MITIGATING DEMAND UNCERTAINTY THROUGH SUPPLY CHAIN STRATEGIES:

THE CASE OF FOOD SMEs IN THE HAJJ PHENOMENON

THESIS OF DOCTOR OF PHILOSOPHY

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ABSTRACT

Hajj is very important to all Muslims across the globe. Because of its religious significance, the Hajj pilgrimage experiences a massive number of visitors each year, most of whom are foreign and require consumer goods during the six-day pilgrimage. The large number of pilgrims often results in a sharp increase in demand for consumer goods. Suppliers must ensure that they have adequate amounts of these products so that they can meet the needs of the pilgrims as well as their different tastes for these goods. It is however usually difficult to determine exactly how much is required. This complexity creates demand uncertainty that the firms in the industry must be able to cope with for them to succeed.

Small- and medium-sized enterprises (commonly referred to as SMEs) play an important role in the food chain throughout the Hajj season in the Kingdom of Saudi Arabia (KSA). However, SMEs are recognised to experience severe obstacles that have the potential to threaten their continuity, and the industry succumbs to the crisis of demand uncertainty throughout the short period of the peak season of Hajj each year. This problem is complex due to the constant increase in the number of pilgrims and the continuous changes in their needs and preferences. Demand uncertainty can ultimately result in an increase in production costs, long lead times, substandard service levels, and quality problems, especially in terms of food obsolescence.

There is a gap in the literature regarding aligning sources of uncertainty with supply chain strategies in an effort to improve supply chain performance. More specifically, the impact of supply chain integration strategies (SCI) on manufacturing strategies, such as postponement practice (PP) and mass customisation capability (MCC) to mitigate demand uncertainty (DUM), has not been fully explored. This study investigates three fundamental issues: 1 - how effective supply chain integration (internal integration and external integration) can be applied in Saudi's SMEs food industry, and how the interaction between them mutually manipulates the improvement of postponement practice and mass customisation capability in food productions in Hajj; 2 - how the volume of cooperation leads to the mitigation of demand uncertainty in maintaining the survival of small and medium enterprises that operate in food production in Hajj; and 3 - how the environmental condition (i.e. competitive intensity) moderates the influence of supply chain integration (SCI) on this interaction in Saudi's food SMEs that operate in Hajj.

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Based on the extended resource-based view (ERBV) of the firm, the strategic resources and knowledge come not only from within the organisation's boundaries, but also from outside. Thus, a firm's overall strategic capability may be embedded in a wider network of inter-firm exchange relationship. Contingency theory furthermore argues that an organisation should align their practices, processes and strategies with their business environment. In consideration to the extant literature, a number of hypotheses were defined, demonstrating the correlation between supply chain integration, postponement practice, mass customisation capability and demand uncertainty mitigation. Subsequently, a conceptual framework was developed with the objective to verify the relationship amongst the constructs. Mixed methodologies were employed; qualitatively, with 12 CEOs working in different SMEs in the food industry across KSA were initially interviewed to validate the conceptual framework. Content and face validity was accomplished with a group of academics and experts. A pilot study was carried out on a sample of 50 subcontractors, Hajj campaigns, pilgrimage institutions and food suppliers. Consequently, an online survey was conducted amongst SMEs to test the hypotheses. As a result, 239 responses were received from the SMEs in the food sector in the KSA. Partial Least Square (PLS) was used for the analysis. The interviewees were identified through snowball sampling (Detailed in the next sections). Quantitative data were collected using the convenience sampling technique, given the non-availability of the sampling frame.

Based upon the extended resource-based view (ERBV) of the firm, alongside contingency theory, the initial and final results of the pilot test and survey were seen to be steady with these theories, where supply chain integration was viewed not only as having a significant direct and indirect effect on the postponement practice and mass customisation capability by SMEs of food during Hajj, but also as playing a critical role throughout the employment of postponement practice as an important strategy, empowering mass customisation capability to mitigate demand uncertainty. Likewise, both results were seen to be consistent with contingency theory; that is, a firm should coordinate their supply chain integration activities, postponement practice and mass customisation capability to their business environment, particularly with high competitive intensity to enhance demand uncertainty mitigation. In order to achieve competitive intensity, organisations are mainly focused on emerging markets and expanding their product lines. In the event that organisations begin targeting similar set opportunities, they risk bringing up

competitive intensity for themselves, which increases the cost of growth. The cost of business will be noticeable when considering marketing speed, media inflation, the rate of innovation and trade spend in marketing, all of which are indicators of completion intensity. Improvements in supply chain efficiency, optimising strategies in marketing and extracting the best of return on investments from promotions by organisations also indicates competition intensity. Costs, competition and the ability to differentiate are some of the main determining factors of competition. Importantly, these are all tied up within uncertainty mitigation.

However, despite the fact that internal integration has a positive direct and indirect effect on the postponement practice, mass customisation capability is created by SMEs of food industry, in addition to its direct effect upon both supplier integration and customer integration. Customer integration has also been found to improve postponement practice as well as mass customisation capability in a direct fashion. Supplier integration has a significant impact on postponement practice; however, it seems not significantly associated positively with mass customisation capability. Moreover, postponement practice also has an effect in mitigating demand uncertainty, both directly and indirectly, through mass customisation capability. Finally, mass customisation capability similarly has been found to enhance demand uncertainty mitigation. Research indicates that the direct and indirect effects of all constructs increase when there is intense competition in Hajj.

Keywords: Supply Chain integration (SCI); Postponement Practice (PP); Mass Customisation Capability (MCC); Demand Uncertainty Mitigation (DUM); Competitive intensity, Responsiveness; Vertical integration; Agility; Survey; Extended Resource-Based View (ERBV); Contingency theory; Small and Medium Enterprises (SMEs); Hajj operation.

DECLARATION

I declare the information, data and materials contained in this work are my original work and have not been previously presented or submitted for a degree in this university nor any other. I further affirm that this thesis is developed by me and is solely based on the findings of my own research. All the information in this document has been obtained and also presented in conformity with academic rules as well as ethical conduct.

Mohammed Yousef Nashar

DEDICATION

This work is dedicated firstly to my father (Yousef. M Nashar), and mother (Widad. M Alshiqairy), to all my brothers (Dr. Majid, Mr. Maher, and Eng. Bilal), and sisters (Dr. Khuloud, Miss. Ghadah, and Miss. Nada), and to my lovely, precious son (Yousef), with my love as the people who have been most supportive, helpful and encouraging during my journey to complete this thesis and to achieve my goal. Words can never be enough to express to them how grateful I am and what they really deserve.

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CHAPTER 1 : INTRODUCTION

This chapter is centred on providing the reader with an overview of the thesis, beginning by discussing the research background and providing a definition of the problem, in addition to the scope of the research. The aim of the study, along with the research question and its main objectives, is articulated throughout the course of the chapter. The research gaps the study seeks to fill and justification for the study are also discussed. The chapter concludes by discussing the motivation for conducting the study (significance) and providing a definition of key terms. This is followed by an outline of the thesis organisation.

1.1 Background of the Study

Because of the immense religious significance of Al Hajj, the Hajj (pilgrimage) experiences massive number of visitors every year with most pilgrims predominantly being foreign (Long, D, 2012). Besides the pilgrimage there are also massive populations of both foreign and local visitors who go to Makkah for the mini pilgrimage (Umrah), which constitute a visit to just the holy mosque (Currie & Shalaby, 2012). During pilgrimage, demand for consumer goods rises sharply because most of the pilgrims are usually foreigners (Turban *et al*., 2015). Consumer goods retailers are, in fact, often faced with a huge challenge of providing all the required consumer goods in the right quantities to satisfy all the pilgrims. This presents a complexity because it is difficult to predict the exact demands as well as tastes of the pilgrims (Turban *et al*., 2015). This creates demand uncertainties which are widespread amongst the SMEs that supply to the pilgrims who go to Makkah to take part in the pilgrimage. Mitigating these problems is key to the success of SMEs.

