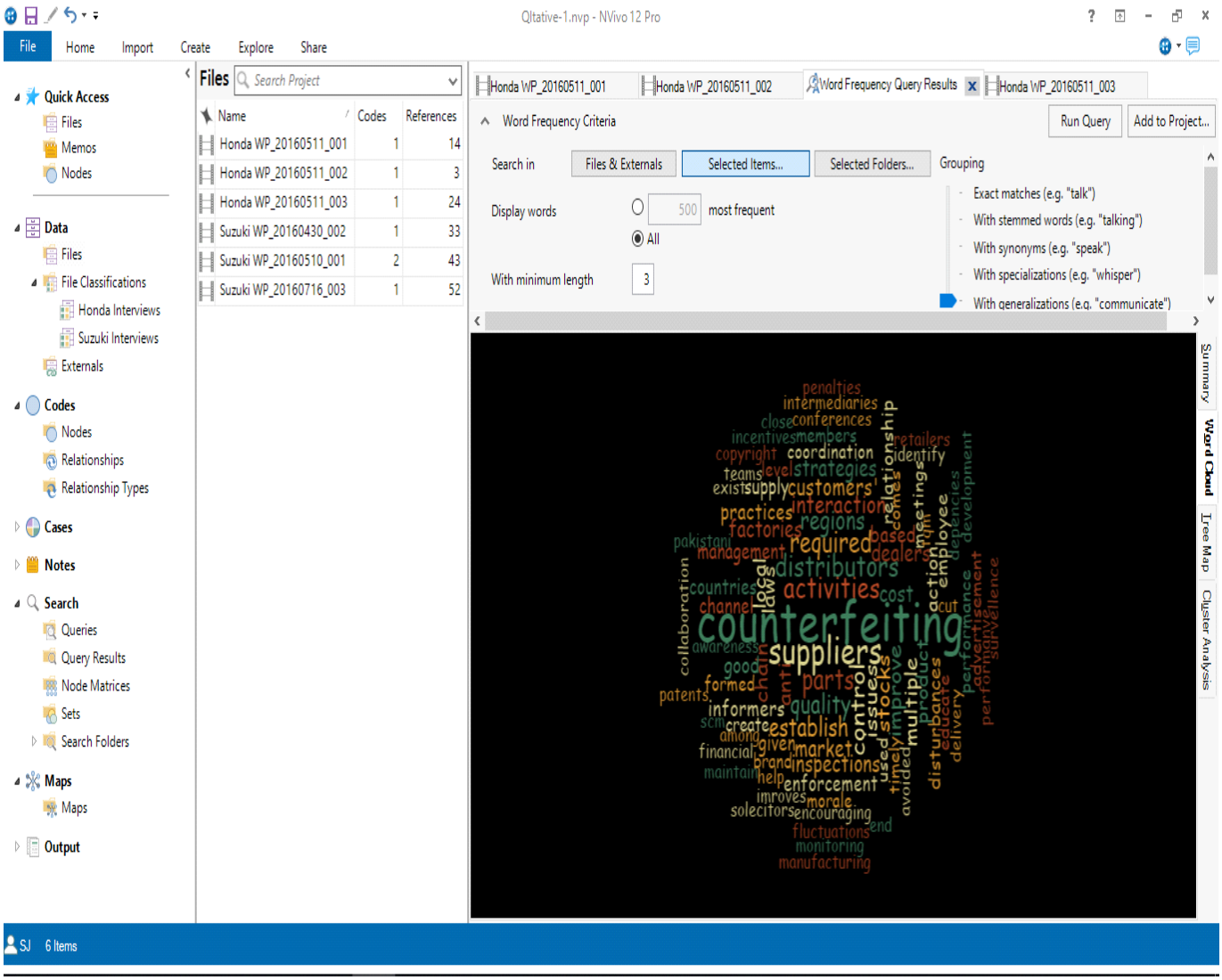


Fig-4.1.1b: Interview files and Cluster analysis results using N-Vivo software

The interviewee(s) showed their concerns about the existence of the product counterfeiting phenomenon in automotive industry's supply chains in Pakistan, mostly in after-market supply chains. They said that OEMs have no control over the open market. As far as before-market condition consideration, during the discussion, the interviewee(s) admitted that there are possibilities of product counterfeiting phenomenon at decoupling points in the licit supply chains under various pressure conditions (delivery, shortage, lead time, customized requirements, etc. According to their opinion, firms should maintain surveillance teams to explore possibilities of product counterfeiting for the automotive industry's supply chain and use market intelligence to monitor any scrupulous activities in the market. Moreover, the local laws should take a due logical course of action to curtail the possibility of product counterfeiting.

4.2 EXPLANATORY STUDY PHASE

4.2.1 SURVEY METHODOLOGIES FOR RESEARCH WORK

Pinsonneault & Kraemer's (1993) study identifies three characteristics of the survey: a) Survey is a quantitative method, which requires standardized information; b) Survey uses structured and predefined questions to collect information (Questionnaire); c) Information is collected via a sample of a population to generalize the findings to the population. According to Pinsonneault and Kraemer's study, the survey instrument can be a written document, an online questionnaire, a face-to-face interview, and a telephone interview completed with the data gathered from the survey (Table-4.2.1a).

Table-4.2.1a: Classify survey research for its purpose

Exploratory surveys	It is used to become more familiar with a subject and to examine any initial concepts.
Descriptive surveys	When a goal is to examine what situations, events, attitudes, or opinions are occurring in a population.
Explanatory surveys	It is used to test a theory and the causal relations within that theory.

Source: Pinsonneault & Kraemer (1993)

Trochim et al.'s (2016) study divided the mapping process into the six-step model: Preparation; Generation; Structuring; Representation; Interpretation; and Utilization. Trochim et al.'s study further says that survey research considers the most widely used method. The main reason for choosing the survey method, along with a Likert scale of 5 is to collect responses, which provides high generalizability of the findings, which is one of the main aims of the study.

4.2.1.1 MAPPING OUT SURVEY RESEARCH PROCESS

The survey research is multifaceted and versatile depending on, Andres's (2012) study says that open-ended and close-ended questions are asked in the survey by using a different combination of approaches to gather data. Andres's study maps out the survey research process and emphasizes that a good survey design requires that the researcher should possess the expertise to not only understand but to follow each facet of the survey research process in its true perspective (see in Fig-4.2.1.1a). Where fifteen (15) steps are involved to complete the survey research process. In the first (1) step of the facets of the survey research process, the research study discusses the research problem and relevant research questions. This study investigates the possibilities of reducing occurrences of product counterfeiting phenomenon in automotive industry's supply chains in Pakistan. In the second (2) step of the facets of the survey research process, the research study locates the workplace in the research design and processes. This study looks for respondents' platforms where employees have at least three (3)

years of direct supply chain experience in the automotive industry in Pakistan and are registered employees of the PMA forum and PAAPAM forum member firms. In the third (3) step of the facets of the survey research process, the research study guides researchers to anticipate several respondents from the automotive industry's supply chains in Pakistan. In the fourth (4) step of the facets of the survey research process, the research study guides the researchers to apply the triangulation technique to determine what is already known (relevant body of knowledge) after anticipating the prospective respondents. Using data from an existing database and adding on a smaller component of primary data collection in the form of a questionnaire or interview may result in a strong research design.

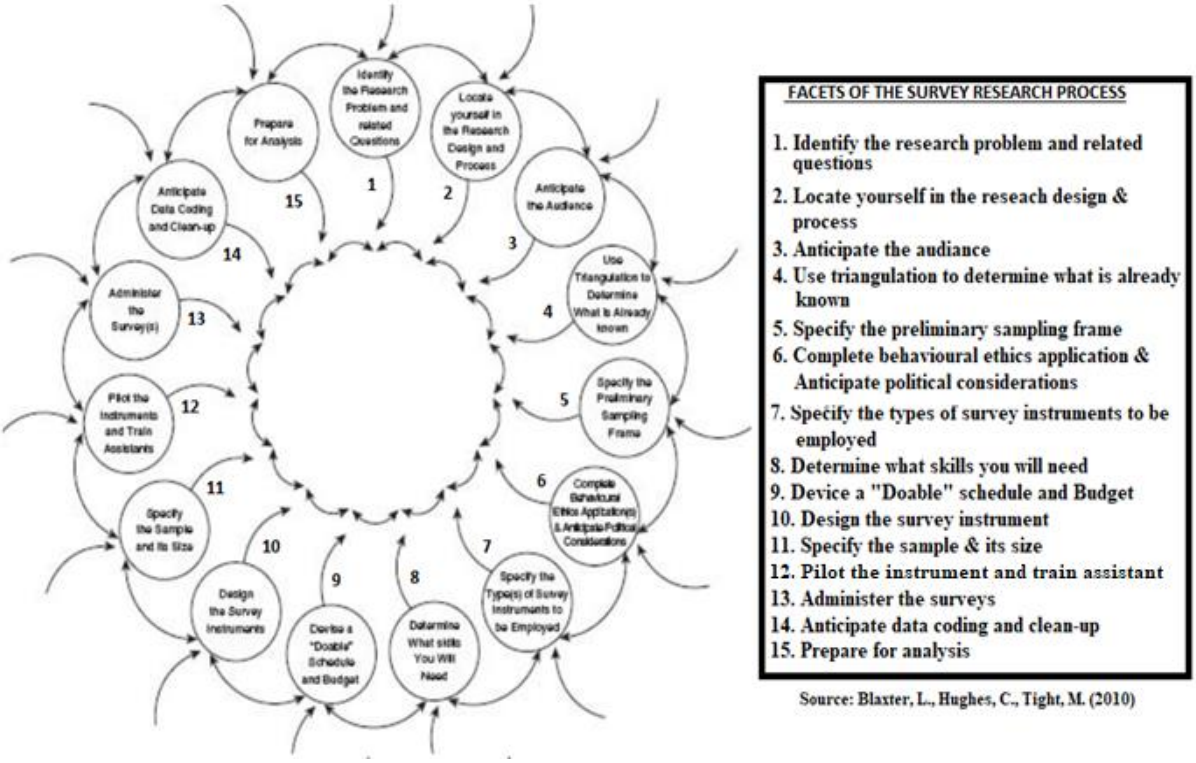


Fig-4.2.1.1a: Ref- Andres (2012) Mapping out the survey research process

After completing the fourth step of the survey research process (see in Fig-4.2.1.1a) to determine what is already known about the research problem, the survey instrument is examined, compared, and scrutinized for its usefulness in the present research study. The universe of interest can be any relevant community (automotive industry in Pakistan) with a related universe of participants (employees of the PAMA and PAAPAM member firms). From the universe of participants, according to Andres's study, "…*the sample is narrowed down by focusing on criteria such as location (e.g., country, region, city), demographic characteristics (e.g., age, gender, ethnicity race of participants), and any other relevant criteria*". In this way,

the fifth (5) step of the facets of the survey research process is complete in specifying the feasible preliminary sampling frame to determine whether the desired sample can be studied under ethical, political, financial, or sheer logical considerations. In the sixth (6) step of the facets of the survey research process, the researchers obtained ethics approval from the respondents' sample in the minimum time frame (apply the complete behavioural ethics application) to complete the survey form. For that matter, Andres's study says that guideline communicates self-explanatory information clearly to the participants before any attempt to fill out a survey form.

In the seventh (7) step of the facets of the survey research process, it may be desirable to employ more than one type of data collection technique. For that matter, this study specifies different types of survey instruments, as modes of communication, which include pen-and-paper questionnaires, face-to-face interviews, and experts' discussions. Different mode of communication results in different responses, which in turn gives strength to triangulation built into data collection. In the eighth (8) step of the facets of the survey research process, the plan of data gathering process in this study covers two survey rounds: the first survey is a part of the exploratory phase, named the "Initial Survey". The second survey is part of the confirmatory phase and is called the "Confirmatory Survey". The exploratory phase assists in developing hypothesized measurement model, while the confirmatory phase assists in validating that hypothesized measurement model against newly obtained data. This study completes the eighth (8) and ninth (9) steps of the facets of the survey research process. Andres's study refers tenth (10) step of the facets of the survey research process in terms of the design of the survey instrument and suggests that after reviewing literature and examining the instrument the required amendment can be done in the research instrument. The study discusses the possibilities of incorporating the existing survey items into the newly developed questionnaire, which allows for direct comparison with previous research. In the eleventh (11) step of the facets of the survey research process, the research study specifies the details of the opted sampling strategies in terms of the probabilistic, non-probabilistic sampling strategies, or both. In other words, every study requires a series of sampling decisions, many of which are purposive. Initially, all survey research begins to form the purposive stance of the researcher. That is, judgments about what is and what is not important to study are used to conceptualize the initial stages of the survey research design, and most often these same judgments shape every step of the decision process. In the twelfth (12) step of the facets of the survey research process, the research study suggests researcher pre-test the entire survey instrument and train

assistants accordingly. In thirteenth (13) step of the facets of the survey research process of the research study depends upon the nature of the survey that encourages researchers to administer the survey activities and follow survey administration procedure. In the fourteenth (14) step of the facets of the survey research process, the research study guides researchers to anticipate data coding and perform clean-up activities where required. Finally, in the fourteenth (14) step of the facets of the survey research process, the research study also specifies a plan for analysing open-ended questions or interview data. For that matter, the codebook is produced in advance of collecting data through the use of quantitative and qualitative software (Andres, 2012). By working through the exercise of developing a code book before the researcher has administered the survey, the study will be able to detect any problems in advance related to the questions. Also, a researcher can assess the labor intensiveness of data entry, which may result in a further revision of the survey instrument.

Lastly, in the fifteenth (15) step of the facets of the survey research process, the research study focuses on how to conduct analyses of survey data after discussing how to prepare a research survey for analysis in step fourteenth (14) of the facets of the survey research process. The data was collected, as referenced in step fourteenth (14), after applying mixed methods of the research study. To perform the data analysis work, Andres's study emphasizes that by using a mixed-methods approach to data analysis it is possible to present rich and accurate information. The entire survey research design process has been mapped out under Andres's study guidelines. In this survey research design process, Fig-3.1.1a illustrates each interrelated facet of the research design, as discussed in this brainstorming exercise. This study uses software applications like "Nvivo" for qualitative analysis (transcription & thematic analysis, and descriptive analysis) and PLS-SmartPlus application for quantitative analysis (Structure Equation Modelling-SEM) along with used SPSS application for data entry, data compilation, and normalization. The following sections within survey design, survey instrument development, and survey execution are listed as follows;

THE SURVEY PROCESS

4.2.1 Survey design

4.2.1.1 Sample selection

4.2.1.2 Sample size

4.2.1.2.1 Degree of Precision

4.2.1.2.2 Statistical power

4.2.1.2.2.1 Effect size as a determinant of power

4.2.1.2.2.2 Sample size as a determinant of power

4.2.1.2.3 Access to subjects

4.2.1.2.4 Stratification and Clustering

4.2.1.2.5 Units of Analysis

4.2.1.3 Choices of Survey media

4.2.1.3.1 Written survey

4.2.1.3.2 Verbal surveys

4.2.1.3.3 Mixed-mode surveys

4.2.2 Survey instrument development

4.2.2.1 Standards for Good Survey Questions

4.2.2.1.1 Question wording

4.2.2.1.2 Feasible and Ethical

4.2.2.1.3 Additional considerations

4.2.2.1.4 Biased wording

4.2.2.1.5 Biased context

4.2.2.1.5.1 General characteristics

4.2.2.1.5.2 Cognitive implications of biased context

4.2.2.1.5.3 Facets of Biased context

4.2.2.2 Types of Survey questions

4.2.2.2.1 Open-ended questions

4.2.2.2.2 Closed-ended questions

4.2.2.2.2.1 Questions that describe that evaluate people, places, and events

4.2.2.2.2.2 Questions that measure responses to ideas, analyses, or proposals

4.2.2.2.2.3 Questions that measure knowledge

4.2.2.3 Subjective responses to survey questions

4.2.2.4 Cognitive tasks required for the survey response

4.2.2.5 Sources of measurement error

4.2.2.3 Survey execution

4.2.2.4 Data analysis and reporting survey results

This study references Figure-4.2.2b as the mixed method of research design (sequential transformative strategies) to highlight step-1 to step-8 approaches.

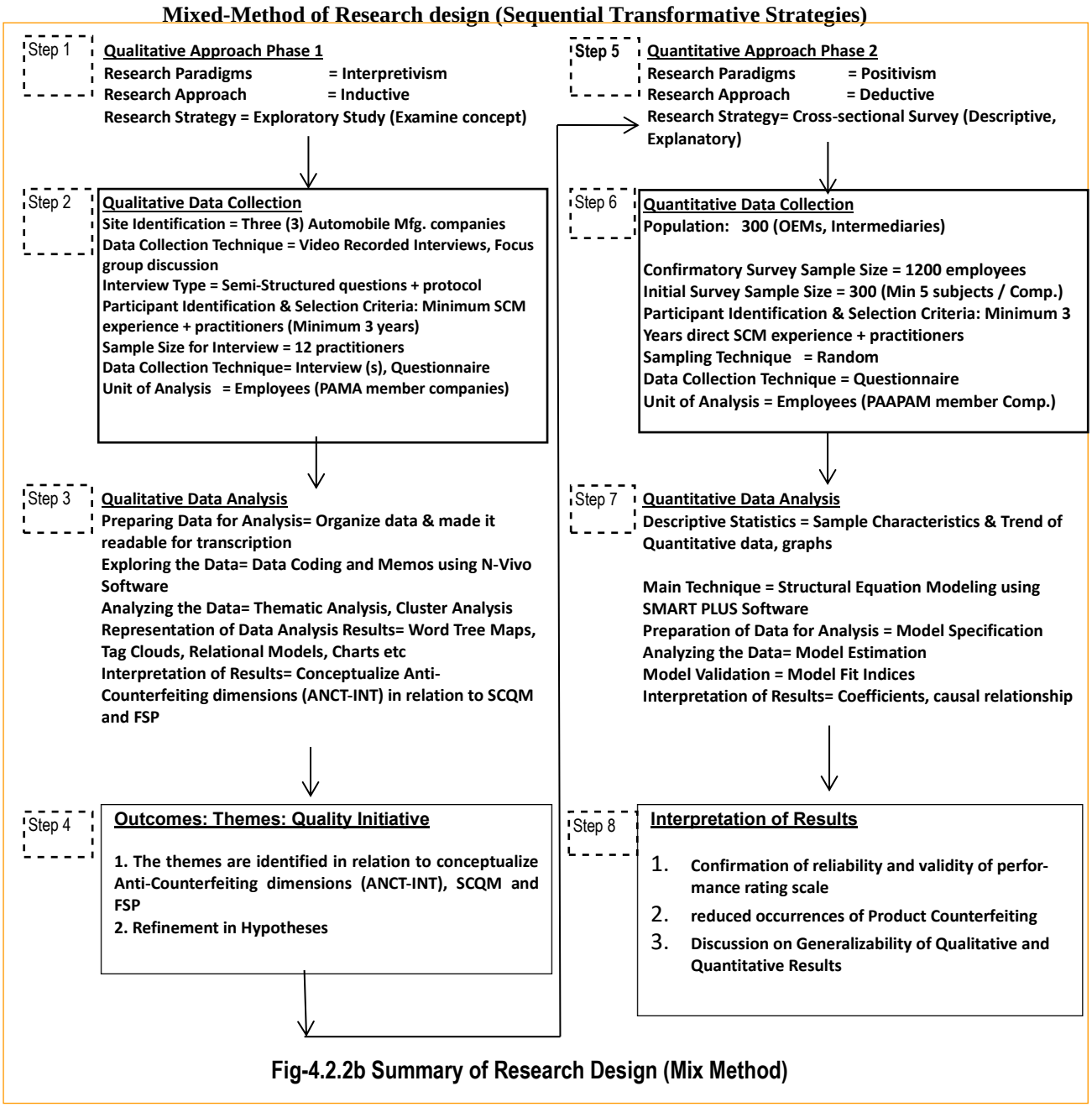


Fig-4.2.2b Summary of Research Design (Mix Method)

Step 1 of phase 1 starts with the qualitative exploratory approach to describe the initial concept, defining the research paradigm as interpretive to follow the research study inductively. The step-2 involves three automobile manufacturing companies (Pak-Suzuki Motors, Honda Motors, and Toyota Motors), which are PAMA members. The convenient sampling approach is used. The twelve (12) interviewees are accessible through friends and colleagues. Interviews are video recorded. Focused structured questions are asked. The participants are selected based

on their experience. The minimum selection criterion is three (3) years of experience in the supply chain area. The employees of the PAMA member companies are selected for interviews. After conducting the interview and completing the recording process, step 3 starts. The step-3 involves different activities related to data organisation, sorting, removing, transcribing & clustering, thematically observing the trend, and categorizing according to the data movement. The N-Vivo software is used to explore the data and data analysis with the help of tags clouds. The themes are then identified concerning conceptualizing Anti-Counterfeiting dimensions (ANCT-INT), SCQM, and FSP. Inductively, step 4 shows the outcome of the data analysis confirms the presence of the product counterfeiting issue in the automotive industry's supply chains in Pakistan. Further explanatory work is required to confirm the theory deductively. As the positivism philosophy explains the investigative phenomenon is to measure "single reality" to discover the causal relationship among variables, considered the basis of generalized knowledge. For that matter, well-defined variables/constructs and research instruments are used to justify hypothesized causal relationships [Creswell et al.'s (2011)]. As a research strategy, step 5 is now followed to conduct a cross-sectional survey to confirm the theory deductively.

Before conducting the confirmatory survey, the initial survey allows researchers to communicate the implications of the study to the managers and authorities. The primary purpose of the initial survey is to check the applicability of the hypothesized model dimensions and measures in the context of the automotive industry's supply chains in Pakistan. Step 6 involves parts manufacturers (OEMs, vendors, and intermediaries) which are PAPAAM member companies in Pakistan. The random sampling approach is used to reduce the response biasness of the samples. For the initial survey, the PAAPAM forum is selected where employees of the PAAPAM member companies attend conferences, seminars, and training programs. For conducting the initial survey, the sample target was approximately 100 participants, but this brings the limitation to conducting EFA analysis where the sample size must be greater than 255 otherwise KMO (Kaiser-Meyer-Olkin) and Bartlett's tests for measuring sampling adequacy and sphericity respectively not conducted (see Table-4B-2.3a). The SPSS will not perform the analysis and print a message "Correlation matric is NPD (Non-Positive Definite)" appears forcing the researcher to adjust the sample size accordingly. This means that some of the Eigenvalues of the correlation matrix are not positive numbers. The participants are selected based on their experience. The minimum selection criterion is three (3) years of experience in the supply chain area. For data collection, the paper-based format of questionnaires was distributed for survey purposes. The step-7 involves quantitative data

analysis to develop descriptive statistics based on sample characteristics. For further quantitative analysis, the SPSS software application is used. During data analysis different activities related to data organisation, sorting, removing, observing the trend, and categorization activities, according to the data movement, are performed for model specification. The initial survey helps to finalize the content and phase validation of the survey instrument and prepare it for a confirmatory survey after doing necessary amendments (based on experts' opinions). This study initiates the initial survey process for data collection to reveal relevant components. Thus, the initial survey helps decide to apply the rules of EFA to emphasize clear decision sequencing and protocols to be used for investigation. Costello & Osborne's (2005, p.1) study emphasizes that EFA provides practical information on making decisions regarding (a) extraction, (b) rotation, (c) the number of factors to interpret, and (d) sample size. This study uses the Scree Plot to reveal a clear break to justify retaining all four components of the construct. The EFA technique identifies the relevant dimensions with the required degree of collinearity. Futuristically, once an instrument is developed using EFA can move to the CFA stage to address questions regarding the validity of the instrument in population subgroups. CFA can allow researchers to test hypotheses via inferential techniques for informative analytical options.

This is important to mention the limitation of the study that the progress of the thesis is against the original intention to survey to confirm the presence of the direct and indirect relationship among the TQMP, SCMP, and ANCT-INT with FSP, in the networked governance model supported SCQM environment. That is, the thesis set out to undertake CFA following EFA using a separate sample of respondents. This was not possible due to the sample size, which was impeded by the pandemic, and so CFA was performed using the same sample as EFA. The data collected was then analysed and specified with the help of the SPSS and the SmartPlus software applications. The SEM technique is applied for extended model estimation and the model fit analysis and the result is interpreted for existing causal relationships. Descriptive statistics are used to study the demographic and the automotive industry's supply chain trends with the help of graphs and charts.

Step-8 is used for confirmation of the reliability and validity of the ANCT-INT items' measures supported construct. The presentation of the result required in the management terms, brings refinement to the hypothesized assumptions, to address the research problem. The outcome of the data analysis leads to strategic decision-making to implement relevant ANCT-INT items' measures in the automotive industry's supply chains in Pakistan.

4.2.1.2 INITIAL SURVEY PREPARATION

The Initial Survey allowed the researcher to communicate the implications of the study to the practitioners and authorities. The Initial Survey helps demonstrate the importance and potential rewards, of Thai model measurement for the participant firms. The primary purpose of the initial survey is to check the applicability of the Thai model dimensions and measures in the Pakistani context and the supplementary purposes are discussed as a): identifying Thai model dimensions and measures; evaluating model appropriateness; understanding development among the participants' firms; identifying various employment cohorts: providing explanatory information for the study; ensuring commitment for confirmation survey. The initial survey exercises not only address the research question Q1 but also addresses the investigative questions. The outcome of the initial survey would help in determining the appropriateness of the existing dimensions and measures of the Thai model that are useful for the use of the automotive industry's supply chains in Pakistan.

To serve the exploratory purpose and to finalize the design of the confirmatory survey, the initial survey deployment exercise not only confirms the capability of the investigative Thai model but observes the impact of the new dimensions and measures of constructs to address the issue of the presence of product counterfeiting phenomenon in automotive supply chains in Pakistan. Whereas the explanatory purpose serves to determine the presence of the degree of objectivity in the research study, capable to interpret the study findings into the measurable reality (evidence) that confirms the presence of the product counterfeiting phenomenon in automotive supply chains in Pakistan.

The chapter is structured and organized into seven sections. The first section discusses the main purpose of the initial survey while the second section focuses on its research context. The second section provides background information about the Pakistan Automotive sector, Associations (PMA, PAAPAM), participating firms, and the selection of the samples. The third section discusses the actual data collection process of the Initial survey, which involves steps such as designing the survey instrument, conducting interviews, and questionnaire dissemination process. The fourth section describes actual respondents and the result of their responses. The respondents classify according to their demographic characteristics. The fifth section discusses methodology, the conduct of the data, and perform content analysis. The sixth section display data analysis results and findings. In the end, the seventh section of the research

study describes the "Extended (LS) system" model with the result findings of the data analysis. Fig-4.2.1.2 depicts the overall initial survey design.

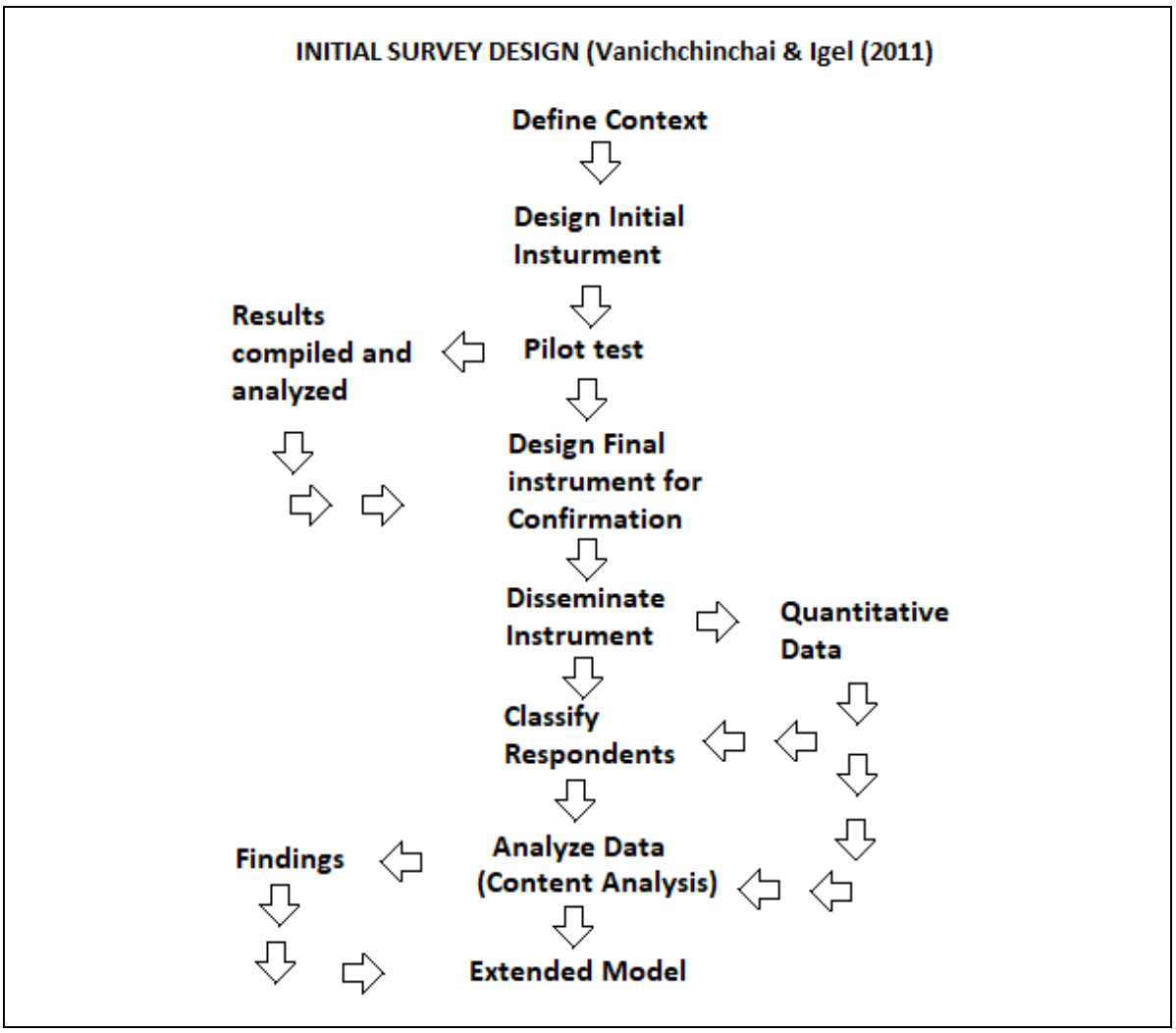


Fig-4.2.1.2: Initial Survey Design

4.2.2 SURVEY INSTRUMENT DISTRIBUTION

To make sure that the survey activity helps collect the data, the distribution of the survey instrument is important. Moreover, it is also important that the survey instrument should show its clarity, comprehensibility, and completeness. This test is concerned with three main points: the design of the instrument and its ability to collect the needed data; the language of the survey instrument; and the best way for disseminating the instrument. The first point is to investigate the design of the survey instrument in terms of the questions asked to collect the needed evidence for the study. Therefore, to make sure that the questions asked are good enough to capture the required information to identify the impacts of the constructs (ANCT-INT, SCQM-Imp) on Firms' supply performance. Three hundred and five (305) participants from sixty participating firms took part in the initial survey. Before the survey, the participants were

briefed about the importance of the topic concerning the automotive industry and asked to cooperate to respond to the questionnaire's requirements so that the research problem could be addressed. The concerned participants communicated the same to their managers & supervisors and requested them to endorse the survey and encourage their subordinates to provide quality responses. As English is the official language of Pakistan, so the respondents faced no difficulty in responding to the questionnaire. For the dissemination of the instrument, feasible, quick, and cost-effective methods were adopted to reach the respondents at the time of PAAPAM members' meetings in Lahore and personal visits where possible. The respondents were asked to write their suggestions to improve the instrument's appearance, ideas, and ways to raise the response rate. Group discussions and experts' opinions were taken to improve the design of the initial survey form. The forty-eight (48) survey forms were rejected as an un-qualified inquiry due to entry errors or participants skipping some of the required information. Therefore, the remaining responses that are considered qualified reach two hundred and fifty-seven (257) only. The initial survey has helped firms in deciding the best method for disseminating survey instruments. In initial testing, electronic mail was used primarily as a means of disseminating the survey instrument. But due to less response rate, the paper-based survey is used as Pakistani prefers face-to-face communication over other means.

4.2.3 INITIAL SURVEY DATA DESCRIPTION

In this section, the survey respondents are described and classified according to the demographic data. This section included an Initial description of the nature of the responses, the number of citations extracted from these responses, and the coverage of these citations.

DESCRIPTION OF THE RESPONDENTS AND THEIR RESPONSES

The respondents are classified in terms of their departments, their demographic data, such as their work experience, the department they work for, and their designation. Two hundred and fifty-seven (257) participants are selected for the initial survey [employment cohort: operational (241), technical (6), and strategic (10)]. Three-employment cohort categories were inferred from participants' occupations/positions in the context of FSP. The "operational category" represents supply chain practitioners & procurement specialists; the "technical category" represents production & operations managers; the "strategic category" represents the CEO and Directors of the company. The selection criteria of participants related to their experience in the automobile industry, at least three years of experience are required. Department-wise details cover several respondents for an initial survey from Employment

Cohort [SC practitioners (50), Purchase / Procurement (specialist) (140), Production & Operations Managers (51), Store and Inventory Control (0), Managerial Coordinator (6), Finance and Accounts Manager (10)]. The textual responses from the respondents, from the Initial survey, were transcribed in the form of paragraphs. The first step in the data analysis of the Initial Survey is to decompose these paragraphs into independent units' "citations". The process of decomposing paragraphs is systematically done using specified criteria. The decomposition process of the responses resulted in 360 distinct citations. These responses decomposed into independent units ensures that every citation is mapped or coded into one category of "measures". To test the completeness and representativeness of the citations, experts' opinions were taken to study these citations' impact. The discussion concluded that the citations covered mostly addressed impacts of the Thai model with few exceptions aligned with the ANCT-INT strategies, under the supported SCQM-Imp environment, required to enhance FSP.

4.2.4 INITIAL SURVEY DATA ANALYSIS

This section describes and explains the content analysis part of the survey data. As illustrated earlier, the data collected are textual (qualitative) in nature. For that matter, a comprehensive literature review of content analysis is required. The section describes the type of content analysis used in this qualitative study. Moreover, the deductive approach to the application is also discussed concerning the type of content analysis in the study.

a) CONTENT ANALYSIS: In this study, the content analysis approach was found suitable for analysing citation data. Content analysis is a systematic & objective method that helps researchers describe and quantify phenomena. The specific strength of content analysis in a mixed-method is that it can combine qualitative approaches to retain rich meaning with powerful quantitative analysis. In the mixed research method, the content analysis concept is theoretically grounded as Hsieh & Shannon's (2005) study discusses conventional (inductive), directed (deductive) and summative approaches. The main difference among these approaches is the initial codes or categories development procedure. Hsieh and Shannon's study emphasises that the number of systematic methods employed for the content analysis. Research methods include ground theory, ethnography, phenomenology, and historical research (Table-4.2.4a).

Table-4.2.4a: Major coding differences among three approaches to content analysis

Approaches / Type of content Analysis	Study starts with	Timing of defining codes or keywords	Source of codes or keywords

Conventional (Inductive)	Observation	Codes defined during data analysis	Codes are derived from data
Directed (Deductive)	Theory	Codes defined before and during data analysis	Codes are derived from theory or relevant research findings
Summative	Keywords	Keywords identified before and during data analysis	Keywords are derived from a literature review by the researcher

Source: Hsieh & Shannon (2005)

An inductive approach is preferred in theory building and the deductive approach is suitable for validating and extending existing theoretical models. The deductive approach is efficiently used for extending or modifying an existing theory or framework.

b) CONTENT ANALYSIS PROCEDURE

Elo & Kyngas's (2008) study discusses the documentation of the content analysis, at times difficult and challenging as it often entails many phases. Some parts of the analysis, such as the researcher's actions and insights, may be difficult to describe. Kurosaki's (2000) study suggests that the data is segmented into manageable text units that are presented to the coders for the task of coding. The following are four (4) steps of the content analysis methodology used in this study:

STEP 1: CITATIONS PREPARATION (SINGLE IDEA OR MESSAGE)

In this step, the participants' responses were decomposed and segmented systematically into smaller and self-contained units called "citations". Kurosaki's (2000) study raises concerns about segmenting the text into citations. First, the researcher may impose considerable data interpretation. Secondly, taking the text from its context may cause loss or alteration of old meaning. To minimize the effects of these concerns, the study followed a systematic segmentation using clear rules that reviewed by other researchers. The rules of segmentation are: (1) Every citation must represent one exclusive idea or message; (2) Every citation written using the exact wording; (3) Every citation presented in a way that preserves the context. Moreover, the application of segmentation rules examines. The segmentation of the responses resulted in 360 distinct citations on the impacts of the constructs (ANCT-INT under the influence of SCQM-IMP environment) over FSP with an average of six (6) citations per respondent, out of 60 firms' respondents.

STEP 2: DEVELOPMENT OF THE CODING AGENDA

The content analysis was applied deductively. It means that categories are predetermined and adopted from the theoretical framework under investigation (Hsieh & Shannon, 2005). The theoretical framework was used to extract the Coding Agenda categories from the Thai model. The Thai model consists of 12 measures and can serve Coding Agenda categories. The Coding Agenda is considered a translation device that helps in mapping data to the relevant categories. Hsieh & Shannon's (2005) study discusses the coding agenda used to guide coders to make decisions when analysing the data. The coding agenda contains the rules and procedures of a systematic, logical, and scientific data analysis. Developing a Coding Agenda with high quality is very important for the reliability of the content analysis methodology. The Thai model measures are mutually exclusive (Vanichchinchai & Igel, 2011). The mutual exclusivity of Thai model measures helps in developing exclusive categories of the Coding Agenda According to the definition of the Thai model measures, the categories of the Coding Agenda define a clear direction of when to code to each given category. The coding agenda used in analysing the Initial Survey data follows the study guideline [Simonofski et al.'s (2019); Hsieh & Shannon (2005)], illustrated in Table-4B.4c:

Table-4.2.4c: List of coding Agenda used in analysing the Initial Survey data

Category	**Definition**	**Direction**	**Example**
Commitment and Strategy	Refers to the level of accuracy of information supplied by the model	If citation describes information (not the model) as being accurate, precise, or right	"…The model offers the right information…."
Customer focus	Refers to the extent the model provides current information to users	If the citation describes data (information) not the model as being up-to-date, real-time, etc.	"…The model provides real-time information..."
Human Resource Management	Refers to the maintenance of the model's measurement contents from being lost	If the citation describes the model's measurements contents status	"…The constructs of model's measurement contents are inadequate."
Information Analysis	Refers to how a model is easily understood	If the citation describes the level of ease or difficulty in which model and its measures used	"..Searching or accessing information easily…."
Supplier Quality Management (SQM)	Refers to how delivery of goods or services to satisfy buyers' needs	If the citation described the unit "fit" to buyers' demand with no or little use of inspection and adjustment	"…search or assess information about key metrics used for scoring SQM…."

Process Management	Refers to how processes are aligned with the firm's strategic goals	If the citation describes process design, process architectures, and process measurement system	"…search or assess info about management of processes at an operational level in firms..."
Information management	Refers to how easy or fast the information can be learned	If the citation describes the level of ease or difficulty in which information be learned	"…assess the possibility of quick and easy access of accurate information and its management…."
Strategy and Organisation	Refers to how firm needs to evolve to meet its objectives	If the citation describes the firm's development process and identifies gaps by comparing the present state with the targeted state	"…to determine what needs to be done to bring a desired change in the process to achieve firmal goals…."
Partnership Management	Refers to how operational profits and firmal management done through a partnership	If the citation shows evidence of a partnership agreement to manage firm operations	"…search and assess the ease of doing business (the legal status of business operations)…."
Lean System	Refers to how a system can provide businesses with a disciplined and focused approach to satisfy customers' needs	If the citation gives systems evidence enabling the firm with the clarity, visibility, and focus to move with agility and speed (lean principles)	"…search and assess the level of implementation of seven lean system guiding principles in firm …."
Contractual Binding with Suppliers	Refers to how the procurement process engages purchasers and suppliers to authorize purchase against PO. Contractual control against production overrun sold extra output with Mfg. trademark, subcontracting order to a cheaper illegal producer. Firm signals that infringements are detected and acted upon (Stevenson & Busby, 2015)	If the citation gives evidence that enables a firm to make purchases to get collateral into business. So the business process can evolve and can generate revenue. The control of contract strategies like Extraction, Distribution, and bundling of counterfeit products with the original product. Provide signal authenticity for the product to avoid misleading signals.	"…search and assess the documented supplier terms and conditions of the contract to make delivery possible (lead time)….". Implement anti-counterfeiting strategies in trade and manufacturing systems…
Campaign against Product Counterfeiting	Refers to how IP infringement takes place in the supply chain during forward-backward integration of processes. The company media campaign says, "Genuine Toyota parts obtained…." (Stevenson & Busby, 2015)	If citation identifies decoupling points that make supply chains vulnerable. Ways of an industry-wide awareness campaign. OEMs lobbying for stringent measures to control product counterfeiting and encourage legitimate' products.	"..search target audience, create knowledge base info about counterfeits signals. from rectification process". Focus on customers' interest protection strategies in trade and Manufacturing systems…
Gain Knowledge	Refers to educating the consumer and other stakeholders as to how genuine and fake parts are differentiated. Effective use	If the citation describes the consequences, using counterfeits and following consumer protection strategies.	"…searching for relevant consumer awareness programs…"

	of fake products (Stevenson & Busby, 2015)		
Formulate programs	Programs support public educational awareness events, product disposals, legal endorsement, audit procedures for suppliers, and quality assurances (Wilcok & Boys, 2014)	If the citation describes quality control plans/programs in support of anti-counterfeiting strategies initiative (ANCT-INT) (Extraction, Distribution, and infiltration scenarios).	"…searching for relevant consumer awareness programs supported by quality control plans…"
The quality aspect of the supply operation	Refers to how products are measured against standards to make them defects free	If citation identifies distinct attributes or characteristics of a product	"...assess the measure of excellence against specific standards, uniform product to satisfy consumers' need"
Cost of the supply operation	Refers to how for a given price each firm supplies a quantity of output to make managerial cost equal to the product price	If citation gives info about keeping the product price above average then variable cost and managerial cost curve can reach its supply curve	"...assess measures to bring efficiency in the processes and turn reduce firms' supply cost.....competitive …"
Flexibility in supply operation	Refers to how firms respond to changes in demand and the business environment	If citation gives info about a firm's flexible operations keeps pace with volatile supply demand	"...assess managerial control over firm's supply operations (lead time)…"
Relationships in supply operation	Refers to how firms determine factors governing other than price	If citation gives info about major determinants of the supply curve including Govt. taxation policy, technology, transportation, communication & competition	"…assess uncontrollable and controllable aspects of firm's supply operations"
Responsiveness in supply operation	Refers to how responsive firms are to meet customer requirements and supply materials purposefully as per the agreed lead time	If citation gives info about the supply capacity to respond to market needs according to the agreed time frame	"…..assess capacity measures of the firm's supply operations…."

STEP 3: VALIDATING THE CODING AGENDA

Simonofski et al.'s (2019) study discuss the significance of validating the coding agenda, as it often resulted in a poor agreement. Therefore, the initial Coding Agenda was modified until arriving at a valid and reliable final Coding Agenda used for coding the entire qualitative data. The reliability and validity of the coding procedure are measured or assessed by its consistency, where different coders can code the same text (Urbach & Ahlemann, 2010) similarly. There are

two types of reliability (Stemler, 2001) intra-coder reliability; 2) and inter-coder reliability. Intra-coder reliability is the extent that which a coder can get the same results every time he codes the same data. On the other hand, inter-coder reliability is the extent that which different coders can get the same results when coding the data using the coding agenda. The study also stresses that higher inter-coder reliability is important to show that the theoretical conclusions drawn from the data (content) analysis are valid and strengthen the confidence of the results among the scientific community. To examine the inter-coder reliability, a double coding exercise was conducted. Help is taken from the department colleague as the expert. In the double coding exercise, a sample of the data was presented to a second coder [20% of the citations as suggested by Carey et al.'s (1996)].

The second coder asked to use the coding agenda as the exclusive guide for the coding procedure. The number of citations presented to the second coder is 72 citations (20% of the total citations of 360). The inter-coder reliability was then calculated using the Percent Agreement index (PAI). Percent Agreement (PA) is calculated by adding up the number of citations that are coded the same way (Stemler, 2001) by the two coders and dividing it by the total number of citations. Foster et al.'s (2012) study cited by Lombard et al.'s (2002) discusses that the advantage of PA is that it is easy to calculate, intuitive, and simple. Moreover, it can accommodate any number of coders. However, PA was criticized for not accounting for an agreement that would occur by chance. However, this problem is less severe when the number of categories in the coding agenda is high [Wang's (2007); Foster et al.'s (2012)], which is the case with this study Coding Agenda. As far as the acceptable level of reliability, Neundorf's (2002) study reviewed several researchers' recommendations that conclude as the coefficient of 0.90 or greater would be acceptable in all situations, 0.80 or greater would be acceptable in most situations, and below that there exists greater disagreement. The PA of the first iteration of the double coding is at the low level of 0.47, which is way below the acceptable level of 0.8 (Neundorf, 2002).

To understand the causes of such low agreement, the second coder was interviewed to discuss the differences resulting from coding the citations. The discussion revealed three causes of disagreement. The first cause is the poor application of the Coding Agenda, as a major factor. The second cause is in the segmentation of the responses, as some citations represented more than one exclusive idea, which is one of the rules of segmentation that is not applied properly. The third cause of the disagreement attributed to unclear definitions of some categories of the Coding Agenda. The researcher conducted the second iteration of the double coding exercise

after dealing with the poor application of the Coding Agenda by the coders and the percent agreement (PA) soared to 0.72. Then, a third iteration of the double coding, after reviewing the segmentation process, made the PA reach 0.76. The last iteration of the double coding exercise was conducted using an amended Coding Agenda (Neundorf, 2002), to deal with the ambiguity of some of its categories. The final PA of the double coding exercise is 0.83, which is over the acceptable level according to Neundorf (2002).

STEP 4: CITATION MAPPING

The final step in this content analysis is coding the textual data using the validated coding agenda that has emerged from the double coding exercise. It is very important to map the citations systematically and carefully according to the Coding Agenda. The quality of the citation mapping can help produce reliable results from the content analysis. The main purpose of the Citation Mapping exercise is to substantiate content mapping decisions related to relevant dimensions of the Thai model. The main criterion to retain any measure is its exclusivity (i.e. citation only mapped to one measure), instantiated at least one time. The measures that are not instantiated in the citation mapping exercise are dropped but this is only done if scholarly support is not available, or experts do not see the importance of the measures. The decision to retain or drop the new/old measures depends upon their importance to the context concerning mapped or unmapped citations.

4.2.5 INITIAL SURVEY TESTING PROCESS AND PROCEDURE

a.1) SURVEY TEST PROCESS

Researchers need to be cl ear about addressing the questions of the testing instrument, such as: (1) what to initial survey test; (2) why to do initial survey test; (3) when to do initial survey test; (4) who to be tested (participating groups); (5) how to conduct a test. While investigating the facts about addressing the said questions during the literature review process, Alotaibi's (2012) investigative study was found quite relevant to the study task. Considering his valuable contribution, the present research work encompasses some important inferences and applied some Initial survey testing steps during the survey. However, ideas from other investigative studies [Kosecoff (1985); Neundorf (2002)], to Initial survey testing procedures, have also been given due weightage. The objective of this study is to develop an understanding of an existing gap between theoretically developed factors (measures/categories) and the factors developed through observations (supported by the Initial survey). After addressing this gap, enough

information is available to formulate common anti-counterfeiting strategies to counter the product counterfeiting issue.

a.2) INITIAL SURVEY PROCEDURE

The initial survey procedure takes two phases to complete, one phase is related to the feedback gathered to bring change in the design of the initial survey instrument, and the second phase is related to improving the face validity of the instrument to achieve a better response rate. Paper-based survey instrument information was disseminated among participants. Expert opinion seeks to investigate the theme and inter-relationship of the impact of the ANCT-INT items' measures on FSP, under the influence of the SCQM-Imp environment. Several themes derived from the analysis of the unmapped citations are then account for as ANCT-INT measures that represent strategies necessary to reduce occurrences of product counterfeiting activities for an automotive industry's supply chains. Moreover, a compiled form of anti-counterfeiting strategies from the present body of knowledge brings resolve to address the product counterfeiting issue in automotive industry's supply chains in Pakistan so that occurrences of counterfeiting phenomenon can be reduced. In turn, reduces the negative effect of product counterfeiting on firms and economies. See Table-4.2.5a, as an outcome of the detailed discussion (chapter-2 & 3) of the study report.

Table-4.2.5a: Initial survey test procedure details

Initial Survey Instrument	The outcome of the initial survey instrument provides insight to a researcher to avoid the instrument's shortcomings. The modification of the instruments starts from the design aspects of the survey instrument. The instrument covers all aspects related to face & content validity (content analysis, content analysis procedure, execution of the process (Initial survey test objectives, test procedures (data collection (instrument design, instrument Initial survey test, conducting discussions, and instrument dissemination), data description & responses), survey findings (mapped & unmapped citations)).
Initial Survey Test Objectives	The test objective help respondents disseminate the desired information within an instrument as comprehensively (with face and content validity) as possible. The test of the initial survey instrument provides insight into the expected response rate, teething problems in data collection, and different research methods used for that matter.
Initial Survey Data Collection	The initial data collection process takes care of initial survey instrument design, an instrument for the Initial survey test, a subsequent workshop on survey instrument for further refinement, and then comes instrument dissemination. The participants are employees of the PAAPAM member firms.

Initial Survey Instrument Design	The first section of the survey questionnaire was designed for collecting descriptive information about the participants and the industry in which he works. In the second section, participants are asked to express their opinion regarding checking the impacts of ANCT-INT items' measures on the Firm Supply Performance (FSP) for automotive-industry supply chains in Pakistan, under the influence of the networked governance model supported SCQM-Imp environment. For that matter, two questions were asked to answer the overall question. Two questions are listed as follows: 1) "How Sharing information supported SCQM approach by integrating TQM and SCM practices in the supply chain can enhance FSP; 2) How Anti-counterfeiting strategies, under an SCQM-Imp environment, can reduce the occurrences of product counterfeiting activities for an automotive industry's supply chains to enhance FSP"?. The initial survey covers some close questions which are related to "anti-counterfeiting initiatives" where respondents are to select a preferred choice by using Likert scale of 5.
Survey Instrument Test	The expectation in the initial survey tests is to contact survey respondents. These respondents are the employees of the PAAPAM member firms. The importance of the topic concerning the automotive industry's is conveyed to them. They are asked to give their responses to address the research problem. The strong feedback mechanism (expert discussions, etc.) improves the appearance of the instrument and helps in redesigning the survey instrument.
Instrument Dissemination	For the dissemination part, the outcome of the expert discussions supported the paper-based distribution of the instrument. According to the experts' opinion, the use of interactive face-to-face communication is preferable to other means.
Initial Survey Data Description	A conclusive description of responses covers the citations later classified according to their relevance. The process covers a description of respondents and responses.
Description of Respondents	In this process, the descriptions of the respondents are classified according to their demographic data, showing various levels of employment cohorts with work experience in different departments of a firm. The unit of observation is an individual (supply chain practitioners) who is an employee of the PAAPAM member firm. The firm is a manufacturer of automotive parts and accessories. PAAPAM is an association that provides a platform where all automotive parts and accessories manufacturers meet and discuss industry issues. The unit of analysis is the control of counterfeiting phenomenon. Two-hundred-fifty-seven (257) respondents participate in the initial survey [employment cohort: operational (241), technical (6), strategic (10)]. These three categories of employment cohorts are inferred from the participant's designation in the context of FSP. This brings the limitation to conducting the EFA analysis part where the sample size must be greater than 255 otherwise KMO (Kaiser-Meyer-Olkin) and Bartlett's tests for measuring sampling adequacy and sphericity respectively were not conducted. The SPSS will not perform the analysis and print a message "Correlation matric is NPD (Non-Positive Definite) appears forcing the researcher to adjust the sample size accordingly. This means that some of the Eigenvalues of the correlation matrix are not positive

numbers. In the employment cohort, the operational category is represented by SC practitioners & procurement specialists; the technical category is by production & operations managers, Stores & Inventory Control and Managerial Coordinators; the strategic category is represented by the F&A, of a company (Table-4.2.5.1a).

Table-4.2.5.1a: List of Employment Cohort details

Employment Cohort	**Operational**	**Technical**	**Strategic**
SC practitioners	50		
Purchase / Procurement (Spl.)	140		
Production & Operations Mng.	51		
Store and Inventory Control			
Managerial Coordinator		6	
Finance &Accounts Manager			10
Total	241	6	10

Descriptive Responses

The survey responses from the instrument were found to be collected in the form of paragraphs. As a primary step, these paragraphs were decomposed into independent units/citations during the data analysis portion of the initial survey. The initial Survey ask the respondents to give comments about the impact of ANC-INT measures under the influence of the SCQM-Imp environment over FSP could be determined. The process of decomposition leads to 360 distinct citations.

Initial Survey Findings

These 360 citations were analysed using a Qualitative Deductive Content Analysis. The Thai model is used to develop the Coding Agenda of the analysis. This Coding Agenda was tested for reliability and validity by conducting a double-coding procedure. In the final step of the data analysis, the citations were mapped into 12 categories (measures) of the Thai model. The predominant goal of the content analysis and citation mapping is to determine which measures are appropriate for the "Pakistani" study context or which are considered a drop. After the completion of the citation mapping, the twelve (12) Thai model measures are categorized (overlapping, instantiated, not instantiated). The unmapped citations help identify new measures that are appropriate for the Pakistani context.

Mapped Citations

The number of mapped citations comes out to two-ninety-three (293) out of the total 360 citations, which accounts for 81.4% of the citations. This high %age exhibits that the Thai model is an appropriate framework to capture the participants' perceptions. There are four dimensions in the model mentioned in the table. The highest percentage of citations (54.6%) was received by TQMP dimensions. While the SCMP and ANCT-INT dimensions received a moderate %age of citations (18.7% and 11.9% respectively). Each dimension demonstrates its applicability (importance through an index). The lowest percentage of citations (5.4%) was received by the FSP dimension (Table-4.2.5.1b).

Table-4.2.5.1b: Model dimensions and citations detail

Model Dimensions	No. of Citations	Citations (%)
Supply Chain Management Practices	55	18.7

Total Quality Management Practices	160	54.6
Anti-Counterfeiting Strategies Initiative	35	11.9
Firm's Supply Performance	43	5.4
Total	293	100

The details are linked with the employment cohort, where citations are arranged according to each cohort. Some cohort shows greater emphasis on certain dimensions of the model. The overall scenario indicates that the highest 55% of the citations received from Employment Cohort related to TQMP as compared to SCMP, ANCT-INT, and FSP. Within a TQMP dimension of an employment cohort, 43.5% of the citations were received from operational staff. Whereas 12% of the citations received from the Employment Cohort related to the ANCT-INT construct exhibit the lowest citation ratio as compared to TQM, SCMP, and FSP. Within the ANCT-INT dimension of an employment cohort, 43% of the citations received from the technical cohort, show that they are more aware of the product counterfeiting issue as compared to others. More awareness is required among the participants to realize that ANCT-INT dimensions have a positive impact on FSP. Whereas 46.5% of citations are related to the FSP shows that the strategic cohort is concerned about linking the impact of the ANCT-INT on FSP. While other cohorts have different percentages of citations showing participants' perceptions about measures concerns. (see Table-4.2.5.1c).

Table-4.2.5.1c: Employment cohort concerning their citations detail

Employment Cohort	**No. of Citations**	**SCMP**	**TQMP**	**ANCT-INT**	**FSP**
Strategic	80 (27.3%)	10 (18%)	40 (25%)	10 (28.5%)	20 (46.5%)
Technical	90 (30.7%)	15 (27%)	50 (31.5%)	15 (43%)	10 (23%)
Operational	123 (42.0%)	30 (55%)	70 (43.5%)	10 (28.5%)	13 (30.5%)
Total	293 (100%)	55 (19%)	160 (55%)	35 (12%)	43 (14%)

Instantiation of Thai model Measures

All 293 mapped citations are exclusively mapped to each measure of the model, which means that there is no overlapping present among the existing twelve (12) measures of the Thai model. This confirms that the Thai model measures are mutually exclusive, as discussed by Vanichchinchai & Igel's (2011) study. All Thai model measures are instantiated in the citation mapping. Any variation attributes to different factors, like the importance of the measures. All measures are expected to have a very high number of instantiations as noticed by a large number of users. The Thai model aims to include all the system's measures that could create an impact over FSP to enhance the model's completeness. Based on the unmapped sixty-seven (67) citations and the experts' suggestions, this study retains all instantiated measures. The outcome of the literature review, initial survey, and interviews show that two measures (Supplier Quality

<table>
<tr><td></td><td>Management, Process Management) from TQMP and One measure (Quality = Supplier quality) from FSP were not instantiated in the Thai model.
Moreover, this study also sought expert opinion to decide whether to add more measures (based on present unmapped citations' evaluation) in the Thai model for which strategic and operational cohort expressed concerns (initial survey, interviews, and experts' meetings). This study includes discussed ANCT-INT, Supplier Quality Management, Process Management, and Quality constructs with applicable dimensions in the Thai model for external validity in the Pakistani context. The study showed that all measures are mutually exclusive (no overlapping measures) and have a higher level of instantiated measures.</td></tr>
<tr><td>The Unmapped Citations</td><td>As mentioned earlier, 293 out of the 360 citations mapped to one of the twelve (12) measures of the Thai model. This leaves sixty-seven (67) unmapped citations (22.87% of the total citations). The unmapped citations were investigated to decide whether any measure was extracted from these citations and added to the Thai Model. Thus, the unmapped citations have the potential to help identify important antecedents or consequent dimensions of the SCQM-Imp construct. Therefore, identifying an antecedent or a consequence could be very useful when validating the Thai model after the Confirmation Survey. The guidelines for formative validation of a construct require assessing the formative variables, focusing on the nomological aspects, by linking the anti-counterfeiting index (ANCT-INT) to other constructs. It found that most of the unmapped citations (60 out of 67) were found to be relevant to the posed survey question. For example, a respondent stated the following: "Counterfeiting phenomenon does occur in supply chains for an automotive industry's", which is relevant to the Thai model. Other citations are directed mapped to a specific measure. Two citations (2 out 67) were found irrelevant where the operational cohort is unaware of the importance of the Sharing information supported SCQM approach and the inter-relationship of TQM & SCM practices. For example, "I am not using SCM practices along with TQM during procurement". Five citations were found too broad to map to specific measures (5 out 67). The remaining 60 unmapped citations were found relevant to adding ANCT-INT items' measures and creating the SCQM-Imp environment. The results of the analysis help to drive one of several distinct categories (Themes), relate to the ANCT-INT items' measures discussed (Table-4.2.5.1d) as follows:

Table-4.2.5.1d: Details of several un-mapped citations
<table>
<tr><th>Category</th><th>Number of Measures</th></tr>
<tr><td>Citation is Irrelevant</td><td>2</td></tr>
<tr><td>The citation is Too broad</td><td>5</td></tr>
<tr><td>Citation is Relevant</td><td>60</td></tr>
<tr><td>Total no. of unmapped citations</td><td>67</td></tr>
</table>
</td></tr>
</table>

Discussions	In their studies, [Vanichchinchai & Igel (2011); Vanichchinchai (2012)] did not discuss the presence of the counterfeiting phenomenon and perform an investigative study on the Thailand automotive industry's supply chains. With the help of the initial survey and interviews, a higher number of citations were received from operational level employee cohort respondents' that show their interest in implementing anti-counterfeiting strategies in automotive industry's supply chains in Pakistan. But for practitioners to enhance the FSP and to successfully implement ANCT-INT items' measures in the automotive industry's supply chains in Pakistan, the networked governance model supported SCQM-Imp environment is needed. Moreover, in recent years scholars and practitioners showed their interest to bring resolve to the product counterfeiting phenomenon in supply chains of varied nature due to the unchecked growth of the sizeable seizers of the smuggled fake items at EU and other ports. This study is based on the present body of knowledge concerning the common anti-counterfeiting strategies, suggested by different scholars within three decades, considering the formative concept (ANCT-INT), developed by different thematically categorized items' measures, and incorporated in the Thai model so that the research problem could be addressed. This study concludes that the ANCT-INT construct is an interesting aspect for conceptualization as an antecedent to the SCQM-Imp environment. As discussed earlier, the conceptualization of the construct and linking of the ANCT-INT construct to the Thai model would contribute greatly to the "Extended LS system" research track. Therefore, the ANCT-INT measures contribute as a first-order reflective, second-order formative model, including two dimensions and twenty indicators. The other relevant themes "Supplier Quality Management" and "Process Management" are established concepts in TQM practices with strong theoretical grounding [Kaynak (2003); Kaynak & Hartley (2008); Wilcock & Boys (2014); Samson & Terziovski (1999); Flynn et al.'s (1994); Ahire et al.'s (1996)] to be included in the Thai model and became a part of the TQMP construct. The same is the case for inclusion with the "Quality" (means supplier quality) concept of product/processes/services in the FSP construct. This study considers that these concepts are very well supported by a mix of input from the initial survey and interviews. Moreover, this study observes some irrelevant themes found during the analysis of the unmapped citations not related to the scope of this study and are no longer included for further investigation. Themes derived from content analysis "supplier involvement" and "customer involvement" are conceptualized as dimensions of "Supplier Quality Management" and "Process Management" respectively [Kaynak (2003); Kaynak & Hartley (2008); Wilcock & Boys (2014)]. Therefore, based on the experts' opinion a decision was taken that "supplier involvement" and "customer involvement" are no longer conceptualized as a part of the SCQM-Imp environment-supported construct. Another unmapped citation, a theme of "evaluation issues" is seen as less important and less relevant to the Thai model. Therefore, considered not related to

	the SCQM-Imp environment. Experts' opinions were also taken to investigate the theme, and their relationship to the SCQM-Imp environment, and to ratify the relationship of the constructs to the unmapped citation categories. In summary, the analysis of the unmapped citations yielded new dimensions (measures) that added to the Thai Model. It is an important part of the study to identify and conceptualize constructs that link to the SCQM-Imp environment, either antecedents or consequences, for the model validity testing. The ANCT-INT construct derived from analyzing the unmapped citations potentially conceptualized as an antecedent to the SCQM-Imp construct. Furthermore, the "Supplier Quality Management" (FSPBPCAQL), "Process Management" (TQMPRM), and the "Quality" (TQMSQM) are concepts of TQMP and FSP and included in this study for further investigation. However, this study considers that the Initial Survey data analysis, alone, is not sufficient for ANCT-INT conceptualization. Therefore, investigative research on CFA is required to support the Initial Survey findings that indicate the potential relationships between ANCT-INT and the development of the networked governance model supported SCQM-Imp environment (see in chapter 2).

4.2.6 THE "EXTENDED LS SYSTEM" MODEL

The Initial Survey helps to investigate the applicability and suitability of the twelve (12) measures of the Thai Model in the Pakistani context. Based on the analysis of the Initial Survey data, all measures taken from the Thai model, as are instantiated (declared) in the citation mapping. Two measures "Supplier Quality Management" and "Process Management" from the TQMP dimension, and one measure "Quality" from the FSP dimension added in the "Large Scale (LS) system" Thai model, as they instantiated in the citation mapping. However, the analysis of the unmapped citations revealed that one new measure was identified. Therefore, three new measures and one dimension were added to the Thai model. Therefore, the "Extended LS system" Model depicts the Thai model as a formative one with four (4) dimensions: SCMP, TQMP, FSP, and ANCT-INT. Each of these dimensions is a first-order Reflective and second-order formative construct that consists of several measures (Fig-4.2-2.4a).

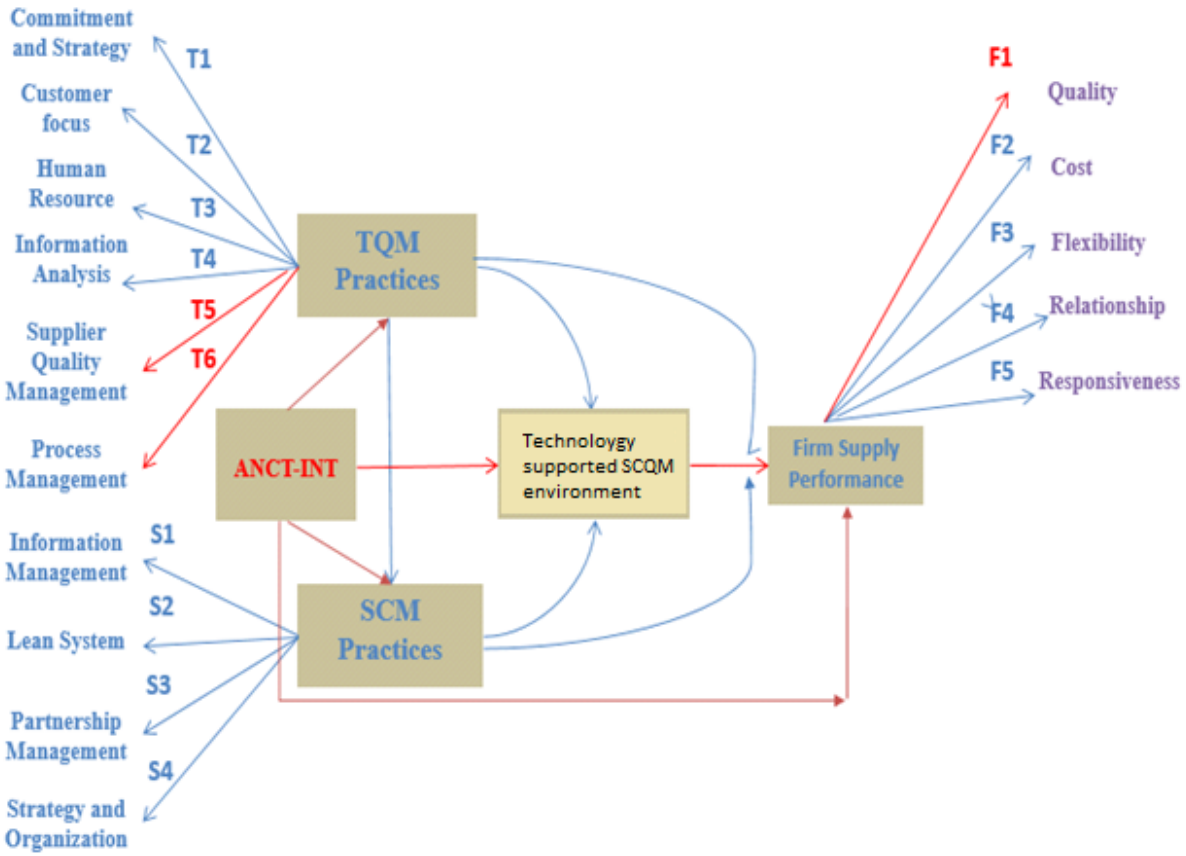


Fig-4.2.6a: Propose Extended LS System Model

4.3 CHAPTER SUMMARY

This chapter discusses the exploratory and explanatory phases of the research study. This study considers experts' opinions as the sources of information to continue with the interviewing process. The recorded interviews and the initial survey are used to collect the responses of the participants. The employees of the PAMA member firms (Pak-Suzuki, Honda, and Toyota) and PAAPAM member firms supported this study. Convenience sampling is used to conduct interviews. These interviews are arranged on a one-to-one basis or in groups. The NVivo software application is used for analytical purposes. This chapter introduces the initial survey discussion, which is one of the most important sections of the study. The Initial Survey instrument was used for collecting data that would help in the process of extending the Thai model in the Pakistani context. The survey is helpful to achieve its objectives, such as: understanding the participating firms; identifying the various employment cohorts; and encouraging firms to continue their commitment to conducting the confirmation survey. The initial survey started with gathering information about the participating firms with the main concern being to implement the hypothetical model in Pakistan. In the first phase, the initial survey is conducted to observe

its effectiveness in the data collection process and to identify any problem of understanding present within the research instrument. The manual distribution of the survey instrument takes place to the participating firms. After completing the data collection process, the analysis work starts first with the descriptive information of the firm and the role respondent performs there. The respondents were classified according to their demographic characteristics. Thus, the content analysis technique (Qualitative Deductive Content Analysis) is applied to analyse responses. This technique helps in mapping the model citations extracted from the response data to the hypothetical model. The results of the content analysis assist the researcher in identifying both the applicable measures and un-applicable measures that require the removal of some measures from the model in the Pakistani context. However, the outcome from the data analysis exercise provides evidence that all measures are retained from the investigated model for application in a new context. The results confirm that there are three new dimensions (measures) and a new construct added to the investigated model. Therefore, the extended model is very similar to the Thai model, with few amendments. The survey data analysis helps to identify constructs that are linked to the SCQM construct as antecedents or consequents. These linkages are useful for Q1.1 formative validation of the model. The guidelines for formative validation of a construct require assessing the formative dimensions and measures, focusing on the nomological aspects, by linking the ANCT-INT measures index to consequents constructs. Data analysis of the initial survey with the help of the combined knowledge streams reveals that ANCT-INT measures are potentially linked as an antecedent to the SCQM-Imp environment that is linked as a consequent to enhancing FSP. The outcome of the study derives the applicability of the "Extended LS system" Model in the Pakistani context, which is an essential step to conduct a confirmation survey.

CHAPTER-5 DESCRIPTIVE STATISTICS

5.0 INTRODUCTION

The chapter provides a clear understanding of the descriptive data which can either be the representation of the entire or a sample of the population. The descriptive statistics are broken down into measures of central tendency and measure of dispersion so that the readership can observe the presence of skewness in the data. Finally, the data is analysed and normalized according to the classification of the respondents with descriptive statistics details of the survey. The descriptive analysis of the items provides the researcher with a way to verify the normality of the data and to scan the data for any possible outliers.

- The descriptive analysis of the items includes the following statistics about the distribution: the mean, the standard deviation, the skewness, and the kurtosis. Skewness refers to the degree of symmetry of the distribution and Kurtosis refers to the degree of peak-ness of the distribution. Skewness is considered positive when the scores are clustered in the left-hand side of the graph. By contrast, skewness is negative when the scores are clustered in the right-hand side of the graph. As for kurtosis, a rather peaked distribution indicates positive kurtosis, and a flatter distribution indicates negative kurtosis. Ghasemi & Zahediasl's (2012) study (cited Pallant, 2005) says that for perfect normal distribution, the skewness and kurtosis value should be equal to zero.

- This study refers to two types of analyses: descriptive analysis and comparative analysis. The descriptive analysis provides information (the mean, the standard deviation, the skewness, and kurtosis statistics of the data distribution.) about each of the items of the survey instrument. Whereas the comparative analysis is conducted to investigate the potential differences between the various groups of interest.

- The descriptive analysis is dedicated to investigating the differences in the mean scores for the dimensions of the model across the respondents' firms. The comparative analysis investigated the differences in the mean scores of the model dimensions for different types of employment cohorts. In general, the findings of the comparative analysis indicated that there are no significant differences among the different groups, except in the case of isolated occasions. This reporting of the descriptive data analysis after conducting several statistical tests of normality performed on the survey instrument items.

As described earlier, the survey instrument covers three (3) topics: “ANCT-INT”; “SCQM-Imp”; FSP. The total number of items is 111 items: TQMP (6 dimensions with 32 items); SCMP (4 dimensions with 37 items). Then, the survey instrument is dedicated to evaluating the “ANCT-INT” construct (4 dimensions with 31 items). Finally, the FSP construct (5 dimensions with 22 items). Each of the items of the survey instrument is investigated and described in terms of its distribution.

5.2 DESCRIPTIVE ANALYSIS FOR SCQM-Imp ITEMs MEASURES

To seek the potential difference between groups of interest, the first analysis investigates the difference in the mean scores for the dimensions of SCQM-Imp across the employees of the PAAPAM member firms. An analysis of variance (ANOVA) test and a post hoc test were used to observe the comparison among different employment cohorts. The second comparative analysis investigates the difference in the mean scores of SCQM-Imp formative dimensions TQMP & SCMP, for different types of cohorts. This analysis is conducted using the Kruscal-Wallis (H test) test, which is a non-parametric alternative to ANOVA.

5.2.1 DESCRIPTIVE ANALYSIS FOR TQMP (Total Quality Management)

The TQMP dimension is defined as a reflective sub-construct with four (4) dimensions. In addition, there is a criteria measure for the firms’ impact dimension. Each of these measures is represented in the confirmation survey instrument by an item. The distribution and descriptive statistics of the items are reported in the graphical representations, including item distribution and descriptive statistics, the mean, standard deviation, skewness, and Kurtosis.

Description Statistics Explanation (Commitment & Strategy): According to Table-5.1 & Fig-5.1, the Commitment & Strategy items have means that are slightly above the middle point of the scale, which is 4.0, ranging from 4.09 to 4.14, which means that the Arithmetic Mean of every measure of Commitment & Strategy is moderate. The distribution of all the items is slightly negatively skewed (left-skewed). This means that the scores tend to cluster toward the higher end of the scale. Furthermore, all the items have negative kurtosis values, demonstrating a slightly flat distribution, which indicates cases of extreme scores. The scores are slightly clustered at the center.

Description Statistics Explanation (Customer Focus): According to Table-5.2 & Fig-5.2, the Customer focus items have means that are slightly above the middle point of the scale, which is 4.0, ranging from 4.04 to 4.05, which means that the Arithmetic Mean of every

measure of Customer focus is moderate. The distribution of all the items is slightly negatively skewed (left-skewed). This means that the scores tend to cluster toward the higher end of the scale. Furthermore, all the items have negative kurtosis values, demonstrating a slightly flat distribution, which indicates cases of extreme scores. The scores are slightly clustered at the center.

Description Statistics Explanation (Human Resource Management): According to Table-5.3 & Fig-5.3, the Human Resource Management (HRM) items have means that are slightly below the middle point of the scale, which is 4.0, ranging from 3.85 to 3.99, which means that the Arithmetic Mean of all measure of HRM is low. The distribution of all the items is slightly positively skewed (Right skewed) except for TQMPHRM6 and TQMPHRM7 (Negatively skewed). This means that the scores tend to slightly cluster toward the higher end of the scale. All negative kurtosis values demonstrate a slightly flat distribution, which indicates cases of extreme scores. Two items TQMPHRM6 & TQMPHRM7 have positive kurtosis values, demonstrating slightly sharp distributions, which indicate that the scores are clustered at the center.

Description Statistics Explanation (Information Analysis): According to Table-5.4 & Fig-5.4, the Information Analysis items have means that are slightly above the middle point of the scale, which is 4.0, ranging from 3.94 to 4.10, which means that the Arithmetic Mean of all measure of Information Analysis is moderate. The distribution of all the items is positively skewed (Right skewed) except TQMPIA6 (slightly negatively skewed). This means that the scores tend to cluster toward the lower end of the scale. All negative kurtosis values demonstrate a flat distribution, which indicates cases of extreme scores. Two items TQMPIA2 & TQMPIA3 have positive kurtosis values, demonstrating slightly sharp distributions, which indicate that the scores are clustered at the center.

Description Statistics Explanation (Supplier Quality Management): According to Table-5.5 & Fig-5.5, the Supplier Quality Management items have means that are slightly above the middle point of the scale, which is 4.0, ranging from 3.86 to 4.11, which means that the Arithmetic Mean of all measure of Supplier Quality Management is moderate. The distribution of all the items is positively skewed (Right skewed) except TQMPSQM3 (slightly negatively skewed). This means that the scores tend to cluster toward the lower end of the scale. However, two items' scores tend to cluster towards the slightly higher end of the scale. All negative kurtosis values demonstrate a flat distribution, which indicates cases of extreme scores. Two

items TQMPSQM3 & TQMPSQM5 have positive kurtosis values, demonstrating slightly sharp distributions, which indicate that the scores are clustered at the center.

Description Statistics Explanation (Process Management): According to Table-5.6 & Fig-5.6, the Process Management items have means that are slightly above the middle point of the scale, which is 4.0, ranging from 3.95 to 4.10, which means that the Arithmetic Mean of all measure of Process Management is moderate. The distribution of all the items is positively skewed (Right skewed) except TQMPRM4, TQMPRM5, TQMPRM6, and TQMPRM7 (Negatively skewed). This means that the scores tend to cluster toward the lower end of the scale. However, two items' scores tend to cluster towards the slightly higher end of the scale. All negative kurtosis values demonstrate a flat distribution, which indicates cases of extreme scores. One item TQMPRM1 has a slightly positive kurtosis value, demonstrating slightly sharp distributions, which indicate that the scores are clustered at the center.

5.2.2 DESCRIPTIVE ANALYSIS FOR SCMP (Supply Chain Management Practices)

The SCMP dimension is defined as a reflective sub-construct with four (4) dimensions. In addition, there is a criteria measure for the firms' impact dimension. Each of these measures is represented in the confirmation survey instrument by an item. The distribution and descriptive statistics of the items are reported in the graphical representations, including Item Distribution and Descriptive statistics, the Mean, Standard Deviation, Skewness, and Kurtosis.

Description Statistics Explanation (Information Management): According to Table-5.7 & Fig-5.7, the Information Management items have means that are slightly above the middle point of the scale, which is 4.0, ranging from 3.98 to 4.32, which means that the Arithmetic Mean of all measure of Information Management is moderate. The distribution of SCMPIM1 and SCMPIM2 items are positively skewed (slightly right-skewed) except for all the items (Negatively skewed). This means that the scores tend to slightly cluster toward the lower end of the scale. However, two items' scores tend to cluster towards the slightly higher end of the scale. All negative kurtosis values demonstrate a flat distribution, which indicates cases of extreme scores. The scores are clustered at the center.

Description Statistics Explanation (Lean System): According to Table-5.8 & Fig-5.8, the Lean System items have means that are slightly above the middle point of the scale, which is 4.0, ranging from 3.96 to 4.11, which means that the Arithmetic Mean of all measure of Lean System is moderate. The distribution of all the items is negatively skewed (left-skewed). This means that the scores tend to cluster toward the higher end of the scale. SCMPLS14 AND

SCMPLS15 items have negative kurtosis values, demonstrating a flat distribution, which indicates cases of extreme scores. The rest of the items have positive kurtosis values, demonstrating moderately sharp distributions, which indicate that the scores clustered at the center.

Description Statistics Explanation (Partnership Management): According to Table-5.9 & Fig-5.9, the Partnership Management items have means that are slightly above the middle point of the scale, which is 4.0, ranging from 3.98 to 4.26 which means that the Arithmetic Mean of all measure of Partnership Management is moderate. The distribution of all the items is negatively skewed (left-skewed). This means that the scores tend to cluster toward the higher end of the scale. SCMPPM6 item is positively skewed (slightly right-skewed) except for all the items (Negatively skewed). This means that the scores tend to slightly cluster toward the lower end of the scale. However, two items' scores tend to cluster towards the slightly higher end of the scale. All negative kurtosis values demonstrate a flat distribution, which indicates cases of extreme scores. The scores are clustered at the center.

Description Statistics Explanation (Strategy & Organisation): According to Table-5.10 & Fig-5.10, the Strategy & Organisation items have means that are slightly above the middle point of the scale, which is 4.0, ranging from 4.17 to 4.28, which means that the Arithmetic Mean of all measure of Strategy & Organisation is high. The distribution of all the items is positively skewed (Right skewed) except SCMPSO1 and SCMPSO7 (Negatively skewed). This means that the scores tend to cluster toward the lower end of the scale. However, two items' scores tend to cluster towards the slightly higher end of the scale. All negative kurtosis values demonstrate a flat distribution, which indicates cases of extreme scores. Two items SCMPSO2 & SCMPSO6 have positive kurtosis values, demonstrating slightly sharp distributions, which indicate that the scores clustered at the center.

5.3 DESCRIPTIVE ANALYSIS FOR FSP (Firm Supply Performance)

The FSP dimension is defined as a reflective sub-construct with 4 dimensions. Each of the criteria measures is represented in the confirmation survey instrument by an item. The distribution and descriptive statistics of the items are reported in the graphical representations, which include Item Distribution and Descriptive statistics, the Mean, Standard Deviation, Skewness, and Kurtosis.

Description Statistics Explanation (Quality): According to Table-5.11 & Fig-5.11, the Quality items have means that are slightly above the middle point of the scale, which is 4.0,

ranging from 3.94 to 4.14, which means that the Arithmetic Mean of all measure of Quality is moderate. The distribution of all the items is positively skewed (Right skewed) except FSPBPCAQL3 and FSPBPCAQL4 (Negatively skewed). This means that the scores tend to cluster toward the lower end of the scale. However, two items' scores tend to cluster towards the slightly higher end of the scale. All negative kurtosis values demonstrate a flat distribution, which indicates cases of extreme scores. The scores are clustered at the center.

Description Statistics Explanation (Cost): According to Table-5.12 & Fig-5.12, the Cost items have means that are slightly above the middle point of the scale, which is 4.0, ranging from 3.80 to 3.87, which means that the Arithmetic Mean of all measures of Cost is low. The distribution of all the items is positively skewed (Right skewed). This means that the scores tend to cluster toward the lower end of the scale. No items' scores tend to cluster towards the higher end of the scale. All negative kurtosis values demonstrate a flat distribution, which indicates cases of extreme scores. The scores are clustered at the center.

Description Statistics Explanation (Flexibility): According to Table-5.13 & Fig-5.13, the Flexibility items have means that are slightly above the middle point of the scale, which is 4.0, ranging from 3.77 to 4.31, which means that the Arithmetic Mean of all measure of Flexibility is moderate. The distribution of all the items is positively skewed (Right skewed) except FSPBPCAFL3 and FSPBPCAFL4 (Negatively skewed). This means that the scores tend to cluster toward the lower end of the scale. However, two items' scores tend to cluster towards the slightly higher end of the scale. All negative kurtosis values demonstrate a flat distribution, which indicates cases of extreme scores. The scores are clustered in the center. Two items FSPBPCAFL1 and FSPBPCAFL2 have positive kurtosis values, demonstrating slightly sharp distributions, which indicate that the scores clustered at the center.

Description Statistics Explanation (Relationship): According to Table-5.14 & Fig-5.14, the Relationship items have means that are slightly above the middle point of the scale, which is 4.0, ranging from 4.17 to 4.26, which means that the Arithmetic Mean of all measure of Relationship is high. The distribution of all the items is positively skewed (Right skewed) except FSPBPCARL1, FSPBPCARL3, and FSPBPCARL4 (Negatively skewed). This means that the scores tend to cluster toward the lower end of the scale. However, two items' scores tend to cluster towards the slightly higher end of the scale. All negative kurtosis values demonstrate a flat distribution, which indicates cases of extreme scores. The scores are clustered in the center. Two items FSPBPCARL1 and FSPBPCARL2 have positive kurtosis

values, demonstrating slightly sharp distributions, which indicate that the scores clustered at the center.

Description Statistics Explanation (Responsiveness): According to Table-5.15 & Fig-5.15, the Responsiveness items have means that are slightly above the middle point of the scale, which is 4.0, ranging from 3.80 to 4.32, which means that the Arithmetic Mean of all measure of Responsiveness is moderate. The distribution of all the items is positively skewed (Right skewed) except FSPBPCARS2 and FSPBPCARS5 (Negatively skewed). This means that the scores tend to cluster toward the lower end of the scale. However, two items' scores tend to cluster towards the slightly higher end of the scale. All negative kurtosis values demonstrate a flat distribution, which indicates cases of extreme scores. The scores are clustered in the center. One item FSPBPCARS2 has a positive kurtosis value, demonstrating slightly sharp distributions, which indicate that the scores clustered at the center.

5.4 DESCRIPTIVE STATISTICS FOR ANCT-INT

The Anti-Counterfeiting Strategies Initiative (ANCT-INT) is defined as a formative measurement model with two (2) measures. This sub-section reports the descriptive analysis of the ANCT-INT items which consists of 20 criterion measures. Each of these measures is represented in the survey instrument. The item distribution and descriptive statistics are reported and exhibited by a graph of the item distribution and descriptive statistics, including the mean, standard deviation, skewness, and kurtosis.

Description Statistics Explanation (Anti-Counterfeiting Strategies Initiative): According to Table-5.16 & Fig-5.16, the ANCT-INT items have means that start slightly above the middle point of the scale, which is 4.0, ranging from 4.17 to 4.38, which means that the Arithmetic Means of every measure of ANCT-INT construct are high. The distribution of all the items is slightly negatively skewed (left-skewed). This means that the scores tend to cluster toward the higher end of the scale. Furthermore, all the items have negative kurtosis values, demonstrating a slightly flat distribution, which indicates cases of extreme scores. The scores are slightly clustered at the center.

The model has a significantly non-normal distribution:

Both ANOVA and regression are relatively robust to violations of normality, the possibility of irregular variables that lead to variation. For that matter, an appropriate process of transformation is required. There are generally three things one can try: a) if there is an

important explanatory variable omitted by the model to explain the deviations which might cause data to appear non-normal. Look for an additional variable to include in the model to explain the deviations; b) Look for outliers that are causing data distribution to appear non-normal; c) Perform a transformation process on the response variable for specific normal distribution. (Fig-5.4a).

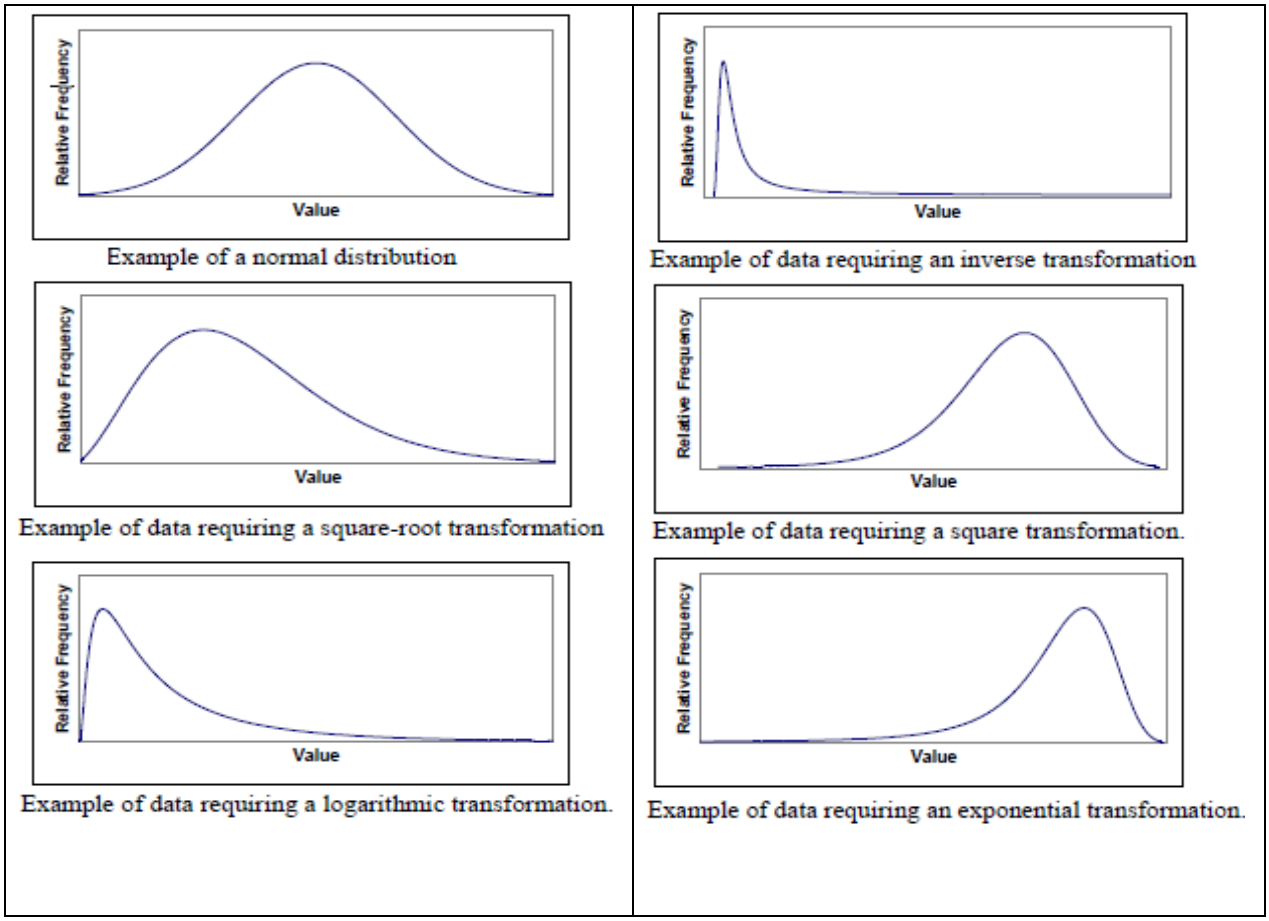


Fig-5.4a: Data description for normal distribution

5.5 COMPARATIVE STATISTICS OF DEPARTMENTS & EMPLOYMENT COHORT

To investigate the difference in the mean scores for the SCQM-Imp environment supported construct's dimensions across various employment cohorts to analyse the potential difference between groups of interest. The additional task is to perform a comparative analysis to investigate differences in the mean scores.

5.5.1 COMPARING THE DEPARTMENTS OF FIRMS

This section works with the mean scores for the SCQM-Imp environment supported construct's dimensions across various employment cohorts. An ANOVA test is selected for this analysis. Furthermore, the Post Hoc employed multiple comparison test provides information about the differences among the departments and identifies where these differences occur. The result of the ANOVA test includes descriptive statistics of the SCQM-Imp dimensions according to the department. The exhibits illustrated Levene's test of homogeneity of variance, to test the variance in mean scores for each department. The test is very important to determine where the ANOVA test can be used to compare the departments. The test checks whether the samples are obtained from a population of equal variances. This is one of the assumptions of the ANOVA test. The assumptions of homogeneity of variance can be confirmed when Levene's significance value is greater than 0.05. All significant values are greater than the threshold of 0.05, which indicates that the variances across departments are equal. In other words, departments are fit for comparison using the ANOVA test. SCQM-Imp environment rating shows a significant difference (at the level of $p<0.05$) between all the departments when rating. This means that the professional and procurement specialists using SCM and TQM practices have different views about the possibility of the formation of the SCQM-Imp environment. However, some professionals and procurement specialists (experts' opinions) have similar views on different dimensions of SCQM.

According the Table-5.17, 5.17(a to c), where the description of the descriptive statistics, a test of homogeneity of variance, and ANOVA analytical details are given concerning the comparison of the different survey participants and employment cohorts. The aim is to investigate whether there is a difference in mean scores of the dimensions for different employment cohorts at the descriptive level. Likewise, the assumption is that different employment cohorts may have different views about the management practices & anti-counterfeiting strategies initiative and consequently may evaluate it differently. Therefore, it is anticipated that there would be different scores from the different cohorts for the said dimensions. The results of the post hoc test point to the following: 1) Supply Chain Management Practices: the results showed that there is a difference among departments in rating the dimension; 2) Total Quality Management Practices: the results showed that there is a difference among departments in rating the dimension; 3) Supply Chain Quality Management: the results showed that there is a difference among departments in rating the dimension.

5.5.2 COMPARING EMPLOYMENT COHORT

The respondents have been classified into three categories of employment cohorts: Strategic, Technical, and Operational. This sub-section is dedicated to conducting a comparison between participants from these employment cohorts in terms of rating the SCQM-Imp environment supported construct's dimensions. The strategic category covered the "Top-level management" position, the Operational category covered the "Middle Management" position, and the technical category covered "Lower Level Management". The aim is to investigate whether there is a difference in mean scores of the dimensions for different employment cohorts. Likewise, the assumption is that different employment cohorts may have different views about the management practices & anti-counterfeiting strategies initiative and consequently may evaluate it differently. Therefore, it is anticipated that there would be different scores from the different cohorts for the SCQM-Imp environment supported construct's dimensions. The comparison between the different employment cohorts is conducted through the Kruskal-Wallis test, which is a non-parametric alternative to ANOVA. According to the Table-5.18, 5.18(a to c), where the comparison in terms of ranking of the employment of the cohort with test statistics-based analysis details are given.

Table-5.18: Ranks

COHORT		N	Mean Rank
Supply Chain Management Practices (SCMP)	Top Level Management (Strategic)	10	165.80
	Middle Level Management (Operational)	241	127.38
	Lower-Level Management (Technical)	6	132.83
	Total	257	
Total Quality Management Practices (TQMP)	Top Level Management (Strategic)	10	112.10
	Middle Level Management (Operational)	241	129.31
	Lower-Level Management (Technical)	6	144.83
	Total	257	
Supply Chain Quality Management (SCQM-Imp)	Top Level Management (Strategic)	10	146.80
	Middle Level Management (Operational)	241	128.02
	Lower-Level Management (Technical)	6	138.50
	Total	257	
Anti-Counterfeiting Strategies Initiative (ANCT-INT)	Top Level Management (Strategic)	10	141.00
	Middle Level Management (Operational)	241	130.64
	Lower-Level Management (Technical)	6	43.17
	Total	257	
Firm's Supply Performance (FSP)	Top Level Management (Strategic)	10	145.55
	Middle Level Management (Operational)	241	130.86
	Lower-Level Management (Technical)	6	26.75
	Total	257	

Table-5.18a: Test Statistics[a,b]					
	SCMP	TQMP	SCQM-Imp	ANCT-INT	FSP
Chi-Square	2.582	.793	.713	8.407	12.000
df	2	2	2	2	2
Asymp. Sig.	.275	.673	.700	.015	.002
a. Kruskal Wallis Test					
b. Grouping Variable: COHORT					

Table-5.18c: Cohort wise Mean Ranked Data

Dimensions	Top Level Management (Strategic)	Middle Level Management (Operational)	Lower Level Management (Technical)
SCMP	165.80	127.38	132.83
TQMP	112.10	129.31	144.83
SCQM-Imp	146.80	128.02	138.50
ANCT-INT	141.00	130.64	43.17
FSP	145.55	130.86	26.75

This test is selected because of the relatively small sample size of the strategic cohort. The results of the Kruskal-Wallis test demonstrate that the differences between the cohorts in the scores are not significant for all the dimensions of SCQM-Imp ($p > 0.05$). This test does not support the assumption that different cohorts have different views on the management system. Moreover, the mean rank exhibit shows that the mean scores of the SCQM-Imp dimensions given by the different cohorts are close to each other. The exhibit provides a closer look at the mean scores for each of the SCQM-Imp environment-supported construct dimensions, as given by different cohorts. The figure showed that the mean scores are close to each other, and they are around the middle point of the scale (4.0). The mean scores between participants and the strategic cohort range from 3.5 to 3.78. That showed the strategic cohort tended to generally rate the SCQM-Imp environment supported construct's dimensions slightly lower than the other cohorts do. The figure also showed that the operational cohort tends to generally rate the dimensions slightly higher than other cohorts do. Overall, the figure supports the Kruskal-Wallis test results, which demonstrated that the differences in the mean scores for the dimensions as given by the cohorts are not significant. This means the strategic cohort tended to generally rate the SCQM-Imp environment supported construct's dimensions although slightly lower than the other cohorts do.

5.6 CHAPTER SUMMARY

The descriptive analysis of the items provides the researcher with a way to verify the normality of the data and to scan the data for any possible outliers. This study refers to two types of analyses: descriptive analysis and comparative analysis. The descriptive analysis provides information about each of the items of the survey instrument. The descriptive analysis of the items includes the mean, the standard deviation, the skewness, and kurtosis statistics of the data distribution. The descriptive data analysis after conducting several statistical tests of normality, support the survey instrument to cover three (3) topics: "ANCT-INT"; "SCQM-Imp"; FSP. The total number of items is 111 items: TQMP (6 dimensions with 32 items); SCMP (4 dimensions with 37 items). Then, the survey instrument is dedicated to evaluating the "ANCT-INT" construct (4 dimensions with 31 items). Finally, the FSP construct (5 dimensions with 22 items). The result of the ANOVA test includes descriptive statistics of the SCQM-Imp dimensions according to the department. The assumptions of homogeneity of variance can be confirmed when Levene's significance value is greater than 0.05. All significant values are greater than the threshold of 0.05, which indicates that the variances across departments are equal. In other words, departments are fit for comparison using the ANOVA test. SCQM-Imp environment rating shows a significant difference (at the level of $p<0.05$) between all the departments when rating. The results of the Kruskal-Wallis test demonstrate in terms of the employment cohort level shows that the differences in scores between the cohorts are not significant for all the dimensions of SCQM-Imp ($p > 0.05$). The data shows that the mean scores are close to each other, and they are around the middle point of the scale (4.0). The mean scores between participants and the employment cohort range from 3.5 to 3.78. The data supports the Kruskal-Wallis test results, which demonstrate that the differences in the mean scores for the dimensions as given by the cohorts are not significant. This means that the strategic cohort tends to rate the presence of the SCQM-Imp environment slightly lower than the other employment cohorts' rate. This means that the managers working under quality management systems rate higher towards the formation of the SCQM-Imp environment.

CHAPTER-6 EXPLORATORY FACTOR ANALYSIS

6.1 INTRODUCTION

This chapter discusses the procedure to apply the EFA technique after completing the initial survey process. The EFA is a complex and multi-step process used to discover the factor structure of a measure and then examine its internal consistency. Conventional wisdom states that despite many options for executing the steps of EFA, the actual difference between them remains very small, so it doesn't matter what method the practitioners choose. Moreover, this study discusses PCA (Principle Component Analysis) concerning Oblique rotation (Direct Oblimin) and Orthogonal rotation (Varimax) methods. Thus, this study applies some clear decisions and rules of EFA to emphasize clear decision sequencing and protocols to be used for investigation. Five steps EFA statistical technique was found useful in contemplating the said research requirements.

- Costello & Osborne's (2005, p.1) study states that "*Exploratory factor analysis (EFA) is a widely utilized and broadly applied statistical technique in the social sciences*". Costello & Osborne's (2005, p.1) study emphasizes that it "*provides practical information on making decisions regarding (a) extraction, (b) rotation, (c) the number of factors to interpret, and (d) sample size*".

- The internet sources say that in multivariate statistics, exploratory factor analysis (EFA) is a statistical method used to uncover the underlying structure of a relatively large set of variables. EFA is a technique within factor analysis whose overarching goal is to identify the underlying relationships between measured variables.

- This study applies the EFA technique to the ANCT-INT construct where its necessary formative components are to be explored after following Costello and Osborne's guidelines. As this study initiates the Initial survey process for data collection to reveal relevant components. This study uses the Scree Plot to reveal a clear break to justify retaining all four components of the construct.

- Futuristically, once an instrument is developed using EFA can move to the CFA stage to address questions regarding the validity of the instrument in certain population subgroups. CFA can allow researchers to test hypotheses via inferential techniques for informative analytical options.

The next chapter reports the procedures and the findings of the validation of the Thai model and attached constructs in the Pakistani context. The Confirmation Survey's main purpose is to operationalize the "Extended LS system" model in the Pakistani context that resulted from the preceding Initial Survey.

6.2 THEORY AND EFA TECHNIQUE APPLICATION

The literature review suggests that the best course of action for the manufacturer is to take recourse both with criminal & civil action. The law has provided sufficient teeth to deal with counterfeiting in Pakistan. The initial survey outcome shows that automotive companies are deeply concerned with the problem of large-scale product counterfeiting activities observed in supply chains. However, the general understanding is that the effort to curb counterfeiting practices should initiate by the state & manufacturer [WHO (1999); Staake et al.'s (2012); Heinonen & Wilson (2012); Olsen & Granzin (1992); Marucheck et al.'s (2011)] by implementing anti-counterfeiting strategies in SC operations and create awareness among customers. Likewise, the theoretical aspect forced researchers and practitioners to explore further the occurrences of the counterfeiting phenomenon in the supply chains of the automotive industry's. Therefore, this chapter explains the investigative endeavor that takes place to explore the possible communalities present in the observations against common Anti-counterfeiting strategies suggested by the body of knowledge about unique and common variances. Here, the focus of the study is on the anti-counterfeiting strategies initiative only.

The anti-counterfeiting strategies suggested by different researchers and experts within three decades, under a deceptive buying environment, are now compiled to determine a clear structure of commonality to strategically control product counterfeiting in supply chains for the automotive industry's in Pakistan (refer to Chapter-2, Table-C). The research study is limited to evaluating anti-counterfeiting strategies only (refer to Table-6.2), concerning its number of citations and relative importance (categories), according to a clear structure of commonalities, and then applying the EFA technique to segregate strategies according to its empirically defined measures/categories. The details of the anti-counterfeiting strategies evaluation process, based on the number of citations, are discussed earlier in the literature review section and encompass theoretically developed common factors (measuring aspects). This study approach is to develop understanding among researchers to address an existing gap between theoretically developed factors (measures/categories) and the factors developed through observation. In this way, enough information captured clearly marks the structure of commonalities (a framework) to

address the product counterfeiting issue. After confirming the need for EFA application on anti-counterfeiting strategies, this study discusses the importance of the Initial survey process, Data collection and Analysis processes, Content analysis and citations preparation process, Survey instrument design, Survey data description, and other important areas of interest related to EFA application. The empirical part of the EFA technique under five important protocols will also be discussed in this chapter. Therefore, a compiled version of anti-counterfeiting strategies provides a clearer picture of sub-categories of product counterfeiting in supply chain research.

Table-6.2: REFERRING STRATEGIES TO CONTROL PRODUCT COUNTERFEITING IN SUPPLY CHAINS

Theme-1: Contractual Binding with Partners	**Code**
Preparation of early steps of checking required. Possibilities of reverse engineering / obsolete items to be checked.	A-CTFIN-IFT-13
Processes are designed to follow ISO-supported Q.M standards for standardized reporting	A-CTFIN-IFT-8
Relationship stability and supplier's commitment to quality	A-CTFIN-IFT-12
Supplier certification and conformance to quality	A-CTFIN-IFT-9
Formation of supplier's selection and performance evaluation criteria	A-CTFIN-SP-1
Theme-2: Campaign against Product Counterfeiting	
Develop customers' ethical buying behaviour	A-CTFIN-IFT-1
Campaign with lobbying and advertisement to address the product counterfeiting issue	A-CTFIN-IFT-2
Campaign announces incentives for cooperative suppliers and distributors to counter counterfeiting	A-CTFIN-SP-9
Create awareness regarding the adverse impact of counterfeits on health and safety	A-CTFIN-IFT-5
Information sharing among partners to support anti-counterfeiting activities	A-CTFIN-IFT-3
Theme-3: Following best industry techniques to counter counterfeiting activities	
Product and package inspection with technical evaluation as per standard	A-CTFIN-SP-5
Data mining and visualization techniques are used to gain market knowledge. Training given.	A-CTFIN-SP-3
Collaboration and coordination among all stakeholders to formulate anti-counterfeiting strategies	A-CTFIN-SP-4
Knowledge about using protection technologies to track and trace items	A-CTFIN-IFT-6
Use data protection techniques to support brand protection strategies with law enforcement agencies	A-CTFIN-SP-7
Apply supply chain risk assessment technique to seek process reliability	A-CTFIN-IFT-4
Theme-4: Formulate Programs to counter counterfeiting activities	
Follow feedback mechanism to improve processes	A-CTFIN-IFT-7
A program to facilitate acquisitions or form joint ventures to reduce counterfeiting activities	A-CTFIN-IFT-10
Program to develop internal resources and invest in protective countries	A-CTFIN-IFT-11
The product specification is maintained along-with product characteristics	A-CTFIN-IFT-14
Loss prevention and audit programs help take back the design documents of the product	A-CTFIN-IFT-15
Monitor disposal activities regarding rejected, spoiled, and disposed of items	A-CTFIN-SP-16
A program that focuses to improve the quality of the processes	A-CTFIN-SP-2
Formulate crisis management plan and surveillance program	A-CTFIN-SP-6
Program development to influence the government to formulate legislation against counterfeiting (as a joint plan)	A-CTFIN-SP-8
Formulate surveillance team to track counterfeiting activities	A-CTFIN-SP-10

Program protection plans to focus on parts / sub-assemblies of sub-systems are critical to the mission	A-CTFIN-SP-11
Monitor SC activities periodically and issue warnings to distributors, suppliers, and agents	A-CTFIN-SP-12
Use law enforcement agencies to provide legal cover to a product	A-CTFIN-SP-13
Certified retailer program to protect partners and products	A-CTFIN-SP-14
Activities as per cost-benefit analysis	A-CTFIN-SP-15

6.3 UNDERSTNDING FACTOR ANALYSIS

Factor analysis is an important tool that could help researchers to evaluate tests, to develop & refine scale (measures) used in the context of the product counterfeiting phenomenon. Therefore, factor analysis is used for dimensional reduction in an original data set where an existing number of common factors captures enough information to understand relevant definitions. For that matter, two-factor techniques are applied: component base PCA and commonality factor-based EFA

6.3.1 PRINCIPAL COMPONENT ANALYSIS (PCA)

The criteria to determine "variance retained" when converting similar features look for decomposition into factors (Eigenvalues), using PCA (Principal Component Analysis) procedure. PCA is the statistical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components. PCA is only concerned with establishing linear component that exists within the data and how a particular variable may contribute to that component. This technique can be used as: (1) first to understand the structure of a set of variables; (2) second to measure variables a questionnaire needs to be developed; (3) third to maintain manageable data size after factorization while retaining as much of the original information as possible.

6.3.2 EXPLORATORY FACTOR ANALYSIS (EFA)

The exploratory Factor Analysis (EFA) approach is used here to analyse the data collected from an industry that helps in capturing the clearly marked structure of commonalities to address the said issue. Williams et. al. (2010) and Kieffer (1999) discussed that the presence of prior or theoretical rationale to hypothesize a specific factor structure (with some particular item loadings), creates the possibility to switch to a CFA approach from EFA. In multiple-regression, multi-collinearity may be a problem where the factor analysis technique is useful by combining variables collinearly. Broadly speaking there is no expectation on behalf of a

researcher about the number or nature of the variables in EFA (more exploration expected). Therefore, the EFA technique allows researchers to explore the main dimensions to generate a theory through a theoretical model with relatively more set of latent constructs represented by the determined set of items. According to the Williams et. al. (2010) and OECD (1998) studies, the EFA objectives are: (1) to reduce the number of variables; (2) to examine the structure and relationship between variables; (3) Uni-dimensionality of the theoretical construct (detection and assessment); (4) Evaluate and test the construct validity of a scale; (5) develop parsimonious (simple) analysis and interpretation; (6) Addresses multi-collinearity (two or more variables that are correlated); (7) Use to develop theoretical constructs; (8) theories proposed should be either disproved or proved.

6.3.3 FIVE STEPS TO IMPLEMENT EFA TECHNIQUE

Step-1: Is the Data suitable for Factor Analysis?

Sample Size: The literature is still speechless about the presence of a particular rule of thumb regarding sample size for exploratory factor analysis. Studies [Field, A. (2009); Fabrigar et. al. (1999)] have revealed that adequate sample size is partly determined by the nature of the data. In factor analysis, strong data means strong variable loading and the presence of uniformly high communalities without any cross-loading. As the generalizability or replicable results are unlikely if, the sample is too small. Three problems emerge when data is not maintained for a larger sample size. [Field, A. (2009); Tabachnick et. al. (2001)] studies discuss that the sample size should be in the range of 300 responses needed to perform factor analysis. Furthermore, if the sample size is in the range of 100 then it is considered as poor, if it is in the range to 200 is considered fair, if it is in the range of 300 is considered as good, if equal to 500 is considered as very good, and if equal to 1000 is considered as excellent [Comrey & Lee (1992)]. Some observations/problems need to discuss as follows;

- Makhubela & Mashegoane's (2019) study refers to Velicer's recommendations in the year 2003, as per loading of an item, the structure of the communalities is considered high if they are greater than and equal to 0.8. In social sciences, common magnitudes of items are considered important, when values reach from 0.4 to 0.7. There may arise two possibilities if commonalities are found less than 0.4. Either item not related to the rest of the items (deleted), or included as an additional factor (explored) for future research.

- As a rule of thumb, the minimum loading of an item [Taherdoost et al.'s (2014); Tabachnick et. al. (2001)] should be 0.32 or above which covers approximately 10% overlapping variance with other items in that factor (cross-loading items). The researcher has to decide whether to keep cross-loading items or remove them from the analytical process, which may be considered a good choice in the presence of a strong loader (0.5 or above) on each factor. There may exist some sizeable cross loaders due to the very reason that items are prematurely written and are not aligned according to a particular inquiry or a priori factor structure may be flawed.
- Situation where less than three items when representing a factor is generally considered as unstable or weak. On the other hand, Five (5) or more strongly loaded items are desirable and indicated as a solid factor.

Sample to Variable Ratio: [Fabrigar et. al. (1999); Taherdoost et al.'s (2014); Tabachnick et. al. (2007); Field, A. (2009)] studies recommended ranges anywhere from 3:1, 6:1, 10:1, and 15:1 or 20:1 were the "good factor recovery" condition reached across different conditions examined (Table-6.3-1).

Factoring Correlation Matrix:

EFA upholds a correlation matrix used to display the relationships between individual variables. [Hair et. al. (1995); Tabachnick et. al. (2007); Taherdoost et al.'s (2014)] studies recommend inspection of the correlation matrix where categorizations of the loadings could be done as >= 0.3 is considered as minimal, >=0.4 is considered as important, and >=0.5 is considered as practically significant. In case of the correlation is found less than 0.3, then the researcher should think twice about using factor analysis as an appropriate statistical. This means that the factor accounted for less than 30% relationship within the data, or in other words 3rd part of the variable share variance, and became nearly impractical for establishing some multicollinearity in the data. On the other hand, the correlation coefficients whose values exceed a a higher limit (greater than 0.9) indicate the the presence of multi-collinearity in the data. Andy Field's study discusses that the top half of the table of the Pearson Correlation Coefficient shows a a certain pattern of relationship where variability in scores (variance) is considered, if necessary, eliminate those variables that do not meet the set criteria. Tables-6.3-2 and 6.3-3 show data that are investigated & checked (variable retained if X>=0.3 or eliminated if X>0.9) and found that variables (ACTFINIFT-4, ACTFINIFT-7, ACTFINIFT-10, ACTFINIFT-11, ACTFINIFT-14, ACTFINIFT-15, ACTFINSP-2, ACTFINSP-8,

ACTFINSP-10 to 16) do not qualify according to the said criteria and should be deleted with the knowledge that those variables may cause a problem during future analysis. Therefore, the remaining variables for analysis considered for further study: ANCTFINT-1, ACTFINIFT-2, ACTFINIFT-3, ACTFINIFT-5, ACTFINIFT-6, ACTFINIFT-8, ACTFINIFT-9, ACTFINIFT-12, ACTFINIFT-13, ACTFINSP-1, ACTFINSP-3, ACTFINSP-3, ACTFINSP-5, ACTFINSP-6, ACTFINSP-7, and ACTFINSP-9. The study has performed preliminary analysis to test the suitability criteria: 1) Checked the descriptive statistics for each variable and checked the number of missing cases; 2) Checked the correlation matrix to ensure that it is "Positive Definite", as eigenvalues and matrix determinant should be positive (issues like Singularity may occur); 3) Checked the Pearson correlation coefficient to determine whether variables poorly, moderately or strongly correlated (one-tailed significance of these coefficients, etc.); 4) Checked the matrix for correlation coefficients for greater than 0.3 and checked for greater than 0.9 to handle a multi-collinearity problem in the data; 5) To determine the multi-collinearity in the correlation matrix, use the determinant of the matrix to apply Haitovsky's test just to check whether determinant is zero (the matrix is singular) or not. Haitovsky's test [X2H= [1+((2x31+5)/6)-300] ln (1-0.000001965)] = (-287.84) * ln (0.999998035) =0.00056560615 and shows that the resultant value is other than zero and higher than necessary value (0.00001). Hence, Haitovsky's test shows fewer possibilities of multi-collinearity as the correlation matrix is significantly different from the identity matrix. The test statistics have a degree of freedom = 31(31-1)/2=465. Checked the DF @p=0.05 in critical value chi-square table=447.63 (DF=400) and 553.13 (DF=500). Both the cases observed much smaller Chi-square values than values indicating non-significance (which means that the determinant is not significantly different from zero). Contradictory evidence reports the presence of multi-collinearity in the data. However, applying the PCA technique will eliminate the possibility of higher multicollinearity in the data. To check anti-image matrices (Table-6.3-4) for MSA (Measure of Sampling Adequacy), where diagonal elements should be greater than 0.5 for all variables. The off-diagonal elements having partial correlation should be very small. In Table-6.3-4, the research study explores the possibility of calculating a variance as the "variability in scores" for any given measure (common variance) and some of them would be specific to a particular measure (unique variance) and can be reliably attributed to only one measure. The presence of unique variance does not ignore the possibility of error or random variances. Therefore, a proportion of common variance present in a variable known as the communality, should be determined. A variable that has no random variance would have a communality of 1; likewise,

a variable that shares none of its variance with any other variable would have a zero commonality.

- A measure of Sampling Adequacy KMO/Bartlett's Test of Sphericity: In Table 6.3-5, the referenced tests are used to test the suitability of the respondent data for factor analysis (KMO and Bartlett's tests). Andy Field's study discusses that the proposed KMO value should lie between 0.8 and 0.9 to consider a greater value, while a minimum acceptable value of KMO equal to 0.5 or a moderate value lies between 0.5 and 0.7 or a good value lies between 0.7 and 0.8. Whereas superb value considered as greater than 0.9, provide confidence about the adequacy of the size of the sample for factor analysis. Removal of variables should affect KMO statistics and likewise re-examine the matrix. KMO = 0.908 showing confidence about adequate sample size for factor analysis and Bartlett's test $p<0.05 = 0.00$. The significance test shows that R-matrix is not an identity matrix; therefore, some acceptable level of correlation does exist between variables included in the analysis. For suitable factor analysis, the value of Bartlett's test of Sphericity should be significant ($p<0.5$).

Table-6.3-5: Results of KMO & Bartlett's test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy		**000.908**
Bartlett's Test of Sphericity	**Approximately Chi-Square**	**3847.772**
	Difference	**120.000**
	Significant	**000.000**

Table-6.3-5 shows, that Bartlett's measure test of sphericity and the anti-image correlation matrix reveals the relationship among different variables. The KMO statistics values for individual variables were produced on the diagonal (highlighted values greater than a bare minimum value of 0.5 for all variables) of the anti-image correlation matrix (Table-6.3-4). The values other than diagonal values (off-diagonal values) show a small partial correlation between variables. The original correlation matrix is an identity matrix and Bartlett's measure tests the null hypothesis. Therefore, the result values show that except for some exception there exist a small partial correlation among variables which means that the R-matrix is not an identity matrix and the test attained a bare minimum level of significance ($p<0.05$).

Step-2: How Factors can be extracted?

The literature review specified different methods of factors extraction: Principal Component Analysis (PCA), Maximum Likelihood Analysis Factor (MLFA); Principal Access Factor (PAF); Un-weighted least-square; Generalize least-square; Image factoring, Alpha factoring, and Canonical. PCA and PAF are used commonly in social sciences research studies. PAF seeks the least number of factors that can account for the common variance (correlation) of a set of variables. However, PCA is recommended in EFA, especially when no prior, theory, or model exists to conduct research studies [Pett et. al. (2003)]. The PCA works on the initial assumption that all variance is common, therefore, before extraction of communalities all variables have a value equal to 1, as a common variance. Extra (un-qualified) variables are discarded after extraction and as a reason, some information is lost. The retained factors do not explain all the variances present in the data. SPSS output also shows components matrix before rotation, displaying all loadings less than 0.4 suppressed in the output. Here, the rotation aims to segregate high loading items on one factor from the low loading items on the remaining factors; i.e, simplifying the factor structure of a group of items to understand the subject better.

Step-3: How to Determine Factor Extraction Criteria?

There are various criteria available to researchers to simplify factor solutions and produce scale Uni-dimensionality. Hair et al.'s (1995) study discusses that there exists no rule of thumb for a particular criterion for factor extraction, instead, multiple criteria depending upon the circumstance may be used as appropriate and desirable (simultaneous multiple decision rules). The Scree test, Kaiser's criteria (Eigen value > 1 rule), the cumulative percentage of variance extracted, and parallel analysis are suggested as multiple approaches used in factor extraction. Most peer reviews publications apply multiple extraction techniques required for manuscripts.

Eigen Values > 1 Rule and Cumulative Percentage of Variance (Kaiser's Criteria): This is considered an area of disagreement using factor analysis tools in different areas of study: Psychology, Sociology, Humanities, and natural sciences studies. In natural sciences, factors stopped when 95% of variances were explained. In Humanities, the explained variance is commonly as low as 50-60% [Hair et al.'s (1995)]. To determine the linear component (factor, Eigenvalues, and vector) within the dataset for R-matrix, the size of the magnitude of the Eigenvalues determines which factor to be retained or discarded. With 31 linear components before extraction within the dataset that filtered into 16 linear components, (Table-6.3-6) shows the Eigenvalues before and after extraction and rotation against each linear component (factor). SPSS extracted all factors (Table-6.3-6) with Eigen values greater than 1, which leaves 4 factors

to clearly explain the definition ("Extraction Sums of Squared Loading"). There is another column labeled "Rotation Sums of Squared Loadings" (showing Eigenvalues of the factors after rotation) that brings an optimization effect on the factor structure where the relative importance of four factors is equalized. Before rotation, factor 1 accounted for considerably more variance than the remaining three Total of Extracted Sums of Squared Loadings (8.532 compared to 1.422, 1.174, and 1.043). After extraction, factor 1 accounts for moderately adjusted values of 7.615, 5.201, 3.265, and 2.022 as the Total Rotation Sums of Squared Loadings. The SPSS output shows the Table-6.3-7 demonstrates the cumulative percentage of the variance of 76.062% with four (4) components (out of 16 components) in total having an Eigenvalue > 1. The SPSS output shows Table-6.3-6 of communality as the proportion of common variance within a variable explains the extraction method. Thereby, SPSS has extracted four factors and exercised Kaiser's criterion that applies when there are less than 30 variables or communalities after extraction is greater than 0.7 (or 70%) or when the sample size exceeds 250 or the average communality is greater than 0.6 (or 60%). The SPSS output shows commonalities where most of the variables have values greater than 0.7 and no values found less than 0.5. The average of the communalities is calculated by summing up all extracted values and divided by the number of variables. The average value becomes (8.532+1.422+1.174+1.043) =12.171/16 = 0.7606875. On both grounds the values were found to be greater than 0.5, so Kaiser's rule applies here, especially in situations where the sample size is small.

Scree Test: The test is subjective and graphic where researchers' judgment is required. Thus, disagreement may lead to an open debate about which factors are retained and which factors are to be discarded [Straub (1989); Taherdoost et al.'s (2014); Tabachnick et. al. (2007)]. This disagreement and subjectivity require a solution in case of large sample size (higher than N: P ratio 3:1) together with higher values of communalities. According to the Andy Field study, "the name of the Scree test given by Cattell (1966) due to its graphical presentation", quoted an example as being the rock debris lying at the bottom of the mountain.

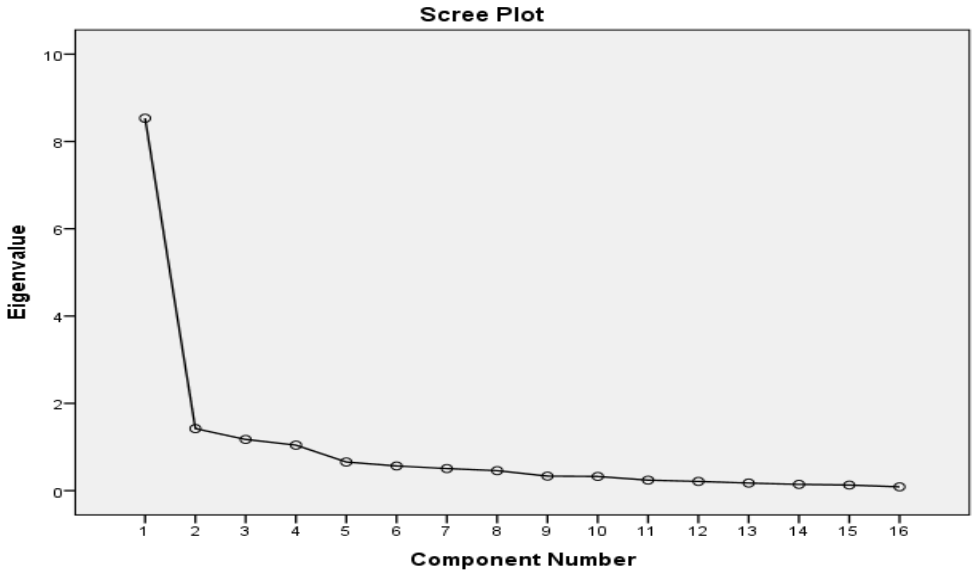


Fig-6.3-1: Scree plot

In a Scree test, two steps are involved during inspection and interpretation of the plot: (1) a straight line should be drawn through smaller Eigenvalues where a curve tilt may be observed leading to visual similarities just like rock debris at the foot of the mountain; (2) to determine the point of inflection where the point above a tilt or a break (not including the brake itself) till then, all items/factors can be retained. The Scree plot (Fig-6.3-1) shows from a beginning to the tail off after three factors of the Scree Plot, yet there observed another drop after the fourth factor before a stable plateau is reached. Therefore, it is properly justified to retain either two or four factors. The following Scree plot shows four (4) factors result where Eigenvalues have produced a departure from linearity.

Parallel Analysis technique: This technique is very helpful in extracting factors, that is, decision-making about how many factors to retain (Fig-6.3-2). Andy Field cited Gorsuch's (1997) study and discusses that the parallel analysis technique although used rarely showed some application and usefulness. In this technique, actual Eigenvalues compare with randomly generated Eigenvalues. Here, we retained those factors whose actual Eigenvalues exceed randomly generated Eigenvalues. Therefore, the best-fit solution extracted and factors' structure were finalized at this stage by Monte Carlo PCA.

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Monte Carlo PCA for Parallel Analysis
Version .


3/14/2017   9:58:44 AM
Number of variables:     16
Number of subjects:     300
Number of replications: 100

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Eigenvalue #     Random Eigenvalue     Standard Dev
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
       1                 1.4157                .0463
       2                 1.3306                .0373
       3                 1.2624                .0316
       4                 1.2061                .0274
       5                 1.1473                .0234
       6                 1.0919                .0204
       7                 1.0468                .0187
       8                 1.0074                .0195
       9                 0.9635                .0193
      10                 0.9211                .0227
      11                 0.8781                .0228
      12                 0.8385                .0230
      13                 0.7955                .0213
      14                 0.7519                .0247
      15                 0.7044                .0279
      16                 0.6389                .0325
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
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Monte Carlo PCA for Parallel Analysis
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Fig-6.3-2: Monte Carlo PCA (parallel analysis)

The data collected from total variance (Fig-6.3-1) is explained by four (4) components (8.532, 1.422, 1.174, 1.043) in which 2 components (8.532, 1.422) are greater than randomly generated Eigenvalues (1.4157, 1.3306) respectively (Fig-6.3-2). In this connection, it was also observed that the other two components (1.174, 1.043) are lower than randomly generated Eigenvalues (1.2624, 1.2061) respectively (Fig-6.3-2). Therefore, the first two components were extracted for the best-fit solution that recommended the final factors structure. However, contextual references preferably supported the theoretical concept for four (4) components as the best fit to make the most conceptual sense, and thus surpass the suggested extraction (2 factors) during parallel analysis for the final structure.

Step-4: Selection of Rotational Method

When data have relations with more than one factor, we apply the rotational method so that clear demarcation of minimum and maximum item loadings is observed. This clear and simplified version can be easily interpreted and can be helpful for the decision-making process. There are two common rotation techniques: Orthogonal rotation and oblique rotation. Researchers have several methods to choose from both rotation options (orthogonal varimax / quartimax and oblique olbimin / promax). The orthogonal varimax rotational technique

produces uncorrelated factor structures. Whereas oblique olbimin rotation produces a correlated factor structure for producing accurate results of research work (involving human behaviours or data) that does not meet prior assumptions. Here, the main question is whether a variable might relate to more than one factor or not? Rotation produces a more interpretable and simplified solution and can be used to provide factor stability (conceptually & intuitively) and best fit. It noted that there observe some situations where items might load on several factors and seems not conceptually fit according to the logical factor structure. Therefore, items can then be re-examined which one to retain and which to discard.

Method-1: Factor Extraction (Oblique Olbimin Rotation with Four Factors: When an oblique rotation is conducted, the factor matrix is split into two matrices: (1) Pattern Matrix; (2) Structure Matrix. The pattern matrix contains factor loadings and is comparable to the factor matrix, interpreted for the orthogonal rotation. The structure matrix is a product of the pattern matrix and the matrix containing the correlation coefficient between the factors. Andy Field discussed as most researchers interpret the pattern matrix due to its simplicity. There are situations where values in the pattern matrix are suppressed because of relationships between the factors. The structure matrix is useful for double-checking (Table-6.3-8). After completing the third step, four factors emerged in the pattern matrix where few loadings are too small to display. Factor 1 represents "Contractual Binding with the Suppliers", Factor 2 represents "Campaign against Product Counterfeiting", Factor 3 represents "Follow best industry technique to counter counterfeiting", and Factor 4 represents "Formulate Programs to streamline surveillance efforts against product counterfeiting". On the contrary, the Structure Matrix differs in "shared variance" which is another important aspect that should not be ignored. As a result, more complicated results were produced from the Structure Matrix because of the relationship between Factors 1, 2, and 3 and Factors 1, 2, and 4. Therefore, the Pattern Matrix is preferable for clearer interpretive reasons: because it contains information about the unique contribution of a variable to a factor. The "Component Correlation Matrix" shows that existing correlation indicates that a construct measured can be interrelated. If the constructs are independent then oblique rotation does exist to provide an identical solution to orthogonal rotation and the "Component Correlation Matrix" should then be an Identity Matrix, having a correlation coefficient equal to zero. Therefore, Table-6.3-8 and Table-6.3-9 show that the final matrix rejects the presence of factors' independence in the data and confirms the presence of interrelationship between factors. This means that the "Component Correlation Matrix" is not an Identity Matrix and considers an obliquely rotated solution more meaningful as compared

to orthogonal rotation. The final portion of the SPSS output is the correlation matrix between factors where a reference is made to Structure Matrix for further discussion. The Structure Matrix (Table-6.3-9) indicates that Factors 1 and 2 are noticeably interrelated to each other but Factors 3 and 4 have no relation to each other.

Method-2: Factor Extraction (Orthogonal Varimax Rotation with Four Factors): The Rotated Component Matrix presents the four factors after Varimax Rotation. Identify what items are loaded on each of the four components. The clustering of the items in each component means some meaning given to the concerned component. Here is the meaning of the first factor related to the manager's decision in situation where counterfeits' infiltrate in supply chain (Campaign against product counterfeiting). The second factor related to the manager's decision about Contractual Binding with supplier in case infiltration of suspected products/components takes place in different phases of operations (Contractual Binding with supplier). The third factor related to the manager's decision about Creating Awareness among practitioners, authorities and academia in relation to Product Counterfeiting. The fourth factor related to Formulate Programs to streamline surveillance efforts against product counterfeiting. The rotated matrix in Table-6.3-10 and Table-6.3-11 show important considerations about the format of the matrix. First, factor loading less than 0.4 have not been displayed showing substantive value for complete interpretation (cited in Andi Field's book "Discovering Statistics Using SPSS"). Second, the variables are listed in the order of size of their factor loadings. A comparison (based on SPSS output) can be made between a Rotated Component Matrix and an un-rotated Component Matrix. There exist situations of uneven distribution of item loadings where some variables loaded highly, and some variables did not get the right loadings. Therefore, the application of the rotation technique of the factor structure has clarified the context and made interpretation possible. The final part of the SPSS output is the Component Transformation Matrix which provides information about the degree to which the factors are rotated to obtain a solution. If no rotation is necessary, this matrix is an Identity Matrix. If orthogonal rotation is completely appropriate, then a symmetrical matrix (same values below and above the diagonal) is expected. Therefore, the referenced matrix found non-symmetric made the orthogonal rotated solution meaningless, and consider the obliquely rotated solution more meaningful.

Step-5: Interpretation and Labelling:

The meaningfulness of latent factors is ultimately dependent upon the researcher's definition. Traditionally, two or more variables loads on a factor should give a meaningful interpretation and then give that factor a name, theme, or label for further usage. The reason for thorough and systematic factor analysis is to isolate items with high loadings in the resultant pattern matrices. In other words, it is a search to find those factors that are taken together to explain most of the responses. Here, the researcher's decision is meaningful with these factors to retain and then operationalized and descriptively labeled. Therefore, these labels or constructs must reflect the theoretical and conceptual intent. For further interpretation of the results, the study of the reliability of the scale was performed.

6.3.4 CHECKING THE RELIABILITY OF SCALE

6.3.4.1 SCALE RELIABILITY ANALYSIS

The item-total statistics table shows what would be the Cronbach α value if that item was deleted. Ensures reliability of the questionnaire at a particular stage where no item should cause a substantial decrease in α. As a good Cronbach α value > 0.7, therefore, all Cronbach α values should be around 0.8 or higher. The inter-item correlations and covariance provide correlation coefficients and averages for items on the scale. On a reliable scale, all items should correlate with the total. Table-6.3-12 to Table-6.3-14 show that all items according to the factors have values greater than 0.3 means that a particular item does correlate very well with the scale. Therefore, items with low correlations may have to drop, which are none so far.

The overall Cronbach α value is 0.947, for Factor-1, and none of the items would increase the reliability if they were deleted. This indicates that all items are positively contributing to the overall reliability. The overall Cronbach α value is 0.947 is also excellent because it is above 0.8 and indicates good reliability. The overall Cronbach α value is 0.854, for Factor-2, and none of the items would increase the reliability if they were deleted. This indicates that all items are positively contributing to the overall reliability. The overall Cronbach's (α) is 0.853 is also excellent because it is above 0.8 and indicates good reliability. The overall Cronbach α value is 0.785, for Factor-3, and none of the items would increase the reliability if they were deleted. This indicates that all items are positively contributing to the overall reliability. The overall Cronbach α value is 0.786 is also "Good" because it is above 0.7 and indicates good reliability.

6.3.4.2 SCALE INTERNAL CONSISTENCY

Checked the Case Processing Summary table for the correct number of cases and the Reliability Statistics table for the correct number of items. The inter-Item-Correlation Matrix table displayed all positive values for the Corrected-Item-Correlation values. All Cronbach α values shown in the Reliability Statistics tables are 0.947, 0.854, and 0.785, for factors 1, 2, and 3 respectively (Table-6.3-12 to Table-6.3-14), suggesting very good overall internal consistency reliability for the scale. The fourth component ACTFIN-SP-6 represented an independent single-item component. The reliability statistics show that none of the items represent the capability of increasing reliability if they are deleted. Therefore, the table shows that all items are positively contributing to the scale reliability. Values in the Inter-Item-Correlation Matrix and the Item-Total Statistics table (Table-6.3-12) indicate the degree to which each item correlated with the total score. Higher values (>0.3) indicate that the item is measuring correctly from the scale. The mean Inter-Item Correlation value suggests quite a moderate overall relationship among the items.

6.4 CHAPTER SUMMARY

The EFA is a complex and multi-step process used to discover the factor structure of a measure and then examine its internal consistency. Conventional wisdom states that despite many options for executing the steps of EFA, the actual difference between them remains very small, so it doesn't matter what method the practitioners choose. This study applies the EFA technique to the ANCT-INT construct where necessary formative components of the referenced construct are to be explored after following Costello and Osborne's guidelines. As this study initiates the Initial survey process for data collection to reveal relevant components. Moreover, this study discusses PCA (Principle Component Analysis) concerning Oblique rotation (Direct Oblimin) and Orthogonal rotation (Varimax) methods. The PCA is conducted on the 31 items (anti-counterfeiting strategies) using SPSS version 20 and data analysis work is performed: first with Oblique rotation (Direct Oblimin) and then with Orthogonal rotation (Varimax) methods. The suitability of data for factor analysis was assessed before performing PCA. The correlation matrix, after inspection, revealed the presence of all correlation coefficients equal to or greater than 0.3. Correlation coefficients whose values exceed a higher limit (> 0.9) are also taken care so to bring possible resolution to the issue of multi-collinearity in the data. The KMO measure confirms the adequacy of the sample size to continue with the analysis [KMO = 0.908, "Excellent" according to Andy Field (2009)] where all KMO values for individual items are greater than 0.7 which are well above the acceptable limit of 0.5. Bartlett's test of sphericity $X2\ (120) = 3847.772$, $p < 0.001$, indicated that the correlations between items are found

sufficiently large for PCA. For that matter, an initial analysis done to obtain eigenvalues for each component in the data. Initially, four (4) components having eigenvalues over Kaiser's criterion of 1.0 and in combination (cumulative) explained 76.062% of the variance (extraction sums of squared loadings). An inspection of the Scree Plot revealed a clear break after the third component. Later on, the Scree Plot is slightly ambiguous and showed inflections that would justify retaining the fourth component as well. The sample size of 257 respondents, the convergence of the scree plot, and Kaiser's criterion focused on four components that were retained in the final analysis. Referring to the analytical Table-B, the item that cluster on the same component suggest that Component-1 represents "Contractual binding with partners", Component-2 represents "Campaign against product counterfeiting", Component-3 represents "Following best industry practices", and Component- 4 represents control product counterfeiting in supply chains for the automotive industry's in Pakistan. The fourth component ("Formulate anti-counterfeiting Programs") represent a component that shows its presence for further analysis in the research model. The ANCT-INT construct was found to be a promising candidate to conceptualize as an antecedent to the SCQM. Sheel et al.'s (2019, P.1353) study discusses that "*…' supply chain practitioners are confident that BC technology will help improve supply chain parameters*' and illustrates '*how BC technology can improve supply chain adaptability, alignment, and agility which collectively enhance competitive advantage which in turn influences firm performance'..."*. Moreover, Sheel et al.'s (2019, P.1353) study state that" …' *trust generated through BC use also increases firm performance* and the '*…confirmatory factor analysis to ascertain the validity of the measures used and a structural model was analysed for testing the proposed conceptual framework'...*". Therefore, some clear decisions and rules apply to EFA emphasizing that clear decision sequencing and protocols are paramount in each investigation. Moreover, the five steps EFA statistical technique was found useful in contemplating the said research requirements. Futuristically, once an instrument is developed using EFA can move to the CFA stage to address questions regarding the validity of the instrument in certain population subgroups. CFA can allow researchers to test hypotheses via inferential techniques for informative analytical options.

CHAPTER-7 CONFIRMATORY FACTOR ANALYSIS

7.0 INTRODUCTION

This chapter starts with an overview of Structural Equation Modelling (SEM). It discusses a comparison between formative constructs and reflective constructs, to understand their characteristics and the assessment approaches suitable for each construct. The chapter proceeds by exploring the various approaches to SEM, which include the Covariance-Based SEM (CBSEM) and the Component-Based SEM, e.g. Partial Least Squares (PLS). The chapter provides a review of the procedures for assessing Structural Equation Models (SEM), which consists of two steps: assessing measurement models (reflective or formative) and assessing the structural model. The chapter concludes by discussing the application of the various tests for assessing the research model, including the assessment of reflective models, formative models, and the structural model. The chapter provides a brief explanation of the Partial Least Squares (PLS) approach, which is the selected approach for this study. The chapter justifies selecting the PLS approach by showing the suitability of the approach through different phases of the research study.

This chapter discusses how the SEM technique used to measure the dimensions and measures of the research model, consists of three (3) constructs: ANCT-INT; SCQM-Imp; FSP. The networked governance model supported SCQM-Imp environment, where practitioners can make educated decisions, is conceptualized as a hierarchal measurement model with two (2) dimensions and ten (10) measures. In the research model, ANCT-INT items' measures supported construct is hypothesized as an antecedent to SCQM-Imp environment construct and conceptualized as a reflective dimensional measurement model. FSP, as the consequent, is conceptualized as a reflective measurement model to the hypothesized ANCT-INT items' measures supported construct.

7.2 LITERATURE REVIEW-STRUCTURE EQUATION MODELING (SEM)

Hazen et al.'s (2015) study provides detail about standardized reporting conventions concerning the decision to operationalize a suitable SEM technique for managerial decision making. Hazen et al.'s (2015, p.627) study state that "*Structure equation modeling (SEM) is a data analysis method of choice for much empirical supply chain management (SCM) researchers*". This study tries to completely follow the steps of the framework for applying PLS in SEM [Urbach & Ahlemann (2010, p.15)] that can be applied to assess the validity of the "Extended LS system" model in the automotive industry's in Pakistan. This study is

strongly influenced by leading contributions made by scholars [Henseler et al.'s (2009, 2012, 2015); Henseler & Weeks (2010); Henseler (2017); Hair et al.'s (2011, 2014, 2015, 2017); Chin (1998); Gefen et al.'s (2000); Bentler & Weeks (1980)].

7.2.1 RATIONALE FOR USING SEM

Gefen et al.'s (2000) study discuss that SEM offers a comprehensive and systematic analysis that helps researchers to answer a set of interrelated research questions. Alazab et al.'s (2021, p.97) study discusses how to measure the sharing information supported "*Trust-Based Information Technology Innovation Acceptance Model*" by using Partial Least Square Structural equation modeling (PLS-SEM) to educate practitioners who are engaged in sharing information adoption projects in their firms". The SEM technique is commonly used by researchers to support the hypothesized model of the positivist epistemological belief of the empirical study. Chin's (1998) study says that SEM is the second generation of multivariate analysis. When applied correctly, SEM-based procedures have substantial advantages over first-generation techniques such as principal components analysis, factor analysis, discriminant analysis, or multiple regression because of the greater flexibility that a researcher has for interplay between theory and data. Gefen et al.'s (2000) study discuss that SEM is a statistical technique that simultaneously tests and estimates the causal relationships between independent and dependent constructs. Ullman & Bentler's (2004) says that the SEM technique allows the examination of complex systems of variables that are both observed and unobserved. The use of latent variables allows relationships between theoretically error-free constructs to be examined. SEM also allows researchers to test hypotheses at the level of the construct rather than needing to test a construct-level hypothesis with a variable measured with error. Furthermore, Ullman & Bentler's (2004, p.2) study states that "*Conceptually, structural equation modeling is a collection of statistical techniques that allow a set of relationships between one or more independent variables (IVs), either continuous or discrete, and one or more dependent variables (DVs), either continuous or discrete, to be examined*". Both IVs and DVs can be either measured variables (directly observed) or latent variables. A latent variable is a variable that is not directly measured but is assessed indirectly through two or more measured (observed) variables. Thus, the higher degree of support to the latent variables (LV) is the most important strength of the SEM technique. As discussed in previous paragraphs, the LVs cannot be measured directly because they are unobservable (e.g., perceptions, intentions, satisfaction, benefits, or impacts of product counterfeiting phenomenon in supply chains. Edwards & Bagozzi's (2000) study discusses that, based on theoretical considerations, the

structural equation models (SEM) consist of two sub-models: the structural model (inner model) and the measurement model (outer model), and states the structural model is concerned with the causal relationships between the latent variables. In these models, independent LVs are called exogenous variables and the dependent LVs are referred to as endogenous variables. On the other hand, measurement models are dedicated to defining each of the LVs within the structural equation model. Henseler's (2017, p.363) study discusses that "*the structural model consists of exogenous and endogenous constructs, as well as the relationships between them. The values of exogenous constructs are assumed to be given from outside the model. Thus, other constructs in the model do not explain exogenous variables, and no arrows in the structural model should point to exogenous constructs. In contrast, other constructs in the model explain endogenous constructs at least partially. Each endogenous construct must have at least one of the structural model's arrows pointing to it. The relationships between the constructs are usually assumed to be linear. The size and significance of path relationships are typically the focus of the scientific endeavors pursued in empirical research*". An example of an SEM is illustrated where a model consists of an exogenous variable (a) and an endogenous variable (b). The relationship between variable (a) and variable (b) is quantified by a path coefficient (r). Variable (a) is a formative construct and variable (b) is a reflective construct. Both variables are operationalized by indicators (xi) for the variable (a) and indicators (Yi) for variable (b). The relationship within the measurement models among the variables and their respective indicators is denoted as (n!); it represents the weights for formative measurement models and factor loadings for reflective models (see in Fig-7.2).

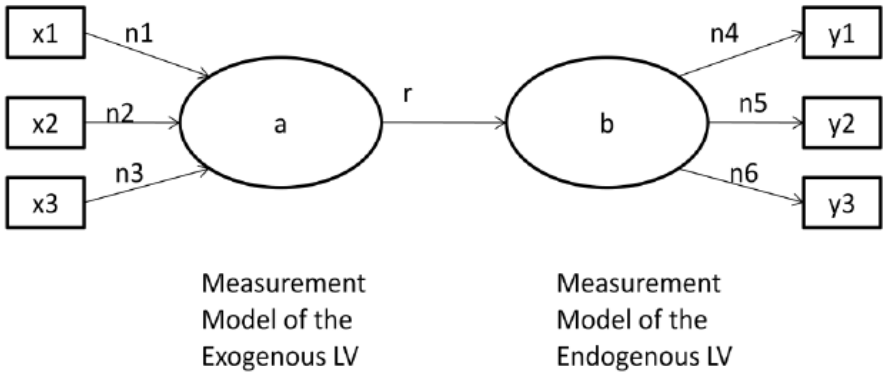


Fig-7.2: Endogenous and Exogenous model structure

The SEM assumes that the relationships between variables are linear. There is a problem in determining the goodness of fit to the sample data on the variables measured. Urbach &

Ahlemann's (2010) study discusses that one of the main statistical issues related to the analysis of structural equation models is the optimal estimation of the model's parameter. Bentler's (1980) study emphasizes that the primary statistical problem is one of optimally estimating the parameters of the model and determining the goodness-of-fit of the model to sample data on the measured variables. If the model does not acceptably fit the data, the proposed model is rejected as a possible candidate for the causal structure underlying the observed variables. If the model cannot be rejected statistically, it is a plausible representation of the causal structure. Since different models typically generate different observed data, carefully specified competing models can be compared statistically.

7.2.2 FORMATIVE AND REFLECTIVE CONSTRUCTS

Chin's (1998, p.ix) study discusses that formative indicators, first introduced by Blalock (1964), are measures that form or cause the creation or change in an LVs. The reflective indicators are offshoots of the LVs representing the effects of the LVs outcome. Moreover, Chin's (1998) study says that the reflective indicators changed according to changes in the LV when measured to check the internal consistency. Therefore, all reflective indicators should correlate positively. Reflective indicators of a given LVs measures the same phenomenon under study (as this study addresses the issue of the product counterfeiting phenomenon in the automotive industry's supply chains). In some cases, the formative indicators may even be inversely related. Likewise, [Diamantopoulos & Winklhofer, 2001; Jarvis et al.'s, 2003; Petter et al.'s, 2007] studies where the indicators are more properly considered as formative indicators, but researchers used them reflectively and then applied validation techniques to validate the reflective models. Petter et al.'s (2007) study show that 30% of the SEM studies in leading Operations Management journals are subject to misspecifications. Urbach & Ahlemann's (2010) study emphasized that researchers make their own choices depending upon different knowledge-based philosophical positioning ranging from strictly positive to interpretive and constructivist epistemological beliefs. Therefore, Urbach & Ahlemann's (2010, p.12) study says that "*Some researchers opt for the exclusive usage of reflective indicators for theory testing since formative constructs seem to have epistemological, logical, and statistical problems (e.g., Wilcox et al.'s, 2008)".* Bagozzi's (2007) study states that the formative measurement could be done, but only for a limited range of cases and under restrictive assumptions, even then problems of interpretation may arise. Jarvis et al.'s (2003) study presented criteria (Table-7.2.2a) to determine the type of model.

DECISION RULES TO DETERMINE A FORMATIVE OR REFLECTIVE CONSTRUCT

Criteria	Formative Model	Reflective Model
1. Direction of causality from construct to measure implied by the conceptual definition	**The direction of causality is from items to construct.**	**The direction of causality is from construct to items.**
Are the indicators (items) (a) defining characteristics or (b) Manifestations of the construct?	Indicators are defining characteristics of the construct.	Indicators are manifestations of the construct.
Would changes in the indicators/ items cause changes in the construct or not?	Changes in the indicators should cause changes in the construct.	Changes in the indicator should not cause changes in the construct.
Would changes in the construct cause changes in the indicators?	Changes in the construct do not cause changes in the indicators.	Changes in the construct do cause changes in the indicators.
2. Interchangeability of the items / indicators	**Indicators need not be interchangeable**	**Indicators should be interchangeable**
Should the indicators have the same or similar content? Do the indicators share a common theme?	Indicators need not have the same or similar content/indicators need not share a common theme.	Indicators should have the same or similar content/indicators and should share a common theme.
Would dropping one of the indicators alter the conceptual domain of the construct?	Dropping an indicator may alter the conceptual domain of the construct.	Dropping an indicator should not alter the conceptual domain of the construct
3. Co-variation among the indicators	**Not necessary for indicators to co-vary with each other**	**Indicators are expected to co-vary with each other**
Should a change in one of the indicators be associated with changes in the other indicators?	Not necessarily	Yes
4. Nomological net of the construct indicators	**The nomological net of the indicators may differ.**	**The nomological net of the indicators should not differ.**
Are the indicators/items expected to have the same antecedents and consequences?	Indicators are not required to have the same antecedents and consequences.	Indicators are required to have the same antecedents and consequences.

Table-7.2.2a: Differences between Formative and Reflective Constructs (adapted from Jarvis et al.'s, 2003)

Since formative constructs seem to have epistemological, logical, and statistical problems. Urbach & Ahlemann's (2010) study asserted that measurement models should be designed with indicators that are either completely formative or completely reflective. This study discusses the structural models (TQMP, SCMP, ANCT-INT, FSP), in Fig-7.2.2a.

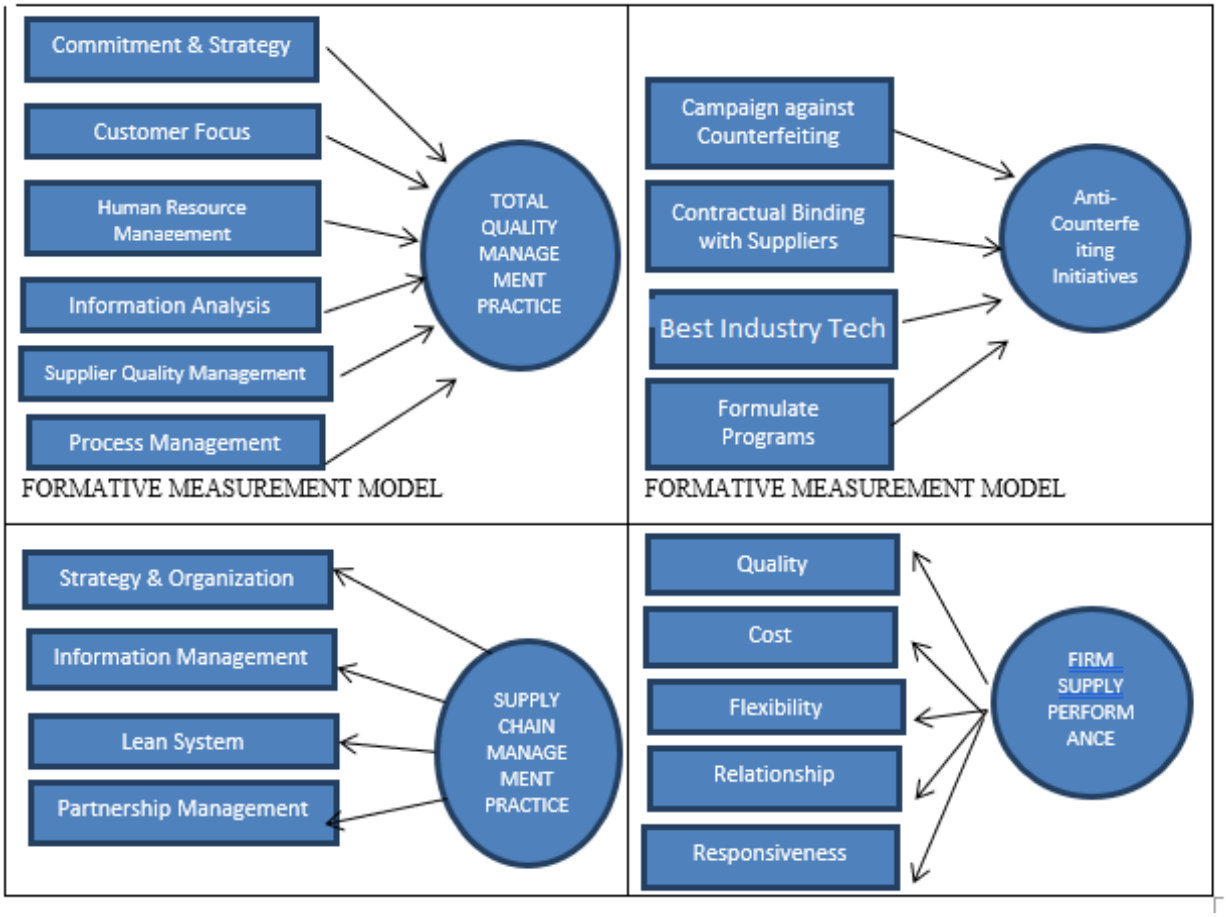


Fig-7.2.2a: Formative and Reflective measurement model

7.2.3 DIFFERENT SEM APPROACHES (PLS AND CBSEM)

Urbach & Ahlemann's (2010, p.12) study discusses that "*Currently, there are two general approaches to SEM: (1) covariance-based structural equation modeling (CBSEM) as implemented in LISREL, AMOS, EQS, SEPATH, and RAMONA and (2) the component-based approach PLS. These approaches differ in their analyses' objectives, their underlying statistical assumptions, and the nature of the fit statistics they produce".* It typically uses a maximum likelihood (ML) function to minimize the difference between the sample covariance and those predicted by the theoretical model. Consequently, the estimated parameters attempt to reproduce the observed values' covariance matrix. If the ML function is applied, the observed variables have to follow a normal distribution. For example, as stated earlier, if the deviations of the data from the average very closely follow a normal distribution, then it makes sense to assume that the sources of uncertainty are normally distributed. In this case, the frequentist parametric inference method is used, based on the maximum likelihood method, instead of the least-squares method. The maximum likelihood method brings confidence to parameters directly without resampling the original dataset and testing the hypothesis. In contrast, Urbach & Ahlemann's (2010, p.12) study discusses that "*the PLS algorithm minimizes the variance of all the dependent variables instead of explaining the covariation. Consequently, PLS makes lower demands on measurement scales, sample size, and residual distributions".* Theoretically (Henseler et al.'s, 2009), each of these approaches is used for distinct purposes.

7.2.3.1 PARTIAL LEAST SQUARES (PLS)

Henseler's (2017, p.372) study discusses that *"…recent research confirms that PLS is a promising technique for prediction purposes (Becker et al.'s 2013). Blindfolding is the standard approach used to examine if the model, or a single effect of it, can predict the values of reflective indicators (Tenenhaus et al.'s 2005). It is already widely applied (Hair et al.'s 2012b; Ringle et al.'s 2012)*". The subject of this study contribution is to encourage managers to gain knowledge in a case when the sample size is a matter of concern, and the application of the PLS technique can be helpful in predicting model parameter estimations. Henseler's (2017, p.361) study states that "*Of the variance-based SEM methods, partial least squares path modelling (PLS) is regarded as the "most fully developed and general system" (McDonald 1996, p. 240), and is the subject of this contribution*". Empirical studies that use structural equation modelling (SEM) consider the Partial Least Squares (PLS) is a component-based approach that allows structural equation testing. Urbach & Ahlemann's (2010, p.12) study says

that the main idea behind PLS of having "…*two iterative procedures using least-squares estimations for single or multi-component models*. *By applying these procedures, the algorithm aims at minimizing the variance of all the dependent variables (Chin 1998b). Accordingly, the cause-and-effect directions between all the variables need to be clearly defined (Huber et al.'s 2007). The model quality improves as more indicators are used to explain the LVs since a larger number of indicators can better explain an LV's variance ("consistency at large") (Huber et al.'s 2007; Lyttkens 1973)*. In addition, Urbach and Ahlemann's study states that with PLS two applications are possible (Chin 1998b): It can either be used for theory confirmation or theory development. In the latter case, PLS is used to develop propositions by exploring the relationships between variables. Chin's (1998) study says that the main objective of the application of two PLS procedures is to minimize the variance of all dependent variables by having more indicators to define and explain the model's LVs more accurately. Jarvis et al.'s (2003) study state that the PLS is one of the methods that are capable of handling both reflective and formative constructs, along with methods such as linear structural relationship (LISREL). A list of comparisons of some of the advantages and disadvantages of PLS is as under (see Table-7.2.3.1a):

ADVANTAGES AND DISADVANTAGES OF THE PLS APPROACH

ADVANTAGES OF PLS	DISADVANTAGES OF PLS
✓ PLS is distribution-free as it does not assume anything regarding the distributional form of LVs (Chin, 1998). ✓ PLS does not generate inadmissible solutions and it does not suffer factor indeterminacy (Fornell & Bookstein, 1982). ✓ Under certain conditions, PLS can work with relatively small sample sizes (Cassel et al.'s, 1999). ✓ PLS produces estimates for LVs for all cases in the data set (Urbach & Ahlemann, 2010). ✓ Independent observations are not needed (Wold, 1980). ✓ There is no need for identical distributions of residuals (Chin & Newsted, 1999; Lohmoller, 1989).	✓ PLS may cause measurement errors to occur because LVs are estimated as the aggregates of the corresponding indicator variables. ✓ PLS may lead to inconsistencies because its estimates are very close to the empirical data (Chin & Newsted, 1999; Fornell & Cha, 1994; Huber et al.'s, 2007). ✓ In the PLS approach, parameter estimates for the structural model are often inferior when compared to those generated by alternative approaches. ✓ With PLS, It is not possible to perform significance tests of model parameters.

Ref: Table-7.2.3.1a (Urbach & Ahlemann, 2010)

7.2.3.2 COVARIANCE-BASED SEM

CBSEM is used for theory testing and PLS is used first for theory development and then for testing predictive model application. In the Henseler et al.'s (2009, p.296) study, the PLS could be used as an alternative for CBSEM for theory development and testing when satisfactory global goodness-of-fit is established. The Henseler et al.'s (2009, p.296) study discusses that the "…*philosophical distinction between these approaches is whether to use CBSEM for theory testing and development, or PLS path modeling for predictive applications".* As visualized in Fig. 7.3b, Henseler et al.'s study say that CBSEM in causal modeling situations where prior theory is strong and further testing and development is a goal, CBSEM is the most appropriate statistical methodology. Yet, due to the indeterminacy of factor score estimations, there is a loss of predictive accuracy. This occurrence, of course, is not of concern in theory testing where structural relationships (i.e., parameter estimations) between concepts is of primary concern. The Henseler et al.'s (2009, p.296) study in comparison drives the theory that the "…*CBSEM is theory-oriented, and emphasizes the transition from exploratory to confirmatory analysis, PLS is primarily intended for causal predictive analysis in situations of high complexity but low theoretical information (Jöreskog and Wold 1982)".* The study assumes that if CBSEM premises such as distributional assumptions, acceptable sample size, or maximal model complexity are violated, PLS is a reasonable alternative for theory testing. However, the lack of established global goodness-of-fit (GoF) criteria limits its use (Henseler et al.'s 2009). The decision to select SEM approaches depends on the research design and the characteristics of the sample. (See Table-7.2.2b for set criteria for selecting PLS or CBSEM approaches).

CRITERIA	**PLS**	**CBSEM**
Objective	Prediction-oriented	Parameter-oriented
Assumption	Predictor specification (nonparametric)	Multivariate normal distribution and independent observations (parametric)
Parameter estimates	Consistent as Indicators and Sample size increase (i.e., consistency at large)	Consistent in all respect
Latent variable scores	Explicitly estimated	Indeterminate
Epistemic relationship between LV & its measures.	Can be modeled in either formative or reflective mode	Only with reflective indicators. However, the formative mode is also supported.
Implications	Optimal for prediction accuracy	Optimal for parameter accuracy
Model complexity	Large complexity (e.g., 100 constructs and 1,000 indicators)	Small to moderate complexity (e.g., less than 100 indicators)
Sample size	Power analysis is based on the portion of the model with the largest number of predictors. Minimal recommendations range from 30 to 100 cases.	Ideally, based on power analysis of a specific model, recommendations range minimum (of 200 to 800)
Type of optimization	Locally iterative	Globally iterative
Significance tests	Only by means of simulations; restricted validity	Available
Availability of global Goodness of Fit (GoF) metrics	Are currently being developed and discussed	Established GoF metrics available

Table-7.2.2b: Comparison between CBSEM and PLS Approaches (adapted from Chin & Newsted, 1999)

Urbach & Ahlemann's (2010, p.14) study discusses that the CBSEM with low-to-medium complexity is a more established approach with recognized GoF metrics and better parameter accuracy and thus being more frequently accepted for rigorous model validation purposes. Whereas PLS can handle structural models of large complexities.

7.3 SUITABILITY OF THE PLS APPROACH FOR THIS STUDY

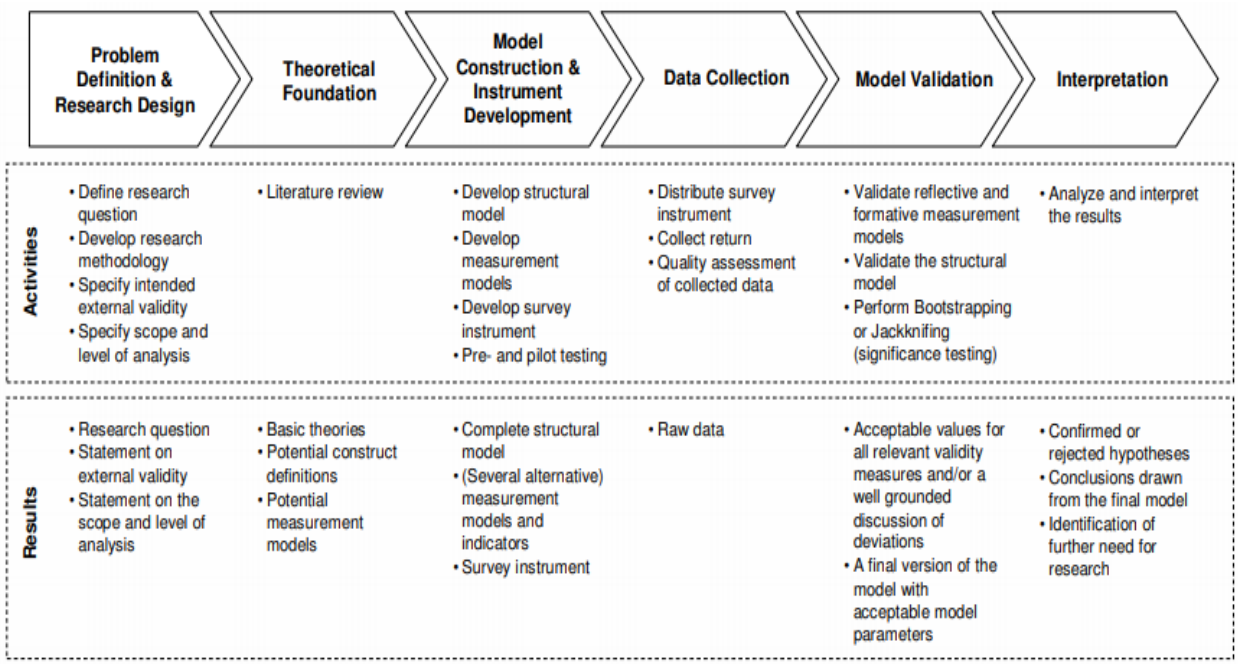


Fig-7.6: The framework for applying PLS in SEM (Urbach & Ahlemann, 2010)

This study tries to completely follow the steps of the framework (Fig-7.6) for applying PLS in SEM to assess the validity of the "Extended LS system" model.

7.3.1 MODEL ASSESSMENT FOR VALIDATION USING PLS APPROACH

Urbach & Ahlemann's (2010, p.18) study discusses that the "*Model validation denotes the process of systematically evaluating whether the hypotheses expressed by the structural model are supported by the data or not. In general, the model validation is an attempt to determine whether the measurement models, as well as the structural model, fulfill the quality criteria for empirical work*". Moreover, the Urbach and Ahlemann study discusses that the model validation process considers a systematic application of the different criteria carried out in a two-step sub-process, encompassing (1) the assessment of the measurement models and (2) the assessment of the structural model. To assess the measurement model, the Urbach and Ahlemann study discusses that the researchers need to distinguish between reflective and

formative models. Chin's (1998) study discusses the model assessment process: Outer model assessment [(Reflective LVs: Reliability & Validity); (Formative LVs: Validity)]; Inner model assessment [Variance explanation of Endogenous; Effect sizes; Predictive relevance]. This study tries to meet the objective of model assessment, that is, to test whether the structural model fulfills the data quality requirements of the empirical research. Therefore, data collection of SEM studies is always followed by the model assessment stage. The first stage entails the evaluation of the measurement models (outer model) and the second stage is dedicated to the evaluation of the structural model (inner model). For that matter, the PLS approach can be used for model assessment by calculating the estimates of model parameters even though it does not provide an established global goodness-of-fit (GoF) criterion (Henseler et al.'s, 2009). However, the PLS approach can offer a reasonable process for model assessment (Urbach & Ahlemann, 2010).

7.3.1.1 ASSESSMENT OF REFLECTIVE MEASUREMENT MODELS

Urbach & Ahlemann's (2010, p.18) study cited (Straub et al.'s, 2004) says that to meet the assessment of the measurement model "…*testing of the reflective measurement models required for at least unidimensionality, internal consistency reliability, indicator reliability, convergent validity, and discriminant validity by applying standard decision rules*". Table-7.3.1.1 illustrates various assessment aspects for reflective measurement models.

Table-7.3.1.1: Assessment of Reflective Measurement Models

Validity type	Criterion(s)	Accepted Values or Conditions	Related References
Uni-dimensionality	Exploratory factor analysis (EFA)	Measurement items should converge in the corresponding factor so that each item loads with a high coefficient on only one factor, and this factor is the same for all items that are supposed to measure it. The number of selected factors is determined by the number of factors with an Eigenvalue exceeding 1.0. An item loading is usually considered high if the loading coefficient is above .600 and considered low if the coefficient is below .400.	Gefen and Straub (2005), Gerbing and Anderson (1988)
Internal consistency reliability	Cronbach's alpha (CA)	Measures the degree to which the MVs load simultaneously when the LV increases. Alpha values range from 0 (completely unreliable) to 1 (perfectly reliable). Proposed threshold value for confirmative (explorative) research: CA > .800 or .900 (0.700). Values must not be lower than .600.	Cronbach (1951), Nunally and Bernstein (1994)
Internal consistency reliability	Composite reliability (CR)	Attempts to measure the sum of an LV's factor loadings relative to the sum of the factor loadings plus error variance. Leads to values	Werts et al.'s (1974), Nunally and Bernstein (1994)

		between 0 (completely unreliable) and 1 (perfectly reliable). Alternative to Cronbach's Alpha, allows indicators to not be equally weighted. Proposed threshold value for confirmative (explorative) research: CA > .800 or .900 (0.700). Values must not be lower than .600.	
Indicator reliability	Indicator loadings	Measures how much of the indicators' variance is explained by the corresponding LV. Values should be significant at the .050 level and higher than .700. For exploratory research designs, lower thresholds are acceptable. The significance can be tested using bootstrapping or jackknifing.	Chin (1998b)
Convergent validity	Average variance extracted (AVE)	Attempts to measure the amount of variance that an LV component captures from its indicators relative to the amount due to measurement error. Proposed threshold value: AVE > 0.500.	Fornell and Larcker (1981)
Discriminant validity	Cross-loadings	Cross-loadings are obtained by correlating the component scores of each latent variable with all other items. If the loading of each indicator is higher for its designated construct than for any of the other constructs, and each of the constructs loads highest with its own items, it can be inferred that the models' constructs differ sufficiently from one another.	Chin (1998b)
Discriminant validity	Fornell-Larcker criterion	Requires an LV to share more variance with its assigned indicators than with any other LV. Accordingly, the AVE of each LV should be greater than the LV's highest squared correlation with any other LV.	Fornell and Larcker (1981)

Ref: Reflective Measurement Models (Urbach & Ahlemann (2010, p.19)

7.3.1.2 ASSESSMENT OF THE FORMATIVE MEASUREMENT MODELS

The validation of formative measurement models requires a different approach than the one applied for reflective models, Urbach & Ahlemann's (2010, p.20) study emphasizes that "*Conventional validity assessments do not apply to formative measurement models, and the concepts of reliability and construct validity are not meaningful when employing such models (Bollen 1984; 1989). Whereas reliability becomes an irrelevant criterion for assessing formative measurement, the examination of validity becomes crucial (Diamantopoulos 2006). Accordingly, Henseler et al.'s (2009) suggest assessing the validity of formative constructs on two levels: the indicator and the construct levels*" (see Table-7.3.1.2). Therefore, reliability is irrelevant for the assessment of formative measurement models. However, the most important decision of accepting and discarding the indicators for validation depends on the researcher's decision after observing the significance of the indicators of the formative measurement model.

Urbach & Ahlemann's (2010, p.20) study emphasizes that "…*in reflective measurement models, a subsequent modification of formative measurement models only based on statistical outcomes is inadmissible. Discarding a formative model's item would omit a unique part of the composite latent construct and, thus, change the meaning of the variable (Jarvis et al.'s 2003). Accordingly, both significant and insignificant formative indicators should be kept in the measurement model as long as this is conceptually justified (Henseler et al.'s 2009)*".

Table-7.3.1.2: Assessment of Formative Measurement Models

Validity type	Criterion(s)	Accepted Values or Conditions	Related References
Indicator validity	Indicator weights	Significance at the .050 level suggests that an indicator is relevant for the construction of the formative index and, thus, demonstrates a sufficient level of validity. Some authors also recommend path coefficients greater than .100 or .200.	Chin (1998b), Lohmöller (1989)
Indicator validity	Variance inflation factor (VIF)	Indicates how much of an indicator's variance is explained by the other constructs' indicators and, thus, indicates how redundant the indicator's information is. Acceptable values are below 10.	Cassel and Hackl (2000), Diamantopoulos and Siguaw (2006), Fornell and Bookstein (1982), Gujarati (2003)
Construct validity	Nomological validity	This means that, within a set of hypotheses, the formative construct behaves as expected. Relationships between the formative construct and other models' constructs, which have been sufficiently referred to in prior literature, should be strong and significant.	Henseler et al.'s (2009), Peter (1981), Straub et al.'s (2004)
Construct validity	Inter-construct correlations	If the correlations between the formative and all the other constructs are less than .700, the constructs differ sufficiently from one another.	Mackenzie et al.'s (2005), Bruhn et al.'s (2008)

Ref: Formative Measurement Models (Urbach & Ahlemann (2010, p.19))

To summarize the assessment of the formative measurement model, various assessment criteria and assessment aspects of formative measurement models are listed in Table-7.3.1.2a.

Table-7.3.1.2a: Summary of Assessment Category for Formative Measurement model

Validity type	Assessment Aspect	Criterion(s)	Accepted Values	References
Indicator Validity	Multi-collinearity	VIF	VIF<10, OR VIF<3.3	Gujarati (2003) Diamantopoulos & Siguaw (2006)
	Indicator Weight	Path Coefficient (β) between the indicator & the LV	β > .100, or β >.200	Lohmoller (1989); Chin (1998); Andreev et al.'s (2009)
	Significance of Indicator weight	t-value	t-value> 0.050	Lohmoller (1989); Chin (1998); Urbach & Ahlemann (2010)
	External Validity	Path Coefficient (β) and t-value between the formative	Path Coefficient should be strong,	Andreev et al.'s (2009);

Construct Validity		construct and the reflective "Phantom" construct.	significant, and positive.	Urbach & Ahlemann (2010); Gotz et al.'s (2010)
	Nomological Validity	Path Coefficient (β) and t-value between the formative construct and the related construct (Antecedent or Consequence)	Path Coefficient should be strong, significant, & with a signed match hypothesized value	Straub et al.'s (2004); Henseler et al.'s (2009)

Ref: Formative Measurement Models (Urbach & Ahlemann (2010, p.19))

7.4 ASSESSMENT TO VALIDATE THE STRUCTURAL MODEL

The next step after validating the measurement models is to examine the structural model. There are two aspects to assessing the structural model of SEMs: Explanatory Power and Predictive Power. Explanatory Power is assessed against two criteria: Coefficient of determination (R2) and Effect size ($f2$). On the other hand, Predictive Power is assessed against three criteria: Path coefficient (β), Predictive Relevance (Q2), and Relative Impact (q2).

Table-7.4: Assessment of the Structural Model

Assessment Aspect for Structural Model	Criterion(s)	Accepted Values	References
Explanatory Power	Coefficient of determination (R2)	Values of approximately 0.670 are considered substantial, values of 0.333 are moderate, and values around 0.190 are weak.	Chin (1998)
	Effect Size ($f2$)	Values of 0.020, 0.150, and 0.350 indicate the predictor variable's low, medium, or large effect in the structural model.	Huber et al.'s (2007)
Predictive Power	Path Coefficient (β)	Path coefficients should exceed 0.100 to account for a certain impact within the model (e.g., Huber et al.'s 2007). Furthermore, path coefficients should be significant at least at the 0.050 level.	Krippendorff (2011), Cohen (1988); Chin (1998)
	Predictive relevance (Q2)	The proposed threshold value is Q2 > 0.	Stone (1974); Geisser (1975); Fornell & Cha (1994)
	Relative impact (q2)	Values of 0.02, 0.15, and 0.35 reveal a small, medium, or large predictive relevance of a certain latent variable.	Henseler et al.'s (2009)

Ref: Urbach & Ahlemann (2010, p.21)

Interpretations: To interpret the outcome of the model assessment for model validation, acceptable results are important for all relevant validation measurements. If this is the case, then the outcome of the parameters of LVs can be interpreted based on the grounded SEM level information availability. The researcher can translate the hypothesis into SEM by using PLS. This study can accept or reject hypotheses based on empirical analysis.

7.5 RESEARCH MODEL ASSESSMENT

7.5.1 THAI MODEL ASSESSMENT

Vanichchinchai & Igel's (2011) study introduces reliable and multiple sub-constructs (SCM practices, TQM practices, and Firm's supply performance) where SCMP sub-constructs are: Information management, Lean system, partnership management, and Strategy and organisation. The results indicate that higher levels of SCM practices can lead to enhanced competitive advantage which has a positive impact on FSP. The present body of knowledge give weightage to other factors that impact FSP, like geographical proximity, JIT / Lean capability (Tan et al.'s, 2002), cross-functional teams, logistics integration (Chen & Paulraj, 2004), agreement with vision and goals, and supply chain leadership (Min & Mentzer, 2004). Vanichchinchai & Igel's (2011) study discusses different aspects of supply chain operations, in terms of efficiency and responsiveness, concerning information management [Li S. et al. (2005); Balsmeier & Voisin (1996)], lean systems, partnership management [Chin et al.'s, 2004; Bagchi & Skjoett-Larsen, 2005], strategy and organisation [Ridwan & Marti, 2012; Steiner (1979)], FSP measures [in terms of cost, flexibility, relationship, and responsiveness]. (See Fig-7.5.1a). This study investigates the relationships among total quality management practices (TQMP), supply chain management practices (SCMP), and firm's supply performance (FSP) for the automotive industry's supply chains in Thailand. Vanichchinchai & Igel's (2011) study introduces measurement instruments for SCMP, TQMP and FSP are introduced based on an extensive literature review, experts' knowledge, pilot test and various statistical techniques to ensure reliability and validity in structural equation modeling (SEM) construct.

Vanichchinchai & Igel's (2011) study model indicates (Table-7.5.1a & b) that the TQMP not only had a significant direct positive impact on SCMP and on FSP but also had a significant indirect positive impact on FSP through SCMP. For empirical research, the hypothesized causal relationships among relevant model constructs can be generalized and become more predictable for decision-making. Moreover, hypothetically the TQM and SCM practices have a positive relationship with the SCQM environment and FSP. Thus, the TQM practices facilitate SCM practices implementation. Vanichchinchai & Igel's study reveals that the TQMP significantly and positively impacts FSP directly. The standardized estimate of their direct relationship is 0.51 with a t-value of 5.46. The TQMP moderately and positively impacts FSP indirectly as well. The standardized estimate of their indirect relationship is 0.34 with a t-value of 4.15. Moreover, the study also reveals that the TQMP significantly and positively impacts SCMP directly. The standardized estimate of their direct relationship is 0.79 with a t-value of 9.56.

And, the SCMP moderately and positively impacts FSP directly. The standardized estimate of their direct relationship is 0.42 with a t-value of 4.55. Comparatively, before extending the Thai model if it is tested in the Pakistani context, this study reveals that the TQMP moderately and positively impacts FSP directly. The standardized estimate of their direct relationship is 0.288 with a t-value of 4.128. The TQMP is low and positively impacts FSP indirectly as well. The standardized estimate of their indirect relationship is 0.021 with a t-value of 1.138. Moreover, the study also reveals that the TQMP moderately and positively impacts SCMP directly. The standardised estimate of their direct relationship is 0.212 with a t-value of 2.936. And, the SCMP low and positively impacts FSP directly. The standardised estimate of their direct relationship is 0.1 with a t-value of 1.276. According to Table-7.5.1c, this study shows higher test reliability acceptability scores for TQMP (0.99), SCMP (0.977), and FSP (0.943). With acceptability scores for TQMP (0.991), SCMP (0.979), and FSP (0.951) as a measure of internal consistency in the scale items (construct's reliability). This study also shows the amount of variance extracted by the construct (AVE) score for TQMP (0.884), SCMP (0.747), and FSP (0.581). Similarly, Table-7.5.1c shows moderately to high alpha, composite reliability, and AVE acceptability score of all the item measures of the constructs.

This study discusses the extended Thai model, where Table-7.5.2a shows results after introducing the SCQM and ANCT-INT concepts in the Thai model, and when the model is tested in the Pakistani context that shows higher test reliability acceptability scores for ANCT-INT (0.924) and SCQM (0.963). With acceptability scores for ANCT-INT (0.928) and SCQM (0.966) as a measure of internal consistency in the scale items (construct's reliability). This study also shows the amount of variance extracted by the construct (AVE) score for ANCT-INT (0.506) and SCQM (0.547). Similarly, Table-7.5.2a shows higher alpha, composite reliability, and AVE acceptability score of all the item measures of the constructs. Therefore, the analytical outcome of this study shows that the Pakistani context encouragingly supports the research instrument used in Vanichchinchai & Igel's study.

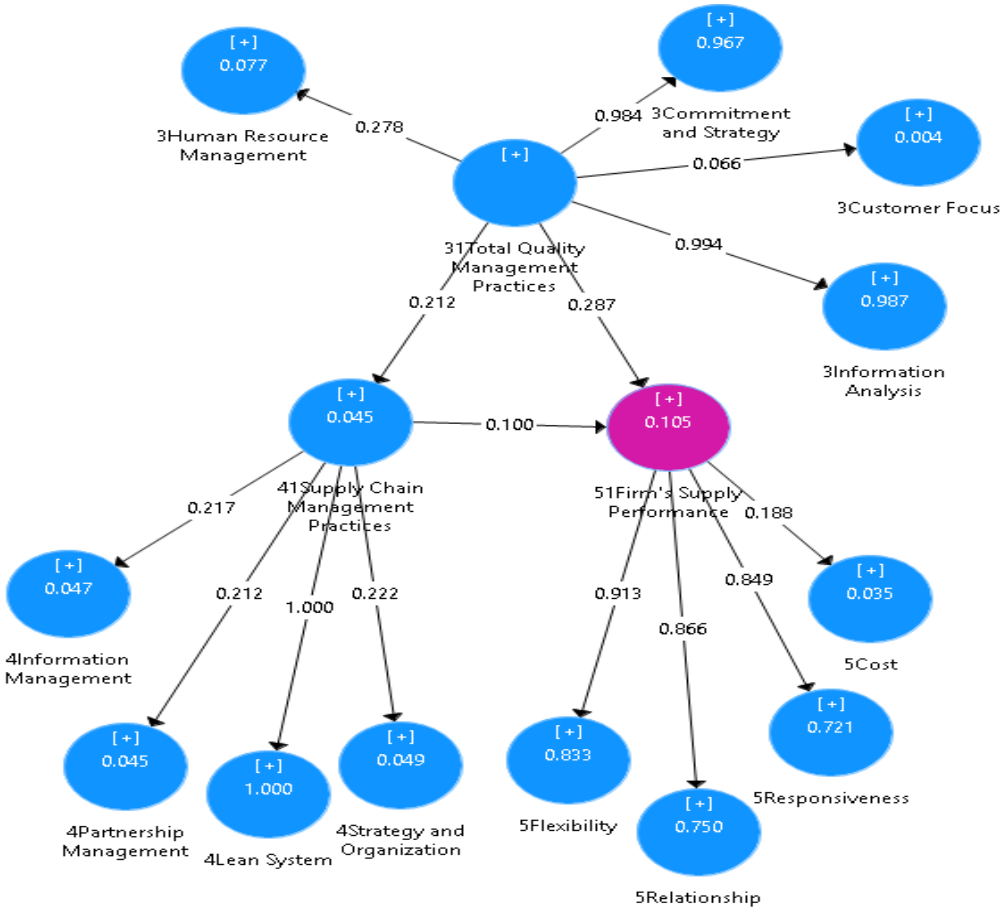


Fig-7.5.1a: Thai Model assessment

The direct and indirect effect of relationship (path coefficients) among constructs in the Thai model is mentioned in the referenced Table-7.5.1a.

TABLE-7.5.1a:	**THAI CONTEXT**			**PAKISTANI CONTEXT**		
Relationship among TQMP, SCMP, & FSP	**Total Effect**	**Direct Effect**	**Indirect Effect**	**Total Effect**	**Direct Effect**	**Indirect Effect**
TQMP ----> SCMP	**0.79 (9.56)**	**0.79 (9.56)**		**0.212 (2.936)**	**0.212 (2.936)**	
TQMP ----> FSP	**0.85 (11.98)**	**0.51 (5.46)**	**0.34 (4.15)**	**0.309 (4.784)**	**0.288 (4.128)**	**0.021(1.138)**
SCMP ----> FSP	**0.42 (4.55)**	**0.42 (4.55)**		**0.100 (1.276)**	**0.100 (1.276)**	

Note: Values in brackets ( ) are T-statistics values

Comparatively, the Pakistani context encouragingly supported the Thai model as per the values (AVE, some outer loadings, & t-statistics except path coefficients) mentioned in a referenced Table-7.5.1(b & c).

TABLE-7.5.1b: Relationship among TQMP, SCMP, & FSP	THAI CONTEXT		PAKISTANI CONTEXT	
	Path Coefficient	T-Statistics	Path Coefficient	T-Statistics
Total Quality Management Practices (TQMP) To SCMP	0.79	9.56	0.212	2.936
Commitment and Strategy	0.89	12.1	0.984	266.416
Customer Focus_	0.71	9.15	0.066	0.718
Human Resource Management	0.93	11.92	0.278	4.54
Information Analysis	0.93	14.52	0.994	687.038
Supply Chain Management Practices (SCMP) To FSP	0.42	4.55	0.100	1.276
Information Management	0.76	8.15	0.217	3.772
Lean System	0.92	8.42	1.000	22,914.15
Partnership Management	0.71	8.63	0.212	3.307
Strategy and Organisation	0.89	11.3	0.222	3.48
TQMP To Firm's Supply Performance (FSP)	0.51	5.46	0.287	4.128
Cost	0.54	11.15	0.188	2.591
Flexibility	0.69	7.65	0.913	70.285
Relationship	0.85	10.91	0.866	41.594
Responsiveness	0.82	12.07	0.849	39.116

TABLE-7.5.1c: THAI MODEL ASSESSMENT

	THAI CONTEXT			PAKISTANI CONTEXT		
Construct Reliability and Validity	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Total Quality Management Practices				0.99	0.991	0.884
Commitment and Strategy	0.853	0.85	0.58	0.982	0.987	0.948
Customer Focus_	0.823	0.83	0.62	0.823	0.863	0.678
Human Resource Management	0.898	0.9	0.57	0.92	0.934	0.671
Information Analysis	0.872	0.87	0.7	0.978	0.982	0.9
Supply Chain Management Practices				0.977	0.979	0.747
Information Management	0.757	0.78	0.42	0.923	0.938	0.684
Lean System	0.853	0.84	0.37	0.977	0.979	0.747
Partnership Management	0.754	0.77	0.36	0.929	0.943	0.703
Strategy and Organisation	0.871	0.87	0.54	0.923	0.937	0.683
Firm's Supply Performance				0.943	0.951	0.581
Cost	0.796	0.81	0.59	0.931	0.948	0.82

Flexibility	**0.8**	**0.8**	**0.58**	**0.943**	**0.957**	**0.817**
Relationship	**0.846**	**0.84**	**0.57**	**0.9**	**0.931**	**0.773**
Responsiveness	**0.851**	**0.87**	**0.69**	**0.878**	**0.911**	**0.671**

7.5.2 EXTENDED RESEARCH MODEL (strategic and operational initiative)

Kuei et al.'s (2001) and levy et al.'s (1995) discussed that total quality supply chain management and organisational performance issues can be addressed through supply chain quality management (SCQM). Carter & Narasimhan (1994), Pagell (2004), and Foster Jr. (2008) stated that Supply chain quality management (SCQM) is defined as a systems-based approach to performance improvement that leverages opportunities created by upstream and downstream linkages with suppliers and customers. Handfield et al.'s (1998) further suggested that the focus of supply chain quality should be to develop quality infrastructure and it consists of leadership and human resource development. The focus on supply chain quality in turn may lead to improved financial results and customer satisfaction. Kannan et al.'s (1998) identified three factors for supply chain quality: supplier evaluation, supplier involvement & decentralization of purchasing. Kuei & Madu's (2001) identifies the critical success factors: supplier relation, IT-driven change, and customer focus for Supply Chain Quality Management (SCQM). The study has developed a framework that guided the practitioners on how to use SCQM's critical success factors to build a competitive advantage. These critical factors could be used as the basis for developing strategic and operational initiatives. Kaynak & Hartley's (2008) study demonstrated that "leadership" is essential to navigating cultural, process-oriented, and human resource practices that differ for firms all along the supply chain. The "Extended LS system" model (Table-7.5.2a), emerged from the Initial Survey and consists of the SCQM-Imp, ANCT-INT, and FSP constructs. The "Extended LS system" model depicts the SCQM-Imp construct as a reflective one with 2 dimensions: TQMP and SCMP. Each of these dimensions is a reflective construct that consists of several indicators. The TQMP (6 dimensions with 32 items); SCMP (4 dimensions with 37 items); Anti-Counterfeiting Strategies Initiative construct (4 dimensions with 16 items); FSP constructs (5 dimensions with 22 items).