Every organisation, whether big, medium or small, takes adequate steps to mitigate demand uncertainty. This arises as a result of the continuous expansion of globalisation and constant growth of technological advancement, which subsequently occurs in the global market. Businesses have to deal with supply and demand in order to ensure customers are adequately served with goods and services, whilst simultaneously maintaining a good inventory management system. When a business has difficulty in predicting demand, it poses challenges to the supply chain: in such circumstances, inventory becomes difficult to control (Christopher, 2005). There are a variety of reasons responsible for the cause in demand uncertainty: for example, there could be an increase in the buying relative to the projections or decrease in buying relative to the expectations. If organisations experience problems in demand uncertainty, they could easily succumb to pressure during peak seasons (Ayers, 2001). Demand uncertainty can however be mitigated with the use of proper management methods. The current research study examines the mitigation of demand uncertainty in Saudi's SME food industry in Hajj seasons.

The study is focused on analysing management practices that will improve the performance of the supply chain, especially on the demand side and under the condition of stiff market competition. The SME food industry during the Hajj season is competitive owing to the enormous demand needing to be fulfilled; however, demand never lacks its uncertain edge, thereby emanating robust competition in the supply chain. For example, during the peak season, there is a plethora of demand uncertainty owing to a wide array of customers' preferences.

Unfortunately, this may result in the development of long lead times that could be considered substandard and deteriorative to service quality provision, as well as the cost of provisions.

Therefore, if appropriate, managerial strategies, such as the capability of mass food customisation, postponement practices and supply chain integration, are implemented in the supply chain, which could go some way to achieving and maintaining a sustainable competitive edge, as suggested by Amit *et al*. (2005).

Demand uncertainty can be detrimental to SMEs as a result of their performance weaknesses; this can result in the deterioration of quality, in addition to delays in delivery (lack of fulfilling timely orders). All of these factors could arise owing to the fact that demand uncertainty contributes to the emanation of supply chain uncertainty, manufacturing chain uncertainty and control uncertainty, especially during the Hajj season, when demand for SMEs food products skyrockets. This is owing to demand amplifications and end-customer demands, which directly or indirectly contribute to inaccurate forecasts (Hult *et al*., 2010). Importantly, this could be caused by a lack of making comprehensive decisions in the supply chain. With regards to demand uncertainty, the decision-maker in the supply chain lacks prudent characteristics that would appropriately guide his/her decisions. Firms in Saudi's SME food industry during the Hajj season could lack relevant information pertaining to the market environment, current supply chain behaviour, processing capacities and effective control actions, which implies making of conclusive decisions to enable them to gain a competitive advantage against their counterparts is not achievable (Boyle, Humphreys & McIvor, 2008).

Studies show that sources of demand uncertainty can be studied from the standpoint of the management of supply chain uncertainty (Amit *et al*., 2005): for example, accurate forecasts can be used to make assumptions regarding the kind of relationship that may exist between customers and a number of SMEs in the food industry in the Hajj season. Appropriate steps can

be undertaken to ensure that the supply chain is apt in meeting all customer demands. This should ensure its provisions are all rounded, fully satisfying customer needs and preferences. Without question, this could create a competitive edge and thus enable firms to strive in the stiff market competition, whilst also gaining and maintaining market control (Boyle, Humphreys & McIvor, 2008). Based on this, the study seeks to examine the mitigation of demand uncertainty in the Saudi SME food industry during the Hajj season by analysing supply chain integration, postponement practices and mass food customisation as used by the SMEs in the industry.

1.2 Problem Statement and Definition

This study primarily seeks to address demand uncertainty mitigation through supply chain management practices in an effort to leverage on SMEs' performance, which in turn leads to satisfy all customers' needs and expectations who attend Hajj. Hajj attracts a wide variety of people who visit Makkah for a week of religious activities. Pilgrims come from different places around the world and have different tastes, all needing to be satisfied. This study looks at ways in which customer prospects can be met to a given quantity and quality level in the SME food industry in Saudi Arabia.

Demand uncertainty has been a burden to most SMEs in the food industry in Saudi Arabia (Turban *et al*., 2015). When demand uncertainty grips an organisation, it affects the way the supply chain is managed. When completing inventory management, organisations strive to minimise stock outs and avoid the costs associated with holding inventory in excess. When an organisation is unable to precisely predict demand, it runs the risk of over-buying and -selling at discounted rates in order to sell off excess (Christopher, 2005). Simultaneously, if an

organisation buys less in order to prevent wastage, peak times lead to stock outs. This erodes customer confidence and can result in the loss of essential customers (Ulrich, 1995).

Several management practices have been put in place by different organisations with the aim of helping mitigate demand uncertainty. The just-in-time system is used as one of the methods of helping mitigate the issues associated with demand uncertainty. Just in-time is an inventory system that primarily seeks to reduce flow times in the production process and response times from the suppliers and to the consumer (Christopher, 2005). This approach seeks to achieve low inventory, low wastage, low costs, high quality production and high customer responsiveness as it seeks to process the final product just in time to meet customer order and not earlier. This process involves inventory data sharing between vendors and retailers. This sharing of data allows retailers to complete the rapid replenishment of stock. Retailers play a key role in food provision during Hajj because of the huge numbers of foreign Muslim pilgrims who go to Makkah during Al Hajj and who must be provided with food as they perform their religious obligation (Turban *et al*., 2015). The food demand by these pilgrimages and other tourists is usually very high because of the large numbers involved and retailers in food provision must therefore ensure that they meet the required demands and standards. Here, the retailers maintain low inventory levels and make frequent but smaller orders (Christopher, 2005). Although this management method is helpful in mitigating demand uncertainty effects, there remains the risk of stock outs when demand rises quickly (Ulrich, 1995). Throughout the Hajji season, the SME food industry in Saudi faces this problem, even though it has adopted the Just in-Time inventory management system. The SME food industry in Saudi has had to face the bullwhip effect that results from demand uncertainty (Shalaby, 2012). According to Lee *et al*. (2007), the bullwhip effect takes place when demand order uncertainties magnify as they move up the chain.

According to these authors, distorted information from one end of the chain to the other can result in tremendous inefficiencies. These authors add that firms can effectively offset the bullwhip effect by understanding and accordingly addressing its underlying causes. This effect is based on psychology, where buyers from a company overreact to conditions where shops have stock outs or excess inventory (Christopher, 2005). Whenever companies face this effect, they tend to over-buy after a stock out problem and under-buy after an excess problem (Ayers, 2001). Either way, this reaction has always resulted in the opposite problem occurring. Without the adoption of adequate management techniques to mitigate the demand uncertainty, the SME food industry faces this bullwhip problem (Can, 2012). In other words, if demand uncertainty is not well mitigated, it leads to several problems in the SME food industry.

One of the most prominent problems facing industries when hit by the effects of demand uncertainty is increases in production costs (Ulrich, 1995). The food industries can face this cost in the event there is an excess in stock. Here, when SMEs overestimate demand, they store more than what is needed. The food items then deteriorate due to its natural obsolescence, thus costing the company providing food services. Therefore, the SME food industry needs to put proper measures in place to mitigate the effects resulting in such costs. As a second effect, long lead times also can result from demand uncertainty in the food industry. Whenever uncertainty is not mitigated, the players in the industry suffer the effects of long lead times. Poor supply chain management practices lead to the elongation of the time between the placement of order by the customer and the delivery of the same. Long lead times result in customers having little confidence in the business (Christopher, 2005). Aside from the problems posed to customers, suppliers also pose a problem in long lead times in the supply chain. Demand uncertainty therefore leads to disconnection in communication between the seller, the buyer and the supplier

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of raw materials (Angerhofer *et al*., 2000). Another outcome is that poor quality service provision may be experienced as a result of demand uncertainty in the SME food industry. In the event that the company cannot precisely predict the demands of the customer, stock outs will occur. This means management will need to provide short-term solutions to the demand experienced during peak periods. When short-term solutions are offered, quality of service is compromised. The success of the goods and services industry in present times is determined by the level of customer satisfaction exhibited (Ulrich, 1995). With a poor supply chain management system, demand uncertainty effects cannot be mitigated, which in turn leads to compromised service quality (Prater *et al*., 2001).

Despite the shortcomings of demand uncertainty during peak times, SME food industries in Saudi Arabia have been on the forefront to initiate the management systems deemed useful in mitigating demand uncertainty. The industries have put several measures in place to deal with demand uncertainty, especially during Hajj, when demand is at its peak. The implementation of a proper supply chain system and the management of such means that the movement of materials, funds and information across the system is done in a correct way in order to avoid excess or stock out. The management of supply chain provides the real time analysis of the flow of products and information across the entire system (Cohen & Roussel, 2005).