Table-7.5.2a: Statistical Summary (Reliability & Validity)

Construct Reliability and Validity	Originial Model (Pakistani Context)			Extended Effect (SCQM & ANCT-INT)		
	Cronbach 's Alpha	Composite Reliability	Average Variance Extracted (AVE)	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Anti-Counterfeiting Strategies Initiative				0.924	0.928	0.506
Supply Chain Quality Management				0.963	0.966	0.547
Total Quality Management Practices	0.99	0.991	0.884	0.990	0.991	0.884
Commitment and Strategy	0.982	0.987	0.948	0.982	0.987	0.948
Customer Focus	0.823	0.863	0.678	0.823	0.863	0.678
Human Resource Management	0.92	0.934	0.671	0.920	0.934	0.671
Information Analysis	0.978	0.982	0.900	0.978	0.982	0.900
Supplier Quality Management				0.970	0.976	0.831
Process Management				0.966	0.972	0.892
Supply Chain Management Practices	0.977	0.979	0.747	0.977	0.979	0.747
Information Management	0.923	0.938	0.684	0.923	0.938	0.684
Lean System	0.977	0.979	0.747	0.977	0.979	0.747
Partnership Management	0.929	0.943	0.703	0.929	0.943	0.703
Strategy and Organisation	0.923	0.937	0.683	0.923	0.937	0.683
Firm's Supply Performance	0.943	0.951	0.581	0.943	0.951	0.581
Cost	0.931	0.948	0.820	0.931	0.948	0.819
Flexibility	0.943	0.957	0.817	0.943	0.957	0.817
Relationship	0.9	0.931	0.773	0.900	0.931	0.863
Responsiveness	0.878	0.911	0.671	0.878	0.911	0.773
Occurrences of Product Counterfeiting				0.948	0.962	0.671

The purpose of this statistical analysis (Fig-7.5.2; Table-7.5.2 (a & b)) is to provide a comprehensive view of the completeness of the available measures, based on the literature review, attached with the latent variables so that further formative construct could be analysed and if possible added into the extended model. The objective of constructing the extended research model is to test the ANCT-INT within its nomological network. The confirmation of the hypothesized relationships in the research model among ANCT-INT, SCQM-Imp, and FSP constructs is important for the validation of the "Extended LS system" model.

Table-7.5.2b: Statistical Summary based on the Literature Review (Path Coefficients)

Relationship among TQMP, SCMP, & FSP	PAKISTANI CONTEXT		Extended Effect (SCQM & Thai model)	
	Path Coefficient	T-Statistics	Path Coefficient	T-Statistics
Anti-Counterfeiting Strategies Initiative To SCQM			0.058	2.370
Anti-Counterfeiting Strategies Initiative To TQMP			0.915	55.963
Supply Chain Quality Management To FSP			4.862	16.056
TQMP To SCQM			0.854	21.896
SCMP To SCQM			0.250	5.059
Total Quality Management Practices (TQMP) To SCMP	0.212	2.936	0.213	2.936
Commitment and Strategy	0.984	266.416	0.983	266.409
Customer Focus	0.066	0.718	0.066	0.718
Human Resource Management	0.278	4.54	0.278	4.540
Information Analysis	0.994	687.038	0.993	687.035
Supplier Quality Management			0.979	154.503
Process Management			0.267	4.067
Supply Chain Management Practices (SCMP) To FSP	0.100	1.276	-1.110	6.331
Information Management	0.217	3.772	0.047	3.796
Lean System	1.000	22,914.149	1.000	22,914.149
Partnership Management	0.212	3.307	0.212	3.307
Strategy and Organisation	0.222	3.48	0.222	3.480
TQMP To Firm's Supply Performance (FSP)	0.287	4.128	-4.124	6.977
Cost	0.188	2.591	0.188	2.591
Flexibility	0.913	70.285	0.911	70.279
Relationship	0.866	41.594	0.867	41.599
Responsiveness	0.849	39.116	0.851	39.122
Occurrences of Product Counterfeiting			-0.131	2.492

As described in the previous section, one of the important formative validation tests is the assessment of the formative variables of the ANCT-INT construct, focusing on the nomological aspects, by linking the ANCT-INT index to the hypothetically related constructs (i.e. Nomological Validity). It is suggested that Nomological Validity be tested as part of the assessment of the reflective formative validity of the "Extended LS system" model (Bagozzi, 1994; Diamantopoulos & Winklhofer, 2001; Jarvis et al.'s, 2003).

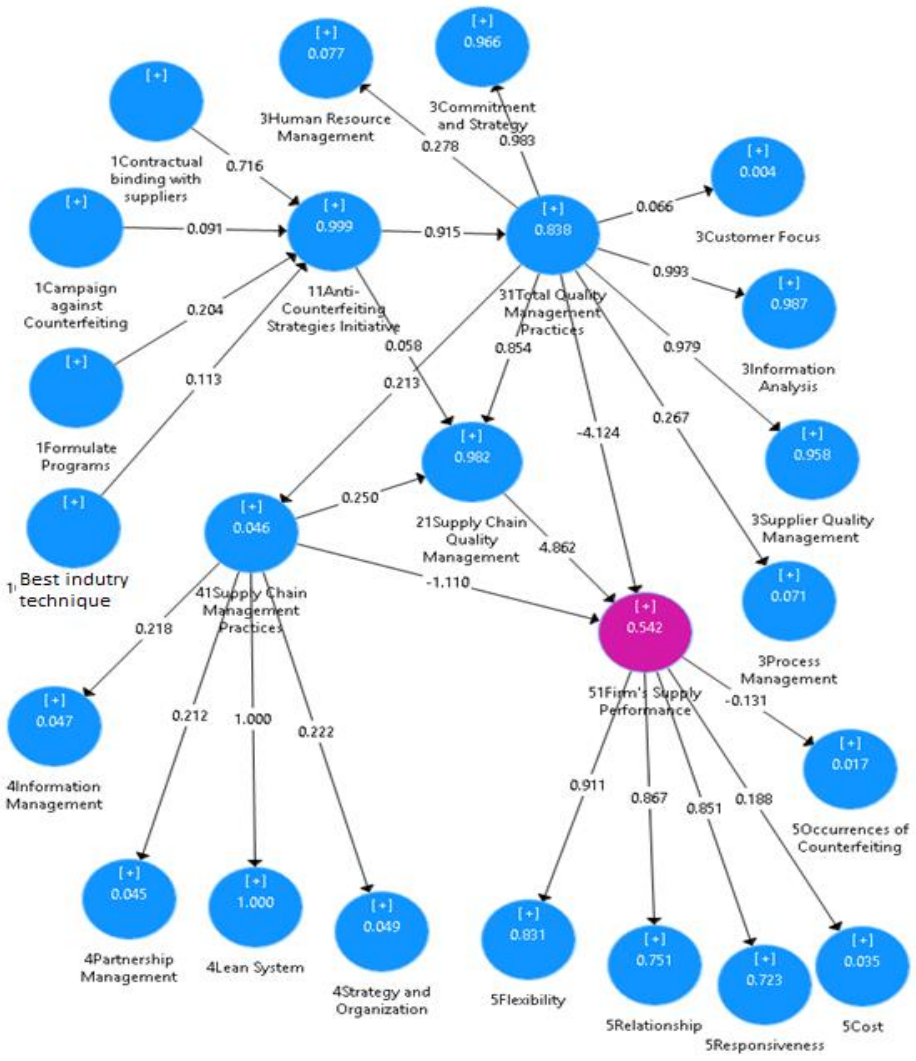


Fig-7.5.2: The complete Extended Model

7.5.2.1 ASSESSMENT OF REFLECTIVE MEASUREMENT MODELS

The research model entails four reflective measurement models which are SCQM, TQMP, SCMP, and FSP. However, the other formative measurement model: Anti-Counterfeiting Strategies Initiative (ANCT-INT) is also measured reflectively using several reflective indicators. These criterion measures are important for conducting one of the formative models' assessment aspects (i.e. External Validity) through a MIMIC model. FSP is conceptualized as a reflective construct with 5 reflective indicators: Quality (occurrences of counterfeiting phenomenon), Cost, Flexibility, Relationship, and Responsiveness. ANCT-INT items' measures construct is measured reflectively through four (4) reflective criterion measures ANCT-INT-1(6 items), ANCT-INT-2 (3 items), ANCT-INT-3 (2 items), and ANCT-INT-4 (5 items). Similarly, the "SCQM Impact" construct is measured reflectively through 2 reflective criterion measures TQMP and SCMP. Therefore, these three reflective measurement models

need to be assessed against the criteria for testing reflective measurement models. These aspects are Indicator Reliability, Internal Consistency Reliability, Convergent Validity, and Discriminant Validity. (see Table-7.5.2.1a).

INDICATORS' RELIABILITY

The first aspect of assessing reflective measurement models is checking the reflective indicators' reliability, which explains the degree of indicator's consistency regarding what they intend to measure. According to Chin (1998), indicator loadings should be significant at the 0.05 level and greater than 0.7 to confirm indicator reliability.

In PLS, (Efron & Tibshirani, 1993) the significance of the indicators' loading can be calculated using the Bootstrapping re-sampling technique. The indicators' loading and their significance are exhibited in the reflective indicators loading table for all the reflective measurement models. The loadings of all the reflective indicators are above the recommended threshold of 0.7. And, the square of each of the outer loadings is also higher than 0.7 for the referenced exploratory research to establish the status of indicators reliability according to the criteria in reference (Hulland, 1999). In addition, the significance of each indicator loading (t-value) on its respective LV is high and above the recommended threshold of 0.05 which confirms the indicators' reliability.

***Table-7.5.2.1a*: Summary for Reflective Outer Model**

Reflective Costructs	Dimensions	Indicators	Mean	S.D	Load -ings	T-Statistics	Cronbach 's Alpha	Composite Reliability	Average Variance Extracted (AVE)
ANCT-INT	Anti-Counterfeiting Strategies Initiative		0.924	0.009	0.711	308.173	**0.924**	**0.928**	**0.506**
SCQM	Supply Chain Quality Management		0.949	0.004	0.739	224.506	0.963	0.966	0.547
TQMP	Total Quality Management Practices		0.949	0.005	0.940	438.482	0.990	0.991	0.884
	Human Resource Management						**0.920**	**0.934**	**0.671**
		TQMPHRM1	0.82	0.05	0.814	16.500			
		TQMPHRM2	0.83	0.05	0.819	16.878			
		TQMPHRM3	0.82	0.05	0.807	16.097			
		TQMPHRM4	0.83	0.03	0.832	28.382			
		TQMPHRM5	0.83	0.03	0.825	27.828			
		TQMPHRM6	0.80	0.04	0.819	22.119			
		TQMPHRM7	0.80	0.04	0.816	21.046			
	Commitment & Strategy						**0.982**	**0.987**	**0.948**
		TQMPCS1	0.99	0.00	0.989	283.817			
		TQMPCS2	0.99	0.00	0.986	221.146			

		TQMPCS3	0.97	0.01	0.974	134.129			
		TQMPCS4	0.94	0.02	0.946	48.263			
	Customer Focus						**0.823**	**0.863**	**0.678**
		TQMPCF1	0.66	0.50	0.790	1.719			
		TQMPCF2	0.66	0.50	0.787	1.717			
		TQMPCF3	0.70	0.30	0.889	2.724			
	Information Analysis						0.978	0.982	0.900
		TQMPIA1	0.95	0.01	0.949	91.206			
		TQMPIA2	0.94	0.02	0.939	51.966			
		TQMPIA3	0.94	0.01	0.940	69.307			
		TQMPIA4	0.96	0.01	0.958	99.598			
		TQMPIA5	0.96	0.01	0.963	128.336			
		TQMPIA6	0.94	0.02	0.942	61.998			
	Supplier Quality Management						0.970	0.976	0.831
		TQMPSQM1	0.96	0.01	0.962	102.334			
		TQMPSQM2	0.97	0.01	0.972	161.087			
		TQMPSQM3	0.93	0.02	0.935	46.782			
		TQMPSQM4	0.94	0.01	0.943	69.198			
		TQMPSQM5	0.91	0.02	0.909	48.768			
	Process Management						0.966	0.972	0.892
		TQMPRM1	0.94	0.01	0.944	68.579			
		TQMPRM2	0.91	0.02	0.912	53.985			
		TQMPRM3	0.92	0.02	0.926	61.385			
		TQMPRM4	0.90	0.02	0.898	40.632			
		TQMPRM5	0.93	0.02	0.928	51.722			
		TQMPRM6	0.90	0.02	0.897	41.942			
		TQMPRM7	0.87	0.03	0.874	28.395			
SCMP	Supply Chain Management SCMP		0.948	0.005	0.864	473.319	**0.977**	**0.979**	**0.747**
	Strategy & Organisation						**0.923**	**0.937**	**0.683**
		SCMPSO1	0.80	0.03	0.758	30.886			
		SCMPSO2	0.82	0.03	0.770	32.149			
		SCMPSO3	0.90	0.01	0.926	93.032			
		SCMPSO4	0.89	0.01	0.916	60.080			
		SCMPSO5	0.83	0.02	0.855	48.686			
		SCMPSO6	0.80	0.03	0.802	26.221			
		SCMPSO7	0.74	0.03	0.735	26.643			
	Lean Systems						**0.977**	**0.979**	**0.747**
		SCMPLS!	0.82	0.03	0.826	25.007			
		SCMPLS2	0.87	0.02	0.873	37.762			
		SCMPLS3	0.86	0.03	0.863	32.930			

		SCMPLS4	0.85	0.03	0.853	29.906			
		SCMPLS5	0.83	0.03	0.831	33.133			
		SCMPLS6	0.80	0.03	0.809	23.148			
		SCMPLS7	0.85	0.02	0.853	44.831			
		SCMPLS8	0.88	0.02	0.877	44.599			
		SCMPLS9	0.94	0.01	0.934	83.661			
		SCMPLS!0	0.82	0.04	0.821	20.927			
		SCMPLS!1	0.86	0.03	0.860	32.250			
		SCMPLS!2	0.88	0.03	0.898	30.563			
		SCMPLS!3	0.88	0.03	0.882	34.501			
		SCMPLS!4	0.88	0.03	0.874	29.859			
		SCMPLS!5	0.90	0.02	0.895	39.581			
		SCMPLS!6	0.89	0.02	0.891	38.530			
	Partnership Management						**0.929**	**0.943**	**0.703**
		SCMPPM1	0.87	0.02	0.873	34.784			
		SCMPPM2	0.87	0.03	0.873	33.981			
		SCMPPM3	0.83	0.03	0.841	28.631			
		SCMPPM4	0.87	0.02	0.865	54.179			
		SCMPPM5	0.81	0.04	0.815	20.839			
		SCMPPM6	0.76	0.03	0.742	27.395			
		SCMPPM7	0.85	0.03	0.855	26.786			
	Information Management						**0.923**	**0.938**	**0.684**
		SCMPIM1	0.76	0.03	0.785	25.519			
		SCMPIM2	0.75	0.03	0.776	25.302			
		SCMPIM3	0.84	0.02	0.857	53.915			
		SCMPIM4	0.75	0.03	0.757	23.974			
		SCMPIM5	0.90	0.02	0.873	54.143			
		SCMPIM6	0.89	0.02	0.862	47.130			
		SCMPIM7	0.90	0.02	0.870	53.026			
FSP		FSP	0.887	0.011	0.762	380.214	**0.943**	**0.951**	**0.581**
	Cost						**0.931**	**0.931**	**0.948**
		FSPBPCACT1	3.86	0.69	0.884	20.543			
		FSPBPCACT2	3.87	0.69	0.832	15.829			
		FSPBPCACT3	3.80	0.73	0.959	73.752			
		FSPBPCACT4	3.80	0.71	0.940	49.674			
	Flexibility						**0.943**	**0.957**	**0.817**
		FSPBPCAFL1	4.12	0.44	0.930	50.133			
		FSPBPCAFL2	4.14	0.44	0.930	56.92			
		FSPBPCAFL3	4.19	0.43	0.836	23.487			
		FSPBPCAFL4	4.16	0.43	0.926	38.845			

		FSPBPCAFL5	4.13	0.45	0.894	33.622			
	Relationship						0.9	0,828	0.773
		FSPBPCARL1	4.22	0.54	0.834	24.286			
		FSPBPCARL2	4.17	0.51	0.939	77.572			
		FSPBPCARL3	4.26	0.51	0.788	20.109			
		FSPBPCARL4	4.18	0.51	0.945	84.924			
	Responsiveness						**0.878**	**0.911**	**0.773**
		FSPBPCARS1	4.18	0.58	0.859	36.995			
		FSPBPCARS2	4.18	0.52	0.809	28.292			
		FSPBPCARS3	4.18	0.55	0.803	25.953			
		FSPBPCARS4	4.21	0.57	0.835	32.042			
		FSPBPCARS5	4.23	0.51	0.789	25.579			
	Occurrences of Counterfeiting						**0.948**	**0.962**	**0.671**
		FSPBPCAQL1	4.04	0.63	0.944	2.700			
		FSPBPCAQL2	4.00	0.63	0.963	2.836			
		FSPBPCAQL3	4.01	0.63	0.959	2.838			
		FSPBPCAQL4	4.02	0.64	0.844	2.782			

INTERNAL CONSISTENCY RELIABILITY

Internal Consistency Reliability is traditionally measured by Cronbach's alpha (CA) and composite reliability (CR). According to Nunnally & Bernstein (1994), CA and CR values above 0.7 are adequate for exploratory research, and values above 0.8 are desirable for confirmatory research. However, values below 0.6 indicated a lack of Internal Consistency Reliability (Nunnally & Bernstein, 1994). The table illustrated the values of Cronbach's alpha and Composite Reliability for the reflective measurement models in the research model. The table described the SCQM, TQMP, SCMP, and FSP have Cronbach's alpha (CA) and composite reliability (CR) scores which are well above the recommended threshold of 0.70. "Anti-Counterfeiting Strategies Initiative" (ANCT-INT) has a CA score quite higher than the recommended value of 0.70. In addition, the CR value for ANCT-INT is well above the recommended value of 0.70. The scores of the CA and CR for the reflective constructs confirm the internal consistency for all reflective constructs in the research model. (see Table-7.5.2.1b))

CONVERGENT VALIDITY

Convergent Validity referred to the degree to which indicators reflected a construct convergence in comparison to items measuring other constructs (Urbach & Ahlemann, 2010). Convergent Validity is assessed by a measure called Average Variance Extracted (AVE), introduced by Fornell & Larcker (1981). The AVE values for a construct should be above 0.5 to demonstrate the acceptable degree of convergent validity. The table illustrated the AVE values for the reflective measurement models. This shows that these reflective measurement models demonstrate convergent validity. (see Fig-7.5.2.1(a to c))).

Table-7.5.2.1b: Constructs for Reflective Measurement Model	Extended Model			
	Indicators	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Anti-Counterfeiting Strategies Initiative	ANCT-INT	0.924	0.928	0.506
Supply Chain Quality Management	SCQM	0.963	0.966	0.547
Total Quality Management Practices	TQMP	0.990	0.991	0.884
Commitment and Strategy	TQMPCS	0.982	0.987	0.948
Customer Focus	TQMPCF	0.823	0.863	0.678
Human Resource Management	TQMPHRM	0.920	0.934	0.671
Information Analysis	TQMPIA	0.978	0.982	0.900
Supplier Quality Management	TQMPSQM	0.970	0.976	0.831
Process Management	TQMPPM	0.966	0.972	0.892
Supply Chain Management Practices	SCMP	0.977	0.979	0.747
Information Management	SCMPIM	0.923	0.938	0.684
Lean System	SCMLS	0.977	0.979	0.747
Partnership Management	SCMPPM	0.929	0.943	0.703
Strategy and Organisation	SCMPSO	0.923	0.937	0.683
Firm's Supply Performance	FSP	0.943	0.951	0.581
Cost	FSPBPCACT	0.931	0.948	0.819
Flexibility	FSPBPCAFL	0.943	0.957	0.817
Relationship	FSPBPCARL	0.900	0.931	0.863
Responsiveness	FSPBPCARP	0.878	0.911	0.773
Occurrences of Product Counterfeiting	FSPBPCAQL	0.948	0.962	0.671

Fig-7.5.2.1a: Cronbach's Alpha

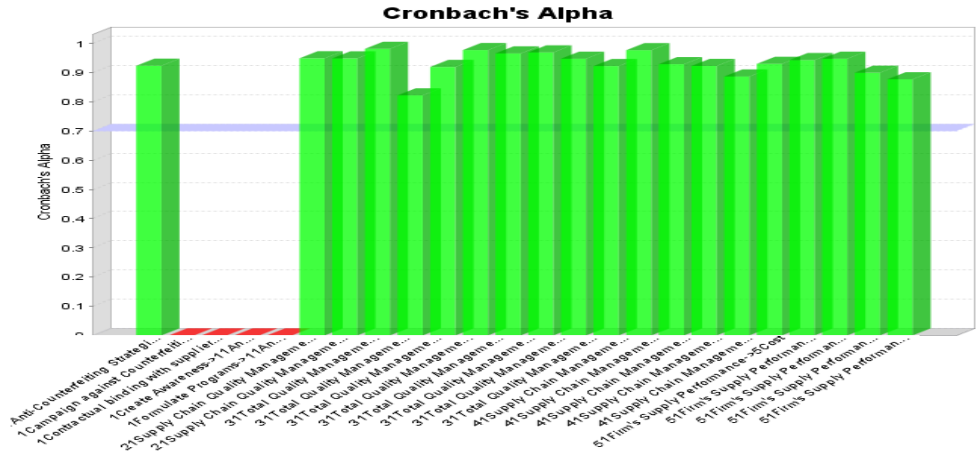


Fig-7.5.2.1b: Composit reliability

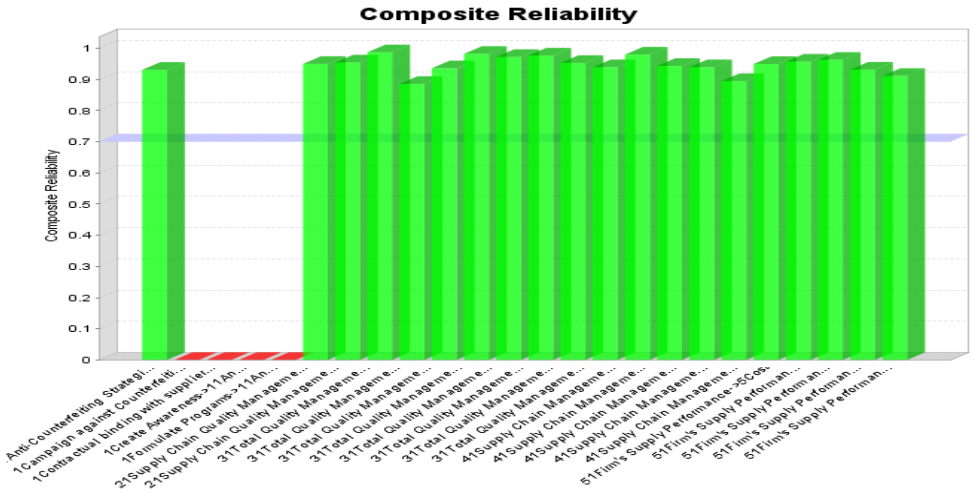
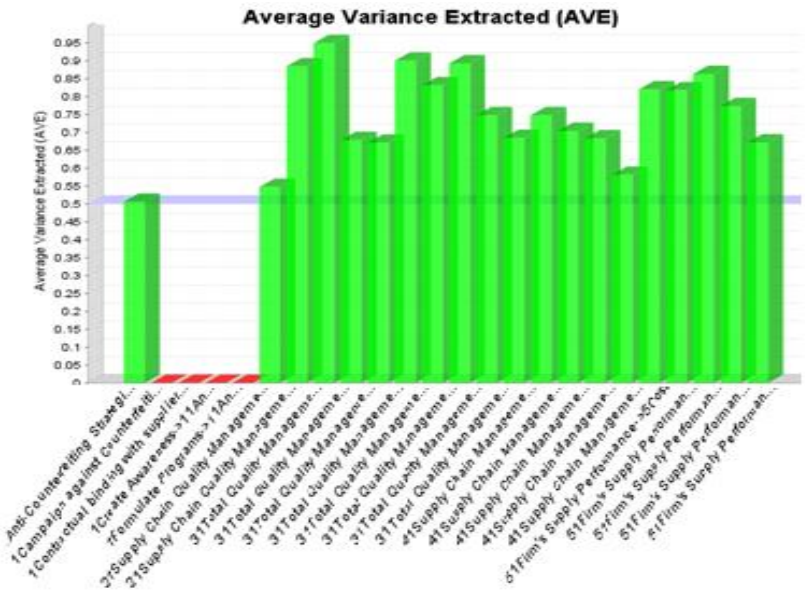


Fig-7.5.2.1c: Avarage Variance Extracted (AVE)



DISCRIMINANT VALIDITY

Discriminant Validity checks whether an indicator of a certain construct is also measuring another construct. Discriminant Validity evaluated the degree to which the indicators of different constructs (LVs) are also different from each other (Urbach & Ahlemann, 2010). In the PLS approach, discriminant validity can be evaluated by two criteria: cross-loadings criteria and Fornell & Larcker criteria (Fornell & Larcker, 1981).

The Cross Loading: Discriminant Validity (Table-7.5.2.1c) of the reflective measurement models can be assessed by comparing the factor loadings and cross-loadings of all the indicators to their respective LVs. To obtain cross-loadings, the score of each construct is correlated with all other indicators (Chin, 1998). Discriminant validity can be inferred when an indicator's loading is higher for the construct, they measure than for any other construct, and each construct loads highest with its assigned indicator. The table showed the factor loading and cross-loading of the reflective measurement models in the research model of this study. The table showed that all reflective indicators loaded highly on their respective LVs, more than other LVs. This indicated that the reflective measurement models are demonstrating discriminant validity.

Table-7.5.2.1c Reflective Indicators (Cross Loadings)	Customer Focus	Commitment and Strategy	Human Resource Management	Information Analysis	Process Management	Supplier Quality Management	Information Management	Lean System	Partnership Management	Strategy and Organisation	Cost	Flexibility	Occurrences of Counterfeiting	Reliability	Responsiveness
TQMPCF1	**0.790**	0.031	0.127	0.012	0.061	0.025	-0.003	0.006	-0.017	0.048	0.076	0.004	-0.011	0.050	0.036
TQMPCF2	**0.787**	0.042	0.106	0.023	0.076	0.043	-0.012	0.006	-0.034	0.037	0.071	-0.005	0.000	0.037	0.031
TQMPCF3	**0.889**	0.060	0.170	0.084	0.061	0.073	-0.073	-0.017	-0.017	0.014	0.069	-0.039	0.032	-0.070	-0.055
TQMPCS1	0.069	**0.989**	0.251	0.965	0.257	0.920	0.172	0.206	0.046	0.435	0.345	0.302	-0.098	0.161	0.334
TQMPCS1	0.069	**0.989**	0.251	0.965	0.257	0.920	0.172	0.206	0.046	0.435	0.345	0.302	-0.098	0.161	0.334
TQMPCS1	0.069	**0.989**	0.251	0.965	0.257	0.920	0.172	0.206	0.046	0.435	0.345	0.302	-0.098	0.161	0.334
TQMPCS2	0.063	**0.986**	0.246	0.961	0.252	0.918	0.165	0.195	0.031	0.433	0.351	0.298	-0.111	0.162	0.332
TQMPCS2	0.063	**0.986**	0.246	0.961	0.252	0.918	0.165	0.195	0.031	0.433	0.351	0.298	-0.111	0.162	0.332
TQMPCS2	0.063	**0.986**	0.246	0.961	0.252	0.918	0.165	0.195	0.031	0.433	0.351	0.298	-0.111	0.162	0.332
TQMPCS3	0.048	**0.974**	0.260	0.965	0.264	0.942	0.185	0.198	0.052	0.450	0.367	0.301	-0.096	0.148	0.331
TQMPCS3	0.048	**0.974**	0.260	0.965	0.264	0.942	0.185	0.198	0.052	0.450	0.367	0.301	-0.096	0.148	0.331
TQMPCS3	0.048	**0.974**	0.260	0.965	0.264	0.942	0.185	0.198	0.052	0.450	0.367	0.301	-0.096	0.148	0.331
TQMPCS4	0.054	**0.945**	0.263	0.906	0.239	0.859	0.113	0.184	0.018	0.387	0.302	0.298	-0.123	0.163	0.356
TQMPCS4	0.054	**0.945**	0.263	0.906	0.239	0.859	0.113	0.184	0.018	0.387	0.302	0.298	-0.123	0.163	0.356
TQMPCS4	0.054	**0.945**	0.263	0.906	0.239	0.859	0.113	0.184	0.018	0.387	0.302	0.298	-0.123	0.163	0.356
TQMPHRM1	0.158	0.174	**0.814**	0.176	0.138	0.187	0.079	-0.006	-0.043	0.344	0.177	0.228	-0.119	0.295	0.207
TQMPHRM2	0.161	0.171	**0.819**	0.175	0.150	0.189	0.090	-0.002	-0.030	0.355	0.173	0.238	-0.109	0.294	0.201
TQMPHRM3	0.164	0.196	**0.807**	0.187	0.153	0.198	0.107	0.017	-0.022	0.364	0.180	0.254	-0.109	0.293	0.202
TQMPHRM4	0.163	0.230	**0.832**	0.251	0.287	0.254	0.011	0.021	0.023	0.385	0.259	0.347	-0.068	0.269	0.177
TQMPHRM5	0.153	0.216	**0.825**	0.223	0.268	0.233	0.006	0.027	0.012	0.337	0.231	0.297	-0.096	0.258	0.197

TQMPHRM6	0.107	0.255	**0.819**	0.266	0.101	0.285	-0.006	0.065	0.097	0.528	0.253	0.526	-0.074	0.444	0.434
TQMPHRM7	0.105	0.229	**0.816**	0.239	0.103	0.266	-0.017	0.043	0.092	0.504	0.226	0.496	-0.072	0.419	0.415
TQMPIA1	0.088	0.905	0.259	**0.949**	0.239	0.872	0.113	0.199	0.050	0.402	0.335	0.280	-0.079	0.129	0.294
TQMPIA1	0.088	0.905	0.259	**0.949**	0.239	0.872	0.113	0.199	0.050	0.402	0.335	0.280	-0.079	0.129	0.294
TQMPIA1	0.088	0.905	0.259	**0.949**	0.239	0.872	0.113	0.199	0.050	0.402	0.335	0.280	-0.079	0.129	0.294
TQMPIA2	0.048	0.877	0.261	**0.939**	0.260	0.898	0.115	0.180	0.042	0.395	0.316	0.248	-0.123	0.154	0.335
TQMPIA2	0.048	0.877	0.261	**0.939**	0.260	0.898	0.115	0.180	0.042	0.395	0.316	0.248	-0.123	0.154	0.335
TQMPIA2	0.048	0.877	0.261	**0.939**	0.260	0.898	0.115	0.180	0.042	0.395	0.316	0.248	-0.123	0.154	0.335
TQMPIA3	0.067	0.888	0.258	**0.940**	0.266	0.883	0.150	0.197	0.074	0.430	0.336	0.282	-0.091	0.178	0.328
TQMPIA3	0.067	0.888	0.258	**0.940**	0.266	0.883	0.150	0.197	0.074	0.430	0.336	0.282	-0.091	0.178	0.328
TQMPIA3	0.067	0.888	0.258	**0.940**	0.266	0.883	0.150	0.197	0.074	0.430	0.336	0.282	-0.091	0.178	0.328
TQMPIA4	0.040	0.969	0.247	**0.958**	0.258	0.919	0.152	0.206	0.036	0.424	0.356	0.281	-0.114	0.167	0.327
TQMPIA4	0.040	0.969	0.247	**0.958**	0.258	0.919	0.152	0.206	0.036	0.424	0.356	0.281	-0.114	0.167	0.327
TQMPIA4	0.040	0.969	0.247	**0.958**	0.258	0.919	0.152	0.206	0.036	0.424	0.356	0.281	-0.114	0.167	0.327
TQMPIA5	0.062	0.975	0.256	**0.963**	0.255	0.932	0.191	0.198	0.057	0.449	0.352	0.306	-0.086	0.148	0.330
TQMPIA5	0.062	0.975	0.256	**0.963**	0.255	0.932	0.191	0.198	0.057	0.449	0.352	0.306	-0.086	0.148	0.330
TQMPIA5	0.062	0.975	0.256	**0.963**	0.255	0.932	0.191	0.198	0.057	0.449	0.352	0.306	-0.086	0.148	0.330
TQMPIA6	0.071	0.932	0.261	**0.942**	0.233	0.939	0.135	0.233	0.021	0.430	0.340	0.241	-0.112	0.177	0.337
TQMPIA6	0.071	0.932	0.261	**0.942**	0.233	0.939	0.135	0.233	0.021	0.430	0.340	0.241	-0.112	0.177	0.337
TQMPIA6	0.071	0.932	0.261	**0.942**	0.233	0.939	0.135	0.233	0.021	0.430	0.340	0.241	-0.112	0.177	0.337
TQMPRM1	0.074	0.259	0.187	0.252	**0.944**	0.259	-0.107	0.008	-0.190	0.099	0.093	0.048	0.071	0.111	0.018
TQMPRM2	0.096	0.246	0.201	0.236	**0.912**	0.217	-0.101	-0.001	-0.204	0.103	0.094	0.045	0.095	0.075	0.006
TQMPRM3	0.102	0.271	0.195	0.261	**0.926**	0.255	-0.101	-0.007	-0.182	0.090	0.113	0.031	0.128	0.045	-0.015
TQMPRM4	0.033	0.259	0.159	0.270	**0.898**	0.249	-0.149	-0.037	-0.182	0.045	0.084	0.039	0.096	0.051	-0.019
TQMPRM5	0.065	0.208	0.212	0.239	**0.928**	0.235	-0.203	-0.005	-0.191	0.090	0.112	0.050	0.131	0.100	0.012
TQMPRM6	0.076	0.231	0.202	0.235	**0.897**	0.267	-0.195	0.019	-0.230	0.088	0.089	0.047	0.110	0.122	0.034
TQMPRM7	0.038	0.160	0.189	0.182	**0.874**	0.179	-0.236	-0.034	-0.188	0.027	0.082	0.003	0.073	0.082	0.006
TQMSQM1	0.080	0.904	0.295	0.921	0.264	**0.962**	0.137	0.200	0.025	0.414	0.373	0.206	-0.109	0.160	0.310
TQMSQM1	0.080	0.904	0.295	0.921	0.264	**0.962**	0.137	0.200	0.025	0.414	0.373	0.206	-0.109	0.160	0.310
TQMSQM1	0.080	0.904	0.295	0.921	0.264	**0.962**	0.137	0.200	0.025	0.414	0.373	0.206	-0.109	0.160	0.310
TQMSQM2	0.069	0.930	0.282	0.941	0.269	**0.972**	0.139	0.199	0.030	0.427	0.354	0.231	-0.109	0.160	0.320
TQMSQM2	0.069	0.930	0.282	0.941	0.269	**0.972**	0.139	0.199	0.030	0.427	0.354	0.231	-0.109	0.160	0.320
TQMSQM2	0.069	0.930	0.282	0.941	0.269	**0.972**	0.139	0.199	0.030	0.427	0.354	0.231	-0.109	0.160	0.320
TQMSQM3	0.077	0.962	0.260	0.955	0.250	**0.935**	0.170	0.191	0.039	0.439	0.347	0.292	-0.082	0.144	0.335
TQMSQM3	0.077	0.962	0.260	0.955	0.250	**0.935**	0.170	0.191	0.039	0.439	0.347	0.292	-0.082	0.144	0.335
TQMSQM3	0.077	0.962	0.260	0.955	0.250	**0.935**	0.170	0.191	0.039	0.439	0.347	0.292	-0.082	0.144	0.335
TQMSQM4	0.057	0.818	0.263	0.862	0.265	**0.943**	0.116	0.184	0.038	0.396	0.280	0.210	-0.094	0.186	0.330
TQMSQM4	0.057	0.818	0.263	0.862	0.265	**0.943**	0.116	0.184	0.038	0.396	0.280	0.210	-0.094	0.186	0.330
TQMSQM4	0.057	0.818	0.263	0.862	0.265	**0.943**	0.116	0.184	0.038	0.396	0.280	0.210	-0.094	0.186	0.330
TQMSQM5	0.032	0.786	0.257	0.828	0.190	**0.909**	0.136	0.210	0.085	0.389	0.271	0.199	-0.122	0.168	0.312
TQMSQM5	0.032	0.786	0.257	0.828	0.190	**0.909**	0.136	0.210	0.085	0.389	0.271	0.199	-0.122	0.168	0.312
SCMPIM1	0.034	0.221	0.039	0.211	-0.085	0.192	**0.785**	0.169	0.309	0.377	0.160	0.248	-0.168	0.199	0.361
SCMPIM2	0.035	0.227	0.032	0.209	-0.107	0.200	**0.776**	0.177	0.285	0.363	0.136	0.240	-0.163	0.189	0.376
SCMPIM3	-0.022	0.219	0.105	0.219	-0.055	0.205	**0.857**	0.233	0.406	0.459	0.168	0.302	-0.288	0.345	0.375
SCMPIM4	-0.121	0.136	0.061	0.126	-0.056	0.134	**0.757**	0.182	0.389	0.295	0.079	0.202	-0.232	0.148	0.248

SCMPIM5	-0.080	0.033	-0.017	0.017	-0.231	0.018	**0.873**	0.159	0.625	0.196	-0.024	0.139	-0.292	0.133	0.172
SCMPIM6	-0.079	0.015	-0.018	0.004	-0.249	0.017	**0.862**	0.140	0.609	0.187	-0.031	0.125	-0.297	0.123	0.174
SCMPIM7	-0.095	0.020	-0.024	0.006	-0.248	0.019	**0.870**	0.151	0.616	0.191	-0.026	0.122	-0.308	0.131	0.168
SCMPLS1	-0.034	0.177	0.053	0.182	-0.015	0.157	0.087	**0.826**	0.089	0.161	0.103	0.077	-0.094	0.132	0.107
SCMPLS1	-0.034	0.177	0.053	0.182	-0.015	0.157	0.087	**0.826**	0.089	0.161	0.103	0.077	-0.094	0.132	0.107
SCMPLS10	-0.033	0.101	0.047	0.114	0.025	0.121	0.132	**0.873**	0.110	0.194	0.026	0.126	-0.161	0.151	0.138
SCMPLS10	-0.033	0.101	0.047	0.114	0.025	0.121	0.132	**0.873**	0.110	0.194	0.026	0.126	-0.161	0.151	0.138
SCMPLS11	-0.023	0.121	0.037	0.115	0.017	0.093	0.104	**0.863**	0.093	0.165	0.016	0.126	-0.159	0.149	0.138
SCMPLS11	-0.023	0.121	0.037	0.115	0.017	0.093	0.104	**0.863**	0.093	0.165	0.016	0.126	-0.159	0.149	0.138
SCMPLS12	-0.040	0.111	0.020	0.107	-0.009	0.086	0.079	**0.853**	0.075	0.142	0.020	0.114	-0.172	0.154	0.155
SCMPLS12	-0.040	0.111	0.020	0.107	-0.009	0.086	0.079	**0.853**	0.075	0.142	0.020	0.114	-0.172	0.154	0.155
SCMPLS13	-0.061	0.106	0.030	0.130	-0.018	0.128	0.233	**0.831**	0.332	0.190	0.057	0.099	-0.121	0.100	0.062
SCMPLS13	-0.061	0.106	0.030	0.130	-0.018	0.128	0.233	**0.831**	0.332	0.190	0.057	0.099	-0.121	0.100	0.062
SCMPLS14	-0.015	0.126	0.057	0.125	-0.080	0.105	0.112	**0.809**	0.100	0.131	0.044	0.090	-0.153	0.121	0.161
SCMPLS14	-0.015	0.126	0.057	0.125	-0.080	0.105	0.112	**0.809**	0.100	0.131	0.044	0.090	-0.153	0.121	0.161
SCMPLS15	-0.004	0.217	0.051	0.229	-0.021	0.212	0.239	**0.853**	0.252	0.270	0.136	0.132	-0.242	0.145	0.183
SCMPLS15	-0.004	0.217	0.051	0.229	-0.021	0.212	0.239	**0.853**	0.252	0.270	0.136	0.132	-0.242	0.145	0.183
SCMPLS15	-0.004	0.217	0.051	0.229	-0.021	0.212	0.239	**0.853**	0.252	0.270	0.136	0.132	-0.242	0.145	0.183
SCMPLS16	-0.008	0.201	0.046	0.227	0.031	0.239	0.213	**0.877**	0.239	0.257	0.054	0.116	-0.197	0.161	0.171
SCMPLS16	-0.008	0.201	0.046	0.227	0.031	0.239	0.213	**0.877**	0.239	0.257	0.054	0.116	-0.197	0.161	0.171
SCMPLS16	-0.008	0.201	0.046	0.227	0.031	0.239	0.213	**0.877**	0.239	0.257	0.054	0.116	-0.197	0.161	0.171
SCMPLS2	0.043	0.208	0.062	0.215	-0.021	0.205	0.242	**0.934**	0.210	0.196	0.042	0.115	-0.189	0.119	0.134
SCMPLS2	0.043	0.208	0.062	0.215	-0.021	0.205	0.242	**0.934**	0.210	0.196	0.042	0.115	-0.189	0.119	0.134
SCMPLS2	0.043	0.208	0.062	0.215	-0.021	0.205	0.242	**0.934**	0.210	0.196	0.042	0.115	-0.189	0.119	0.134
SCMPLS3	-0.008	0.201	-0.010	0.210	0.067	0.207	0.235	**0.821**	0.189	0.225	-0.021	0.092	-0.191	0.139	0.129
SCMPLS3	-0.008	0.201	-0.010	0.210	0.067	0.207	0.235	**0.821**	0.189	0.225	-0.021	0.092	-0.191	0.139	0.129
SCMPLS3	-0.008	0.201	-0.010	0.210	0.067	0.207	0.235	**0.821**	0.189	0.225	-0.021	0.092	-0.191	0.139	0.129
SCMPLS4	-0.010	0.144	0.057	0.159	0.005	0.156	0.229	**0.860**	0.209	0.190	-0.012	0.101	-0.200	0.144	0.118
SCMPLS4	-0.010	0.144	0.057	0.159	0.005	0.156	0.229	**0.860**	0.209	0.190	-0.012	0.101	-0.200	0.144	0.118
SCMPLS5	0.022	0.202	0.002	0.215	-0.022	0.227	0.198	**0.878**	0.186	0.179	0.015	0.113	-0.182	0.080	0.154
SCMPLS5	0.022	0.202	0.002	0.215	-0.022	0.227	0.198	**0.878**	0.186	0.179	0.015	0.113	-0.182	0.080	0.154
SCMPLS5	0.022	0.202	0.002	0.215	-0.022	0.227	0.198	**0.878**	0.186	0.179	0.015	0.113	-0.182	0.080	0.154
SCMPLS6	0.017	0.205	0.000	0.218	-0.018	0.213	0.197	**0.882**	0.193	0.184	0.025	0.120	-0.196	0.096	0.142
SCMPLS6	0.017	0.205	0.000	0.218	-0.018	0.213	0.197	**0.882**	0.193	0.184	0.025	0.120	-0.196	0.096	0.142
SCMPLS6	0.017	0.205	0.000	0.218	-0.018	0.213	0.197	**0.882**	0.193	0.184	0.025	0.120	-0.196	0.096	0.142
SCMPLS7	0.009	0.204	0.001	0.216	-0.023	0.230	0.208	**0.874**	0.186	0.184	0.022	0.115	-0.192	0.075	0.144
SCMPLS7	0.009	0.204	0.001	0.216	-0.023	0.230	0.208	**0.874**	0.186	0.184	0.022	0.115	-0.192	0.075	0.144
SCMPLS7	0.009	0.204	0.001	0.216	-0.023	0.230	0.208	**0.874**	0.186	0.184	0.022	0.115	-0.192	0.075	0.144
SCMPLS8	0.007	0.222	0.002	0.236	-0.017	0.237	0.226	**0.895**	0.210	0.192	0.026	0.119	-0.189	0.077	0.142
SCMPLS8	0.007	0.222	0.002	0.236	-0.017	0.237	0.226	**0.895**	0.210	0.192	0.026	0.119	-0.189	0.077	0.142
SCMPLS8	0.007	0.222	0.002	0.236	-0.017	0.237	0.226	**0.895**	0.210	0.192	0.026	0.119	-0.189	0.077	0.142
SCMPLS9	0.011	0.224	0.001	0.239	-0.013	0.243	0.230	**0.891**	0.212	0.194	0.023	0.117	-0.181	0.072	0.144
SCMPLS9	0.011	0.224	0.001	0.239	-0.013	0.243	0.230	**0.891**	0.212	0.194	0.023	0.117	-0.181	0.072	0.144
SCMPLS9	0.011	0.224	0.001	0.239	-0.013	0.243	0.230	**0.891**	0.212	0.194	0.023	0.117	-0.181	0.072	0.144
SCMPPM1	-0.020	-0.010	0.041	0.001	-0.103	0.015	0.399	0.166	**0.873**	0.229	0.015	0.168	-0.179	0.149	0.130

SCMPPM2	-0.023	-0.032	0.044	-0.009	-0.105	0.007	0.376	0.162	**0.873**	0.198	0.002	0.151	-0.151	0.145	0.131
SCMPPM3	-0.052	-0.012	0.067	0.003	-0.155	0.008	0.377	0.187	**0.841**	0.224	-0.039	0.214	-0.172	0.191	0.127
SCMPPM4	-0.025	0.046	-0.003	0.054	-0.206	0.046	0.608	0.201	**0.865**	0.295	0.093	0.202	-0.203	0.103	0.155
SCMPPM5	-0.036	0.067	-0.011	0.067	-0.231	0.046	0.419	0.168	**0.815**	0.245	0.096	0.193	-0.135	0.074	0.240
SCMPPM6	0.039	0.087	0.064	0.093	-0.248	0.089	0.563	0.148	**0.742**	0.409	0.043	0.257	-0.233	0.247	0.291
SCMPPM7	-0.024	0.079	-0.007	0.081	-0.208	0.058	0.461	0.188	**0.855**	0.263	0.106	0.205	-0.118	0.085	0.237
SCMPSO1	-0.019	0.249	0.372	0.241	0.028	0.236	0.378	0.127	0.328	**0.758**	0.116	0.605	-0.174	0.526	0.427
SCMPSO2	-0.033	0.244	0.380	0.238	0.043	0.237	0.374	0.118	0.320	**0.770**	0.122	0.619	-0.184	0.526	0.426
SCMPSO3	0.060	0.437	0.460	0.440	0.097	0.435	0.346	0.238	0.257	**0.926**	0.229	0.678	-0.120	0.759	0.790
SCMPSO3	0.060	0.437	0.460	0.440	0.097	0.435	0.346	0.238	0.257	**0.926**	0.229	0.678	-0.120	0.759	0.790
SCMPSO4	0.086	0.447	0.461	0.451	0.103	0.445	0.326	0.213	0.230	**0.916**	0.210	0.630	-0.106	0.723	0.766
SCMPSO4	0.086	0.447	0.461	0.451	0.103	0.445	0.326	0.213	0.230	**0.916**	0.210	0.630	-0.106	0.723	0.766
SCMPSO5	0.016	0.440	0.379	0.455	0.138	0.457	0.295	0.219	0.286	**0.855**	0.277	0.605	-0.145	0.572	0.694
SCMPSO5	0.016	0.440	0.379	0.455	0.138	0.457	0.295	0.219	0.286	**0.855**	0.277	0.605	-0.145	0.572	0.694
SCMPSO6	0.012	0.296	0.459	0.299	0.033	0.287	0.223	0.135	0.196	**0.802**	0.142	0.908	-0.079	0.734	0.638
SCMPSO7	-0.005	0.312	0.405	0.329	0.002	0.313	0.264	0.163	0.256	**0.735**	0.209	0.587	-0.088	0.542	0.484
FSPBPCACT1	0.029	0.262	0.256	0.266	0.121	0.243	-0.017	0.002	0.034	0.152	**0.884**	0.183	0.021	0.037	0.071
FSPBPCACT2	0.003	0.257	0.234	0.257	0.090	0.260	-0.042	0.006	0.020	0.133	**0.832**	0.155	0.039	0.009	0.100
FSPBPCACT3	0.105	0.361	0.242	0.364	0.087	0.340	0.139	0.050	0.057	0.260	**0.959**	0.166	-0.042	0.114	0.272
FSPBPCACT4	0.115	0.353	0.249	0.367	0.095	0.369	0.159	0.065	0.070	0.261	**0.940**	0.131	-0.042	0.117	0.281
FSPBPCAFL1	-0.056	0.319	0.356	0.300	0.035	0.236	0.277	0.146	0.256	0.736	0.174	**0.930**	-0.086	0.639	0.578
FSPBPCAFL2	-0.010	0.291	0.434	0.267	0.059	0.220	0.242	0.097	0.201	0.737	0.170	**0.930**	-0.070	0.631	0.574
FSPBPCAFL3	-0.058	0.219	0.358	0.207	-0.020	0.163	0.158	0.099	0.199	0.620	0.080	**0.836**	-0.139	0.679	0.597
FSPBPCAFL4	-0.026	0.269	0.399	0.241	0.044	0.223	0.206	0.107	0.206	0.700	0.151	**0.926**	-0.097	0.654	0.625
FSPBPCAFL5	0.028	0.292	0.419	0.287	0.075	0.252	0.246	0.132	0.203	0.741	0.196	**0.894**	-0.033	0.583	0.523
FSPBPCAQL1	0.035	-0.115	-0.101	-0.093	0.094	-0.083	-0.310	-0.184	-0.203	-0.160	-0.007	-0.154	**0.944**	-0.112	-0.174
FSPBPCAQL2	0.006	-0.070	-0.100	-0.081	0.106	-0.102	-0.281	-0.199	-0.170	-0.122	-0.012	-0.021	**0.963**	-0.115	-0.121
FSPBPCAQL3	0.006	-0.062	-0.100	-0.072	0.106	-0.093	-0.273	-0.200	-0.173	-0.127	-0.010	-0.024	**0.959**	-0.122	-0.124
FSPBPCAQL4	0.011	-0.151	-0.108	-0.155	0.115	-0.142	-0.235	-0.182	-0.192	-0.129	-0.043	-0.100	**0.844**	-0.082	-0.059
FSPBPCARL1	-0.080	0.130	0.295	0.139	0.064	0.146	0.173	0.101	0.137	0.608	0.031	0.564	-0.109	**0.834**	0.554
FSPBPCARL2	0.025	0.159	0.387	0.161	0.087	0.171	0.263	0.157	0.167	0.726	0.095	0.654	-0.102	**0.939**	0.592
FSPBPCARL3	-0.068	0.143	0.335	0.140	0.087	0.131	0.121	0.075	0.116	0.624	0.095	0.619	-0.088	**0.788**	0.410
FSPBPCARL4	0.019	0.140	0.396	0.148	0.082	0.157	0.246	0.143	0.158	0.717	0.093	0.646	-0.110	**0.945**	0.589
FSPBPCARS1	0.004	0.336	0.353	0.326	0.022	0.321	0.265	0.110	0.169	0.682	0.180	0.632	-0.069	0.533	**0.859**
FSPBPCARS2	-0.004	0.427	0.361	0.421	0.042	0.416	0.314	0.176	0.181	0.718	0.241	0.614	-0.100	0.493	**0.809**
FSPBPCARS3	-0.067	0.196	0.209	0.208	-0.021	0.212	0.325	0.131	0.213	0.574	0.177	0.455	-0.145	0.472	**0.803**
FSPBPCARS4	-0.026	0.208	0.189	0.205	-0.018	0.190	0.241	0.105	0.157	0.549	0.128	0.444	-0.128	0.515	**0.835**
FSPBPCARS5	0.004	0.233	0.227	0.224	-0.007	0.235	0.238	0.136	0.186	0.569	0.198	0.462	-0.135	0.499	**0.789**

Fornell-Larcker criterion: The second criterion for examining discriminant validity for the reflective measurement models. Henseler et al.'s (2015) [cited in Haier et al.'s (2016)] stated that recent research that critically examined the performance of Cross-loadings and the Fornell-

Larcker criterion for discrimination validity assessment found that neither approach reliably detects discriminant validity issues. Furthermore, especially cross-loadings fail to indicate a lack of discriminant validity when two constructs are perfectly correlated, which renders this criterion ineffective for empirical research. Similarly, the Fornell-Larcker criterion performs very poorly, especially when indicator loadings of the constructs under consideration differ only slightly (between 0.6 and 0.8). For remedy, Henseler et al.'s (2015) proposed the approach of assessing the Heterotrait-Monotrait Ratio (HTMT) of correlation. However, considering Fornell & Larcker's (1981) criterion then according to their suggestions, the square root of AVE in each latent variable can be used to establish discriminant validity, if this value is larger than other correlation values among the latent variables. Additionally, the Fornell-Larcker criterion demands that any reflective LV captures more variance with its assigned indicators than with any other LVs. To confirm this, the value of the AVE of each LV should be greater than the LV's highest squared correlation with any other LV.

Table-7.5.2.1d: Discriminant validity in terms of Fornell-Larcker criteria

Discriminant Validity - Fornell-Larcker Criterion	Anti-Counterfeiting Strategies Initiative	Supply Chain Quality Management	Total Quality Management Practices	Commitment and Strategy	Customer Focus	Human Resource Management	Information Analysis	Process Management	Supplier Quality Management	Supply Chain Management Practices	Information Management	Lean System	Partnership Management_	Strategy and Organization	Firm's Supply Performance	Cost	Flexibility	Occurrences of Counterfeiting	Reliability	Responsiveness_
Anti-Counterfeiting Strategies Initiative	**0.711**																			
Supply Chain Quality Management	0.882	**0.739**																		
Total Quality Management Practices	0.915	0.960	**0.940**																	
Commitment and Strategy	0.894	0.944	0.983	**0.974**																
Customer Focus	0.103	0.067	0.066	0.060	**0.823**															
Human Resource Management	0.491	0.299	0.278	0.262	0.173	**0.819**														
Information Analysis	0.904	0.956	0.993	0.975	0.066	0.271	**0.948**													
Process Management	0.283	0.240	0.267	0.260	0.077	0.210	0.266	**0.912**												
Supplier Quality Management	0.907	0.938	0.979	0.935	0.067	0.288	0.957	0.263	**0.944**											
Supply Chain Management Practices	0.171	0.442	0.213	0.203	-0.008	0.032	0.215	-0.008	0.211	**0.864**										
Information Management	0.091	0.235	0.156	0.164	-0.054	0.039	0.151	-0.166	0.148	0.218	**0.827**									
Lean System	0.169	0.440	0.211	0.201	-0.008	0.033	0.213	-0.008	0.208	1.000	0.215	**0.864**								
Partnership Management_	0.012	0.128	0.045	0.038	-0.026	0.031	0.049	-0.214	0.045	0.212	0.547	0.209	**0.839**							
Strategy and Organization	0.496	0.560	0.447	0.438	0.030	0.502	0.445	0.087	0.438	0.222	0.375	0.221	0.315	**0.826**						
Firm's Supply Performance	0.372	0.410	0.309	0.317	-0.028	0.448	0.308	0.052	0.289	0.161	0.310	0.161	0.240	0.876	**0.762**					
Cost	0.383	0.345	0.357	0.351	0.083	0.267	0.358	0.105	0.346	0.042	0.093	0.041	0.055	0.238	0.188	**0.905**				
Flexibility	0.332	0.362	0.283	0.308	-0.028	0.435	0.288	0.043	0.242	0.128	0.250	0.128	0.236	0.782	0.911	0.171	**0.904**			
Occurrences of Counterfeiting	-0.140	-0.160	-0.110	-0.110	0.019	-0.110	-0.106	0.111	-0.109	-0.205	-0.302	-0.204	-0.202	-0.149	-0.131	-0.018	-0.095	**0.929**		
Reliability	0.263	0.269	0.170	0.163	-0.026	0.404	0.167	0.091	0.173	0.137	0.232	0.138	0.166	0.762	0.867	0.090	0.706	-0.117	**0.879**	
Responsiveness_	0.379	0.439	0.348	0.347	-0.020	0.332	0.343	0.006	0.340	0.161	0.337	0.161	0.220	0.759	0.851	0.226	0.642	-0.138	0.614	**0.819**

Table-7.5.2.1d showed the Fornell-Larcker criterion matrix. The diagonal of the table provides the values of AVE for each LV (bolded) whereas, the other values represent the squared correlation between the LVs. The table showed the values of AVE located in the table diagonals (bolded) except very few are greater than the values located in their corresponding column/row.

Table-7.5.2.1(d-1): Fornell-Larcker criteria

Fornell-Larcker criterion	ANCT-INT	SCQM	TQMP	SCMP	FSP
ANCT-INT	1				
SCQM	0.882	1			
TQMP	0.915	0.960	1		
SCMP	0.171	0.442	0.213	1	
FSP	0.372	0.410	0.309	0.161	1

Note: The blue color blocks show Monotrait-Heteromethod values and the green color blocks show Heterotrait-Heteromethod values

This confirms the presence of Discriminant Validity of the reflective measurement models in the research model. The referenced table showed a few problematic constructs, having correlation values greater than SQRT (AVE) values at the diagonal path, which need some improvements. These problematic values are explaining that a construct explains less variance in its indicator measures than it shares with the other construct, which implies that two constructs which are conceptually different, are not sufficiently different in terms of their empirical standards. For calculating the HTMT ratio manually, the following summarized table, based on inner structural constructs, can be drawn from the previous Fornell-Larcker criterion matrix. For Monotrait-Heteromethod calculation:

1) = 0.882 + (0.915 + 0.960)/2 = 1.819 / 2 constructs = 0.909
2) = (0.213 + 0.309)/2 + 0.161 = 0.422 / 2 constructs = 0.211

For Heterotrait-Heteromethod calculation:

1) = (0.171 + 0.372)/2 + (0.442 + 0.410)/2 = 0.697 / 2 = 0.348

HTMT = [0.348 / SQRT (0.909 * 0.211)] = 0.79 (DISCRIMINANT)

Heterotrait-Monotrait Ratio (HTMT) Criterion: HTMT is the ratio of the between-trait correlations to the within-trait correlations. It is the mean of all correlations of indicators across constructs measuring different constructs (heterotrait heteromethod correlations) relative to the Geometric mean of the average correlations of indicators measuring the same construct (monotrait heteromethod correlations). Technically, the HTMT approach is an estimate of what the true correlation between two constructs would be if they were perfectly measured. This true correlation is also referred to as disattenuated correlation. A disattenuated correlation between two constructs close to 01.0 indicates a lack of discriminate validity. This requires computing bootstrapping confidence interval obtained by running the bootstrapping options. Hair et al.'s (2015) discussed in their book that the exact threshold level of HTMT is debatable, based on previous research, Henseler et al.'s (2016) suggest a threshold value of 0.90 if the path model

includes constructs that are conceptually very similar (e.g., effective satisfaction, cognitive satisfaction, and loyalty). In other words, an HTMT value above 0.90 suggests a lack of discriminant validity. When the constructs in the path model are conceptually more distinct, a lower and thus more conservative threshold value of 0.85 seems warranted (Henseler et al.'s, 2015). Furthermore, the HTMT can serve as the basis of a statistical discriminant validity test. However, as PLS-SEM does not rely on any distributional assumptions, standard parametric significance tests cannot be applied to test whether the HTMT statistic is significantly different from 1. Instead, researchers have to rely on a procedure called bootstrapping to derive a distribution of the HTMT statistic.

Table-7.5.2.1e: Discriminant validity in terms of Heterotrait-Monotrait Ratio criteria

Heterotrait-Monotrait Ratio (HTMT)	Anti-Counterfeiting Strategies Initiative	Supply Chain Quality Management	Total Quality Management Practices	Commitment and Strategy	Customer Focus	Human Resource Management	Information Analysis	Process Management	Supplier Quality Management	Supply Chain Management Practices	Information Management	Lean System	Partnership Management_	Strategy and Organization	Firm's Supply Performance	Cost	Flexibility	Occurrences of Counterfeiting	Reliability	Responsiveness_
Anti-Counterfeiting Strategies Initiative																				
Supply Chain Quality Management	0.743																			
Total Quality Management Practices	0.810	0.908																		
Commitment and Strategy	0.795	0.894	0.996																	
Customer Focus	0.157	0.077	0.060	0.058																
Human Resource Management	0.758	0.289	0.284	0.270	0.184															
Information Analysis	0.805	0.910	1.009	0.995	0.058	0.278														
Process Management	0.305	0.230	0.270	0.263	0.087	0.222	0.270													
Supplier Quality Management	0.809	0.897	0.998	0.955	0.062	0.297	0.981	0.268												
Supply Chain Management Practices	0.157	0.623	0.214	0.205	0.053	0.044	0.217	0.038	0.213											
Information Management	0.150	0.270	0.151	0.160	0.083	0.082	0.148	0.195	0.143	0.219										
Lean System	0.157	0.623	0.214	0.205	0.053	0.044	0.217	0.038	0.213	1.023	0.219									
Partnership Management_	0.070	0.192	0.061	0.060	0.046	0.076	0.064	0.226	0.057	0.218	0.604	0.218								
Strategy and Organization	0.565	0.567	0.445	0.439	0.060	0.533	0.445	0.085	0.439	0.221	0.393	0.221	0.352							
Firm's Supply Performance	0.457	0.433	0.319	0.329	0.071	0.459	0.321	0.072	0.302	0.168	0.318	0.168	0.259	0.931						
Cost	0.400	0.316	0.358	0.354	0.083	0.284	0.361	0.113	0.349	0.051	0.125	0.051	0.081	0.229	0.193					
Flexibility	0.424	0.377	0.292	0.320	0.054	0.446	0.300	0.063	0.252	0.134	0.255	0.134	0.253	0.857	0.958	0.187				
Occurrences of Counterfeiting	0.168	0.199	0.115	0.111	0.036	0.121	0.112	0.117	0.118	0.213	0.316	0.213	0.213	0.161	0.131	0.055	0.088			
Relationship	0.370	0.302	0.181	0.174	0.076	0.434	0.179	0.099	0.185	0.146	0.236	0.146	0.185	0.830	0.940	0.101	0.768	0.125		
Responsiveness_	0.424	0.471	0.368	0.368	0.064	0.349	0.365	0.036	0.364	0.174	0.360	0.174	0.249	0.806	0.942	0.219	0.699	0.144	0.688	

Table-7.5.2.1e showed a few problematic constructs, having values >= 0.90, which need to be improved. To reduce the correlation values below the 0.90 threshold level, a few constructs having lower correlation values (customer focus, etc.) may be merged with the other relevant constructs or deleted items from the problematic constructs, in turn adjusting the Heterotrait or Monotrait Heteromethod values to decrease HTMT ratio ($x < 0.9$), so that discriminant validity can be ensured. However, overall values at a level of inner constructs confirm the presence of Discriminant Validity of the reflective measurement models in the research model. Hair et al.'s (2017) discussed that there is another option for handling discriminant issues. The bootstrapping option builds on randomly drawn bootstrap samples (e.g.: 5000), which will differ every time the procedure is done, showing the lower and upper bounds of the 95%

(biased-corrected and accelerated) confidence interval, as per non-zero values. The table under consideration confirms the presence of Discriminant Validity of the reflective measurement models in the research model. The confidence interval is the range into which the true HTMT population value falls (95%). If the confidence interval contains a value of 1.0, it will indicate a lack of discriminant validity. In the model, the lower and upper bounds of the confidence interval resulted in the HTMT criteria speaking in favor of the discriminant validity of the constructs: ANCT-INT, SCQM, TQMP, SCMP, and FSP. However, there are a few values (marked in red) that showed a significant lack of discriminant validity. The overall result showed that the undermentioned relationship evaluation criteria have been met (i.e. HTMT confidence interval does not include a value of 1.0 in the interval), providing support for the measures' reliability and validity. (see Table-7.5.2.1(f & g)).

Table-7.5.2.1f: Heterotrait-Monotrait Ratio (HTMT) **(Mean, STDEV, T-Values, P-Values)**	Sample (O)	Sample Mean (M)	Standard Deviation	T-Statistics	P Values
Supply Chain Quality Management -> Anti-Counterfeiting Strategies Initiative	0.743	0.754	0.024	31.038	0.000
Total Quality Management Practices -> Anti-Counterfeiting Strategies Initiative	0.810	0.809	0.025	31.793	0.000
Total Quality Management Practices -> Supply Chain Quality Management	0.908	0.908	0.010	92.670	0.000
Supply Chain Management Practices_ -> Anti-Counterfeiting Strategies Initiative	0.157	0.181	0.047	3.311	0.001
Supply Chain Management Practices_ -> Supply Chain Quality Management	0.623	0.622	0.039	15.959	0.000
Supply Chain Management Practices_ -> Total Quality Management Practices	0.214	0.211	0.069	3.104	0.002
Firm's Supply Performance -> Anti-Counterfeiting Strategies Initiative	0.457	0.459	0.059	7.691	0.000
Firm's Supply Performance -> Supply Chain Quality Management	0.433	0.436	0.053	8.194	0.000
Firm's Supply Performance -> Total Quality Management Practices	0.319	0.317	0.064	4.987	0.000
Firm's Supply Performance -> Supply Chain Management Practices_	0.168	0.180	0.073	2.316	0.021

Table-7.5.2.1g: Confidence Intervals	Sample (O)	Sample Mean (M)	2.5%	97.5%
Supply Chain Quality Management -> Anti-Counterfeiting Strategies Initiative	0.743	0.754	0.705	0.799
Total Quality Management Practices -> Anti-Counterfeiting Strategies Initiative	0.810	0.809	0.757	0.857
Total Quality Management Practices -> Supply Chain Quality Management	0.908	0.908	0.887	0.927

Supply Chain Management Practices_ -> Anti-Counterfeiting Strategies Initiative	0.157	0.181	0.100	0.277
Supply Chain Management Practices_ -> Supply Chain Quality Management	0.623	0.622	0.551	0.697
Supply Chain Management Practices_ -> Total Quality Management Practices	0.214	0.211	0.084	0.351
Firm's Supply Performance -> Anti-Counterfeiting Strategies Initiative	0.457	0.459	0.344	0.568
Firm's Supply Performance -> Supply Chain Quality Management	0.433	0.436	0.327	0.539
Firm's Supply Performance -> Total Quality Management Practices	0.319	0.317	0.191	0.441
Firm's Supply Performance -> Supply Chain Management Practices_	0.168	0.180	0.075	0.335

7.5.3 ASSESSMENT OF FORMATIVE MEASUREMENT MODELS

Bollen's (1989) stressed that assessing reliability and construct validity (convergent & discriminant validity) is meaningless for formative measurement models. Formative measurement models are conceptually different from reflective measurement models and are assessed against different categories and aspects from the traditional ones used for reflective measurement models (Bagozzi, 1994; Bollen, 1989). According to Fornell & Larker (1981), convergent and discriminant validity are not reasonable for evaluating formative measurement models, because formative indicators do not have to be strongly interrelated. Most recent studies (e.g. Gotz et al.'s, 2010; Henseler et al.'s, 2009) focused on the qualities that have consensus among researchers as relevant and applicable for formative measurement models. They propose a relatively similar procedure for evaluating formative measurement models. The validity assessment procedure consists of statistical analyses on two levels: indicator level and constructs level. The indicator level validity can be assessed by three important aspects: Significance of Weights, indicator weight (magnitude of path coefficient), and Multi-collinearity (Chin, 1998; Gotz et al.'s, 2010; Henseler et al.'s, 2009). On the other hand, the construct level validity can be assessed using two aspects: External validity, and Nomological validity (Gotz et al.'s, 2010; Henseler et al.'s, 2009).

In PLS, hierarchical models cannot be evaluated directly and there is a need to repeat the indicators of the lower-order latent variables to the higher-order latent variable (Wetzels et al.'s, 2009), as specified in SmartPLS (2.0) (Ringle et al.'s, 2005). The figure depicts the "Extended LS System" model. The research model shown in the figure contains two formative measurement models: one for the SCQM-Impact construct and another for the "Anti-Counterfeiting Strategies Initiative" constructs. Referring to Rai et al.'s (2006), the second-

order formative model consists of the linear composites from the indicators used to measure each of the dimensions in the first order.

7.5.3.1 VALIDATING FIRST ORDER ANCT-INT MEASUREMENT MODEL

ANCT-INT construct is conceptualized as a hierarchical model (first-order formative, second-order reflective). First, ANCT-INT was assessed as a first-order formative model only against indicator level validity aspects. Then, it is assessed as a second-order reflective model against both indicator level and construct level validity aspects. The first-order formative model simply consists of all the 16 indicators of ANCT-INT and is assessed against the three (3) aspects of indicator level validity: Degree of Multi-collinearity (VIF), Indicator Weight (magnitude of path coefficient) and Significance of Weights (t-value). The results of the Indicator Level Validity tests of the first order ANCT-INT model are presented in table. The VIF values of the 16 indicators of the first-order ANCT-INT model are below the recommended threshold value of 10.0 (Feyzian et al.'s, 2009), which indicated that multi-collinearity is not a problem for the first-order ANCT-INT model. According to the Diamantopoulos & Siguaw (2006) study, the present formative model assessment shows some of the VIF values are less than 3.3, and these values are considered excellent values. The indicator weight for the 16 indicators of the first order ANCT-INT model is above the recommended value of 0.10. In addition, all the indicators' weights have shown a significance level that is above the recommended value of 0.05. Therefore, the first-order ANCT-INT model completely exhibited indicator level validity.

INDICATOR LEVEL VALIDITY (Item inter-correlation)

The estimation of this validity is performed by the PLS approach with a bootstrapping method to calculate item weights and the T-values of each formative indicator whether are significant (Bruhn et al.'s, 2008; Diamantopoulos & Winklhofer, 2001; Chin, 1998). Similarly, indicator relationships with construct antecedents and consequences are also analysed by using PLS with outer item coefficients for first-order formative indicators, and inner path co-efficiencies for second-order formative constructs whether having the right signs and adequate t-statistics (Coltman et al.'s, 2008). To check the indicator level reliability and validity test of the formative reflective model, before and after bootstrapping process run is required. The process calculates estimated standard errors with confidence intervals of the relevant construct and is ready to perform the hypothesis testing for multiple iterations [see Fig-7.5.3.1 (a & b)].

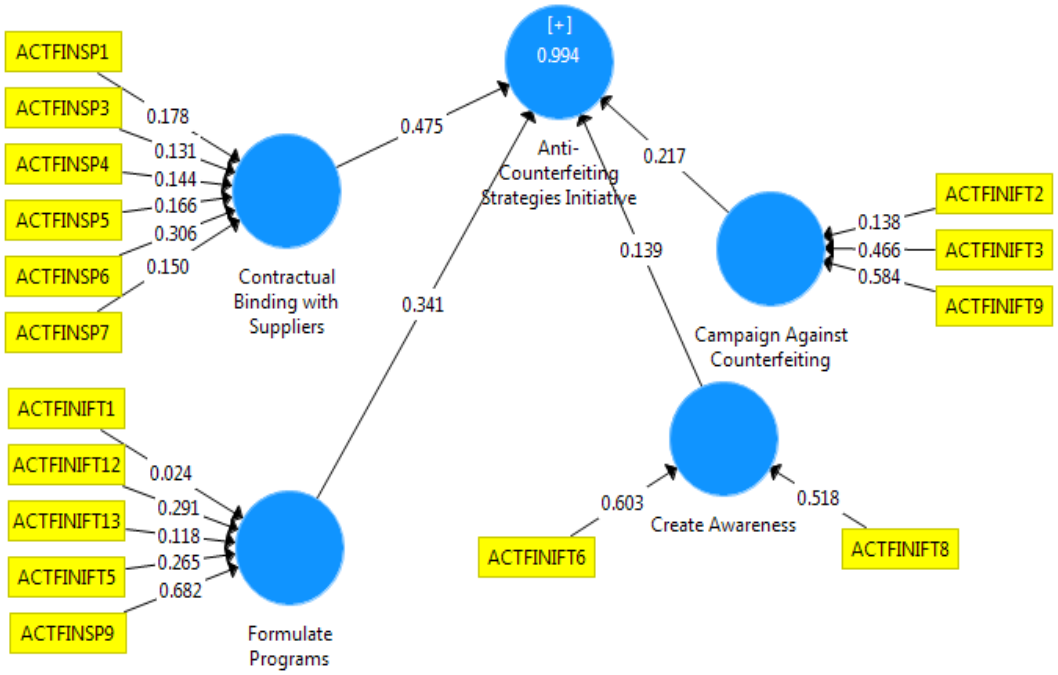


Fig-7.5.3.1a: Indicator Level Reliability and Validity test (Before Bootstrapping)

To check the indicator level reliability and validity test of the formative construct, Petter et al.'s (2007) study suggests that the item weights for indicators that have insignificant values may be eliminated (Diamantopoulos & Winklhofer, 2001) or keep insignificant indicators to preserve content validity (Bollen & Lennox, 1991).

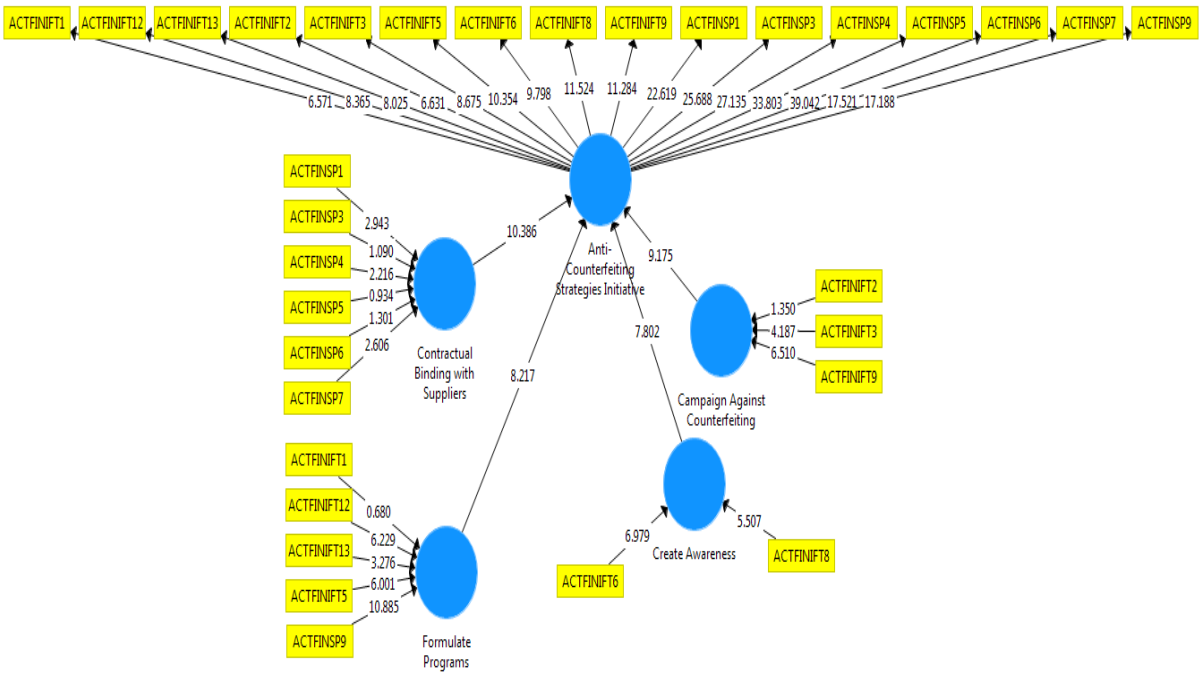


Fig-7.5.3.1b: Indicator Level Reliability and Validity test (After Bootstrapping)

Petter et al.'s (2007) study addresses that removing indicators with low weights removes the beta weight associated with these indicators. According to Cenfetelli & Bassellier's (2009) studies, one of the factors that can cause such low weights is the large number of indicators in the formative construct, as they compete with one another in explaining the variance in the formative construct. However, the removal of any indicator from formative constructs can omit a unique part of the conceptual domain of the construct and change its meaning (Jarvis et al.'s, 2003; MacKenzie et al.'s, 2005). Moreover, the Cenfetelli & Bassellier's (2009) study argues that indicator weight only determines the relative contribution of the indicator to the formative construct. Petter et al.'s and Cenfetelli & Bassellier studies emphasises that indicator weight is an important aspect for assessing formative indicators but not sufficient for removing the indicator. The studies suggest that problematic indicators should be investigated further against their absolute importance because low weights or higher VIF value do not necessarily indicate the unimportance of the indicators. The absolute importance of the indicators can be evaluated by their loadings on the formative construct and the correlation with the construct. As it is known that a two-tailed T-test critical value is considered with 1.645, 1.96, and 2.576 critical values of "T" at significant level (P-values) 0.1, 0.05, and 0.01 respectively (Wagner, 1992). The table shows T-values of all formative indicators are significant, in different p-values. Therefore, the indicator validity test of the formative constructs is accepted. Similarly, the first stage within the dimensionality reduction process is feature extraction (by keeping most relevant variables from the original dataset) and elimination, which process of selecting a subset of columns for use in the model. The table in reference shows that except ACTFINISP5 and ACTFINISP6, all thirteen (13) indicators of ANCT-INT measurement model have VIF values lower than the recommended threshold value of 10 (Feyzian et al.'s, 2009), indicates that multi-collinearity is not strongly evident in the ANCT-INT measurement model. Therefore, multi-collinearity is not a serious concern for the referenced measurement model. Moreover, outer weights of all indicators are above the recommended value of 0.10 except ACTFINIFT1 (0.024) insignificant indicator which shows that the probability (P) of using the random sampling through bootstrapping method yielded some T-Values more than critical level (1.645, 1.96 & 2.576) and some less, resulted into a highly significant ($P < 0.1, 0.5, 0.01$ respectively) relationship. The indicators that are found not at par with the recommended level (showing bold higher VIF values or weights with insignificant lower values) are always under consideration for removal from the formative construct (Diamantopoulos & Winklhofer, 2001).

SUMMARY OF FORMATIVE MODEL ASSESSMENT

Assessment aspects of Indicators for First order model	Mean	S.D	VIF	Outer Weights	T-Values	Significance P-Value
Campaign Against Counterfeiting	4.01	0.03	3.686	0.217	9.175	P<0.01
ACTFINIFT2	4.05	0.65	3.012	0.138	1.652	P<.0.1
ACTFINIFT3	3.99	0.65	3.483	0.466	3.981	P<0.01
ACTFINIFT9	3.98	0.58	1.299	0.584	7.231	P<0.01
Contractual Binding with Suppliers	4.15	0.02	4.475	0.475	10.386	P<0.01
ACTFINSP1	4.14	0.63	4.344	0.178	2.943	P<0.01
ACTFINSP3	4.13	0.64	8.224	0.131	1.090	-
ACTFINSP4	4.16	0.64	5.825	0.144	2.216	P<0.1
ACTFINSP5	**4.13**	**0.62**	**15.373**	**0.166**	**0.934**	-
ACTFINSP6	**4.14**	**0.61**	**21.221**	**0.306**	**1.301**	-
ACTFINSP7	4.19	0.58	2.431	0.150	2.606	P<0.01
Follow best industry technique	3.93	0.05	3.487	0.139	7.802	P<0.01
ACTFINIFT6	3.89	0.62	1.556	0.603	6.979	P<0.01
ACTFINIFT8	3.96	0.57	1.556	0.518	5.507	P<0.01
Formulate Programs	4.01	0.12	7.491	0.341	8.217	P<0.01
ACTFINIFT1	4.15	0.66	1.889	**0.024**	**0.680**	-
ACTFINIFT12	3.99	0.65	1.895	0.291	6.229	P<0.01
ACTFINIFT13	3.90	0.62	2.934	0.118	3.376	P<0.01
ACTFINIFT5	3.88	0.62	2.996	0.265	6.001	P<0.01
ACTFINSP9	4.12	0.62	1.065	0.682	10.885	P<0.01

Table-7.5.3.1a: Various Assessment Aspects of Indicator Level Validity for ANCT-INT

Indicators having higher VIF and lower outer weight are investigated further by checking their outer loading and correlation values as suggested by Cenfetelli & Bassellier's (2009). The indicator loading should be above 0.70 to indicate strong loading. The indicator correlation with the formative construct can be estimated by following an approach provided by Diamantopoulos & Winklofer's (2001). To calculate the correlation between the results of the measurement made and the results of the criterion measurement, criterion validity is important. If there is a high correlation according to the criteria, this gives a good indication that criteria test applied is measuring what it intends to measure (criterion validity). In this approach, the formative indicators are correlated with a criterion measure (CM) or a global item that summarizes the formative construct. Krippendorff's (2011) and Cohen (1988) considers correlation to be small if it is under 0.3, large if it is above 0.5 and moderate if it is between 0.3 and 0.5. The loading values and correlations of the indicators ACTFINSP5 and ACTFINSP6 showed an outer loading value of 0.934 and 1.301 respectively, which are considered high according to the Krippendorff's (2011) and Cohen (1988) studies, achieving moderate level of correlation. Therefore, these indicators showed absolute importance for the formative construct despite their high VIF value and lower outer weight and these indicators are then retained within

the formative model. Furthermore, ACTFINIFT1 showed a medium level of loading (0.680) and a relatively moderate level of correlation. Henseler et al.'s (2009) emphasized that a conceptual justification for removing an indicator is as important as statistical evidence is. Gotz et al.'s (2010) [cited in Hair Jr. et al.'s (2016)] suggested that Condition Indices (CI) or Bivariate Correlation (BC) are techniques that can be used to assess the possibility of multi-collinearity in the data. Where the resulting indices should be less than 30 for CI and less than 0.60 for BC to meet the cut-off conditions. The assessment exercise could confirm the absence of multicollinearity issues in the model. However, these indicators were also conceptually reviewed in a workshop to ensure that the removal of these indicators would not jeopardize the content validity of the model. That is why it is decided to keep indicators.

7.5.3.2 VALIDATING SECOND-ORDER ANCT-INT MEASUREMENT MODEL

ANCT-INT construct is conceptualized as a hierarchical model (first-order formative, second-order reflective construct). The second step of assessing ANCT-INT is to assess a second-order reflective model against both indicator level and construct level validity aspects. The indicator level validity is already discussed while the construct level validity is discussed as follows.

CONSTRUCT LEVEL VALIDITY (Item relationships with construct)

The second step in assessing the second-order ANCT-INT construct is to validate it against the construct level validity aspects: External Validity and Nomological Validity.

External Validity: Henseler et al.'s (2012) [cited in Hair Jr. et al.'s (2016)] study emphasizes that all partial regression models are estimated by the PLS-SEM algorithm's iterative procedures, which include two stages. One stage is where the construct scores are estimated and the second stage is where the final estimates of outer weights and loadings are calculated, as well as the structural model coefficients and the resulting R-Square values of the endogenous latent variable. Hair Jr. et al.'s (2016) study also discusses that, as a rule of thumb, for the sample size of up to 1000 observations path coefficients with standardized values above 0.20 are usually significant and values below 0.10 are not significant. Nevertheless, making definite statements about β value significance requires deciding the coefficient estimates' standard error. In an empirical consideration for item relationships with construct antecedents and construct consequences, the items may not have a similar significance of relationships. For that matter, the empirical test is performance, in which nomological validity can be assessed by

using the MIMIC model, and/or structural linkages with another criterion variable. The nomological network is a philosophical foundation that was developed by Cronbach & Meehl's (1995) which clearly defines what the concept is by setting forth the laws in which it occurs (i.e., establishing theoretical propositions), clarifying how the concept in question is going to be measured (e.g., operationalizing the theoretical constructs/concepts), elaboration the nomological network by adding a construct or a relation to the theoretical framework, as well as specifying and establishing the empirical linkages of the theoretical and empirical frameworks.

The central aspect of the nomological network of a psychological concept is the creation of a link between the conceptual/theoretical domain with the observable one. Therefore, external validity is assessed through a Multiple Indicators and Multiple Causes (MIMIC) model, which can be specified using two constructs in PLS. The first one is the formative measurement model under investigation (ANCT-INT model). The second construct is the reflective conceptualization of the ANCT-INT construct. The reflective model has 4 reflective indicators (criterion measures). The results of the MIMIC model described in the figure, are used to assess the External Validity of the second-order ANCT-INT construct, including path coefficient (β) [β=(T-value*S.D) / SQRT(sample size)] and the significance of the path (T-value). The path coefficient between the formative ANCT-INT measurement model and the reflective measurement model of ANCT-INT (the phantom construct in the MIMIC model) is fairly moderately and significantly represented with β value of (0.217, 0.475, 0.139, 0.341) and t-value of (9.175, 10.386, 7.802, 8.217) respectively. In addition, the variance in the reflective ANCT-INT measurement model is largely explained by the formative ANCT-INT construct with R^2 value of 0.994. These results confirm the External Validity of the second-order ANCT-INT measurement model.

TABLE-7.5.3.2a: SUMMARY OF ASSESSMENT OF CONSTRUCTS AND CONTENTS VALIDITY

Assessment aspects of Indicators for First-order model	Mean	S.D	VIF	Outer Weights	T-Values	Significance P-Value	Path Coefficient (β)
Campaign Against Counterfeiting	4.01	0.03	3.686	0.217	9.175	P<0.01	0.217
Contractual Binding with Suppliers	4.15	0.02	4.475	0.475	10.386	P<0.01	0.475
Follow best industry technique	3.93	0.05	3.487	0.139	7.802	P<0.01	0.139
Formulate Programs	4.01	0.12	7.491	0.341	8.217	P<0.01	0.341

Nomological Validity: Nomological validity of the ANCT-INT model can be assessed by checking whether it performs as expected within a nomological net hypothesis. The research model (confirmatory model) of the study placed the ANCT-INT construct in a structural

relationship with SCQM-Impact. The ANCT-INT construct was theoretically linked to SCQM-Impact based on previous literature. In this relationship, SCQM-Impact was conceptualized as an immediate antecedent of the SCQM-Impact. The hypothesis is that a higher ANCT-INT construct yields a higher level of SCQM-Impact. Fig-7.5.3.2 (a & b) showed the path coefficient (β) and the significance of the path (t-value) between the ANCT-INT construct and SCQM-Impact. The path coefficient between the formative measurement ANCT-INT model and SCQM-Impact (the hypothesized immediate consequence in its nomological network) is positive, which confirms the hypothesized relationship. The path coefficient is fairly strong and significant, with a β value of 0.837 and a t-value of 17.951. In addition, the variance in SCQM is largely explained by the second order ANCT-INT construct, with an R^2 value of 0.700. These results confirm the Nomological Validity of the second order ANCT-INT construct measurement model.

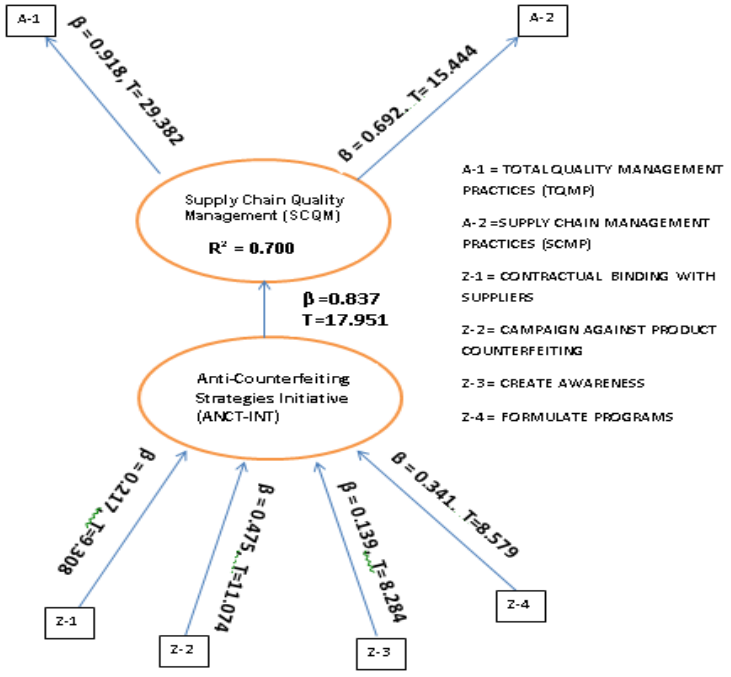


Fig-7.5.3.2a: Nomological Validity of ANCT-INT measurement model

Furthermore, the ANCT-INT model is theoretically linked to FSP based on literature review and earlier discussions in chapters 2 & 5. In this relationship, FSP was conceptualized as an immediate consequence of SCQM. The hypothesis infers that the higher the possibility of a successful implementation of the "Anti-counterfeiting strategies initiative" (ANCT-INT) in the automotive firm, the higher the level of FSP.

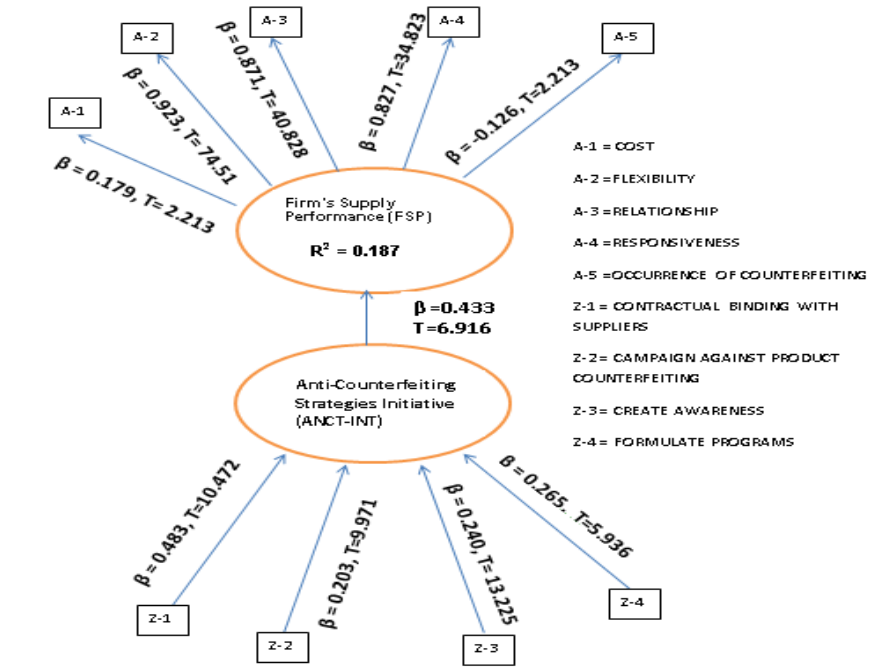


Fig-7.5.3.2b: Nomological Validity of ANCT-INT measurement model

The path coefficient between the second-order ANCT-INT model and FSP (the hypothesized immediate consequence in its nomological network) is positive, which confirms the hypothesized Relationship. The path coefficient is strong and significant, with a β value of 0.433 and a t-value of 6.916. In addition, the variance in FSP is largely explained by the second-order ANCT-INT model, with an R^2 value of 0.187. These results confirm the nomological validity of the second-order ANCT-INT measurement model.

7.5.3.3 ASSESSING FORMATIVE MEASUREMENT MODEL FOR COLLINEARITY

On examining the correlation matrix in the table, the indicators Formulating Programs (X1), Contractual Binding with Suppliers (X2), Campaign against product counterfeiting (X3), and Follow best industry technique (X4) are positively correlated with the construct Anti-Counterfeiting Strategies Initiative (ANCT-INT, 0.966, 0.872, 0.710, and 0.698 respectively) have lower inter-item correlation (0.825, 0.660, 0.654, 0.325, 0.331, 0.824 respectively), which means high collinearity is not present in the model.

Table-7.5.3.3: Matrix of Formative Measurement Model for collinearity

Correlation Matrix	ANCT-INT	X1	X2	X3	X4
ANCT-INT	1.000				
X1	**0.966**	1.000			
X2	0.872	**0.825**	1.000		
X3	0.710	0.660	**0.325**	1.000	

X4	0.698	0.654	0.331	**0.824**	1.000

In Table-7.5.3.3, the outer weights of X1, X2, X3, and X4 are positive which shows that all indicators are correlated with their constructs and provide a true interpretation of results. So, no collinearity issue in the model.

7.5.3.4 ASSESSMENT OF SCQM FORMATIVE MEASUREMENT MODEL

Supply Chain Quality Management (SCQM) is conceptualized as a formative construct that is measured with two second-order indicators (TQMP & SCMP). SCQM model will be assessed through construct level and indicator level validity. (see Fig-7.5.3a).