This thesis analyses three supply chain management methods adopted by the SME food industry in Saudi in an effort to mitigate the risks and effects. The thesis analyses supply chain integration, postponement practices and mass food customisation, as adopted by the SMEs of food industry in Saudi Arabia. This study will centre on the Hajj season in the country. These practices have been identified in literature as being the most effective in mitigating demand

uncertainty (Simangunsong *et al*., 2011; Shabah, 2015; Lai *et al*., 2012; Yeung *et al*., 2007; Yang & Yang, 2009; Cholette, 2009).

1.3 Research Scope and Justification

Uncertainty arising from the supply chain is an issue every practising manager struggles to control (Simangunsong *et al*., 2011). According to these authors, this uncertainty arises from the complex nature of globalised supply networks, and includes potential for quality issues over supplying and delays in delivery. Although supply chain uncertainty arises from various sources, including internal manufacturing and supply-side processes, this study focuses on the uncertainty arising from demand-side issues (commonly end-customer demand). According to Simangunsong *et al*., the management of the supply chain is key to mitigating this type of uncertainty. These authors argue that inadequate risk management practices and policies can have severe repercussions on the performance of the organisation. Enhancing understanding of uncertainty and its management therefore remains an important consideration in today's competitive and dynamic market, which is characterised by many challenges and changes that continue to unfold in this IT-driven global arena (Simangunsong *et al*., 2011). This is particularly important to SMEs in the food industry in Saudi Arabia, which are required to meet and satisfy the varying demands of customers during Hajj without compromising on cost and quality, whilst also ensuring they remain profitable (Turban *et al*., 2015).

In mind of the above, the scope of this study therefore is centred on analysing three supply chain management methods adopted by the SME food industry in Saudi during peak times in an effort to help mitigate the risks and effects arising from demand uncertainty. The study will be limited to analysing supply chain integration, postponement practices and mass food customisation, as

used by SMEs in Saudi's food industry. This is because Hajj is very important to all Muslims across the globe as it is a yearly pilgrimage to the city of Makkah which all Muslims are required to visit at least once in their lifetime, provided they have the financial ability to do so (Currie & Shalaby, 2012). Because of its religious significance, the Hajj pilgrimage experiences numerous visitors every year with most of those coming for the pilgrimage largely being foreign, hence the demand for consumer goods rises sharply (Turban *et al*., 2015). As a result, consumer goods retailers are faced with a huge challenge of providing all the required consumer goods and in required quantities and quality to meet the needs of the pilgrims. This is quite complicated, particularly since it is difficult to predict the exact demands and product tastes of the pilgrims (Turban *et al*., 2015). These uncertainties are common amongst SMEs that supply to the pilgrims who go to Makkah to take part in the pilgrimage. Mitigating this problem is therefore vital to all serious SMEs that not only seek to avoid losses and succeed in the industry but also that seek to satisfy the needs of their consumers.

The study will also focus on the Hajj season, as this is the time when the industry faces demand uncertainty as a result of many customers from different parts of the world with different expectations concerning the taste and quality of food, and how it is served.

1.4 Research Question

How can SMEs in Saudi's food sector in Hajj mitigate demand uncertainty against similar and dissimilar firms operating in the sector through the adoption of managerial strategies, including supply chain integration (SCI), postponement practice (PP), and mass customisation capability (MCC)?

1.5 Research Aim and Objectives

The aim of this study is concerned with exploring how SMEs in the food sector can mitigate demand uncertainty in an effort to increase their sustainability and competitiveness against similar and dissimilar firms operating in the sector through managerial strategies by identifying the relationship and, accordingly, examining and validating the impact of supply chain integration (SCI), postponement practice (PP) and mass customisation capability (MCC) on mitigating demand uncertainty (DUM).

The purpose is to establish how all of these factors reduce costs, long lead times, provide good service levels, avoid quality problems and accordingly satisfy customers through quick responses to demands.

In order to achieve this, the following objectives will be explored:

1. To conduct a systematic review of the relevant literature in order to identify the relationship between internal integration, customer integration, supplier integration, integration, postponement practice, mass customisation capability, and demand uncertainty mitigation.

2. To develop a theoretical model that establishes the effect of supply chain integration (SCI), postponement practice (PP) and mass customisation capability (MCC) on demand uncertainty mitigation (DUM) under high competitive intensity.

3. To empirically assess and validate the conceptual framework and hypotheses with a number of SMEs in the food industry during Hajj

1.6. Research Gaps

Supply chain uncertainty is one of the issues which every business manager struggles with, stemming from today's global supply networks that are quickly becoming increasingly complex (Simangunsong, 2011).These complexities include increased potential for quality problems, as well as delivery delays. Such uncertainties characterising complex networks are a vital problem and therefore important to understand. Whilst extensive research has been conducted in an effort to identify the specific factors giving rise to supply chain uncertainty, most have focused on the manufacturing processes and supply-side processes, leaving demand-side uncertainties (end-customer, demand issues) under-researched (Simangunsong, 2011).

Research on the mitigation of demand uncertainty amongst SMEs is also scarce. Many sources of demand uncertainty, as well as mitigation through supply chain management, have not received sufficient attention (Simangunsong, 2011). Specific research on SMEs in the food industry that operate during Hajj season in Saudi Arabia is yet to be conducted; however, this is a key area significantly contributing to the economic growth of the Kingdom. Studies show that demand uncertainty is the most severe type of uncertainty in the supply chain, resulting from volatile demand and inaccurate forecasts (Currie &Shalaby, 2011). Volatile demand and inaccurate forecasts are likely to characterise SMEs that operate in supplying food during the Hajj season, yet studies on how such firms manage these risks are non-existent (Currie & Shalaby, 2011). Accordingly, this study will extend literature on management practices that can be used by SMEs in the food industry (in general, as well as in Saudi Arabia in particular) to mitigate demand uncertainty, hence filling the existing gap.

This study also observes another gap in the literature, as identified by Simangunsong *et al*. (2011), who recognise that, thus far, no attempts have been made to establish a comprehensive understanding of the various sources of uncertainty and how these can be brought into line with management strategies so as to improve supply chain performance. Lai *et al*. (2012) also recommends the need for future studies in exploring the influence of supply chain integration on manufacturing practices and strategies, such as modularity, product differentiation and postponement, which in turn have an effect on mass customisation capability development and the overall application of this strategy in a dynamic business environment. The objective of the current study is to fill these gaps in the context of SMEs in Hajj. This study will also form a basis for future research by identifying areas necessitating further inquiry.

1.7 Research Motivations

This study is motivated by the fact that SMEs in the food industry in Saudi Arabia face volatile demands and are likely to make inaccurate forecasts during the Hajj season as the volume of customers and their desires are difficult to predict. Based on the fact that demand uncertainty has the most severe effect on an organisation, there is a need to investigate how such firms can address demand uncertainty mitigation through supply chain management practices, allowing them to satisfy all customers visiting Makkah to attend Hajj, whilst simultaneously leveraging their performance. Besides providing insight on management practices that can be used by practitioners in the industry, this study is also motivated by the fact that previous studies focused on SMEs in Saudi Arabia – specifically on those operating in the food industry – are unavailable. The findings of this study therefore will contribute not only to practice but also to research and the overall body of knowledge on the mitigation of demand uncertainty through management

practices for SMEs in the food industry. Further, the study is also motivated by the need to provide recommendations to SMEs on how they can mitigate demand uncertainty during seasons of high customer demand.

1.8 Definition of Key Terms

Supply Chain Management: Wong *et al*. (2005) define 'supply chain management' practices as ways of managing integration and coordination of demand, supply, and their relationships, with the aim of providing customers with satisfaction.

Supply Chain Uncertainty: This term is recognised as broader than 'supply chain risk', and refers to uncertainties (risks included) that may arise at any point within the supply chain network (Simangunsong *et al*., 2011).

Supply Chain Integration: Lai *et al*. (2012) define Supply Chain Integration as the degree to which a firm strategically collaborates with its partners in the supply chain and accordingly manages inter and intra-organisation processes in an effort to attain the effective and efficient flows of information, services, money, products and decisions, with the goal of providing maximum value to its clients.

Postponement Practice: Can (2008) defines 'postponement' as the process of delaying product finalisation in the supply chain until orders from customers are received with the aim of customising products, as opposed to performing activities with the expectation of getting future orders.

Mass Customisation: Davis (1987) defines 'mass customisation' as a process where manufacturers tailor-make products to satisfy individual customer needs at the same prices as those of mass-produced items, whilst mass customisation capabilities are defined as the ability of a firm to offer a comparatively high volume of product alternatives for a comparatively large market that demands customisation without significant trade-offs in quality, cost or delivery (Lai *et al*., 2012).

Mass Customisation Capabilities: Lai *et al*. (2012) define MCC as the ability of a firm to offer a comparatively high volume of product alternatives for a comparatively large market that demands customisation without significant trade-offs in quality, cost or delivery.

Competitive intensity: Competitive intensity refers to the extent to which firms that operate within the same industry put pressure on one another and hence limit each other's profit potential. In markets where intensity is high, competitors try to market share and profits from each other which reduce profit potential for all organisations within the industry. Firms therefore have to develop and implement strategies that will enable them to obtain a competitive edge over the others (Abdallah *et al*., 2014).

According to Luhmann (2005), the competitive intensity of any organisation is affected by several supply chain factors. All of these factors help in demand uncertainty mitigation. Under supply chain integration, there is customer integration, supplier integration and internal integration. All of these affect the postponement practices and mass customisation capability. In turn, these help in the mitigation of demand uncertainty.

Demand uncertainty: Demand uncertainty is defined by various scholars as variations and fluctuations in demand (Chen & Paulraj, 2008; Lai *et al*., 2012).

Demand uncertainty mitigation: According to Amit *et al*. (2005), demand uncertainty mitigation can be defined as those actions reducing the adverse effects of the outcome of activities associated with the demand side of the supply chain.

1.9 Outline and Organisation of the Thesis

This thesis is organised into seven individual chapters. *Chapter 1* provides an introductory section, delivering an overview of the research problem, its background, the research question, aim and objectives, its scope, the gap it seeks to fill, and the general motivation for its undertaking. It also defines the key words to be used in the thesis. In a nutshell, this chapter provides insight into the nature of the research and how the study will be conducted.

Chapter 2 provides a literature review, with emphasis placed on discussing existing literature relating to demand uncertainty and how supply chain management practices can be used in order to ensure its mitigation. The section reviews previous studies and findings on how management practices, such as supply chain integration, postponement and mass customisation capabilities, can be used in demand uncertainty mitigation. Studies discussing the relationship between these practices are also reviewed. Moreover, this section identifies existing gaps in previous studies and explains how the present study seeks to fill them.

Chapter 3 discusses the theoretical framework. In this section, the theories and concepts guiding the study, and from which the study is developed, are discussed. The contingency theory and the resource based view (RBV) theory, along with their application in supply chain management, are

considered. The contingency theory suggests that the most appropriate management strategy, in a particular context, depends on a set of contingency factors, possibly including uncertainty of the environment, whilst RBV suggests firms can gain sustainable advantage by developing and acquiring infrastructural resources, as well as knowledge-based capabilities that are difficult for competitors to replicate. This section discusses how the two theories complement one another in explaining organisational performance. The adequacy of the contingency theory and resource based view theory (RBV) in management decisions regarding strategies for improving firm performance is discussed and related to supply chain practices, namely supply chain integration, postponement practice and mass customisation capability in mitigating demand uncertainty. A conceptual framework illustrating the relationship between the main constructs is also highlighted and hypotheses are developed based on the framework.

Chapter 4 outlines the methodological framework and research paradigms used to conduct the study. This section also provides justification for each method adopted. Methods used for data collection, including survey questionnaire, semi-structured interviews and archive data/ literature review, will be illustrated. The sample selection process will also be described, along with analytical procedures for both qualitative and quantitative data.

Chapter 5 covers analysis and presentation of data collected empirically using the survey questionnaire and the interviews. Data analyses from the interviews are presented and used to validate the theoretical model. The data collected using questionnaire instruments are screened and various constructs are tested for validity and reliability using exploratory factor analysis (EFA). The descriptive statistics of the research constructs, as suggested in the measurement mode using SPSS software are also summarised in this section. Finally, this chapter presents the

findings of the partial least square-structural equation modelling (PLS-SEM), exploratory factor analysis, and confirmatory factor analysis as well as results of hypotheses testing using smart-PLS. Control variables are also tested as well as the mediating effect, explained under this section. Subsequently, this chapter will discuss the results of hypotheses testing and the implications drawn from hypotheses testing.

Chapter 6 portrays the validated model, and discusses the hypotheses testing by comparing the results and justifying the insignificancy of some relationships. This chapter also provides an in-depth analysis of how exactly demand uncertainty can be mitigated through adoption of supply chain strategies using Saudi's food SMEs during Hajj as the study context. The chapter provides a candid and more detailed discussion by assessing the information gathered through secondary research in the literature review and from primary data collected through interviews and surveys. It will provide a synthesis of the information that is gathered through primary and secondary data collection with the aim of attaining the objectives of this study and provides answers to the research questions.

Chapter 7 will present a summary of this study and draw conclusions, based on findings from testing the research hypotheses. This chapter of the thesis serves to reaffirm the thesis made in this study, provides a brief description of the findings made by the Research, elaborates how the researcher arrived at the findings and conclusions made, describes the potential influences and limitations of the research and identifies areas that further researchers can focus on.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The aim of this chapter is to review existing literature on the topic so as to enhance understanding, establish what previous researchers found, the methodologies they used and the existing gap that the present study seeks to fill. The review will cover the issues already addressed in the introductory section. This will be achieved with consideration of the various literature available on mass customisation capabilities, supply chain integration and postponement practices and how these are associated with mitigation of demand uncertainty in manufacturing organisations. The study would have preferred to review only those studies conducted on food SMEs but unfortunately, research that specifically examines demand uncertainty mitigation in food SMEs is very scarce. Hence, the review considered various studies in spite of the industry they focused on as long as it was manufacturing. However, priority was given to those studies that focused on the food manufacturing industry. The literature review focused on studies that have explored demand uncertainty mitigation through supply chain management practices and particularly MCC, PP and SCI.

To obtain relevant articles and materials, a list of key words was prepared and typed into various online libraries in order to obtain the articles. The databases used were BURA and Google Scholar. The review considered studies conducted on SMEs in the food industry that operate during Hajj and particularly those in the food manufacturing and supply sector. Particular focus was placed on peer-reviewed articles and those published within the last 10 years so as to avoid using outdated information. In the event where articles published after 2005 could not be

obtained, older articles were considered because this topic has not been widely studied. The list of key terms used to search for the articles included:

- Hajj, pilgrimage, religious tourism.

- SMEs, Saudi SMEs, Saudi SMEs Catering, food SMEs food suppler, SMEs food supplier, SMEs food SC, SMEs SCI.

- Food supply chain, SC catering.

- Supply chain uncertainty, food manufacturing.

- Demand uncertainty mitigation.

- Lean Manufacturing

- SC agile, Legality.

- Managerial practices.

- Internal integration, customer integration, supplier integration.

- PP, MCC

- SCI types enabling MCC, enabling PP.

The literature review is structured as follows:

The review starts by providing a background on Al Hajj so that the reader understands what the Hajj pilgrimage is and what it involves. The second section discusses the food industry in Saudi Arabia during the Hajj season. The structure of the industry and the mechanism SMEs in the industry use to select catering materials presented to pilgrims are discussed. The third section discusses SME development in Saudi Arabia and provides an overview of the factors that influence the development of SMEs in the country and the supporting systems put in place. The

fourth section discusses supply chain management, in general, and what it entails. The review then goes on to discuss management practices adopted by firms and how they relate to the success of supply chain management particularly in the manufacturing sector and with some specific studies on food. The sixth section reviews literature on supply chain uncertainty. The review in this section also examines the different types of uncertainty and includes studies that discuss strategies used to cope with and to mitigate uncertainty in supply chains. The seventh section discusses literature on demand uncertainty. The causes of demand uncertainty and strategies for reducing this type of uncertainty are discussed in depth. The eighth section discusses the specific managerial practices used for mitigating demand uncertainty. This section discusses supply chain integration, postponement practices and mass customisation capabilities and their associated concepts in detail as managerial strategies used to control and mitigate demand uncertainty.

Various studies are reviewed and their weaknesses are identified. The existing gap in the literature that the present study seeks to address is identified and explained.