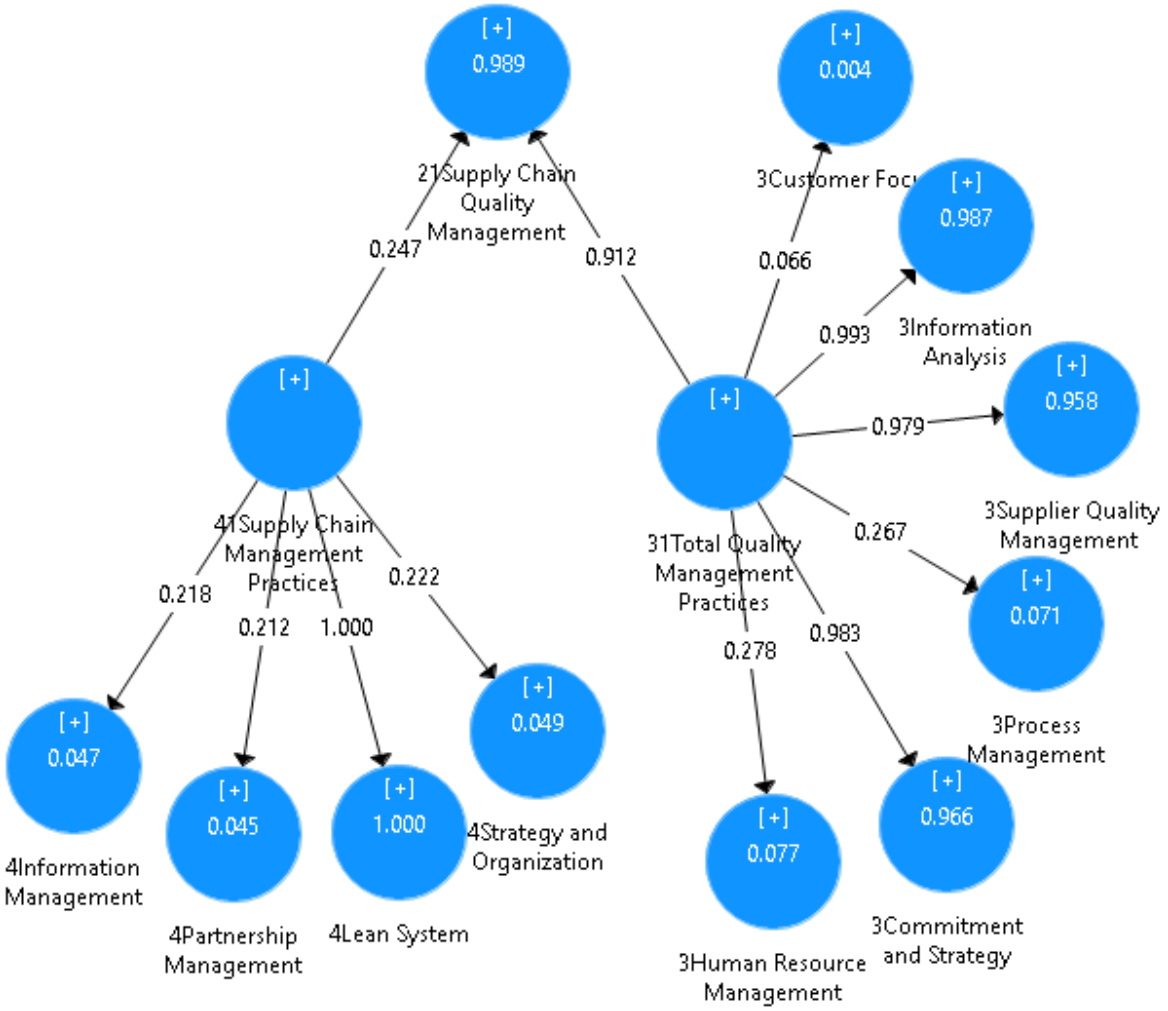


Fig-7.5.3a: SCQM as a formative measurement model

CONSTRUCT LEVEL VALIDITY

External validity: It is assessed through a multiple indicators and multiple causes (MIMIC) model, which can be specified using two constructs in PLS. One is the formative measurement model under investigation (SCQM) and the second construct is the reflective conceptualization of SCQM. The reflection model has various indicators (criteria measures) representing the MIMIC model used to evaluate the external validity of the SCQM model, including path coefficient (β) and the significance of the path (t-value). As shown in the figure, the path

coefficient (β) between the formative SCQM measurement model and the reflective measurement model of SCQM (the phantom construct in the MIMIC model) is strong and significant, with a (β) value of 0.971 and a t-value of 495.269. In addition, the variance in the reflective SCQM measurement model is fairly explained by the formative SCQM model, with an R2 value of 0.971. These results confirm the external validity of the SCQM formative measurement model. (see Fig-7.5.3b).

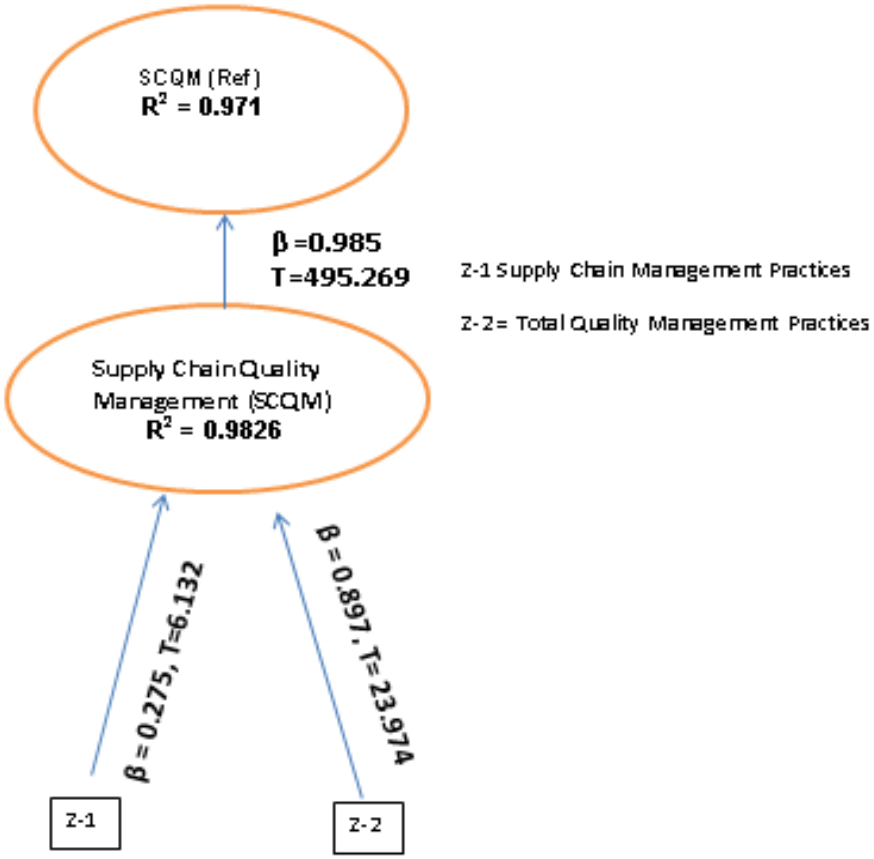


Fig-7.5.3b: The MIMIC model for the SCQM measurement model

Nomological Validity: SCQM model nomological validity can be assessed by checking whether it performs as expected within a net hypothesis. The overall research of the study places SCQM in a structural relationship with FSP. SCQM was theoretically linked to FSP based on previous literature. In this relationship, SCQM was conceptualized as an antecedent of FSP. The hypothesis is that a higher support for a network governance based SCQM environment to firm yields a higher level of FSP. As shown in the figure, the path coefficient (β) between the formative SCQM measurement model and the reflective measurement model of FSP is moderately strong and significant, with a (β) value of 0.409 and a t-value of 6.724. In addition, the variance in the reflective SCQM measurement model is weakly explained by the

reflective FSP model, with an R2 value of 0.168. These results confirm the external validity of the FSP reflective measurement model. (see Fig-7.5.3c).

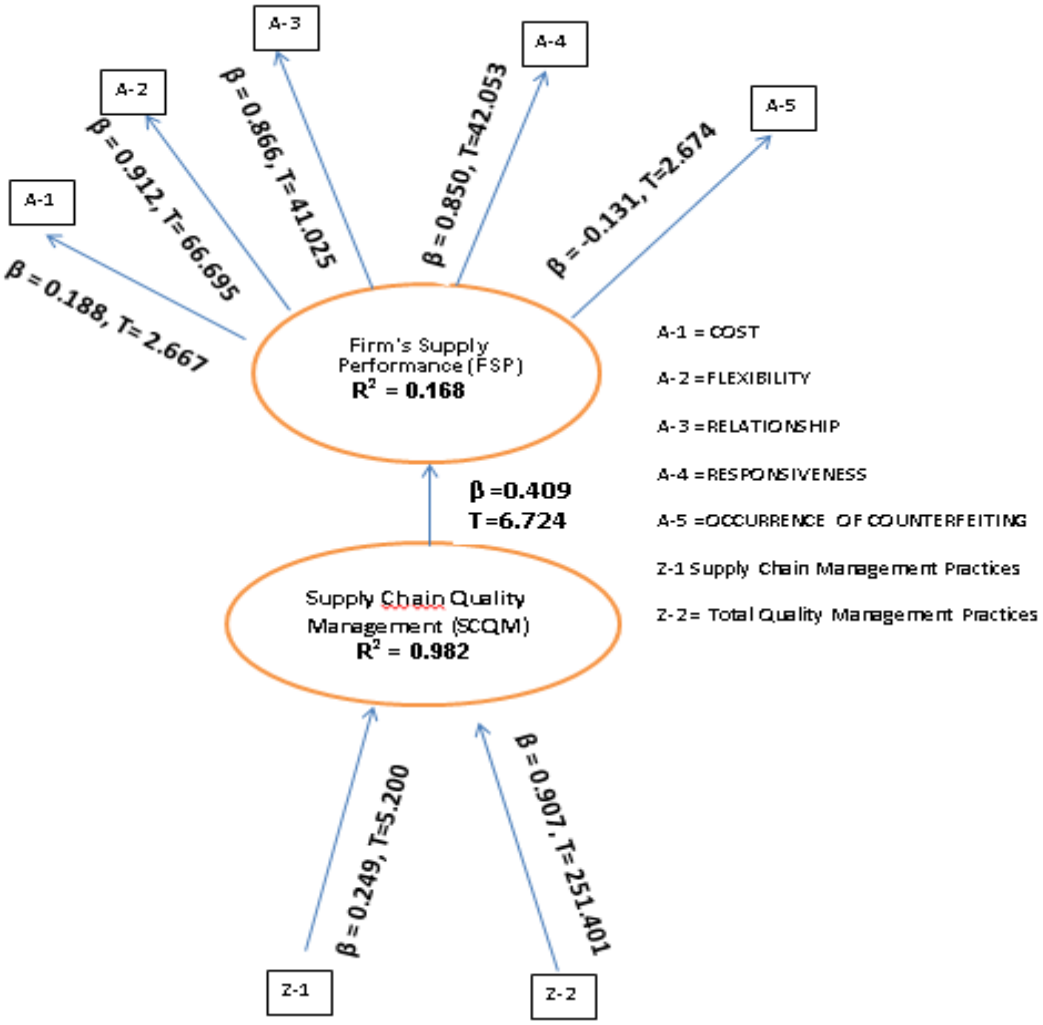


Fig-7.5.3c: The Nomological validity of the SCQM measurement model

7.5.4 ASSESSMENT OF STRUCTURAL MODEL (ANCT-INT WITH SCQM INDIRECT)

After validating the measurement models of the research model, the last step of the assessment is validating the structural model. It is important to examine the structural model for collinearity first because the estimation of path coefficient in the structural model is based on OLS regressions of each endogenous LV on its corresponding predecessor constructs. Therefore, the path coefficient might be biased if the estimation involves critical levels of collinearity among the predictor constructs. For that matter, it is important to understand the PLS-SEM estimates in the structural model so that the explained variance of the endogenous LV is maximized.

Here Goodness of Fit (GoF) estimates of the structural model are not fully transferable to PLS-SEM (Hair et al.'s, 2016), instead, it is primarily assessed based on heuristic criteria that are determined by the model's predictive capabilities. That is, how well the model predicts the endogenous LV. As mentioned earlier, structural models can be evaluated against two aspects: Explanatory Power; Predictive Power. Explanatory Power can be assessed against 2 criteria: Coefficient of determination (R2) and Effect size ($f2$). On the other hand, Predictive Power is assessed against 3 criteria: Path Coefficient (β), Predictive Relevance (Q2), and Relative Impact (q2). Following are the structural model assessment procedure, Table-7.5.4a:

Table-7.5.4a: List of the structural model assessment procedure

Step-1:	Assess structural model for collinearity issues
Step-2:	Assess the significance and relevance of the structural model relationships
Step-3:	Assess the level of $\mathbf{R^2}$
Step-4:	Assess the $\mathbf{f^2}$ effect size
Step-5:	Assess the predive relevance of $\mathbf{Q^2}$
Step-6:	Assess the $\mathbf{q^2}$ effect size

Assess structural model for collinearity issues: Grewal et al.'s (2004) and Zainodin & Yap (2013) studies discuss that multi-collinearity is a leading problem in regression showing inaccurate estimates of coefficients and standard errors as well as inference errors. The problem can be avoided with higher $\mathbf{R^2}$ and increased sample size. In the context of SEM, the remedy of multi-collinearity depends on a case-to-case basis, depending upon the clear direction derived from the literature. Introducing the PLS-based "ridge estimation" by accepting tolerance of a small amount of bias in return for greater efficiency or introducing composite indicators (factor scores) may be a way to avoid multicollinearity problems. In a nutshell, the increasing explained variance in the dependent variable can reduce the multi-collinearity effect

of the model. As the presence of measurement error is likely to mask the true correlation among latent exogenous constructs. In the present context, TQMP and SCMP jointly explain SCQM and directly and indirectly affect FSP. Likewise, the ANCT-INT as a strategic initiative affects TQMP, SCMP, and SCQM directly, leading to the combined effect of SCQM on FSP. Whereas, ANCT-INT also affects FSP directly. The outcome of the analysis (see Table-7.5.3.2a) and correlation matrix (Table-7.5.3.3), after checking the multi-collinearity issue of the formative ANCT-INT construct, shows that the variance in the reflective ANCT-INT measurement model is largely explained by the formative ANCT-INT construct with an R^2 value of 0.994 (Fig-7.5.3.1a) and the VIF values lie within the range of 3 to 5 as well which is moderately acceptable [Hair et al.'s (1995); Diamantopoulos & Siguaw (2006)] and the VIF values do no show a critical level of collinearity. The assessment of the model (first-order and second-order) indicated that multicollinearity is not a problem in the model.

Assess the significance & relevance of the Structural Model relationships:

In examining the significance of the relationship, Hair et al.'s, 2016 study discusses that the path coefficients have standardized values (fall between, +1 to -1). The closer the values of correlation coefficients to zero, the weaker are the relationships. Very low values close to zero are usually not significantly different from zero. Based on the standard errors, the empirical t-values larger than the critical value for two-tailed tests [t=1.65 (p=10%), t=1.96 (p=5%), t=2.57 (p=1%)], it concludes that the path coefficient is statistically significant at a certain error probability (significant level). The confidence interval (95%) provides information on the stability of the estimated coefficient by offering a range of standard population values for the parameter dependent on the variation in the data and sample size. If a confidence interval for an estimated path coefficient does not include zero, the hypothesis that the path coefficient equal to zero is rejected. Referring to the Fig-7.5.2, the outcome of the entirmodel demonstrated to the reader with e the help of the Fig-7.5.4a shows that the ANCT-INT, TQMP, and SCMP explain 98.2 % of the variances in SCQM-Impact, with R^2 = (0.982), which is considered as substantial. Similarly, SCQM along with all constructs in the model directly or indirectly explains 55.8% of variances of FSP, with R^2 = 0.558, which is also considered highly significant. Whereas ANCT-INT strategies initiative can become an integral part of TQMP & SCMP which explains 82.4% (R^2 = 0.824) and 4.9% (R^2 = 0.049) variances in practices respectively. There is an indirect relationship between TQMP with SCMP, relating adversely, towards highly affecting FSP (R^2=0.558).

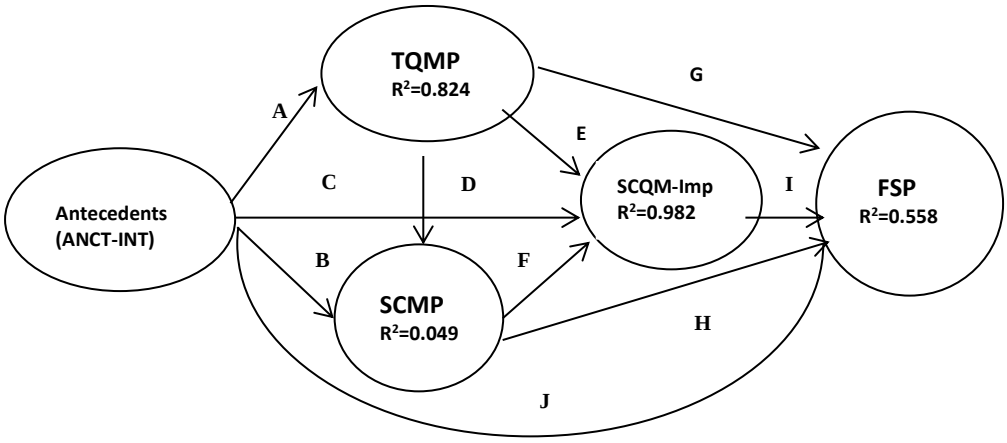


Fig-7.5.4a: Hypothetical Structural model

A= [β = (0.908), T=(50.452)]; B= [β = (-0.145, T=(1.201)]; C= [β = (0.059), T=(2.300)]; D= [β = (0.346), T=(2.667)]; E= [β = (0.853), T=(23.482)]; F= [β = (0.250), T=(5.308)]; G= [β = (-4.249), T=(7.744)]; H= [β = (-1.060), T=(5.857)]; I= [β = (4.692), T=(9.447)]; J= [β = (0.306), T=(2.592)]

According to Henseler et al.'s (2009) study, moderate R^2 values are acceptable when the endogenous LV is explained by few exogenous LVs. The acceptable values for the coefficient of determination (R^2) demonstrated the explanatory power (see Fig-7.5.).

Table-7.5.4b: Hypothesized relationship of the complete structural model

Path Code	Hypo-thesis	Paths of the model	Path coefficient (β)	T-Statistics	P-Value	95% Confidence Interval	Significant P< 0.10
A	H5	ANCT-INT & TQMP	0.908	50.452	0.000	[0.872, 0.943]	Yes
B	H6b	ANCT-INT & SCMP	-0.145	1.201	0.230	[-0.361, 0.093]	No
C	H6a	ANCT-INT & SCQM	0.059	2.300	0.022	[0.014, 0.114]	Yes
J	H6c	ANCT-INT & FSP	0.306	2.592	0.000	[0.100, 0.552]	Yes
D	H1	TQMP & SCMP	0.346	2.667	0.008	[0.075, 0.585]	Yes
E	H3	TQMP & SCQM	0.853	23.482	0.000	[0.768, 0.919]	Yes
F	H4a	SCMP & SCQM	0.250	5.308	0.000	[0.143, 0.326]	Yes
G	H0	TQMP & FSP	-4.249	7.744	0.000	[-5.521, -3.347]	Yes
H	H2	SCMP & FSP	-1.060	5.857	0.000	[-1.392, -0.675]	Yes
I	H4b	SCQM & FSP	4.692	9.447	0.000	[3.781, 5.746]	Yes

The path coefficients and statistical values can also help in demonstrating explanatory power of the model. The values between constructs are: ANCT-INT & TQMP = [β = (0.908),

T=(50.452)]; ANCT-INT & SCMP= [β = (-0.145, T=(1.201)]; ANCT-INT & SCQM= [β = (0.059), T=(2.300)]; TQMP & SCMP= [β = (0.346), T=(2.667)]; TQMP & SCQM= [β = (0.853), T= (23.482)]; SCMP & SCQM= [β = (0.250), T=(5.308)]; TQMP & FSP= [β = (-4.249), T=(7.744)]; SCMP & FSP= [β = (-1.060), T=(5.857)]; SCQM & FSP= [β = (4.692), T=(9.447)]; ANCT-INT & FSP= [β = (0.306), T=(2.592)].

The figure shows some strong direct and indirect influences (path coefficients) of exogenous LV on some of the endogenous LV, particularly in relationships like ANCT-INT & TQMP, TQMP & SCQM, TQMP & FSP, SCMP & FSP, and SCQM & FSP. After examining the Significance of Relations (Table-7.5.4b), it is important to assess the Relevance of Significant Relations because it is crucial for interpreting the results and drawing conclusions as small coefficients (having high statistical significance) may not warrant managerial attention. Hair et al.'s (2016) study says that the larger structural model path coefficient from its predecessor may have a greater effect on the endogenous LV. This means that one unit change of the exogenous construct can change the endogenous construct by the size of the path coefficient when all other constructs and their path coefficients remain constant.

Assess the level of R^2 and $f2$: PLS-SEM aims at maximizing the R^2 values of the endogenous LVs in the path model. Hair et al.'s (2016) study says that normally R^2 values of 0.75, 0.50, and 0.25 for the endogenous construct can be described as respectively substantial, moderate, and weak. The explanatory power can be assessed by two criteria: Coefficient of determination (R^2) and Effect size ($f2$). According to Chin (1998), R^2 values of around 0.670 are considered substantial, values of approximately 0.333 are deemed average, and values of 0.190 and lower are described as weak. The coefficient of determination of different constructs in the model shows that the ANCT-INT, TQMP, and SCMP explain 98.2 % of the variances in SCQM-Impact, with R^2 = (0.982), which is considered substantial. Similarly, SCQM along with all constructs in the model directly or indirectly explains 55.8% of variances of FSP, with R^2 = 0.558, which is also considered highly significant. Whereas, ANCT-INT strategies initiative can become an integral part of TQMP and SCMP which explains 82.4% (R^2 = 0.824) and 4.9% (R^2 = 0.049) variances in practices respectively. There is an indirect relationship between TQMP with SCMP, relating adversely, towards highly affecting FSP (R^2=0.558). As Henseler et al.'s (2009) study, moderate to substantial R^2 values of the structural model are acceptable when the endogenous LV is explained by a few exogenous LVs (a case for SCQM-Impact and FSP). The effect size f^2 allows assessing an exogenous construct's contribution to an endogenous latent variable's R^2 value. Hair et al.'s (2016) study says that the effective size

f^2 values of 0.02, 0.15, and 0.35 indicate an exogenous construct's small, medium, and large effect respectively on an endogenous construct. The result shows that SCMP has a large effect size of 3.335 and 0.557 on SCQM and FSP respectively. Likewise, TQMP has a large effect size of 7.018 and 0.877 on SCQM and FSP respectively, having a small effect size of 0.022 on SCMP. Furthermore, SCQM has a large effect size of 0.890 on FSP. Therefore, the referenced values show higher effective sizes of different paths for indirect effect (like FSP is indirectly affected by SCQM-Impact through TQMP and SCMP constructs). However, for direct impact, the Effect size has no meaning for the endogenous LVs of this structural model (SCQM-Impact and ANCT-INT). That is because they are affected by only one exogenous LV (SCQM-Impact by ANCT-INT).

Assess the predictive relevance Q^2 and q^2: The predictive power of the structural model can be assessed by 3 criteria: Path coefficient (β), Predictive Relevance (Q^2), and Relative Impact (q^2). Path coefficient (β) is based on the magnitude, sign, and significance. The magnitude of the path coefficient indicates the strength of the relationship between LVs. The recommended value for path coefficient is over 0.10 to indicate a certain impact within the model. The sign of the path coefficient is also important; it should correspond to the proposed hypothesis. In addition, the path coefficient should be significant at least at the 0.05 level. The significance can be determined by a bootstrapping procedure in PLS. The second criterion to assess the predictive power of structural models is the predictive relevance (Q^2) using the Stone-Geisser test. The Stone-Geisser (Q^2) test can be performed using a blindfolding procedure. Q^2 values estimated by the blindfolding procedure represent a measure of how well the path model can predict the originally observed values. The value of (Q^2) should be greater than zero to indicate the structural model's predictive relevance. Hair et al.'s (2017) study discusses the blindfolding results report obtaining procedure. The bootstrapping method is used with the help of blindfolding rounds. Similarly, in the f^2 effect size approach for assessing R^2 values, the relative impact of the predictive relevance can be compared through the measure to the Relative Impact (q^2) effect size. The third criterion for evaluating the structural model's predictive power is Relative Impact (q^2). As a relative measure of predictive relevance, values of 0.02, 0.15, & 0.35 indicate that an exogenous construct has a small, medium, and large predictive relevance respectively for a certain endogenous construct. As $Q2 > 0$ values indicate that the exogenous construct has predictive relevance for the endogenous construct.

Hair et al.'s (2017) study discusses that whether one is discussing constructs in the inner model or indicators in the outer model, there are two versions of Q^2: redundancy and communality.

The redundancy is only calculated for endogenous variables in the model, and it is more consistent with the PLS approach which focuses on paths involving the endogenous variables. For this reason, it is preferred. Whereas communality is calculated for all constructs & indicators in a model and the commonality coefficients run higher than redundancy coefficients. Moreover, the commonality calculation is done without the knowledge of the path model based only on construct scores. The results of the path coefficient between the constructs and the predictive relevance (Q^2) in the structural model LVs demonstrated the predictive power of the structural model. Thus, the predictive relevance of the hypothesized structural model (Fig-7.5.4a) is based on the constructs' causal relationship in terms of their statistical significance concerning different paths of the model (path coefficient, total effect, and f-square values) [(Table-7.5.4 (b to d)]. The extraction of the bootstrapping results of the structural model estimates is available. The concerned result is the one for the Construct Cross validated Redundancy estimates. The bootstrapping method is used with the help of blindfolding rounds (already executed but not displayed as bootstrapping report). The summary included the total outcomes of the blindfolding procedure (Case1 to Case7 outcomes of seven blindfolding rounds). In the table displayed, SSO (sum of the squared observations) and SSE (sum of the squared prediction errors), and the last column (i.e., 1 – SSE/SSO), displayed the final value Q^2, which is interpreted to judge the model's predictive relevance concerning each endogenous construct. (see Table-7.5.4e).

Table-7.5.4e: Complete structural model, Values Q2 (Included)

Total - Construct Cross validated Redundancy	**SSO**	**SSE**	**(INCLUDED) Q^2 (=1-SSE/ SSO)**
Anti-Counterfeiting Strategies Initiative (ANCT-INT)	3,598.000	1,811.138	0.497
Supply Chain Quality Management (SCQM)	6,682.000	3,095.398	0.537
Total Quality Management Practices (TQMP)	3,855.000	1,073.889	0.721
Supply Chain Management Practices (SCMP)	4,112.000	3,968.998	0.035
Firm's Supply Performance (FSP)	3,598.000	2,449.015	0.319

As can be seen, the Q^2 values of all endogenous constructs are above zero. More precisely, TQMP has the highest Q^2 values (0.721), followed by SCQM (0.537), ANCT-INT (0.497), FSP (0.319), and, finally, SCMP (0.035). These results provide clear support for the model's predictive relevance regarding the endogenous latent variables. Moreover, the predictive relevance is confirmed between ANCT-INT and SCQM, with a Stone-Geisser (Q^2) positive value of (0.537). Similarly, the predictive relevance is confirmed between ANCT-INT and

TQMP, with a Stone-Geisser (Q^2) positive value of (0.721). Furthermore, the predictive relevance is confirmed by a combined effect of TQMP, SCMP, and SCQM on FSP with a Stone-Geisser (Q^2) positive value of (0.319). In case we exclude one of the constructs (SCQM) from the model then the following result will come. (see Table-7.5.4f).

Table-7.5.4f: Complete structural model, Values Q2 (Excluded)

Total - Construct Cross validated Redundancy	SSO	SSE	(EXCLUDED) Q^2 (=1-SSE / SSO)
Anti-Counterfeiting Strategies Initiative (ANCT-INT)	3,598.000	1,799.839	0.500
Total Quality Management Practices (TQMP)	3,855.000	1,160.065	0.699
Supply Chain Management Practices (SCMP)	4,112.000	3,968.901	0.035
Firm's Supply Performance (FSP)	3,598.000	3,243.958	0.098

The final assessment addresses the q^2 effect sizes. Hair et al.'s (2017) study discusses that q^2 effect sizes must be computed manually because the SmartPLS software does not provide results. To compute the q^2 value of a selected endogenous latent variable, we need the Q (included)^2 and Q (excluded)^2 values. The Q (excluded)^2 value is obtained from a model re-estimation after deleting a specific predecessor of that endogenous latent variable. These two values are the inputs for computing the q2 effect size of SCQM on FSP: q (SCQM→FSP)^2 = Q (included)^2 − Q (excluded)^2 / 1− Q (included)^2. (see Table-7.5.4g).

Table-7.5.4g: Complete structural model, Values Q2 (Effective sizes)

Q2 Effect Sizes	ANCT-INT	TQMP	SCQM	FSP	SCMP
ANCT-INT	**Excluded**	**0.000**	**0.537**	**0.309**	**0.033**
SCQM	**0.500**	**0.699**	**Excluded**	**0.098**	**0.035**
TQMP	**0.501**	**Excluded**	**0.450**	**0.105**	**0.019**
SCMP	**0.497**	**0.720**	**0.512**	**0.239**	**Excluded**

For example, the endogenous latent variable **FSP** has an original Q^2 value of 0.319 [Q (included)^2]. When **SCQM** is deleted from the path model and the model is re-estimated, the Q^2 of FSP drops to 0.098 [Q (excluded)^2]. These two values are the inputs for computing the q2 effect size of SCQM on FSP: **q** (SCQM→FSP)^2 = 0.319−0.098 / 1−0.319 = 0.221 / 0.681 = 0.324. The q^2 effect size for this relationship can be considered large. When **SCMP** is deleted from the path model and the model is re-estimated, the Q^2 of FSP drops to 0.239 [Q (excluded)^2]. These two values are the inputs for computing the q2 effect size of SCMP on FSP: **q** (SCMP→FSP)^2 = 0.319−0.239 / 1−0.319 = 0.080 / 0.681 = 0.117. The q^2 effect size for this relationship can be considered small. When **TQMP** is deleted from the path model and the

model is re-estimated, the Q^2 of FSP drops to 0.105 [Q (excluded)^2]. These two values are the inputs for computing the q2 effect size of TQMP on FSP: **q** (TQMP→FSP)^2 = 0.319−0.105 / 1−0.319 = 0.214 / 0.681 = 0.314. The q^2 effect size for this relationship can be considered large. When the **ANCT-INT** is deleted from the path model and the model is re-estimated, the Q^2 of FSP drops to 0.309 [Q (excluded)^2]. These two values are the inputs for computing the q2 effect size of ANCT-INT on FSP: **q** (ANCT-INT→FSP)^2 = 0.319−0.309 / 1−0.319 = 0.010 / 0.681 = 0.147. The q^2 effect size for this relationship can be considered small.

Table-7.5.4h: Complete structural model, Values q^2 (Effective sizes)

q^2 Effect Sizes	ANCT-INT	TQMP	SCQM	FSP	SCMP
ANCT-INT		**0.986**	**-0.080**	**0.147**	**0.921**
SCQM	**0.079**	**-0.350**		**0.324**	**1.083**
TQMP	**0.791**		**0.974**	**0.314**	**2.521**
SCMP	**-0.479**	**-0.710**	**-0.494**	**0.117**	

Table-7.5.4h summarizes the results of the q^2 effect sizes concerning all the relationships in the model. Therefore, the relative measure of predictive relevance (Q^2), and values of Relative Impact (q^2) indicate that an exogenous construct has a small to medium predictive relevance for FSP endogenous construct. Likewise, the exogenous construct has large predictive relevance for SCMP and TQMP. Which means, that the outer models connecting latent constructs to their indicators show that the outer model has a moderate degree of predictive relevance? For theory testing, consider Standardized Root Mean Square Residual (SRMR) and RMS_{theta} or the exact fit test. Hair et al.'s (2017) study discusses that these tests are not researched in the PLS-SEM context in-depth and threshold values have not been derived yet. However, Hair et al.'s (2016) study say that following a conservative approach, SRMR (RMS_{theta}) values of less than 0.08 (0.12) indicate a good fit. Therefore, the referenced research model shows two versions of SRMR measures: The saturated model (0.132); the Estimated model (0.205), and RMS_{theta} = 0.177, which does not represent a good model fit. It is recommended not to use GOF to determine model fit (Hair et al.'s, 2016).

7.5.5 ASSESSMENT OF THE STRUCTURAL MODEL (ANCT-INT + SCQM DIRECT APPROACH TO FSP)

Explore Explanatory Power and Predictive Power in the structural model with direct approach where SCQM-Impact directly influences FSP. (See Fig-7.5.6a).

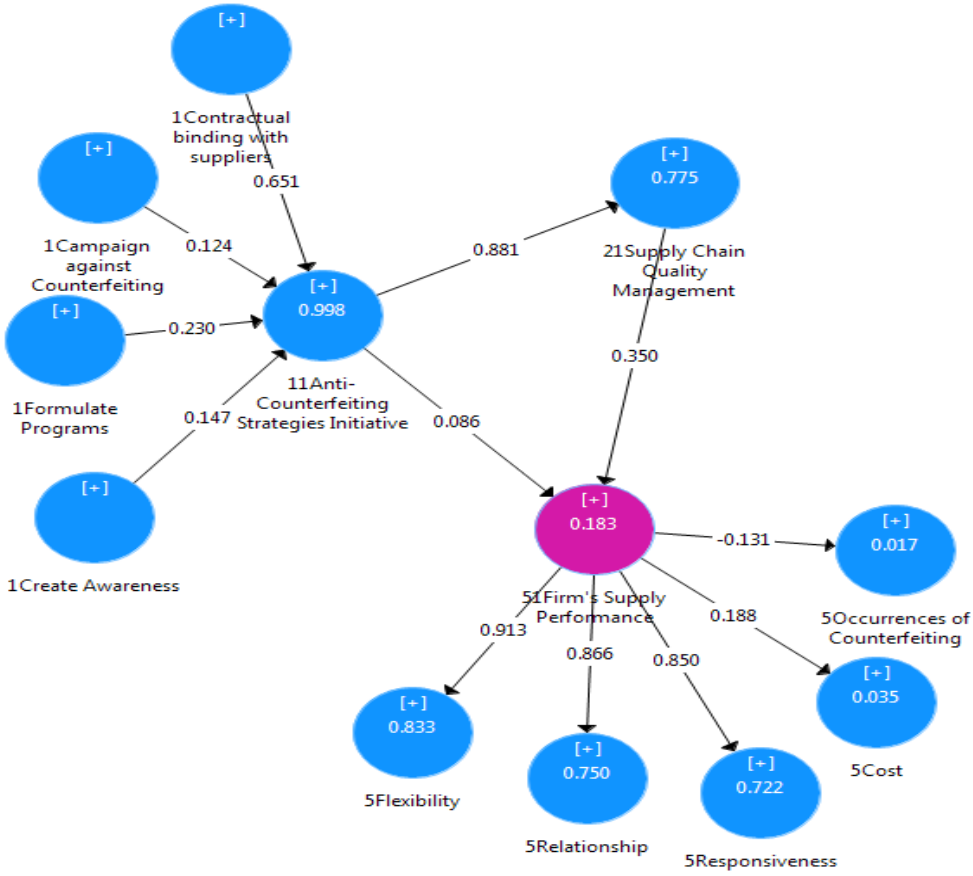


Fig-7.5.6a: Assessment of the Structural Model (ANCT-INT With SCQM Direct)

EXPLANATORY POWER (DIRECT CASE)

The explanatory power can be assessed by two criteria: Henseler et al.'s (2009) study says that the Coefficient of determination (R2) and Effect size ($f2$). According to Chin (1998), R2 values of around 0.670 are considered substantial, values of approximately 0.333 are deemed average, and values of 0.190 and lower are described as weak. In fact, moderate R2 values are acceptable when the endogenous LV is explained by few exogenous LVs (a case for SCQM-Impact and FSP. Effect size has no meaning for the endogenous LVs of this structural model (SCQM-Impact & ANCT-INT). This is because they are affected by only one exogenous LV (SCQM-Impact by ANCT-INT and FSP by SCQM-Impact). The values of R2 for the endogenous LVs

(SCQM-Impact & FSP) are illustrated in the following figure. Henseler et al.'s study further says that the important information about the predictive power of the structural model can be seen the previous section. The recommended value for path coefficient is over 0.10 to indicate a certain impact within the model. The sign of the path coefficient is also important; it should correspond to the proposed hypothesis. In addition, the path coefficient should be significant at least at the 0.05 level. The significance can be determined by a bootstrapping procedure in PLS. For this study, the bootstrap sample size is equal to the original sample size because of the small sample sizes employed in PLS. The Fig-7.5.6b shows that the ANCT-INT explains 77.5 % of the variance in SCQM-Impact, with R^2 = (0.775), which is considered as substantial. According to Henseler et al.'s (2009), moderate R^2 values are acceptable when the endogenous LV is explained by few exogenous LVs. The Fig-7.5.6b shows that only SCQM-Imp explains around 18.3 % of the variance of FSP, with higher value of R^2 (0.183).

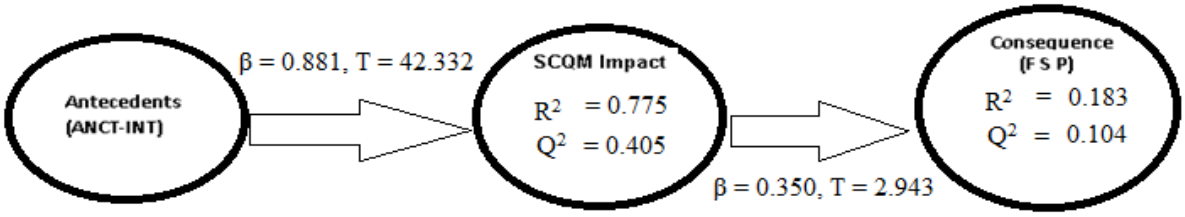


Fig-7.5.6b: Antecedent & Consequent relationship among ANCT-INT, SCQM-Imp, FAP

The acceptable values for the coefficient of determination (R^2) demonstrated the explanatory power. The path coefficient between ANCT-INT and SCQM-Impact is considered relatively strong, with β = (0.881) and significant, with t-value= (42.332) and 95% confidence interval (0.837, 0.918). The path coefficient between SCQM-Impact and FSP is also strong, with β = (0.350), t-value = (2.943) and 95% confidence interval (0.110, 0.588), along with a direct insignificant (p=0.533) effect of ANCT-INT on FSP [β = (0.086), (t=0.640) and 95% confidence interval (-0.183, 0.326)].

PREDICTIVE POWER (DIRECT CASES)

The predictive relevance is confirmed between ANCT-INT and SCQM-Impact, with a Stone-Geisser (Q2) positive value of (0.405). Similarly, the predictive relevance is confirmed between SCQM-Impact and FSP, with a Stone-Geisser (Q2) positive value of (0.104). However, for the direct impact, the q^2 effect size has no meaning for the endogenous LVs of this structural model (SCQM-Impact and ANCT-INT). That is because they are affected by only one exogenous LV (SCQM-Impact by ANCT-INT). For example, the endogenous latent variable **FSP** has an original Q^2 value of 0.104 [Q (included)^2]. When **SCQM** is deleted from the path model and

the model is re-estimated, the Q^2 of FSP drops to 0.102 [Q (excluded)^2]. These two values are the inputs for computing the q2 effect size of SCQM on FSP: **q** (SCQM→FSP)^2 = 0.104−0.102 / 1−0.104 = 0.002 / 0.896 = 0.002. The q^2 effect size for this relationship can be considered very small. The results of the path coefficient between the constructs and the predictive relevance (Q^2) in the structural model LVs demonstrate the predictive power of the structural model. Furthermore, the Standardized Root Mean Square Residual (SRMR) is a measure of approximate fit of the researcher's model where the model has a good fit when SRMR is less than 0.08. The referenced research model shows two versions of SRMR measures: Saturated model (0.150); Estimated model (0.219), and RMS_{theta} = 0.212, which do not represent a good model fit.

7.5.6 TESTING THE HYPOTHESIS

Tan (2001) study says that the formal model (i.e, the measurement model) deals with the reliability and validity of the constructs in measuring the LV, while the latter model (i.e, the structure model) is concerned with the direct and indirect relations among the LV (cited in C. Lin et al.'s, 2005). SEM technique is therefore suited for our research purpose. Table-7.5.4b shows the summary results of the hypothesis testing of the structural relationships among LV. The Path coefficient (β) values addressed possible causal links among different hypothetical dimensions. The SEM helps to establish such causal links. The empirical data support ANCT-INT's positive relationship with TQMP and shows that these practices are positively related to "SCQM-Imp". Therefore, the strength of the SCQM environment can further enhance FSP (R2=0.558). The study suspects that the performance of FSP is further influenced by the SCQM-Imp environment along with the specialized supply chain management practices (SCMP) as a strategic means to revive automotive industry's performance in Pakistan.

Hypothetical questions & answers:

H0: TQM practices have a positive relationship with the FSP.

Explanation H0: The TQMP---→FSP relationship is statistically significantly correlated. But the negative magnitude (-4.249) shows the possibility of a knowledge gap among the participants about the pronounced effect of the TQMP on FSP (theoretically understood). According to the participant's understanding, without a suitable environment, the TQMP is difficult to implement successfully to enhance FSP. The data value needs confirmation.

H1: TQM practices have a positive relationship with SCM practices.

Explanation H1: The data shows that TQMP is significantly correlated (β=0.346) with SCMP. Theoretical evidence explains the moderately strong TQMP--→SCMP relationship as the participants' responses do. The data value needs confirmation.

H2: SCM practices have a positive relationship with the FSP.

Explanation H2: The data showed that SCMP--→FSP relationship is significantly correlated (β=-1.060) statistically with FSP. But the negative magnitude of the SCMP---→FSP relationship shows that there may be a knowledge gap among the participants about the pronounced effect of the SCMP on FSP (theoretically understood). The data value needs confirmation.

H3: TQM practices have a positive relationship with the SCQM environment.

Explanation H3: The data shows that TQMP is significantly correlated (β=0.853) with SCQM-Imp (both magnitude-wide and statistically). The respondents' responses favour the presence of a suitable environment for the successful implementation of the TQMP.

H4a: The presence of the SCQM environment has a positive relationship with SCM practices.

Explanation H4a: The data shows that statistically SCMP is significantly correlated (β=0.250) with the SCQM-Imp environment. However, its magnitude is reflected less strongly. The data value needs confirmation. There may be a knowledge gap among the participants about the importance of the presence of the SCQM-Imp environment to implement SCMP to enhance FSP.

H4b: The presence of the SCQM environment has a positive relationship with FSP.

Explanation H4b: The data shows that the SCQM-Imp environment is significantly correlated (β=4.692) with FSP. The strongly reflected participants' responses show that without the presence of the SCQM-Imp environment, the successful implementation of the TQMP is difficult to enhance FSP.

H5: TQM practices have a positive relationship with the ANCT-INT initiative.

Explanation H5: The data showed that TQMP is significantly correlated (β=0.908) with ANCT-INT. The strongly reflected participants' responses show that the higher the level of successful implementation of TQMP, the higher the possibility of a successful implementation of the ANCT-INT items' measures in the automotive industry's supply chains.

H6a: ANCT-INT initiative has a positive relationship with the SCQM environment.

Explanation H6a: The data showed that ANCT-INT is significantly correlated (β=0.059) with SCQM-Imp. The highly reflected participants' responses show that the higher the possibility of a successful implementation of the ANCT-INT items' measures in the automotive industry's supply chains, the higher the possibility of using the SCQM-Imp environment to integrate quality and process improvement strategies by implementing TQM practices in the automotive industry's supply chains.

H6b: ANCT-INT initiative has a positive relationship with the SCM practices

Explanation H6b: The data showed that ANCT-INT is insignificantly correlated (β= -0.145) with SCMP. The data value is not reliable and needs confirmation. The negative magnitude of the ANCT-INT---→SCM relationship shows the possibility of a knowledge gap present among the participants about the pronounced effect of the ANCT-INT on SCMP acceptability to enhance FSP (theoretically understood). Furthermore, there may be a possibility that in the participants' understanding without a suitable environment, SCMP is difficult to take the ANCT-INT initiative and implement strategies successfully to enhance FSP. Therefore, the higher the possibility of a successful implementation of the ANCT-INT items' measures, the higher the acceptability of SCM practices in the automotive industry's supply chains.

H6c: ANCT-INT initiative has a positive relationship with the FSP.

Explanation H6c: The data showed that ANCT-INT is significantly correlated (β=0.306) with FSP. However, its magnitude is reflected moderately strongly. There may be a knowledge gap among the participants about the importance of a possibility of a successful implementation of the ANCT-INT items' measures to enhance FSP. The data value needs confirmation. Therefore, the higher the possibility of a successful implementation of the ANCT-INT items' measures, the higher is the possibility of FSP.

CONCLUSION

Findings of the Thai model bring insights into the debate concerning the impact of TQM practices on SCM practices and on FSP. The quantitative result of the Vanichchinchai & Igel (2011) study, in Thailand automotive industry' SC context, suggest that TQM practices can directly facilitate the implementation of SCM and can directly enhance the FSP. Moreover, TQM practices can indirectly improve FSP through SCMP [Table-7.5.1 (a to c)]. This study out-come in Pakistan automotive industry's SC context, having CFA application limitation, has also broadened the scope of TQM (H1, H3, H4a, H4b) to cover SCM practices in SCQM environment and firm's performance dimensions, such as cost, quality, and responsiveness. The data shows

that TQMP construct significantly correlated with SCMP and FSP. Three negative relationships (H0, H2) infer the possibility of a knowledge gap among the participants to understand the pronounced effect of TQMP on other constructs. Similarly, outcome of this study with broadened scope of TQM supports that the ANCT-INT initiative taken in the presence of SCQM environment would enhance FSP. The data shows that TQMP construct significantly correlated with ANCT-INT, SCQM, and FSP (H5, H6a, H6c). The negative relationship (H6b) infers the possibility of a knowledge gap among the participants to understand the pronounced effect of ANCT-INT on SCMP. This study also sees the possibility that participants may have the understanding that without a suitable environment SCMP is difficult to take the ANCT-INT initiative and implement strategies successfully to enhance FSP. As in Fig-7.5.4a, the proportion of variance present in the dependent variable that can be explained by the strength of the SCQM environment to further enhance FSP (R2=0.558). This study, having CFA application limitation, infers that the SCQM environment would impact positively on FSP when relevant SCMP is applied.

7.6 CHAPTER SUMMARY

The main objective of this chapter is to assess the research model, which is depicted as a Structural Equation Model that consists of five measurement models (ANCT-INT, SCQM-Impact, TQMP, SCMP, and FSP).

a) **FIRM'S SUPPLY PERFORMANCE (FSP):** Conceptualized as a reflective measurement model with five (5) indicators. The FSP measurement model was evaluated against the reflective assessment aspects: indicator reliability, internal consistency reliability, convergent validity, and discriminant validity. All five indicators of FSP have moderate loading and significance, which confirms the reliability of these indicators. The internal consistency reliability of the reflective measurement model was confirmed, with Cronbach's alpha (CA) values and Composite Reliability (CR) values well above the minimum accepted value of (0.7). The convergent validity of the FSP measurement model was also investigated and confirmed with AVE values well above the minimum accepted value of (0.5). The AVE values below the acceptable critical value mean that Error Variance exceeds the Explained Variance. Finally, the Discriminant Validity of the FSP was confirmed through three criteria: cross-loading, Fornell-Larcker criterion, and HTMT.

b) **SCQM-IMPACT MEASUREMENT MODEL:** SCQM Impact is conceptualized as a hierarchical model (first-order reflective, second-order formative). The second-order

formative model simply consists of two dimensions of SCQM-Impact (TQMP, SCMP). The first-order reflective model consists of the linear composites from 54 indicators used to measure each of the dimensions in the second order. First, SCQM-Impact Model was validated as a second-order formative model against indicator and construct level validity aspects. Then, the SCQM-Impact Model was assessed as a first-order reflective model only against indicator level validity aspects. In the first and second-order of the SCQM-Impact model certain indicators' validity are assessed (Multi-collinearity, Indicator weights, and their significance, and construct level validity.

b.1) Second-order SCQM-Impact Model: The second-order model was assessed against indicator level validity (multi-collinearity, indicator weight, and significance of the weight and construct level validity (external and nomological validity). The two indicators of the second-order SCQM-Impact model have VIF values under the recommended threshold value, which indicates that multi-collinearity is not a concern for the model. The values of all indicators weights are above the recommended value of 0.10 showing their statistical significance ($p< 0.1, 0.05, 0.01$). Therefore, the second-order model completely demonstrated indicator level validity. For construct level validity, the external validity was confirmed for the SCQM-Impact model, as the path coefficient between the formative construct and the reflective phantom construct in the MIMIC model is fairly strong and significant, with β value and t-value. The nomological validity was also confirmed, as the path coefficient between the second-order SCQM-Impact model and FSP (the hypothesized immediate consequence in its nomological network) is positive, which confirmed the hypothesized relationship. The path coefficient is fairly strong and significant, with a β value of 0.433 and a t-value of 6.916. Likewise, for ANCT-INT and SCQM-Impact constructs, the path coefficient is fairly strong and significant, with a β value of 0.837 and a t-value of 17.951.

b.2) First-order SCQM-Impact Model: The first-order SCQM-Impact model was assessed against four aspects of indicator level validity. The research model entails reflective measurement models which are SCQM, TQMP, SCMP, and FSP. The “SCQM Impact” construct is measured formatively through 2 reflective criterion measures TQMP and SCMP. In PLS, (Efron & Tibshirani’s, 1993) the significance of the indicators’ loading can be calculated using the Bootstrapping re-sampling technique. The indicators’ loading and their significance are exhibited in the reflective indicators loading table for all the reflective measurement models. The loadings of all the reflective indicators are above the

recommended threshold of 0.7. And, the square of each of the outer loadings is also higher than 0.7 for the referenced exploratory. And, the significance of each indicator loading (t-value) on its respective LV is high and above the recommended threshold of 0.05 which confirms the indicators' reliability. Convergent Validity is assessed by a measure called Average Variance Extracted (AVE), introduced by Fornell & Larcker (1981). The AVE values for a construct should be above 0.5 to demonstrate an acceptable degree of convergent validity. The AVE values for the reflective measurement models demonstrate convergent validity. In the model, the lower and upper bounds of the confidence interval resulted in the HTMT criteria speaking in favor of the discriminant validity of the constructs: ANCT-INT, SCQM, TQMP, SCMP, and FSP. Few values showed a significant lack of discriminant validity. The overall result showed that the HTMT confidence interval does not include a value of 1.0 in the interval and provided support for the measures' reliability and validity.

c) ANTI-COUNTERFEITING STRATEGIES INITIATIVE MODEL: The ANCT-INT measurement Model was assessed against indicators' level validity (Multi-collinearity, Indicator Weight, Significance of Weights. and construct level validity (External and Nomological validity). All 16 indicators of ANCT-INT have VIF values under the recommended threshold value of 10 (Feyzian et al.'s, 2009), which indicated that multicollinearity is not a problem for the first-order ANCT-INT model. However, Hair et al.'s (2011) study suggests later for multi-collinearity, each indicator's variance inflation factor (VIF) value should be less than five (5). The summary of the formative model assessment shows some of the VIF values are less than 3.3 and these values are considered excellent values (Diamantopoulos & Siguaw, 2006). The indicator weight for the 16 indicators of the first order ANCT-INT model is above the recommended value of 0.10. In addition, all the indicators' weights have shown a significance level that is above the recommended value of 0.05. Therefore, the first order ANCT-INT model completely exhibited indicator level validity. The indicators that are found not at par with the recommended level such as: showing high VIF values or weights with insignificant lower values were subjected to further investigation, by checking their loading and correlation, as suggested by Cenfetelli & Bassellier's (2009). However, it was concluded that due to the subjective importance (because of the literature review) of the indicator, it is very important for the formative model to retain the indicator. The convergent validity of the ANCT-INT measurement model was also investigated and confirmed with AVE values, which should be above the minimum accepted value of (0.5).

AVE below the acceptable value means that Error Variance exceeds the Explained Variance. Finally, the Discriminant Validity of the ANCT-INT was also confirmed through three criteria: cross-loading, Fornell-Larcker criterion, and HTMT.

The second step of the research model assessment is evaluating the structural model, which demonstrated explanatory and predictive power. The results of the assessment of the research model confirmed the validity of the "Extended Large Scale (LS) system" Model in the Pakistani context, which is the main goal of the study. The "Extended Large Scale (LS) system" Model was validated as a hierarchical model with five dimensions and 83 indicators. In addition, the validity of the conceptualized ANCT-INT model was also confirmed. Moreover, the results have confirmed the validity of the new conceptualization of FSP as a reflective construct with five measures/indicators, instead of four measures/indicators as in the original study (Vanichchinchai & Igel., 2011). In addition, the results support the hypothesized relationship between SCQM Impact and ANCT-INT and confirm that ANCT-INT is an antecedent of SCQM Impact. Moreover, the results re-confirm that FSP is an immediate consequence of SCQM-Impact, as concluded in the original model Study by Vanichchinchai & Igel., 2011. The following figure illustrates the Validated Context "Extended Large Scale (LS) system" Model.

The Chapter entailed a comprehensive literature review in the areas of Structural Equation Modelling (SEM), Formative and Reflective constructs, the Partial Least Squares (PLS) approach, and an assessment of SEMs. The assessment process of the SEM model of the study consists of two stages, as suggested by Chin (1998). The first stage entailed the evaluation of the measurement models (outer Model) and the second stage was dedicated to the evaluation of the structural model (inner model). Measurement models can be either reflective or formative and each type has unique characteristics and can be assessed against different aspects and criteria. The results of the model assessment are summarized in Table-7.5.8a as follows.

Table-7.5.8a: Summary of Assessment of Measurement Model Constructs

Dimensions / Indicators Description	Indicators	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Anti-Counterfeiting Strategies Initiative	ANCT-INT	0.924	0.928	0.506
Supply Chain Quality Management	SCQM	0.963	0.966	0.547
Total Quality Management Practices	TQMP	0.990	0.991	0.884
Supply Chain Management Practices	SCMP	0.977	0.979	0.747
Firm's Supply Performance	FSP	0.943	0.951	0.581

7.7.1 SUMMARY OF SCQM INDIRECT / DIRECT CASES:

Fig-7.5.4a and Table-7.5.4b refers that the hypothesized relationships show that the SCQM explains 82.4 % of the variance in TQMP, with R2 = (0.824) and SCQM explains 4.90 % of the variance present in SCMP, with R2 = (0.049), which are considered as substantial TQM impact. According to Henseler et al.'s (2009) study, moderate R2 values are acceptable when the endogenous LV is explained by a few exogenous LVs. Otherwise, with the case of SCMP where SCQM lags explaining comparatively as strongly as it explains the variance present in the TQMP. There is an indirect relationship between TQMP with SCMP with an overall combined effect of SCQM-Imp significantly explaining the variance present in the FSP (R2=0.558). Both TQMP and SCMP, directly and indirectly, explain around 55.8 % of the variance of FSP. The acceptable values for the coefficient of determination (R2) demonstrated the explanatory power. In the presence of the indirect causes (see Table-7.5.4b) during the model structural assessment, the path coefficient between ANCT-INT and TQMP is considered strong and significant, with β = (0.908) and t-value= (50.452). The path coefficient between ANCT-INT and SCMP is considered as not strong and not significant, with β = (-0.145) and t-value= (1.201). Likewise, the path coefficient between ANCT-INT and SCQM is considered relatively less strong and less significant, with β = (0.059) and t-value= (2.300). The path coefficient between ANCT-INT and FSP is considered as relatively strong and relatively significant, with β = (0.306) and t-value = (2.592). Moreover, the path coefficient between TQMP and SCMP is considered as relatively strong and relatively significant, with β = (0.346) and t-value = (2.667). The path coefficient between TQMP and SCQM is considered as strong and significant, with β = (0.853) and t-value = (23.482). The path coefficient between SCMP and SCQM is considered as relatively strong and relatively significant, with β = (0.250) and t-value = (5.308). Another direct relationship between SCQM and FST exists, where the path coefficient between SCQM and FSP is considered very strong and significant, with β = (4.692) and t-value = (9.447). There is an indirect relationship of TQMP and SCMP with FSP where both observed negative path coefficient [(β = (-4.249) and T= (7.744)); (β = (-1.060) and T= (5.857)) respectively] not affecting significantly towards FSP. Whereas, in the presence of the direct cases during the model structural assessment, the path coefficient between ANCT-INT and SCQM-Imp shows that the ANCT-INT construct acts as the antecedent to the SCQM-Imp environment construct with significantly stronger β = (0.881) value and t-value= (42.332), an environment where practitioners can make educated decisions. The path coefficient between SCQM-Imp and FSP shows that the SCQM-Imp construct acts as the consequent to the FSP construct with significantly less-stronger β = (0.350) and t-value = (2.943), as more FSP

enhancement needs more efforts to control the quality of parts supplies and it is only possible when occurrences of the counterfeiting phenomenon in automotive industry's supply chains in Pakistan can be reduced. This chapter discusses the assessment of the ANCT-INT model (mediator) role in the structure model is discussed where the convergent and discriminant role of the ANCT-INT-1 to 4 to ANCT-INT relationship is evident. As discussed earlier, the antecedent role of the ANCT-INT is also established in this research where it impacts the SCQM environment. The chapter discusses the details of the conditions when applied the effect may come through different median procedures (no mediation, full mediation, and partial mediation). However, this study still requires to perform further analysis of the TQMP, SCMP, and FSP causal relationship with the latent variables in terms of convergent and discriminant validity of the model.

CHAPTER-8 CONTRIBUTIONS, LIMITATIONS, AND FUTURE POSSIBILITIES

8.1 INTRODUCTION

This chapter discusses the contribution made in extending the product counterfeiting knowledge stream, by adding up-to-date knowledge, to confirm the presence of the auto parts counterfeits infiltrating the automotive industry's supply chain (both before and after-market) in Pakistan. The study aims to investigate and assess the relationship between the anti-counterfeiting strategies and improvement in the firm's supply performance within the internal and external supply chain quality management context in the auto-parts industry's supply chains in Pakistan. The study objectives are a) To explore and synthesize relevant ant-counterfeiting strategies to control product counterfeiting problems; b) To develop new insights on how the anti-counterfeiting strategies interact with SCQM to control product counterfeiting; c) To evaluate and assess the anti-counterfeiting concept that influences FSP, in the auto-parts industry supply chains in Pakistan.

This study uses the primary source of information (interviews & group discussion, and a survey) to address the gaps present in the counterfeiting knowledge stream. The confirmation of the issue from the primary source encourages the researcher to investigate further how a SCQM environment can provide an auto-parts' traceability platform in the automotive industry's supply chain (before and after-market) in Pakistan. The OEMs do keep systematic parts' tracing capability at their end till the vehicle leaves the factory. But at sub-tier and aftermarket levels, the parts' traceability information is not supportive (see section 2.2.3). There exists a gap where chances of parts' infiltration are possible in the licit automotive industry's supply chains. For example, sometimes obsolete parts are no longer available in the OEM's inventory reserve pool and that gap could become the biggest risk for the licit supply chain.

This chapter briefly discusses the contributions (gaps & theoretical challenges) and the importance of this study. This chapter discusses the academic contributions to the knowledge stream which includes theoretical and contextual contributions. This chapter also discusses the contribution to practice for managers. Every study has some limitations, so this chapter discusses the limitations of the research with its practical implications. Finally, this study suggests some potential future research possibilities to overcome the limitations of this research.

8.2 INTEGRATED DISCUSSION OF EMPIRICAL FINDINGS

This section summarises the main contributions of the research described in this thesis. It does so with specific reference to the research questions.

RQ.1) What theoretical arguments and relationships (antecedent and consequent) exist in the literature to control the counterfeiting problem?

This study recognises the importance of the suppliers' resources (RBV) and their expanded attributes (cultural factors, I.T based systems support (technology), process of resource development, and deployment of capabilities) to meet suppliers' selection criteria (see Table-2.2.1e). For justification, key details are added, like RBV strategy formulation analysis [Fig-2.2.1a, Table-2.2.1b, Table-2.2.1c]; key signal theory constructs [Table-2.2.1d]. Theories in the reference section explain why and how counterfeiters exploit the signals to deceive buyers. Key details are added, like SCQM benefits [Table-2.3.4(a.1)] and scope of QM and SCM framework characteristics [Table-2.3.4a]. This study discusses theories and their strategic implication for technology supported SCQM environment: A) Theoretical SCQM perspective [see Section-2.3.4 and Section-2.3.5] covers wider scope with more partners and adds value through total integration; B) Implications of the technology from different theoretical perspectives (see section-2.3.5) shows how different technology attributes can be integrated into four theories (CPT, ST, RBV, DT). Table-2.3.5a shows a theoretical framework that can be applied to technology supported SCQM environment to create smart contracts, improve transaction transparency, and remove process ambiguities. As noted in the section-2.3.4 & section-2.3.5, the SCQM knowledge stream emphasises that the TQM and SCM are large scale management systems where the managers of the automotive companies consider them as one system (see Fig-8.3a). The wider scope of SCQM is more strategic and reaches to more partners. Both could be implemented together to achieve excellent performance in the firm supply-related business process system (as one concept of SCQM).

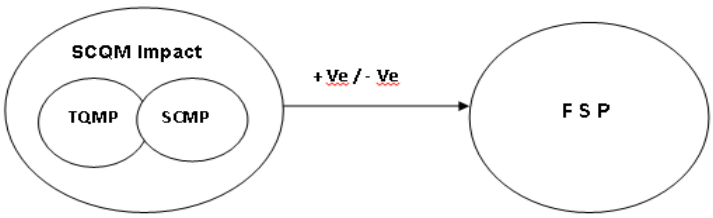


Fig-8.3a: SCQM impact on FSP

The Counterfeiting Protection Model (CPM) is the only model introduced by Michael Harvey, in the year 1987, to control the counterfeiting problem administratively at the management level, missing the need to emphasize the processes improvement aspect [SCQM, Quality-based performance (Q.M & TQM framework like MBNQA & EFQM)]. Significantly limited research exists in integration of TQM & SCM concept. The concept of the integration to SCQM not only simplifies finance operations but reduces working capital requirements. Berman (2008), Stevenson & Busby (2015) and Chaudhry et al. (2005) emphasising need to detect and reduce counterfeiting activities (anti-counterfeiting initiatives) via a networked governance model of SCQM so that the firms' supply performance (FSP) can be improved. The resulting SCM practices and TQM practices measures the firm's supply performance having four sub-constructs: Cost, Flexibility, Relationship, and Responsiveness. This study explores the counterfeit knowledge stream in supply chains in terms of theory, context, and method. This study follows the theory/context extension method. The deception and signalling theories (see section-2.2.1) informed the study that the counterfeiters use deceptive status (brands) signalling as a misleading strategy that influences observers to purchase counterfeits. Therefore, the product presentation using the trusted channel manipulates the signals of a fake product as genuine (Mavlanova & Benbunan-Fich, 2011). The results of this study provide the basis for a cautionary note to buyers to gather new knowledge about the advanced presentation techniques used by the vendors. This study also confirms that both concepts ANCT-INT and SCQM have knowledge link / relationship (see Table-2.3.7) and suggest that with the higher the level of successful implementation of ANCT-INT items' measures, under SCQM environment, in the automotive industries supply chains will enhance the firm's supply performance (FSP). The higher level of successful implementation of ANCT-INT items' measures in the automotive supply chains in Pakistan is only possible in a suitable technologically supported SCQM environment. This study provides theoretical evidences to integrate varied concepts of ANCT-INT and SCQM with FSP in order to validate the model (see section-2.3.4a, Fig-8.3b).

Fig-8.3b: Antecedent and Consequent relationships among ANCT-INT, SCQM-Imp, & FSP

Q1.1) How the theoretical arguments, SC complexities, and assumptions underpin the counterfeiting knowledge stream and help SC practitioners to detect counterfeit signals to avoid an illicit purchase?

The theoretical arguments, supply chain complexities, and assumptions that underpin the counterfeiting knowledge stream can help supply chain practitioners to detect counterfeit signals and avoid an illicit purchase by providing a framework for understanding the problem of counterfeiting and the various factors that contribute to it. Theoretical arguments such as crime protection theory and deception theory, for example, can help practitioners to understand the motivations and methods of counterfeiters and the ways in which they attempt to deceive consumers (section-3,2.4b). This knowledge can help practitioners to identify and detect signs of counterfeiting, such as suspicious behaviour or patterns of activity, and to implement measures to prevent counterfeiting. Supply chain complexities, such as the global nature of supply chains and the increased use of e-commerce, can also contribute to the problem of counterfeiting (section-2.2.4c). Understanding these complexities can help practitioners to identify and address vulnerabilities in the supply chain, such as weak links in the distribution chain, and to implement measures to secure sensitive areas and control access to equipment and materials used in the production process (see section-2.2.5). In summary, the theoretical arguments, SC complexities, and assumptions underpinning the counterfeiting knowledge stream can help practitioners to detect counterfeit signals, and avoid an illicit purchase by providing a framework for understanding the problem of counterfeiting, identifying and addressing vulnerabilities in the supply chain and challenging assumptions that may be hindering the detection of counterfeit signals (see Table-2.2.5a). This study contributes to the joint knowledge stream of the theories [RBV, signalling, and deception theory] that recognises the fact that the counterfeiters use deceptive status (brands) signalling as a misleading strategy that influences observers to purchase counterfeits (deceptive buying). Thus, the theoretical arguments, SC complexities, and assumptions underpin the counterfeiting knowledge stream consider theory as a direct guidance for managerial actions (Q1.1). This study guides managers that technology supports the SCQM capabilities (anticipative, responsive, recovery, adaptive, learning) that can strengthen anti-counterfeiting strategies to counter counterfeiting (see section-2.3.5). Managers can use SCQM capabilities as an evaluation tool to assess supply chain resilience, weaknesses and strength, and the effectiveness of the elements and practices that support these capabilities to avoid illicit purchases.

RQ.2) What concepts contribute to controlling the product counterfeiting problem?

Several concepts can contribute to controlling the product counterfeiting problem. These include: Supply Chain Management, Intellectual Property Rights, Product Authentication, Brand Protection, Legal Measures, Consumer Education, Technology, and Collaboration. (see section-2.2.5). This study discusses different variables / theoretical concepts present in the literature to support the development of the constructs (Q2.1). In section-2.3.3a.1, this study referenced the Vanichchinchai & Igel's (2011) study where reliable and multiple indexes of (SCMP, TQMP, FSP) sub-constructs are discussed, the SCM practices sub-constructs are: information management, lean system, partnership management, and strategy and organisation. Likewise, TQM practices sub-constructs are: customer focus, commitment & strategy, HRM, and information analysis. FSP sub-constructs are: cost, flexibility, relationship, and responsiveness. This study enhances the existing knowledge of the supply chain practitioners about the presence of a positive relationship between the TQMP, SCMP, and ANCT-INT with FSP (see section-2.3.4a and section-4.2.6). During the analysis, this study observes some irrelevant themes (the unmapped citations) not related to the scope of this study and are removed from further investigation (supplier involvement, customer involvement, evaluation issues). Furthermore, mapped concepts like Supplier Quality Management (FSPBPCAQL), Process Management (TQMPRM), and the Quality (TQMSQM) are concepts included in this study for further investigation (see Fig-4.2.6a). The ANCT-INT construct derived from analysing the unmapped citations potentially conceptualized as an antecedent to the SCQM construct (see discussion part of the Table-4.2.5a). In section-2.2.7 (g.1), this study worked out the sorted and condensed version of the anti-counterfeiting strategies, according to the specified theory definition matching criteria, are then clustered to reach four (4) mutually exclusive themes to uncover dominant directions present in the literature and to support a theoretical discussion. These themes are: 1) Contractual binding with partners (28 anti-counterfeiting strategies); 2) Campaign against product counterfeiting (69 anti-counterfeiting strategies); 3) Following best industry techniques to counter counterfeiting activities (115 anti-counterfeiting strategies); 4) Formulate programs to counter counterfeiting activities (130 anti-counterfeiting strategies). However, this study considers that the initial survey data analysis, alone, is not sufficient for ANCT-INT conceptualization. Therefore, investigative research on CFA is required to support the Initial Survey findings that indicate the potential relationships between ANCT-INT and the SCQM environment (see table-2.3.7).

Q2.1) What variables / theoretical concepts are present in the literature to support the development of the constructs?

This study confirms the relevancy (constructs' reliability and validity) and applicability of the dimensions and measures of the theoretical model (Fig-2.4.0a) for the automotive industry's supply chains in Pakistan. The ANCT-INT construct is hypothesized as directly and positively associated with TQMP, SCMP, SCQMP, and FSP. The TQMP is hypothesized as directly and positively associated with FSP and indirectly associated with SCMP. Thus, the ANCT-INT measures supported model is conceptualized as an antecedent to the networked governance model supported SCQM environment and plays mediating role between TQMP and FSP through SCMP to enhance FSP. Table-7.5.2.1a) shows model indicators and constructs [ANCT-INT items' measures construct is measured reflectively through four (4) reflective criterion measures ANCT-INT-1 (6 items), ANCT-INT-2 (3 items), ANCT-INT-3 (2 items), and ANCT-INT-4 (5 items). Similarly, the SCQM construct is measured reflectively through two (2) reflective criterion measures TQMP and SCMP. The TQMP (6 dimensions with 32 items); SCMP (4 dimensions with 37 items); FSP is conceptualized as a reflective construct with five (5) reflective indicators: Quality (occurrences of counterfeiting phenomenon), Cost, Flexibility, Relationship, and Responsiveness. This study operationalizes the hypothesized model, where the constructs (measurement and structural constructs) within the model are empirically tested with the help of the validated instrument to capture the impact of ANCT-INT on the FSP in the automotive industry's supply chains in Pakistan, under the influence of the SCQM environment. The exploratory phase is supported by secondary information, interviews, and group discussion, where respondents' views are evaluated by using Nvivo applications. The interviewee (s) shows their concerns about the existence of the product counterfeiting phenomenon in the automotive industry's supply chains in Pakistan, mostly in aftermarket supply chains, the interviewees say that the OEMs have no control over the open market. As far as the before the market is concerned, the interviewee (s) admitted that there are possibilities of product counterfeiting phenomenon at decoupling points in the licit supply chains under pressing conditions. The interviewee (s) also show their preferences for anti-counterfeiting strategies. The counterfeit knowledge stream and the content analysis-based information sources (as a unit of analysis) are used as data collection techniques. The Journal articles & publications are used as a unit of observation. Thus, secondary information source support is available for the investigation to answer the first and second research questions (R1 & R2). That is, the ANCT-INT measures supported model is conceptualized as an antecedent

to the technology supported SCQM environment and plays mediating role between TQMP and FSP through SCMP to enhance FSP. To confirm the observations, sizeable responses are required from the SC practitioners to address the research problem. The explanatory study processed 257 responses (out of 305 survey responses) and analysed them on an individual level in a functional group (employment cohort) to get an estimate of the size of the effect of their interests (perceptions). The responses are not analysed on the firm's level. The study uses the collective wisdom of a functional group instead of relying on a single informed (or potentially not much informed) source to answer the research question. The respondents (individuals) are SC-decision-makers representing the auto-parts manufacturing industry and perform their role (employment cohort) at their workplace (PAAPAM member firm). Therefore, the cohort/groups (strategic, operational, technical) are considered as a unit of analysis, a survey is considered as a data collection method, and the respondents (SC practitioners) of the automotive firms (PAAPAM members) are considered as a unit of observation. This study completes the content analysis and citation mapping activity to cover all the dimensions of the model (addresses Q1.1 & Q2.1).

RQ.3) What is the impact of the anti-counterfeiting strategies on a firm's supply performance?

Anti-counterfeiting strategies can have a significant impact on a firm's supply performance. These strategies can help to improve the overall quality and reliability of a firm's products and services, which can lead to increased customer satisfaction and loyalty. Effective anti-counterfeiting strategies can help to reduce the number of counterfeit products in the market, which can help to protect a firm's brand reputation, improve efficiency, reduce cost, and intellectual property rights. This can lead to increased brand recognition and customer trust, which can in turn drive sales and revenue (section-2.2.4 (a & b)). By taking steps to prevent counterfeiting, firms can reduce their exposure to legal action and financial losses that can result from selling counterfeit products. Section (7.5.4) discusses (H0 to H6c) that this study broadened the scope of TQM (H1, H3, H4a, H4b) to cover SCM practices in SCQM environment and firm's performance dimensions, such as cost, quality, and responsiveness. The data shows that TQMP construct significantly correlated with SCMP and FSP. Three negative relationships (H0, H2) infer the possibility of a knowledge gap among the participants to understand the pronounced effect of TQMP on other constructs. Similarly, outcome of this study with broadened scope of TQM supports that the ANCT-INT initiative taken in the presence of SCQM environment would enhance FSP. The data shows that TQMP construct significantly correlated with ANCT-INT, SCQM, and FSP (H5, H6a, H6c). The negative relationship (H6b) infers the possibility of a knowledge gap among the participants to understand the pronounced effect of ANCT-INT on SCMP. This study also sees the possibility that participants may have the understanding that without a suitable environment SCMP is difficult to take the ANCT-INT initiative and implement strategies successfully to enhance FSP. As in Fig-7.5.4a, the proportion of variance present in the dependent variable that can be explained by the strength of the SCQM environment to further enhance FSP (R^2=0.558). This study, having CFA application limitation, infers that the SCQM environment would impact positively on FSP when relevant SCMP is applied.

Q3.1) How can a structural model building technique examine the relationships among the constructs?

In section-7.2, the constructed level of the model assessment includes testing the External Validity and Nomological Validity of the SCQM-Imp environment-supported construct. The External Validity is assessed through a MIMIC model, which is specified using two constructs in PLS (The formative and the reflective SCQM-Imp environment-supported construct conceptualizes as the "Phantom construct"). Fig-7.5.3b shows that the path coefficient (β) between the formative SCQM measurement model and the reflective measurement model of the SCQM (the phantom construct in the MIMIC model) is strong and significant, with a (β) value of 0.971 and a t-value of 495.269. The variance in the reflective SCQM measurement model is fairly explained by the formative SCQM model, with an R2 value of 0.971. These results confirm the external validity of the SCQM formative measurement model. The path coefficient (β= 0.985) and the significance of the path (t-value=495.269) between the two constructs in the MIMIC model confirmed the External Validity under the influence of the SCQM-Imp environment (see Fig-7.5.3b), to respond to Investigative question Q3.2. Finally, Fig-7.5.3c shows that the path coefficient (β) between the formative SCQM measurement model and the reflective measurement model of FSP is moderately strong and significant, with a (β) value of 0.409 and a t-value of 6.724. In addition, the variance in the reflective SCQM measurement model is weakly explained by the reflective FSP model, with an R2 value of 0.168. This indicates that the SCQM-Imp environment-supported construct performs as expected to enhance the FSP within its nomological network. To assess the formative ANCT-INT items' measurement construct and contents validity [see Section-7.5.3.1, Table-7.5.3.1 (a & b), Table-7.5.3.2a], the indicator level assessment indicates that all the thirty-one (31) measures of the ANCT-INT items' measures are significant and important.

During the model structural assessment (see Table-7.5.4b) and determination of the level of coefficient (see Fig-7.5.6a), the path coefficient among the constructs was found strong and significant except the path coefficient between ANCT-INT and SCMP, which is considered as not strong and not significant, with β = (-0.145) and t-value= (1.201). Thus, the path coefficient between SCQM-Imp and FSP shows that the SCQM-Imp construct acts as the consequent to the FSP construct with significantly less-stronger β = (0.350) and t-value = (2.943), as more FSP enhancement needs more efforts to control the quality of parts supplies and it is only possible when occurrences of the parts' counterfeiting in automotive industry's supply chains in Pakistan can be reduced.

Q3.2) How reliability and validity of the constructs can be determined?

Section-7.3 discusses the details of the model assessment for validation using the PLS approach. Based on the initial survey responses, after the validity test exercise of the extended model [Fig-7.5.2; Table-7.5.2 (a & b)], the outcome of the study supports the ANCT-INT initiative taken in the presence of the SCQM environment to enhance FSP. The indicator level assessment indicates that all indicators' loading and their significance are exhibited in the reflective indicators loading table, [see Section-7.5.2.1, Table-7.5.2.1a as the reflective measurement model]. The loadings of all the reflective indicators are above the recommended threshold of 0.7 [see indicators reliability discussion concerning Cronbach's alpha (CA) & composite reliability (CR) scores, AVE, and the Fornell-Larcker criterion matrix]. Table-7.5.3.1a shows T-values of all formative indicators are significant, in different p-values. Therefore, the indicator validity test of the formative constructs is accepted. The details about the assessment of the validity of the ANCT-INT constructs (first and second order) and the stages of the construct's dimensionality reduction process are discussed in Section-7.5.3.

8.3 CHALLENGES AND GAPS IN THE STUDY (CONTRIBUTION)

To fulfil the investigative need (to justify exploratory and explanatory studies for hypothetical model generalization), this study recognizes the gaps (contribution) identified as follows:

1) There is significantly limited research on increased academic attention on the SCQM environment, anti-counterfeiting, and traceability issues in supply chain. Attentions to scholarly contribution to the theories is also limited.

2) Relying only on the secondary information-based statistical evidence lags in controlling the occurrences of the counterfeiting phenomenon in supply chains (Staake et al., 2009, p.341). Significantly, limited research exists to fulfil the need to contribute empirical efforts to create counterfeiting research streams separately.

3) There is no investigative study found introducing combined anti-counterfeiting strategies to control product counterfeiting in the automotive industry's supply chains in Pakistan.

4) Additionally, there is no investigative study found that integrates different knowledge streams (Annexure-S-1 to S-3) to create counterfeiting research streams (focused approach to ANCT-INT and SCQM).

5) The Counterfeiting Protection Model (CPM) is the only model introduced by Michael Harvey, in the year 1987, to control the counterfeiting problem administratively at the management level, missing the need to emphasize the processes improvement aspect [SCQM, Quality-based performance (Q.M & TQM framework like MBNQA & EFQM)]. Significantly, limited research exists.

6) Additionally, Wilcock & Boys's (2014) study discusses that the standard quality management (SQM) plan is important to maintain product quality and there are quality implications on counterfeiting. The study says that there is a substantial interconnection between the reduction of product counterfeiting and quality management. The study emphasizes the integration of anti-counterfeiting strategies and elements of the SQM. Significantly, limited research exists.

7) Additionally, the structural model introduced by the Vanichchinchai & Igel's (2011) study has managerial limitations related to model incompleteness, model testing, and model validation in the research study.

8) There is no investigative study found related to the hypothetical model where causal relationships are established among constructs (ANCT-INT, SCQM, TQMP, SCMP, and the FSP). A clear integrated discussion on the contribution to theory & implication exists.

9) Additionally, confirmation of the completeness of the structural model and ability to capture the impact of the anti-counterfeiting measures (model appropriateness) on the FSP in the automotive industry's supply chains in Pakistan. Also, confirmation of the statistical validity of the model. The investigative need exists.

10) Exploratory and explanatory study is required, as Vanichchinchai & Igel's (2011) study tests the model in the automotive industry in Thailand and lacks observation and verification steps for external validity in the new context. An investigative study is not available. Vanichchinchai & Igel's (2011) study showed the possibility of response biasness due to convenience samples and requiring random samples for generalization.

11) Additionally, there are limited investigative studies found to unfold the reasons for the existing reality that the national cultural context matters where ethical buying behaviour of the consumers can counter the deceptive buying patterns in automotive industry supply chains in Pakistan.

12) Limited research found about addressing the importance of an environment quality signals to detect counterfeits and provide parts' traceability platform to counter illicit purchases. And, the literature also found limited research about SCQM & addressing the counterfeiting issue by focusing on survey, longitudinal, and field studies.

13) There is no investigative study found that contributes to the knowledge stream of the theories [RBV, enterprise theory of crime, crime protection theory, signalling and deception theories] introducing the concept of the "Resource supported signal symmetry (RSSS)" in a cultural context to control the counterfeiting phenomenon in the automotive industry's supply chains.

14) This study with the help of its scholarly reviews and a survey outcome reveals that the technology is in its early stage of exploration at firm level. Future research opportunities can explore to find the answer as to how managers, in the presence of the SCQM environment, can trace and track auto parts for decision making to control product counterfeiting possibilities.

15) The literature review found limited research on addressing reasons for over-dependence on the suppliers, categorizing counterfeiting activity signals, and determining a relationship between time pressure and workload pressure, in making purchasing decisions.

16) There exist methodological challenges (see section-3.2.1) in conducting mixed method of investigation (resource with multiple forms of data, sampling issues, page & words limitations, inter & multi-disciplinary team work, analytical & interpretive issues).

8.3.1) THEORETICAL CONTRIBUTIONS

This study begins by exploring the essential theories, directly or indirectly linked to the counterfeiting phenomenon in supply chains and are helpful in managerial decisions making to counter counterfeiting activities. The combined theories (CPT, RBV, ST, DT) provide reasons for the concept of integration (TQM & SCM) to SCQM, which was missing in the Michael Harvey CPM model. The concept of the integration to SCQM helps in building an environment where the quality management systems are used to improving supply chain operations to control product counterfeiting. The combined theoretical contribution also provides reasons to managers to implement the anti-counterfeiting strategies in their businesses to prevent the production and distribution of counterfeit goods. This study contributes that the ANCT-INT items' measures (Themes#1 to 4) can act as an antecedent to the SCQM environment. This study recognises (known) that the abrupt changes in an environment and the complexity in the processes may affect firm's competitive advantage negatively. What is not known is how important is a context to signalling environment to enhance firm's competitive advantage.

This study contributes to the ongoing investigation concerning SCQM and counterfeiting literature by shedding light on how the technology attributes can be integrated into combined theories. This study reveals that supplier selection, supplier management, and quality assurance processes are important in the area of SCQM knowledge stream. Furthermore, the relationship between the quality management practices and the performance of the supply chain (cost, lead time, flexibility, and responsiveness) is also important.

This study recognises (known) the main study concern that the buyers look for the original parts are deceived by the false (deceptive) signals' communication. This study recognises (known) the technological resources (networks, clouds computing and big data) for an integrated understanding for long-term firm competitiveness. This study also recognises the fact (known) that the technology promises to create smart contracts to improve transparency in the transactions and remove process ambiguities. What is not known is whether technology helps the practitioners to control product counterfeiting activities in SC and enhance FSP in the automotive industry's supply chains in Pakistan. This study directly contributes to signalling theory (see section-2.2.1-part-C) by taking measures to implement relevant anti-counterfeiting strategies (parts' quality signal) successfully, mediating through SCQM (signalling environment), to enhance the FSP in the automotive industry's supply chains in Pakistan.

This study confirms the presence of the auto parts counterfeits infiltrating the automotive industry's supply chain (both before and after-market) in Pakistan. Thus, this study contributes to the RBV and signal theory concerning technology where information and communication technologies (ICTs) have extended their powerful reach to utilize internal resources. The RBV makes a useful distinction between information technology (asset-based) and information systems (mixture of assets and capabilities). The technology supply chain, anti-counterfeiting strategies, and the parts' traceability aspect embraces the RBV and invites experienced researchers to capitalize on the RBV and signal theories' potential when contributing to counterfeiting knowledge streams (see Table-2.3.5a). Therefore, the combined theories informed the research model to improve the supply performance and control product counterfeiting issue.

Table-8.3.1: Theories informed the research model

Informed	**SCQM**	**ANCT-INT**	**FSP**
CPT	real quality performance requires an equal focus on both intra-firm (purchasing consortia, warehousing, internal operations) and inter-firm relationships (off-shore operations, distribution-DCs). Thus, the CPT supports SCQM practices to deliver quality products as per the delivery schedule within the minimum cost.	ANCT-INT (Theme#4) that real quality performance can be achieved by introducing the surveillance program to maintain the product specification according to the product characteristics, to improve the quality of the processes, and to use law enforcement agencies to provide legal cover to a product (crisis management plan).	The successful implementation of anti-counterfeiting strategies (Theme#1 to 4) can help firms to proactively protect themselves from criminal activities, and improve their supply performance and control product counterfeiting issue.
RBV	real quality performance requires an equal focus on both intra-firm (pur-	ANCT-INT (Theme#4) to achieve real quality performance by introducing the surveillance	The successful implementation of anti-counterfeiting strategies

	chasing consortia, warehousing, internal operations) and inter-firm relationships (off-shore operations, distribution-DCs). Thus, the RBT supports SCQM practices to deliver quality products according to the delivery schedule within the minimum cost.	program to maintain the product specification according to the product characteristics, to improve the quality of the processes, and to use law enforcement agencies to provide legal cover to a product (crisis management plan).	(Theme#2 to 4) can help firms to establish strategic partnerships with other firms to access resources and capabilities that it lacks internally. A flexible firm can utilize their best resources to address cost, quality, and suppliers' relationship issues to enhance FSP and control product counterfeiting problem in the automotive industry's SCs.
ST	real quality performance requires an equal focus on both intra-firm (SOPs, regulated operations, inspection and logistics) and inter-firm relationships (SOPs, agreements of outsourcing, campaign, inspection and logistics). Thus, the ST supports SCQM practices to protect the licit supply chains through regulated procedures**.**	ANCT-INT (Theme#3) the techniques like the product technical evaluation, tracking and tracing, inspection and logistics, data protection, data mining & data visualization are important to address the product counterfeiting issue**.**	The successful implementation of anti-counterfeiting strategies (Theme#1 to 3) can help firms to send the product quality signal to their customers by investing in advanced technologies. A flexible firm can utilize their communication platform (lobbying, advertisement) to address cost, quality, and suppliers' relationship issues to enhance FSP to control product

			counterfeiting problem in the automotive industry's SCs.
DT	real quality performance requires an equal focus on both intra-firm (purchasing consortia, warehousing, internal operations) and inter-firm relationships (off-shore operations, distribution-DCs). Thus, the DT supports SCQM practices to deliver quality products through licit supply channels within a minimum cost.	ANCT-INT (Theme#4) to achieve real quality performance by introducing the surveillance program to maintain the product specification according to the product characteristics, to improve the quality of the processes, and to use law enforcement agencies to provide legal cover to a product (crisis management plan)	The successful implementation of anti-counterfeiting strategies (Theme#3 to 4) can help firms to use the auto parts traceability technology to detect and prevent deception in the marketplace. A flexible firm can utilize their best resources to address cost, quality, and suppliers' relationship issues to enhance FSP and control product counterfeiting problem in the automotive industry's SCs

The other contribution is to develop the joint knowledge streams (Annexure-S-1, S-2, and S-3), which reveal that the managers have a strong willingness to work in an environment where parts' traceability is possible to control the product counterfeiting activities in the automotive industry's supply chains. Counterfeiters make strategies to exploit signals (quality, traceability, vital parts' demand, over-dependence on suppliers, time pressure, workload pressure, and markets' accessibility) and make counterfeits available in the market. This study introduces the anti-counterfeiting strategies to signal the counterfeiters to refrain from their illicit attempt to penetrate the licit supply chain (penalties & legal cover).

8.3.2 CONTRIBUTION TO PRACTICE FOR MANAGERS

This study recognises that the managerial contribution of supply chain quality management includes setting quality standards and goals, implementing processes and procedures to ensure compliance with those standards, monitoring and measuring performance, and taking corrective action when necessary. This includes implementing quality management systems such as ISO 9001, developing and maintaining supplier relationships, and implementing continuous improvement initiatives. Effective communication and collaboration with all stakeholders in the supply chain, including suppliers, customers and internal teams, is also crucial for the success of supply chain quality management. The product's quality continues to be an important attribute in any relationship to increase firm's performance. Managers should understand how firm's resources influences its competitive position (RBV). Managers should also understand the importance of meaningfully aggregate signals, interpret signals in sequence and read message patterns. Moreover, the supportive signalling environment, either within a firm or between organizations, can reduces information asymmetry. Managers should understand that the environmental distortion occurs whenever the medium that propagate the signal reduces the observability of the signal (signal deception). Firms should recognize the cost of observability of the signals, as customer can recognize signals of trust. For that matter, managers should make a quality plan for the SCQM environment to help firms to take competitive advantage. This study recognises that contribution within the RBV is conceptual rather than empirical in nature.

Managers should first identify & assess the potential risks of counterfeiting, so that the company can prioritize and allocate resources effectively. This study evaluates the structural model (see section-8.2b) that can help managers to implement anti-counterfeiting strategies effectively to protect companies brand reputation, revenues and gain customer trust. For example, in the supply chains "anti-counterfeiting strategies initiative" (ANCT-INT) context, it is difficult for buyers to evaluate which suppliers are genuinely committed to take ANCT-INT initiative (managerial limitation). The expansion of supplier selection criteria highlights the increasing need for suppliers to signal their commitment to meet buyers' continued value determination. This study tries to overcome this limitation and guides suppliers to take ANCT-INT initiative to signal their commitment to buyers. Thus, a supportive environment to supplier's attributes affects buyers' purchase intensions regardless of any economic viability.

This study says that four anti-counterfeiting dimensions (themes) are important to counter counterfeiting activities and managers should collaborate with (upstream/downstream) partners through contractual binding. The managers can use advertising and lobbying tools effectively to create awareness about the harmful effect of the use of counterfeits among the stakeholders. There are security challenges concerning the frequent introduction of modern technologies that made illicit imitation possible. Therefore, managers should use parts' track and trace facility, by using innovative technologies, to counter counterfeiting. The managers should develop special anti-counterfeiting programs for long-term basis to counter counterfeiting. Furthermore, the clear definitions and distinctions of the interrelated terms will help practitioners better understand the factors influencing ANCT-INT.

The four complementary theories (CPT, S.T, RBV, D.T) that serve as a starting point in the study are general theories requiring further refinement, validation, and testing. Combining theories to disclose answer to the research questions (by analysing, explaining, predicting, designing, and acting) help managers to better understand the implications of the use of technology in SC to control product counterfeiting problem. The SC structural issues are addressed by CPT and S.T processes [see section-2.3.5 (a-1); Table-2.3.5a] where CPT explains how complex inter/intra-organizational dependencies are handled, and the increasing importance of information transparency. The S.T focuses on the cost of observability of the signals, quality plan, and strategic relationships. To understand how technology attributes can lead to an adjustment in firm size and design of the contractual agreements. Finally, the D.T provides a rationale for assessing the role of smart contracts that can enhance control on processes offered by technology, after harmonizing the conflicting goals. The methodological knowledge, needed to address research questions, is derived systematically. This study benefits managers to understand how the theoretical framework applied to SCQM research would impact firms' domain.

8.4 RESEARCHER'S VIEW & REFLECTION ON THE RESEARCH OUTCOM

The main concern of this study is that buyers look for the original auto parts in Pakistan and are deceived by the false signals' communication. Also, the fake auto parts are easily available in Pakistan and no supply chain control exists. So, the research problem is to control the product counterfeiting phenomenon in the automotive industry's SC in Pakistan.

- The secondary knowledge streams revealed that product counterfeiting is an international problem and considered as a serious crime in the business operations. The secondary knowledge streams also revealed (see section-2.1) that the product counterfeiting brings clear cost to companies, brings damage to brand equity, and brings negative multiplier effect to governments. It leads to lower fiscal spending and higher economic losses. In turn lead to higher shortfall in revenue collection and higher negative impact on GDP of a country. The secondary knowledge base confirms that the product counterfeiting activities is an investigative challenge considering its clandestine nature. During the investigation it was found (see section-2.2.4b) that hardly any related trust-worthy statistics exist which can reflect the real situation at the international ports. So, there is a need to contribute empirical efforts to create autonomous counterfeiting knowledge stream separately instead of building blocks to defend efforts distributed around the management efforts.

- Mostly existing literature discusses the non-deceptive counterfeits' buying instead of the deceptive counterfeits' buying (see section-2.2.4). My research contribution is that I have investigated and collected the relevant knowledge, compiled the information, sorted and analysed the information, and develop the framework that can integrate (Annexure S-1 to S-3) the mismatch of the two most critical disciplines (TQM & SCM) for organisational competitiveness to enhance the FSP. Highlights the theoretical evidence that support the SCQM environment to enhance FSP. The theorised research questions are helpful for the incremental development of a research design that makes it easier to replicate or reject previous findings. The next step was to identify the factors that may have contributed to the product counterfeiting problem.