2.2 Background of Al Hajj

According to Long (2012), approximately two million Muslims perform the great Pilgrimage to Makkah (Hajj) each year. Moreover, around 58% of Hajj Pilgrims are from overseas, representing different tastes, needs, expectations and demands, especially in terms of food (Kaysi *et al*., 2010). The Hajj season accounts for approximately 70% of Makkah's total annual revenue and further accounts for approximately 3% of Saudi's GDP. Saudi Arabia gained a reported $16.5 billion from religious tourism in 2012. By 2030, it expects to witness an increase in the number of visitors at Makkah city during pilgrimage by 40% (Zuhur, 2011). The religion

requires all Muslims visit once in their lifetime, as long as they are mentally, physically and financially able. For this period, the Saudi government is required to ensure that all pilgrims have adequate housing (usually tents), food, health, water, sanitation, public safety and security, as well as ground transport (Long, 2012). This author reports that Hajj has significant administrative, social, political and economic impacts on Saudi Arabia. However, the present study will mainly focus on the economic impact of the Hajj.

Long (2012) explains that, prior to the discovery of oil, Hajj acted as the economic backbone of the KSA. With the vast oil wealth and the revenues generated as a result, however, the Saudi government is no longer dependent on revenue from Hajj. However, Hajj remains a major source of income for the Kingdom's private sector. Long explains that, besides the Hajj service industry, Hajj also is a major season for the consumer industry as well, similar to the Christmas season in western countries, such as the United States and the United Kingdom (Zuhur, 2011). Those celebrating Hajj, particularly from developing countries, buy items that are not available or are highly taxed at home, including luxury items, such as jewellery and perfumes, as well as medicines. Hajj also creates employment for young Saudis, such as the young men who are usually trained and hired to accompany the Hajjis as they make the sacred journey (Long, 1979).

The impact of Hajj on the private service industry is the most significant factor. According to Long (2012), Hajj administration, for many centuries, was controlled by ancient, family-organised associations that arranged food, transportation and lodging, and also guided the Hajjis (Pilgrims) through the religious rites and guided them to Al-Madinah. Since Hajj was recognised as the backbone of the Kingdom's economy, the guilds took advantage and charged the pilgrims whatever they could bear (Long, 1979). However, the Saudi government, which is the

responsible custodian of the two Islam holy places, took this responsibility very seriously, and now strictly regulates what guilds charge in an effort to ensure Hajjis (pilgrims) are not overcharged. Presently, the guilds function more as public utilities. The responsibility of providing Hajjis personal care now rests with the Mutawwifs; in essence, they act as religious tour guide agencies for designated nations of origin. They look after the Hajjis from the time they leave for Saudi Arabia to the time they go back home again (Long, 2012).

Besides the guilds, the Hajj service industry has grown to include other private sector enterprises that provide catering services, transport and accommodation. This study is focused on SMEs that provide food services and how they manage demand uncertainty through management practices of supply chain.

2.2.1   Hajj (Pilgrimage)

Currie and Shalaby (2012) state that Hajj takes place over a period of six days, spanning the 8th to the 13th day of Thul-Hijjah (TH); consequently, the 12th and the last month of the Islamic calendar. According to this article, we see that Umrah—the lesser pilgrimage, as they term it—constitutes visiting the Grand mosque only, and can be done at any time of the year. Pilgrims can choose to conduct their Umrah separately or collectively with the Hajj. It is noted that the times for Umrah are mainly before Hajj and during Ramadan, which normally occurs two months before Hajj.

The Research by Currie and Shalaby (2012) also identifies that, within the period of Hajj, a good number of people in Makkah are normally visitors, constituting a population of approximately 4.2 million or so in some years, with Hajj people known to travel more than residents. The

authors state that research shows that most Hajj pilgrims travel in groups, which are basically known as Hamla (campaigns). The Hajj pilgrims travel with a selected guide managed by their home region, together with managed accommodation. Similarly, it is concluded that, since Umrah occurs throughout the year, it is not that strict. The research also elaborates that Umrah is carried out continuously, thus experiencing its peak during Ramadan.

2.3 Food Industry During the Hajj Season in Saudi Arabia

The great pilgrimage to Makkah, the holy city of followers of Islam, is regarded as Hajj. Considered as an essential and traditional visit for all believers of Islam, the Hajj is one of the five pillars of Islam. It is mandatory for all believers who are physically, mentally and financially capable to visit at least once in their lifetime. Accordingly, each year, millions of Muslims perform the Hajj in Saudi Arabia (Long, 2012). As stated previously, Saudi Arabia secured $16.5 billion revenues from Hajj in 2012, representing 3% of its GDP. Given the worldwide participation and its sheer size, consistent food supply is one the fundamental essentials during the period of the Hajj season (Rashid, 2012). Saudi authorities forbid perishable food items, and allow only limited quantities of packaged and canned food into the country. A variety of fruits and dairy products, along with water, are widely available across Saudi Arabia during the Hajj season, with the exception of poultry and other meat products (Mousa, 2013). Hundreds of kitchens are spread across Mina and distributed amongst the tents hosting the pilgrims (Information Office, 2013). The pilgrims also rely on restaurants and other catering companies for their meals. Food is sourced via domestic/ local and/ or foreign channels through a well-connected market structure (Mousa, 2013). The diagrammatic representation of the Saudi food

service industry is outlined in Figure 2.1, which is exclusively adapted with slight modifications from the flow chart devised by Mousa (2013).
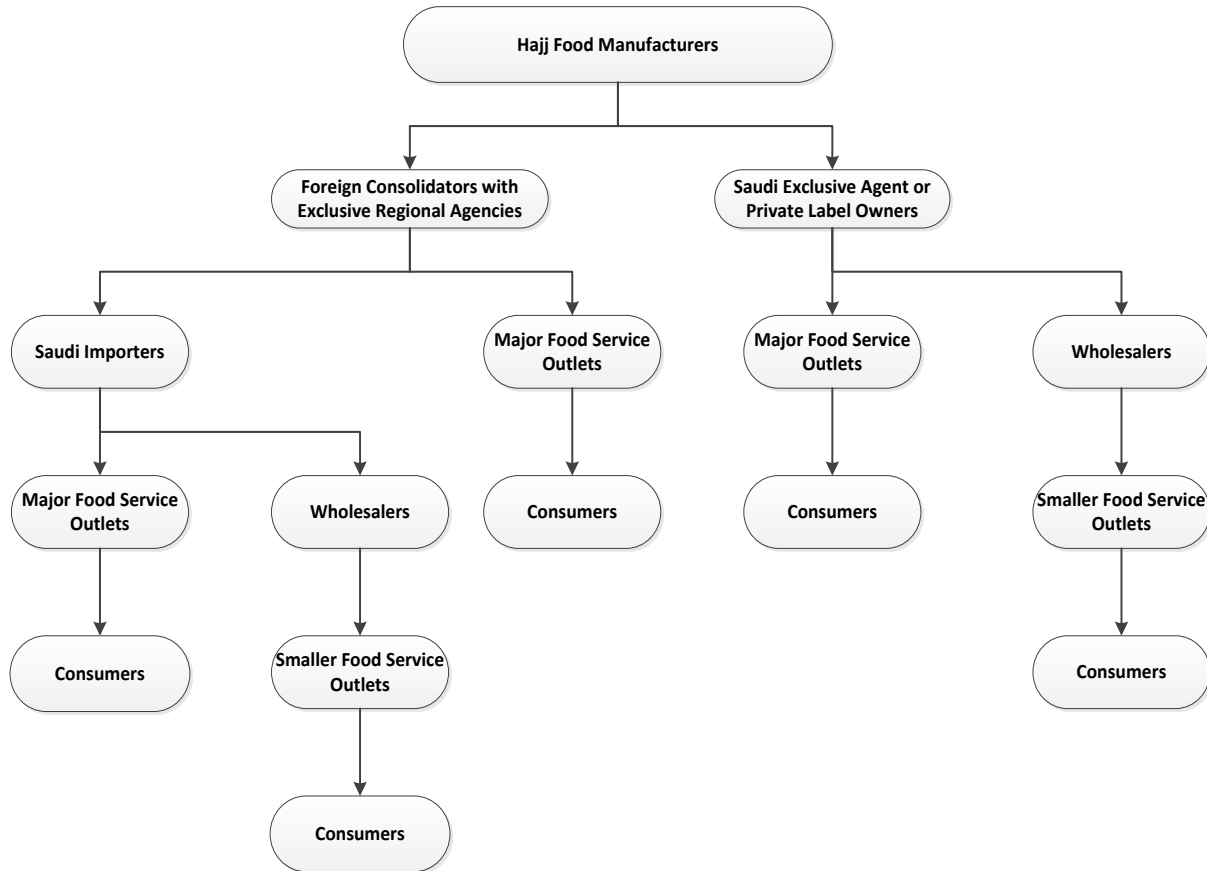
Figure 2.1: Diagrammatic representation of Saudi's food service industry. Adapted from (Mousa, 2013)

The figure above is a diagrammatic representation of Saudi's food service industry and is a slight modification of Mousa's (2013) flow chart. The figure shows that Hajj food is manufactured by both foreign and Saudi agents. Food from outside Saudi is imported by Saudi agencies from exclusive regional agencies who then distribute it through the major food service outlets and wholesalers. The smaller food service outlets then buy the food from these outlets and wholesalers and prepare it to be sold to the consumer. The chart shows that the chain begins from

the manufacturers who may be local or foreign and then flows down through the importers and food service outlets before it reaches the consumer through the smaller food service outlets.