- This study generates novel insight to the counterfeiting issue and collected / sorted / compiled anti-counterfeiting strategies after performing review-based synthesis process and condensed /clustered them to reach to 31 strategies (see table-C). Thus, this study contributes to introduce (see fig-2.2.7k) the new concept (ANCT-INT).

- After finalising the investigative requirements (reciprocity, reflexivity, and reflection), the exploratory process was adopted (see section-3.2.1.1) to narrow down the scope of the topic and transform the undefined problem into the defined problem by highlighting the specific research objectives. I decided to use methods (interviews and initial survey) to gain insights into the problem.
- Before conducting an interview planning, the steps mentioned in the guideline for qualitative research interview [Myers & Newman (2007), Fig-3.2.2.2.2] were followed. The next step was then to plan to conduct the interview of the qualified interviewee, using convenience sampling techniques, and performed the pertest exercise which made final interview successful in the limited time (see secton-3.2.3.2). Here, good communication is necessary to satisfy the investigative need of the respondent.
- I also learned from the interview process that well-defined script should be prepared beforehand so that interviews can be used for surveys to confirm the reality. Maintaining a comfortable environment and positive rapport during the interview are very important during phase-to-phase interviews (see section-3.2.3.4). Also, post interview stage of the interview process is also important where interview responses of the interviewee are recorded, transcribed, summarized, coded, and themed according to the research objectives.
- I also learned after conducting the interview that the question asked should be neutral and specific to the problem that invite reflection by the interviewee about things they have said (encourage interviewee to reveal as much as possible). The issue of mutual trust is important here.
- I also learned that language usage revealed itself as problematic (geo-ethnic accent), like how words are pronounced, vocalized with irregular grammar, use of slangs in speech, and non-verbal communication.
- I also learned after the interview that I (as a researcher) should bracket my views and put myself in other shoes to understand what it is that they see and saying.
- I also learned that the transcription is a powerful act of representation. In a naturalized transcription, the respondents' remarks should be presented as spoken by the respondents and it should not over-filtered. I also learned that transcription presents real challenges to qualitative research.

- I also learned the Nvivo application to process the collected data after interview. The Nvivo application helps in coding and thematically analysing the data (see Fig-4.1.1 (a & b)).
- I also learned that the qualitative process showed that interviewee (s) particularly concerned about the existing product counterfeiting phenomenon in the automotive industry's SC in Pakistan (OEMs & Open market). The interviewee (s) are of the opinion that product counterfeiting mostly takes place in after-market SC and they have no control over the open market. As far as before-market condition consideration, during the discussion, the interviewee(s) admitted that there are possibilities of product counterfeiting phenomenon at decoupling points in the licit supply chains under various pressure conditions (delivery, shortage, lead time, customized requirements, etc. According to their opinion, firms should maintain surveillance teams to explore possibilities of product counterfeiting for the automotive industry's supply chain and use market intelligence to monitor any scrupulous activities in the market. Moreover, the local laws should take a due logical course of action to curtail the possibility of product counterfeiting.
- Before conducting the explanatory survey (quantitative study) to confirm the outcome of the exploratory interview process (qualitative study), Andres (2012) study guideline (to map out the survey research process) was followed (see section-4.2.1.1). I learned that mixed research sees positive value in both the quantitative and qualitative views of human behaviour (see Fig-4.2.2b).
- I also learned that the positivism philosophy explains the investigative phenomenon to measure "single reality" to discover the causal relationship among variables, consider the basis of generalized knowledge. For that matter, well-defined variables/constructs and research instruments are used to justify hypothesized causal relationships (see Fig-2.4.0a).
- I also learned after literature review that the grounded theorists and the critical discourse analysts focus on the meanings contained in a transcript, while conversation analyst focus on the empirical description and analysis of speech
- I also learned the strategy to conduct explanatory survey. Before conducting the confirmatory survey (CFA), the initial survey (EFA) allows researchers to communicate the implications of the study to the qualified respondents. The primary purpose of the initial survey is to check the applicability of the hypothesized model dimensions and measures in the context of the automotive industry's supply chains in Pakistan.

- I also learned that survey instrument should show its clarity, comprehensibility, and completeness. The test is concerned with the design of the instrument and its ability to collect the needed data, the language of the survey instrument, and the best way for disseminating the instrument.
- I also learned that EFA provides practical information on making decisions regarding extraction, rotation, number of factors to interpret, and the sample size.
- To address research question-1, I also learned that in the model extension (exploratory study) phase, the data is collected for analysis. In data analysis, content mapping citations and coding techniques are used.
- The study outcome says that all dimensions and measures of the Thai model are complete according to the collective wisdom of a functional group in the automotive industry's supply chains in Pakistan.
- I also learned SPSS and SmartPlus software applications and the data collected was then analysed (see section-4.2.4), processed (see Table-4.2.5a) and specifically reported with the help of the said software applications. The SEM technique is applied for extended model estimation and the model fit analysis.
- To address research question-2, I also learned that in the model validation (explanatory study) phase, the initial survey was conducted to collect data for analysis. The study outcome says that all measures of the extended model under the SCQM environment are significantly important. New dimensions & measures are identified. The external validity and nomological validity of the SCQM construct are confirmed.
- To address research question-3, I also learned that in the model validation (explanatory study) phase, the same data based on the initial survey was used for CFA study. The study outcome says that all measures of the extended model after the addition of the new ANCT-INT construct under SCQM environment are significantly important. The ANCT-INT construct is valid as a formative reflective measurement model. The external validity and nomological validity of the ANCT-INT construct are confirmed.
- I also learned from the study outcome that large sample size is important to reduce the sampling biasness. Thus, this study still requires more investigative knowledge to confirm the appropriateness of the constructs concerning the extended model.

- I also learned from the study that the present model is complex and the small sample size creates misspecification issues for formative reflective construct, affecting the validity of the outcome of the study. Due to sample size limitation, the measuring instrument used in this study still requires external validity in a new context.
- I also learned from the study that conducting SLR for systematic literature review is important to understand the product counterfeiting phenomenon. A continued research challenge exists for researcher to explore more anti-counterfeiting strategies.
- I also learned from the study that presence of subjectivity in the outcome of the study leads to incompleteness in the model (to capture all dimensions and measures of the construct).
- I also learned from the study that the chance of the generalization of the results of the study is limited due the narrow focus of this study (automotive industry only). Contextual scenario is important for the applicability of any strategy and managers should take caution not to generalize the applicability of one strategy to all consumers, markets, nations, product categories, and industries.
- I also learned that the literature review still needs to reach the unanimous definition of the SCQM environment and its concepts.
- I also learned that the SCQM research considers technology as an important tool to solve problems caused by distrust, lack of transparency, and higher intermediation in the SCQM environment to improve products' quality.
- I also learned that this study gives importance to the SCQM practices to enhance FSP without sacrificing customer satisfaction (influx of counterfeits & vulnerabilities).
- I also learned that the SCQM knowledge stream recognizes the importance of the existing role of the industrial (organisation) and national (social) cultures in a society. The SCQM knowledge stream also recognizes that product counterfeiting is not free from a culture (Table-2.2.1b) where the ethical buying behaviour of the consumers counter the deceptive buying patterns. The existing counterfeiting knowledge stream lacks empirical evidence to confirm the existing gap between counterfeiting and culture.
- I also learned that the cross-sectional study process has its limitation of sample biasness to address the protective nature of product counterfeiting phenomenon. So, this study suggests the managers to conduct a longitudinal study to understand this phenomenon.

- I also learned that the present model still needs more evidences to reduce model mis-specification and incompleteness issue. So, more sampling is required.
- I also learned that theoretical and empirical gap exist to cover the supply side of the counterfeits market (Quach & Thaichon, 2018) to protect brands.
- I also learned that Pakistan in among the several East-Asian countries where product counterfeiting activities are prevailing at a rapid pace. The secondary sources of information confirm that the informal waste assemblers, recyclers, and counterfeiters support smuggling activities through Afghanistan to international treaties (European & Western ports, Free trade zones, etc). Therefore, Pakistan as a case study is important [Taraba, P..et al's (2020); OECD-EUIPO (2017)].
- The progress of the study is against the original intention of the study. The original intention of the study was to conduct a full survey to confirm the theoretical evidence of the study, with the help of a hypothetical model, in the automotive industry in Pakistan. That is, the thesis was set out to undertake CFA using a separate sample of respondents. The pandemic situation impedes the separate survey process to reach to the desired the sample size. So, CFA was performed using the same sample of respondents as used in the EFA.
- In section-8.3, this section summarises the main contributions of the research described in this thesis. It does so with specific reference to the research questions.

CONCLUSION AND OBSERVATION

- This study encourages researchers to conduct longitudinal field and secondary studies to develop and validate theoretical and conceptual research to develop combined knowledge stream (SCQM, ANCT-INT) to enhance FSP.
- This study recognises the theoretical evidence-based studies (Table-2.3.7) that consider counterfeiting as a sensitive issue and recognises that there is a substantial interconnection between the reduction of product counterfeiting & quality management (Q.M). The integrated anti-counterfeiting initiatives with SCQM can reduce counterfeits penetration risk in licit supply chains.
- This study brings insight on how the anti-counterfeiting strategies interact with SCQM to control product counterfeiting in the automotive industry's SC. Emphases given to the supplier quality management (T5) and the process management (T6) within the SCQM environment.
- This study brings insight that four (4) mutually exclusive themes support ANCT-INT concept (see Fig-2.2.7k) that influences FSP. These themes are: 1) Contractual binding with partners; 2) Campaign against product counterfeiting; 3) Following best industry techniques to counter counterfeiting activities; 4) Formulate programs to counter counterfeiting activities.
- This study brings insight that in the presence of the direct relationship between ANCT-INT and SCQM, the path coefficient in the structural model shows that the ANCT-INT construct acts as the antecedent to the SCQM-Imp environment construct with significantly stronger $\beta = (0.881)$ value and t-value= (42.332), an environment where practitioners can make educated decisions.
- This study recognizes that the present literature lacks the theoretical and empirical studies in sharing information technology to enhance spare parts traceability to counter counterfeiting in the automotive industry SC in Pakistan. This study also recognizes that technology in automotive SC is a relatively new and promising domain for investigation.
- This study recognizes that the present literature lacks the theoretical and empirical efforts for both upstream & downstream SC to tie their results together to reach to a conclusive study outcome. This study outcome then helps companies to develop such ethical environment where potential anti-counterfeiting strategies can be implemented successfully to control the product counterfeiting in the automotive industry SC.

- This study recognizes more investigative need to link cultures, ethical buying behaviour, technology supported SCQM environment and product counterfeiting in SC.
- This study recognizes that the quality performance requires an equal focus on both inter-firm and intra-firm relationships (SCQM) among SC partners.
- This study is limited to automotive supply chains in Pakistan and the study results are therefore difficult to generalize to other countries (populations). Thus, a broader and higher level of analysis (national/regional, cross-cultural) is needed in future research studies.
- This research study strongly suggests that the initial survey data analysis alone is not sufficient to conceptualize the concepts of the present model. Therefore, this research study suggests further investigation (detailed survey at firm's level, etc) to confirm the research outcome to perform CFA to give support to the initial survey findings.
- To avoid the sample biasness issue, this study recognizes the importance of the SEM analysis & correlated residuals techniques to complete the longitudinal study. Counterfeiters exploit the latest technologies to deceive the customers.

8.6 RESEARCH LIMITATIONS

Theoretical limitations exist to understand the unobservable and protective counterfeiting phenomenon in the product counterfeiting body of knowledge stream. The present knowledge deficit exists in terms of the case studies / empirical studies to support the exemplary evidence to uncover the reality behind the clandestine nature of the counterfeiting phenomenon. Gathering primary and secondary data is another limitation, in the pandemic scenario, to reach the expected respondents' data (survey & interview). The valid responses from interviewees are necessary to confirm the presence of the counterfeiting phenomenon in the automotive industry supply chains in Pakistan.

This empirical study outcome relies on the interviewee responses, initial survey, and the secondary data to check the presence of the counterfeiting phenomenon in the automotive industry supply chains in Pakistan with the help of the initial survey method. But the initial survey is limited to the sampling size which leads to sampling biasness again, so as a limitation in the pandemic situation that continues to limit the further step of conducting CFA. Therefore, the respondents' data from the initial survey is used to conduct the confirmation study. This means that the ANCT-INT measurement construct still requires more investigative knowledge to fully account for according to the context of the study and further requires efforts to confirm the appropriateness of the construct concerning the extended model.

Another theoretical limitation of the study is the process of developing the concept of the ANCT-INT construct, as a non-exhaustive exercise, as the evolution of the technologies continues to absorb the outcome of the future research endeavour to enhance the product counterfeiting body of knowledge stream. This affects the completeness and representativeness of the items' measures as research continues according to the future development of the scenarios for evaluating the ANCT-INT (formative reflective structure of the construct) items' measures.

One theoretical limitation of the study is in the process of developing the anti-counterfeiting model and integrating it into the extended knowledge-based SCQM environment. For that matter, the never ended endeavour on behalf of the scholars to perform SLR to address the product counterfeiting issue. A continued research challenge for researcher to explore new strategies to control counterfeiting phenomenon in the context of the diversified research studies.

In the theory definition matching (see Fig.2.2.7j-1), there may be a chance that mutual exclusive selection criteria may be compromised to develop relevant themes. Multiple coder techniques should be applied to segregate the anti-counterfeiting strategies according to the relevant themes. Further analytical improvement is required.

One of the limitations is the possibility of the incompleteness of the research model, likely presence of subjectivity, which arises in the study by introducing SCQM environment signals to capture all dimensions and measures of the construct.

This study acknowledges the limitation of its narrow focus on the automotive industry's supply chains (both before and after-market) in Pakistan, thus precluding the generalization of findings to other sectors that may receive help from different anti-counterfeiting strategies. This study also acknowledges that contextual scenario is important for the applicability of any strategy and managers should take caution not to generalize the applicability of one strategy to all consumers, markets, nations, product categories, and industries.

The opportunities provided by the literature gaps have not been empirically tested in varied context to assure their validity.

Anti-Counterfeiting Strategies Initiative (ANCT-INT) Study Issues

- ✓ The complexity of the model and small sample size may lead to misspecification issues for formative reflective constructs that can affect the validity of the studies. Due to sample size limitations, the measuring instrument may lack external validity in a new context.
- ✓ As a newly developed research stream, limited theoretical support available for the net-worked governance model supported SCQM environment for building typology to organize counterfeits controlling strategies and to handle face model validity limitation issues.
- ✓ Another limitation is in the categorization of counterfeit signals in purchasing decisions that may create problems for decision-makers to make the right purchase decisions.

8.7 FUTURE RESEARCH

This study findings highlights several gaps in the existing technology supported SCQM environment literature and provide an agenda for future research. First, lack of unanimous SCQM environment definition and its concepts that confirm the base of its concept. Second, findings suggest that in the SCQM research tries to use technology to solve problems caused by distrust, lack of transparency, and higher intermediation in the SCQM environment to improve products' quality. Third, findings reveal that literature lacks theoretical and empirical studies as sharing information technology is comparatively a new subject in management. This study encourages researchers to conduct longitudinal, field and secondary studies to develop and validate theoretical and conceptual the SCQM research. There is a need to apply theories (see Table-2.3.5a) that address the dynamic nature of the SCQM environment capabilities. In addition, the role of culture with relational capabilities/competencies in SCQM environment context is under-explored. Future research should exploit different relational theories to gain a better understanding of relational capabilities of technology supported SCQM environment. Further investigative work is required to explore possibilities of improvement in the model.

- ✓ This study is limited to automotive supply chains in Pakistan and the study results are therefore difficult to generalize to other countries (populations). Thus, a broader and higher level of analysis (national/regional, cross-cultural) is needed in future research studies.
- ✓ Possibilities of research for both streams of the supply chain (upstream & downstream) and tie their results together to reach conclusive study outcome in establishing the control of product counterfeiting in supply chains. In this way explore relationships further in the automotive industry's supply chain in Pakistan.
- ✓ Technology in automotive SC is a relatively new and promising domain, future studies could attempt to strengthen the technology supported SCQM framework through refinement and validation across countries and test its usefulness and applicability in different settings and sectors.
- ✓ Theory-building efforts, to enhance parts traceability, in the technology supported SCQM environment are scarce (Touboulic & Walker, 2015), and the refinement and adaptation of existing theories encourage researchers to perform investigative studies.
- ✓ Need to investigate the use of innovative technologies (tagging and DNA analysis, web-based track and trace platform etc.) to counter counterfeiting activities.

- ✓ The buying and selling behaviour of the customers in society is controlled by ethical codes, depending upon their inherited ethical habits. More investigation needs exist to understand the cultural context of a relevant industry before making any strategic decision.
- ✓ This research study strongly suggests that the initial survey data analysis alone is not sufficient to conceptualize the ANCT-INT concept. Therefore, this research study suggests further investigation (detailed survey at firm's level, etc) to confirm the research outcome to perform CFA to give support to the initial survey findings.
- ✓ More qualitative responses (interviews, group discussions, experts' opinions, etc.) are required for the model that should be capable of measuring the impacts of the ANCT-INT on different TQMP, SCMP, and FSP relationship paths
- ✓ More qualitative, Nvivo-based, insight is required to support the results. The study suggested to managers the importance of making the SCQM environment to provide the parts traceability platform for the managers to take the right decision at the right time to control product counterfeiting activities in the automotive supply chains in Pakistan.
- ✓ This study sees the importance of SCRES in the academic and practitioner's communities as the desired level of SCRES is attained by establishing the technology supported SCQM environment. The secondary information reveals that there is a lack of consensus over a well-grounded definition of SCRES to improve firm's competitiveness [Dias et al.' (2018); Kochan & Nowichi's (2018)]. Future researchers are encouraged to explore further to reach to a unified SCRES definition and scope.
- ✓ In the presence of the pandemic situation and GDPR regulation, the initial survey (cross-sectional study) process has its limitation of sample biasness. It is recommended that the different techniques (SEM analysis & correlated residuals, etc) should be applied after completing the longitudinal study. The study requires a longitudinal research study based on empirical testing so that occurrences of the counterfeiting phenomenon can be reduced in the automotive industry supply chains in Pakistan.
- ✓ One of the future purposes of this research is a cross-cultural study which will provide a comparison among cultures of the countries, concerning integrated models' supported anti-counterfeiting strategies. This decision is made to minimize the complexity of the study and to narrow down its scope.

- ✓ The RSSS conceptual understanding enhances the possibility of theoretical testability with internal validity in the automotive industry's supply chains in Pakistan. Future researchers are encouraged to enhance RSSS conceptual understanding.
- ✓ Counterfeiters exploit the latest technologies to deceive the customers. A wide research gap exists to investigate the supply side of the counterfeits market and how the OEMs protect brands (Quach & Thaichon, 2018). Limited research exists.

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25)

LIST OF ANNEXURES – Chapter-5

Table-5.1: Statistics (COMMITMENT & STRATEGY)

COMMITMENT & STRATEGY		TQMPCS1	TQMPCS2	TQMPCS3	TQMPCS4
N	Valid	257	257	257	257
	Missing	0	0	0	0
Mean		4.09	4.10	4.09	4.14
Std. Deviation		.643	.642	.638	.628
Skewness		-.087	-.093	-.074	-.113
Std. Error of Skewness		.152	.152	.152	.152
Kurtosis		-.584	-.580	-.543	-.515
Std. Error of Kurtosis		.303	.303	.303	.303
Minimum		3	3	3	3
Maximum		5	5	5	5

Fig-5.1: Normality (COMMITMENT & STRATEGY)

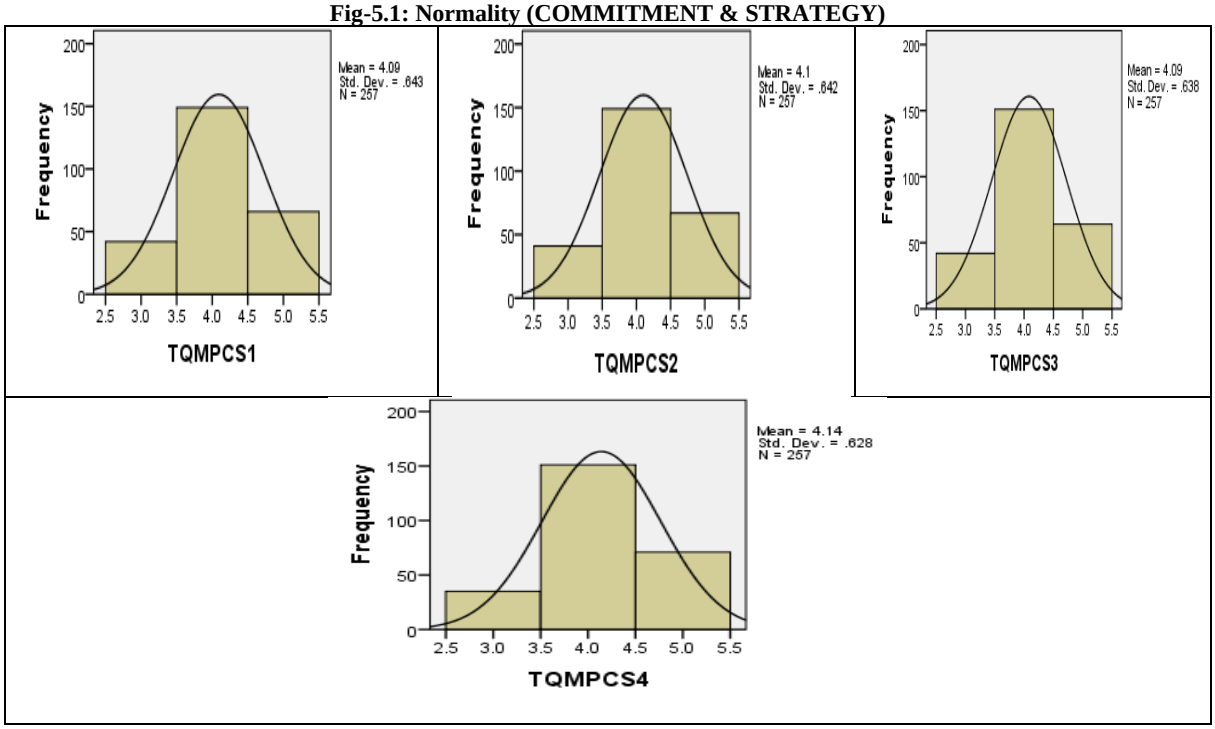


Table-5.2: Statistics (CUSTOMER FOCUS)

CUSTOMER FOCUS		TQMPCF1	TQMPCF2	TQMPCF3
N	Valid	257	257	257
	Missing	0	0	0
Mean		4.04	4.04	4.05
Std. Deviation		.695	.697	.748
Skewness		-.052	-.058	-.089
Std. Error of Skewness		.152	.152	.152
Kurtosis		-.916	-.932	-1.202
Std. Error of Kurtosis		.303	.303	.303
Minimum		3	3	3
Maximum		5	5	5

Fig-5.2: Normality (CUSTOMER FOCUS)

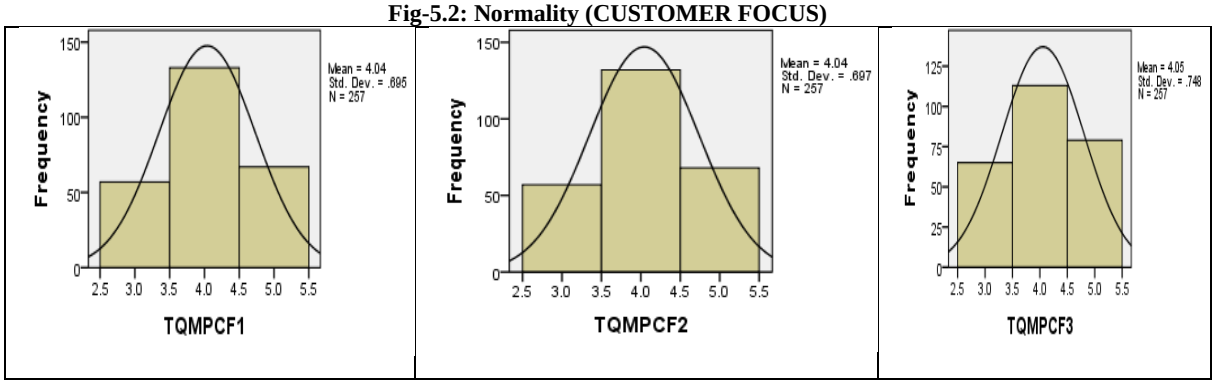
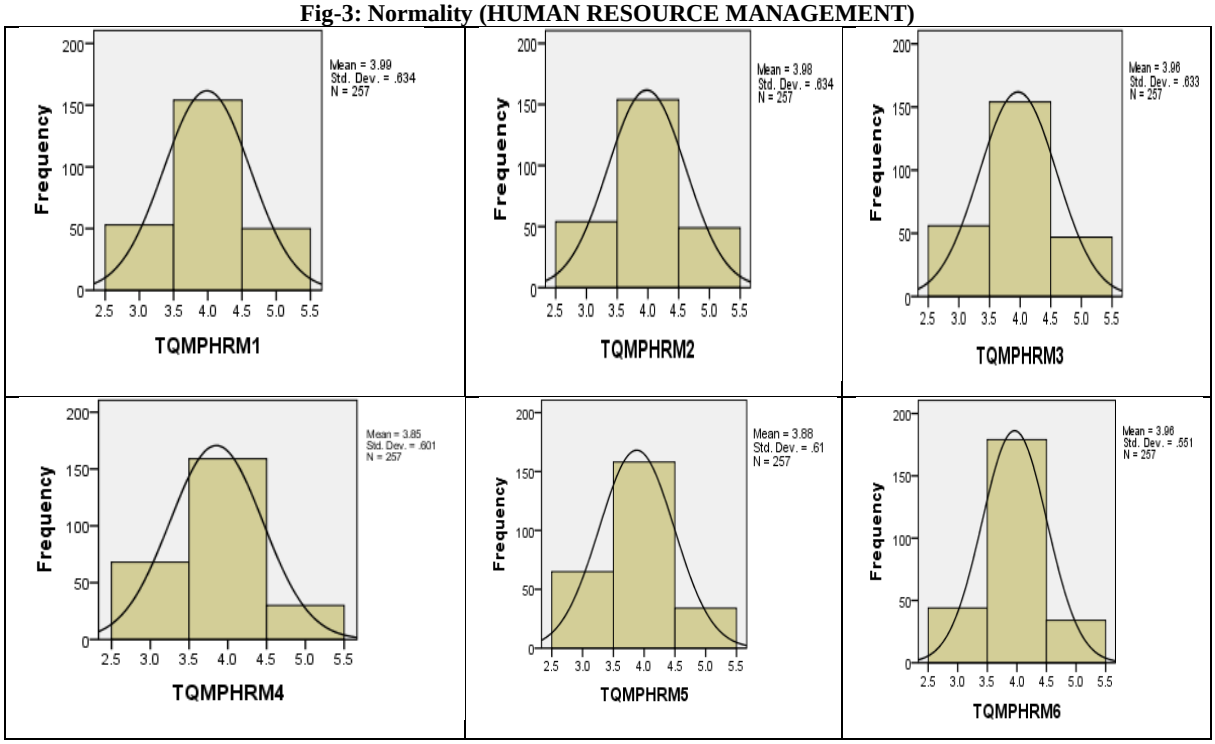


Table-5.3: Statistics (HUMAN RESOURCE MANAGEMENT)

HUMAN RESOURCE MANAGEMENT		TQMPHRM1	TQMPHRM2	TQMPHRM3	TQMPHRM4	TQMPHRM5	TQMPHRM6	TQMPHRM7
N	Valid	257	257	257	257	257	257	257
	Missing	0	0	0	0	0	0	0
Mean		3.99	3.98	3.96	3.85	3.88	3.96	3.96
Std. Deviation		.634	.634	.633	.601	.610	.551	.554
Skewness		.009	.016	.028	.069	.068	-.022	-.017
Std. Error of Skewness		.152	.152	.152	.152	.152	.152	.152
Kurtosis		-.491	-.490	-.488	-.333	-.363	.321	.280
Std. Error of Kurtosis		.303	.303	.303	.303	.303	.303	.303
Minimum		3	3	3	3	3	3	3
Maximum		5	5	5	5	5	5	5

Fig-3: Normality (HUMAN RESOURCE MANAGEMENT)



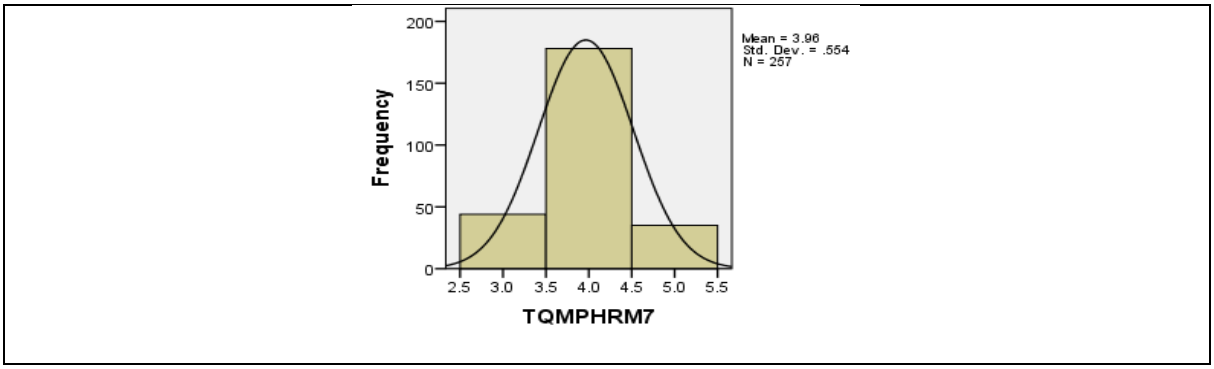


Table-5.4: Statistics (INFORMATION ANALYSIS)

INFORMATION ANALYSIS		TQMPIA1	TQMPIA2	TQMPIA3	TQMPIA4	TQMPIA5	TQMPIA6
N	Valid	257	257	257	257	257	257
	Missing	0	0	0	0	0	0
Mean		3.94	4.10	4.10	3.95	4.00	4.00
Std. Deviation		.634	.557	.561	.671	.637	.634
Skewness		.051	.038	.028	.064	0.000	-.003
Std. Error of Skewness		.152	.152	.152	.152	.152	.152
Kurtosis		-.506	.144	.110	-.766	-.516	-.491
Std. Error of Kurtosis		.303	.303	.303	.303	.303	.303
Minimum		3	3	3	3	3	3
Maximum		5	5	5	5	5	5

Fig-5.4: Normality (INFORMATION ANALYSIS)

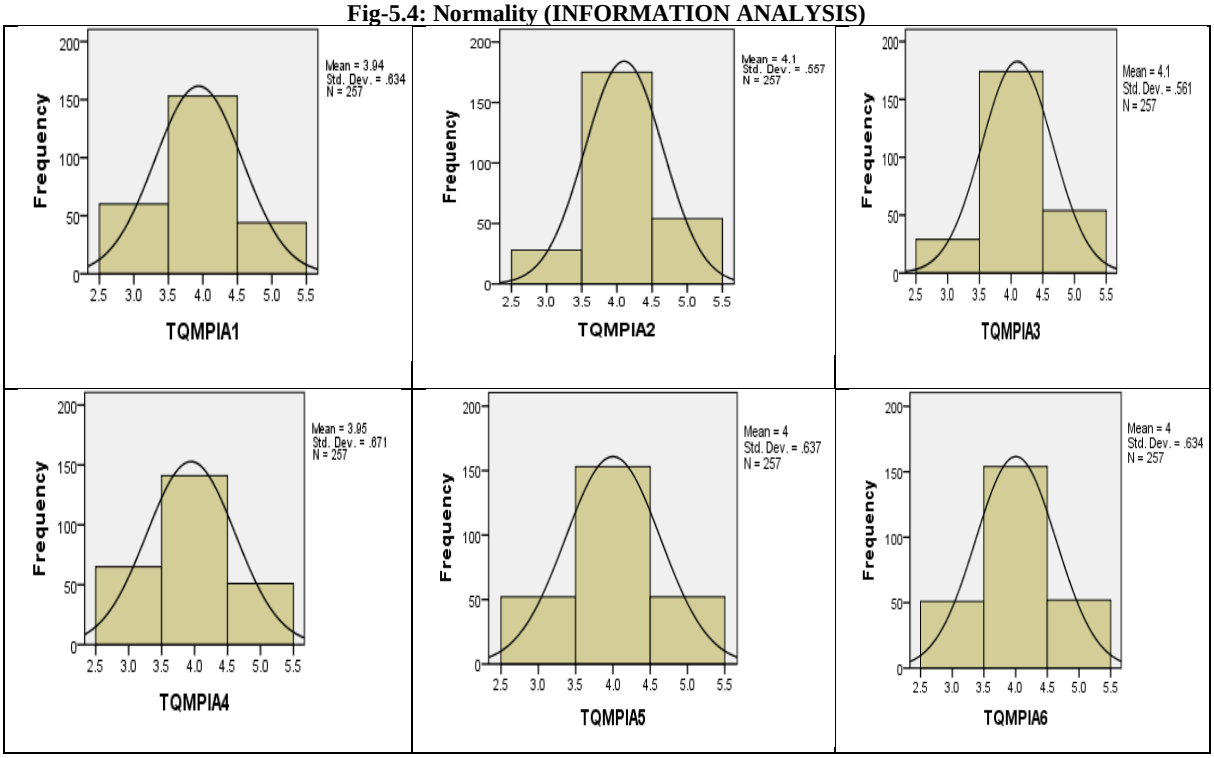


Table-5.5: Statistics (SUPPLIER QUALITY MANAGEMENT)

SUPPLIER QUALITY MANAGEMENT		TQMSQM1	TQMSQM2	TQMSQM3	TQMSQM4	TQMSQM5
N	Valid	257	257	257	257	257
	Missing	0	0	0	0	0
Mean		3.86	3.89	3.96	3.94	4.11
Std. Deviation		.598	.612	.554	.638	.560
Skewness		.062	.065	-.021	.050	.032
Std. Error of Skewness		.152	.152	.152	.152	.152
Kurtosis		-.309	-.366	.279	-.530	.107
Std. Error of Kurtosis		.303	.303	.303	.303	.303
Minimum		3	3	3	3	3
Maximum		5	5	5	5	5

Fig-5.5: Normality (SUPPLIER QUALITY MANAGEMENT)

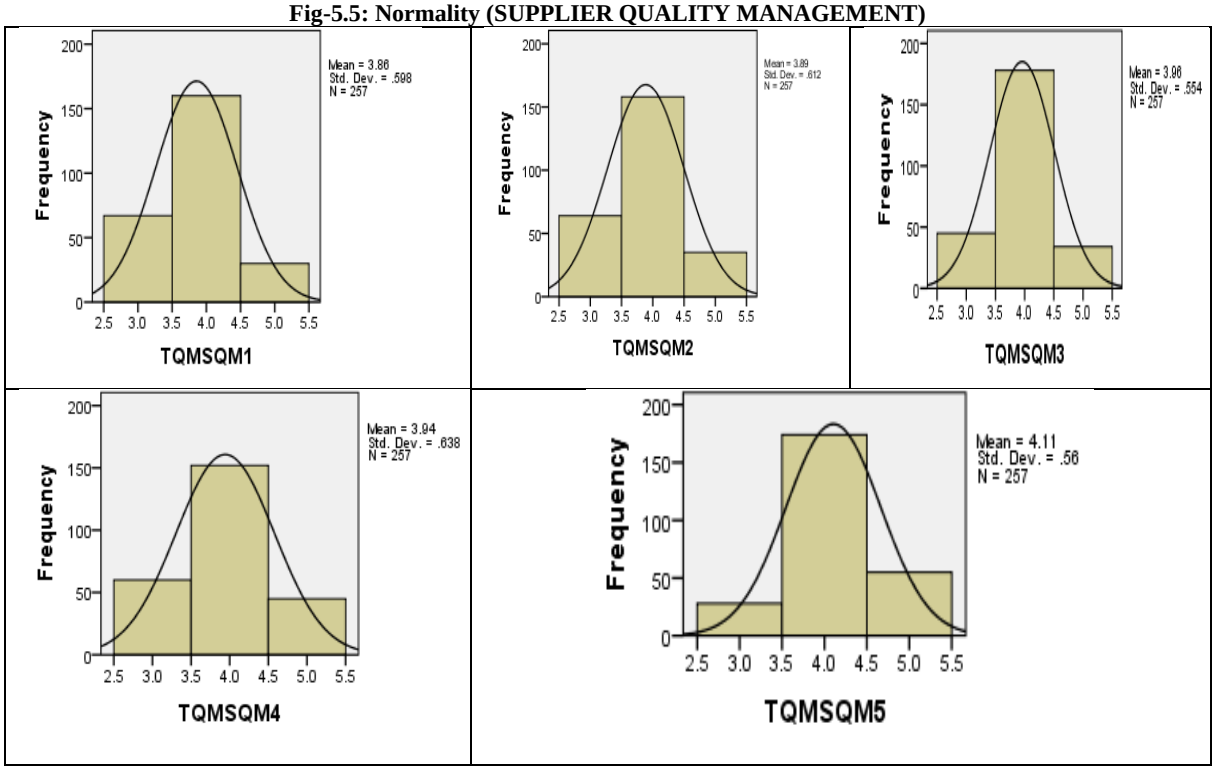


Table-5.6: Statistics (PROCESS MANAGEMENT)

PROCESS MANAGEMENT		TQMPRM1	TQMPRM2	TQMPRM3	TQMPRM4	TQMPRM5	TQMPRM6	TQMPRM7
N	Valid	257	257	257	257	257	257	257
	Missing	0	0	0	0	0	0	0
Mean		4.10	3.95	4.00	4.04	4.07	4.04	4.02
Std. Deviation		.561	.671	.637	.642	.652	.686	.646
Skewness		.028	.064	0.000	-.035	-.070	-.055	-.018
Std. Error of Skewness		.152	.152	.152	.152	.152	.152	.152
Kurtosis		.110	-.766	-.516	-.559	-.638	-.863	-.585
Std. Error of Kurtosis		.303	.303	.303	.303	.303	.303	.303
Minimum		3	3	3	3	3	3	3
Maximum		5	5	5	5	5	5	5

Fig-5.6: Normality (PROCESS MANAGEMENT)

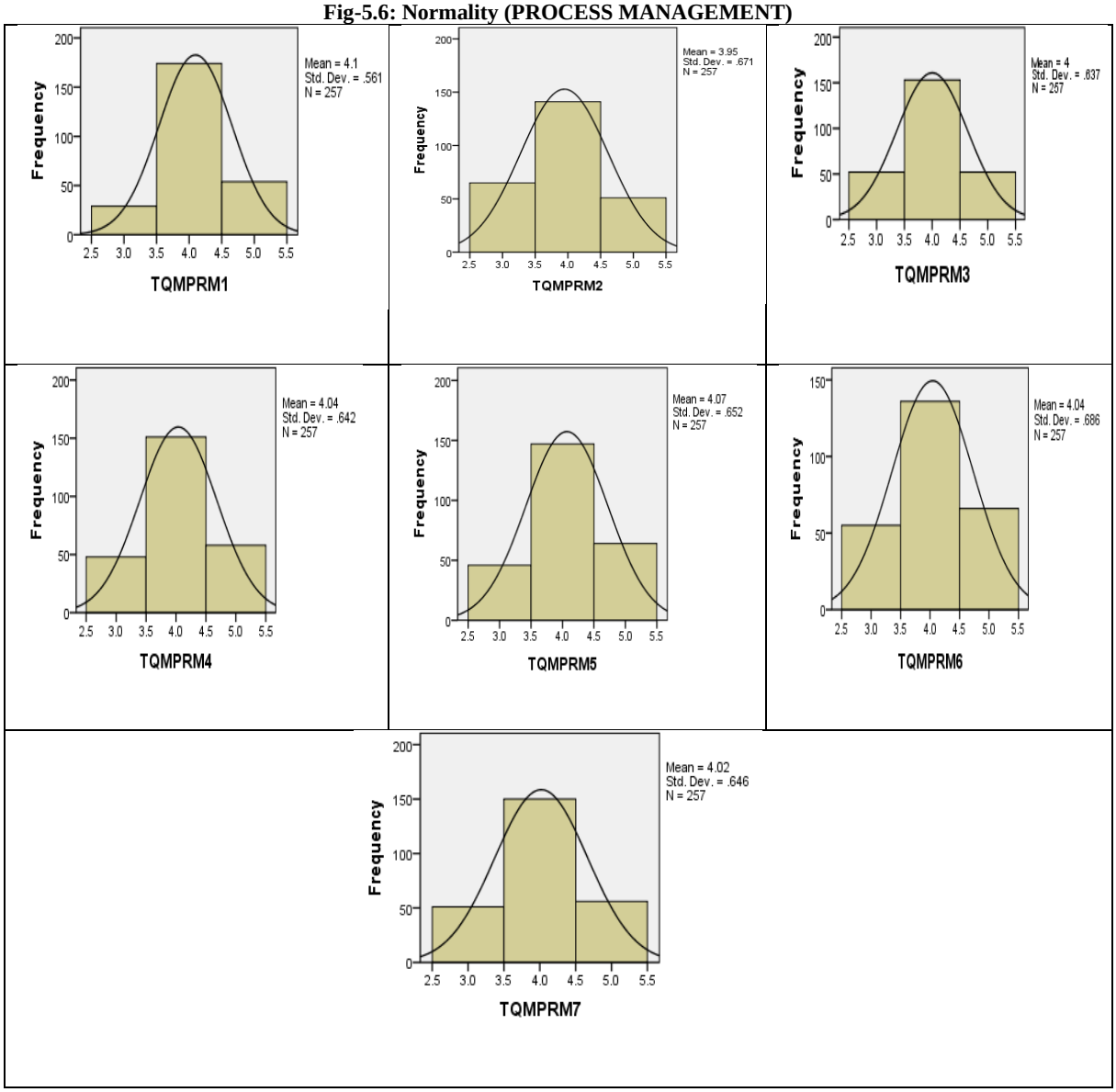


Table-5.7: Statistics (INFORMATION MANAGEMENT)

INFORMATION MANAGEMENT		SCMPIM1	SCMPIM2	SCMPIM3	SCMPIM4	SCMPIM5	SCMPIM6	SCMPIM7
N	Valid	257	257	257	257	257	257	257
	Missing	0	0	0	0	0	0	0
Mean		3.98	3.99	4.32	4.19	4.12	4.14	4.13
Std. Deviation		.739	.734	.677	.704	.792	.781	.779
Skewness		.025	.012	-.483	-.280	-.354	-.392	-.385
Std. Error of Skewness		.152	.152	.152	.152	.152	.152	.152
Kurtosis		-1.162	-1.136	-.785	-.962	-.923	-.830	-.823
Std. Error of Kurtosis		.303	.303	.303	.303	.303	.303	.303
Minimum		3	3	3	3	2	2	2
Maximum		5	5	5	5	5	5	5

Fig-5.7: Normality (INFORMATION MANAGEMENT)

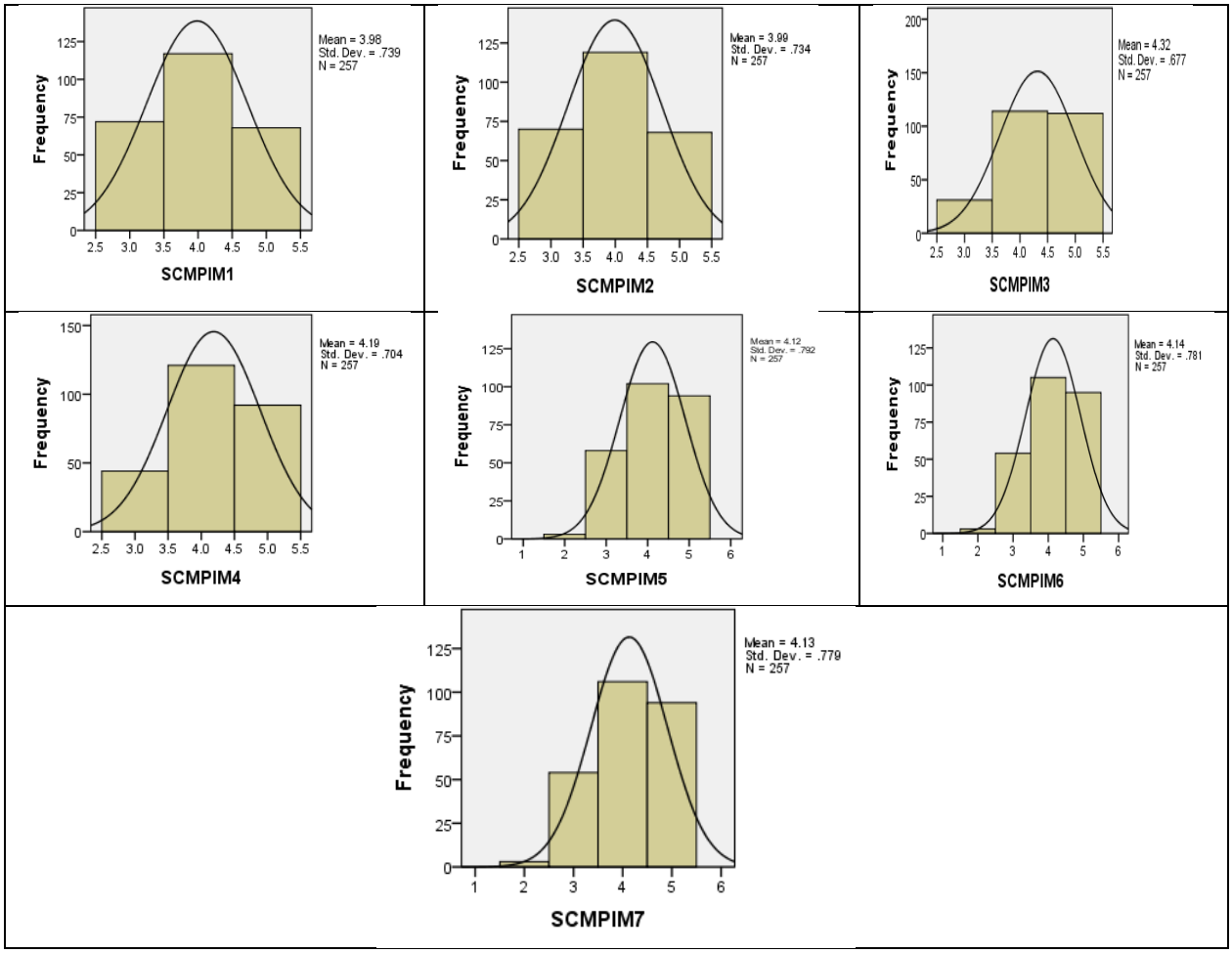


Table-5.8: Statistics (Lean System)

LEAN SYSTEM	N		Mean	S.D	Skewness	Std. Error of Skewness	Kurtosis	Std. Error of Kurtosis	Mini-mum	Maxi-mum
	Valid	Missing								
SCMPLS1	257	0	4.07	.605	-.247	.152	.555	.303	2	5
SCMPLS2	257	0	4.09	.573	-.246	.152	1.050	.303	2	5
SCMPLS3	257	0	4.05	.607	-.235	.152	.505	.303	2	5
SCMPLS4	257	0	4.05	.607	-.341	.152	.894	.303	2	5
SCMPLS5	257	0	4.11	.567	-.242	.152	1.166	.303	2	5
SCMPLS6	257	0	4.11	.567	-.242	.152	1.166	.303	2	5
SCMPLS7	257	0	4.10	.571	-.245	.152	1.095	.303	2	5
SCMPLS8	257	0	4.09	.569	-.244	.152	1.121	.303	2	5
SCMPLS9	257	0	4.09	.573	-.246	.152	1.050	.303	2	5
SCMPLS10	257	0	4.04	.595	-.234	.152	.664	.303	2	5
SCMPLS11	257	0	4.05	.611	-.232	.152	.453	.303	2	5
SCMPLS12	257	0	4.06	.609	-.240	.152	.484	.303	2	5
SCMPLS13	257	0	4.04	.645	-.216	.152	.021	.303	2	5
SCMPLS14	257	0	4.08	.657	-.249	.152	-.080	.303	2	5
SCMPLS15	257	0	3.96	.680	-.097	.152	-.417	.303	2	5
SCMPLS16	257	0	4.01	.609	-.215	.152	.437	.303	2	5

Fig-5.8: Normality (Lean System)

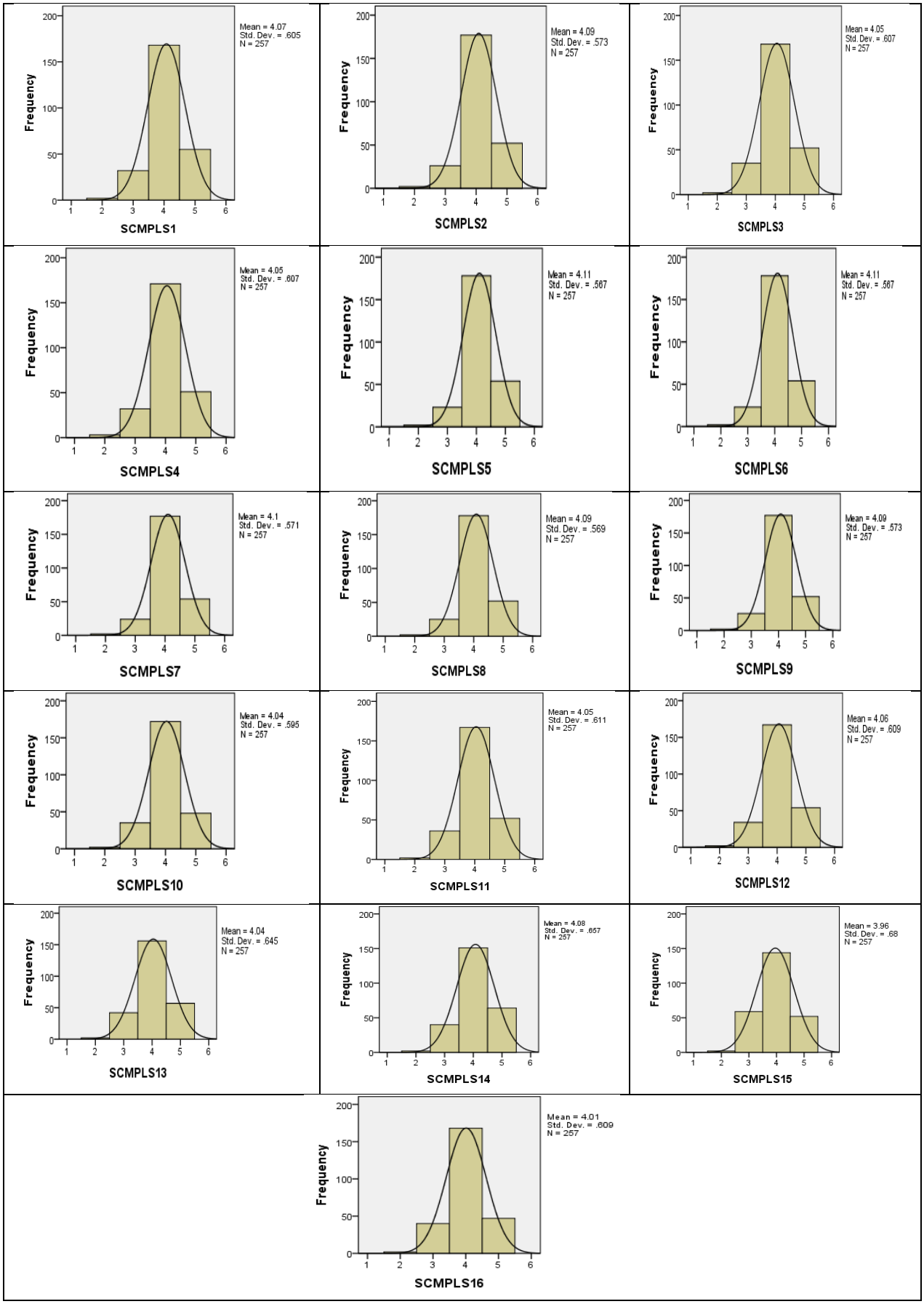


Table-5.9: Statistics (PARTNERSHIP MANAGEMENT)

PARTNERSHIP MANAGEMENT		SCMPPM1	SCMPPM2	SCMPPM3	SCMPPM4	SCMPPM5	SCMPPM6	SCMPPM7
N	Valid	257	257	257	257	257	257	257
	Missing	0	0	0	0	0	0	0
Mean		4.26	4.26	4.19	4.11	4.19	3.98	4.16
Std. Deviation		.590	.612	.611	.717	.666	.631	.674
Skewness		-.134	-.222	-.129	-.170	-.237	.012	-.202
Std. Error of Skewness		.152	.152	.152	.152	.152	.152	.152
Kurtosis		-.498	-.586	-.472	-1.040	-.775	-.466	-.811
Std. Error of Kurtosis		.303	.303	.303	.303	.303	.303	.303
Minimum		3	3	3	3	3	3	3
Maximum		5	5	5	5	5	5	5

Fig-5.9: Normality (PARTNERSHIP MANAGEMENT)

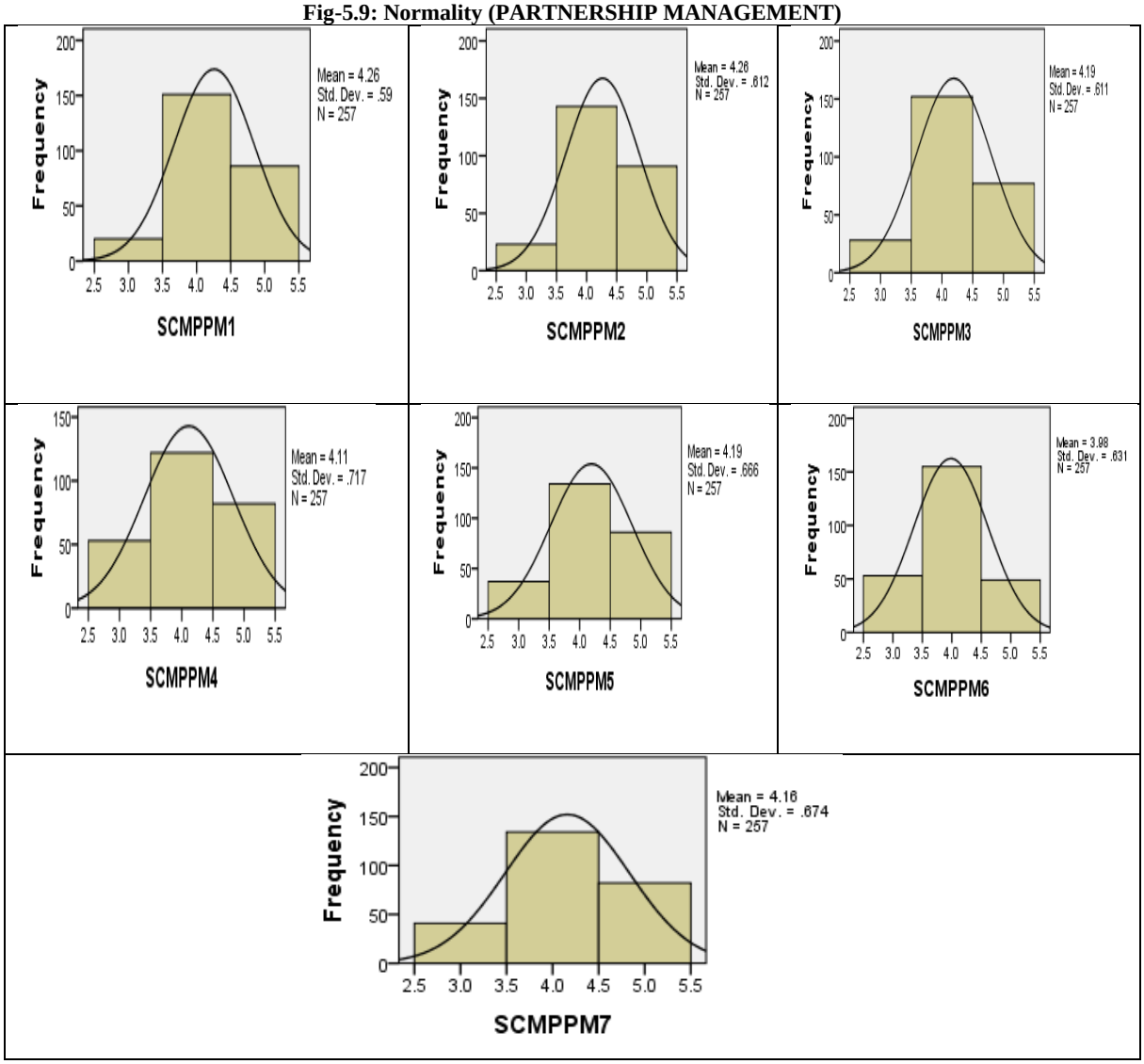


Table-5.10: Statistics (STRATEGY & ORGANISATION)

STRATEGY & ORGANISATION		SCMPS O1	SCMPS O2	SCMPS O3	SCMPS O4	SCMPS O5	SCMPS O6	SCMPS O7
N	Valid	257	257	257	257	257	257	257
	Missing	0	0	0	0	0	0	0
Mean		4.03	4.03	4.28	4.27	3.86	4.15	3.81
Std. Deviation		.582	.579	.452	.446	.752	.359	.847
Skewness		-.002	.000	.963	1.029	.237	1.953	-.208
Std. Error of Skewness		.152	.152	.152	.152	.152	.152	.152
Kurtosis		-.023	.012	-1.080	-.949	-1.200	1.827	-.642
Std. Error of Kurtosis		.303	.303	.303	.303	.303	.303	.303
Minimum		3	3	4	4	3	4	2
Maximum		5	5	5	5	5	5	5

Fig-5.10: Normality (STRATEGY & ORGANISATION)

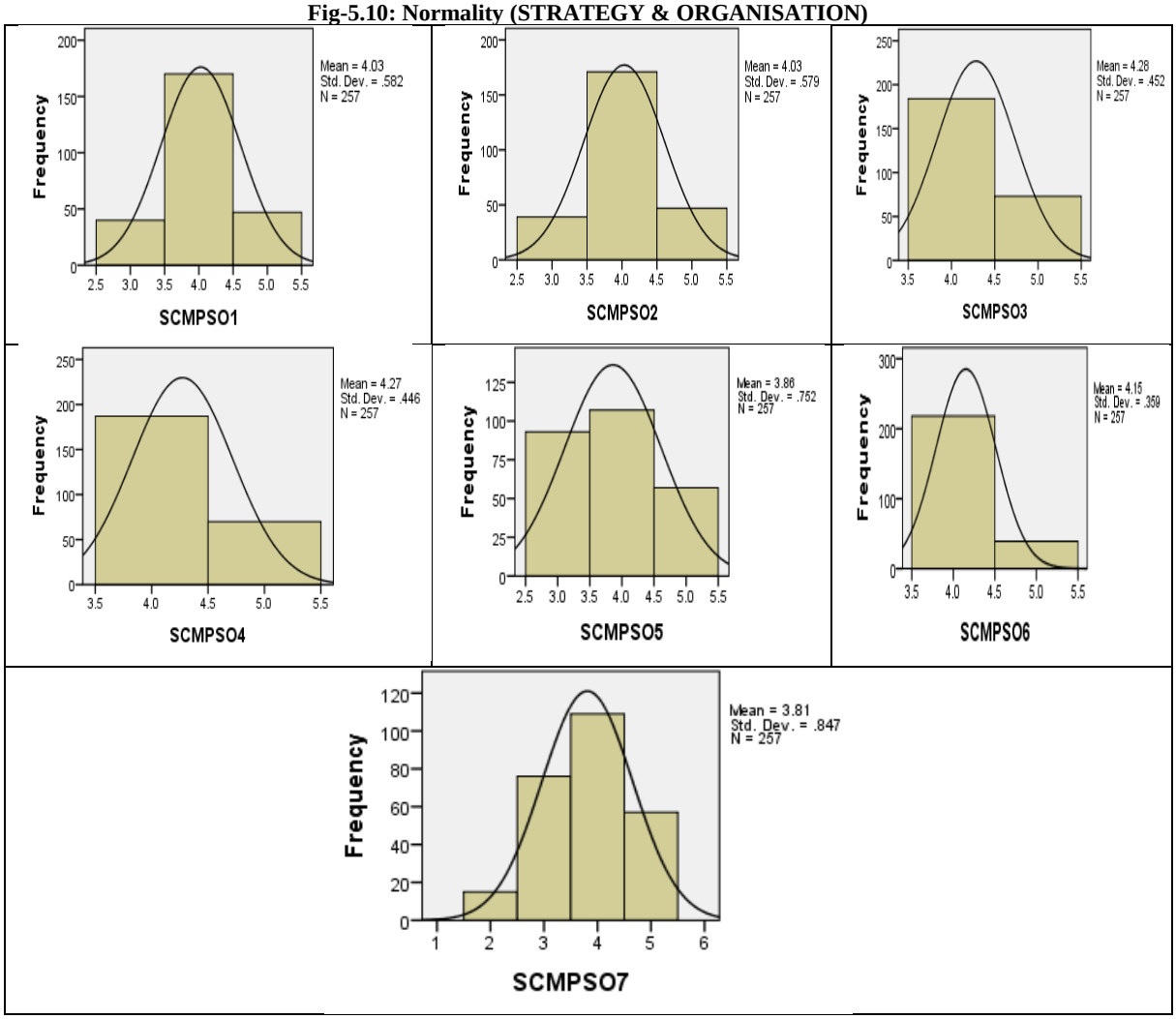


Table-5.11: Statistics (QUALITY)

QUALITY		FSPBPCAQL1	FSPBPCAQL2	FSPBPCAQL3	FSPBPCAQL4
N	Valid	257	257	257	257
	Missing	0	0	0	0
Mean		3.94	4.00	4.00	4.14
Std. Deviation		.668	.637	.634	.613
Skewness		.067	0.000	-.003	-.085

Std. Error of Skewness	.152	.152	.152	.152
Kurtosis	-.745	-.516	-.491	-.406
Std. Error of Kurtosis	.303	.303	.303	.303
Minimum	3	3	3	3
Maximum	5	5	5	5

Fig-5.11: Normality (QUALITY)

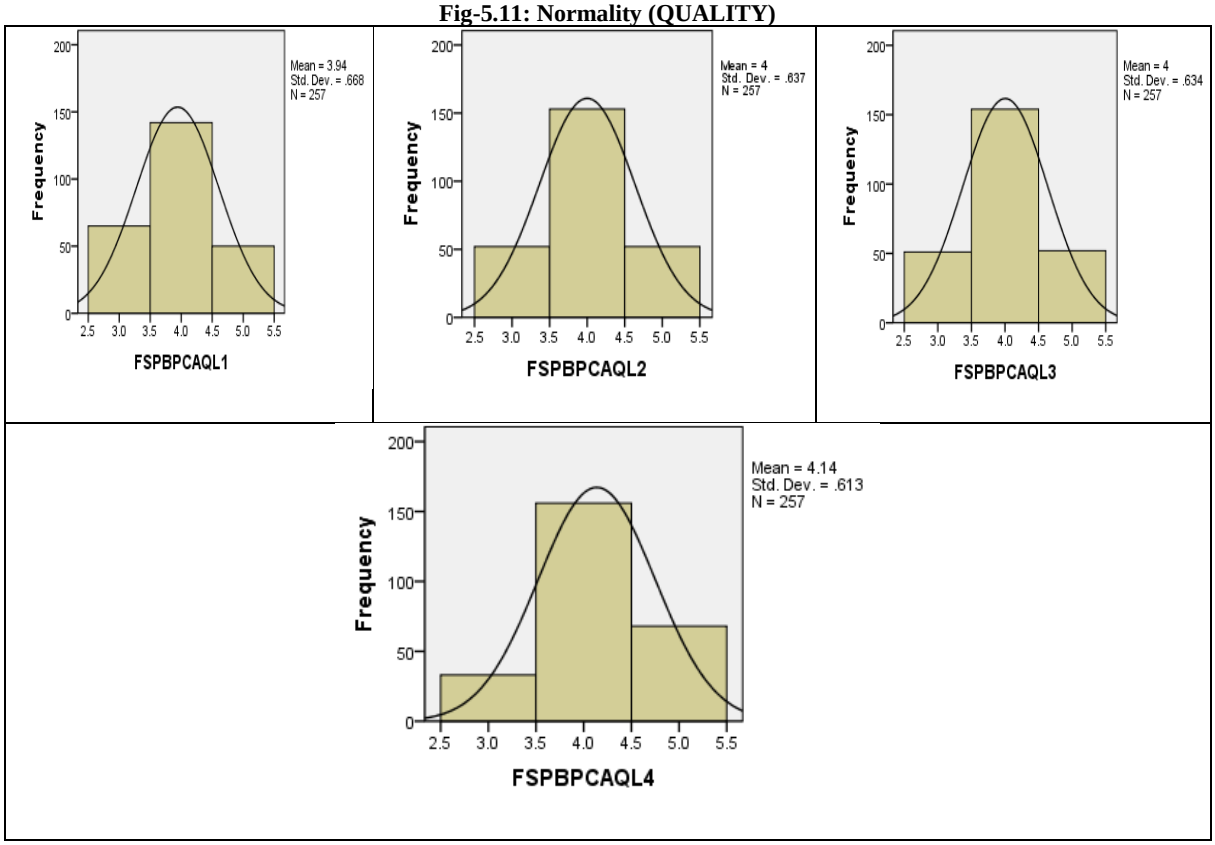


Table-5.12: Statistics (COST)

COST		**FSPBPCACT1**	**FSPBPCACT2**	**FSPBPCACT3**	**FSPBPCACT4**
N	Valid	257	257	257	257
	Missing	0	0	0	0
Mean		3.85	3.87	3.80	3.80
Std. Deviation		.691	.692	.727	.715
Skewness		.204	.176	.331	.312
Std. Error of Skewness		.152	.152	.152	.152
Kurtosis		-.902	-.907	-1.058	-1.006
Std. Error of Kurtosis		.303	.303	.303	.303
Minimum		3	3	3	3
Maximum		5	5	5	5

Fig-5.12: Normality (COST)

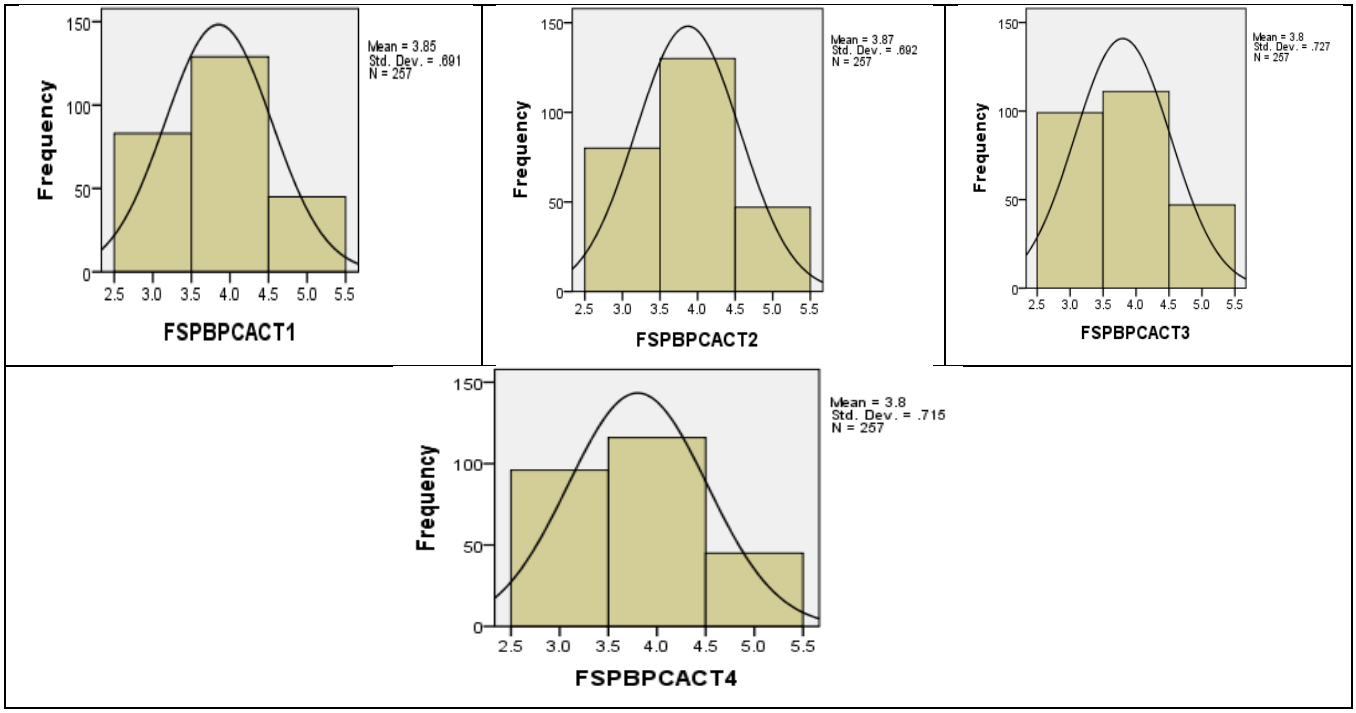
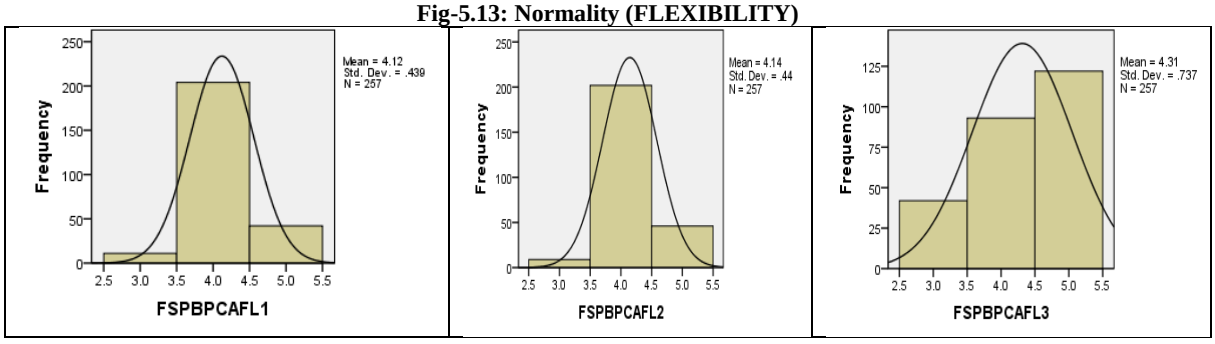


Table-5.13: Statistics (FLEXIBILITY)

FLEXIBILITY		FSPBPCAFL1	FSPBPCAFL2	FSPBPCAFL3	FSPBPCAFL4	FSPBPCAFL5
N	Valid	257	257	257	257	257
	Missing	0	0	0	0	0
Mean		4.12	4.14	4.31	4.30	3.77
Std. Deviation		.439	.440	.737	.733	.877
Skewness		.593	.681	-.567	-.526	.457
Std. Error of Skewness		.152	.152	.152	.152	.152
Kurtosis		1.555	1.234	-.970	-.983	-1.550
Std. Error of Kurtosis		.303	.303	.303	.303	.303
Minimum		3	3	3	3	3
Maximum		5	5	5	5	5

Fig-5.13: Normality (FLEXIBILITY)



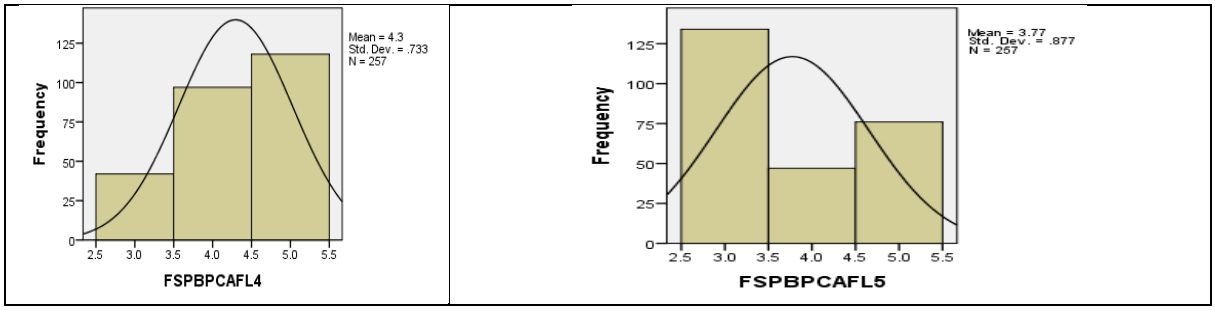


Table-5.14: Statistics (RELATIONSHIP)

RELATIONSHIP		FSPBPCARL1	FSPBPCARL2	FSPBPCARL3	FSPBPCARL4
N	Valid	257	257	257	257
	Missing	0	0	0	0
Mean		4.19	4.17	4.26	4.18
Std. Deviation		.587	.510	.514	.509
Skewness		-.066	.255	.280	.268
Std. Error of Skewness		.152	.152	.152	.152
Kurtosis		-.337	.300	-.379	.222
Std. Error of Kurtosis		.303	.303	.303	.303
Minimum		3	3	3	3
Maximum		5	5	5	5

Fig-5.14: Normality (RELATIONSHIP)

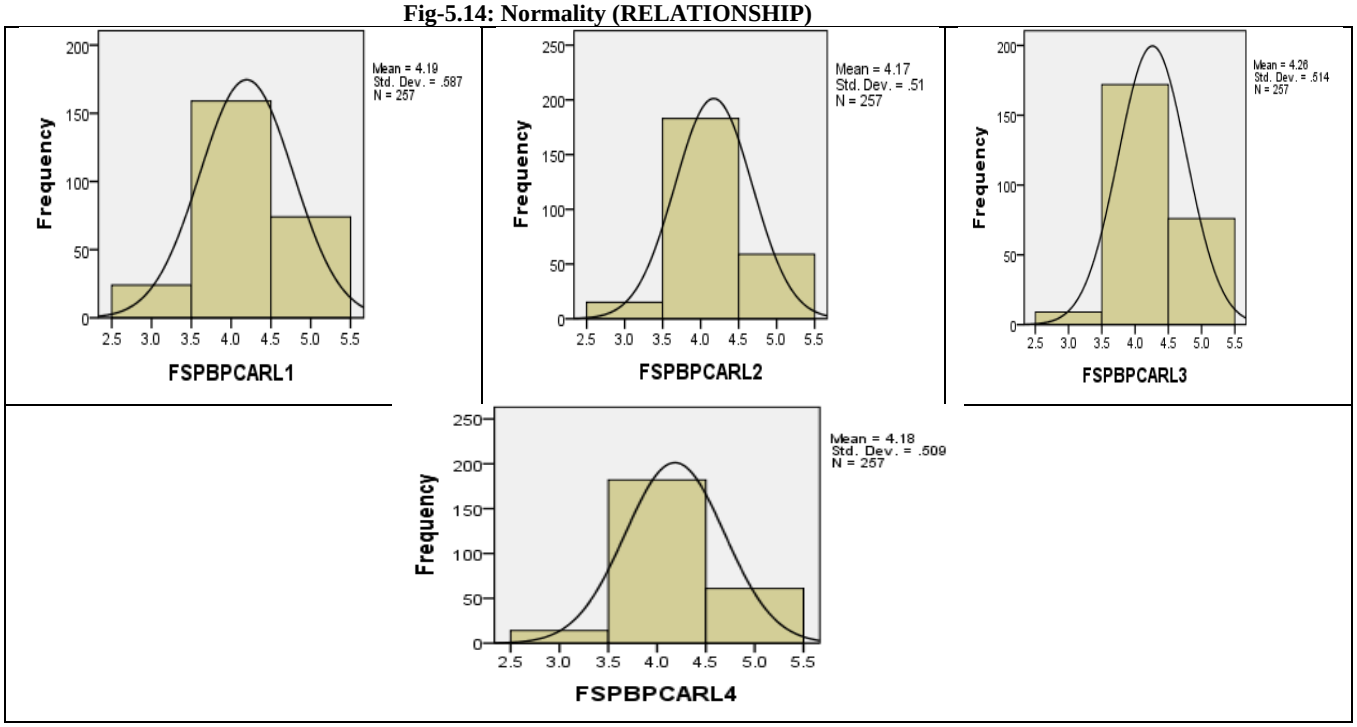


Table-5.15: Statistics (RESPONSIVENESS)

RESPONSIVENESS		FSPBPCARS1	FSPBPCARS2	FSPBPCARS3	FSPBPCARS4	FSPBPCARS5
N	Valid	257	257	257	257	257
	Missing	0	0	0	0	0
Mean		4.18	4.18	4.28	4.32	3.86
Std. Deviation		.581	.517	.722	.735	.857

Skewness	-.040	.225	-.471	-.591	.266
Std. Error of Skewness	.152	.152	.152	.152	.152
Kurtosis	-.269	.169	-.972	-.941	-1.592
Std. Error of Kurtosis	.303	.303	.303	.303	.303
Minimum	3	3	3	3	3
Maximum	5	5	5	5	5

Fig-5.15: Normality (RESPONSIVENESS)

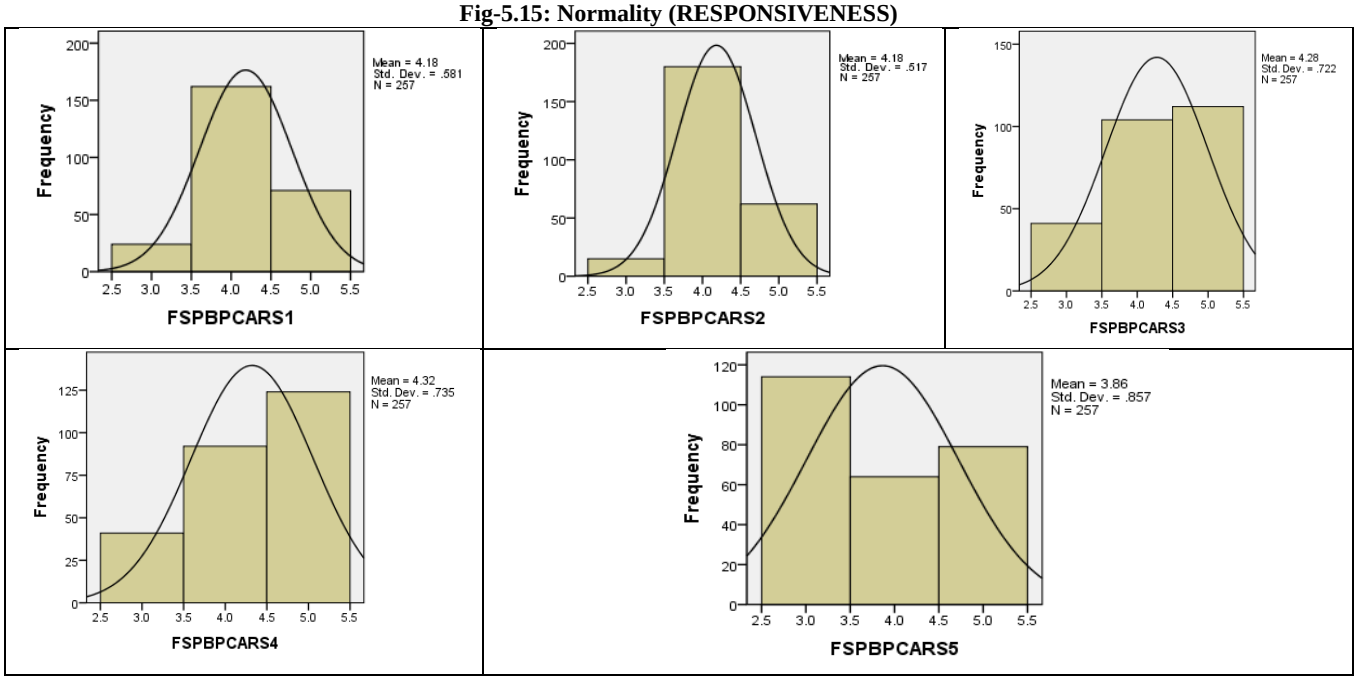
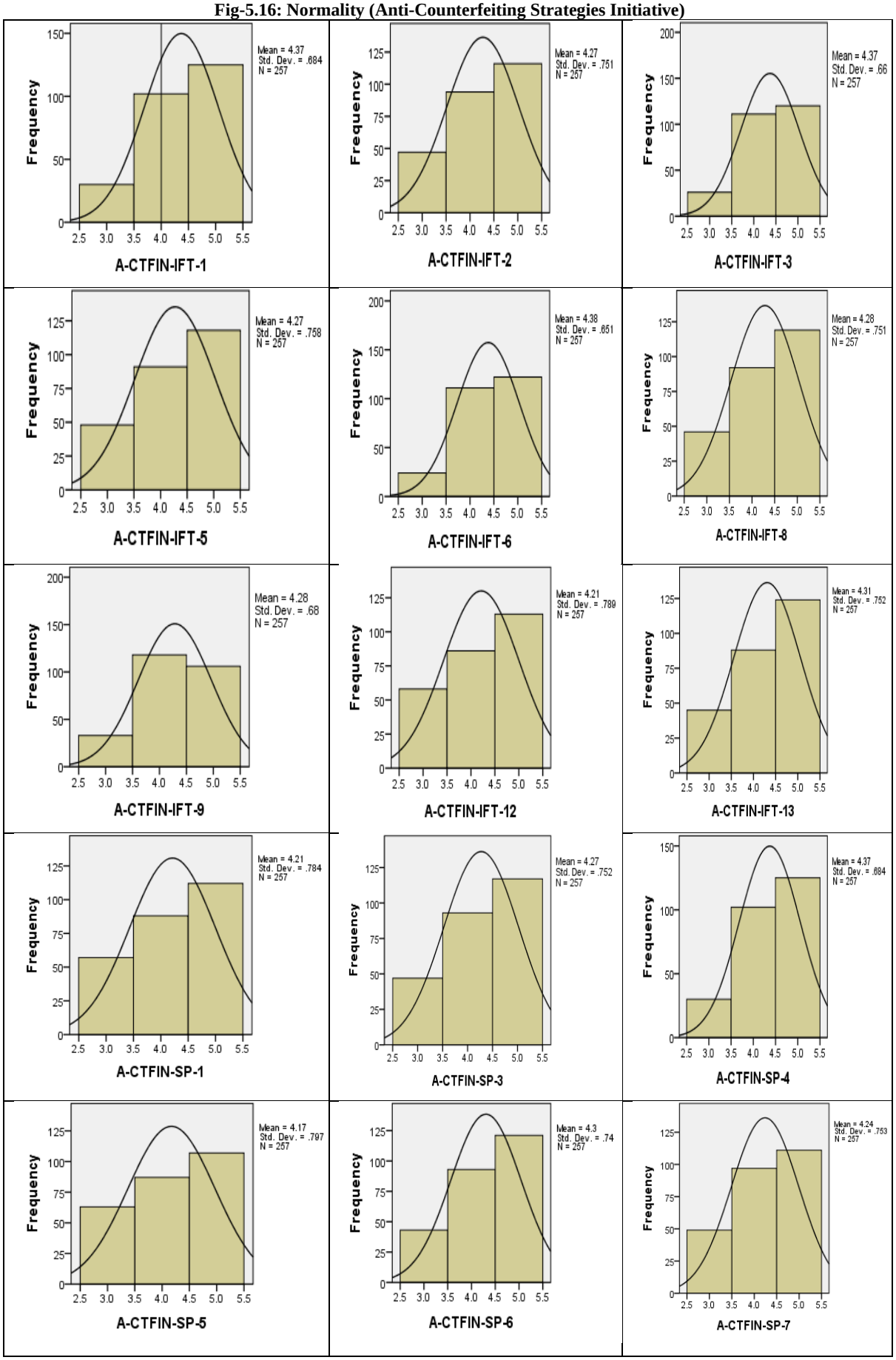


Table-5.16: Statistics (Anti-Counterfeiting Strategies Initiative)

Anti-Counterfeiting Strategies Initiative	N		Mean	Std. Deviation	Skewness	Std. Error of Skewness	Kurtosis	Std. Error of Kurtosis	Min.	Max.
	Valid	Missing								
A-CTFIN-IFT-1	257	0	4.37	.684	-.626	.152	-.716	.303	3	5
A-CTFIN-IFT-2	257	0	4.27	.751	-.486	.152	-1.084	.303	3	5
A-CTFIN-IFT-3	257	0	4.37	.660	-.561	.152	-.682	.303	3	5
A-CTFIN-IFT-5	257	0	4.27	.758	-.500	.152	-1.101	.303	3	5
A-CTFIN-IFT-6	257	0	4.38	.651	-.577	.152	-.646	.303	3	5
A-CTFIN-IFT-8	257	0	4.28	.751	-.520	.152	-1.060	.303	3	5
A-CTFIN-IFT-9	257	0	4.28	.680	-.422	.152	-.818	.303	3	5
A-CTFIN-IFT-12	257	0	4.21	.789	-.399	.152	-1.286	.303	3	5
A-CTFIN-IFT-13	257	0	4.31	.752	-.574	.152	-1.023	.303	3	5
A-CTFIN-SP-1	257	0	4.21	.784	-.396	.152	-1.268	.303	3	5
A-CTFIN-SP-3	257	0	4.27	.752	-.496	.152	-1.083	.303	3	5
A-CTFIN-SP-4	257	0	4.37	.684	-.626	.152	-.716	.303	3	5
A-CTFIN-SP-5	257	0	4.17	.797	-.317	.152	-1.357	.303	3	5
A-CTFIN-SP-6	257	0	4.30	.740	-.552	.152	-.994	.303	3	5
A-CTFIN-SP-7	257	0	4.24	.753	-.430	.152	-1.124	.303	3	5
A-CTFIN-SP-9	257	0	4.24	.753	-.430	.152	-1.124	.303	3	5

Fig-5.16: Normality (Anti-Counterfeiting Strategies Initiative)



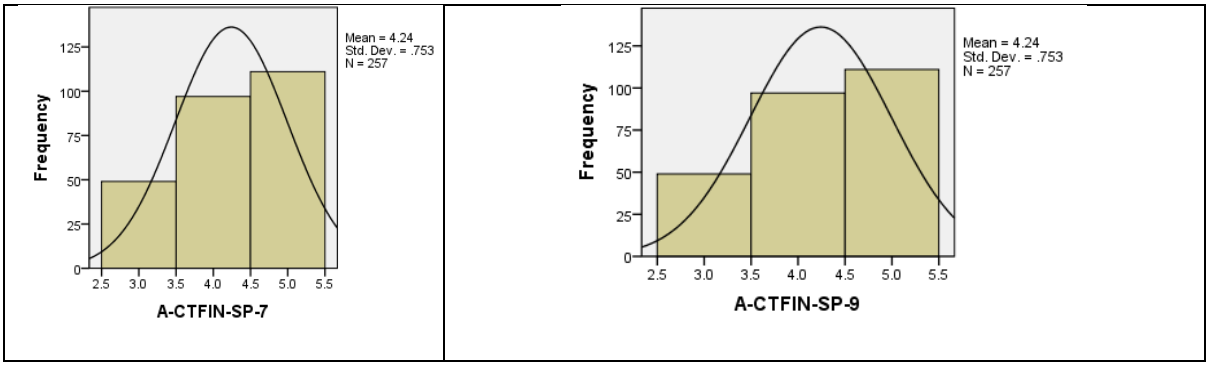


Table-5.17: Descriptive Statistics

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Supply Chain Management	Finance & Accounts	65	.3679	.06553	.00813	.3517	.3841	.21	.51
	Human Resource	17	.4059	.03472	.00842	.3881	.4238	.33	.46
	Purchase	128	.3707	.07364	.00651	.3578	.3835	.21	.49
	Stores & inventory Control	3	.4255	.01280	.00739	.3937	.4573	.42	.44
	Manufacturing & Warehousing	25	.3665	.07588	.01518	.3352	.3978	.22	.47
	Managerial Coordination	19	.4058	.03428	.00787	.3893	.4223	.33	.45
	Total	257	.3751	.06823	.00426	.3667	.3835	.21	.51
Total Quality Management	Finance & Accounts	65	.4655	.04794	.00595	.4537	.4774	.35	.55
	Human Resource	17	.4699	.03896	.00945	.4499	.4899	.41	.55
	Purchase	128	.4565	.04103	.00363	.4493	.4636	.33	.54
	Stores & inventory Control	3	.4680	.03682	.02126	.3765	.5595	.43	.50
	Manufacturing & Warehousing	25	.4708	.03954	.00791	.4545	.4872	.38	.55
	Managerial Coordination	19	.4660	.04028	.00924	.4465	.4854	.36	.53
	Total	257	.4619	.04252	.00265	.4567	.4671	.33	.55
Supply Chain Quality Management	Finance & Accounts	65	.4167	.04044	.00502	.4067	.4267	.32	.49
	Human Resource	17	.4379	.02474	.00600	.4252	.4506	.41	.48
	Purchase	128	.4136	.04297	.00380	.4060	.4211	.31	.50
	Stores & inventory Control	3	.4467	.01336	.00771	.4136	.4799	.43	.46
	Manufacturing & Warehousing	25	.4187	.04802	.00960	.3988	.4385	.33	.48
	Managerial Coordination	19	.4359	.02516	.00577	.4238	.4480	.38	.47
	Total	257	.4185	.04117	.00257	.4134	.4236	.31	.50

Anti-Counterfeiting Strategies Initiative	Finance & Accounts	65	2.2294	.25477	.03160	2.1662	2.2925	1.74	2.60
	Human Resource	17	1.9673	.15643	.03794	1.8868	2.0477	1.69	2.35
	Purchase	128	2.2736	.21600	.01909	2.2359	2.3114	1.74	2.66
	Stores & inventory Control	3	2.1353	.01767	.01020	2.0914	2.1792	2.12	2.16
	Manufacturing & Warehousing	25	2.1200	.24409	.04882	2.0193	2.2208	1.74	2.53
	Managerial Coordination	19	2.2577	.22368	.05132	2.1499	2.3655	1.71	2.52
	Total	257	2.2244	.23845	.01487	2.1952	2.2537	1.69	2.66
Firm's Supply Performance	Finance & Accounts	65	1.9677	.15573	.01932	1.9291	2.0063	1.75	2.33
	Human Resource	17	1.8525	.08653	.02099	1.8080	1.8970	1.69	2.07
	Purchase	128	2.0120	.18852	.01666	1.9790	2.0450	1.68	2.33
	Stores & inventory Control	3	1.9783	.08334	.04811	1.7713	2.1853	1.92	2.07
	Manufacturing & Warehousing	25	1.9257	.13115	.02623	1.8715	1.9798	1.76	2.33
	Managerial Coordination	19	1.9618	.10957	.02514	1.9090	2.0146	1.82	2.18
	Total	257	1.9778	.16914	.01055	1.9570	1.9985	1.68	2.33

Table-5.17a: Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
Supply Chain Management	6.512	5	251	.000
Total Quality Management	.788	5	251	.559
Supply Chain Quality Management	3.729	5	251	.003
Anti-Counterfeiting Strategies Initiative	3.290	5	251	.007
Firm's Supply Performance	7.481	5	251	.000

Table-5.17b: **ANOVA**

		Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Supply Chain Management	Between Groups	.049	5	.010	2.173	.058
	Within Groups	1.142	251	.005		
	Total	1.192	256			
Total Quality Management	Between Groups	.008	5	.002	.902	.480
	Within Groups	.455	251	.002		
	Total	.463	256			
Supply Chain Quality Management	Between Groups	.018	5	.004	2.157	.059
	Within Groups	.416	251	.002		
	Total	.434	256			
Anti-Counterfeiting	Between Groups	1.753	5	.351	6.876	.000
	Within Groups	12.802	251	.051		

Strategies Initiative	Total	14.555	256			
Firm's Supply Performance	Between Groups	.496	5	.099	3.646	.003
	Within Groups	6.828	251	.027		
	Total	7.324	256			

Table-5.17c: **POST HOC TEST - Multiple Comparisons**

Dimension	Dependent Variable (I)	Dependent Variable (J)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Supply Chain Management	Finance & Accounts	Human Resource	-.03802*	.01838	.040	-.0742	-.0018
		Purchase	-.00276	.01028	.788	-.0230	.0175
		Stores & inventory Control	-.05758	.03984	.150	-.1360	.0209
		Manufacturing & Warehousing	.00142	.01588	.929	-.0299	.0327
		Managerial Coordination	-.03792*	.01760	.032	-.0726	-.0033
	Human Resource	Finance & Accounts	.03802*	.01838	.040	.0018	.0742
		Purchase	.03526*	.01742	.044	.0010	.0696
		Stores & inventory Control	-.01956	.04225	.644	-.1028	.0636
		Manufacturing & Warehousing	.03944	.02121	.064	-.0023	.0812
		Managerial Coordination	.00010	.02252	.997	-.0443	.0445
	Purchase	Finance & Accounts	.00276	.01028	.788	-.0175	.0230
		Human Resource	-.03526*	.01742	.044	-.0696	-.0010
		Stores & inventory Control	-.05482	.03941	.165	-.1324	.0228
		Manufacturing & Warehousing	.00418	.01475	.777	-.0249	.0332
		Managerial Coordination	-.03516*	.01659	.035	-.0678	-.0025
	Stores & inventory Control	Finance & Accounts	.05758	.03984	.150	-.0209	.1360
		Human Resource	.01956	.04225	.644	-.0636	.1028
		Purchase	.05482	.03941	.165	-.0228	.1324
		Manufacturing & Warehousing	.05900	.04122	.154	-.0222	.1402
		Managerial Coordination	.01966	.04191	.639	-.0629	.1022
	Manufacturing & Warehousing	Finance & Accounts	-.00142	.01588	.929	-.0327	.0299
		Human Resource	-.03944	.02121	.064	-.0812	.0023

		Purchase	-.00418	.01475	.777	-.0332	.0249
		Stores & inventory Control	-.05900	.04122	.154	-.1402	.0222
		Managerial Coordination	-.03934	.02053	.057	-.0798	.0011
	Managerial Coordination	Finance & Accounts	.03792*	.01760	.032	.0033	.0726
		Human Resource	-.00010	.02252	.997	-.0445	.0443
		Purchase	.03516*	.01659	.035	.0025	.0678
		Stores & inventory Control	-.01966	.04191	.639	-.1022	.0629
		Manufacturing & Warehousing	.03934	.02053	.057	-.0011	.0798
Total Quality Management	Finance & Accounts	Human Resource	-.00437	.01159	.707	-.0272	.0185
		Purchase	.00908	.00648	.162	-.0037	.0218
		Stores & inventory Control	-.00246	.02513	.922	-.0520	.0470
		Manufacturing & Warehousing	-.00531	.01002	.596	-.0250	.0144
		Managerial Coordination	-.00042	.01110	.970	-.0223	.0214
	Human Resource	Finance & Accounts	.00437	.01159	.707	-.0185	.0272
		Purchase	.01345	.01099	.222	-.0082	.0351
		Stores & inventory Control	.00191	.02665	.943	-.0506	.0544
		Manufacturing & Warehousing	-.00094	.01338	.944	-.0273	.0254
		Managerial Coordination	.00394	.01421	.782	-.0240	.0319
	Purchase	Finance & Accounts	-.00908	.00648	.162	-.0218	.0037
		Human Resource	-.01345	.01099	.222	-.0351	.0082
		Stores & inventory Control	-.01154	.02486	.643	-.0605	.0374
		Manufacturing & Warehousing	-.01439	.00931	.123	-.0327	.0039
		Managerial Coordination	-.00950	.01046	.365	-.0301	.0111
		Finance & Accounts	.00246	.02513	.922	-.0470	.0520

	Stores & inventory Control	Human Resource	-.00191	.02665	.943	-.0544	.0506
		Purchase	.01154	.02486	.643	-.0374	.0605
		Manufacturing & Warehousing	-.00285	.02600	.913	-.0541	.0484
		Managerial Coordination	.00203	.02644	.939	-.0500	.0541
	Manufacturing & Warehousing	Finance & Accounts	.00531	.01002	.596	-.0144	.0250
		Human Resource	.00094	.01338	.944	-.0254	.0273
		Purchase	.01439	.00931	.123	-.0039	.0327
		Stores & inventory Control	.00285	.02600	.913	-.0484	.0541
		Managerial Coordination	.00489	.01295	.706	-.0206	.0304
	Managerial Coordination	Finance & Accounts	.00042	.01110	.970	-.0214	.0223
		Human Resource	-.00394	.01421	.782	-.0319	.0240
		Purchase	.00950	.01046	.365	-.0111	.0301
		Stores & inventory Control	-.00203	.02644	.939	-.0541	.0500
		Manufacturing & Warehousing	-.00489	.01295	.706	-.0304	.0206
Supply Chain Quality Management	Finance & Accounts	Human Resource	-.02120	.01109	.057	-.0430	.0006
		Purchase	.00316	.00620	.611	-.0091	.0154
		Stores & inventory Control	-.03002	.02404	.213	-.0774	.0173
		Manufacturing & Warehousing	-.00195	.00958	.839	-.0208	.0169
		Managerial Coordination	-.01917	.01062	.072	-.0401	.0017
	Human Resource	Finance & Accounts	.02120	.01109	.057	-.0006	.0430
		Purchase	.02435*	.01051	.021	.0037	.0451
		Stores & inventory Control	-.00882	.02549	.730	-.0590	.0414
		Manufacturing & Warehousing	.01925	.01280	.134	-.0060	.0445
		Managerial Coordination	.00202	.01359	.882	-.0247	.0288
	Purchase	Finance & Accounts	-.00316	.00620	.611	-.0154	.0091
		Human Resource	-.02435*	.01051	.021	-.0451	-.0037

		Stores & inventory Control	-.03318	.02378	.164	-.0800	.0137
		Manufacturing & Warehousing	-.00510	.00890	.567	-.0226	.0124
		Managerial Coordination	-.02233*	.01001	.027	-.0420	-.0026
	Stores & inventory Control	Finance & Accounts	.03002	.02404	.213	-.0173	.0774
		Human Resource	.00882	.02549	.730	-.0414	.0590
		Purchase	.03318	.02378	.164	-.0137	.0800
		Manufacturing & Warehousing	.02807	.02487	.260	-.0209	.0771
		Managerial Coordination	.01085	.02529	.668	-.0390	.0607
	Manufacturing & Warehousing	Finance & Accounts	.00195	.00958	.839	-.0169	.0208
		Human Resource	-.01925	.01280	.134	-.0445	.0060
		Purchase	.00510	.00890	.567	-.0124	.0226
		Stores & inventory Control	-.02807	.02487	.260	-.0771	.0209
		Managerial Coordination	-.01723	.01239	.166	-.0416	.0072
	Managerial Coordination	Finance & Accounts	.01917	.01062	.072	-.0017	.0401
		Human Resource	-.00202	.01359	.882	-.0288	.0247
		Purchase	.02233*	.01001	.027	.0026	.0420
		Stores & inventory Control	-.01085	.02529	.668	-.0607	.0390
		Manufacturing & Warehousing	.01723	.01239	.166	-.0072	.0416
Anti-Counterfeiting Strategies Initiative	Finance & Accounts	Human Resource	.26213*	.06152	.000	.1410	.3833
		Purchase	-.04427	.03440	.199	-.1120	.0235
		Stores & inventory Control	.09411	.13336	.481	-.1685	.3568
		Manufacturing & Warehousing	.10935*	.05315	.041	.0047	.2140
		Managerial Coordination	-.02836	.05890	.631	-.1444	.0876
	Human Resource	Finance & Accounts	-.26213*	.06152	.000	-.3833	-.1410
		Purchase	-.30639*	.05830	.000	-.4212	-.1916
		Stores & inventory Control	-.16801	.14143	.236	-.4465	.1105
		Manufacturing & Warehousing	-.15278*	.07100	.032	-.2926	-.0130

		Managerial Coordination	-.29048*	.07540	.000	-.4390	-.1420
	Purchase	Finance & Accounts	.04427	.03440	.199	-.0235	.1120
		Human Resource	.30639*	.05830	.000	.1916	.4212
		Stores & inventory Control	.13838	.13191	.295	-.1214	.3982
		Manufacturing & Warehousing	.15362*	.04938	.002	.0564	.2509
		Managerial Coordination	.01591	.05552	.775	-.0934	.1253
	Stores & inventory Control	Finance & Accounts	-.09411	.13336	.481	-.3568	.1685
		Human Resource	.16801	.14143	.236	-.1105	.4465
		Purchase	-.13838	.13191	.295	-.3982	.1214
		Manufacturing & Warehousing	.01524	.13799	.912	-.2565	.2870
		Managerial Coordination	-.12247	.14031	.384	-.3988	.1539
	Manufacturing & Warehousing	Finance & Accounts	-.10935*	.05315	.041	-.2140	-.0047
		Human Resource	.15278*	.07100	.032	.0130	.2926
		Purchase	-.15362*	.04938	.002	-.2509	-.0564
		Stores & inventory Control	-.01524	.13799	.912	-.2870	.2565
		Managerial Coordination	-.13770*	.06874	.046	-.2731	-.0023
	Managerial Coordination	Finance & Accounts	.02836	.05890	.631	-.0876	.1444
		Human Resource	.29048*	.07540	.000	.1420	.4390
		Purchase	-.01591	.05552	.775	-.1253	.0934
		Stores & inventory Control	.12247	.14031	.384	-.1539	.3988
		Manufacturing & Warehousing	.13770*	.06874	.046	.0023	.2731
Firm's Supply Performance	Finance & Accounts	Human Resource	.11521*	.04493	.011	.0267	.2037
		Purchase	-.04427	.02512	.079	-.0937	.0052
		Stores & inventory Control	-.01059	.09740	.913	-.2024	.1812
		Manufacturing & Warehousing	.04208	.03882	.279	-.0344	.1185

		Managerial Coordination	.00594	.04301	.890	-.0788	.0907
	Human Resource	Finance & Accounts	-.11521*	.04493	.011	-.2037	-.0267
		Purchase	-.15947*	.04258	.000	-.2433	-.0756
		Stores & inventory Control	-.12580	.10329	.224	-.3292	.0776
		Manufacturing & Warehousing	-.07313	.05185	.160	-.1752	.0290
		Managerial Coordination	-.10927*	.05506	.048	-.2177	-.0008
	Purchase	Finance & Accounts	.04427	.02512	.079	-.0052	.0937
		Human Resource	.15947*	.04258	.000	.0756	.2433
		Stores & inventory Control	.03367	.09633	.727	-.1561	.2234
		Manufacturing & Warehousing	.08635*	.03606	.017	.0153	.1574
		Managerial Coordination	.05020	.04055	.217	-.0297	.1301
	Stores & inventory Control	Finance & Accounts	.01059	.09740	.913	-.1812	.2024
		Human Resource	.12580	.10329	.224	-.0776	.3292
		Purchase	-.03367	.09633	.727	-.2234	.1561
		Manufacturing & Warehousing	.05267	.10078	.602	-.1458	.2511
		Managerial Coordination	.01653	.10247	.872	-.1853	.2183
	Manufacturing & Warehousing	Finance & Accounts	-.04208	.03882	.279	-.1185	.0344
		Human Resource	.07313	.05185	.160	-.0290	.1752
		Purchase	-.08635*	.03606	.017	-.1574	-.0153
		Stores & inventory Control	-.05267	.10078	.602	-.2511	.1458
		Managerial Coordination	-.03614	.05020	.472	-.1350	.0627
	Managerial Coordination	Finance & Accounts	-.00594	.04301	.890	-.0907	.0788
		Human Resource	.10927*	.05506	.048	.0008	.2177
		Purchase	-.05020	.04055	.217	-.1301	.0297
		Stores & inventory Control	-.01653	.10247	.872	-.2183	.1853
		Manufacturing & Warehousing	.03614	.05020	.472	-.0627	.1350

*. The mean difference is significant at the 0.05 level.

LIST OF TABLE ANNEXURES - CHAPTER-6
(EXPLORATORY FACTOR ANALYSIS (EFA))

Table-6.3-1. Descriptive statistics details in relation to anti-counterfeiting strategy							
Descriptive Statistics							
Dimensions	Mean	Standard Deviation	Analysis N	Dimensions	Mean	Standard Deviation	Analysis N
A-CTFIN-IFT-1	4.36	0.687	257	A-CTFIN-SP-1	4.21	0.772	257
A-CTFIN-IFT-2	4.35	0.685		A-CTFIN-SP-2	4.30	0.636	
A-CTFIN-IFT-3	4.29	0.649		A-CTFIN-SP-3	4.24	0.761	
A-CTFIN-IFT-4	4.29	0.647		A-CTFIN-SP-4	4.34	0.683	
A-CTFIN-IFT-5	4.29	0.643		A-CTFIN-SP-5	4.27	0.735	
A-CTFIN-IFT-6	4.31	0.634		A-CTFIN-SP-6	4.28	0.729	
A-CTFIN-IFT-7	4.01	0.828		A-CTFIN-SP-7	4.27	0.735	
A-CTFIN-IFT-8	4.28	0.677		A-CTFIN-SP-8	4.34	0.683	
A-CTFIN-IFT-9	4.26	0.675		A-CTFIN-SP-9	4.17	0.799	
A-CTFIN-IFT-10	4.23	0.716		A-CTFIN-SP-10	3.78	0.721	
A-CTFIN-IFT-11	4.15	0.753		A-CTFIN-SP-11	3.80	0.708	
A-CTFIN-IFT-12	4.18	0.729		A-CTFIN-SP-12	4.10	0.429	
A-CTFIN-IFT-13	4.22	0.708		A-CTFIN-SP-13	4.13	0.420	
A-CTFIN-IFT-14	4.34	0.688		A-CTFIN-SP-14	4.15	0.358	
A-CTFIN-IFT-15	4.13	0.819		A-CTFIN-SP-15	4.24	0.428	
				A-CTFIN-SP-16	3.75	0.871	

TABLE-6.3-2: Overall Compiled Correlation Matrix before Exclusion of Variables

Correlation Matrix		A-CTFIN-IFT-1	A-CTFIN-IFT-2	A-CTFIN-IFT-3	A-CTFIN-IFT-4	A-CTFIN-IFT-5	A-CTFIN-IFT-6	A-CTFIN-IFT-7	A-CTFIN-IFT-8	A-CTFIN-IFT-9	A-CTFIN-IFT-10	A-CTFIN-IFT-11	A-CTFIN-IFT-12	A-CTFIN-IFT-13	A-CTFIN-IFT-14	A-CTFIN-IFT-15	A-CTFIN-SP-1	A-CTFIN-SP-2	A-CTFIN-SP-3	A-CTFIN-SP-4	A-CTFIN-SP-5	A-CTFIN-SP-6	A-CTFIN-SP-7	A-CTFIN-SP-8	A-CTFIN-SP-9	A-CTFIN-SP-10	A-CTFIN-SP-11	A-CTFIN-SP-12	A-CTFIN-SP-13	A-CTFIN-SP-14	A-CTFIN-SP-15	A-CTFIN-SP-16
Correlation	A-CTFIN-IFT-1	1.000	.736	.786	-.068	.792	.812	.010	.778	.765	-.042	-.092	.692	.714	-.053	-.067	.745	.042	.763	.709	.791	.811	.829	.030	.706	.096	.072	.018	.076	.035	-.021	.094
	A-CTFIN-IFT-2	.736	1.000	.768	-.062	.782	.782	.059	.767	.746	.012	-.031	.688	.719	-.001	-.025	.718	.013	.720	.693	.786	.788	.792	.000	.724	.108	.132	-.005	.095	.048	-.039	.139
	A-CTFIN-IFT-3	.786	.768	1.000	-.082	.976	.960	.042	.933	.934	-.033	-.044	.830	.850	-.046	-.059	.760	.115	.760	.763	.761	.733	.747	.139	.763	.109	.118	.134	.094	.022	-.048	.134
	A-CTFIN-IFT-4	-.068	-.062	-.082	1.000	-.082	-.099	.412	-.104	-.067	.553	.717	-.082	-.080	.597	.832	-.097	.370	-.087	-.003	-.078	-.075	-.078	.391	-.107	.239	.266	.054	.205	.274	.269	.269
	A-CTFIN-IFT-5	.792	.782	.976	-.082	1.000	.960	.024	.925	.949	-.053	-.066	.844	.842	-.066	-.059	.793	.116	.752	.785	.774	.753	.767	.127	.770	.091	.100	.111	.086	.004	-.067	.116
	A-CTFIN-IFT-6	.812	.782	.960	-.099	.960	1.000	-.023	.949	.950	-.085	-.101	.812	.860	-.097	-.073	.796	.094	.767	.797	.788	.781	.781	.093	.787	.048	.057	.082	.053	-.023	-.094	.073
	A-CTFIN-IFT-7	.010	.059	.042	.412	.024	-.023	1.000	.019	.064	.740	.526	.005	-.027	.709	.500	.065	.432	-.065	-.147	-.003	-.066	-.020	.453	.092	.693	.714	.337	.656	.510	.349	.740
	A-CTFIN-IFT-8	.778	.767	.933	-.104	.925	.949	.019	1.000	.935	-.073	-.086	.798	.832	-.085	-.080	.776	.155	.738	.716	.754	.734	.747	.153	.783	.118	.092	.145	.130	-.018	-.084	.125
	A-CTFIN-IFT-9	.765	.746	.934	-.067	.949	.950	.064	.935	1.000	-.063	-.074	.801	.816	-.076	-.047	.805	.215	.730	.716	.726	.714	.726	.199	.798	.178	.134	.186	.179	-.010	-.077	.149
	A-CTFIN-IFT-10	-.042	.012	-.033	.553	-.053	-.085	.740	-.073	-.063	1.000	.732	-.058	-.060	.926	.652	-.059	.379	-.065	-.125	-.001	-.050	-.036	.420	.008	.542	.542	.243	.507	.555	.384	.569
	A-CTFIN-IFT-11	-.092	-.031	-.044	.717	-.066	-.101	.526	-.086	-.074	.732	1.000	-.064	-.068	.780	.845	-.120	.339	-.110	-.068	-.045	-.099	-.083	.376	-.062	.386	.411	.147	.352	.447	.439	.439
	A-CTFIN-IFT-12	.692	.688	.830	-.082	.844	.812	.005	.798	.801	-.058	-.064	1.000	.791	-.071	-.067	.758	.118	.670	.652	.739	.654	.665	.137	.718	.142	.069	.095	.127	-.015	-.077	.100
	A-CTFIN-IFT-13	.714	.719	.850	-.080	.842	.860	-.027	.832	.816	-.060	-.068	.791	1.000	-.072	-.062	.874	.079	.690	.702	.885	.689	.675	.088	.855	.083	.041	.066	.093	-.012	-.077	.073
	A-CTFIN-IFT-14	-.053	-.001	-.046	.597	-.066	-.097	.709	-.085	-.076	.926	.780	-.071	-.072	1.000	.716	-.071	.389	-.076	-.132	-.013	-.061	-.048	.437	-.005	.526	.549	.231	.481	.562	.395	.575
	A-CTFIN-IFT-15	-.067	-.025	-.059	.832	-.059	-.073	.500	-.080	-.047	.652	.845	-.067	-.062	.716	1.000	-.097	.377	-.124	-.042	-.040	-.075	-.059	.378	-.073	.334	.372	.112	.325	.407	.400	.400
	A-CTFIN-SP-1	.745	.718	.760	-.097	.793	.796	.065	.776	.805	-.059	-.120	.758	.874	-.071	-.097	1.000	.132	.711	.641	.888	.703	.712	.107	.911	.239	.125	.068	.253	-.024	-.121	.169
	A-CTFIN-SP-2	.042	.013	.115	.370	.116	.094	.432	.155	.215	.379	.339	.118	.079	.389	.377	.132	1.000	.043	-.302	-.027	-.055	-.027	.906	.186	.528	.302	.667	.551	.160	.079	.382
	A-CTFIN-SP-3	.763	.720	.760	-.087	.752	.767	-.065	.738	.730	-.065	-.110	.670	.690	-.076	-.124	.711	.043	1.000	.662	.708	.847	.838	.063	.719	.079	.009	-.010	.074	-.026	-.109	.015
	A-CTFIN-SP-4	.709	.693	.763	-.003	.785	.797	-.147	.716	.716	-.125	-.068	.652	.702	-.132	-.042	.641	-.302	.662	1.000	.739	.749	.732	-.308	.592	-.201	-.047	-.320	-.216	-.038	-.043	-.079
	A-CTFIN-SP-5	.791	.786	.761	-.078	.774	.788	-.003	.754	.726	-.001	-.045	.739	.885	-.013	-.040	.888	-.027	.708	.739	1.000	.793	.797	-.039	.843	.048	.056	-.071	.036	.036	-.050	.078
	A-CTFIN-SP-6	.811	.788	.733	-.075	.753	.781	-.066	.734	.714	-.050	-.099	.654	.689	-.061	-.075	.703	-.055	.847	.749	.793	1.000	.985	-.066	.688	-.003	.005	-.106	-.014	-.008	-.095	.019
	A-CTFIN-SP-7	.829	.792	.747	-.078	.767	.781	-.020	.747	.726	-.036	-.083	.665	.675	-.048	-.059	.712	-.027	.838	.732	.797	.985	1.000	-.039	.674	.040	.040	-.082	.028	.004	-.082	.062
	A-CTFIN-SP-8	.030	.000	.139	.391	.127	.093	.453	.153	.199	.420	.376	.137	.088	.437	.378	.107	.906	.063	-.308	-.039	-.066	-.039	1.000	.202	.562	.324	.681	.547	.214	.103	.403
	A-CTFIN-SP-9	.706	.724	.763	-.107	.770	.787	.092	.783	.798	.008	-.062	.718	.855	-.005	-.073	.911	.186	.719	.592	.843	.688	.674	.202	1.000	.257	.147	.143	.256	.035	-.075	.190
	A-CTFIN-SP-10	.096	.108	.109	.239	.091	.048	.693	.118	.178	.542	.386	.142	.083	.526	.334	.239	.528	.079	-.201	.048	-.003	.040	.562	.257	1.000	.615	.528	.918	.407	.253	.713
	A-CTFIN-SP-11	.072	.132	.118	.266	.100	.057	.714	.092	.134	.542	.411	.069	.041	.549	.372	.125	.302	.009	-.047	.056	.005	.040	.324	.147	.615	1.000	.500	.560	.746	.587	.880
	A-CTFIN-SP-12	.018	-.005	.134	.054	.111	.082	.337	.145	.186	.243	.147	.095	.066	.231	.112	.068	.667	-.010	-.320	-.071	-.106	-.082	.681	.143	.528	.500	1.000	.506	.481	.485	.485
	A-CTFIN-SP-13	.076	.095	.094	.205	.086	.053	.656	.130	.179	.507	.352	.127	.093	.481	.325	.253	.551	.074	-.216	.036	-.014	.028	.547	.256	.918	.560	.506	1.000	.365	.214	.666
	A-CTFIN-SP-14	.035	.048	.022	.274	.004	-.023	.510	-.018	-.010	.555	.447	-.015	-.012	.562	.407	-.024	.160	-.026	-.038	.036	-.008	.004	.214	.035	.407	.746	.481	.365	1.000	.846	.697
	A-CTFIN-SP-15	-.021	-.039	-.048	.269	-.067	-.094	.349	-.084	-.077	.384	.439	-.077	-.077	.395	.400	-.121	.079	-.109	-.043	-.050	-.095	-.082	.103	-.075	.253	.587	.485	.214	.846	1.000	.539
	A-CTFIN-SP-16	.094	.139	.134	.269	.116	.073	.740	.125	.149	.569	.439	.100	.073	.575	.400	.169	.382	.015	-.079	.078	.019	.062	.403	.190	.713	.880	.485	.666	.697	.539	1.000
Sig. (1-tailed)	A-CTFIN-IFT-1		.000	.000	.120	.000	.000	.428	.000	.000	.235	.056	.000	.000	.180	.123	.000	.232	.000	.000	.000	.000	.000	.303	.000	.048	.108	.380	.096	.275	.361	.052
	A-CTFIN-IFT-2	.000		.000	.142	.000	.000	.154	.000	.000	.415	.297	.000	.000	.496	.336	.000	.413	.000	.000	.000	.000	.000	.499	.000	.031	.011	.467	.050	.203	.248	.008
	A-CTFIN-IFT-3	.000	.000		.080	.000	.000	.232	.000	.000	.285	.225	.000	.000	.214	.155	.000	.023	.000	.000	.000	.000	.000	.008	.000	.030	.021	.010	.051	.351	.203	.010
	A-CTFIN-IFT-4	.120	.142	.080		.078	.044	.000	.037	.124	.000	.000	.077	.084	.000	.000	.047	.000	.067	.480	.088	.097	.088	.000	.031	.000	.000	.174	.000	.000	.000	.000
	A-CTFIN-IFT-5	.000	.000	.000	.078		.000	.341	.000	.000	.179	.128	.000	.000	.127	.153	.000	.023	.000	.000	.000	.000	.000	.014	.000	.057	.041	.028	.068	.474	.124	.022
	A-CTFIN-IFT-6	.000	.000	.000	.044	.000		.345	.000	.000	.071	.040	.000	.000	.047	.103	.000	.052	.000	.000	.000	.000	.000	.055	.000	.203	.161	.079	.179	.346	.052	.103
	A-CTFIN-IFT-7	.428	.154	.232	.000	.341	.345		.370	.136	.000	.000	.464	.319	.000	.000	.129	.000	.132	.005	.476	.128	.365	.000	.055	.000	.000	.000	.000	.000	.000	.000
	A-CTFIN-IFT-8	.000	.000	.000	.037	.000	.000	.370		.000	.104	.069	.000	.000	.072	.083	.000	.004	.000	.000	.000	.000	.000	.004	.000	.020	.056	.006	.012	.381	.072	.015
	A-CTFIN-IFT-9	.000	.000	.000	.124	.000	.000	.136	.000		.137	.099	.000	.000	.095	.207	.000	.000	.000	.000	.000	.000	.000	.000	.000	.001	.010	.001	.001	.431	.090	.005
	A-CTFIN-IFT-10	.235	.415	.285	.000	.179	.071	.000	.104	.137		.000	.159	.150	.000	.000	.154	.000	.132	.015	.493	.194	.266	.000	.445	.000	.000	.000	.000	.000	.000	.000
	A-CTFIN-IFT-11	.056	.297	.225	.000	.128	.040	.000	.069	.099	.000		.136	.120	.000	.000	.019	.000	.028	.120	.216	.044	.075	.000	.143	.000	.000	.005	.000	.000	.000	.000
	A-CTFIN-IFT-12	.000	.000	.000	.077	.000	.000	.464	.000	.000	.159	.136		.000	.111	.125	.000	.021	.000	.000	.000	.000	.000	.009	.000	.007	.116	.050	.014	.400	.090	.042
	A-CTFIN-IFT-13	.000	.000	.000	.084	.000	.000	.319	.000	.000	.150	.120	.000		.105	.143	.000	.086	.000	.000	.000	.000	.000	.064	.000	.076	.237	.128	.053	.416	.092	.104
	A-CTFIN-IFT-14	.180	.496	.214	.000	.127	.047	.000	.072	.095	.000	.000	.111	.105		.000	.111	.000	.096	.011	.409	.145	.204	.000	.465	.000	.000	.000	.000	.000	.000	.000
	A-CTFIN-IFT-15	.123	.336	.155	.000	.153	.103	.000	.083	.207	.000	.000	.125	.143	.000		.046	.000	.016	.235	.248	.099	.155	.000	.102	.000	.000	.026	.000	.000	.000	.000
	A-CTFIN-SP-1	.000	.000	.000	.047	.000	.000	.129	.000	.000	.154	.019	.000	.000	.111	.046		.011	.000	.000	.000	.000	.000	.033	.000	.000	.015	.121	.000	.342	.018	.002
	A-CTFIN-SP-2	.232	.413	.023	.000	.023	.052	.000	.004	.000	.000	.000	.021	.086	.000	.000	.011		.230	.000	.323	.173	.323	.000	.001	.000	.000	.000	.000	.003	.087	.000
	A-CTFIN-SP-3	.000	.000	.000	.067	.000	.000	.132	.000	.000	.132	.028	.000	.000	.096	.016	.000	.230		.000	.000	.000	.000	.138	.000	.087	.437	.430	.101	.327	.030	.397
	A-CTFIN-SP-4	.000	.000	.000	.480	.000	.000	.005	.000	.000	.015	.120	.000	.000	.011	.235	.000	.000	.000		.000	.000	.000	.000	.000	.000	.208	.000	.000	.254	.231	.086
	A-CTFIN-SP-5	.000	.000	.000	.088	.000	.000	.476	.000	.000	.493	.216	.000	.000	.409	.248	.000	.323	.000	.000		.000	.000	.253	.000	.204	.167	.110	.268	.267	.192	.089
	A-CTFIN-SP-6	.000	.000	.000	.097	.000	.000	.128	.000	.000	.194	.044	.000	.000	.145	.099	.000	.173	.000	.000	.000		.000	.127	.000	.478	.467	.033	.402	.444	.051	.374
	A-CTFIN-SP-7	.000	.000	.000	.088	.000	.000	.365	.000	.000	.266	.075	.000	.000	.204	.155	.000	.323	.000	.000	.000	.000		.253	.000	.245	.245	.079	.314	.476	.077	.143
	A-CTFIN-SP-8	.303	.499	.008	.000	.014	.055	.000	.004	.000	.000	.000	.009	.064	.000	.000	.033	.000	.138	.000	.253	.127	.253		.000	.000	.000	.000	.000	.000	.037	.000
	A-CTFIN-SP-9	.000	.000	.000	.031	.000	.000	.055	.000	.000	.445	.143	.000	.000	.465	.102	.000	.001	.000	.000	.000	.000	.000	.000		.000	.005	.007	.000	.275	.097	.000
	A-CTFIN-SP-10	.048	.031	.030	.000	.057	.203	.000	.020	.001	.000	.000	.007	.076	.000	.000	.000	.000	.087	.000	.204	.478	.245	.000	.000		.000	.000	.000	.000	.000	.000
	A-CTFIN-SP-11	.108	.011	.021	.000	.041	.161	.000	.056	.010	.000	.000	.116	.237	.000	.000	.015	.000	.437	.208	.167	.467	.245	.000	.005	.000		.000	.000	.000	.000	.000
	A-CTFIN-SP-12	.380	.467	.010	.174	.028	.079	.000	.006	.001	.000	.005	.050	.128	.000	.026	.121	.000	.430	.000	.110	.033	.079	.000	.007	.000	.000		.000	.000	.000	.000
	A-CTFIN-SP-13	.096	.050	.051	.000	.068	.179	.000	.012	.001	.000	.000	.014	.053	.000	.000	.000	.000	.101	.000	.268	.402	.314	.000	.000	.000	.000	.000		.000	.000	.000
	A-CTFIN-SP-14	.275	.203	.351	.000	.474	.346	.000	.381	.431	.000	.000	.400	.416	.000	.000	.342	.003	.327	.254	.267	.444	.476	.000	.275	.000	.000	.000	.000		.000	.000
	A-CTFIN-SP-15	.361	.248	.203	.000	.124	.052	.000	.072	.090	.000	.000	.090	.092	.000	.000	.018	.087	.030	.231	.192	.051	.077	.037	.097	.000	.000	.000	.000	.000		.000
	A-CTFIN-SP-16	.052	.008	.010	.000	.022	.103	.000	.015	.005	.000	.000	.042	.104	.000	.000	.002	.000	.397	.086	.089	.374	.143	.000	.000	.000	.000	.000	.000	.000	.000	
Determinant = 3.544E-023																																

Table-6.3-3: Revised Correlation Matrix after Exclusion of variables that do not meet criteria

Correlation Matrix		A-CTFIN-IFT-1	A-CTFIN-IFT-2	A-CTFIN-IFT-3	A-CTFIN-IFT-5	A-CTFIN-IFT-6	A-CTFIN-IFT-8	A-CTFIN-IFT-9	A-CTFIN-IFT-12	A-CTFIN-IFT-13	A-CTFIN-SP-1	A-CTFIN-SP-3	A-CTFIN-SP-4	A-CTFIN-SP-5	A-CTFIN-SP-6	A-CTFIN-SP-7	A-CTFIN-SP-9
Correlation	A-CTFIN-IFT-1	1.000	0.767	0.647	0.499	0.334	0.412	0.407	0.357	0.405	0.360	0.428	0.303	0.483	0.336	0.472	0.625
	A-CTFIN-IFT-2	0.767	1.000	0.631	0.446	0.374	0.499	0.568	0.535	0.579	0.429	0.583	0.341	0.617	0.337	0.606	0.518
	A-CTFIN-IFT-3	0.647	0.631	1.000	0.517	0.429	0.544	0.601	0.561	0.583	0.522	0.626	0.435	0.661	0.363	0.671	0.400
	A-CTFIN-IFT-5	0.499	0.446	0.517	1.000	0.382	0.399	0.404	0.342	0.418	0.333	0.426	0.420	0.477	0.386	0.456	0.326
	A-CTFIN-IFT-6	0.334	0.374	0.429	0.382	1.000	0.593	0.459	0.426	0.581	0.454	0.373	0.647	0.517	0.346	0.378	0.332
	A-CTFIN-IFT-8	0.412	0.499	0.544	0.399	0.593	1.000	0.764	0.666	0.821	0.665	0.550	0.344	0.760	0.353	0.597	0.361
	A-CTFIN-IFT-9	0.407	0.568	0.601	0.404	0.459	0.764	1.000	0.804	0.811	0.543	0.719	0.407	0.743	0.353	0.724	0.404
	A-CTFIN-IFT-12	0.357	0.535	0.561	0.342	0.426	0.666	0.804	1.000	0.781	0.560	0.662	0.379	0.718	0.339	0.665	0.402
	A-CTFIN-IFT-13	0.405	0.579	0.583	0.418	0.581	0.821	0.811	0.781	1.000	0.681	0.657	0.374	0.847	0.348	0.641	0.378
	A-CTFIN-SP-1	0.360	0.429	0.522	0.333	0.454	0.665	0.543	0.560	0.681	1.000	0.483	0.345	0.720	0.302	0.540	0.310
	A-CTFIN-SP-3	0.428	0.583	0.626	0.426	0.373	0.550	0.719	0.662	0.657	0.483	1.000	0.377	0.667	0.310	0.822	0.411
	A-CTFIN-SP-4	0.303	0.341	0.435	0.420	0.647	0.344	0.407	0.379	0.374	0.345	0.377	1.000	0.432	0.314	0.419	0.303
	A-CTFIN-SP-5	0.483	0.617	0.661	0.477	0.517	0.760	0.743	0.718	0.847	0.720	0.667	0.432	1.000	0.352	0.750	0.405
	A-CTFIN-SP-6	0.336	0.337	0.363	0.386	0.346	0.353	.353	0.339	0.348	0.302	0.310	0.314	0.352	1.000	0.389	0.365
	A-CTFIN-SP-7	0.472	0.606	0.671	0.456	0.378	0.597	0.724	0.665	0.641	0.540	0.822	0.419	0.750	0.389	1.000	0.435
	A-CTFIN-SP-9	0.625	0.518	0.400	0.326	0.332	0.361	0.404	0.402	0.378	0.310	0.411	0.103	0.405	0.365	0.435	1.000
Sig. (1-tailed)	A-CTFIN-IFT-1	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.000	0.000
	A-CTFIN-IFT-2	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	A-CTFIN-IFT-3	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	A-CTFIN-IFT-5	0.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	A-CTFIN-IFT-6	0.000	0.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	A-CTFIN-IFT-8	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	A-CTFIN-IFT-9	0.000	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	A-CTFIN-IFT-12	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	A-CTFIN-IFT-13	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	A-CTFIN-SP-1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000
	A-CTFIN-SP-3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000
	A-CTFIN-SP-4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	0.000	0.000
	A-CTFIN-SP-5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	0.000
	A-CTFIN-SP-6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000
	A-CTFIN-SP-7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-	0.000
	A-CTFIN-SP-9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-

a. Determinant = 1.965E-006

Table-6.3-4: Explores the variability in scores (Anti-Image Matrices)																
Anti-image Correlation	A-CTFIN-IFT-1	A-CTFIN-IFT-2	A-CTFIN-IFT-3	A-CTFIN-IFT-5	A-CTFIN-IFT-6	A-CTFIN-IFT-8	A-CTFIN-IFT-9	A-CTFIN-IFT-12	A-CTFIN-IFT-13	A-CTFIN-SP-1	A-CTFIN-SP-3	A-CTFIN-SP-4	A-CTFIN-SP-5	A-CTFIN-SP-6	A-CTFIN-SP-7	A-CTFIN-SP-9
A-CTFIN-IFT-1	0.803a	-0.592	-0.373	-0.179	-0.093	-0.066	0.021	0.115	0.123	0.002	0.072	-0.004	-0.009	0.082	0.070	-0.471
A-CTFIN-IFT-2	-0.592	0.910a	0.034	0.058	0.017	0.085	-0.024	-0.062	-0.141	0.061	-0.089	-0.006	-0.074	-0.048	-0.084	0.062
A-CTFIN-IFT-3	-0.373	0.034	0.950a	-0.107	0.001	0.011	-0.037	-0.066	0.021	-0.105	-0.102	-0.056	-0.085	-0.073	-0.140	0.162
A-CTFIN-IFT-5	-0.179	0.058	-0.107	0.960a	-0.007	-0.035	0.021	0.087	-0.048	0.059	-0.049	-0.178	-0.073	-0.043	-0.032	-0.026
A-CTFIN-IFT-6	-0.093	0.017	0.001	-0.007	0.835.3	-0.320	0.164	0.049	-0.263	0.018	-0.020	-0.577	0.088	-0.027	0.057	0.121
A-CTFIN-IFT-8	-0.066	0.085	0.011	-0.035	-0.320	0.916a	-0.374	0.040	-0.222	-0.204	0.132	0.207	-.0110	0.145	-0.056	-0.031
A-CTFIN-IFT-9	0.021	-0.024	-0.037	0.021	0.164	-0.374	0.922a	-0.313	-0.253	0.163	-0.143	-0.153	0.077	-0.168	-0.148	-0.012
A-CTFIN-IFT-12	0.115	-0.062	-0.066	0.087	0.049	0.040	-0.313	0.953a	-0.253	-0.060	-0.034	-0.085	-0.011	-0.102	-0.052	-0.134
A-CTFIN-IFT-13	0.123	-0.141	0.021	-0.048	-0.263	-0.222	-0.253	-0.253	0.901a	-0.122	-0.166	0.194	-0.438	0.034	0.253	-0.023
A-CTFIN-SP-1	0.002	0.061	-0.105	0.059	0.018	-0.204	0.163	-0.060	-0.122	0.951a	0.005	-0.073	-0.264	0.090	-0.024	-0.039
A-CTFIN-SP-3	0.072	-0.089	-0.102	-0.049	-0.020	0.132	-0.143	-0.034	-0.166	0.005	0.921a	0.017	0.107	-0.031	-0.540	-0.054
A-CTFIN-SP-4	-0.004	-0.006	-0.056	-0.178	-0.577	0.207	-0.153	-0.085	0.194	-0.073	0.017	0.815.3	-0.096	-0.039	-0.072	0.098
A-CTFIN-SP-5	-0.009	-0.074	-0.085	-0.073	0.088	-0.110	0.077	-0.011	-0.438	-0.264	0.107	-0.096	0.929a	-0.044	-0.341	0.021
A-CTFIN-SP-6	0.082	-0.048	-0.073	-0.043	-0.027	0.145	-0.168	-0.102	0.034	0.090	-0.031	-0.039	-0.044	0.901a	0.026	-0.052
A-CTFIN-SP-7	0.070	-0.084	-0.140	-0.032	0.057	-0.056	-0.148	-0.052	0.253	-0.024	-0.540	-0.072	-0.341	0.026	0.903a	-0.078
A-CTFIN-SP-9	-0.471	0.062	0.162	-0.026	0.121	-0.031	-0.012	-0.134	-0.023	-0.039	-0.054	0.098	0.021	-0.052	-0.078	0.876a
*Measures of Sampling Adequacy																

Table-6.3-6: Extraction Method: Principal Component Analysis (Total Variance explained)

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings (a)
	Total	Variance (%)	Cumulative (%)	Total	Variance (%)	Cumulative (%)	Total
1	8.532	53.326	53.326	8.532	53.326	53.326	7.615
2	1.422	8.885	62.211	1.422	8.885	62.211	5.201
3	1.174	7.335	69.546	1.174	7.335	69.546	3.265
4	1.043	6.516	76.062	1.043	6.516	76.062	2.022
5	0.657	4.105	80.167	-	-	-	-
6	0.566	3.538	83.705	-	-	-	-
7	0.506	3.161	86.866	-	-	-	-
8	0.458	2.860	89.726	-	-	-	-
9	0.332	2.077	91.803	-	-	-	-
10	0.325	2.034	93.837	-	-	-	-
11	0.242	1.510	95.347	-	-	-	-
12	0.212	1.327	96.674	-	-	-	-
13	0.174	1.088	97.762	-	-	-	-
14	0.143	0.896	98.658	-	-	-	-

15	0.128	0.797	99.455	-	-	-	-
16	0.087	0.545	100.000	-	-	-	-
a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance							

Table-6.3-8: Details of Factor Extraction (oblique rotation with four factors)

Pattern Matrix (a)

Dimensions	Component			
	1	2	3	4
A-CTFIN-IFT-13	0.925	-	-	-
A-CTFIN-IFT-8	0.891	-	-	-
A-CTFIN-IFT-12	0.828	-	-	-
A-CTFIN-IFT-9	0.817	-	-	-
A-CTFIN-SP-1	0.805	-	-	-
A-CTFIN-SP-5	0.799	-	-	-
A-CTFIN-SP-7	0.586	-	-	-
A-CTFIN-SP-3	0.582	-	-	-
A-CTFIN-IFT-1	-	0.952	-	-
A-CTFIN-SP-9	-	0.779	-	-
A-CTFIN-IFT-2	-	0.697	-	-
A-CTFIN-IFT-5	-	0.511	0.463	-
A-CTFIN-IFT-3	-	0.491	-	-
A-CTFIN-SP-4	-	-	0.848	-
A-CTFIN-IFT-6	-	-	0.725	-
A-CTFIN-SP-6	-	-	-	0.900

Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 7 iterations.

Structure Matrix

Dimensions	Component			
	1	2	3	4
A-CTFIN-IFT-13	0.931	0.462	-	-
A-CTFIN-SP-5	0.900	0.560	0.429	-
A-CTFIN-IFT-9	0.881	0.487	-	0.431
A-CTFIN-IFT-8	0.880	0.431	0.408	-
A-CTFIN-IFT-12	0.853	0.439	-	0.417
A-CTFIN-SP-7	0.784	0.615	-	0.443
A-CTFIN-SP-1	0.782	-	-	-
A-CTFIN-SP-3	0.758	0.571	-	0.492
A-CTFIN-IFT-1	0.427	0.920	-	-
A-CTFIN-IFT-2	0.601	0.831	-	-
A-CTFIN-SP-9	0.420	0.778	-	-
A-CTFIN-IFT-3	0.658	0.719	0.463	-
A-CTFIN-IFT-5	0.405	0.611	0.572	-
A-CTFIN-SP-4	0.405	-	0.879	-
A-CTFIN-IFT-6	0.568	-	0.833	-
A-CTFIN-SP-6	-	-	-	0.900

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

Table-6.3-9: Details of Component Correlation Matrix

Component Correlation Matrix

Component	1	2	3	4
1	1.000	0.508	0.387	0.241
2	0.508	1.000	0.240	0.217
3	0.387	0.240	1.000	0.096
4	0.241	0.217	0.096	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

Table-6.3-10: Details of Factor Extraction (Orthogonal Varimax Rotation with four factors)

Rotated Component Matrix (a)

Dimensions	Component			
	1	2	3	4
A-CTFIN-IFT-13	0.872	-	-	-
A-CTFIN-IFT-8	0.833	-	-	-
A-CTFIN-SP-5	0.800	-	-	-
A-CTFIN-IFT-9	0.798	-	-	-
A-CTFIN-IFT-12	0.790	-	-	-

A-CTFIN-SP-1	0.747	-	-	-
A-CTFIN-SP-7	0.646	0.430		
A-CTFIN-SP-3	0.631	-	-	-
A-CTFIN-IFT-1	-	0.889	-	-
A-CTFIN-SP-9	-	0.760	-	-
A-CTFIN-IFT-2	-	0.733	-	-
A-CTFIN-IFT-3	0.451	0.576	-	-
A-CTFIN-IFT-5	-	0.519	0.509	-
A-CTFIN-SP-4	-	-	0.844	-
A-CTFIN-IFT-6	0.429	-	0.769	-
A-CTFIN-SP-6	-	-	-	0.888
Extraction Method: Principal Component Analysis AND Rotation Method: Varimax with Kaiser Normalization.				
a. Rotation converged in 5 iterations.				
Component Matrixa				
Dimensions	Component			
	1	2	3	4
A-CTFIN-SP-5	0.890	-	-	-
A-CTFIN-IFT-13	0.872	-	-	-
A-CTFIN-IFT-9	0.859	-	-	-
A-CTFIN-SP-7	0.834	-	-	-
A-CTFIN-IFT-12	0.814	-	-	-
A-CTFIN-IFT-8	0.813	-	-	-
A-CTFIN-SP-3	0.801	-	-	-
A-CTFIN-IFT-3	0.792	-	-	-
A-CTFIN-IFT-2	0.757	0.401	-	
A-CTFIN-SP-1	0.714	-	-	-
A-CTFIN-IFT-1	0.650	0.608	-	-
A-CTFIN-IFT-6	0.620	-	0.504	-
A-CTFIN-IFT-5	0.594	-	0.407	-
A-CTFIN-SP-9	0.541	0.584	-	
A-CTFIN-SP-4	0.548	-	0.612	-
A-CTFIN-SP-6	-	-	-	0.819
Extraction Method: Principal Component Analysis.				
a. 4 components extracted.				

Table-6.3-11: Details of Component Correlation Matrix				
Component Transformation Matrix				
Component	1	2	3	4
1	0.759	0.504	0.356	0.207
2	-0.423	0.847	-0.321	0.039
3	-0.423	0.128	0.863	-0.245
4	-0.258	-0.113	0.159	0.946
Extraction Method: Principal Component Analysis, Rotation Method: Varimax with Kaiser Normalization.				

Table-6.3-12: Factor-1; Details of Inter-item correlation matrix								
Factor-1: Inter-Item Correlation Matrix								
Contractual Binding with Suppliers	A-CTFIN-IFT-8	A-CTFIN-IFT-9	A-CTFIN-IFT-12	A-CTFIN-IFT-13	A-CTFIN-SP-1	A-CTFIN-SP-3	A-CTFIN-SP-5	A-CTFIN-SP-7
A-CTFIN-IFT-8	1.000	0.764	0.666	0.821	0.665	0.550	0.760	0.597
A-CTFIN-IFT-9	0.764	1.000	0.804	0.811	0.543	0.719	0.743	0.724
A-CTFIN-IFT-12	0.666	0.804	1.000	0.781	0.560	0.662	0.718	0.665
A-CTFIN-IFT-13	0.821	0.811	0.781	1.000	0.681	0.657	0.847	0.641
A-CTFIN-SP-1	0.665	0.543	0.560	0.681	1.000	0.483	0.720	0.540
A-CTFIN-SP-3	0.550	0.719	0.662	0.657	0.483	1.000	0.667	0.822
A-CTFIN-SP-5	0.760	0.743	0.718	0.847	0.720	0.667	1.000	0.750
A-CTFIN-SP-7	0.597	0.724	0.665	0.641	0.540	0.822	0.750	1.000

Table-6.3-12: Factor-1; Details of Item-Total Statistics					
Factor-1: Item-Total Statistics					
Contractual Binding with Suppliers	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
A-CTFIN-IFT-8	30.03	19.665	0.802	0.736	0.940
A-CTFIN-IFT-9	29.97	19.788	0.857	0.797	0.937
A-CTFIN-IFT-12	30.05	19.626	0.808	0.708	0.940
A-CTFIN-IFT-13	30.04	19.166	0.882	0.847	0.935

A-CTFIN-SP-1	29.78	20.438	0.687	0.567	0.947
A-CTFIN-SP-3	29.98	19.742	0.754	0.724	0.943
A-CTFIN-SP-5	29.99	19.010	0.876	0.815	0.935
A-CTFIN-SP-7	29.95	19.704	0.788	0.774	0.941

Table-6.3-12: Factor-1; Details of Reliability Statistics		
Factor-1: Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of Items
0.947	0.947	8

Table-6.3-13 Factor-2; Details of Inter-item correlation matrix					
Factor-2: Inter-Item Correlation Matrix					
Campaign against Product Counterfeiting	A-CTFIN-IFT-1	A-CTFIN-IFT-2	A-CTFIN-IFT-3	A-CTFIN-IFT-5	A-CTFIN-SP-9
A-CTFIN-IFT-1	1.00	0.77	0.65	0.50	0.63
A-CTFIN-IFT-2	0.77	1.00	0.63	0.45	0.52
A-CTFIN-IFT-3	0.65	0.63	1.00	0.52	0.40
A-CTFIN-IFT-5	0.50	0.45	0.52	1.00	0.33
A-CTFIN-SP-9	0.63	0.52	0.40	0.33	1.00

Table-6.3-13: Factor-2; Details of Item-Total Statistics					
Factor-2: Item-Total Statistics					
Campaign against Product Counterfeiting	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
A-CTFIN-IFT-1	15.9	6.69	0.81	0.70	0.78
A-CTFIN-IFT-2	15.6	7.01	0.75	0.62	0.80
A-CTFIN-IFT-3	15.9	7.16	0.69	0.50	0.82
A-CTFIN-IFT-5	15.9	7.78	0.54	0.32	0.86
A-CTFIN-SP-9	15.3	8.28	0.56	0.40	0.85

Table-6.3-13: Factor-2; Details of Reliability Statistics		
Factor-2: Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of Items
0.854	0.853	5

Table-6.3-14: Factor-3; Details of Inter-Item Correlation matrix		
Factor-3: Inter-Item Correlation Matrix		
Follow best industry technique to counter counterfeiting	A-CTFIN-IFT-6	A-CTFIN-SP-4
A-CTFIN-IFT-6	1.000	0.647
A-CTFIN-SP-4	0.647	1.000

Table-6.3-14: Factor-3; Details of Item-Total Statistics					
Factor-3: Item-Total Statistics					
Follow best industry technique to counter counterfeiting	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
A-CTFIN-IFT-6	4.4	0.5	0.6	0.4	-
A-CTFIN-SP-4	4.2	0.6	0.6	0.4	-

Table-6.3-14: Factor-3; Details of Reliability Statistics		
Factor-3: Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of Items
0.785	0.786	2

ANNEXURE-IT-1: INTERVIEWS TRANSCRIPTIONS

Interviewee Introduction (Pak Suzuki Motors) Table-IT-1 (a)	My name is **Shakeel Ahmed Khan (Deputy Manager);** experience 6 years; Looking after "Vendor Industry of North Region" for component supply for manufacturing 2 vehicles and 4 vehicles.
Q.1 How company maintain close relationship (integration & cooperation) with suppliers (tier-1 and tier-2)?	Suzuki team holds two bi-annual coordination meetings with tier-1 suppliers and discuss annual production plan supply targets expected supply flow. Tier-1 supplier controlling the Tier-2 suppliers, ensure the parts quality and supplier development issues. The Suzuki team monitor the performance of all suppliers according to lead-time and supply targets.
Q.2 How company exhibits control over suppliers in order to maintain logistics assurance and quality assurance?	Suzuki team performs random inspections of supplies at supplier place, administer quality test, audit of the supplier, and grade suppliers' performance. Suzuki SRM (supplier relationship management) portal is available to all parts suppliers to maintain supplies. There is a feedback mechanism attached with this system.
Q.3 How company handle dependency problem with respect to key suppliers?	All critical parts management done by appointing single source vendors. These vendors are reliable in the sense that they are serving Suzuki motors since decades. The performance of these vendors found consistent. The quality of these critical parts important because they can create safety problems for the drivers.
Q.4 How company classifies inbound logistic supply chains flows?	A big conveyor system installed at Karachi manufacturing plant that carries not only chassis but whole car also to different sections of production. This system can handle missing parts assembly issues in cars during the car manufacturing / assembly process. The parts classified according to inbound logistic flow during parts assembly process.
Q.5 How far TQM and SCM practices in your organisation impacts on performance factors, like Employee Moral, Customer Satisfaction, Inventory Management, and Quality?	Since July 1st 2016, Suzuki motors following Government automotive policy recommended by authorities for all OEMs working in Pakistan. The company is now bound to deliver cars to their customers within 2 months after taking the 20% payment of the purchase price of the car. Otherwise, company will compensate their customers. Now the customer is more satisfied that their full payment not blocked with known car delivery details. Earlier OEMs deduct 100% car purchase amount in advance and delivery normally delayed without compensation to the customers.
Q.6 How far company believe that product counterfeiting does exist in supply chain?	In inbound logistics there is very remote possibility that product counterfeiting exists. Suzuki does not rely on any 3PL for upstream supply chain instead maintain logistics activities by utilizing its own resources. Procurement teams directly monitor the supply activities. At the time when parts received at factory gate, the quality team checks the quality of the parts and perform fatigue & endurance tests. However, in Suzuki outbound logistics remote chances of counterfeiting activities due to the presence of transitional insurance. In an uncontrollable aftermarket situation, product counterfeiting does exists. .
Q.7 How far you believe that registered trademark, patents, industrial designs and copyrights are among most effective counterfeiting actions? Is IPR issue in practices?	Yes, we believe that these comes under product counterfeiting and company is addressing IPR issue.
Q.8 How far company believe that product counterfeiting is among common disturbance in supply chain?	Yes, because of product counterfeiting overall business of the company disturbed at large. People get counterfeit spares parts from the market buying willingly or unwillingly due to compromised prices.
Q.9 How far company believe that that taking anti-counterfeiting actions affect organisational performance?	Definitely, actions affect organisational performance positively and in turn curtail product-counterfeiting activities. As a brand ethics, it shows good gesture of the company.
Q.10 How far company believe that TQM and SCM practices under SCQM environment	Company believe that FSP, brand positioning and competitive advantage under SCQM (TQM and SCM practices in supply chain) positively affect overall organisation performance, brand loyalty and brand equity.

affects positively on Firms supply performance (FSP)?	
Q.11 Is there any strategy your company has applied to control counterfeiting activities?	Educate customer about the life threatening affects due to counterfeits usage. Suzuki adopted policy to educate customers.
Q.12 Would you like to discuss some of the most common disturbances in inbound supply chain and logistic flows?	Major three factors (weather, petroleum prices and political stability) really play very important role in smoothing out the supply chain activities. If these are stable then very little chances of any disturbance in Suzuki supply chain activities. In situations where mixed parts supplied to the factory and found defective at production line, due to a counterfeiting phenomenon, then lead-time issue created. Suzuki maintain buffer stocks for 3 to 5 days to address the demand issue. Safety stocks also maintained for two to three months at suppliers and dealers level as contractual binding to meet customers' needs. Suzuki vendors send parts by using their own trucks and monitor their supply chain activities by themselves. After transition time (36 hours) if the truck reaches factory safe and sound then no problem. Alternatively, Suzuki utilize inventory maintained at different regional vendor facilities with certain delay.
Q.13 Does company follow routines to control supply chain disturbances?	Suzuki Customer relationship management (CRM) portal is available to all vendors where every vendor logs on for getting desired information shared along with company supported performance feedback and vendor related information.
Q.14 What are most important anti-counterfeiting activities?	Educate internal customers and channel members, advertise dangerous effects of counterfeits to customers by using commercials, financial incentive given to retailers and distributors so to encourage them to update company about occurrence of counterfeiting events and practices in the market so that company could address the issue, announce warning about penalties against involvement of any counterfeiting activities, formation of surveillance teams to monitor counterfeiting activities, monitor retailers and distributors business activities in the market, solicitation activities perform from retailer and distributors, pursue injunction and laws enforcement policies, aggressively cut price policy to establish factories in lower cost areas / countries

Interviewee Introduction (Pak Suzuki Motors) Table-IT-1 (b)	My name is **Ashiq Hussain (Deputy Manager spare parts & sales)**; experience 9 years; look after activities of spare parts supply in the Lahore and allied regions.
Q.1 How company maintain close relationship (integration & cooperation) with suppliers (tier-1 and tier-2)?	Company maintain close relationship with vendors and suppliers. All parties installed Suzuki integrated management system that linked to their supply chain management systems. Suzuki team monitor the performance of all suppliers according to lead-time and supply targets. They organize meetings / seminars and conferences on yearly basis to understand vendors & suppliers need.
Q.2 How company exhibits control over suppliers in order to maintain logistics assurance and quality assurance?	Suzuki integrated management system monitor and control activities of vendors and suppliers. When company receive spare parts from the suppliers, the Suzuki team performs inspection and quality tests. In case of non-conformance, the parts rejected and returned to supplier for further quality improvements. Company look after the supply chain activities deeply with respect to Tier-1 & Tier-2 suppliers.
Q.3 How company handle dependency problem with respect to key suppliers?	Company maintained two vendors for the manufacturing of each spare part. In case one vendor found non-compliant in maintaining standards according to the company agreement then other option utilize to meet lead-time requirements.
Q.4 How company classifies inbound logistic supply chain flows?.	Suzuki supply chain department oversee logistics and availability of spare parts while quality assurance team works side by side to facilitate company level activities. In case of a quality issue, both teams work together to bring resolve to the problem.

Q.5 How far TQM and SCM practices in your organisation impacts on performance factors, like Employee Moral, Customer Satisfaction, Inventory Management, and Quality?	Suzuki follow advance level best industry activities to maintain TQM and SCM practices. The quality assurance and control team work in the guidance of these practices. Definitely, industry best practices enhance employee performance and moral.
Q.6 How far company believe that product counterfeiting does exist in supply chain?	Yes, product counterfeiting is a serious issue in Pakistan and 80% of spare parts in the markets are counterfeits. People are price conscious and buy non-genuine spare parts from other sources instead buying genuine parts. As the quality compromised by non-genuine spare parts, it threaten customer life safety.
Q.7 How far you believe that registered trademark, patents, industrial designs and copyrights are among most effective counterfeiting actions? Is IPR issue in practices?	Yes, we believe that these comes under product counterfeiting and company is addressing IPR issue. Company use social media and other platforms to advertise and educate customers about product counterfeiting issue.
Q.8 How far company believe that product counterfeiting is among common disturbance in supply chain?	Yes, because of product counterfeiting overall business of the company disturbed at large. As I said earlier, 80% of the spares parts in the market are counterfeits and definite disturb the company sale and fade good will.
Q.9 How far company believe that that taking anti-counterfeiting actions affect organisational performance?	Yes, actions affect organisational performance and in turn curtail product-counterfeiting activities. Customer satisfaction enhance employee morale and overall organisational performance.
Q.10 How far company believe that TQM and SCM practices under SCQM environment affects positively on Firms supply performance (FSP)?	Company believe that FSP, brand positioning and competitive advantage under SCQM (TQM and SCM practices in supply chain) positively affect overall organisation performance, brand loyalty and brand equity.
Q.11 Is there any strategy your company has applied to control counterfeiting activities?	Mostly imported expensive parts copied, so localizing parts would be a good option. Suzuki adopted policy to manufacture imported spare parts locally to offer competitive market price range.
Q.12 Would you like to discuss some of the most common disturbances in inbound supply chain and logistic flow?	Main disturbance do occur due to unavailability of parts in the market. Company maintain safety stock levels in case demand fluctuates in the market. Safety stock also maintained for two to three months at suppliers and dealers level as contractual binding to satisfy the customers' needs.
Q.13 Does company follow routines to control supply chain disturbances?	Company time to time review different policies with respect to dealers, distributors and suppliers so to perform stock level monitoring activities and their logistic flows and meetings arranged when necessary.
Q.14 What are most important anti-counterfeiting activities?	Educate internal customers and channel members, advertise dangerous effects of counterfeits to customers by using commercials, financial incentive given to retailers and distributors so to encourage them to update company about occurrence of counterfeiting events and practices in the market so that company could address the issue, announce warning about penalties against involvement of any counterfeiting activities, formation of surveillance teams to monitor counterfeiting activities, monitor retailers and distributors business activities in the market, solicitation activities perform from retailer and distributors, pursue injunction and laws enforcement policies, aggressively cut price policy to establish factories in lower cost areas / countries

Interviewee Introduction (Pak Suzuki Motors) Table-IT-1 (c)	My name is **Imran Ahmed (Deputy Manager After-Sales Services),** experience 2 years; major responsibility to maintain dealership development network in order to enhance company policy compliance.

Q.1 How company maintain close relationship (integration & cooperation) with suppliers (tier-1 and tier-2)?	Suzuki parts management department that hire vendors and encourage them to develop different parts. At the time of launch of a new model, department provide parts' specification to local suppliers / vendors. In case of any issue during quality checks, Suzuki engineers facilitate vendors to rectify problems.
Q.2 How company exhibits control over suppliers in order to maintain logistics assurance and quality assurance?	Field technical report prepared in case any part problem or subassemblies. The Suzuki parts management department closely coordinate with vendors and guide them to overcome that problem and ensure parts availability.
Q.3 How company handle dependency problem with respect to key suppliers?	Suzuki management is taking care of dependency problem and not related to my job responsibility.
Q.4 How company classifies inbound logistic supply chains flows?	Suzuki management is taking care of dependency problem and not related to my job responsibility.
Q.5 How far TQM and SCM practices in your organisation impacts on performance factors, like Employee Moral, Customer Satisfaction, Inventory Management, and Quality?	Suzuki is a ISO certified company and follow TQM and SCM practices in the organisation. These practices have a direct effect on all performance factors. .
Q.6 How far company believe that product counterfeiting does exist in supply chain?	In inbound logistics have remote possibility that product counterfeiting exists. However, in an uncontrollable aftermarket situation, product counterfeiting does exists. Customer is price conscious and buy parts from the local market. Pak Suzuki supply chain use imported parts supplied from Thailand and local parts assembly where chances of counterfeiting is negligible.
Q.7 How far you believe that registered trademark, patents, industrial designs and copyrights are among most effective counterfeiting actions? Is IPR issue in practices?	Yes, we believe that these comes under product counterfeiting and company is addressing IPR issue. It is not easy to fight against existing mafias in the market. However, Suzuki launched its own dealer at Mountgomri Road Lahore that assure availability of the genuine parts in the market.
Q.8 How far company believe that product counterfeiting is among common disturbance in supply chain?	Yes, because of product counterfeiting overall business of the company disturbed at large. People get counterfeit spares parts from the market buying willingly or unwillingly due to compromised prices and disturb Suzuki dealership network.
Q.9 How far company believe that that taking anti-counterfeiting actions affect organisational performance?	Definitely, actions affect organisational performance positively and in turn curtail product-counterfeiting activities. Suzuki dealership network will be protected by then and sales will be improved.
Q.10 How far company believe that TQM and SCM practices under SCQM environment affects positively on Firms supply performance (FSP)?	Company believe that FSP, brand positioning and competitive advantage under SCQM (TQM and SCM practices in supply chain) positively affect overall organisation performance, brand loyalty and brand equity.
Q.11 Is there any strategy your company has applied to control counterfeiting activities?	Educate customer about the life threatening affects due to counterfeits usage. Suzuki adopted policy to educate customers. Showroom displays used to display both counterfeit and genuine parts to educate customers.
Q.12 Would you like to discuss some of the most common disturbances in inbound supply chain and logistic flows?	Lead-time and short supply parts can be an issue with respect to availability. Especially in case of new product launch and demand variability.
Q.13 Does company follow routines to control supply chain disturbances?	Suzuki Customer relationship management (CRM) portal is available to all vendors where every vendor logs on for getting desired information shared along with company supported performance feedback and vendor related information.

Q.14 What are most important anti-counterfeiting activities?	Educate internal customers and channel members, advertise dangerous effects of counterfeits to customers by using commercials, financial incentive given to retailers and distributors so to encourage them to update company about occurrence of counterfeiting events and practices in the market so that company could address the issue, announce warning about penalties against involvement of any counterfeiting activities, formation of surveillance teams to monitor counterfeiting activities, monitor retailers and distributors business activities in the market, solicitation activities perform from retailer and distributors, pursue injunction and laws enforcement policies, aggressively cut price policy to establish factories in lower cost areas / countries

Interviewee Introduction (Honda Motors) **Table-IT-1(d)**	My name is **Amir Nazir (Senior Manager – Production control and planning);** experience 12 years; look after all local and imported parts supply for mass production ensure parts' delivery from receiving to assembly line. **Group Discussion** Farrukh Abbas Khan (Parts procurement officer) Sufian Mukhtar (Executive – Imports, Purchase & Logistics) Hameed Kamran (Executive – Production control supply division) Zahid Nadeem (Assistant Manager – Production control division) Mushahid Bukhari (Executive Product Planning & Marketing) Muhammad Haroon (Sales Manager)
Q.1 How company maintain close relationship (integration & cooperation) with suppliers (tier-1 and tier-2)?	Company follow policy of maintaining single supplier per part based on volume. Financing done to develop company suppliers. Quality focused teams confirm the conformance level of supplied parts at different levels and then Chief engineer quality confirm the complete process of manufacturing. International Honda office support also available at local level in case extraordinary issue arises.
Q.2 How company exhibits control over suppliers in order to maintain logistics assurance and quality assurance?	Honda follow Milk run concept by collecting parts from all the suppliers and facilitate logistics activities to ensure timely delivery of parts to assembly line. Quality checks made for every lot after approval by teams. Parts rejected as any non-conformance occurs.
Q.3 How company handle dependency problem with respect to key suppliers?	Company maintained long-term relationship with all suppliers. We do not have material manufacturing facility in Pakistan and we import it from Japan through Thailand. Then supply to our suppliers to maintain quality of the material for local markets.
Q.4 How company classifies inbound logistic supply chain flows?.	Company import all materials from different sources in bonded CKD conditions and do not classify inbound logistics supply chain flows. Mostly materials imported from Thailand, Indonesia and Japan.
Q.5 How far TQM and SCM practices in your organisation impacts on performance factors, like Employee Moral, Customer Satisfaction, Inventory Management, and Quality?	Company follow best industry activities to maintain TQM and SCM practices. Follow PDCA procedures and central SCM policies. Quality management done on regular basis and quarterly management reports prepared for senior management to see the progress in performance factors as far as the organisational process is concerned. Also closely monitor market activities with respect to customer satisfaction.
Q.6 How far company believe that product counterfeiting does exist in supply chain?	We do not see chance of product counterfeiting in company upstream supply chain where all materials and parts imported in bonded CKD form. Yes, there are chances of counterfeiting in aftermarket situation.

Q.7 How far you believe that registered trademark, patents, industrial designs and copyrights are among most effective counterfeiting actions? Is IPR issue in practices?	Yes, we believe that all terms comes under product counterfeiting and the company is addressing IPR issue.
Q.8 How far company believe that product counterfeiting is among common disturbance in supply chain?	We do not see chance of product counterfeiting in company upstream supply chain where all materials and parts imported in bonded CKD form. Yes, there are chances of counterfeiting in aftermarket situation and when used create disturbance in supply chain.
Q.9 How far company believe that that taking anti-counterfeiting actions affect organisational performance?	Yes, actions affect organisational performance and in turn curtail product-counterfeiting activities. Customer satisfaction enhance employee morale and overall organisational performance.
Q.10 How far company believe that TQM and SCM practices under SCQM environment affects positively on Firms supply performance (FSP)?	Company believe that FSP, brand positioning and competitive advantage under SCQM (TQM and SCM practices in supply chain) positively affect overall organisation performance, brand loyalty and brand equity.
Q.11 Is there any strategy your company has applied to control counterfeiting activities?	Dealers' agreements revised and no-conformant penalized. Company feedback information should be shared among partners. On the other side work in process to develop fixed seal with Honda logo pasted on each part but this process is still at brain storming stage..
Q.12 Would you like to discuss some of the most common disturbances in inbound supply chain and logistic flow?	Natural disaster, Strikes & political situation, delays due to late delivery and vendor issue.
Q.13 Does company follow routines to control supply chain disturbances?	Formal project management and its contingency plan is in practice. Formal dealers meetings organized in every six months.
Q.14 What are most important anti-counterfeiting activities?	Educate internal customers and channel members, advertise dangerous effects of counterfeits to customers by using commercials, financial incentive given to retailers and distributors so to encourage them to update company about occurrence of counterfeiting events and practices in the market so that company could address the issue, announce warning about penalties against involvement of any counterfeiting activities, formation of surveillance teams to monitor counterfeiting activities, monitor retailers and distributors business activities in the market, solicitation activities perform from retailer and distributors, pursue injunction and laws enforcement policies, aggressively cut price policy to establish factories in low cost areas / countries

Interviewee Introduction (Toyota Motors) Table-IT-1(e)	My name is Imtiaz Ahmed (Assistant manager parts sales)**,** experience 6 years; major responsibility to maintain parts sales and dealership network.
Q.1 How company maintain close relationship (integration & cooperation) with suppliers (tier-1 and tier-2)?	Company parts management teams maintain suppliers list and encourage them to supply and develop different parts. Close consultation meetings with suppliers and vendors are organized.
Q.2 How company exhibits control over suppliers in order to	Close coordinated meetings and monitoring activities to exhibit control over suppliers to overcome parts availability problem.

maintain logistics assurance and quality assurance?	
Q.3 How company handle dependency problem with respect to key suppliers?	Company maintained multiple vendors for the manufacturing spare part. Vendors /dealers agreements revised in case of non-compliant activities
Q.4 How company classifies inbound logistic supply chains flows?	Company oversee logistics to make spare parts available in the market while quality assurance team works side by side to facilitate company level activities.
Q.5 How far TQM and SCM practices in your organisation impacts on performance factors, like Employee Moral, Customer Satisfaction, Inventory Management, and Quality?	Company follow TQM and SCM practices. The quality team work in the guidance of these practices. Definitely, industry best practices enhance performance factors
Q.6 How far company believe that product counterfeiting does exist in supply chain?	Very remote possibility of counterfeiting in case of mixed parts supply. Otherwise, we have strong systems and policies in place. People buy non-genuine spare parts from other sources in after market situation
Q.7 How far you believe that registered trademark, patents, industrial designs and copyrights are among most effective counterfeiting actions? Is IPR issue in practices?	Yes, we believe that these comes under product counterfeiting and company is addressing IPR issue. Company use social media and other platforms to advertise and educate customers about product counterfeiting issue.
Q.8 How far company believe that product counterfeiting is among common disturbance in supply chain?	Not as common disturbance. There are other disturbances in supply chain include natural clamity, weather, short supply, lead-time and political issues.
Q.9 How far company believe that that taking anti-counterfeiting actions affect organisational performance?	Yes, Customer satisfaction enhance employee morale and overall organisational performance. Anti-counterfeiting actions require in order to address a prevailing issue.
Q.10 How far company believe that TQM and SCM practices under SCQM environment affects positively on Firms supply performance (FSP)?	SCQM (TQM and SCM practices in supply chain) environment positively affect overall organisation performance, brand loyalty and brand equity.
Q.11 Is there any strategy your company has applied to control counterfeiting activities?	Company adopted policy to manufacture imported expensive spare parts locally to offer competitive market price range.
Q.12 Would you like to discuss some of the most common disturbances in inbound supply chain and logistic flows?	There are disturbances in supply chain include weather, short supply, lead-time and political issues in the country. Safety stock also maintained for four months at suppliers and dealers level as contractual binding to satisfy the customers' needs.
Q.13 Does company follow routines to control supply chain disturbances?	Company time to time review policies and agreements with respect to dealers, distributors and suppliers so to perform stock level monitoring activities.
Q.14 What are most important anti-counterfeiting activities?	Educate internal customers and channel members, advertise dangerous effects of counterfeits to customers by using commercials, financial incentive given to retailers and distributors so to encourage them to update company about occurrence of counterfeiting events and practices in the market so that company could address the issue, announce warning about penalties against involvement of any counterfeiting activities, formation of surveillance teams to monitor counterfeiting activities, monitor retailers and distributors business activities in the market, solicitation activities perform from retailer and distributors, pursue injunction and laws enforcement policies, aggressively cut price policy to establish factories in lower cost areas / countries

List of Annexures (Table-3.2.7.2.1a): Interview questions

TABLE-3.2.7.2.1a: PAK SUZUKI MOTORS - Interview Questions (IQ) -COMPANY-1 Q1. Research questions (RQ)	IQ-1	IQ-2	IQ-3	IQ-4	IQ-5	IQ-6	IQ-7	IQ-8	IQ-9	IQ-10	IQ-11	IQ-12	IQ-13	IQ-14
Is the "Large Scale (LS) system" Thai model complete and able to capture contributory evidences, supported by the knowledge base, in the context of networked governance model supported SCQM-Imp environment by combining TQM and SCM practices and their impact on firm's supply performance (FSP), with the objective to address product counterfeiting issue in automotive industry's supply chains?	X													
1.1) All parties installed integrated management system	X													
1.2) All parties maintain lead time and meet supply targets	X													
1.3) Organize meetings, seminars, and conferences for vendors / suppliers	X													
1.3.1) Firms follow single vendor development policy														
1.3.2) Firms follow multiple vendor development policy	X													
1.4) Monitor and control supplier activities		X												
1.4.1) Collecting parts from all suppliers and facilitate logistics activities to meet lead time requirements														
1.5) Inspection and quality test performed while handling spare parts		X												
1.6) In case of non-conformance, parts rejected and returned to supplier		X												
1.7) Firms maintain multiple vendor policy to meet lead time requirement			X											
1.7.1) Parts are imported from Japan via Thailand and then supplied to local market														
1.8) Two teams (department and quality assurance) work together to ensure spare parts availability				X										
1.9) Firms follow industry best practices (TQM & SCM practices) to maintain its performance factors					X									
1.10) Buyers are price conscious and fake parts are a serious threat to health and safety						X								
1.10.1) Parts are imported at CKD level and chances of counterfeiting may occur in after-market situation.														
1.10.2) Local parts are used and chances of counterfeiting may occur in after-market situation.						X								
1.11) Firms uses social media and other platforms to advertise and educate customers about product counterfeiting issue.							X							
1.12) Counterfeit parts disturb the firms' supply performance								X						
1.13) Customers satisfaction enhances firm supply performance									X					
1.14) SCQM environment positively affect Firm's Supply Performance										X				

1.15) Firms' policy to localize expensive imported spare parts to control counterfeiting activities											X			
1.16) Safety stocks maintained at suppliers and dealers' level as contractual binding to satisfy customers' needs												X		
1.16.1) Firms maintain information feedback mechanism to maintain original parts presence in the market														
1.17) Firms time to time review policies with respect to dealers, distributors and suppliers to maintain stocks levels													X	
1.18) Project management with contingency plan in practice														
Q2. Research questions (RQ)														
Is the "Large Scale (LS) system" model valid as a hierarchical multidimensional formative measurement model for evaluating the impact of ANCT-INT measures on FSP for the automotive industry's supply chains in Pakistan?														X
1) Dealing with Customs and law enforcement agencies with the use of track & trace technologies by: Lobbying for more rigorous counterfeit controls, e.g.; Products attributes and Packaging														X
2) Dealing with market institutions and industry groups by: Lobbying for more rigorous counterfeit controls, e.g. forming alliances and networks & Joint advertisements														X
3) Discourage product counterfeiting with the goal of increasing the business and legal risks and making counterfeiting / Imitation costly														
4) Develop centralized distribution network														
5) Advertise about the safety, performance and financial risks associated with counterfeits and financial incentives for channel members to reject counterfeits														X
6) Introduce Public Awareness Program about product counterfeiting phenomenon														X
7) Introduce Process of investigation to address complaints														
8) Supplier should consider product/service features that are difficult to replicate and/or easy to distinguish from those of non-legitimate producers during product development/ improvement.														
9) Introduce Destruction process for obsolete products and components														
10) Introduce Collaboration and Joint Venture														
11) Develop Internal Resources and Invest in IPR protective countries														
12) Introduce Cooperation across supply chain, Supplier qualification, Supplier penalties for counterfeits and pass-through, Making product replication difficult and costly														X
13) Introduce strategies to prohibit counterfeit products, Introduce Strict Liability concept, Return of outsourced technology and product, Ensure authenticity of material and components, Use of track & trace technologies, Vigilant to control supply chain risk, Lean management, Sharing information with suppliers, dealers and retailers														X
14) Alter product characteristics on the basis of customer need														
15) Introduce Loss Prevention and Audit Programs														
16) Follow Industry Standards for Inspection and Acceptance in open market														
17) Introduce Supplier Audit Program														

18) To Develop Training Material for customer awareness regarding counterfeiting phenomenon														
19) Educate all Stakeholders regarding the product counterfeit phenomenon and serious issues related to it, especially employees, customers, authorities, law enforcement agencies and others														X
20) Strategic contribution to protect IP and implement best industry specific strategies to curb product counterfeiting phenomenon														
21) Formulate Crisis Management Plan and Surveillance Program for firms														X
22) Collaborative strategies, sharing intelligence of product counterfeiting activities with authorities and law enforcement agencies														
23) Develop Joint-Anti-Counterfeiting Action Plan														
24) Warn distributors and retailers about possible penalties using counterfeits														
25) Use of Product Track & Trace Technologies														
26) Develop Risk Management Plan														
27) Introduce Quality Assurance Program														
28) To exercise firm's power by taking Legal action against product counterfeiting														
29) Introduce Certified Retailer Program														
30) Do nothing, as one of the strategy to address counterfeiting phenomenon														
31) Introduce Product Disposal Program for firms														

TABLE-3.2.7.2.1b: HONDA MOTORS - Interview Questions (IQ): AS COMPANY-2 **Q1. Research questions (RQ)**	IQ-1	IQ-2	IQ-3	IQ-4	IQ-5	IQ-6	IQ-7	IQ-8	IQ-9	IQ-10	IQ-11	IQ-12	IQ-13	IQ-14
Is the "Large Scale (LS) system" Thai model complete and able to capture contributory evidences, supported by the knowledge base, in the context of networked governance model supported SCQM-Imp environment by combining TQM and SCM practices and their impact on firm's supply performance (FSP), with the objective to address product counterfeiting issue in automotive industry's supply chains?	X													
1.1) All parties installed integrated management system														
1.2) All parties maintain lead time and meet supply targets	X													
1.3) Organize meetings, seminars, and conferences for vendors / suppliers	X													
1.3.1) Firms follow single vendor development policy	X													
1.3.2) Firms follow multiple vendor development policy														
1.4) Monitor and control supplier activities		X												
1.4.1) Collecting parts from all suppliers and facilitate logistics activities to meet lead time requirements		X												
1.5) Inspection and quality test performed while handling spare parts		X												
1.6) In case of non-conformance, parts rejected and returned to supplier		X												

1.7) Firms maintain multiple vendor policy to meet lead time requirement.														
1.7.1) Parts are imported from Japan via Thailand and then supplied to local market			X											
1.8) Two teams (department and quality assurance) work together to ensure spare parts availability														
1.9) Firms follow industry best practices (TQM & SCM practices) to maintain its performance factors					X									
1.10) Buyers are price conscious and fake parts are a serious threat to health and safety						X								
1.10.1) Parts are imported at CKD level and chances of counterfeiting may occur in after-market situation.						X								
1.10.2) Local parts are used and chances of counterfeiting may occur in after-market situation.														
1.11) Firms uses social media and other platforms to advertise and educate customers about product counterfeiting issue.							X							
1.12) Counterfeit parts disturb the firms' supply performance								X						
1.13) Customers satisfaction enhances firm supply performance									X					
1.14) SCQM environment positively affect Firm's Supply Performance										X				
1.15) Firms' policy to localize expensive imported spare parts to control counterfeiting activities											X			
1.16) Safety stocks maintained at suppliers and dealers' level as contractual binding to satisfy customers' needs												X		
1.16.1) Firms maintain information feedback mechanism to maintain original parts presence in the market												X		
1.17) Firms time to time review policies with respect to dealers, distributors and suppliers to maintain stocks levels													X	
1.18) Project management with contingency plan in practice													X	
Q2. Research questions (RQ)														
Is the "Large Scale (LS) system" model valid as a hierarchical multidimensional formative measurement model for evaluating the impact of ANCT-INT measures on FSP for the automotive industry's supply chains in Pakistan?														X
1) Dealing with Customs and law enforcement agencies with the use of track & trace technologies by: Lobbying for more rigorous counterfeit controls, e.g.; Products attributes and Packaging														X
2) Dealing with market institutions and industry groups by: Lobbying for more rigorous counterfeit controls, e.g. forming alliances and networks & Joint advertisements														X
3) Discourage product counterfeiting with the goal of increasing the business and legal risks and making counterfeiting / Imitation costly														
4) Develop centralized distribution network														
5) Advertise about the safety, performance and financial risks associated with counterfeits and financial incentives for channel members to reject counterfeits														X
6) Introduce Public Awareness Program about product counterfeiting phenomenon														X
7) Introduce Process of investigation to address complaints														X

8) Supplier should consider product/service features that are difficult to replicate and/or easy to distinguish from those of non-legitimate producers during product development/ improvement.														X
9) Introduce Destruction process for obsolete products and components														
10) Introduce Collaboration and Joint Venture														
11) Develop Internal Resources and Invest in IPR protective countries														
12) Introduce Cooperation across supply chain, Supplier qualification, Supplier penalties for counterfeits and pass-through, Making product replication difficult and costly														X
13) Introduce strategies to prohibit counterfeit products, Introduce Strict Liability concept, Return of outsourced technology and product, Ensure authenticity of material and components, Use of track & trace technologies, Vigilant to control supply chain risk, Lean management, Sharing information with suppliers, dealers and retailers														X
14) Alter product characteristics on the basis of customer need														
15) Introduce Loss Prevention and Audit Programs														
16) Follow Industry Standards for Inspection and Acceptance in open market														
17) Introduce Supplier Audit Program														
18) To Develop Training Material for customer awareness regarding counterfeiting phenomenon														
19) Educate all Stakeholders regarding the product counterfeit phenomenon and serious issues related to it, especially employees, customers, authorities, law enforcement agencies and others														X
20) Strategic contribution to protect IP and implement best industry specific strategies to curb product counterfeiting phenomenon														
21) Formulate Crisis Management Plan and Surveillance Program for firms														X
22) Collaborative strategies, sharing intelligence of product counterfeiting activities with authorities and law enforcement agencies														
23) Develop Joint-Anti-Counterfeiting Action Plan														
24) Warn distributors and retailers about possible penalties using counterfeits														
25) Use of Product Track & Trace Technologies														
26) Develop Risk Management Plan														
27) Introduce Quality Assurance Program														
28) To exercise firm's power by taking Legal action against product counterfeiting														
29) Introduce Certified Retailer Program														
30) Do nothing as one of the strategy to address counterfeiting phenomenon														
31) Introduce Product Disposal Program for firms														

TABLE-3.2.7.2.1c: TOYOTA MOTORS - Interview Questions (IQ): AS COMPANY-3	IQ-1	IQ-2	IQ-3	IQ-4	IQ-5	IQ-6	IQ-7	IQ-8	IQ-9	IQ-10	IQ-11	IQ-12	IQ-13	IQ-14
Q1. Research questions (RQ)														

Is the "Large Scale (LS) system" Thai model complete and able to capture contributory evidences, supported by the knowledge base, in the context of networked governance model supported SCQM-Imp environment by combining TQM and SCM practices and their impact on firm's supply performance (FSP), with the objective to address product counterfeiting issue in automotive industry's supply chains?	X													
1.1) All parties installed integrated management system	X													
1.2) All parties maintain lead time and meet supply targets	X													
1.3) Organize meetings, seminars, and conferences for vendors / suppliers	X													
1.3.1) Firms follow single vendor development policy														
1.3.2) Firms follow multiple vendor development policy	X													
1.4) Monitor and control supplier activities		X												
1.4.1) Collecting parts from all suppliers and facilitate logistics activities to meet lead time requirements														
1.5) Inspection and quality test performed while handling spare parts		X												
1.6) In case of non-conformance, parts rejected and returned to supplier		X												
1.7) Firms maintain multiple vendor policy to meet lead time requirement			X											
1.7.1) Parts are imported from Japan via Thailand and then supplied to local market														
1.8) Two teams (department and quality assurance) work together to ensure spare parts availability				X										
1.9) Firms follow industry best practices (TQM & SCM practices) to maintain its performance factors					X									
1.10) Buyers are price conscious and fake parts are a serious threat to health and safety						X								
1.10.1) Parts are imported at CKD level and chances of counterfeiting may occur in after-market situation.														
1.10.2) Local parts are used and chances of counterfeiting may occur in after-market situation.						X								
1.11) Firms uses social media and other platforms to advertise and educate customers about product counterfeiting issue.							X							
1.12) Counterfeit parts disturb the firms' supply performance								X						
1.13) Customers satisfaction enhances firm supply performance									X					
1.14) SCQM environment positively affect Firm's Supply Performance										X				
1.15) Firms' policy to localize expensive imported spare parts to control counterfeiting activities											X			
1.16) Safety stocks maintained at suppliers and dealers' level as contractual binding to satisfy customers' needs												X		
1.16.1) Firms maintain information feedback mechanism to maintain original parts presence in the market														
1.17) Firms time to time review policies with respect to dealers, distributors and suppliers to maintain stocks levels													X	
1.18) Project management with contingency plan in practice														

Q2. Research questions (RQ)														
Is the "Large Scale (LS) system" model valid as a hierarchical multidimensional formative measurement model for evaluating the impact of ANCT-INT measures on FSP for the automotive industry's supply chains in Pakistan?														X
1) Dealing with Customs and law enforcement agencies with the use of track & trace technologies by: Lobbying for more rigorous counterfeit controls, e.g.; Products attributes and Packaging														X
2) Dealing with market institutions and industry groups by: Lobbying for more rigorous counterfeit controls, e.g. forming alliances and networks & Joint advertisements														X
3) Discourage product counterfeiting with the goal of increasing the business and legal risks and making counterfeiting / Imitation costly														
4) Develop centralized distribution network														
5) Advertise about the safety, performance and financial risks associated with counterfeits and financial incentives for channel members to reject counterfeits														X
6) Introduce Public Awareness Program about product counterfeiting phenomenon														X
7) Introduce Process of investigation to address complaints														
8) Supplier should consider product/service features that are difficult to replicate and/or easy to distinguish from those of non-legitimate producers during product development/ improvement.														
9) Introduce Destruction process for obsolete products and components														
10) Introduce Collaboration and Joint Venture														
11) Develop Internal Resources and Invest in IPR protective countries														
12) Introduce Cooperation across supply chain, Supplier qualification, Supplier penalties for counterfeits and pass-through, Making product replication difficult and costly														X
13) Introduce strategies to prohibit counterfeit products, Introduce Strict Liability concept, Return of outsourced technology and product, Ensure authenticity of material and components, Use of track & trace technologies, Vigilant to control supply chain risk, Lean management, Sharing information with suppliers, dealers and retailers														X
14) Alter product characteristics on the basis of customer need														
15) Introduce Loss Prevention and Audit Programs														
16) Follow Industry Standards for Inspection and Acceptance in open market														
17) Introduce Supplier Audit Program														
18) To Develop Training Material for customer awareness regarding counterfeiting phenomenon														
19) Educate all Stakeholders regarding the product counterfeit phenomenon and serious issues related to it, especially employees, customers, authorities, law enforcement agencies and others														X
20) Strategic contribution to protect IP and implement best industry specific strategies to curb product counterfeiting phenomenon														
21) Formulate Crisis Management Plan and Surveillance Program for firms														X

22) Collaborative strategies, sharing intelligence of product counterfeiting activities with authorities and law enforcement agencies														
23) Develop Joint-Anti-Counterfeiting Action Plan														
24) Warn distributors and retailers about possible penalties using counterfeits														
25) Use of Product Track & Trace Technologies														
26) Develop Risk Management Plan														
27) Introduce Quality Assurance Program														
28) To exercise firm's power by taking Legal action against product counterfeiting														
29) Introduce Certified Retailer Program														
30) Do nothing, as one of the strategies to address counterfeiting phenomenon														
31) Introduce Product Disposal Program for firms														

Annexure-IP-1

Interview protocol

Title: An Empirical Analysis to Control Counterfeiting in Supply Chains of Automotive industry's

Introduction

The purpose of this doctoral study is to assess the firms' level of readiness against counterfeiting activities in their supply chains and to develop standardized "Anti-counterfeiting Performance Rating Scale" so that firm's readiness can be determined, specifically in automotive industry's in Pakistan. In other words, the study aims to find out how anti-counterfeiting strategies and SCQM environment affect firm supply performance. Whereas, the term counterfeiting phenomenon, refer to a range of illicit activities linked to Intellectual Property Right (IPR) infringements; deals with registered activities as Trademarks / Patents / Industrial Design / Copyright. The Interviews are recorded.

Introduction of Researcher and Purpose of the Interview

Saad Akhter Jaffery,
Doctoral Candidate,

Technological University
Dublin, Ireland

The purpose of the interview is to conduct exploratory study to determine most important anti-counterfeiting strategies for practitioners to combat against counterfeiting phenomenon. Advocating extended concept of networked governance model supported SCQM-Imp environment by implementing practices of SCM and TQM in the automotive industry supply chains in Pakistan to enhance Firm's supply performance (FSP).

Information of the Company

Company Name: ----------
Business Types: ----------
Presence in countries: ----------
Number of Employees: ----------
Established in: ----------
Quality Management Systems (QMS) implemented (Any): ----------
Firm's Experience in SCQM Environment based business application implementation: ----------

Information of the Participant

Designation: ----------
Department: ----------
Date and Time of Interview: ----------
Highest Education: ----------
Experience in QMS implementation: ----------
Experience in SCQM Environment based business application implementation: ----------

CONCEPTUAL DEFINITIONS:

1. COUNTERFEITING

The World Trade Organisation (WTO, 2014) defined counterfeiting as the "*unauthorized representation of a registered trademark carried on goods identical to or similar to goods for which the trademark is registered, with a view to deceiving the purchaser into believing that he/she is buying the original goods*". Yang et al.'s, 2004 and Staake et al.'s, 2009 have discussed seriousness of the counterfeiting threat based on the central idea that counterfeiting is a deception that some product comes from another, more reputable source (Cited in Stevenson and Busby, 2015).

Registered Trademarks: A proprietary term, usually registered with the patent, which legally differentiate it from all other products. It may be symbol, insignia, phrase and / or design etc.

Patents: A government authority or license conferring a right or title for a set period, especially the sole right to exclude others from making, using or selling an invention. Copyright licenses, Charter, and Franchise etc.

Industrial Design: A professional service of creating products and systems that optimize function, value and appearance for the mutual benefit of both users and manufacturers.

Copyright: Exclusive and assignable legal right, given to the originator for a fixed number of years to print, publish, perform, film or record literary, artistic or musical material.

Deceptive and Non-Deceptive Counterfeiting: Staake et al.'s (2009) introduced the classification scheme as it is a subset of illicit trade and IPR infringements that is separate from contraband trade, illicit trade in controlled goods and stolen goods trading. Counterfeiting can occur in the area of money and official documents, services and physical goods. It can be of a deceptive or non-deceptive nature. In "deceptive counterfeiting", the consumer is unaware that the item is a counterfeit, whereas with "non-deceptive counterfeits", the consumer is fully aware of the illicit nature of the product.

2. AUTOMOTIVE PARTS / COMPONENTS UNDER INVESTIGATION:

The OECD (2008) report stated that "…*the automotive parts include engine parts, body panels, air bags, windscreens, tires, bearings, shock absorbers, suspension and steering components, automatic belt tensioners, spark plugs, disc brake pads, clutch plates, oil, filters, oil pumps, water pumps, chassis parts, engine components, lighting products, belts, hoses, wiper blades, grilles, gasket materials, rings, interior trim, brake fluid, sealing products, wheels, hubs, anti-freeze, and windshield wiper fluid*".