2.3.1 Mechanism of Selecting Catering Materials Presented to Hajj and Pilgrims (Mutamers)

According to the study conducted by Asem (2010), 61 percent of the catering companies were found to be the providers of the catering materials. A larger percentage (about 69 of the providers of the catering materials) rely on the mechanism of previous experience in approximating the demand of goods throughout the Haji season. The mechanisms presented in selecting the catering materials were mentioned by Asem. First and foremost, the relevance of consumer meals focuses on the Haji that comes from southern Asia since they represent the greatest number of Haji that traverse corporation locations in Arafat and Muzdalifa. The second mechanism is that meal taste should be excellent as well as not affected by the process of storage and re-preparation. Thirdly, the technique of preparation as well as presentation should be suitable and simple owing to a shortage of high facilities at the locations of presentation in the Holy Shrines. Lastly, the meal ingredients should be compliant with the law of Islam according to material quality as well as slaughtering method. It is for this reason that the Haji and Mutamer's excluded the products from India and China.

In addition, Asem (2010) mentions that the meal is tasted then gradually introduced in the programmes of Haji in terms of the extent of satisfaction of the Haji regarding the meal, since Haji and Mutamer estimates consumer satisfaction through the authorities concerned. The Haji and Mutamer's gift also examines and notes down the remarks of Haji concerning each and every service of the charitable foundation.

Similarly, the study undertaken by Asem states that Haji and Mutamer's distribution of charitable meals is conducted amongst the pilgrims found at the reception as well as the points of departure at the Holy Makkah borders. Moreover, the study also mentions that Arafat and Muzdalifa fixed locations of distribution of meals are believed to be amongst the distinguished sites since they hold tables and seats that are sufficient for the provision of food for a capacity of about 450 pilgrims and around 9600 meals served in one location. Besides the fixed locations or rather sites, there are fridges to enable distribution of the meals to the pilgrims who are along the routes. In addition, announcements are also made to show the meals as well as their types in numerous languages.

Similarly, Asem goes on to state that meal weight ranges from 250 to 300 grams and is sufficient to feed the pilgrims and that every meal is boneless, all meal contents are consumable hence there is minimisation of lost parts as well as waste. The author notes that meals cost 2 US dollars or more till it finally reaches the consumer. On the other hand, Asem (2010) notifies us that large containers are available near the restaurants where waste deposits take place. Transportation of the waste is then done to the compressor, creating awareness that there is little general waste volume due to the fact that the meals simply require hot water for preparation and desalinated water is not needed.

Despite the huge efforts that have been enacted to realise a Haji season free from barriers, the study conducted by Asem (2010) reveals that incidents of food poisoning have still been prevalent. For instance, about 570 incidents of food poisoning had been identified in a year in locations of Makkah Al-Mukkarramah as well as the Holy Shrines. According to Asem, most of the prevalent meals suspected to contain food poisoning include animal origin foods, like meat,

egg and liver and plant origin foods such as vegetables and rice. It is asserted that meals ought to be preserved at certain temperatures to do away with microbe proliferation. For this reason, Asem explains that a new technology has been identified in keeping the cooked meal. The meal is prepared and kept in special bags made of bronze and air is then sucked out of the bags, therefore the food can be stored with no storage conditions since it can be stored in ordinary temperatures. The food eventually becomes excellent for eating for a duration of one year from the production date. Similarly, Asem argues that the food does not require to be cooked more than four times through putting the food together with its bag in hot water. The food is eventually taken out and hence is ready to be eaten. According to Asem, the meal consists of seven items, that is; chicken pieces, minced meat, cocktail of vegetables, rice and chicken, rice with vegetables, chicken and rice with meat kufta. Research studies indicate that by observation, ready meals are in high demand and readily accepted by pilgrims in large numbers. Therefore, this has caused the Hajj and Mutamers to increase the quantities of meals to be imported to around 90 thousand throughout the pilgrimage season.

2.4 SME Development in Saudi Arabia

According to Otsuki (2009), the Kingdom of Saudi Arabia needs to provide its young population, which is expected to reach 30 million by 2020 (Statista, 2015), appropriate job opportunities. Otsuki notes that development of SMEs is one way through which this can be achieved. It is important to recognise that there is no consensus definition for the term SMEs. However, most countries like Saudi Arabia use different parameters and factors to define SME. These descriptive parameters include annual sales turnover, amounts of capital, and number of employees. Shalaby (2012) defines small enterprises as those firms that have up to 25-90

workers, whereas medium enterprises are those with 91-190 workers, as provided by the Chamber of Commerce and Industry (Shalaby, 2012). According to this definition, both small- and medium-sized enterprises must have a capital of less than 15 million Saudi riyals. Furthermore, the Saudi Arabian General Investment Authority (SAGIA 2010) stated that, the implemented and applicable definition of SME was founded on the following factors: Small-sized enterprises: 30 – 100 employees, and medium-sized enterprises 101 – 200 employees.

The global economies' increased liberalisation during the past decade has had a significant impact on the expectations of customers and on competition for local and foreign business entities, hence paving the way for opportunities of SMEs (Amosalam, 2008). According to a report by Capitas (n.d), SMEs in Saudi Arabia are the key to unlocking its economy's vast potential.

Alarape (2007) reports that there has been a growing and increasing interest in Saudi's small business sector throughout the last decade. These authors attribute this growth to economic liberalisation policies implemented by the Saudi government in compliance with the requirements of the World Trade Organisation. According to Bundagji (2005), small- and medium-sized enterprises (SMEs) form up to 90% of Saudi's private enterprises. They are the major source of the Kingdom's private sector investment, and as such, form the primary source of employment, alleviate poverty, develop new products, promote the innovation of new technologies, encourage entrepreneurial culture and are expected to contribute more than 50% of Saudi's total industrial production in the near future. However, Al-Awwaad (2007) observes that, in spite of their importance, the development of SMEs in Saudi Arabia remains slow with a high failure rate. Studies claim that up to 80% of SMEs in Saudi fail within their first five years,

whilst 16% of the remaining ones fail within the following five years, thus implying that 96% of SMEs in Saudi Arabia fail within the first 10 years of their establishment. The report further explains that, although SMEs have a strong footing in the Kingdom owing to the fact they form 90% of all businesses, their contribution towards GDP remains low. This is an area of concern into which research should be conducted in order to establish causes of failure and how these can be prevented. The current study contributes to this by exploring ways through which SMEs can manage supply chain uncertainty.

2.4.1 Factors Influencing the Development of SMEs in Saudi

According to Otsuki (2002), SMEs make up a large part of entire business entities worldwide, and are one of the most significant drivers in the national economy. The author states that SMEs in Saudi Arabia also are expected to play a significant role in the nation's industrial and economic growth. These firms are however influenced by various factors that inhibit their growth. In his discussion of challenges that face SMEs in Saudi Arabia, Shalaby (2012) identifies inability to gain financial access as the main challenge, and further identifies dependence on foreign resources—particularly foreign manpower and technicians—as a disadvantage not only to the firms but also to the locals as they do not benefit from new jobs created by the firms.

Limited market skills are also another limiting factor contributing to the failure of SMEs in Saudi. According to Shalaby, most Saudi SME managers do not have formal training in marketing or in product distribution; thus, they are unable to take advantage of economies of scale in their operations, hence the tendency to undergo high costs. The study also found that most SME managers in the manufacturing sector are not the owners, whilst entrepreneurs were

found to manage their own enterprises. This study established a lack of commercial knowhow, legal status, feasibility study, exhibitions and training needs assessment as other areas requiring focus in order for SMEs in Saudi to be more successful (Shalaby, 2012). According to Darling *et al*. (2007), the major factors influencing the development of SMEs include finance, operational setbacks, the existence of good quality staff, limited communication with regulatory authorities, such as national chambers of commerce, and necessities on the regulatory operations of SMEs. Darling *et al*. (2007) suggest that regulations and procedural requirements involve additional business costs for SMEs. This eventually influences SMEs in terms of development due to costs, and may push them to informal sectors, which, as a result, also deters economic growth.

However, it is presumed that governments have come up with programmes and measures in an effort to try and trim down the influence of finance on the growth of SMEs. In an attempt to salvage SMEs in the Kingdom, the Saudi government formed the SMEs Development Centre (SMEDEC) in 2004, and later in 2006, the National Competitive Centre (NCC) (Shalaby, 2012). According to Shalaby, the goal of the SMEDEC is to support initiatives that focus on improving the overall competitiveness of SMEs using members of the Commerce and Industry Chamber. Another government support initiative in support of entrepreneurs in Saudi Arabia is the Saudi Industrial Development Fund (SIDF), the objective of which is to support the development of the Kingdom's industrial sector through funding. A review of the sector by the NCC indicated that entrepreneurial activity in the Kingdom was low to the extent that the government's goals of increasing the role of SMEs in the economy were not going to be achieved (Al-Awwaad, 2007). Given the important role of SMEs in Saudi and the fact that their development is slow, and that failure is very high amongst them, the current study significantly contributes to reducing failure

by providing empirical evidence on how uncertainty can be mitigated—particularly in the supply chain and on the demand side.

2.5 Supply Chain Management

Christopher (2005) regards supply chain as a link of networks, involving several companies operating across different processes that end up producing value in the form of services and products for their customers. Through this definition, upstream and downstream linkages prominently feature as the necessary elements of the supply chain to work properly. According to Mentzer *et al*. (2004), supply chain is a set of three or more entities that are directly involved in the flow of products, information and finances—on either an upstream or a downstream basis. Krajewski *et al*. (2007) give an alternative definition of the supply chain, considering this as the set of links involving suppliers of materials and services. They describe it using the diagram illustrated in Figure 2.2. According to this diagram, the supply chain involves every aspect associated with a product or service and starts with the suppliers of raw materials, the components, the manufacturers, retailers and ends with the consumer.
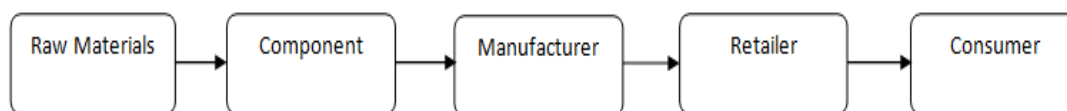
Figure 2.2: Generalised Supply Chain Diagram. Source (Krajewski *et al*., 2007).

According to Krajewski *et al*. (2007), the link spans from the transformation of raw materials into services and products. For purposes of clarity, this thesis adopts the definition provided by Hult *et al* (2010), which states that the supply chain consists of interdependent companies acting together in order to control, improve and accordingly manage the material, information, product

and service flow from the point of origin to the point of delivery. The main aim of the linkages is to provide satisfaction to the needs of customers whilst also ensuring all involved incur the lowest possible costs. According to Lambert and Cooper (2000), supply chains are different and vary from one company to another. A company manager may look at his firm as the main point of the company. This point of view is important because one company can belong to several linkages of the supply chain. Therefore, it becomes essential that the company understands its point of focus. Mills *et al.*, (2004) and Huo (2012) identify with this point of view.

According to the authors, four perspectives should be adopted whilst examining the supply chain, including upstream, downstream, dynamic network and static network. When adopting the upstream point of view, the purchaser needs to manage the relationship with the supplier. The downstream point of view indicates the need for a supplier to supply the customer with the correct product. Essentially, there are circumstances where the managers adopt the auditor role in the supply network. This is the static network, which typically comprises the analysis of the supply chains in which the company is involved when doing business. In a dynamic network, the manager works as a strategist: he/ she looks for opportunities that can help to improve the position of the company in a network that already exists. Dynamic systems help in the creation of a strategic and long-term view. This set is prone to changes, where delivery frequencies and inventory levels can be changed (Angerhofer *et al.*, 2000; Ramanathan, 2013). It should be noted that, despite the fact that all approaches to defining and analysing supply chains have been clearly explained, there is a lack of consensus in regard to how the state of the supply chain should be defined. Different authors have attempted to give their own definition. Kelton *et al.* (2003), for example, look at the supply chain state of a system as a snapshot showing all relevant details. In considering the purpose of this thesis, the definition provided by Carvalho *et al.*

(2012) can be adopted. This definition approaches the state of supply chain as a specific arrangement of the entities of supply chain and the related links dealing with information flows, management policies, product cost, quality, lead times and performance level.

An examination by Li and Schulze (2011) indicates that an understanding of the various elements of the supply chain is needed if one is to develop the best strategies in their management. They begin their research by introducing the various aspects of the supply chain, which involves raw materials, unfinished and finished products. They state that it is a process that starts with the suppliers, and progresses to include the manufacturing plants, distribution centres and, finally, retail stores. This is in line with the definition provided by Lambert *et al*., (1998), although Li and Schulze (2011) argue that, in developing management strategies, there is a need to consider all factors that affect the different areas of the supply chain.

The study carried out by Li (2008) adds to the definition of the supply chain; this is by defining it as a logistics network. Previous texts have looked at logistics networks as part of the supply chain (Li, 2008). Li considers that influencing factors that determine the logistic network would lead to better service for the customer. They provide a summary of researches that have been written in the past on the subject. The research by Li and Schulze (2011) provides various significant time frames through which there have been developments in the way in which network designs may be done. Their consideration to past research on the subject provides the ability to show that, over time, there have been simplifications made in terms of the assumptions made of the supply chain. This has made it simple to implement the strategies suggested under the logistics network (Li & Schulze, 2011).

Liu and Schulze (2011) contend that, in creating a flexible network, a company is able to better mitigate the risk factors accompanying uncertainty. In looking at the network of the supply chain, the most suitable strategy proposed is looking at the performance of different characteristics within the supply chain; this will be dependent upon the specific industry and the goals to be achieved by the company. The research by Liu and Schulze further points to the fact that, companies seek to gain a competitive edge over rivals through the management of their supply chain. This is a factor that has been identified in numerous other texts (Van Weele, 2005). Vijayasarathy (2010) also considers the issue of the supply chain and how it may be managed. This study adds to the knowledge presented by Li and Schluze (2011) by considering the supply chain as a constituent of many different dimensions. Vijayasarathy further argues that supply chain management should involve the management of each of these dimensions. It also adds to the discussions by introducing what is referred to as 'supply chain integration'. This factor will be discussed later on in the literature review. The discussions are presented by a consideration of data from 276 firms (Vijayasarathy, 2010).

The study's consideration of the different dimensions of the supply chain provides a different look at how best supply chains can be managed. The presentation by Vijayasarathy (2010) provides a more in-depth understanding of the supply chain; this also aids in understanding the different strategies that may be applied in the management of supply chains. Vijayasarathy further provides evidence from previous researches that have looked at the subject of supply chain management, with the author further demonstrating that each of the studies reviewed has idealised the supply chain as a combination of various factors. Vijayasarathy has also created one point in terms of integration that would require further study, which is in terms of the curvilinear relationship between integration and company performance. One area in which the study by

Vijayasarathy falls short relates to the use of a limited number of respondents in the development of the conclusions. In the study, the response rate was that of 9%, compared to the higher rates of 15% -20% documented in other research methods (Vijayasarathy, 2010).