3. SUPPLY CHAIN MANAGEMENT (SCM) PRACTICES

SCM requires internal and external business process integration across the whole supply chain (Gimenez 2004) and its effectiveness and efficiency depend significantly on the degree of integration (Chin et al.'s 2004). SCMP measurement for the automotive industry's was developed based on the research of Li et al.'s (2006), Min and Mentzer (2004), Tan et al.'s (2002), Lee and Kincade (2003), Sahay and Mohan (2003), Chin et al.'s (2004), GSCF in Lambert et al.'s (2005) and Kim (2006). As a

result, SCMP measures included four sub-constructs, namely Information Management, Lean System, Strategy and Organisation, and Partnership Management [cited in Vanichchinchai and Igel (2011)].

3.a) INFORMATION MANAGEMENT

Li S. et al.'s (2005) discussed that "Information sharing" refers to the extent to which critical and proprietary information is communicated to one's supply chain partner [Balsmeier & Voisin (1996); Lalonde (1998); Mentzer et al.'s (2000); Monczka et al.'s (1998); Novack et al.'s (1995); Stein & Sweat (1998); Towill (1997); Yu et al.'s (2001)]. Organisations need to view their information as a strategic asset and ensure that it flows with minimum delay and distortion. Kanji and Wong (1999) discussed that the order completion process for shipped orders wholly encompasses many functional areas, as opposed to a compilation of fragmented departmental information. Sharing information with other parties, within the supply chain, can use as a source of competitive advantage. [Stein & Sweat (1998); Lalonde (1998); Yu et al.'s (2001); Tompkins & Ang (1999)] discussed that sharing information with the supply chain partners regularly as a single entity is advantageous. Hence, firm respond to market change quickly. Moreover, the negative impact of the bullwhip effect on a supply chain reduced or eliminated by sharing information with trading partners. Stein & Sweat (1998) explained that the effective use of relevant and timely information by all functional elements within the supply chain as a key competitive and distinguishing factor.

3.b) LEAN SYSTEM

The term ''lean'' is used to refer to a system that uses less input to produce at a mass production speed, while offering more variety to the end customers. Vanichchinchai & Igel (2011) discussed that streamline business processes (e.g.. Ordering, receiving, shipping, and other related paper work) with trade partners is necessary in order to bring excellence in Firm' Supply Performance. The study regarding implementation of lean management in the organisation, Carvalho et al.'s, 2011 discussed two important factors: JIT, Supplier relationship (cited in Azevedo et al.'s (2012). [Anand & Kodali (2010); Azevedo et al.'s (2012); Mahidhar (2005); Gurumurthy & Kodali (2009); Gurumurthy & Kodali (2009)] discussed that there are nine lean management practices implemented purposefully and strategically in the organisation: 1) Purpose (Focus on cost reduction and flexibility through continuous elimination of waste or non-value added activities across the chain); 2) Manufacturing focus (Maintains a high average utilization rate. Just in time (JIT) practices used by pulling goods through the system, based on the demand; 3) Alliances with suppliers and customers (participate in traditional alliances – partnerships, ,joint ventures at the operational level); 4) Organisational structure (static organisational structure with few levels in the hierarchy); 5) Approach to choose suppliers (Supplier attributes involved low cost and high quality); 6) Inventory strategy (generates high turns and minimizes inventory throughout the chain); 7) Lead time focus (shortens lead time as long as it does not increase cost); 8) Product design strategy (maximizes performance and minimizes cost); 9) Market (serves current market segments with predictable demand). Cited in Li S. et al.'s (2005), reference is made to "Internal Lean practices" [Handfield & Nicholes (1999); Manson-Jones& Towill (1997); McIvor (2001); Womack & Jones (1996)] it is defined as the practices of eliminating waste (cost, time, etc.) in a manufacturing system, characterized by reduced setup time, small lot sizes, and pull production.

3.c) PARTNERSHIP MANAGEMENT

Supply chain effectiveness & efficiency depend significantly on the degree of integration across the whole supply chain (Chin et al.'s, 2004; Bagchi et al.'s, 2005). Although SCM emphasizes external integration, the actual implementation must begin by integrating internal functions & then moving to external integration among business partners. Therefore, human resource & employee involvement

issues within the organisation should be critical in achieving SCM excellence (Halldorsson et al.'s, 2008; Gowen & Tallon, 2003; Shub & Stonebraker, 2009). Various terms used in SCM literature to describe external business partnership, such as sup-plier & customer relationship, strategic partnership, long-term relationship, & collaboration. Most SCM frameworks include business partner issues but almost ignore the internal employee component, such as the SCM frameworks proposed by the Global Supply Chain Forum (GSCF) (Lambert et al.'s, 2005), Li et al.'s (2006), Tan et al.'s (2002), Lee & Kincade (2003), & Chin et al.'s (2004).

3.d) STRATEGY AND ORGANISATION

[Ridwan & Marti, 2012; Steiner (1979)] discussed that strategy planning as a process of setting organisational goal, developing detailed plan and implementing strategy to achieve goal. Soni & Kodali (2011) investigated the mediating role of supply chain strategy between competitive strategy and supply chain performance in Indian manufacturing industry. The result of this study revealed that choices of competitive strategy and supply chain strategy affect business and supply chain performance. Karim (2011) examined the extent to which management information system was implement-ed in strategic and tactical planning for decision-making. Results from the study revealed that management information system primarily used in banks to enhance strategy planning. Forker et al.'s (1997) demonstrated the relation-ship strategies between the performance of the supply chain and the adoption of TQM practices.

4. TOTAL QUALITY MANAGEMENT (TQM) PRACTICES

TQM is a firm-wide management philosophy of continuously improving the quality of the products/services/processes by focusing on the customers‟ needs and expectations to enhance customer satisfaction and firm performance. The reason of implementing TQM practices is improving customer satisfaction, quality of products and / or services, productivity, capacity of the production line, employee performance, and quality of work life, market share, and competitive position. TQMP measures comprised Customer Focus, Commitment and Strategy, Human Resource Management, Information Analysis [cited in Vanichchinchai and Igel (2011); Sadikoglu and Olcay (2014)]. Kannan and Tan (2005) found that TQM, SCM and JIT reinforce each other.

4.a) LEADERSHIP (COMMITMENT & STRATEGY)

Leadership is one of the key factors in implementing. TQM must be truly organisation-wide and start with the top management in the organisation (Oakland, 1989). In a TQM process, effective leadership should develop a clear mission statement and then build up strategies to support the mission. The top management needs to identify the critical success factors and to review the management structure. The leadership must ensure that the principles of quality management implemented continually. Moreover, participation by senior management is not enough (Puffer & McCarthy, 1996). TQM demands that organisation should move away from 'Management by Control' to 'Management by Commitment'. This principle includes participative management, empowerment of all an organisation's members to focus on and achieve total quality objectives, and commitment to organisational systems that designed to ensure total quality (Ugboro & Obeng, 2000). Everyone in the process, top to bottom, administration to factory, headquarters to local sites, must play their part. Individuals and groups look to themselves to improve what they themselves do. Apart from senior management, the middle management also played an important role in the process. They must explain TQM principles to the employees and ensure their responsibilities identified. Everyone in the bottom stage should understand their task, and respect quality. Because most total quality work done far from the immediate view of senior management, it is important to ensure every part of the company and everyone does their job correctly and positively.

Only when the whole organisation accepts the responsibility and commitment of QM, then TQM process implemented effectively.

4.b) CUSTOMER FOCUS

Quality complaints have different problems that require different actions. Based on customer complaint information, it is important to identify the "vital few" serious complaints that demand in-depth study in order to discover the basic causes and to remedy those causes (Juran & Gryna, 1993). As a total approach to help an organisation achieve this objective, TQM demands continual examination of organisation's quality system to see as if it is responsive to ever-changing customer requirements. Lindborg (2003) discussed that with TQM, a 'customer' is more than one who is external to the business. These customers directly or indirectly relate and cooperate with each other to establish a quality chain. Chang (2009) stated that the customer focus is the core principle and idea of TQM because quality effort comes of customer's needs and ends with customer's acceptance. In supply chain circumstance, customer includes not only the end user but also many in-between users, such as suppliers, manufacturers, sellers, etc. In SCQM, some traditional tools of TQM are also effective. For example, we can use Quality Function Deployment (QFD) to identify the distinct and potential needs and preferences of users, use Fishbone Chart to investigate the factors affecting the satisfaction level of users and then use Pareto Chart to find out the key factors.

4.c) HUMAN RESOURCE MANAGEMENT

Employees do not expect to produce quality if they are not equipped with the necessary skills and knowledge base (Chow and Lui, 2003). Okeudo (2012) explored the relationship between HRM practices and logistics firm performance with logistics and SCM as the focus. The study proved that HRM practices are effective in building logistics and supply chain capabilities. Doerflein (2005) investigated the relationship between HRM and effective SCM in United States. The findings showed that HRM had a significant relationship with effective SCM. Gowen & Tallon (2002) examined the impact of human resource factors on the competitive advantage of SCM practices. Based on correlation assessment and partial correlation analysis, two important human resource factors, namely management and employee support, positively affected the competitive results of SCM practices.

4.d) INFORMATION ANALYSIS

[Rampersad, 2005; Ju et al.'s (2006)] discussed that the information analysis covered information and knowledge management, measurement & analysis of organisational performance. Samuel et al.'s (2011) studied the relationship between knowledge management and SCM. The findings showed that knowledge management enhances the SCM competitiveness. Vanichchinchai & Igel (2011) study findings showed that information analysis had direct effect on SCM practices. Forker et al.'s (1997) also studied the impact of TQM (including information analysis) in the supply chain performance. The findings encouraged manufacturers to continue promoting TQM practices throughout the supply chain as certain practices did lead to better performance, which include information analysis.

4.e) SUPPLIER QUALITY MANAGEMENT

Supplier quality management defined as the set of supplier-related quality management practices for improving suppliers' quality of products and services. The extensive literature review by Anderson H. C. (1994) and Anderson et al.'s (1994) discussed that external cooperation between a firm and its suppliers has merits in the just-in-time purchasing systems. Working collaboratively with suppliers on a long-term basis is truly beneficial. According to Juran & Gryna (1993), it is an effective practice to optimize quality costs when a purchasing decision made. To the purchasing price, the buyer must add a

whole array of quality-related costs: Incoming inspection, materials review, production delays, downtime, extra inventories, internal failure costs, and external failure costs. The lowest purchasing price does not always result in the lowest total costs. Surveillance can take several forms: Inspection of product, meetings with suppliers to review quality status, audits of elements of the supplier, review of SPC data, and witnessing of specific operations. These requirements of a supplier must established long before it produces any material.

4.f) PROCESS MANAGEMENT

Davenport (1993) defines processes as a structured and measured set of activities designed to produce specific output for a particular customer or market. La Londe & Masters (1994) proposes that SCM is the process of managing relationships, information, and materials flow across enterprise borders to deliver enhanced customer service and economic value through synchronized management of the flow of physical goods and associated information from sourcing to consumption.

5) SUPPLY CHAIN QUALITY MANAGEMENT (SCQM) ENVIRONMENT

The environment where the SCQM goal is to achieve customer satisfaction, trust relationship between customers and suppliers, and high-level Supply Chain Information System sharing. Essentials information covers:

- Market demands and requirements driven activities
- Emphasis is on relationship building, information sharing, and innovation activities
- Joint short term and long term goals on total SC optimization are emphasized
- Enable conditions and enhance trust for total quality along the supply chain
- Quality reduces “whole life cost” of a product
- Narrow view of quality, one-way communication, and lack of commitment to entire supply chain
- Involves every member of the supply chain but requires dominant partner to take the lead to ensure that quality driven change is effectively implemented
- Never ending philosophy of joint customer-supplier quality is emphasized, and partnership (co-maker) is the approach
- Horizontal / Vertical / Diagonal approach, allows supply chain members in making quality decisions; Integrated
- Team approach with team members comprising of supply chain members

6. FIRM SUPPLY PERFORMANCE (FSP)

SCM requires internal and external business process integration across the whole supply chain (Gimenez 2004) and its effectiveness and efficiency depend significantly on the degree of integration (Chin et al.’s 2004). Therefore, an ultimate integration can be a source for both, synergy and barriers in improving Firm Supply Performance when implementing a combined set of SCM and TQM systems. FSP measures were composed of Cost, Flexibility, Relationship, and Responsiveness (cited in Vanichchinchai and Igel, 2011).

7. MEASURE OF ANTI-COUNTERFEITING STRATEGIES EFFECTIVENESS (AE)

Yang et al.’s (2006) study emphasizes measures of the Anti-counterfeiting strategies effectiveness, such as: First measure, stopping counterfeiting production - This measure is relevant because eliminating counterfeiting act will help licit companies to avoid the unhealthy competition from counterfeiters, and focus their efforts on product performance and consumer relations. Second measure, mitigating damage to the firm based on Yang et al.’s (2004) argument that corporate efforts, which alleviate the scale and

scope of counterfeiting, will reduce the extent of damage to sales. Third measure, expanded prior effectiveness measures to include maintaining Brand Reputation, as counterfeiting taints the reputation of the original brands [Chaudhry and Walsh (1996); OECD (2007)]. Anti-counterfeiting actions in the form of Brand Positioning can help a company sustain its reputation and correct the bad publicity caused by counterfeited goods [cited in Yang and Fryxell (2009)]. Therefore, anti-counterfeiting strategies can be helpful in reducing the occurrences of counterfeiting phenomenon in supply chains for industry of concern.

Logistics Assurances: Policies and documents to prevent the appearance of quantitative disturbances from subcontractors in the supply chain. The overall steps, as the documents, listed as follows;

- Manufacturer project time schedule, logistic objectives, landed cost and list of team members in the planning group
- Supplier's project time schedule, logistic assurance plan and review of logistic objectives.
- Supplier's material flow plan, logistic assurance plan, flexibility and capacity plan, Logistic flow and lead time plan, Logistic Failure Mode Effects Analysis (FMEA), system and communication flow plan.
- Manufacturer packaging, verification of internal material handling, verification of material and production planning system, verification of flexibility and capacity and verification of logistics and transportation flow, documentation of parameters in the supply chain.
- Electronic data interchange contract and selection of supply class (A, B, C components).

Quality Assurances: Policies and documents to prevent the appearance of qualitative disturbances from subcontractors in the supply chain. The overall steps, as the documents, listed as follows;

- Manufacturer project time schedule and quality targets (document with product description).
- Manufacturer's quality improvement experience from planning, quality output and quality risks.
- Supplier's project time schedule, quality assurance plan, tooling schedule with teams.
- Supplier's review of technical specifications and process flow chart, estimated quality output, process, FMEA, control plan for suppliers at components level, process control plan during production, in-process testing, analysis of measuring systems, vital safety parts (i.e, documents and traceability), emission related components (i.e, traceability), confirmation concerning trial production run, trial production run report, review of material handling-assembly plant and confirmation of supplier.
- Supplier's general information / explanation. The document also contains further guidelines and checklists, which specify the details of each step of the document.

Q & A Session

Q.1 How company maintain close relationship (integration & cooperation) with suppliers (tier-1 and tier-2)?

Q.2 How company exhibits control over suppliers in order to maintain logistics assurance and quality assurance?

Q.3 How company handle dependency problem with respect to key suppliers?

Q.4 How company classifies inbound logistic supply chains flows?

Q.5 How far TQM and SCM practices in your organisation impacts on performance factors, like Employee Moral, Customer Satisfaction, Inventory Management, and Quality?

Q.6 How far company believe that product counterfeiting does exist in supply chain?

Q.7 How far you believe that registered trademark, patents, industrial designs and copyrights are among most effective counterfeiting actions? Is IPR issue in practices?

Q.8 How far company believe that product counterfeiting is among common disturbance in supply chain?

Q.9 How far company believe that that taking anti-counterfeiting actions affect organisational performance?

Q.10 How far company believe that TQM and SCM practices under SCQM environment affects positively on Firms supply performance (FSP)?

Q.11 Is there any strategy your company has applied to control counterfeiting activities?

Q.12 Do you like to discuss some of the most common disturbances in inbound supply chain and logistic flows?

Q.13 Do you think company follow routines to control supply chain disturbances?

Q.14 What do you think, which Anti-Counterfeiting Strategies With-In Supply Chain can reduce the Occurrences of Counterfeiting phenomenon and enhance Firm Supply Performance?. The anti-counterfeiting strategies are listed as follows;

1) Dealing with Customs and law enforcement agencies with the use of track & trace technologies by: Lobbying for more rigorous counterfeit controls, e.g.; Products attributes and Packaging
2) Dealing with market institutions and industry groups by: Lobbying for more rigorous counterfeit controls, e.g. forming alliances and networks & Joint advertisements
3) Discourage product counterfeiting with the goal of increasing the business and legal risks and making counterfeiting / Imitation costly
4) Develop centralized distribution network
5) Advertise about the safety, performance and financial risks associated with counterfeits and financial incentives for channel members to reject counterfeits
6) Introduce Public Awareness Program about product counterfeiting phenomenon
7) Introduce Process of investigation to address complaints
8) Supplier should consider product/service features that are difficult to replicate and/or easy to distinguish from those of non-legitimate producers during product development/ improvement.
9) Introduce Destruction process for obsolete products and components
10) Introduce Collaboration and Joint Venture
11) Develop Internal Resources and Invest in IPR protective countries
12) Introduce Cooperation across supply chain, Supplier qualification, Supplier penalties for counterfeits and pass-through, Making product replication difficult and costly
13) Introduce strategies to prohibit counterfeit products, Introduce Strict Liability concept, Return of outsourced technology and product, Ensure authenticity of material and components, Use of track & trace technologies, Vigilant to control supply chain risk, Lean management, Sharing information with suppliers, dealers and retailers
14) Alter product characteristics on the basis of customer need
15) Introduce Loss Prevention and Audit Programs

16) Follow Industry Standards for Inspection and Acceptance in open market
17) Introduce Supplier Audit Program
18) To Develop Training Material for customer awareness regarding counterfeiting phenomenon
19) Educate all Stakeholders regarding the product counterfeit phenomenon and serious issues related to it, especially employees, customers, authorities, law enforcement agencies and others
20) Strategic contribution to protect IP and implement best industry specific strategies to curb product counterfeiting phenomenon
21) Formulate Crisis Management Plan and Surveillance Program for firms
22) Collaborative strategies, sharing intelligence of product counterfeiting activities with authorities and law enforcement agencies
23) Develop Joint-Anti-Counterfeiting Action Plan
24) Warn distributors and retailers about possible penalties using counterfeits
25) Use of Product Track & Trace Technologies
26) Develop Risk Management Plan
27) Introduce Quality Assurance Program
28) To exercise firm's power by taking Legal action against product counterfeiting
29) Introduce Certified Retailer Program
30) Do nothing, as one of the strategies to address counterfeiting phenomenon
31) Introduce Product Disposal Program for firms

Q.I) What do you think how SCMP & TQMP can enhance Firm Supply Performance (FSP) and make positive impact on Management factors, such as: Information Flow, Process Flow, Supplier's Quality, Firm's Supply Performance (Quality, Cost, Flexibility, Relationship, & Responsiveness)?

Q.2) How far you believe that your firm achieved the SCQM-Imp Environment based business application goals to enhance FSP?

[redacted]

INITIAL RESEARCH STUDY

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Fall 2017

AN EMPIRICAL ANALYSIS TO CONTROL COUNTERFEITING IN SUPPLY CHAINS OF AUTOMOTIVE INDUSTRY'S

We would like to welcome you in the scientific research study that deals with the control of counterfeiting in supply chains of the automotive industry's. We have approached you to initiate Initial (Pilot) research study because you are among those multinational and local companies that deals with overseas operations in automotive industry's in Pakistan and generally considered as being the most resourceful, sizeable, technologically automated & QMS supported operators in Pakistan. We request you to fill out the attached questionnaire.

The aim of this study is to develop understanding among companies that a systematic and interactive approach necessary to conceptualize vulnerabilities and risks (due to counterfeiting activities) in their supply chains domain, so that practitioners can use best industry practices against this complex individual, social & global phenomenon.

This survey consists of a single relatively simple questionnaire attached. We estimate it will take 20 to 30 minutes to complete in most circumstances.

We would like to appreciate your cooperation for the completion of this study. If for any reason you feel that you are unable to answer the asked questions, please feel free to return the unanswered questionnaire. Thank you for your assistance.

We assure you that neither your name nor the name of your organisation revealed in reporting the findings of this research. Your responses will remain strictly confidential and not used for any other purpose other than this study. We would also like to assure you that the results of the study also be shared with you, depending upon your interest. If you have any question or concerns regarding this matter, please contact the undersigned.

Thank you for your attention and your cooperation.

Yours Sincerely,

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Before you begin, please take few moments to read the following terms:

Aim of a questionnaire:
To perform empirical analysis based on the responses gathered from an automotive industry's survey, under the patronage of PAAPAM member firms, so that this investigative review could highlight the importance of the salient aspect of the study. Advocating successful implementation of Anti-Counterfeiting strategies in automotive industry's supply chains, keeping Supply Chain Management Practices (SCMP) and Total Quality Management Practices (TQMP) intact, to enhance Firm Supply Performance (FSP).

Questions to address in the Questionnaire

1) *What do you think how SCMP & TQMP can enhance Firm Supply Performance (FSP) and make positive impact on Management factors, such as: Information Flow, Process Flow, Supplier's Quality, Firm's Supply Performance (Quality, Cost, Flexibility, Relationship, & Responsiveness)?*
2) *Do you believe that your firm achieved SCQM goals, enhance customer satisfaction, trusted relationship between customers & suppliers and established high-level Supply Chain Information System?*
3) *What do you think, which Anti-Counterfeiting Strategies can reduce the Occurrences of Counterfeiting phenomenon in supply chains and enhance Firm Supply Performance?*

We think it is important to give contextual definitions of the key concepts, developed during a literature review, used in the study and therefore questionnaire attached has driven from these concepts. Following are concepts:

1. COUNTERFEITING

The World Trade Organisation (WTO, 2014) defined counterfeiting as the "unauthorized representation of a registered trademark carried on goods identical to or similar to goods for which the trademark is registered, with a view to deceiving the purchaser into believing that he/she is buying the original goods". Yang et al.'s, 2004 and Staake et al.'s, 2009 have discussed seriousness of the counterfeiting threat based on the central idea that counterfeiting is a deception that some product comes from another, more reputable source (Cited in Stevenson and Busby, 2015).

Registered Trademarks: A proprietary term, usually registered with the patent, which legally differentiate it from all other products. It may be symbol, insignia, phrase and / or design etc.

Patents: A government authority or license conferring a right or title for a set period, especially the sole right to exclude others from making, using or selling an invention. Copyright licenses, Charter, and Franchise etc.

Industrial Design: A professional service of creating products and systems that optimize function, value and appearance for the mutual benefit of both users and manufacturers.

Copyright: Exclusive and assignable legal right, given to the originator for a fixed number of years to print, publish, perform, film or record literary, artistic or musical material.

Deceptive and Non-Deceptive Counterfeiting: Staake et al.'s (2009) introduced the classification scheme as it is a subset of illicit trade and IPR infringements that is separate from contraband trade, illicit trade in controlled goods and stolen goods trading. Counterfeiting can occur in the area of money and official documents, services and physical goods. It can be of a deceptive or non-deceptive nature. In "deceptive counterfeiting", the consumer is unaware that the item is a counterfeit, whereas with "non-deceptive counterfeits", the consumer is fully aware of the illicit nature of the product.

2. AUTOMOTIVE PARTS / COMPONENTS UNDER INVESTIGATION:

The OECD (2008) report stated that automotive parts include engine parts, body panels, air bags, windscreens, tires, bearings, shock absorbers, suspension and steering components, automatic belt tensioners, spark plugs, disc brake pads, clutch plates, oil, filters, oil pumps, water pumps, chassis parts, engine components, lighting products, belts, hoses, wiper blades, grilles, gasket materials, rings, interior trim, brake fluid, sealing products, wheels, hubs, anti-freeze, and windshield wiper fluid.

3. SUPPLY CHAIN MANAGEMENT (SCM) PRACTICES

SCM requires internal and external business process integration across the whole supply chain (Gimenez 2004) and its effectiveness and efficiency depend significantly on the degree of integration (Chin et al.'s 2004). SCMP measurement for the automotive industry's was developed based on the research of Li et al.'s (2006), Min and Mentzer (2004), Tan et al.'s(2002), Lee and Kincade (2003), Sahay and Mohan (2003), Chin et al.'s (2004), GSCF in Lambert et al.'s (2005) and Kim (2006). As a result, SCMP measures included four sub-constructs, namely Information Management, Lean System, Strategy and Organisation, and Partnership Management [cited in Vanichchinchai and Igel (2011)].

3.a) INFORMATION MANAGEMENT

Li S. et al.'s (2005) discussed that "Information sharing" refers to the extent to which critical and proprietary information is communicated to one's supply chain partner [Balsmeier & Voisin (1996); Lalonde (1998); Mentzer et al.'s (2000); Monczka et al.'s (1998); Novack et al.'s (1995); Stein & Sweat (1998); Towill (1997); Yu et al.'s (2001)]. Organisations need to view their information as a strategic asset and ensure that it flows with minimum delay and distortion. Kanji and Wong (1999) discussed that the order completion process for shipped orders wholly encompasses many functional areas, as opposed to a compilation of fragmented departmental information. Sharing information with other parties, within the supply chain, can use as a source of competitive advantage. [Stein & Sweat (1998); Lalonde (1998); Yu et al.'s (2001); Tompkins & Ang (1999)] discussed that sharing information with the supply chain partners regularly as a single entity is advantageous. Hence, firm respond to market change quickly. Moreover, the negative impact of the bullwhip effect on a supply chain reduced or eliminated by sharing information with trading partners. Stein & Sweat (1998) explained that the effective use of relevant and timely information by all functional elements within the supply chain as a key competitive and distinguishing factor.

3.b) LEAN SYSTEM

The term ''lean'' is used to refer to a system that uses less input to produce at a mass production speed, while offering more variety to the end customers. Vanichchinchai & Igel (2011) discussed that streamline business processes (e.g.. Ordering, receiving, shipping, and other related paper work) with trade partners is necessary in order to bring excellence in Firm' Supply Performance. The study regarding implementation of lean management in the organisation, Carvalho et al.'s, 2011 discussed two important factors: JIT, Supplier relationship (cited in Azevedo et al.'s (2012). [Anand & Kodali (2010); Azevedo et al.'s (2012); Mahidhar (2005); Gurumurthy & Kodali (2009); Gurumurthy & Kodali (2009)] discussed that there are nine lean management practices implemented purposefully and strategically in the organisation: 1) Purpose (Focus on cost reduction and flexibility through continuous elimination of waste or non-value added activities across the chain); 2) Manufacturing focus (Maintains a high average utilization rate. Just in time (JIT) practices used by pulling goods through the system, based on the demand; 3) Alliances with suppliers and customers (participate in traditional alliances – partnerships, ,joint ventures at the operational level); 4) Organisational structure (static organisational structure with few levels in the hierarchy); 5) Approach to choose suppliers (Supplier attributes involved low cost and high quality); 6) Inventory strategy (generates high turns and minimizes inventory throughout the chain); 7) Lead time focus (shortens lead time as long as it does not increase cost); 8) Product design strategy (maximizes performance and minimizes cost); 9) Market (serves current market segments with predictable demand). Cited in Li S. et al.'s (2005), reference is made to "Internal Lean practices" [Handfield & Nicholes (1999); Manson-Jones& Towill (1997); McIvor (2001); Womack & Jones (1996)] it is defined as the practices of eliminating waste (cost, time, etc.) in a manufacturing system, characterized by reduced setup time, small lot sizes, and pull production.

3.c) PARTNERSHIP MANAGEMENT

Supply chain effectiveness & efficiency depend significantly on the degree of integration across the whole supply chain (Chin et al.'s, 2004; Bagchi et al.'s, 2005). Although SCM emphasizes external integration, the actual implementation must begin by integrating internal functions & then moving to external integration among business partners. Therefore, human resource & employee involvement issues within the organisation should be critical in achieving SCM excellence (Halldorsson et al.'s, 2008; Gowen & Tallon, 2003; Shub & Stonebraker, 2009). Various terms used in SCM literature to describe external business partnership, such as sup-plier & customer relationship, strategic partnership, long-term relationship, & collaboration. Most SCM frameworks include business partner issues but almost ignore the internal employee component, such as the SCM frameworks proposed by the Global Supply Chain Forum (GSCF) (Lambert et al.'s, 2005), Li et al.'s (2006), Tan et al.'s (2002), Lee & Kincade (2003), & Chin et al.'s (2004).

3.d) STRATEGY AND ORGANISATION

[Ridwan & Marti, 2012; Steiner (1979)] discussed that strategy planning as a process of setting organisational goal, developing detailed plan and implementing strategy to achieve goal. Soni & Kodali (2011) investigated the mediating role of supply chain strategy between competitive strategy and supply chain performance in Indian manufacturing industry. The result of this study revealed that choices of competitive strategy and supply chain

strategy affect business and supply chain performance. Karim (2011) examined the extent to which management information system was implement-ed in strategic and tactical planning for decision-making. Results from the study revealed that management information system primarily used in banks to enhance strategy planning. Forker et al.'s (1997) demonstrated the relation-ship strategies between the performance of the supply chain and the adoption of TQM practices.

4. TOTAL QUALITY MANAGEMENT (TQM) PRACTICES

TQM is a firm-wide management philosophy of continuously improving the quality of the products/services/processes by focusing on the customers‟ needs and expectations to enhance customer satisfaction and firm performance. The reason of implementing TQM practices is improving customer satisfaction, quality of products and / or services, productivity, capacity of the production line, employee performance, and quality of work life, market share, and competitive position. TQMP measures comprised Customer Focus, Commitment and Strategy, Human Resource Management, Information Analysis [cited in Vanichchinchai and Igel (2011); Sadikoglu and Olcay (2014)]. Kannan and Tan (2005) found that TQM, SCM and JIT reinforce each other.

4.a) LEADERSHIP (COMMITMENT & STRATEGY)

Leadership is one of the key factors in implementing. TQM must be truly organisation-wide and start with the top management in the organisation (Oakland, 1989). In a TQM process, effective leadership should develop a clear mission statement and then build up strategies to support the mission. The top management needs to identify the critical success factors and to review the management structure. The leadership must ensure that the principles of quality management implemented continually. Moreover, participation by senior management is not enough (Puffer & McCarthy, 1996). TQM demands that organisation should move away from 'Management by Control' to 'Management by Commitment'. This principle includes participative management, empowerment of all an organisation's members to focus on and achieve total quality objectives, and commitment to organisational systems that designed to ensure total quality (Ugboro & Obeng, 2000). Everyone in the process, top to bottom, administration to factory, headquarters to local sites, must play their part. Individuals and groups look to themselves to improve what they themselves do. Apart from senior management, the middle management also played an important role in the process. They must explain TQM principles to the employees and ensure their responsibilities identified. Everyone in the bottom stage should understand their task, and respect quality. Because most total quality work done far from the immediate view of senior management, it is important to ensure every part of the company and everyone does their job correctly and positively. Only when the whole organisation accepts the responsibility and commitment of QM, then TQM process implemented effectively.

4.b) CUSTOMER FOCUS

Quality complaints have different problems that require different actions. Based on customer complaint information, it is important to identify the "vital few" serious complaints that demand in-depth study in order to discover the basic causes and to remedy those causes (Juran & Gryna, 1993). As a total approach to help an organisation achieve this objective, TQM demands continual examination of organisation's quality system to see as if it is responsive to ever-changing customer requirements. Lindborg (2003) discussed that with TQM, a 'customer' is more than one who is external to the business. These customers directly or indirectly relate and cooperate with each other to establish a quality chain. Chang (2009) stated that the customer focus is the core principle and idea of TQM because quality effort comes of customer's needs and ends with customer's acceptance. In supply chain circumstance, customer includes not only the end user but also many in-between users, such as suppliers, manufacturers, sellers, etc. In SCQM, some traditional tools of TQM are also effective. For example, we can use Quality Function Deployment (QFD) to identify the distinct and potential needs and preferences of users, use Fishbone Chart to investigate the factors affecting the satisfaction level of users and then use Pareto Chart to find out the key factors.

4.c) HUMAN RESOURCE MANAGEMENT

Employees do not expect to produce quality if they are not equipped with the necessary skills and knowledge base (Chow and Lui, 2003). Okeudo (2012) explored the relationship between HRM practices and logistics firm performance with logistics and SCM as the focus. The study proved that HRM practices are effective in building logistics and supply chain capabilities. Doerflein (2005) investigated the relationship between HRM and effective SCM in United States. The findings showed that HRM had a significant relationship with effective SCM. Gowen & Tallon (2002) examined the impact of human resource factors on the competitive advantage of SCM practices. Based on correlation assessment and partial correlation analysis, two important human resource factors, namely management and employee support, positively affected the competitive results of SCM practices.

4.d) INFORMATION ANALYSIS

[Rampersad, 2005; Ju et al.'s (2006)] discussed that the information analysis covered information and knowledge management, measurement & analysis of organisational performance. Samuel et al.'s (2011) studied the relationship between knowledge management and SCM. The findings showed that knowledge management enhances the SCM competitiveness. Vanichchinchai & Igel (2011) study findings showed that information analysis had direct effect on SCM practices. Forker et al.'s (1997) also studied the impact of TQM (including information analysis) in the supply chain performance. The findings encouraged manufacturers to continue promoting TQM practices throughout the supply chain as certain practices did lead to better performance, which include information analysis.

4.e) SUPPLIER QUALITY MANAGEMENT

Supplier quality management defined as the set of supplier-related quality management practices for improving suppliers' quality of products and services. The extensive literature review by Anderson H. C. (1994) and Anderson et al.'s (1994) discussed that external cooperation between a firm and its suppliers has merits in the just-in-time purchasing systems. Working collaboratively with suppliers on a long-term basis is truly beneficial. According to Juran & Gryna (1993), it is an effective practice to optimize quality costs when a purchasing decision made. To the purchasing price, the buyer must add a whole array of quality-related costs: Incoming inspection, materials review, production delays, downtime, extra inventories, internal failure costs, and external failure costs. The lowest purchasing price does not always result in the lowest total costs. Surveillance can take several forms: Inspection of product, meetings with suppliers to review quality status, audits of elements of the supplier, review of SPC data, and witnessing of specific operations. These requirements of a supplier must established long before it produces any material.

4.f) PROCESS MANAGEMENT

Davenport (1993) defines processes as a structured and measured set of activities designed to produce specific output for a particular customer or market. La Londe & Masters (1994) proposes that SCM is the process of managing relationships, information, and materials flow across enterprise borders to deliver enhanced customer service and economic value through synchronized management of the flow of physical goods and associated information from sourcing to consumption.

4.g) FIRM SUPPLY PERFORMANCE (FSP)

SCM requires internal and external business process integration across the whole supply chain (Gimenez 2004) and its effectiveness and efficiency depend significantly on the degree of integration (Chin et al.'s 2004). Therefore, an ultimate integration can be a source for both, synergy and barriers in improving Firm Supply Performance when implementing a combined set of SCM and TQM systems. FSP measures were composed of Cost, Flexibility, Relationship, and Responsiveness (cited in Vanichchinchai and Igel, 2011).

7. SUPPLY CHAIN QUALITY MANAGEMENT (SCQM)

The goals of SCQM are to achieve customer satisfaction, trusted relationship between customers and suppliers, and high-level Supply Chain Information System. Essentials information covers:

- Market demands and requirements driven
- Emphasis is on relationship, information, and innovation
- Joint short and long term goals on total SC optimization are emphasized
- Enable conditions and enhance trust for total quality along the supply chain
- Quality reduces "whole life cost" of a product
- Narrow view of quality, one way communication, and lack of commitment to entire supply chain
- Involves every member of the supply chain but requires dominant partner to take the lead to ensure that quality driven change is effectively implemented
- Never ending philosophy of joint customer-supplier quality is emphasized, and partnership (co-maker) is the approach
- Horizontal / Vertical / Diagonal approach, allows supply chain members in making quality decisions; Integrated
- Team approach with team members comprising of supply chain members

8. MEASURE OF ANTI-COUNTERFEITING EFFECTIVENESS (AE)

Yang, Fryxell and Sie (2006) emphasized Measures of Anti-counterfeiting strategies Effectiveness, such as: First, Stopping counterfeiting production - This measure is relevant because eliminating counterfeiting act will help licit companies to avoid the unhealthy competition from counterfeiters, and focus their efforts on product performance and consumer relations. Second, Mitigating Damage to the firm based on Yang et al.'s (2004) argument that corporate efforts, which alleviate the scale and scope of counterfeiting, will reduce the extent of damage to sales.

Third, we have also expanded prior effectiveness measures to include Maintaining Brand Reputation, as counterfeiting taints the reputation of original brands [Chaudhry and Walsh (1996); OECD (2007)]. Anti-counterfeiting actions in the form of Brand Positioning can help a company sustain its reputation and correct the bad publicity caused by counterfeited goods [cited in Yang and Fryxell (2009)]. Therefore, anti-counterfeiting strategies can be helpful in reducing the occurrences of counterfeiting phenomenon in supply chains for industry of concern.

YOUR OPINION ABOUT YOUR FIRM: Please use best of your knowledge during your choice selection. **Your personal views** about the serious efforts your management has made to-date to control counterfeiting activities in supply chains of your firm. Your answers in anonymity will give confidence to research efforts.

Initial Survey Questionnaire

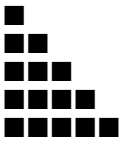
FOR OFFICE USE ONLY

Please provide your answer by using the tick (✓) mark.

1. Type of Business of your organisation	☐ Service ☐ Manufacturing ☐ Trading
2. Your organisation focuses on operations.	☐ Domestic ☐ International ☐ Both
3. Your organisation has implemented ISO standards	☐ ISO 9001 ☐ ISO 14001 ☐ OHSAS 18001 ☐ Others
4. Management practices your organisation is focusing	☐ TQM ☐ SCM ☐ Others
5. Since how long your organisation is following Management Practices (TQM, SCM, & Others)?	☐ Less than 1 Year ☐ 1-3 Years ☐ 4-6 Years ☐ More than 6 years
6. Your organisation yearly turnover	☐ Less than Rs.20 M ☐ Rs. 20 M – Rs. 100 M ☐ Rs. 101M – Rs. 200 M ☐ More than Rs. 200 M
7. Employee strength in your organisation	☐ Less than 200 ☐ 201 - 600 ☐ 601- 1000 ☐ More than 1000
8. Your Position in your Organisation	☐ Top Level Management ☐ Middle Level Management ☐ Lower Level Management ☐ Other than Management
9. Gender	☐ Male ☐ Female
10. Your work experience in procurement, under TQM and SCM environment	☐ Less than 1 Year ☐ 1-3 Years ☐ 4-6 Years ☐ More than 6 years
11. Your Education	☐ Intermediate ☐ Graduation ☐ Master ☐ Other_____
12. Your Department (Employment Cohort)	☐ CEO and / or Directors ☐ Finance & Accounts ☐ Purchase/Procurement ☐ Production / Operations ☐ Store & Inventory Control ☐ Managerial Coordinators

To what extent do you agree or disagree with the statements given below. Please answer each question by using the tick (✓) mark between the range of 1 to 5. The given scale represents the following values:

- Strongly Disagree (SD) 1
- Disagree (D) 2
- Neutral (N) 3
- Agree (A) 4
- Strongly Agree (SA) 5



Sr. #	MEASURES AND ITEMS DESCRIPTION					
A.	**WHAT DO YOU THINK, HOW SCMP & TQMP PRACTICES IN SUPPLY CHAIN CAN IMPACT FSP?**					
a)	**SUPPLY CHAIN MANAGEMENT PRACTICE (SCMP)**					
	Information Management (IM)					
	We contact the end users of our products to get feedback on product performance and service	1	2	3	4	5
	We work with our trade partners to survey and define customer requirement	1	2	3	4	5
	We have a common standard for information sharing (e.g. product order, shipment, inventory) for our trade partners to follow	1	2	3	4	5
	We evaluate formal and informal complaints as well as satisfaction of our trade partners	1	2	3	4	5
	We effectively share information with our trade partners to facilitate business planning and react to changes	1	2	3	4	5
	We apply advanced information technology in our supply chain	1	2	3	4	5
	We have information sharing among functions for the objectives of supply chain management	1	2	3	4	5
	Lean System (LS)					
	We delay final manufacturing activities until customer orders have actually been confirmed	1	2	3	4	5
	We reduce inventory levels	1	2	3	4	5
	We reduce set-up time	1	2	3	4	5
	We reduce inspection of incoming materials/components/products	1	2	3	4	5
	We order in small lot sizes	1	2	3	4	5
	We streamline business processes (e.g. ordering, shipping, receiving and other paperwork) with our trade partners	1	2	3	4	5
	We reduce response time	1	2	3	4	5
	We have continuous improvement activity	1	2	3	4	5

	We deliver products directly to points of use (e.g. customer's assembly lines)	1	2	3	4	5
	We involve in teams our trade partners to improve our supply chain	1	2	3	4	5
	We use a pull production system (pull means producing only when there is demand not to keep high inventory)	1	2	3	4	5
	We share supply chain management practices or resources (e.g. manufacturing, warehousing, distribution, marketing, etc.) with our trade partners	1	2	3	4	5
	We place our personnel at the business facilities of our trade partners to facilitate cooperation	1	2	3	4	5
	We store our goods at appropriate distribution points close to our customers	1	2	3	4	5
	We design our products for modular or unit part assembly (e.g. brake systems, wiring harness, air-conditioning systems, steering column, instrument cluster)	1	2	3	4	5
	We have contingency management system for unexpected events (e.g. order change or cancellation, computer network down)	1	2	3	4	5
	Partnership Management (PM)					
	We share knowledge about core business processes with our trade partners	1	2	3	4	5
	We share improvement benefits as well as other risks and rewards with our trade partners	1	2	3	4	5
	We develop a long-term relationship and trust with our trade partners	1	2	3	4	5
	We rely on a small number of quality trade partners	1	2	3	4	5
	We participate in the sourcing decisions of our suppliers	1	2	3	4	5
	We include our trade partners in our product development projects	1	2	3	4	5
	We have common goals agreed with our trade partners	1	2	3	4	5
	Strategy and Organisation (SO)					
	We have a supply chain performance measurement system	1	2	3	4	5
	We certify our suppliers using supply chain performance criteria (e.g. quality, cost, delivery)	1	2	3	4	5
	We extend our trade partners to include partners beyond immediate suppliers and customers	1	2	3	4	5
	We have organisational structure which facilitates business process integration with our trade partners	1	2	3	4	5
	Our top level managers strongly encourage employee (worker) involvement in supply chain management	1	2	3	4	5
	Our employees (workers) are actively involved in supply chain management-related activities	1	2	3	4	5
	Our organisation has an open, trusting culture with low bureaucracy. Our working environment is very good for supply chain management	1	2	3	4	5
b)	**TOTAL QUALITY MANAGEMENT PRACTICE (TQMP)**					
	Commitment and Strategy (CS)					
	Our top level managers strongly encourage employee (worker) involvement in quality management	1	2	3	4	5
	We have a clear vision, mission, policies, long term objectives and plan for improving quality	1	2	3	4	5
	We have a clear quality goal and short-term business performance plans	1	2	3	4	5
	Our top managers allocate adequate resources toward efforts to improve quality	1	2	3	4	5
	Customer Focus (CF)					
	We have a system for collecting complaints or suggestions from customers	1	2	3	4	5
	We actively seeks ways to improve the products in order to achieve greater customer satisfaction	1	2	3	4	5
	We have introduced and maintained the ''customer focus'' philosophy for a long time	1	2	3	4	5
	Human Resource Management (HRM)					
	We provide training and training resources to employees (workers) and encourage them to attend these training programs	1	2	3	4	5
	We have many active improvement teams	1	2	3	4	5
	We actively evaluate and implement employees' suggestions related to quality and supply chain management, if they are suitable	1	2	3	4	5
	Our line employees (workers) are responsible for and inspect the quality of their own work (self-inspection)	1	2	3	4	5
	We have an assistance mechanism (problem solving network) to help line employees solve quality problems	1	2	3	4	5
	Our employees (workers) are actively involved in quality management-related activities	1	2	3	4	5
	We provide awards to individuals and groups for excellent suggestions	1	2	3	4	5
	Information Analysis (IA)					
	We have information sharing among functions for the objectives of quality improvement	1	2	3	4	5
	We display information on quality performance at most of the work stations and everybody knows it	1	2	3	4	5
	We uses quality improvement tools and techniques extensively for process management and improvement	1	2	3	4	5
c)	**FIRM'S SUPPLY PERFORMANCE (FSP)**					
	Cost (CT)					
	We have a good overall inventory management performance (e.g. inventory turnover, obsolete, availability)	1	2	3	4	5

	We have a good overall financial performance (e.g. ROA, ROI, ROS)	1	2	3	4	5
	We have an effective and efficient production plan Flexibility (FL)	1	2	3	4	5
	Flexibility (FL)					
	We have the ability to produce products with various specification (e.g. features, options, sizes, colors, special specification)	1	2	3	4	5
	We have the ability to rapidly adjust production capacity in response to changes in customer demand	1	2	3	4	5
	We have the ability to handle rapid introduction of new products	1	2	3	4	5
	Relationship (RL)					
	Our suppliers have a good overall performance (e.g. quality, cost, delivery)	1	2	3	4	5
	We have a good overall relationship with trade partners	1	2	3	4	5
	We have an accurate demand forecasting	1	2	3	4	5
	We have effective & efficient business process (e.g. less clerical, documented, inspection jobs)	1	2	3	4	5
	Responsiveness (RS)					
	We have a good overall delivery performance (e.g. on-time, fast)	1	2	3	4	5
	We have a good overall quality of products and services	1	2	3	4	5
	We have the ability to provide our customers real time information	1	2	3	4	5
B.	**WHAT DO YOU THINK, WHICH ANTI-COUNTERFEITING STRATEGIES WITH-IN SUPPLY CHAIN CAN ENHANCE FSP?**					
	In case of counterfeits Extraction, Distribution, Production and Infiltration in supply chain, firms should:					
	Deal with Customs and law enforcement agencies with the use of track & trace technologies by: Lobbying for more rigorous counterfeit controls, e.g.; Products attributes and Packaging	1	2	3	4	5
	Deal with market institutions and industry groups by: Lobbying for more rigorous counterfeit controls, e.g. forming alliances and networks & Joint advertisements	1	2	3	4	5
	Discourage product counterfeiting with the goal of increasing the business and legal risks and making counterfeiting / Imitation costly	1	2	3	4	5
	Develop centralized distribution network	1	2	3	4	5
	Advertise about the safety, performance and financial risks associated with counterfeits and financial incentives for channel members to reject counterfeits	1	2	3	4	5
	Introduce Public Awareness Program about product counterfeiting phenomenon	1	2	3	4	5
	Introduce Process of investigation to address complaints	1	2	3	4	5
	Supplier should consider product/service features that are difficult to replicate and/or easy to distinguish from those of non-legitimate producers during product development/ improvement.	1	2	3	4	5
	Introduce Destruction process for obsolete products and components	1	2	3	4	5
	Introduce Collaboration and Joint Venture	1	2	3	4	5
	Develop Internal Resources and Invest in IPR protective countries	1	2	3	4	5
	Introduce Cooperation across supply chain, Supplier qualification, Supplier penalties for counterfeits and pass-through, Making product replication difficult and costly	1	2	3	4	5
	Introduce strategies to prohibit counterfeit products, Introduce Strict Liability concept, Return of outsourced technology and product, Ensure authenticity of material and components, Use of track & trace technologies, Vigilant to control supply chain risk, Lean management, Sharing information with suppliers, dealers and retailers	1	2	3	4	5
	Alter product characteristics on the basis of customer need	1	2	3	4	5
	Introduce Loss Prevention and Audit Programs	1	2	3	4	5
	Follow Industry Standards for Inspection and Acceptance in open market	1	2	3	4	5
	Introduce Supplier Audit Program	1	2	3	4	5
	Develop Training Material for customer awareness regarding counterfeiting phenomenon	1	2	3	4	5
	Educate all Stakeholders regarding the product counterfeit phenomenon and serious issues related to it, especially employees, customers, authorities, law enforcement agencies and others	1	2	3	4	5
	Strategic contribution to protect IP and implement best industry specific strategies to curb product counterfeiting phenomenon	1	2	3	4	5
	Formulate Crisis Management Plan and Surveillance Program for firms	1	2	3	4	5
	Collaborative strategies, sharing intelligence of product counterfeiting activities with authorities and law enforcement agencies	1	2	3	4	5
	Develop Joint-Anti-Counterfeiting Action Plan	1	2	3	4	5
	Warn distributors and retailers about possible penalties using counterfeits	1	2	3	4	5
	Use of Product Track & Trace Technologies	1	2	3	4	5
	Develop Risk Management Plan	1	2	3	4	5
	Introduce Quality Assurance Program	1	2	3	4	5
	Exercise firm's power by taking Legal action against product counterfeiting	1	2	3	4	5
	Introduce Certified Retailer Program	1	2	3	4	5
	Do nothing as one of the strategy to address counterfeiting phenomenon	1	2	3	4	5
	Introduce Product Disposal Program for firms	1	2	3	4	5

C.	**WHAT DO YOU THINK, HOW SCQM & ANTI-COUNTERFEITING STRATEGIES CAN REDUCE THE OCCURRENCES OF COUNTERFEITING PHENOMENON IN SUPPLY CHAINS AND ENHANCES FSP?**

This question intentionally left open ended to encourage you to identify as many impacts (strategic, operational, or any other) as possible within your firm's supply chain, after implementation of TQM and SCM practices. Your input in this regard would help in determining **EFFECTIVENESS OF ANTI-COUNTERFEITING STRATEGIES** in firms' supply chains. Please use following blank spaces to register your comments. Feel free to overflow on to another page if required.

A) Improvement suggestions (practices regarding TQM & SCM) and FSP, under the influence of the networked governance model supported SCQM-Imp environment

B) Improvement suggestions (Anti-counterfeiting Initiatives)

Many, many sincere thanks for your assistance and cooperation in completing this questionnaire.

Appendix Table-A: Compiled list of Anti-Counterfeiting Strategies (literature review)

<table>
<tr><th>Contribution</th><th>Number of Anti-Counterfeiting Strategies proposed</th><th>Dimensions explored</th></tr>
<tr><td>Ghadge, A. et al.'s (2021)

(A)</td><td>1. Anti-counterfeiting campaigns, publications about counterfeit risk
2. Improved communication and collaboration between different departments (e.g., commercial, legal, quality and technical staff)
3. developing common knowledge-sharing platforms to share counterfeit experiences and statistics for wider SC networks
4. Supplier relationship management and supplier contract management &development Contract performance review and continuous improvements
5. Evaluation of market & commodity options assessment with high level specification</td><td>Campaign, advertising, communication, legal, knowledge sharing, Supplier relationship management, supplier contract management & development / Performance, Supplier selection criteria and audit, market knowledge, monitor SC activities</td></tr>
<tr><td>Zhou et al.'s (2020)
(B)</td><td>1. Authentication technologies should be used like fabricated multiplexed SERS labels application in signature anti-counterfeiting.</td><td>Authentication technologies to be used</td></tr>
<tr><td>Soon & Manning (2019)

(C)</td><td>1. Communication related to anti-counterfeiting measures (ACMs)
2. Distribution related to ACMs
3. Price related to ACMs
4. Product related to ACMs
5. Social value related to ACMs
6. Management systems related to ACMs</td><td>Policies related to distributors, producers, public, management</td></tr>
<tr><td>Chen et al.'s (2018)
(D)</td><td>1. Tighten their laws and regulations against counterfeiting
2. Marketers and policymakers should communicate to consumers product counterfeit harmful effects</td><td>Laws and regulations, policies formulation</td></tr>
<tr><td>Machado et al.'s (2018)

(E)</td><td><table><tr><td>1. Traceability</td><td>2. Collaboration inside / outside supply chain</td></tr><tr><td>3. Trust and control</td><td>4. IP internal / external capability</td></tr><tr><td>5. Preparedness</td><td>6. Redundancy</td></tr><tr><td>7. Visibility and predictive capability</td><td>8. Agile (response, recovery, redesign, growth)</td></tr></table></td><td>Track and trace, IPR, responsiveness in SC, SC capacity</td></tr>
<tr><td>Hussain et al.'s (2017)

(F)</td><td>1. Companies should concentrate more on distinguishing their products compared to counterfeits with the intention of making it easier for individuals to identify original products.
2. Run awareness campaigns to educate consumers about the negative consequences resulting from the consumption of counterfeit products and highlight the aspects of quality
3. Policy makers in developing countries should also develop anti-counterfeiting campaigns directed at those consumers who are unknowingly purchasing counterfeit products by highlighting the ethical issues related to consumption of counterfeit products.</td><td>Create awareness, advertising, Policy formulation, deceptive buyer decisions</td></tr>
<tr><td>Quoquab et al.'s (2017)

(G)</td><td>1. Government, legislators, and decision makers in Malaysia are recommended strongly to instil the ethical values, beliefs, and behaviour through the education system to ensure improvement in the quality of life in Malaysia.
2. Additionally, conferences, seminars, and public talks can be organised by private and public organisations to address this phenomenon and to come up with some strategies that can help to control and minimise counterfeits' usage.</td><td>Legislation to protect consumers, Conferences, seminars, presentations, awareness campaign</td></tr>
<tr><td>Sullivan et al.'s (2017)

(H)</td><td>1. Improving the identification and investigation of counterfeit products
2. Observation of the businesses and markets help in analysing the data on counterfeits' possible infiltration in legitimate supply chains, provide baseline understanding of these activities</td><td>Data mining, Protection strategies market knowledge</td></tr>
</table>

DiMase et al.'s (2016) (I)	1. Prioritize high risk parts 2. Move beyond certificates of conformance 3. Incentivise best practices 4. Adoption of standards 5. Designing and managing supply chain resilience	Promotion & incentives, Quality standards, SC practices
Bodner (2014, 15) (J)	1. "Acquisition regulations addressing supplier qualification, suspect counterfeit reporting, supplier penalties for counterfeits and pass-through" 2. "Use of a secure trusted foundry network of suppliers to reverse engineer and reproduce obsolete parts" 3. "Testing regimens to detect counterfeits at entry points in supply chain" 4. "Traceability of components throughout traversal of supply chain" 5. "Criticality analysis under Program Protection Plans to focus on parts/sub-systems deemed critical to mission" 6. "Industry standards for supplier qualification" 7. "Obsolescence management and re-engineering obsolete sub-systems" 8. "Law enforcement to identify and remove counterfeiters"	Supplier qualification and selection criteria, procedures to check possibilities of reverse engineering / obsolete items. Protection technologies used to track and trace items, Program Protection Plans to focus on parts/sub-systems critical to mission, Obsolescence management, use of law enforcement agencies to provide legal cover
Eser et al.'s (2015) (K)	1. "Forming alliances and networks to fight counterfeiting" 2. "Proposing and adopting rules and form to protect legitimate businesses" 3. "Cooperating with and informing law enforcement agencies" 4. "Activating sanctioning bodies against counterfeiters" 5. "Raising awareness of end users" 6. "Striving to make the deliberate purchase of counterfeits an offense"	Collaboration and coordination to support anti-counterfeiting program, law cover and information sharing, formation of education program for creating awareness
Stevenson & Busby (2015) (L)	1. "Reacquiring obsolete products, incentivizing returns by customers and meeting the costs of returns" 2. "Requiring destruction of obsolete products and components, incentivizing destructions, e.g.. By paying for certificates of destruction or destroyed items, and providing resources for destruction processes" 3. "Informing inadvertent suppliers of counterfeiters and incentivizing them not to supply counterfeiters, paying for intelligence from suppliers, and designing appropriate and perhaps exclusive supply contract" 4. "In-sourcing the production of particularly critical materials" 5. "Incorporating the potential for "leakage" in the supplier selection process" 6. "Avoiding the over rapid discontinuation of product lines" 7. "Undermining physical functions and appearance, e.g.. after a certain shelf life" 8. "Making it costly for the counterfeiters to change marks and labels that would show that components and materials have been in prior use" 9. "Designing contracts that prohibit dealings with counterfeiters" 10. "Enforcing contracts with closer personal relationships, auditing and monitoring" 11. "Incentivizing conformant behaviour, such as by paying for intelligence about counterfeits" 12. "Providing suppliers with strict quantities of materials and components just in time (JIT)" 13. "Forbidding unauthorized subcontracting by suppliers" 14. "Creating activation requirements that increase counterfeiters' costs by: Requiring codes, passwords or keys that activate the product after the market entry date" 15. "Avoiding the over regular introduction of new products"	Monitoring disposal process and return activities, control documentation, collaboration and coordination with suppliers with contractual binding, Monitoring supplier selection process, audit and performance evaluation of suppliers, market knowledge, formation of incentivised policies for suppliers and distributors, follow authorized contracts with sub-contracting, information sharing among partners, Awareness campaign and communication with

<table>
<tr><td></td><td>16. “Sharing intelligence with customs and trading authorities; otherwise, this is beyond the legitimate supply chain’s influence”
17. “Communicating the potential for dilution to customers and consumers”
18. “For experience products, making dilutions physically costly or impossible to buy, e.g.. Using chemical markets”
19. “Sharing intelligence with custom and trading authorities, but otherwise, this is beyond the legitimate supply chain’s influence”
20. “Undermining the false credibility of the counterfeiters’ distribution processes by: informing potential customers about its possibility”
21. “Educating customers how to differentiate between genuine and counterfeit products”
22. “Information and negotiating with other supply chain actors, like logistics providers (alerting them to specific cues, e.g.., divided consignments) and accessory distribution, alerting them to relevant cues, e.g., bulk buying of accessories”
23. “Raising risk awareness and knowledge among potential consumers by: admitting products being counterfeited”
24. “Explaining the consequences of consuming counterfeits”
25. “Educating consumers about different channels, their characteristics and how to authenticate them”
26. “Educate consumers about how to differentiate between genuine and counterfeits”
27. “Developing distinctive and hard to imitate packaging”
28. “Developing packaging that is frequently changed and can’t be authenticated in real time”
29. “Dealing with market institutions by: lobbying for more rigorous counterfeit controls (controls on auction websites)”</td><td>consumers, monitoring SC and perform risk analysis, introduce new information channels for creating awareness among customers against the impact of the use counterfeits in health and safety, lobbying and use of the advertisement tools, law enforcement activities with legal cover</td></tr>
<tr><td>Zhang & Zhang (2015)

(M)</td><td>1. A brand name company can establish reliable distribution channel with 100% authenticity / guaranty, e.g.., a certified or own store.
2. The branch name company should sell through dual channel (B2B / C2C) when counterfeits’ quality is relatively high.
3. A brand name company must carefully evaluate the trade-off between its profitability under the dual channel structure and the rampancy of the counterfeits.</td><td>Brand protection strategies, quality management, channel awareness campaign</td></tr>
<tr><td>Grenoble (2014)

(N)</td><td>1. Focus on counterfeit part intelligence
2. Risk based multi-layered approach
3. Identify trusted / distributed parties
4. Employ authentication technology application
5. Strengthen internal line of defence
6. Capitalize on external re-enforcement through collaboration and information sharing
7. Achieving internal re-enforcement through organisation-wide culture and policies</td><td>Market knowledge, use of authentication technologies, SC risk analysis, collaboration and information sharing, culture and policies</td></tr>
<tr><td>Hoecht & Trott (2014); Hung (2003); Shultz & Saporito (1996); Yoo & Lee (2009); Nakkash & Yoo (2009)

(O)</td><td><table><tr><td>1. Legislation formation</td><td>2. Do nothing</td></tr><tr><td>3. Co-opt offenders</td><td>4. Educate stakeholders at source</td></tr><tr><td>5. Aggressive advertising</td><td>6. Investigation and surveillance</td></tr><tr><td>7. High-tech labelling</td><td>8. Create a moving target</td></tr><tr><td>9. Coalitions</td><td>10. Internal & external guanxi</td></tr><tr><td>11. Withdraw from the market</td><td></td></tr></table></td><td>Awareness, Campaign, Advertising, investigative team formation, Collaboration and information sharing, watch the market</td></tr>
<tr><td>Ting & Tsang (2014)

(P)</td><td>1. Understanding should be developed about business, data visualisation and analysis of the logistics flow in a supply chain
2. Use the techniques (e.g. overt, covert, machine-readable, etc.) to authenticate the end product.
3. Examine the supply chain parties’ roles systemically</td><td>Data mining and visualization, RFID enabled products with tags</td></tr>
</table>

Wilcock & Boys (2014) (Q)	1. "Establish contacts with active members and consider taking leadership roles in trade and industry associations that support anti-counterfeiting" 2. "Demonstrate commitment, provide resources, and support public awareness and consumer education regarding the negative effects of counterfeiting at the micro (firm level) and macro (societal) levels" 3. "Establish relationships with law enforcement, customs officials, etc. so such groups are made aware of, and remain vigilant for, the firm's counterfeit products" 4. "Demonstrate a respect for IP in business practices and policies, explicitly forbidding employees to engage in piracy and counterfeiting" 5. "Train employees to identify counterfeit products, and encourage/reward ongoing vigilance" 6. "Develop whistle-blower reporting mechanisms and protections" 7. "Incorporate anti-counterfeiting technologies and security considerations into new product development and product evolution programs" 8. "Consider the potential for counterfeiting/piracy of products and/or technologies in decision-making concerning raw material suppliers, manufacturing locations, distribution networks, etc." 9. "Consider locating overseas production in countries where foreign governments have a demonstrated interest and capacity to enforce laws pertaining to counterfeiting and infringement" 10. "Consider centralizing distribution networks (i.e., ship from a centralized address to assist in product identification)" 11. "Develop joint anti-counterfeiting action plans with key strategic business partners" 12. "Establish agreements and mechanisms to ensure confidentiality and share information that would help combat counterfeiting" 13. "A process to forward counterfeit item inquiries/complaints to a designated and centralized brand protection specialist /department (to facilitate tracing counterfeit sources)" 14. "A process to address complaints from individuals who purchased a product that they believed to be authentic, returned it, and then discovered it isn't the real product" 15. "Formulate plans to address media issue / Customer complains" 16. "Emphasize the importance of IP rights, the value of IP to the business, and the need to respect those rights for other companies" 17. "Teach how to identify counterfeit products of own firm and those of strategic business partners" 18. "Develop and participate in training for employees of company partners to help them to identify the firm's counterfeit products (i.e., training for law enforcement, customs officials, Employees of partner firms)" 19. "Ensure contact information for those responsible for anti-counterfeiting programs is readily and publicly available" 20. "Introduce traceability into the supply chain. 21. Develop a loss prevention program; establish an auditing program for all components of the supply chain to identify and help prevent counterfeiting" 22. "Develop an efficient supplier audit program: Consider developing/expanding supplier qualification process to include behavioural assessments, detailed verification of record keeping, and comprehensive site audits" 23. "Develop a product disposal program to ensure that defective, expired/outdated, and spoiled products are permanently removed from the supply chain" 24. "Remain vigilant and continually enhance the technologies and processes used to protect IP"	Collaboration and coordination with other organisations to serve common objective, information sharing, Management commitment to implement anti-counterfeiting strategies, IPR protection, Education program to create awareness among stakeholder, Quality standards with ownership, use of protection technologies for item track and trace, Monitor SC activities, use of law enforcement agencies, formation of surveillance teams, data protection techniques applied, brand protection strategies, Advertisement and media to use for creating general awareness among masses, formulation of anti-counterfeiting programs, customers buying behaviour assessment, supplier audit program, monitor information about rejected or spoiled or dispose products, form feedback mechanism and process improvement

	25. "Track effectiveness of counterfeiting program to enable firm to adjust quickly, and improve results when appropriate" 26. "Consider product/service features that are difficult to replicate and/or easy to distinguish from those of non-legitimate producers during product development/ improvement"	
D'Amato & Papadimitriou (2013) (R)	1. "Utilize risk management procedures to verify legitimacy of customers (track customer history, develops guideline for sales force on how to assess the legitimacy of customers?)" 2. "Enhance marketing intelligence" 3. "Monitor sales of brand name products on the internet" 4. "Develop informational materials that explain the harm that counterfeit products cause businesses, consumers, and governments" 5. "Verify product authenticity" 6. "Consider using technology to ensure product security" 7. "Employ track & trace methodology with bar codes or RFID" 8. "Ensure the authenticity of raw materials and component parts (authorized suppliers, qualify vendors, agreement on spot audit / controls)" 9. "Employ the concept of "strict liability" for failure to deliver authentic components and parts in contracts with suppliers" 10. "Institute shipping policies to certify that product iste and damaged and unusable products are destroyed or appropriately disposed-off" 11. "Authenticate distribution partners" 12. "Partner with retailers (certified retailers programs)" 13. "Collaborate with local custom authorities" 14. "Vigorously pursue legal remedies to deter trademark infringements" 15. "Meet with key federal, state, and local officials and customs authorities to personally brief them and learn more about their priorities" 16. "Establish procedures for sharing information that can be used in law enforcement investigations and offer to provide legitimate products, under appropriate conditions, to assist in investigations"	Guideline for employees to perform SC risk assessment to track historical activities and monitor SC activities, Market knowledge, use protection technologies for track and trace, collaboration and coordination to support anti-counterfeiting program, law cover and information sharing, formation of education program for creating awareness, suppliers' audit and performance evaluation, introduce retailers, suppliers and distributors certification programs, use law enforcement agencies to cover investigation
Zimmerman (2014) (S)	1. Develop an IP protection strategy 2. Establish a brand integrity team 3. Assure the registration of copyrights, trademarks, and patents 4. Create a monitoring program to direct information about the IP environment to a central database 5. Develop a full information plan directed at employees, distribution channels, contract manufacturers, local law enforcement, and international organisations 6. Take actions against counterfeiters on every level–retailers, distributors, and manufacturing sources–requesting injunctions and cooperating with local law enforcement 7. Develop an evaluation and feedback system	IPR protection, Help from Law enforcement agencies, Program formalization, coordination and collaboration with all stakeholders, feedback system for information
Heinonen & Wilson (2012) (T)	1. Review existing state-level intellectual property rights legislation 2. Focus training on counterfeit product identification and investigation 3. Facilitate inter-agency coordination in and across states 4. Assess awareness and needs of local and state police 5. Educate the public about product counterfeiting harms and risk	IPR, training and awareness, investigative teams,
Li (2012) (U)	1. "Product Authentication Technologies" 2. "Product Tracking Technologies" 3. "Product Tracing Technologies"	Authentication technologies for track and trace
Peterson (2012) (V)	1. Use potential power of company pressures on legislative activities 2. Urge key overseas strategic partners to lobby their own governments for reform of intellectual property laws 3. Maintain business relationships only with companies that have demonstrated a longstanding commitment to the respect of intellectual property. 4. Develop effective collaborative relationships on a global scale	Legislation for protection, IPR, management commitment, collaboration and information sharing

Staake & Fleisch (2008, 2012) (W)	1. "Determine the market share of counterfeit goods" 2. "Investigate the characteristics of the counterfeit producers" 3. "Understand the properties of the illicit supply chain" 4. "Analyse the behaviour of consumers of counterfeits" 5. "Conduct a risk analysis and assess the monetary loss" 6. "Analyse best practice strategies for anti-counterfeiting from within and outside the industry" 7. "Setup or refine your brand and product protect task force" 8. "Implement defined monitoring and reaction processes" 9. "Assess and select preventative measures" 10. "Consider the implementation of large scale product checks" 11. "Signal top-management support" 12. "Develop knowledge of the supply side of counterfeits" 13. "Develop country-specific knowledge of the counterfeit trade" 14. "Know the impact of counterfeit trade on your business" 15. "Know the quality of counterfeit producers" 16. "Know the profiles of consumers of counterfeits" 17. "Have defined processes to govern response to counterfeits" 18. "Have defined processes to monitor for existence of counterfeits" 19. "Standardize counterfeit reporting tools" 20. "Develop indicators to assess performance of anti-counterfeiting measures" 21. "Appoint NGOs to assist in counterfeit issues" 22. "Engage government to assist in counterfeit issues" 23. "Engage industry groups to assist in counterfeit issues" 24. "Protection technologies" 25. "Legal actions" 26. "Supply-chain security measures" 27. "Secure distribution systems" 28. "Participation in industry groups" 29. "Make anti-counterfeiting knowledge explicit" 30. "Have multiple authorities across departments on counterfeits" 31. "Use websites to help consumers be able to identify counterfeits and risky supply channels" 32. "Educate purchasing departments, suppliers and vendors on how to spot counterfeits" 33. "Use standardized processes, monitoring and analysis of counter-feits"	Market knowledge, Monitor SC driving factors and enablers in SC, Surveillance team formation, Signalling concept in SC, Education program and awareness, Inspection and technical evaluation of the product & package, Process are designed according to Q.M and standardize reporting tools, use of protection technologies, legal support, SC risk analysis
Reynolds (2011) (X)	1. Learn the business to find vulnerabilities 2. Attack the entry point 3. Exploit weaknesses to raise costs and risks 4. Conditional response – teaching good behaviour 5. Measuring impact and positive benefit to the company	Observe SC activities, Evaluate SC strategies
Sood et al.'s (2011) (Y)	1. "Utilize industry standards for inspection and acceptance of parts sourced in the open market" 2. "Use External Visual Inspection" 3. "Use X-Ray and other NDI of parts" 4. "Use Material evaluation and characterization" 5. "Use packaging evaluation" 6. "Use Die Inspection on electronic parts" 7. "Inspections need to be accomplished in short time span to be effective"	Best industry practices, Q.M, Inspection and technical evaluation of the product & package, Technology used
Berman & Swani (2010) (Z)	1. Developing an organisational unit responsible for product safety 2. Securing greater control over raw material sourcing 3. Using extreme care in choosing subcontractors 4. Conducting continuous product testing by multiple parties 5. Being especially vigilant for counterfeits 6. Improving product traceability	Product safety, Procurement check, product testing, monitoring SC activities

Nunes & Donnelly (2010) (AA)	1. "Defend product with the goal of fortifying the supply chain" 2. "Detect product to help victims of spot fakes" 3. "Doubt in purchasing product, customer should think twice" 4. "Discourage product counterfeiting with the goal of increasing the business and legal risks & costs"	Use protection technology to track and trace items in SC, Cooperate with agency enforcement and suppliers and distributors, implement anti-counterfeiting prgm.
Stumpf & Chaudhry (2010) (AB)	1. "Employ anti-counterfeiting product markings and packaging" 2. "Individual firm can develop advertising about the safety, performance and financial risks associated with counterfeits" 3. "Trade group development of advertising about the safety, performance and financial risks associated with counterfeits" 4. "International discourse on countering the problems" 5. "Use product authentication technology in supply side operations" 6. "Work with media outlets to educate the public on the pervasive issues related to counterfeit foodstuffs, pharmaceuticals, etc." 7. "Work with global agencies such as World" 8. "Bank to immobilize global flow of funds to support counterfeiting activities" 9. "Reduced Price / Rebate" 10. "Offer Site Licenses" 11. "Emphasize Warranties" 12. "Emphasize Benefits" 13. "Lists of Authorized Sellers" 14. "Stress Harmful Effects of Counterfeits"	Monitor SC driving factors and enablers in SC, Surveillance team formation, Signalling concept in SC, Education program, advertisement and awareness, Inspection and safety of product & package, use of protection technologies, legal support, SC risk analysis
Chaudhry et al.'s (2009) (AC)	1. "Register trademark / patents" 2. "Encourage distributors to notify manufacturer" 3. "Educate employees about counterfeit goods" 4. "Educate channel members" 5. "Warn distributors and retailers about possible penalties" 6. "Obtain local police support" 7. "Encouraging enforcement of existing laws" 8. "Pursue injunctions against counterfeiters" 9. "Monitor information sources for anti-counterfeiting developments" 10. "Monitor and investigate retailers and distributors" 11. "Acquisitions / Joint venture with counterfeiter" 12. "Aggressively cut prices" 13. "Provide financial incentives for distributors / retailers to reject counterfeits" 14. "Stress the harmful effects of counterfeiting in advertisements" 15. "Establish factories in lower cost countries" 16. "Solicit retailers / distributor suggestions for anti-counterfeiting tactics" 17. "Implement surveillance program to check products in stores"	IPR protection, Education program -educate all stakeholders, Monitor SCA activities, Warn distributor and other for consequences, Local police support, Protection with technologies and laws coverage, Acquisitions & Joint ventures, formation of anti-counterfeit strategies, investment, and pricing policies, Surveillance team formation
Staake et al.'s (2009) (AD)	1. Companies should study their businesses and be aware about the possibilities of possible penetration of the counterfeits at some point in their licit supply chains. 2. Companies should pay attention to drivers of the counterfeits' market. 3. Consumer role is very important to avoid deceptive buying, requires awareness about the enablers of the counterfeit trade. Consumers' education is important. 4. Companies protect their brands from IPR infringements	Monitoring SC activities, Customer buying patterns, create awareness, Education, IPR
Yang & Fryxell (2009) (AE)	1. Consumer awareness is important in pre / post buying situation, guidance required from the company. 2. Advertising is important for consumers' strategic attention to a great extent on what message or 'theme' was being emphasized. 3. Advertising and promotion emphasise product reliability to the customer and can be used directly in targeting counterfeit activity.	Awareness about the counterfeits, Campaign and advertisement, brand protection, Effective strategies formulation

	4. Managers should link brand positioning as a weapon of defence and prevention with more direct anti-counterfeiting activities (e.g. corporate anti-counterfeiting strategies and government actions) to enhance their effectiveness.	
Berman (2008) (AF)	1. "Employ Private Investigators" 2. "Establish fake companies to purchase counterfeit goods" 3. "Have an internal investigation division to monitor counterfeits" 4. "Employ IP protection (trademarks, copyrights, patents)" 5. "Consumers education programs on counterfeits" 6. "Use product authentication technology in demand (consumer) side" 7. "Publish information for consumers on how to validate authenticity of products" 8. "Individual firms can develop advertising campaign about the safety, performance and financial risks associated with counterfeits" 9. "Trade group development of advertising about the safety, performance, and financial risks associated with counterfeit" 10. "Joint development of advertisements (trade groups, firms, government & authorities) about the safety, performance and financial risks associated with counterfeits" 11. "Train customers to report counterfeit goods" 12. "Employ anti-counterfeiting product markings and packaging" 13. "Controlling outsourcing" 14. "Selecting suppliers based on trust and past performances" 15. "Ensure outsources should return production technology, sales and marketing information" 16. "Monitor Outsourcing through surprise inspection" 17. "Use partial outsourcing to prevent having all resources needed to replicate product" 18. "Complete production at internal facilities" 19. "Use website monitoring software to search for counterfeits" 20. "Take action to shut down websites selling counterfeits" 21. "Take legal actions against counterfeiters" 22. "Reduce grey market activity by withholding payment until product verification is complete" 23. "Reduce grey market activity by not using wholesalers who also sell in secondary markets" 24. "Require suppliers to return all seconds and out-of-spec items for disposal" 25. "Reporting Counterfeits needs to happen quickly"	Surveillance team formulation, IPR, Education programs and awareness, authentication technology, Campaign and advertising, Collaboration and coordination with suppliers, SC monitoring and risk assessment, Joint program's introduction, Contractual binding in outsourcing with suppliers, surprise supplier inspection, audit and quality measures, suppliers' past performance, market intelligence, Program to check disposals and return of the products.
Cooper & Eckstein (2008) (AG)	1. "Tighten Supply Chain" 2. "Monitor Distribution Chain" 3. "Investigate Leads Fully" 4. "Establish Excellent Government Relations" 5. "Employ Excellent Internal Record keeping" 6. "Update Packaging" 7. "Formulate Crisis Management Plan" 8. "Prepare to Litigate"	Monitor SC activities, establish program for anti-counterfeiting strategies implementation, SC risk assessment, law enforcement agencies cover
Kwok et al.'s (2008) (AH)	1. The intelligent system and data mining techniques with RFID technologies can be used by manufacturing enterprises to combat counterfeiting in supply chains with multiple Materials / parts suppliers. 2. Visualization of global parts supply chain information, manufacturing enterprises can detect transactions involving counterfeit parts, investigate irregularities in transactions, and locate the source of rogue items cost effectively	Data mining, data visualization, monitoring procurement activities
Lybecker (2007, 2008) (AI)	1. "Bring technological changes to product and packaging" 2. "Made to make product replication more difficult & costly" 3. "Cooperation across the supply chain in order to increase the costs of distributing counterfeit product into SC" 4. "Cooperation in agencies enforcement, increase possibility of detection and prosecution"	Use protection technologies to track and trace items in SC, Cooperation with agencies enforcement and suppliers and distributors,

		implement anti-counterfeiting strategies and programs
Mura (2018) (AJ)	1. A systematic protocol for detecting counterfeiting devices consists of external visual inspection, marking permanency test, x-rays inspections, material evaluation and characterization, die marking inspection for parts modification (re-marked, re-packaged and re-furnished) 2. The technological characterization and the selective de-processing were then fundamental for the confirmation of the poor quality of the devices under analysis. Latent defects could remain undetected and either sudden fail in field operation, or, could cause erratic performance. 3. Buying from the authorized distributors or resellers and perform elementary screening procedures seems to be the only approach able to stop the spread of counterfeiting.	Technology used to protect product and package, monitoring SC activities, quality standards, awareness among distributors or resellers and incentives
Amine & Magnusson (2007) (AK)	1. Educate Fashionistas and Redirect Demand. 2. Report, Co-Opt or Ignore the Source of Supply for Opportunists 3. "Bottom-of-the-Pyramid" (BOP) Marketing to the Vulnerable. 4. Identify, Attack, and Remove Threats to Victims	Monitor SC activities, Surveillance teams, market knowledge
Lehtonen et al.'s (2007) (AL)	1. "Use product authentication technology in demand (consumer) side" 2. "Use product authentication technology in supply side operations"	Technology used in monitoring SC activities
Minagawa et al.'s (2007) (AM)	1. "Continuously alter product/component characteristics to make it harder to imitate" 2. "Collaborate with alleged or suspected imitators to develop products for local sale which would be mutually beneficial in terms of accessing cheapest sources of distribution, manufacturing supplies and efficient distribution" 3. "Price products to attract more customers, which reduces the margin for counterfeits and increases demand" 4. "Consider product imitation as part of strategic decision making" 5. "Focus on R&D efforts, since imitators don't have R&D capacity"	Collaboration and coordination with suppliers and distributors, pricing policies, R & D and technology for track and tracing
Bosworth & Yang (2006) (AN)	1. "Monitoring the need for IP" 2. "Familiar with the legal and administrative rules, seeking governmental support while enforcing corporate IP" 3. "Internal management of IP (ownership, tax, information)" 4. "Assessing the value of IP" 5. "Evaluating the IP returns" 6. "Monitoring counterfeiting, and take legal actions with evidential proof when appropriate" 7. "Maintain access to legal experts" 8. "Pricing and quality control" 9. "Using anti-counterfeiting technologies" 10. "Licensing management and commercialization" 11. "Establishing anti-counterfeiting networks with other firms and specialized firms" 12. "Familiar with the culture and IP environment across countries"	IPR culture, Law enforcement and legal cover, formation of price and quality management policies, protection technologies used for track and trace, Collaborate and coordinate against counterfeiters,
CACP & Accenture (2006) (AO)	1. "Secure legitimate inputs" 2. "Verify legitimacy of customers & Distributors" 3. "Managing production site and damaged or unusable inventory" 4. "Ensure legitimacy of purchased products at retail level" 5. "Monitor Brand Integrity" 6. "Outreach to law enforcement & regulatory officials"	Establish legitimate protection procedures, DB for unusable inventory, protection technology used for track and trace, monitor SC activities, use of law

		enforcement agency cover
Eisend & Schuchert-Guler (2006) (AP)	1. Signposting the illegality of counterfeiting at borders or airports would be a helpful first step to prevent consumers from purchasing counterfeit products abroad since in doing so dissonant elements of purchase decisions carry more weight. 1. More lobbying is required to create brand awareness and legitimate distribution channels with welfare benefits to people.	Lobbying and advertisement to create awareness among consumers
Santos & Ribeiro (2006) (AQ)	2. Firms must be enrolled in global cooperation [International Trademark Association (INTA), the International Anti-Counterfeiting Coalition (IACC), Global Business Leaders' Alliance Against Counterfeiting (GBLAAC), International Federation of the Phonographic Industry (IFPI) and the Business Software Alliance (BSA)] to inform governments and politicians in general about the major problems of intellectual property theft. 3. Brand owners need to have its own intellectual property protection in place. After that, developing anti-counterfeiting tactics can be an effective way of preventing or reducing trademark counterfeiting. 4. Many brand owners should place forensic features to products or packaging as a means of authentication (overt features such as holograms, or covert features such as invisible fluorescent inks, digital water marking, bar coding or tracking)	Collaboration and Coordination with different protection agencies, information sharing, forensic feature on the product and package
Tang (2006) (AR)	1. The secure supply chain collaboration protocols that will enable supply chain partners to develop collaborative plans without revealing private information to any of the parties. 2. Supply alliance network. 3. Lead time reduction. 4. Recovery planning systems. 5. The RFID tags can also help a supply chain to reduce shrinkage, misplacement and transaction errors.	Collaboration and Coordination with suppliers and monitoring agencies, RFID tags, information sharing
Chaudhry & Zimmerman (2005) (AS)	1. "Emphasis benefits of genuine product" 2. "Provide lists of legitimate channel members" 3. "Emphasis warranties and after sale service" 4. "Offer site licenses" 5. "Offer reduced price, related product lines" 6. "Educate channel members about counterfeiting phenomenon" 7. "Provide warnings to distributors/retailers" 8. "Give financial incentives to reject counterfeits" 9. "Solicit dealer suggestions to develop tactics" 10. "Use tracking devices, such as RFID tags" 11. "Establish internal enforcement team" 12. "Use surveillance program in retail outlets" 13. "Monitor and investigate channel members" 14. "Warn counterfeiters of possible legal action" 15. "Aggressively cut prices" 16. "Use covert actions" 17. "Develop supplier quality assurance program" 18. "Educate employees about copycats" 19. "Use acquisition and/or joint venture strategy" 20. "Establish factories in lower cost countries" 21. "Register trademarks and patents" 22. "Educate local law enforcement" 23. "Injunctions against counterfeit goods" 24. "Lobby for more stringent laws/enforcement" 25. "Seek assistance from tax authorities" 26. "Managers conceptualize the IP environment" 27. "IPR environment affect the market entry decision" 28. "Anti-counterfeiting strategies are frequently used" 29. "Effective controlling techniques applied in the host country market" 30. "Identifying and punishing retail outlets"	IPR protection, SC risk analysis, collaboration and coordination with suppliers, distributors and authorities, Education programs to create awareness, incentivise scheme, monitor the SC activities, protection technologies use, Warrants and Claims and pricing and investment policies, effective controlling strategies to follow, Lobbying and advertisement for strict legal cover, General awareness among masses, surveillance team formation

	31. "Destroying the production facilities of pirates" 32. "Protecting the CEO with security guards" 33. "Converting pirates into legitimate businesses" 34. "Lobbying for stricter penalties in the legal system" 35. "Obtaining local policy support for operations" 36. "Securing government officials assistance" 37. "Forming surveillance / anti-counterfeiting team"	
Staake et al.'s (2005) (AT)	1. Secure authentication from RFID and Advanced Cryptography Provide the stated security goals requires implementing product authentication. 2. Use a track & trace approach, passive tags storing a unique Electronic Product Code (EPC) is sufficient for many applications.	RFID tags, EPC technologies, track and trace, monitoring SC activities
Hoe et al.'s (2003) (AU)	1. Consumer awareness necessary to use differentiating technique to buy original product 2. Advertisement required to create awareness	lobbying and advertisement to create awareness
Chaudhry & Walsh (1996); Harvey & Ronkainen (1985); Harvey (1988); Bush et al.'s (1989) (AV)	1. "Warning Strategy" 2. "Withdrawal Strategy" 3. "Prosecution Strategy" 4. "Hands-Off Strategy" 5. "Creating Awareness" 6. "Action oriented approach" 7. "Assertion approach" 8. "Participate in International Anti-Counterfeiting Coalition (lACC)" 9. "Pursue litigation" 10. "Lobby for stronger anti-counterfeiting laws" 11. "Encourage enforcement of laws" 12. "Add unique identifiers to the product for identification" 13. "Provide financial incentives for channel members to reject counterfeits" 14. "Inform the public and trade about risks"	Strategies to deal with suppliers and distributors like warning, withdrawal, penalties, law enforcement and legal cover, provide financial incentives to channel member for cooperation, lobbying and advertisement to create awareness

Appendix Table-A-1: INTEGRATING ANTI-COUNTERFEITING STRATEGIES AS THEMES

Contribution	Practices proposed	Dimensions explored
Ghadge, A. et al.'s (2021)	Campaign, advertising, communication, legal, knowledge sharing, Supplier relationship management, supplier contract management & development / performance, Supplier selection criteria and audit, market knowledge, monitor SC activities	Market knowledge-based campaign against counterfeiting activities and consumers' awareness
Zhou et al.'s (2020)	Authentication technologies to be used	Best industry techniques to counter counterfeiting
Soon & Manning (2019)	Policies related to distributors, producers, public, management	Policy based program implementation to counter counterfeiting activities
Chen et al.'s (2017)	Laws and regulations, policies formulation	Laws and regulations to protect Policy based program
Machado et al.'s (2018)	Track and trace, IPR, responsiveness in SC, SC capacity	Industry used track and trace technique to protect intellectual rights of the product
Hussain et al.'s (2017)	Create awareness, advertising, Policy formulation, deceptive buyer decisions	Knowledge provided to consumers about deceptive Vs. original items
Quoquab et al.'s (2017)	Legislation to protect consumers, Conferences, seminars, presentations, awareness campaign	Laws and regulations to protect policy-based program and its awareness
Sullivan et al.'s (2017)	Data mining, Protection strategies market knowledge	Best industry techniques to counter counterfeiting
DiMase et al.'s (2016)	Promotion & incentives, Quality standards, SC practices	Processes are designed to follow ISO supported Q.M standards for reporting
Bodner (2014, 15)	Supplier qualification and selection criteria, procedures to check possibilities of reverse engineering / obsolete items. Protection technologies used to track and trace items, Program Protection Plans to focus on parts/sub-systems critical to mission, Obsolescence management, use of law enforcement agencies to provide legal cover	Contractual binding with suppliers to maintain supply of the quality items, and used track and trace technique to protect items
Eser et al.'s (2015)	Collaboration and coordination to support anti-counterfeiting program, law cover and information sharing, formation of education program for creating awareness	Supporting program implementation to counter counterfeiting activities and educate consumers
Stevenson & Busby (2015)	Monitoring disposal process and return activities, control documentation, collaboration and coordination with suppliers with contractual binding, Monitoring supplier selection process, audit and performance evaluation of suppliers, market knowledge, formation of incentivised policies for suppliers and distributors, follow authorized contracts with sub-contracting, information sharing among partners, Awareness campaign and communication with consumers, monitoring SC and perform risk analysis, introduce new information channels for creating awareness among customers against the impact of the use counterfeits in health and safety, lobbying and use of the advertisement tools, law enforcement activities with legal cover	Supporting program implementation to counter counterfeiting activities and educate consumers. Contractual binding with suppliers to maintain supply of the quality items and used track and trace technique to protect items. Market knowledge-based campaign against counterfeiting activities and consumers' awareness
Zhang & Zhang (2015)	Brand protection strategies, quality management, channel awareness campaign	Processes are designed to follow ISO supported Q.M standards for reporting. Laws and regulations to protect policy-based program and its awareness
Grenoble (2014)	Market knowledge, use of authentication technologies, SC risk analysis, collaboration and information sharing, culture and policies	Market knowledge-based campaign against counterfeiting activities. Used track and trace technique to protect intellectual rights of the product

Hoecht & Trott (2014); Hung (2003); Shultz & Saporito (1996); Yoo & Lee (2009)	Awareness, Campaign, Advertising, investigative team formation, Collaboration, and information sharing, watch the market	Information sharing and market knowledge-based campaign against counterfeiting activities and consumers' awareness
Ting & Tsang (2014)	Data mining and visualization, RFID enabled products with tags	Best industry techniques to counter counterfeiting
Wilcock & Boys (2014)	Collaboration and coordination with other organisations to serve common objective, information sharing, Management commitment to implement anti-counterfeiting strategies, IPR protection, Education program to create awareness among stakeholder, Quality standards with ownership, use of protection technologies for item track and trace, Monitor SC activities, use of law enforcement agencies, formation of surveillance teams, data protection techniques applied, brand protection strategies, Advertisement and media to use for creating general awareness among masses, formulation of anti-counterfeiting programs, customers buying behaviour assessment, supplier audit program, monitor information about rejected or spoiled or dispose products, form feedback mechanism and process improvement	Information sharing and market knowledge-based campaign against counterfeiting activities. Used track and trace technique to protect intellectual rights of the product. Supporting program implementation to counter counterfeiting activities and educate consumers. Process formulation and improvement to reject spoiled or dispose products, form feedback mechanism
D'Amato & Papadimitriou (2013)	Guideline for employees to perform SC risk assessment to track historical activities and monitor SC activities, Market knowledge, use protection technologies for track and trace, collaboration and coordination to support anti-counterfeiting program, law cover and information sharing, formation of education program for creating awareness, suppliers' audit and performance evaluation, introduce retailers, suppliers and distributors certification programs, use law enforcement agencies to cover investigation	Info sharing, risk assessment and market knowledge-based campaign against counterfeiting activities and consumers' awareness. Used track and trace technique to protect intellectual rights of the product. Laws and regulations to protect policy-based program
Zimmerman (2014)	IPR protection, help from Law enforcement agencies, Program formalization, coordination and collaboration with all stakeholders, feedback system for information	Info sharing and market knowledge-based campaign against counterfeiting activities and consumers' awareness Laws and regulations to protect policy-based program
Heinonen & Wilson (2012)	IPR, training and awareness, investigative team formation.	Information sharing and market knowledge-based campaign against counterfeiting activities
Li (2012)	Authentication technologies for track and trace	Best industry techniques to counter counterfeiting and used track and trace technique to protect items
Peterson (2012)	Legislation for protection, IPR, management commitment, collaboration and information sharing	Info sharing and used track and trace technique to protect intellectual rights of the product. Laws and regulations to protect policy-based program
Staake & Fleisch (2008, 2012)	Market knowledge, Monitor SC driving factors and enablers in SC, Surveillance team formation, signalling concept in SC, Education program and awareness, Inspection and technical evaluation of the product & package, Process are designed according to Q.M and standardize reporting tools, use of protection technologies, legal support, SC risk analysis	Surveillance team formation. Information sharing and market knowledge-based campaign against counterfeiting activities and consumers' awareness Supporting program implementation to counter counterfeiting activities and educate consumers. Processes are designed to follow ISO supported Q.M standards for reporting.

Reynolds (2011)	Observe SC activities, Evaluate SC strategies	Performance and best industry techniques to counter counterfeiting
Sood et al.'s (2011)	Best industry practices, Q.M, Inspection and technical evaluation of the product & package, Technology used	Best industry techniques to counter counterfeiting. Processes are designed to follow ISO supported Q.M standards for reporting
Berman & Swani (2010)	Product safety, Procurement check, product testing, monitoring SC activities	Contractual binding with suppliers to maintain supply of the quality items
Nunes & Donnelly (2010)	Use protection technologies to track and trace items in SC, Cooperation with agencies enforcement and suppliers and distributors, implement anti-counterfeiting strategies and programs	Info sharing and used track and trace technique to protect intellectual rights of the product. Laws and regulations to protect policy-based program
Stumpf & Chaudhry (2010)	Monitor SC driving factors and enablers in SC, Surveillance team formation, Signalling concept in SC, Education program, advertisement and awareness, Inspection and safety of product & package, use of protection technologies, legal support, SC risk analysis	Surveillance team formation and Supporting program implementation to counter counterfeiting activities and educate consumers. Risk analysis, inspection & safety of product and package
Chaudhry et al.'s (2009)	IPR protection, Education program -educate all stakeholders, Monitor SCA activities, Warn distributor and other for consequences, Local police support, Protection with technologies and laws coverage, Acquisitions & Joint ventures, formation of anti-counterfeit strategies, investment, and pricing policies, Surveillance team formation	Surveillance team formation, Info sharing and market knowledge-based campaign against counterfeiting activities. Used track and trace technique to protect intellectual rights of the product.
Staake et al.'s (2009)	Monitoring SC activities, Customer buying patterns, create awareness, Education, IPR	Supporting program implementation to counter counterfeiting activities and educate consumers.
Yang & Fryxell (2009)	Awareness about the counterfeits, Campaign and advertisement, brand protection, Effective strategies formulation	Supporting program implementation to counter counterfeiting activities and educate consumers.
Berman (2008)	Surveillance team formulation, IPR, Education programs and awareness, authentication technology, Campaign and advertising, Collaboration and coordination with suppliers, SC monitoring and risk assessment, Joint program's introduction, Contractual binding in outsourcing with suppliers, surprise supplier inspection, audit and quality measures, suppliers' past performance, market intelligence, Program to check disposals and return of the products.	Surveillance team formation, Info sharing and market knowledge-based campaign against counterfeiting activities and consumers' awareness. Contractual binding with suppliers to maintain supply of the quality items, and used track and trace technique to protect items
Cooper & Eckstein (2008)	Monitor SC activities, establish program for anti-counterfeiting strategies implementation, SC risk assessment, law enforcement agencies cover	Supporting program implementation to counter counterfeiting activities and educate consumers.
Kwok et al.'s (2008)	Data mining, data visualization, monitoring procurement activities	Use best industry techniques to counter counterfeiting and used track and trace technique to protect items
Lybecker (2007, 2008)	Use protection technologies to track and trace items in SC, Cooperation with agencies enforcement and suppliers and distributors, implement anti-counterfeiting strategies and programs	Use best industry techniques to counter counterfeiting and used track and trace technique to protect items
Mura (2018)	Technology used to protect product and package, monitoring SC activities, quality standards, awareness among distributors or resellers and incentives	Use best industry techniques to counter counterfeiting and used track and trace technique to protect items
Amine & Magnusson (2007)	Monitor SC activities, Surveillance teams, market knowledge (Marketing oriented)	Surveillance team formation, Info sharing and market knowledge-based campaign against counterfeiting activities and consumers' awareness.

Lehtonen et al.'s (2007)	Technology used in monitoring SC activities	Use best industry techniques to counter counterfeiting and used track and trace technique to protect items
Minagawa et al.'s (2007)	Collaboration and coordination with suppliers and distributors, pricing policies, R & D and technology for track and tracing	Contractual binding with suppliers to maintain supply of the quality items. Use best industry techniques to counter counterfeiting and used track and trace technique to protect items
Bosworth & Yang (2006)	Product's rights, Law enforcement and legal cover, formation of price and quality management policies, protection technologies used for track and trace, Collaborate and coordinate against counterfeiters,	Supporting program implementation to counter counterfeiting activities and educate consumers. Use best industry techniques to counter counterfeiting and used track and trace technique to protect items
CACP & Accenture (2006)	Establish legitimate protection procedures, DB for unusable inventory, protection technology used for track and trace, monitor SC activities, use of law enforcement agencies cover	Use best industry techniques to counter counterfeiting and used track and trace technique to protect items. Laws and regulations to protect policy-based program
Eisend & Schuchert-Guler (2006)	Lobbying and advertisement to create awareness among consumers	Info sharing and market knowledge-based campaign against counterfeiting activities and consumers' awareness
Santos & Ribeiro (2006)	Collaboration and Coordination with different protection agencies, information sharing, forensic feature on the product and package	Supporting program implementation to counter counterfeiting activities. Use best industry techniques to counter counterfeiting.
Tang (2006)	Collaboration and Coordination with suppliers and monitoring agencies, RFID tags, information sharing	Supporting program implementation to counter counterfeiting activities. Use best industry techniques to counter counterfeiting and used track and trace technique to protect items
Chaudhry & Zimmerman (2005)	Rights' protection, SC risk analysis, collaboration and coordination with suppliers, distributors and authorities, Education programs to create awareness, incentivise scheme, monitor the SC activities, protection technologies use, Warrants and Claims and pricing and investment policies, effective controlling strategies to follow, Lobbying and advertisement for strict legal cover, General awareness among masses, surveillance team formation	Surveillance team formation, Info sharing and market knowledge-based campaign against counterfeiting activities and consumers' awareness.
Staake et al.'s (2005)	RFID tags, EPC technologies, track and trace, monitoring SC activities	Use best industry techniques to counter counterfeiting and used track and trace technique to protect items
Hoe et al.'s (2003)	lobbying and advertisement to create awareness	Info sharing and market knowledge-based campaign against counterfeiting activities and consumers' awareness.
Chaudhry & Walsh (1996); Harvey & Ronkainen (1985); Harvey (1988); Bush et al.'s (1989)	Strategies to deal with suppliers and distributors like warning, withdrawal, penalties, law enforcement, and legal cover, provide financial incentives to channel members for cooperation, lobbying, and advertisement to create awareness	Contractual binding with suppliers to maintain supply of the quality items. Market knowledge-based campaign against counterfeiting activities and consumers' awareness.

APPENDIX TABLE-2.2.7A-2: CONTRACTUAL BINDING WITH PARTNERS (THEME-1)		
Contributions	**Dimensions**	**No.**
Berman & Swani (2010)	Careful selection of sub-contractors	Z-3
Berman (2008)	Supplier willingness to control counterfeiting	AF-13
Berman (2008)	Suppliers selected on previous performance and trust	AF-14
Berman (2008)	Surprise inspection and monitor outsourcing partners	AF-16
Berman (2008)	Partial outsourcing to prevent product replication	AF-17
Berman (2008)	Complete production at internal facilities	AF-18
Bodner (2014, 2015)	Supplier qualification & penalties to deal in counterfeits	J-1
Bodner (2014, 2015)	Secure processes to counter re-engineering possibilities of obsolete parts/components of the products	J-2
Bodner (2014, 2015)	Prescribed tests to check counterfeits	J-3
Bodner (2014, 2015)	Industry standards for supplier qualification	J-6
D'Amato & Papadimitiou (2013)	Authenticate distribution partners	R-11
D'Amato & Papadimitiou (2013)	Contract to accept strict liability to deliver quality parts	R-9
DiMase et al. (2016)	Standards, certificate of conformance, Design and management SC resilience	I-2/4
Eser et al. (2015)	Discourage counterfeits purchases deliberately	K-6
Ghadge, A. et al. (2021)	Supplier relationship management, supplier contract management, contract performance, and continuous improvement	A-4
Ghadge, A. et al. (2021)	market evolution, options assessment, high-level specification	A-5
Hussain et al. (2018)	Product features distinguished to establish originality	F-1
Machado et al. (2018)	Trust and control in SC	E-3
Machado et al. (2018)	Supply chain agility	E-8
Sood et al. (2011)	Utilize industry standards for parts' inspections and acceptance	Y-1
Stevenson & Busby (2015)	Suppliers meet JIT requirements and avoid unauthorized subcontracts	L-12/13
Stevenson & Busby (2015)	Negotiation with SC actors ad alert distributors & logistics providers	L-22
Stevenson & Busby (2015)	Knowledge of counterfeit product risk awareness and its usage consequences	L-23/24
Stevenson & Busby (2015)	Make marks and labels difficult to copy	L-8
Stevenson & Busby (2015)	Contract to avoid counterfeits	L-9
Sullivan et al. (2017)	Identification of counterfeits by suppliers	H-1
Wilcock & Boys (2014)	Agreement to maintain info confidentiality	Q-12
Zhou et al. (2020)	Signature and label application and authentication technologies	B-1

APPENDIX TABLE-2.2.7A-3: CAMPAIGN AGAINST PRODUCT COUNTERFEITING (THEME-2)		
Contributions	**Dimensions**	**No.**
Amine & Magnusson (2007)	Educate customers/partners	AK-1
Berman & Swani (2010)	Develop an organizational unit responsible for product safety	Z-1
Berman (2008)	Joint advertisement about product safety, risk, and performance associated with counterfeits	AF-10
Berman (2008)	Training is given to customers to report counterfeits	AF-11
Berman (2008)	Investigate and monitor counterfeits	AF-3
Berman (2008)	Public info for customers to recognize counterfeits	AF-7
Berman (2008)	Campaign about safety, performance & counterfeit risk	AF-8
Berman (2008)	Joint (trade groups) advertisement about safety, performance, risk	AF-9
Bodner (2014, 2015)	Law enforcement to identify and remove counterfeiting	J-8
Chaudhry & Walsh (1996); Harvey & Ronkainen (1985); Harvey (1988); Bush et al. (1989)	Warning / withdrawal/ prosecution/ hands-off strategies	AV-1 to 4
Chaudhry & Walsh (1996); Harvey & Ronkainen (1985); Harvey (1988); Bush et al. (1989)	Provide financial incentives for channel members to reject counterfeits	AV-13
Chaudhry & Zimmerman (2005)	Emphasis on benefits of a genuine product	AS-1
Chaudhry & Zimmerman (2005)	Monitor & investigate channel members	AS-13
Chaudhry & Zimmerman (2005)	Educate employees about copycat	AS-18
Chaudhry & Zimmerman (2005)	Educate about local law enforcement agency	AS-22
Chaudhry & Zimmerman (2005)	Injunctions against counterfeit goods	AS-23
Chaudhry & Zimmerman (2005)	Lobbying for more stringent laws and their enforcement	AS-24
Chaudhry & Zimmerman (2005)	Lobby for strict penalties in the legal system	AS-34
Chaudhry & Zimmerman (2005)	Educate channel members about the counterfeiting phenomenon	AS-6
Chaudhry & Zimmerman (2005)	Provide warnings to distributes / retailers	AS-7
Chaudhry & Zimmerman (2005)	Financial incentives to reject counterfeits	AS-8
Chaudhry & Zimmerman (2005)	Solicit dealers' suggestions to develop tactics	AS-9
Chaudhry et al. (2009)	Register trademark and patents	AC-1
Chaudhry et al. (2009)	Financial incentives for distributers/retailers to reject counterfeits	AC-13
Chaudhry et al. (2009)	Warn distributors and retailers about possible penalties	AC-5
D'Amato & Papadimitiou (2013)	Develop a relationship with authorities to realize the issue of the product counterfeiting	R-15
DiMase et al. (2016)	Incentivise best practices used	I-3
Eisend & Schuchert-Guler (2006)	Lobbying is required to create awareness about product distribution	AP-2
Eser et al. (2015)	Forming alliances, networks	K-1
Eser et al. (2015)	Propose and adopt rules to protect legitimate business	K-2
Eser et al. (2015)	Raising awareness of end users	K-5
Ghadge, A. et al. (2021)	The campaign, publications about counterfeits risk	A-1
Heinonen & Wilson (2012)	To investigate company should provide training to confirm counterfeits' identification and inspection procedures	T-2
Heinonen & Wilson (2012)	Assess awareness /needs of local authorities	T-4
Heinonen & Wilson (2012)	Educate the public about product counterfeiting	T-5
Hoe et al. (2003)	Consumer awareness necessary to use original products	AU-1
Hoe et al. (2003)	Advertisement requires creating awareness	AU-2
Hoecht & Ttott (2014); Hung (2003); Shultz & Saporio (1996); Yoo & Lee (2009); Nakkash & Yoo (2009)	Educate stakeholders at the source	O-4
	Use aggressive advertising	O-5
Hussain et al. (2017)	Awareness campaign to educate customers against counterfeits	F-2
Hussain et al. (2017)	Awareness campaign to protect consumers from deception	F-3
Minagawa et al. (2007)	Reduce price of original product to reduce counterfeits' margin	AM-3
Minagawa et al. (2007)	Product imitation is difficult as a anti-counterfeiting strategy	AM-4
Minagawa et al. (2007)	Focus on R&D, as imitation does not carry R&D work	AM-5
Mura (2018)	Buying from authorised distributors and resellers with preliminary component screen check	AJ-3

Peterson (2012)	Focus on legislative power	V-1
Quoquab et al. (2017)	Use the education system to educate customers and organizations	G-1
Quoquab et al. (2017)	Conference, seminar, and public talks to address a counterfeit phenomenon	G-2
Staake & Fleisch (2008, 2012)	Large-scale product check	W-10
Staake & Fleisch (2008, 2012)	Educate suppliers, vendors, and purchase dept. to recognize counterfeits	W-32
Staake & Fleisch (2008, 2012)	Assess/select preventive measures	W-9
Staake et al. (2009)	Pay attention to drivers of the counterfeit market	AD-2
Staake et al. (2009)	Educate consumers to avoid deceptive buying	AD-3
Stevenson & Busby (2015)	Communication to deceive consumers	L-17
Stevenson & Busby (2015)	Brnad owners and customers should be watchful of counterfeiters misleading messages	L-20
Stevenson & Busby (2015)	Educate customers to recognize the genuine products	L-21/26
Stevenson & Busby (2015)	Educate consumers about channels that authenticate products	L-25
Stevenson & Busby (2015)	Looking for more counterfeits control/market institutions	L-29
Stevenson & Busby (2015)	Incentivize suppliers do not supply counterfeits	L-3
Stumpf & Chaudhry (2010)	Advertising about product safety, performance, counterfeit risks	AB-2
Stumpf & Chaudhry (2010)	Trade group development- advertising about safety, risk, performance	AB-3
Stumpf & Chaudhry (2010)	Media outlets educate the public about counterfeits' usage issues	AB-6
Wilcock & Boys (2014)	Provide training to employees and authorities to identify genuine products	Q-18
Yang & Fryxell (2009)	Consumer awareness and guidance-(pre-post buying situation)	AE-1
Yang & Fryxell (2009)	Advertising is important for strategic attention	AE-2
Yang & Fryxell (2009)	Advertise and promote product reliability	AE-3
Zhang & Zhang (2015)	Brand company own outlet and product authenticity/guaranty	M-1
Zhang & Zhang (2015)	Establish reliable distribution channel, B2B / C2C channels used	M-2
Zhang & Zhang (2015)	Brand company should be watchful of counterfeiters and dual channel	M-3

APPENDIX TABLE-2.2.7A-4: FOLLOW BEST INDUSTRY TECHNIQUES TO COUNTER COUNTERFEITING ACTIVITY (THEME-3)		
Contributions	**Dimensions**	**No.**
Berman & Swani (2010)	Improve product traceability	Z-6
Berman (2008)	Avoid wholesalers, who deal in counterfeits	AF-23
Berman(2008)	Employ the anti-counterfeiting strategy by marking and packaging	AF-12
Berman(2008)	Employ IP protection	AF-4
Berman(2008)	Use of product authentication technologies	AF-6
Bodner (2014, 2015)	Traceability of components through SC	J-4
Bodner (2014, 2015)	Obsolescence management and discourage re-engineering	J-7
Bosworth & Yang (2006)	Monitoring the need for intellectual rights (IP)	AN-1
Bosworth & Yang (2006)	Understanding culture and IP environment	AN-12
Bosworth & Yang (2006)	Familiar with the legal and administrative rules, enforcing corporate IP	AN-2
Bosworth & Yang (2006)	Internal management of IP (ownership, tax, information)	AN-3
Bosworth & Yang (2006)	Assessing the value of intellectual right (IP)	AN-4
Bosworth & Yang (2006)	Evaluating the intellectual right (IP) returns	AN-5
Bosworth & Yang (2006)	Monitor and legal action against counterfeits	AN-6
Bosworth & Yang (2006)	Consultation with legal experts	AN-7
Bosworth & Yang (2006)	Use authentication technologies	AN-9
Chaudhry & Walsh (1996); Harvey & Ronkainen (1985); Harvey (1988); Bush et al. (1989)	Add unique identifier for product identification	AV-12
Chaudhry & Zimmerman (2005)	Tracking RFID devices	AS-10
Chaudhry & Zimmerman (2005)	Provide lists of legitimate channel members	AS-2
Chaudhry & Zimmerman (2005)	The technology used to register trademarks and patents	AS-21
Chaudhry & Zimmerman (2005)	The technology used to assist tax authorities	AS-25
Chaudhry & Zimmerman (2005)	The technology used to conceptualize IP requirements	AS-26
Chaudhry & Zimmerman (2005)	IPR decisions affect market entry decision	AS-27
Chaudhry & Zimmerman (2005)	Action against retailers and manufacturers	AS-30
Chaudhry & Zimmerman (2005)	Destroying the production facilities of pirates	AS-31
Chaudhry & Zimmerman (2005)	Protecting the CEO with security guards	AS-32
Chaudhry & Zimmerman (2005)	Converting pirates into legitimate businesses	AS-33
Chaudhry et al. (2009)	Monitor and investigate retailers and distributors	AC-10
Chaudhry et al. (2009)	Obtain local police support	AC-6
Chaudhry et al. (2009)	Encouraging enforcement of existing laws	AC-7
Chaudhry et al. (2009)	Pursue injunctions against counterfeiters	AC-8
Chaudhry et al. (2009)	Monitor information sources for anti-counterfeiting developments	AC-9
Chen et al. (2018)	Marketers and policy makers communicate to consumers about the harmful effects of counterfeits' usage	D-2
D'Amato & Papadimitriou (2013)	Collaborate with local customs authorities	R-13
D'Amato & Papadimitriou (2013)	Legal remedies to deter IP rights	R-14
D'Amato & Papadimitriou (2013)	Sharing info with law enforcement agencies for investigation	R-16
D'Amato & Papadimitriou (2013)	Enhance market intelligence	R-2
D'Amato & Papadimitriou (2013)	Monitor sales of brands on the internet	R-3
D'Amato & Papadimitriou (2013)	Develop info material, explain consequences of using counterfeits	R-4
D'Amato & Papadimitriou (2013)	Verify product authenticity, use technology for protection	R-5
D'Amato & Papadimitriou (2013)	Consider using technology to ensure product security	R-6
D'Amato & Papadimitriou (2013)	RFID is used for track and trace purpose	R-7
DiMase et al. (2016)	Prioritize high-risk parts	I-1
DiMase et al. (2016)	Design and manage high SC resilience	I-5
Eisend & Schuchert-Guler (2006)	Sign posting against the illegibility of counterfeits at the border	AP-1
Eser et al. (2015)	Activate commodity sanction bodies	K-4
Ghadge, A. et al. (2021)	Common knowledge sharing platform among departments	A-3
Grenoble (2014)	Focus on counterfeit part intelligence	N-1
Grenoble (2014)	Information-based multi-layered approach	N-2

Grenoble (2014)	Identify trusted distribution parties	N-3
Grenoble (2014)	Authentication technology application used	N-4
Grenoble (2014)	Sharing information and reinforcement internal/external	N-6
Heinonen & Wilson (2012)	Review IPR legislation	T-1
Heinonen & Wilson (2012)	Inter-agency coordination	T-3
Hoecht & Trott (2014); Hung (2003); Shultz & Saporito (1996); Yoo & Lee (2009); Nakkash & Yoo (2009)	Internal & external locations / guanxi	O-10
	Legislation formation against offenders	O-1
	Co-opt offenders for their operations	O-3
	Investigation and surveillance	O-6
	High-tech labelling for products	O-7
	Market information (targets, coalitions, and withdrawals)	O-8/9/11
Kwok et al. (2008)	Use of RFID technology, data mining, intelligence systems	AH-1
Kwok et al. (2008)	Use RFID and data mining with an intelligence system	AH-2
Lehtonen et al. (2007)	Use product authentication technologies to support consumers	AL-1
Lehtonen et al. (2007)	Use product authentication technologies	AL-2
Li (2012)	Use of authentication (track / trace) technologies	U-1 to 3
Lybecker (2007, 2008)	Bring technology change in production/packing	AI-1
Lybecker (2007, 2008)	Use technology to make product replication difficult	AI-2
Machada et al. (2018)	Collaborate with partners in supply chains	E-2
Machado et al. (2018)	Traceability/visibility and predictability	E-1/7
Machado et al. (2018)	Redundancy, IP internal/external capability	E-4/6
Mura (2018)	Use deducting technologies, visual inspection, x-ray inspection, marking permanency test and specification test	AJ-1
Mura (2018)	Selective de-processing and technological characterization to check product quality	AJ-2
Peterson (2012)	Reforms applied for IPR laws	V-2
Sood et al.'s (2011)	Use External Visual Inspection	Y-2
Sood et al.'s (2011)	Use X-Ray and other NDI of parts	Y-3
Staake & Fleisch (2008, 2012)	Appoint NGO's and engage with authorities	W-21
Staake & Fleisch (2008, 2012)	Engage government to assist in counterfeit issues	W-22
Staake & Fleisch (2008, 2012)	Engage industry groups to assist in counterfeit issues	W-23
Staake & Fleisch (2008, 2012)	Use protection technologies	W-24
Staake & Fleisch (2008, 2012)	Conduct a risk analysis and assess the monetary loss	W-5
Staake & Fleisch (2008, 2012)	Analyse industry best practice strategies for anti-counterfeiting	W-6
Staake & Fleisch (2008, 2012)	Monitor implementation and reaction process	W-8
Staake & Fleisch (2008, 2012)	Implement defined monitoring and reaction processes	W-8
Staake et al. (2005)	RFID, cryptography used to get product authentication	AT-1
Staake et al. (2005)	EPC used to track and trace product	AT-2
Staake eta al. (2009)	Companies protect their brands from IPR infringements	AD-4
Stevenson & Busby (2015)	Product activation requirements to introduce	L-14
Stevenson & Busby (2015)	Avoid the regular introduction of the new products	L-15
Stevenson & Busby (2015)	Sharing intelligence with customs and trading authorities	L-16
Stevenson & Busby (2015)	Make chemical marks to discourage counterfeits	L-18
Stevenson & Busby (2015)	Sharing intelligence with custom and trading authorities	L-19
Stevenson & Busby (2015)	Developing distinctive and hard-to-imitate packaging	L-27
Stevenson & Busby (2015)	Change packaging to make imitating difficult	L-28
Stumpf & Chaudhry (2010)	International discourse on countering the problem	AB-4
Stumpf & Chaudhry (2010)	Used product authentication technologies with usage	AB-5
Sullivan et al. (2017)	Analyse data on counterfeit's infiltration	H-2
Tang (2006)	RFID tags used to find misplacement & transaction errors	AR-5
Ting & Tsang (2014)	Develop an understanding of data visualization, logistics flow	P-1
Ting & Tsang (2014)	Authenticate technologies used	P-2
Ting & Tsang (2014)	Examine SC parties' systematic role in technology	P-3
Wilcock & Boys (2014)	Use a centralized distribution network for product identification	Q-10
Wilcock & Boys (2014)	Inquiries/complaints handled with centralized distribution n/w	Q-13

Wilcock & Boys (2014)	IP rights for businesses/technologies used to protect IP	Q-16
Wilcock & Boys (2014)	Provide training to identify counterfeits	Q-17
Wilcock & Boys (2014)	Traceability in SC	Q-20
Wilcock & Boys (2014)	Remain vigilant and continually enhance the technologies and processes used to protect IP	Q-24
Wilcock & Boys (2014)	Relationship with law enforcement agencies and authorities	Q-3
Wilcock & Boys (2014)	IP in business practices, policies to restrict the employee to use counterfeits	Q-4
Wilcock & Boys (2014)	Provide training to the employees to identify fake and get reward	Q-5
Wilcock & Boys (2014)	Whistle blower reporting mechanism for protection	Q-6
Wilcock & Boys (2014)	Use of technologies in decision making	Q-8
Wilcock & Boys (2014)	FDI in law-abiding countries	Q-9
Zhang & Zhang (2015)	Alter characterization of parts to discourage imitation	M-1
Zimmerman (2014)	IP protection strategy	S-1
Zimmerman (2014)	Registration of copyrights, trademarks, and patents	S-3

APPENDIX TABLE-2.2.7A-5: FORMULATE SUPPORT PROGRAM TO COUNTER COUNTERFEITING ACTIVITIES (THEME #4)		
Contributions	**Dimensions**	**No.**
Amine & Magnusson (2007)	Find a source of supply opportunist and report	AK-2
Amine & Magnusson (2007)	Campaign to vulnerable	AK-3
Amine & Magnusson (2007)	Identify the threat and provide support to control	AK-4
Berman & Swani (2010)	Securing greater control over raw material sourcing	Z-2
Berman & Swani (2010)	Conducting continuous product testing by multiple parties	Z-4
Berman & Swani (2010)	Being especially vigilant for counterfeits	Z-5
Berman (2008)	Employ private investigators	AF-1
Berman (2008)	Ensure the return of all intellectual information from outsources	AF-15
Berman (2008)	Website removed & monitored that involved in counterfeits sale	AF-19/20
Berman (2008)	Establish fake companies to buy counterfeits	AF-2
Berman (2008)	Take legal action against counterfeits	AF-21
Berman (2008)	Reduce grey market activity after holding payment	AF-22
Berman (2008)	Suppliers to return all items for disposals	AF-24
Berman (2008)	Report any illicit activities	AF-25
Bodner (2014, 2015)	Product protection program	J-5
Bosworth & Yang (2006)	Licensing management and commercialization	AN-10
Bosworth & Yang (2006)	Establish an anti-counterfeiting network with firms	AN-11
Bosworth & Yang (2006)	Pricing and quality control	AN-8
CACP & Accenture (2006)	Secure legitimate inputs	AO-1
CACP & Accenture (2006)	Verify the legitimacy of consumers/distributors	AO-2
CACP & Accenture (2006)	Managing production site, inventory demand	AO-3
CACP & Accenture (2006)	Ensure the legitimacy of purchased products at a retail level	AO-4
CACP & Accenture (2006)	Monitor brand integrity	AO-5
Chaudhry & Walsh (1996); Harvey & Ronkainen (1985); Harvey (1988); Bush et al.'s (1989)	Lobby for stronger anti-counterfeiting laws	AV-10
	Encourage enforcement of laws	AV-11
	Inform the public and trade about risks	AV-14
	Action oriented approach	AV-6
	Assertion approach"	AV-7
	Participate in International Anti-Counterfeiting Coalition (lACC)	AV-8
	Pursue litigation	AV-9
Chaudhry & Zimmerman (2005)	Establish an internal enforcement team	AS-11
Chaudhry & Zimmerman (2005)	Use surveillance programs in retail outlets	AS-12
Chaudhry & Zimmerman (2005)	Aggressively cut prices	AS-15
Chaudhry & Zimmerman (2005)	Use covert actions	AS-16
Chaudhry & Zimmerman (2005)	Develop supplier quality assurance program	AS-17
Chaudhry & Zimmerman (2005)	Follow acquisition/joint venture strategy	AS-19
Chaudhry & Zimmerman (2005)	Maintain a list of channel members, warranties, offer site licenses, reduced price products	AS-2 to 5
Chaudhry & Zimmerman (2005)	Establish factories in lower-cost countries	AS-20
Chaudhry & Zimmerman (2005)	Anti-counterfeiting strategies are frequently used	AS-28
Chaudhry & Zimmerman (2005)	Effective control techniques apply in host markets	AS-29
Chaudhry & Zimmerman (2005)	Obtaining local policy support for operations	AS-35
Chaudhry & Zimmerman (2005)	Secure governments support	AS-36
Chaudhry & Zimmerman (2005)	Formulate surveillance team	AS-37
Chaudhry & Zimmerman (2005)	Monitor program to direct information of any incident of infringements to DB	S-4
Chaudhry & Zimmerman (2005)	Develop a full information plan for all stakeholders	S-5
Chaudhry & Zimmerman (2005)	Take action and request all stakeholders to cooperate	S-6
Chaudhry & Zimmerman (2005)	Develop a report on the evaluation and feedback system	S-7
Chaudhry et al.'s (2009)	Acquisitions / Joint venture with counterfeiter	AC-11
Chaudhry et al.'s (2009)	Aggressively cut prices	AC-12
Chaudhry et al.'s (2009)	Establish factories in lower-cost countries	AC-13
Chaudhry et al.'s (2009)	Solicit retailers/distributor suggestions for anti-counterfeiting tactics	AC-14
Chaudhry et al.'s (2009)	Implement a surveillance program to check products in stores	AC-15

Chen et al.'s (2018)	Tighten their laws and regulations against counterfeiting	D-3
Cooper & Eckstein (2008)	Monitor SC distribution chain, investigate leads	AG-1/3
Cooper & Eckstein (2008)	Monitor Distribution Chain"	AG-2
Cooper & Eckstein (2008)	Enhance relations with authorities, good record keeping	AG-4/5
Cooper & Eckstein (2008)	Update Packaging"	AG-6
Cooper & Eckstein (2008)	Formulate a crisis management plan	AG-7
Cooper & Eckstein (2008)	Prepare to litigate	AG-8
D'Amato & Papadimitriou (2013)	Utilize risk management procedures to verify legitimate sale	R-1
D'Amato & Papadimitriou (2013)	Ensure disposal program	R-10
D'Amato & Papadimitriou (2013)	Partner with retailers (certified retailers programs)	R-12
D'Amato & Papadimitriou (2013)	Ensure the authenticity of material/components	R-8
Eser et al. (2015)	Contact law enforcement agencies	K-3
Ghadge, A. et al. (2021)	Improved communication, and collaboration among departments	A-2
Ghadge, A. et al.'s (2021)	Evaluation of market & commodity options assessment with high level specification	A-5
Grenoble (2014)	Achieving internal re-enforcement through organisation-wide culture and policies	N-7
Hoecht & Trott (2014); Hung (2003); Shultz & Saporito (1996); Yoo & Lee (2009); Nakkash & Yoo (2009)	Do nothing	O-2
Lybecker (2007, 2008)	Cooperation in reducing the cost of distribution	AI-3
Lybecker (2007, 2008)	Cooperation with agencies to detect fake items and prosecution	AI-4
Minagawa et al. (2007)	Find cheap distributer/mfg sites for suspected imitation	AM-2
Nunes & Donnelly (2010)	Product protection from counterfeits, deduct fakes, purchase original product, discourage counterfeits	AA-1 to 4
Peterson (2012)	Maintain long-term business relationships to protect IP	V-3/4
Reynolds (2011)	Learn the business to find vulnerabilities	X-1
Reynolds (2011)	Find weak entry points, and conditional responses to measure input	X-2 to 4
Reynolds (2011)	Measuring impact and positive benefit to the company	X-5
Santos & Ribeiro (2006)	Firms must be enrolled in global cooperation [(INTA), (IACC), (GBLAAC), (IFPI), and (BSA)] to inform governments about major problems of intellectual property theft.	AO-2
Santos & Ribeiro (2006)	Brand owners need to have its own intellectual property protection in place. After that, developing anti-counterfeiting tactics can be an effective way of preventing or reducing trademark counterfeiting.	AO-3
Santos & Ribeiro (2006)	Many brand owners should place forensic features to products or packaging as a means of authentication	AO-4
Sood et al.'s (2011)	Use Material evaluation and characterization	Y-4
Sood et al.'s (2011)	"Use X-Ray and other NDI of parts"	Y-5
Sood et al.'s (2011)	"Use Material evaluation and characterization"	Y-6
Sood et al.'s (2011)	Inspections need to be accomplished in short time to be effective	Y-7
Soon & Manning (2019)	Communication related to anti-counterfeiting measures (ACMs)	C-1
Soon & Manning (2019)	Communicate ACM to distributors, retailers, consumers, and the management system	C-1 to 6
Soon & Manning (2019)	Distribution related to ACMs	C-2
Soon & Manning (2019)	Price related to ACMs	C-3
Soon & Manning (2019)	Product related to ACMs	C-4
Soon & Manning (2019)	Social value related to ACMs	C-5
Soon & Manning (2019)	Management systems related to ACMs	C-6
Staake & Fleisch (2008, 2012)	Determine the market share of counterfeits	W-1
Staake & Fleisch (2008, 2012)	Signal top-management support"	W-11
Staake & Fleisch (2008, 2012)	Develop knowledge of SC activities, trading quality products, and counterfeits, buyers of counterfeits	W-12 to 15
Staake & Fleisch (2008, 2012)	Have defined processes to govern response to counterfeits"	W-17
Staake & Fleisch (2008, 2012)	Develop process to monitor counterfeits	W-18

Staake & Fleisch (2008, 2012)	Investigate characteristics of counterfeits	W-2
Staake & Fleisch (2008, 2012)	Establish key indicators to assess anti-counterfeiting measures	W-20
Staake & Fleisch (2008, 2012)	Website identify counterfeits	W-25
Staake & Fleisch (2008, 2012)	SC security measures, secure distribution system, enhance knowledge, meet authorities	W-26 to 31
Staake & Fleisch (2008, 2012)	Use standardized processes, monitoring and analysis of counterfeits	W-33
Staake & Fleisch (2008, 2012)	Assess and select preventative measures"	W-9
Staake et al. (2009)	Look for infiltration possibilities in licit SC	AD-1
Stevenson & Busby (2015)	Disposal management system and destruction process obsolete items	L-1/2
Stevenson & Busby (2015)	Information and negotiating with logistics providers (alerting them to specific cues, e.g.., divided consignments) and bulk buying accessory distribution	L-22
Stevenson & Busby (2015)	In-sourcing the production of particularly critical materials"	L-4
Stevenson & Busby (2015)	the potential for "leakage" in the supplier selection process"	L-5
Stevenson & Busby (2015)	Maintain production line strategically	L-6
Stevenson & Busby (2015)	Undermining physical functions and appearance, e.g. after a certain shelf life"	L-7
Stumpf & Chaudhry (2010)	Employ anti-counterfeiting marking and packaging	AB-1
Stumpf & Chaudhry (2010)	Off-site licenses, emphasize warranties, benefits, list of authorized sellers	AB-10 to 13
Stumpf & Chaudhry (2010)	Stress harmful effects of counterfeits	AB-14
Stumpf & Chaudhry (2010)	Work with global partners	AB-7
Stumpf & Chaudhry (2010)	Banks to immobilize the flow of fund	AB-8
Stumpf & Chaudhry (2010)	Reduce price rebate	AB-9
Tang (2006)	Supply alliance network to reduce lead time	AR-2
Tang (2006)	Lead time reduction.	AR-3
Tang (2006)	Recovery planning system	AR-4
Wilcock & Boys (2014)	Contact made with authorities of association	Q-1
Wilcock & Boys (2014)	Joint anti-counterfeiting action plan with key strategic partners	Q-11
Wilcock & Boys (2014)	Complaint about original product found fake after	Q-14
Wilcock & Boys (2014)	Formulate plans to address media issues and customer complaints	Q-15
Wilcock & Boys (2014)	Develop loss preventive program, show audit program	Q-21
Wilcock & Boys (2014)	Develop supplier audit program	Q-22
Wilcock & Boys (2014)	Develop product disposal program	Q-23
Wilcock & Boys (2014)	Track effectiveness of counterfeiting program to control counterfeiting	Q-25
Wilcock & Boys (2014)	Bring improvement in product/services features	Q-26
Wilcock & Boys (2014)	For product development and product evolution program (use anti-counterfeiting technologies and security)	Q-7
Yang & Fryxell (2009)	Brand protection strategy	AE-4
Zimmerman (2014)	Establish a brand integrity team	S-2

APPENDIX TABLE-B: INTEGRATING ANTI-COUNTERFEITING STRATEGIES AS THEMES

A) CONTRACTUAL BINDING WITH PARTNERS (THEME-1)		
A-4, B-1, D-1, D-2, E-3, E-8, Q-12, R-9	Strategies to prohibit counterfeit products, introduce strict liability concept, return outsourced technology and product, ensure the authenticity of material and components, vigilant to control supply chain risk, lean management, and sharing information with suppliers, dealers, and retailers.	Preparation of early steps of checking required. Possibilities of reverse engineering / obsolete items to be checked.
F-1, H-1, J-3, L-8/9, I-4	A supplier should consider product/service features that are difficult to replicate and/or easy to distinguish from those of non-legitimate producers during product development/ improvement.	Processes are designed to follow ISO-supported Q.M standards for standardized reporting
J-1/2, AF-16 to 18, Y-1	Cooperation across the supply chain, Supplier qualification, Supplier penalties for counterfeits and pass-through, Making product replication difficult and costly	Relationship stability and supplier's commitment to quality
K-6, L-23/24, I-2	Destruction process for obsolete products and components	Supplier certification and conformance to quality
L-12/13, R-11, AF-13/14, Z-3, J-6	Follow standards for inspection and acceptance	Formation of supplier's selection and performance evaluation criteria
B) CAMPAIGN AGAINST PRODUCT COUNTERFEITING (THEME-2)		
L-17, L-20/21, L-25/26, O-4, T-5, W-32, AB-6, AF-7, AF-11, AK-1, AS-1/6, AS-18, AS-22, AU-1 & 2, AV-5, AD-3, K-5, AC-3/4/14, Q-2/18, T-2	Educate stakeholders regarding the product counterfeit phenomenon and serious issues related to it, especially employees, authorities, law enforcement agencies, and others	Develop customers' ethical buying behaviour
A-1, G-1/2, F-2/3, K-1/2, O-5, AE-1, AS-23/24, AS-34, R-15, L-29, M-1 to 3, AP-2	Dealing with market institutions and industry groups by Lobbying for more rigorous counterfeit controls	Campaign with lobbying and advertisement to address the product counterfeiting issue
J-8, L-3, AS-7 to 9, AS-13, I-3, AV-1 to 4, L-11, AV-13, AC-1/5/13	Warn distributors and retailers about possible penalties for using counterfeits. Give financial incentives to channel members for rejecting counterfeits	Campaign announces incentives for cooperative suppliers and distributors to counter counterfeiting
T-4, AB-2 to 3, AD-2, AE-2 & 3,	Advertising about the product safety, performance, and financial risks associated with counterfeits	Create awareness regarding the adverse impact of counterfeits on health and safety
V-1, W-9/10, AF-3, AF-8 to 10, AJ-3, AM-3 to 5	Discourage product counterfeiting to increase the business and legal risks and make counterfeiting / Imitation costly	Information sharing among partners to support anti-counterfeiting activities
C) FOLLOW BEST INDUSTRY TECHNIQUES TO COUNTER COUNTERFEITING ACTIVITIES (THEME-3)		
E-4/6, N-1 to 6, O-8 to 11, Q-4, Q-9, Q-16, Q-24, R-14, S-1, S-3, T-1, V-2, AD-4, AF-4, AI-1 & 2, AS-21, AS-25 to 27, AN-1 to 5, AN-12	Strategic contribution to protect IP and implement best industry-specific strategies to curb the product counterfeiting phenomenon	Product and package inspection with technical evaluation as per standard
P-1 to 3, Q-5, Q-17, R-4, AH-1 & 2, Q-8, H-2, AJ-1	Develop training material to introduce new techniques to apply technology to protect products.	Data mining and visualization techniques are used to gain market knowledge. Training given.
A-3, L-16, R-2/3/13/16, T-3, Q-3/6, AF-23, AR-1, AM-1, W- 1 to 4, O-9, E-2, D-2	Dealing with Customs and law enforcement agencies with the use of technologies by rigorous counterfeit controls, e.g.; Products attributes and Packaging	Collaboration and coordination among all stakeholders to formulate anti-counterfeiting strategies

AL-1 & 2, AN-9, AR-5, AS-10, Q-20, R-5 to 7, U-1 to 3, Z-6, AF-6, AB-4/5, AT-1 & 2, J-4, E-1/7, AV-12, L-18, W-24, Y-2/3, AJ-2	Knowledge about counterfeiting activities-monitoring techniques	Knowledge about using protection technologies to track and trace items (product authentication technologies)
O-1/3/6/7, AP-1, AN-6 & 7, L-14/15/19, AC-6/7/8,	Sharing intelligence about product counterfeiting activities with authorities and law enforcement agencies	Use data protection techniques to support brand protection strategies with law enforcement agencies
I-1/5, Q-10, Q-13, L-27/28, J-7, W-5/6, AF-12, W-21/22/23, AC-9/10, AS-30 to 33, K-4, W-8	Develop a centralized distribution network to assess risks	Apply supply chain risk assessment technique to seek process reliability
D) FORMULATE A SUPPORT PROGRAM TO COUNTER COUNTERFEITING ACTIVITIES (THEME-4)		
Q-14, AO-5, Q-15, S-7	Program/process of investigation to address complaints	Follow feedback mechanism to improve processes
Q-11, V-3/4, AM-2, AS-19/20, AI-3, AQ-2/3/4, AC-11/12	Acquisitions, collaborations, and joint venture programs to control counterfeiting	A program to facilitate acquisitions or form joint ventures to reduce counterfeiting activities
AD-1, AR-4, W-11 to 20, AB-10 to 14, AS-28/29, AC-15, W-1/2/9, N-7	Program to develop internal resources and invest in protective countries	Program to develop internal resources and invest in protective countries
Q-26, AO-3, AB-1/9, Z-2	Alter product characteristics to control counterfeiting	The product specification is maintained along-with product characteristics
Q-21, AN-10, AF-24/25	Loss prevention and audit programs to see the compliance level of activities	Loss prevention and audit programs help take back the design documents of the product
Q-23, R-10, L-1/2/6/7	Product disposal program to control counterfeiting activities	Monitor disposal activities regarding rejected, spoiled, and disposed of items
Q-22, R-8, AR-2/3, Q-7	Supplier audit program to ensure quality supply	A program that focuses to improve the quality of the processes
W-26 to 31, AK-2 to 4, AG-7, AO-1/2, AS-35/36	Formulate a crisis management program	Formulate crisis management plan and surveillance program
AG-1 to 6, Q-25, S-4 to 6, AE-4, AF-1/2, AV-6 to 8, X-1 to 5, Q-1, D-1	Joint-anti-counterfeiting action plan	Program development to influence the government to formulate legislation against counterfeiting (as a joint plan)
AN-11, AS-11/37, AC-17, W-7, S-2	Formulate a surveillance team to track counterfeiting activities	Formulate a surveillance team to track counterfeiting activities
R-1, Z-5, AS-2 to 5, AV-14, AB-7/8, J-5, A-5, L-22, L-4/5, AF-22,	Develop a risk management plan to control counterfeiting	Program protection plans to focus on parts / sub-assemblies of sub-systems are critical to the mission
W-33, Y-4 to 7, Z-4, AN-8, AS-15 to 17, AA-1 to 4, AF-15,	Quality assurance program to maintain specified standards	Monitor SC activities periodically and issue warnings to distributors, suppliers, and agents
W-25, AV-9 to 11, AI-4, AG-8, AF-19/20, K-3, AF-21	Legal action to control counterfeiting activities	Use law enforcement agencies to provide legal cover to a product
R-12, AO-4, AS-12, AC-16, Q-19, C-1 to 6	Certified retailer program and incentivize pricing	Certified retailer program to protect partners and products
O-2, A-2	Activity if benefits (Do nothing)	Activities as per cost-benefit analysis

Appendix Table-(S-1): List of Scholarly contributions emphasises on the SCQM with interaction among the QM and SCM practices to examine the effect of SCQM environment (during 1997 and 2021)

AUTHOR NAME	DESCRIPTION	DIMENSIONS	CITED / PUBLISHED / JOURNAL	KEY TERMS
Chau et al.'s (2021)	Investigation of critical success factors for improving SCQM in manufacturing. This study identified five critical success factors for improving SCQQM under the context of Industry 4.0. these factors are customer focus, quality of information technology systems, collaboration among SC members, process integration, leadership, supplier quality management. Customer focus and supplier quality management has the most and least significant effect on improving SCQM.	SCQM, Industry 4.0 context, customer focus, quality of information technology systems, collaboration among SC members, process integration, leadership, supplier quality management	5 / Taylor & Frances / Enterprise Information Systems	SCQM, Industry 4.0
Peng et al.'s (2020)	Integration of SCM and QM within a quality focused organisational framework. The study discusses that integration is possible within the context of a quality focused organisational (MBNQA) framework. The study outcome shows that SCM stands as a major organisational construct with direct results on organisation performance. The result also shows that SCM acts as a mediator for leadership & measurement analysis and knowledge- management, which influences organisational performance.	Integration of SCM and QM practices, organisational framework MBNQA,	20 / Taylor & Frances / Int'l journal of Production Research	SCM, QM, SCQM
Kaur et al.'s (2019)	Synergetic success factors of TQM and SCM. The study identifies the relationships among TQM and SCM practices in order to explore the concept of SCQM. The study mentioned six critical success factors [management support, commitment, customer focus, information, supplier relationship] when integrate shows strong organisation performance.	Integration of practices (TQM, SCM)	31 / Emerald / Int'l Journal of Quality & Reliability Management	TQM, SCM, SCQM
Parast (2019)	A learning perspective of SCQM: empirical evidences from U.S SCs. This study focus is to establish the importance of trust in predicting SCQ practices and SCQ performance outcomes. Study proposes a model and work for to support the reliability and validity of that model. The outcome shows that "impact of trust" on "process improvement" is mediated by "information sharing" and "inter-firm trust". The "information sharing", "inter-firm trust", and "process improvement" are significant predictors of SC performance. A) Scope of QM practices at firm's level [top management support, information systems, employee involvement, process improvement, product service design, customer satisfaction]. B) Scope of network / Sc level [Trust, Governance, information integration, cooperative learning]	SCQM, scope of QM practices at firm's level, Scope of Network / SC level	15 / Emerald / Supply Chain Management: An International Journal	SCQM
Bastas & Liyanage (2018)	Sustainable SCQM: A systematic review. This study introduces the concept of sustainable SCQM (quality, SC and Sustainability management practices). The study discusses the evolution of SCQM (Fig-13).	SSCQM, QM practices	158 / Elsevier / Journal of Cleaner Production	SSQM
Fernandes et al.'s (2017)	Supply chain management and quality management integration: A conceptual model proposal	QM and SCM integration	124 / Emerald / Int'l Journal of Quality & Reliability Management	QC, SCM

Gu et al.'s (2017)	Management Practice of Supply Chain Quality Management (SCQM) in Service-oriented Manufacturing Industry	SCQM in Mfg.	15 / Matec-conference / Matec Web of conference	SCQM
Azizi et al.'s (2016)	The impact of knowledge management practices on SCQM and competitive advantage. This study emphasises that the knowledge management practices has a positive and significant effect on SCQM and competitive advantage. SCQM dimensions [customer focus, SQM, SCM leadership, SCQ strategies, process approach, SC information system, HR development,	SCQM, competitive advantage, knowledge management	40 / Mper / Management and Production Engineering review	SCQM practices, (information, process)
Quang et al.'s (2016)	An extensive structural model of SCQM and firm performance. This study relates the SCQM practices with firm performance [operational, customer satisfaction, financial] with four dimensions: 1) upstream [supplier assessment, SQM]; 2) downstream [customer focus]; 3) internal process [product / service design, process management, logistics]; 4) support practices [top management support, HRM, information and SCM integration].	SCQM practices, firm performance, Internal processes, Support practices	101 / Emerald / Int'l Journal of Quality & Reliability Management	SCQM practices, (information, process)
Sarrico & Rosa (2016)	Supply chain quality management in education	SCQM	30 / Emerald / Journal of Quality & Reliability Management	SCQM
Zhong et al.'s (2016)	SCQM: an empirical study. This study emphasises on the supply chain quality (SCQ) with interaction among the QM and SCM practices to examine the effect on the causal relationship among contextual variables.	Practices (SCQM, QM, SCM), SCQ management in the hospital industry	40 / Emerald / Int'l Journal of Contemporary Hospitality Management	
Sharma & Modgil (2015)	Supply chain and total quality management framework design for business performance-case study evidence	SC, TQM, business performance	30 / Emerald / Journal of Enterprise Information Management	SC, TQM
Sheikhy & Hamzei e (2015)	The relationship between total quality management and supply chain development of automotive companies listed in Tehran stock exchange	TQM, SC development	5 / AENSI / Advances in Environmental Biology	TQM and SC
Chen et al.'s (2013)	Quality control in food supply chain management: An analytical model and case study of the adulterated milk incident in China	QC, SCM	148 / Elsevier / Int'l Journal of Production Economics	QC, SCM
Fernand es et al.'s (2014)	Literature review of QM and SCM: A perspective of integration. QM considered as important strategic management tool, which involves the application of principles and practices of quality at all levels of the organisation (Talib et al.'s 2011). Robinson & Malhotra (2005) study suggested that SCQM is the formal coordination and integration of business processes involving all partners in the SC to measure, analyse and continually improve product, services and processes in order to create-value and achieve satisfaction of intermediate and final customers in the market place.	SCQM is the formal coordination and integration of business processes, QM as a strategic management tool	12 / online / International Conference on Quality Engineering and Management (ICQEM	
Chadha & Gagand eep (2013)	Empowering Quality Management Systems Through Supply Chain Management Integration: A Survey of Select Hospitals in Chandigarh, Mohali and Panchkula	QMS, SCM	20 / EBSCOhost / IUP Journal of Supply Chain Management	QMS, SCM

Jraisat & Sawalha (2013)	Quality control and supply chain management: a contextual perspective and a case study	QC, SCM	65 / Emerald / Supply Chain Management: An Int'l Journal of Research	QC, SCM
Lin et al.'s (2013)	Identifying critical enablers and pathways to high performance supply chain quality management	SCQM	90 / Emerald / Int'l Journal of operations and Production Management	SCQM
Mellat-Parast (2013)	Supply Chain Quality Management: An Inter-organisational learning perspective. The study findings suggest that the QM facilitates cooperative learning and improves inter-organisational learning processes. It enhances SC satisfaction and performance. The study provides theoretical evidence in relation to QM practices within a SC environment from an inter-organisational perspective. It extends quality to SC concept through focusing on key QM practices that influence the quality of SC relationships. SC quality practices [Trust, governance, information integration, process integration, cooperative learning]; SC QM practices [Buyers-suppliers satisfaction & performance]; Firm's level quality practices [top management support, information systems, employee involvement, process improvement, product / service design, customer satisfaction].	cooperative learning improves inter-organisational learning processes, SC quality practices, SC QM practices; Firm's level quality practices conceptualization of buyer-supplier quality practices is the first step to develop SC level quality practices that enable both buyer-supplier to improve quality practices.	101 / Emerald / Int'l Journal of Quality and Reliability Management	SCQM, QM practices
Zeng et al.'s (2013)	SCQM practices and performance: An empirical study. the study mentioned three dimensions of SCQM: 1) Internal QM; 2) interaction for quality with suppliers on the upstream side of SC (Upstream QM); 3) interaction for quality with customers (downstream QM). The study result shows the dominant role of QM in SCQM, which has a positive impact on the other SCQM dimensions.	SCQM practices, SCQM performance, up and down stream QM	70 / Springer / Operations Management Research	SCQM practices
Mahdiraji et al.'s (2012)	Supply chain quality management	SCM	25 / Growing Science / Management Science Letters	SCM
Sharma et al.'s (2012)	Quality Management in Supply Chains: The Literature Review	QM in SC	45 / Research Gate / Int'l Journal of Quality Research	QM, SC
Siddiqui et al.'s (2012)	The Impact of Supply Chain Management Practices in Total Quality Management Practices and Flexible System Practices Context: An Empirical Study in Oil and Gas Industry.	TQM and SCM practices	25 / Springer / Global Journal of Flexible Systems Management	TQM, SCM
Foster Jr. et al.'s (2011)	Towards an understanding of SCQM. The study discusses important company processes, certified by the ISO standardized processes, and managers are advised to collaborate in making supplier development programs and complaint resolutions.	SCQM practices, collaborate approach to supplier development programs and complaint resolutions	110 / Taylor & Frances / Int'l journal of Production Research	SCQM, ISO standards
Kuei et al.'s (2011)	Developing global SCQM systems. The study discusses global SCQM framework as extension of the traditional SC operations and QM. Study discusses four SCQM themes: six sigma; international standards; SCM; global leadership and HRM, as a global SCQM strategy.	global SCQM, SCQ, systems; six sigma; ISO standards; SCM; global leadership and HRM	113 / Taylor & Frances / Int'l journal of Production Research	global SCQM, SCQ

Talib et al.'s (2011)	A study of total quality management and supply chain management practices	TQM, SCM practices	231 / Emerald /Int'l Journal of Productivity and Performance Management	TQM, SCM
Terziovski & Hermel (2011)	The Role of Quality Management Practice in the Performance of Integrated Supply Chains: A Multiple Cross-Case Analysis	QM practices in SC	57 / ProQuest / Quality Management Journal	QM, SCM
Vanichchinchai & Igel (2011)	The impact of total quality management on supply chain management and firm's supply performance	TQM, SCM, FSP	224 / Taylor & Francis / Int'l Journal of Production Res.	TQM, SCM, FSP
Xu, Li Da (2011)	Information architecture for supply chain quality management. This study discusses the importance of service-oriented architecture (RFID, IoT key technologies) as enabler for real-time QM and control in the supply chain. Technology help allow real time collaborative SCM, SC integration, SCQM. The goal of SCQM is to develop extended enterprise cooperative systems capable of promoting cooperation between component enterprises in SCQM.	Automated SCQM, cooperation among component enterprises in SCQM, extended enterprises cooperative systems	352 / Taylor & Frances / Int'l journal of Production Research	real time collaborative SCM, SC integration, SCQM
Azar et al.'s (2010)	Relationship between supply chain quality management practices and their effects on organisational performance	SCQM practices, organisational performance	69 / Gala Academic online / Singapore Institute of Management	SCQM practices
Grubic et al.'s (2010)	Towards integrative SC model. The study emphasises that there are some generic set of SC processes, which support material & information flows in a dyadic relationship. Two SC processes framework, a) SC operation reference; b) Global SC forum, with nine evaluation criteria.	SC operation reference, Global SC forum,	20 / Taylor & Frances / Int'l journal of logistics: research and applications	integrative SC model
Jiang et al.'s (2010)	Research on Quality Management System for Supply Chain Based-Customer Satisfaction	QMS, SC	5 / IEEE / conference of Logistics Systems and Intelligent Management	QM, SCS
Talib et al.'s (2010)	Integrating Total Quality Management and Supply Chain Management: Similarities and Benefits	TQM and SCM similarities	56 / online / Journal of Information Technology and Economic Development	TQM, SCM
Carmignani (2009)	Supply chain and quality management: The definition of a standard to implement a process management system in a supply chain	SCQM, process management system in a SC	55 / Emerald / Business Process Management Journal	SCQM, SCM
Lou et al.'s (2009)	Production-Outsourcing Supply Chain Quality Management Based on Multi-Agent System	SCQM, Multi-agent	5 / IEEE /	SCQM
Shalij et al.'s (2009)	Design of ISO 9001:2000 based Supply Chain Quality Management Systems	ISO, SCQM	20 / Inder science ./ Int'l Journal of Process Management & Benchmarking	ISO, SCQM
Vanichchinchai & Igel (2009)	Total quality management and supply chain management: similarities and differences	TQM, SCM similarities	178 / Emerald / The TQM Journal	TQM, SCM
Fabbe & Jahre (2008)	Supply chain integration and performance: A review of evidences. The study explains the importance of SC integration in relation to	Supply chain integration, trade-off	502 / Emerald / Int'l Journal of	SCM, SCI

	firm's performance. It is possible to differentiate SCI in relations to layers, scope and degree. The possible trade-off between integration and flexibility to a certain extent requires a suitable approach (modularization + standardisation) in terms of plug-in and plug-out situations.	between integration and flexibility	Logistics Management	
Foster & Ogden (2008)	On differences in how operations and supply chain managers approach quality management	QM, SCM	85 / Taylor & Francis / Int'l Journal of Production Research	QC, SCM
Foster Jr. (2008)	Towards an understanding of SCQM. The study provide information about the importance of QM practices in SCM and effects to operationalized SCQM. Seven themes presented: customer focus, quality practices, supplier relations, leadership, HR practices, business results, and safety.	SCQM, QM practices, SCM, customer focus, quality practices, supplier relations, leadership, HR practices, business results, and safety	386 / Elsevier / Journal of Operations Management	SCQM, QM practices, SCM
Kaynak & Hartley (2008)	A replication and extension of QM in SC. The study sees the SC practices as of duel nature (internal and external) which connect everyone in the SC operations. The SQM and Customer focus are two QM practices clearly lies within SCM. QM practices (Management leadership, training, employee relations, customer focus, quality data & reporting, SQM, product / service design, process management). This study is the continuation of Kaynak (2003) contribution towards the development of SCQM theory (include SQM + customer focus in QM model) to improve quality performance after integrating SC members. The study confirms that eight QM practices and firm's performance are stable across study outcome.	Extension of QM in SC lead to SCQM theory, QM practices,	595/ Elsevier / Journal of operations management	QM, SQM, SCM
Kuei et al.'s (2008)	Implementing SCQM. This study helps the researchers to make effective and efficient SCQM plans. As SCQM is the outcome of the strategic framework developed with the help of the SCQ practices / activities / programs. The drivers of SCQ is SC competence, critical success factors, and strategic components.	SCQM, SCQ practices / activities / programs	138 / Taylor & Frances / Total Quality Management	SCQM
Peck (2006)	Reconciling SC vulnerability, risk and SCM. The study argues that attitudes to risk and approaches to risk management vary greatly within SCM disciplines. The SCM is an integrative, cross-functional discipline, so it must be recognised that SC vulnerability is also a concern for practitioners and academics in other disciplines, including BCM and corporate risk management. Securing SCs from malign interventions (counterfeiting etc.) is recognized as important task. Contingency plan is needed to mitigate the risk impact when preventive measurement fails.	SC risk management and risk mitigation, contingency plan	437 / Taylor & Frances / Int'l journal of logistics: research and applications	
Casades ús & de Castro (2005)	How improving quality improves supply chain management: empirical study	Quality, SCM	135 / Emerald / The TQM Magzine	Quality, SCM
Flynn & Flynn (2005)	Synergies between supply chain management and quality management: emerging implications	QC, SCM	360 / Taylor & Francis / Int'l Journal of Production Research	QC, SCM

Fynes et al.'s (2005)	The impact of supply chain relationship quality on quality performance	SCRQ, quality performance	550 / Elsevier / Int'l Journal of Production Economics	SCRQ
Kannan & Tan (2005)	JIT, TQM, and SCM: understanding their linkages and impact on business performance. The study helps researcher in understanding how practices are viewed by organisations as part of their operations strategy. The study outcome shows that "commitment to quality" and an understanding of "SC dynamics" have the greatest effect on SC performance. By explicitly and effectively integrating JIT, TQM & SCM practices into operations strategies, the companies can meet the competitive pressures.	JIT, TQM, and SCM practices, "commitment to quality", understanding of "SC dynamics	987 / Elsevier / The Int'l Journal of Management Sciences	JIT, TQM, and SCM
Lin et al.'s (2005)	A structural equation model of SCQM and organisational performance. The study outcome shows that QM practices are significantly correlated with the supplier participation strategy, customer satisfaction and business results. This means that QM practices are directly correlated with the supplier selection strategy. The result shows that the SCQM environment support its programs that include QM practices and support its process that include TQM practices	Global-SCQM, SCQM-environment, TQM practices, QM practices, organisational performance, QM and SC practices,	522 / Elsevier / Int'l Journal of Production Economics	SCQM, SEM, QM, TQM
Robinson & Malhotra (2005)	Defining the concept of SCQM and relevance to academic and industrial practice. This study evaluates the concept of SCQM environment relevance, with respect to by reviewing prior quality and SCM literature comprehensively according to the present SCQM body of knowledge stream. The study emphasised that the SCQM concept emerged within the review process. This study encourages future researchers to seek possibilities to integrate quality and process improvement strategies across SC to make SCQM concept more relevant to the industrial need.	SCQM environment, Quality-SCM framework, integrative process Management	699 / Elsevier / Int'l Journal of Production Economics	SCQM, Quality-SCM
Forker et al.'s (1997)	TQM in the SC: what is its impact on performance?. The study outcome encourages manufacturers to continue promoting TQM practices throughout SC. As TQM utilizes both quantitative and qualitative method with HR (behavioural) practices to improve material and service inputs, **intra- and Inter-organisational processes, a**nd to sharpen the focus on meeting customers' needs.	TQM practices throughout SC with HR practices, **intra- and Inter-organisational processes,** customer satisfaction	251 / Taylor & Frances / Int'l journal of Production Research	TQM & SCM practices, SCQM

Appendix Table-(S-2): List of Scholarly contributions to define the role of anti-counterfeiting strategies to control product counterfeiting in supply chains (after the year 2000)

AUTHOR'S NAME	DESCRIPTION	DIMENSIONS	CITED / PUBLISHED / JOURNAL	KEY TERMS
Ghadge, A. et al.'s (2021)	Deceptive counterfeit risk in global supply chain. A systems approach for modelling supply chain risks. Mention risk mitigation strategies in B2B procurement. Network transparency, cost of quality, pre-supply evaluation approaches and supplier relationship management.	Deceptive counterfeits, B2B procurement, cost of quality	5 / Taylor & Francis / Supply Chain Forum: An International Journal	Deceptive counterfeits
Zhou et al.'s 2020	Multiplexed SERS Barcodes for Anti-Counterfeiting. SERS coding system with phone applications are developed to identify genuine products. SERS inks are produced and applied in signature anti-counterfeiting.	SERS inks, SERS Barcodes for Anti-Counterfeiting	7 /ACS Publication/ Applied Material	SERS Barcodes for Anti-Counterfeiting
Soon & Manning (2019)	Developing anti-counterfeiting measures: The role of smart packaging. The study says that premium brands are often targeted by fraudsters. A topology of counterfeiting activities is developed including: tear-down counterfeiting, product overruns, malicious activities and document counterfeiting.	Covert and overt technology, anti-counterfeiting measures	25 / Elsevier / Food Research International	anti-counterfeiting measures
Chen et al.'s (2017)	Counterfeit luxuries: Does moral reasoning strategy influence consumers' pursuit of counterfeits?. This study result shows that morality has adverse impact on customers' purchase intention based on moral dis-engagement theory. Study mentioned two type of moral reasoning strategies: moral rationalization and moral decoupling.	consumers' pursuit of counterfeits, customers' purchase intention	30 / Springer / Journal of Business Ethics	consumers' pursuit of counterfeits , customers' purchase intention
Machado et al.'s (2018)	Counterfeiting: addressing mitigation and resilience in supply chains. This study discusses the concerns of the companies to control counterfeiting phenomenon in SC. Risk averse companies are more proactive and have a broad number of mitigation capabilities.	Anti-counterfeiting strategies, SC risk, risk mitigation	25 / Emerald / Int'l Journal of Physical Distribution & Logistics Management	Anti-counterfeiting strategies, SC risk, capability analysis
Mura (2018)	Reliability concerns from the grey market. This study give warning against the lack of reliability culture for end users of microelectronics devices higher risks, purchased from open market, due to the low quality and poor reliability. Much of the problem is due to the lack of diligence on the part of buyers.	Reliability concerns from the grey market	5 / Elsevier / Micro-electronics Reliability	Reliability concerns from the grey market
Souiden et al.'s (2018)	Is buying counterfeit sinful? Investigation of consumers' attitudes and purchase intensions of counterfeit products in a Muslim country. The study describes the effects of individuals' ethics, religiosity and attitude on purchase intension to buy counterfeits.	consumers' attitudes, purchase intensions of counterfeits	20 / Wiley / Int'l Journal of Consumer Studies	Attitude and purchase intentions
Hussain et al.'s (2017)	Intention to purchase counterfeit luxury products: A comparative study between Pakistani and the UK Consumers. The study says that there exists some relationship among four factors: perceived quality; status consumption, low price and ethics. Pakistani consumers exhibit less ethical behaviour compare to UK consumers.	perceived quality; status, consumption of low-price products	25 / Taylor & Francis / Journal of International Consumer marketing	Purchase intention
Quoquab et al.'s (2017)	Factors affecting consumers' intention to purchase counterfeit product. This study discusses the social and personal factors in reference to counterfeit product purchase intention. The purpose of this paper is to investigate the direct & indirect effect of ethical aspects on the attitude of consumers'	Consumer buying behaviour	79 / Emerald / Asia Pacific Journal of Marketing Intelligence	direct & indirect effect of ethical aspects on the attitude

	counterfeit product purchase in the Malaysian market.			
Sullivan et al.'s (2017)	Assessing the developing knowledge-base of product counterfeiting: a content analysis of four decades of research. This study trying to uncover the knowledge of product counterfeiting as a crime. Focused policies and procedures need to be developed to address counterfeiting phenomenon. Criminology theories and the lack of response efforts from the authorities should be investigated to understand counterfeiting phenomenon.	Criminology theories investigation, cross-disciplinary collaboration and integration	10 / Springer / Trend Organized Criminology	Product counterfeiting, Criminology
DiMase et al.'s (2016)	Traceability and Risk Analysis strategies for addressing counterfeit electronics in SC for complex systems. This study attempts to implement risk-based approaches against disruption of the SCM. The efforts towards traceability to track parts at different levels of SC.	Traceability and Risk Analysis strategies	42 / Wiley / Society for Risk Analysis	Traceability, Risk Analysis
Eser et al.'s (2015)	Counterfeit Supply Chains. This study is conducted in Turkey from actors in SC where study suggested five anti-counterfeiting strategies. Various technical, commercial, and organisational measures suggested to secure products and supply chains.	Product authentication measures, vendor inspections	15 / Elsevier / Procedia Economics and Finance	Counterfeit supply chains
Stevenson & Busby (2015)	An exploratory analysis of counterfeiting strategies. This study proposes counter-measures for increasing the resilience of supply chains to the counterfeiting threat. The study identified four sets of strategies: a) extraction – for obtaining products or materials form the legitimate economy; b) Production – for manufacturing counterfeit goods; c) distribution; d) infiltration – for introducing counterfeits into legitimate economy.	Counterfeiting strategies, resilient SC,	84 / Emerald / Int'l Journal of Operations & Production Management	Counterfeiting strategies, resilient SC,
Yao, Jen-Te's (2015)	The impact of counterfeit-purchase penalties on anti-counterfeiting under deceptive counterfeiting. This paper discusses that anti-counterfeiting strategies have different impact on the firm's pricing strategy. So, in would impact the product demand for legitimate supply chain. The legitimate producer raises the product price.	counterfeit-purchase penalties, firm's pricing strategy	15 / Elsevier / Journal of Economics and Business	counterfeit-purchase penalties,
Zhang & Zhang (2015)	Supply chain structure in a market with deceptive counterfeits. There is a possibility of counterfeits sale at the counter where retailer may replace brand name products with its counterfeits.	deceptive counterfeits, product's brand name	30 / Elsevier / European Journal of Operational research	deceptive counterfeits
Barnier (2014)	Counterfeiting: The challenges for governments, companies and consumers. This study discusses the importance of the topic and its effects on health and security of the customers.	Product counterfeiting	5 / Research Gate /Handbook of Security	Product counterfeiting
Bodner (2014)	Enterprise Modelling Framework for Counterfeit Parts in Defense Systems. This study presents an enterprise modelling framework for studying the counterfeiting problem. The framework elements are: the exogenous environment, policy, enterprise actors, supply chain flows, system/constituent behaviour and performance.	Enterprise framework, counterfeit parts, computational traceability	15 / Elsevier / Procedia Computer Science	Enterprise framework, counterfeit parts, traceability
Grenoble et al.'s (2014)	Counterfeiting: An omnipresent, critical and yet exclusive supply chain issue. This study discusses five categories of counterfeiting (grey market, re-marked / re-packaged, green market, surplus, illegally acquired). Study also mentioned countermeasures to address issue.	categories of counterfeiting, countermeasures	5 / online / Supply Chain Management Review	categories of counterfeiting, countermeasures
Hoecht & Trott (2014)	How should firms deal with counterfeiting?. This study discusses the implementation of the eleven anti-counterfeiting strategies at risky places. The root cause is likely to be high price margin for low technology products and can easily be copied.	anti-counterfeiting strategies	40 / Emerald / Int'l Journal of Emerging Markets	anti-counterfeiting strategies

Ting & Tsang (2014)	Using social network analysis to combat counterfeiting. This study applies the theory of SNA in the SC in order to combat counterfeiting problem with accomplishment of two objectives: 1) understanding about SNA based logistics flow; 2) applying techniques and effectiveness of detecting counterfeiting parties through a case study.	SNA based logistics flow, theory of SNA in the SC	21 / Taylor & Francis / Int'l Journal of Production Research	SNA, logistics flow
Wilcock & Boys (2014)	Reduce product counterfeiting: An integrated approach. This study says that there is a substantial connection between QM and reduction of product counterfeiting. It demonstrates how integrating anti-counterfeiting initiatives in the QM strategies can reduce risk in the supply chain. Application of quality principles can offset counterfeiting and risk in supply chain.	QM strategies, QM and reduction of product counterfeiting, Risks in SC	49 / Elsevier / Kelly School of Business, Indiana University	QM, reduction of product counterfeiting
Zimmerman (2014)	Contending with Chinese counterfeits: Culture, growth, and Management responses. This study emphasises the importance of IPR protection and express dissatisfaction. The study says that virtually impossible to estimate the total size and value of the counterfeits originated from China. However, the figure out to be US$ 150 billion.	Importance of IPR protection, Management response in deeds	42 / Elsevier / Kelley School of Business	IPR protection
Heinonen & Wilson (2012)	Product counterfeiting at the state level: An empirical examination of Michigan-related incidents. This study emphasises the importance of evidence-based research and as case study taken from Michigan product counterfeiting incident. Strategies described.	Product counterfeiting	20 / Taylor & Francis / Int'l Journal of cooperative and Applied Criminal Justice	Product counterfeiting
Peterson (2012)	Global strategic collaboration: Trade secrets and firm value. This study indicates the risks involved with IP collaboration with countries where less enforcement given to IPR. The study addresses the question as to how value creation can be attained for companies through collaborative relationships by exploiting from unique IP assets.	Strategic collaboration, IPR, advertisement	5 / Canadian Centre for Science and Education / Journal of Management & Sustainability	Strategic collaboration, IPR, advertisement
Staake et al.'s (2012)	Business strategies in the counterfeit market. The study discusses counterfeiters' groups-based cluster analysis. There are five different groups (dis-aggregators; imitators; fraudsters; desperados; smugglers. Countermeasures suggested in this study against counterfeiting.	counterfeiters' groups-based cluster analysis	87 / Elsevier / Journal of Business Research	group based cluster analysis, awareness to consumers
Reynolds (2011)	Manipulating perceived risk to deter and disrupt counterfeiters. This study discusses several factors that shows the presence of counterfeits in the high price market: 1) High price market to per capital disposable income; 2) Informal distribution channels; 3) Presence and strength of organized crime	Counterfeits' risks and risks manipulation	15 / Emerald / Journal of Financial Crime	Counterfeits' risks and risks manipulation
Berman & Swani (2010)	Managing product safety of imported Chinese goods. China need to develop well defined strategy to protect safety of the product. Study discusses SC issues in China characterised by cost pressures and quality fade, small procedural bottlenecks in outsourcing, large volume of counterfeits, technological edge from detection and poor surveillance.	Product traceability, quality standards, safety audit	55 / Elsevier / Kelley School of Business	traceability, QM
Hung (2003)	The business of product counterfeiting in China and the post-WTO membership environment. This study discusses the existing problems related to counterfeiting issue and authority's inability to address the issue.	Product counterfeiting in post-WTO environment	90 / Frank Cass / Asia Pacific Business Review	Product counterfeitign
Mavlanova & Benbun	Deception tactics and counterfeit deception in online environment. The study stresses the need to put control on the usage of internet as this medium is used as a convenient platform to do the	B2B, B2C selling, deceptive selling, use of internet,	10 / online / Int'l Conference on Information Systems (ICIS)	B2B, B2C

an-Fich. (2010)	counterfeiting where online selling is doing the rest what counterfeiter needs. This study emphasises to build trust in the eyes of the customers by providing true information about the product and the sellers.	convenience in online selling		
Blos et al.'s (2009)	Supply chain risk management (SCRM): a case study on the automotive and electronic industry in Brazil. This study highlighted two areas of research [S.C risks; SCRM implementation (better SC communication; SCRM & BCP training program; risk manager placement)].	Risk assessment program, business continuity program	288 / Emerald / Supply Chain Management: An International Journal	S.C risks; SCRM implementation
Chaudhry et al.'s (2009)	Preserving IPR: Managerial insight into the escalating counterfeit market quandary. This study focuses on creating awareness among the distributors and other parties in the supply chain against the drawbacks of the usage of the counterfeits. Specific programs to be introduced for that matter. Central repositories to be developed.	Preserving IPR, creating awareness, to develop Specific programs & Central Repositories.	65 / Elsevier / Kelley School of Business	IPR protection, awareness against use of counterfeits
Commuri (2009)	The impact of counterfeiting on genuine-item consumers' brand relationships. The study trying to answer the question, how do consumers of the genuine items react to the erosion of exclusivity and prestige? There are three strategies: 1) flight; 2) reclamation; 3) a-branding (disguising all brand cues)].	Erosion of the brand value,	255 / online / Journal of Marketing	Brand value
Staake et al.'s (2009)	The emergence of counterfeit trade: a literature review. The study discusses the trading of counterfeits at global level and the economic principles of counterfeiting. Also discusses the diversity of the counterfeiting phenomenon, mechanism and structure of the illicit markets. The paper critical review knowledge gaps present at counterfeiting level in SC.	Counterfeit trade and enablers, diversity of counterfeiting phenomenon	327 / Emerald / European Journal of Marketing	counterfeiting phenomenon
Yang & Fryxell (2009)	Brand Positioning and Anti-Counterfeiting effectiveness. This study examines the relationship between brand positioning and anti-counterfeiting with different brands present in China. Product reliability and customer services are compatible with efforts to counter counterfeiting.	Brand Positioning, Product reliability, Anti-Counterfeiting effectiveness	25/ Springer / Management International Review	Brand Positioning, Product reliability
Kuei et al.'s (2008)	Implementing supply chain quality management. The study discusses the drivers of supply chain quality (SCQ): 1) SC competence; 2) CSF; 3) strategic component; 4) SCQ practices / activities / programs. The knowledge of SCQ drivers help practitioners to effectively and efficiently make SCQM plans.	SCQM plan, SC competence, CSF, strategic component, SCQ practices / activities / programs	140 / Taylor & Francis / Total Quality Management	SCQM plan, SC competences, SCQ practices
Kwok et al.'s (2008)	An intelligent RFID-based electronic anti-counterfeit system (InRECS) for the Manufacturing industry: intelligent system, data mining, RFID tags and visualization of parts SC info and transactions	intelligent RFID-based electronic anti-counterfeit system	30 / The Int'l Federation of Automatic Control	intelligent RFID-based electronic anti-counterfeit system
Amine & Magnusson (2007)	Cost-benefit models of stakeholders in the global counterfeiting industry and marketing response strategies. The study emphasises that bot supply and demand sides anti-counterfeiting strategies should be made to control the issue and one-sided approach is not enough. This study proposed a typology of counterfeits with four different consumers segments.	supply and demand sides anti-counterfeiting strategies	30 / online / The Multinational Business Review	Market response strategies (4) to address counterfeiting issue
Bosworth & Yang (2006)	Conceptual Issues of Global Counterfeiting on Products and Services. This study discusses the severity of the counterfeiting issue at global level. The result of the study mentioned key causal	Global Counterfeiting issue	10 / online / Journal of Intellectual Property Rights	counterfeits

	factors associated with the production and flows of counterfeits. The issue can not be eliminated due to brands success (incentive to counterfeiters).			
Eisend & Schuchert-Guler (2006)	Explaining counterfeit purchases: a review and preview. This study mentions the good and the bad impact of the presence of counterfeits in the market. Its deceptive and non-deceptive aspect of supply chain.	deceptive and non-deceptive aspect of supply chain	525 / online / Academy of Marketing Science Review	Counterfeit purchases
Lowe (2006)	Counterfeiting: Links to organized crime and terrorist funding. The study reveals that terrorist groups and concerned resource benefited from counterfeiting from both illicit and licit channels.	Counterfeiting benefits criminal activities, anti-counterfeiting measures	43 / Emerald / Journal of Financial Crime	anti-counterfeiting measures
Santos & Ribeiro (2006)	An exploratory study of the relationship between counterfeiting and culture. This study examines the impact of Hofstede's cultural dimensions on the attraction of int'l counterfeiting in EU countries. Counterfeiter country has cultural profile in terms of low power distance, low uncertainty avoidance and low individualism.	counterfeiting and culture, Hofstede's cultural dimensions	21 / Research Gate / Polytechnical Studies Review	counterfeiting and culture, Hofstede's cultural dimensions
Tang (2006)	Robust Strategies for mitigating supply chain disruptions. This study introduced strategies against disruptions in SC to make it more resilient. Disruptions may be due to counterfeiting which can reduced by forming: supply alliance network, lead time reduction, recovery planning systems.	supply chain disruptions, supply alliance network, lead time reduction, recovery plan	1310 / Taylor & Francis/ Int'l Journal of Logistics Research and Applications	Counterfeiting, supply chain disruptions
Staake et al.'s (2005)	Extending the EPC network – The potential of RFID in anti-counterfeiting: Discusses RFID and advance cryptography to provide secure authentication; Use track and trace approach, passive tags with EPC code	Electronic platform with DB structure, EPC tags	58 / ACM Symposium on applied computing	RFID, Track and trace technologies used
Hoe et al.'s (2003)	Fakin' IT: counterfeiting and consumer contradictions. This study discusses how consumers relate to fake brand and the implications of counterfeit for consumers. This study discusses deceptive and non-deceptive buying behaviour (material and social risk).	counterfeiting and consumer behaviour, deceptive and non-deceptive buying	152 / online / European Advances in Consumer Research	Counterfeiting consumer behaviour, deceptive and non-deceptive buying

Appendix Table-(S-3): List of Scholarly contributions to define the role of anti-counterfeiting strategies to control product counterfeiting in SC by establishing BCT supported SCQM Environment (during 2017 and 2021)

AUTHAR NAME	DESCRIPTION	DIMENSIONS	CITED / PUBLISHED / JOURNAL	KEY TERMS
Blossey et al.'s (2019)	The BCT in SCM. This paper combines two perspective BCT and SCM to summarize present status of the body of knowledge to drive future research. The framework developed to analyse 53 applications of BCT in SCM after systematic literature review.	Integrated BCT and SCM body of knowledge,	67 / online / AIS e-Library (Journal of the Association of Information Systems)	BC, SCM
Alzahrani & Bulusu (2018)	A new product counterfeiting BC using a truly decentralized dynamic consensus protocol. This study proposes decentralized dynamic protocol that does not require low and randomly employed validators each time whenever new block is proposed in the BC. The proposed protocol utilizes a game theoretical model to analyse the risk-likelihood of the new block's proposing nodes in the BC.	Product counterfeiting BC uses decentralized dynamic protocol	77 / CryBlock (Munich, Germany), Association for Computing Machinery (ACM)	BC,
Roeck et al.'s 2020	Sharing information technology (DLT) in SCs: A transaction cost perspective. This paper discusses that the effects of DLT on SC transactions are two sided. There are six effects of DLT solutions that have a cost-reducing and avoidance impact on SC transactions by reducing reliance on the third party for confirmation.	Sharing information Technology used to balance the power distribution between buyers and suppliers	5 / Springer / BC and Sharing information Technology	DLT, SCM
Clauson et al.'s (2018)	Leveraging Technology to Enhance Supply Chain Management in Healthcare. This study uses BC technology to enhance SCM performance in healthcare area. The study discusses the challenges and opportunities in the health supply chain.	technology to enhance SCM performance	102 / Cross mark / BC in health care	BC, SCM
Gupta et al.'s (2020)	BC based security attack resilience schemes for autonomous vehicles in industry 4.0: a systematic review. This study discusses the present single point of failure (SPF) centralized architecture to tackle vehicles automation related problems. Explore the open issues and challenges of BC-based Vehicle Automation System.	BC-based Vehicle Automation System in Industry 4.0	35 / Elsevier, Computers and Electronics Engineering	BC
Ellul et al.'s 2020	Regulating BC, DLT and Smart Contracts. Regulating BC, DLT and Smart contracts: a technology regulator's perspective. The study says that the purpose of technology is to provide means to ensure that processes are verifiable, transparent, and tamper proof. There is a need to implement, t regulatory framework and to meet the technology assurance requirements.	BC, DLT and Smart contracts, regulatory framework, technology assurance requirements	10 / Springer / ERA Forum	BC, DLT
Soon & Manning (2019)	The Developing anti-counterfeiting measures. Typologies of counterfeiting activities [tear-down counterfeiting, product overrun, malicious activities, document counterfeiting	Typology of counterfeiting activities, smart covert and overt technologies, Integrated anti-counterfeiting systems, packages anti-counterfeiting measures	25 / Elsevier / Food Research International	BC, CF
Yiu, N.C.K (2021a, 2021b)	Towards BC-enabled SC Anti-Counterfeiting and Traceability. This study emphasises that the centralized system control of cross-functional activity leads to a system's failure and creates sustainability issue. The reasons could be a compromised control of business operations and product traceability issue in supply chains. The technology supported distributed environment brings sustainability into the business operations	technology, distributed environment, product transparency & traceability, NFC-enabled anti-counterfeiting system	5 / MDPI / Future Internet	BC

	to protect the system from being compromised. This study introduced NFC-enabled anti-counterfeiting system, which will be secure and provide immutable scientific data provenance tracking and management platform where provenance records are recorded to verify the counterfeits.			
Rejeb et al.'s (2019)	Leveraging the internet of Things and BC technology in SCM. The study discusses the combination of BC with IoT infrastructure bring effectiveness and efficiency in the modern SC.	IoT and BC in SCM, track and trace, scalability, security, immutability and auditing, flow of quality information	95 / Online / Future Internet MDPI	BC, IoT, SCM
Fraga-Lamas & Fernandez-Carames (2019)	A review on BCT for an Advanced and Cyber resilient automotive industry's. The study says Industry 4.0 allows the massive deployment of sensors, the application of big data techniques, the improvement in systems' connectivity and computational power, the emerging machine learning approaches to address cyber-resilient automotive industry's.	BCT for Cyber resilient automotive industry's, Industry 4.0 allows the massive deployment of sensors and machine computational power	136 / Online / IEEE Access	BC, Industry 4.0
Toyoda et al.'s (2017)	A Novel BC based product ownership management system (POMS) for anti-counterfeits in the post SC. The study says that POMS and RFID attached product used for anti-counterfeits.	BC, product ownership management system (POMS) for anti-counterfeits in SC.	313 / Online / IEEE Access	BC, POMS
Zhu, Peng et al.'s (2020)	Enhancing Traceability of Infectious Diseases: A BC-Based Approach. This study proposes a technology-based method for medication information storage, inquiry, and anti-counterfeiting along a medication supply chain. An access control policy model based on smart contract is designed to prevent medication information from being altered or disclosed at nodes of the BC. The proposed solution eliminates the needs for centralized institutions and third-party organisation to provide record of the medication circulation process.	technology-based method, access control mechanism	5 / Elsevier / Information Processing Management	BC
Sillaber et al.'s (2020)	Laying the foundation for smart contract development: an integrated engineering process model. This study sees the Smart contracts as the major building blocks for future autonomous BC & Sharing information Technology (DLT)-based applications. This study develops and integrates generic framework of the model that support application development in all fields	BC & Sharing information Technology (DLT)-based applications,	10 / Springer / Information Systems and e-Business Management (ISeBM)	BC
Lu, Donghang et al.'s (2019)	The Reducing automotive counterfeiting by using BC describing benefits and challenges. The paper talks about the adversity of the hardware-based authentication control with RFID tags and discusses advantages of using technology	Sharing information and append only ledger governed by SC parties, Use of consensus algorithm for authentication, Hyper ledger fabric approach to mitigate product counterfeiting risk	16 / IEEE / Int'l Conference on Decentralized Applications and Infrastructures (DAPPCON)	BC, CF
Chen, S. et al.'s (2021)	A BC based SCQM framework. The study says that with centralized system trust issue in SC need to be resolved. BCT is promisingly improve SCQM and proposed its framework	BC based SCQM framework	175 / IEEE / Int'l Conference on e-Business Engineering (ICeBE)	BC, SCQM
Souiden et al.'s (2018)	Title Is buying counterfeit sinful? Investigation of consumers' attitudes and purchase intentions of counterfeit products in Muslim country. The study investigates the effect of individuals' ethics (idealism, relativism), religiosity (fear of divine punishment, interest in religion and practices, and beliefs in religion), and attitudes toward	The effect of religiosity and attitude on counterfeits' ethical consumption behaviour, idealism, relativism, economic benefits	19 / Wiley, Int'l Journal of Consumer Studies (IJCS)	culture

	counterfeits (economic benefits) on purchase intension of counterfeit products.			
Tseng et al.'s (2018)	Governance on the Drug supply chain via Gcoin BC. The study says that BC based surveillance net model involves in the drug SC to prevent counterfeit drugs.	BC Governance in Drug supply chain, BC based surveillance net model	5 / MDPI / Int'l Journal of Environmental Research and Public Health (IJERPH)	BC, SCM & Governance
Kshetri (2018)	BC's roles in meeting key SCM objectives. This study examines how BC is likely to affect key SCM objectives (cost, quality, speed, dependability, risk reduction, sustainability, and flexibility].	BC increases transparency and traceability, technology usage	825 / Elsevier / Int'l Journal of Information Management	Transparency and traceability
Sabari, Sara et al.'s (2019)	The BCT and its relationship to sustainable SCM. The distributed digital ledger technology ensures transparency, traceability, and security. BCT critically examined with SCM application with smart contract and disruptive technologies can overcome potential barrier.	Distributed digital ledger technology, disruptive technology, smart card, potential barriers (a. Inter and Intra-organisational barrier, b. technical barrier, c. external barrier), evaluation towards adopting Technology in SC.	850 / Taylor & Francis / Int'l Journal of Production Research	BCT, SCM
El Messiry & El Messiry (2018)	CRYPTO COPYCAT: A Fashion Centric B.C Framework for Eliminating Fashion Infringement: BC framework for Textile SCM. This study proposes BC based framework for textile quality improvement identify defective batches at real time cross chain information sharing with guaranteed authenticity and accuracy.	BC framework for SCM Transparency, traceability, quality	5 / Springer / Int'l Publications, AG	BC, SCM
Mir, Imran (2013)	Examination of attitudinal and intentional drivers of non-deceptive counterfeiting in a South Asian Context. The result of the study shows that positive word of mouth about non-deceptive counterfeits and less sensitivity of ethics positively influence consumers' attitudes toward the non-deceptive counterfeits and has profound impact on the consumers' purchase intention.	non-deceptive counterfeits, less sensitivity of ethics, consumers' attitude, consumers' purchase intention	12 / VGTU online, Journal of Business Economics and Management (JBEM)	culture
Leng et al.'s (2019)	Makerchain: A BC with chemical signature for self-organizing process in social manufacturing. The study discusses the Maker-chain decentralized application (DApp) to address counterfeiting issue by using automated mechanism of smart contacts among makers.	Maker-chain decentralized application (DApp), smart contracts	56 / Elsevier / Journal of Cleaner Production (JCP)	BC
Karami et al.'s (2017)	Key cultural values underlying consumers' buying behaviour: Iranian context. The study says that the cosmopolitanism found to be the most influential value affecting consumer buying behaviour; faithfulness found to be the least, as compare to innovation, convenience, youthfulness.	Marketing mix decision, consumer buying behaviour, Cosmopolitanism, faithfulness, innovation, convenience, youthfulness	15 / Emerald, Journal of Islamic Marketing Research (JIMR)	culture
Sahoo et al.'s 2019	A BC based model to eliminate Drug Counterfeiting. One of the main reason behind drug counterfeiting is imperfect SC. Using BCT for traceability, visibility and security in SC.	Imperfect SC, BC brings traceability, visibility and security in SC	5 / Springer / Machine Learning & Information Processing, Advances in Intelligent Systems & Computing	BC, CF
Harun et al.'s 2020	Understanding experienced consumers towards repeat purchase of counterfeit products: the mediating effect of attitude. This study discusses the repurchase behaviour of consumer related to the counterfeits (their demographics, past purchases, materialism, economic and social	mediating effect of attitude with respect to repurchase behaviour of consumers and other factors, Hierarchical regression analysis	16 / Growing Science / Management Science Letters	CF, culture

	factors). There is a negative relationship with repurchase behaviour indicating that experience counterfeits' consumer in materialism addresses economic need.			
John & Pam (2018)	Complex Adaptive BC Governance. The study says that smart contract need governance when beset with the unknown problems. The issue of BC governance from the complex adaptive system (CAS) helps address the problem of decentralization.	BC Governance, smart contract, complex adaptive system (CAS)	10 / EDP Sciences / MATEC web of conferences	BC, governanc e
Zavolokin a et al.'s (2020)	Management, Governance and Value Creation in a BC consortium. The stud discusses the growing number of BC consortia is providing both opportunities for new forms of collaboration built around the potential benefits of technology, and uncertainty caused by the tensions such collaborations bring.	BC consortium, collaboration	26 / Online / MIS Quarterly Executive	BC
Syed T.A. et al.'s (2020)	A noval BC based framework for vehicle life cycle tracking: An End-to-End solution. This paper introduced the usage control model and discusses that BC is customized to enable usage control for transactions, such as inspection, renting and insurance. The usage control model is used to address problems with trust management, transparency, and access control. By using sharing information with complete history of record.	Usage control model integrated with IoT devices, centralized system brings issues like trust management, transparency, and access control	5 / IEEE / Open Access Journal	BC, trust
Jinhua et al.'s (2020)	A BC-Based Application System for Product Anti-Counterfeiting. The contents of the technology-based system architecture is intact and free from any intrusion. The system can confirm the legitimacy of the transaction record without relying on a centralized system. This paper uses technology to ensure that consumers do not fully rely on the merchants to determine if products are genuine.	technology based application system for product anti-counterfeiting	10 / IEEE / Open Access Journal	BC, CF
Jain & Karande (2020)	Application of BC & Artificial Intelligence in E-commerce supply chain to reduce product counterfeiting & increase transparency. This study is based on the use of technology along with AI to curb the problem of product counterfeiting and maintain transparency. R-studio application is for data analytics purpose. This study helps the supplier side in curbing the losses and also the consumer side in receiving the genuine product that build trust among stakeholders.	Technology, Artificial intelligence, transparency & traceability, product counterfeiting, deceptive buying	5 / online / Psychology and Education	BC, CF, AI
Chen, S. et al.'s (2017)	Traceability and risk analysis strategies for addressing counterfeit electronics in SC for complex system. This paper discusses how to improve the SCQM practices by adopting the technology, and propose a framework for BC based SCQM environment.	BC based SCQM framework	42 / Wiley / Risk analysis	BC, SCQM
Maull et al.'s (2017)	This study discusses the applications and implications of sharing information technology (DLT), identify challenges to act between technology development and the business model.	Features of DLT	105 / Wiley / Strategic Change	BC, DLT
Wang et al.'s (2018)	The Understanding BCT for future SC. Trust being the pre-dominated factor driving the adoption of BCT in SCM. Focus area are: extended visibility and traceability; SC digitalization and intermediation; improved data security and smart contract.	BCT enable SC design, diffusion of BCT and SCM	316 / Emerald / Supply Chain Management	BC, SCM

Cole et al.'s (2019)	BCT: Implications for operations and SCM. The study says that companies need to take benefits from BCT to enhance market position. Human capital expertise need to develop.	BCT, product safety & security, QM, counterfeiting, Supply Chain sustainability	180 / Emerald / Supply Chain Management: An Int'l Journal	BC, SCM
Latif et al.'s (2018)	A review of counterfeiting research on demand side: Analysing prior progress and identifying future direction. The study discusses the systematic approach of research to explore possible purchase intention behind demand of the counterfeit consumption.	Purchase intention, theory of reasoned action, theory of social representation, social identity theory, equity theory, cultural cognition theory	10 / Wiley, The Journal of World Intellectual Property (TJWIP)	CF
Yiu, N.C.K (2021)	Decentralized SC anti-counterfeiting systems using BCT. Centralized control of cross functional activities lead to system failure or create sustainability issue due to compromised control and un-traceability modifications. With technology the drawbacks of the centralized system can be avoided. technology brings a mechanism of developing de-centralized product anti-counterfeiting and traceability ecosystem to control product counterfeiting activities.	technology enable SC anti-counterfeiting and traceability ecosystem	3 / IEEE / University of Oxford, United Kingdom	BC, CF