2.6 Management Practices

Lambert *et al*., (1998) are some of the authors who have written in the area of supply chain management. In their work, they state that the success of supply chain management depends on the ability of individual companies in the network to overcome their recession and accordingly adopt an approach that is a process in nature. According to the study review conducted by Mentzer *et al*. (2000), supply chain management is looked at as the systemic and strategic coordination of the traditional functions of business and the tactics used across the businesses within particular companies. Wong *et al*. (2005) define supply chain management practices as ways of managing integration and coordination of demand, supply, and their relationships, with the aim of providing satisfaction to consumers. This satisfaction should be carried out in an effective and profitable manner. Supply chain practices have to be aligned with supply chain strategies; these are those that become paramount in mitigating the demand uncertainty effects during peak times (Cohen & Roussel, 2005).

In the study of the management of the supply chain, Li *et al*. (2005) chose to investigate the differences in the management of supply chains across different companies. Examination was carried out from the perspective of the competitive advantage firms, as has been done before by other studies (Wolf, 2008). The research developed knowledge on the issue of how a given supply chain can be managed. Li and his colleagues were able to identify six major supply chain management techniques, which included strategic partnerships with suppliers. This was where

the company seeks to form long-term working relationships with their suppliers. The other was in the building of a good relationship with the customer so as to ensure a long-term and satisfactory relationship. They identified the need to understand the extent to which information is shared with suppliers. There is also the need to consider the quality of information. Companies might practice lean internal operations where wastage is kept to a minimum. There is also postponement involving the moving forward of certain operations. The study involved examining 196 organisations to which structural equations were modelled in order to validate the theories developed (Li *et al*., 2005).

Li *et al*. (2005) identify the reasons of leading companies to consider the management of supply chains. They show that the management of supply chains by companies was a response to their need to improve the performance of the company and similarly improve the supply chain. They identify that, despite the recognition by a company executive concerning the importance supply chain management has on performance, the implementation and adoption of these strategies are poor. This was attributed to the complexity of supply chain management, a factor attributed to playing an influential role in the strategies applied (Gattorna, 1998). A notable aspect of the study conducted by Li *et al*. (2005) can be seen in terms of its ability to develop a conceptual framework using research that had been written earlier. This is considering that these previous research considered only specific elements of supply chain management. Therefore, the research is able to connect upstream, internal and downstream supply chain points (Li *et al*., 2005). The authors state that the findings of the research will be used in the development of future research, especially concerning the connection that supply chain management has to other business areas. Li *et al*. (2005) conclude their study by considering the idea that the scope covered in the research is limited in terms of the measures applied in their study of the measurement of the

management of supply chains. Accordingly, they call for future research to include more measures. It also identifies the various industries in which different supply management techniques may be applied (Li *et al*., 2005). In their examination, they are able to identify certain factors that may be considered mitigating factors in the application of the certain management techniques to the supply chain. A noteworthy limitation in their research is that it sought response from only one respondent in a firm rather than from multiple respondents—a factor that has many limitations, including the fact that the information may not be collaborated (Bajpai, 2011). Qi *et al*, (2011) extend this analysis with consideration to the relationship apparent between the strategies a company implements and how this is influenced by the external uncertainty faced by the company. In their examination, they chose to use 604 questionnaires, which were distributed amongst Chinese firms. Their research classifies strategy into three major categories, namely differentiation, cost leadership and focus. This follows early thoughts in management that identify these as the major strategies companies can adopt in maximising their returns (Schermerhorn, 2010). The study by Qi *et al*. (2011) further indicates and contributes to the growing number of evidence emphasising the company's need to be competitive as the guiding principle behind the need is to manage supply chains. Qi *et al*. (2011) contribute to the discussions by indicating that supply chain management largely involves two main strategies of being lean and agile. Any company therefore would need to undertake an analysis based on contingency theory, in line with which best suits their needs (Qi *et al*., 2011).

Qi *et al*. (2011) state that conceptual framework is a hypothesises where the environment impacts on the supply chain strategies and competitive strategies adopted by companies to improve their business performance. They tested this framework using empirical measurements which created a connection between theoretical knowledge and the practical knowledge on the

subject. By so doing, they were able to argue the findings in the research in a much better way as suggested by (Zikmund, 2013). Another strong point for this study is that it conducted an analysis across different regions of the Chinese market, where the large number of respondents lends both external and internal validity to the data collected. This is from the realisation that the year of the research was during a time when China played an important role in world trade, as well as the fact that most of the companies in China directly or indirectly have an influence on the supply chain of most of the world's companies (Coyle & Coyle, 2009).

The research written by Qi *et al*. (2011), however, offers only one side of the strategies undertaken in supply chain management by considering that the company will adopt a cost benefit approach. This excludes differentiation and focus as strategies. Differentiation is one of the approaches a company might apply when looking to mass customise. Hence, they conclude by indicating that future research will need to include consideration to this aspect (Qi *et al*., 2011).

Another side of the argument for the need of the management of supply chains is provided by Koçoglu *et al*. (2011) in their study. These authors contend that the need for firms to manage their supply chains arises from the integration of such supply chains. According to authors, the integration of supply chains leads to a need for better communication, both within and outside the supply chain. In order for this to work best, there is the need to manage the supply chain so as to achieve the best communication structure within it. This is a different argument to that given in most texts that look at integration as a management strategy requiring effective communication to be effective (Dam & Skjott-Larsen, 2006). This integration involves both internal and external concerns of the supply chain. The study by Qi *et al*. (2011) came with the

realisation that this has been an area in which minimal research has been conducted in the past. As a result, the scholars sought to build a relationship between supply chain integration, information sharing and the performance of the supply chain. The study is carried out using empirical evidence from 158 manufacturing firms in the Turkish region (Koçoglu *et al*., 2011).

In their research, Koçoglu *et al*. (2011) argue for integration as a means of achieving competitive advantages similar to most other researchers. The researchers' opinion is that this advantage is provided by cutting down turnaround times on products, with the researchers further contending that the increased integration and sharing of information improves performance by allowing for effective use of resources and capabilities by the companies. The research was able to conclude that information sharing with suppliers, customers and within the firm was able to improve the relationship of all those involved, which had the effect of improving the company's performance overall. This is a factor that has been the focus of much discussion in previous texts (Yao & Song, 2001). However, the research has one limitation in that it has considered only specific environments and industries that limit the external validity of the data collected (Koçoglu *et al*., 2011).

A different research by Mikkola and Skjott-Larsen (2004) considers the management of supply chains with the use of three management techniques. These are customisation, postponement and modularisation. The research introduces the concept of information into the management of the supply chain. This is an aspect that may have been overlooked in most other research on the subject of managing supply chains. This is a role that is important in the management of supply chains (Mentzer, 2001), building on the concepts discussed by other researchers who have been considered in their studies. In the research, they argue that the increase in flexible production has

improved and been necessitated by the need to customise products. the same finding was established by Govindan *et al*. (2011), whereby increased outsourcing may be credited to the need to build relationships in the supply chain that would lead to better services for the customer (Mikkola & Skjott-Larsen, 2004). Importantly, the research of Mikkola and Skjott-Larsen (2004) provides an example of Dell computers where the integration of different supply chain management methods leads to success in different areas of the supply chain. The researchers indicate that the information played a vital role in the efficiency and working on this model, notably between Dell, the company and its suppliers. This exemplifies the application of strategies discussed that look beyond the empirical and theoretical evidence provided in other research. The research also has created a theoretical connection between postponement and mass customisation with the use of modularisation. Mikkola and Skjott-Larsen (2004) also look at how the application of these three strategies affect companies, and further contribute to the discussions on mass customisation by indicating that the creation of modular products improves the overall customisation process. Their research also indicates that, through this process, there is new information that is gained by the company. The research presents knowledge on the different kinds of customisation available in different literature and the different strategies utilised in customisation (Mikkola & Skjott-Larsen, 2004).

The study conducted by Mikkola and Skjott-Larsen (2004) is however characterised by one limitation in that it does not provide empirical evidence to back the models that have been developed in the paper. The developed model only looks at the effect of the management, but does not suggest the best practices. The other factor is that the simulation only considers the use of modularisation as the link between postponement and mass customisation, but does not consider some other strategies that may have had an influential role in the study. The paper

though has provided more information on the connections that need to be established in managing supply chains. These are with the improvements in communication that increases and eases the flow of information both within the organisation as well as with other elements of the supply chain (Mikkola & Skjott-larsen, 2004).

A summary of these studies indicates that the success of supply chain management depends on the ability of individual companies in the network to overcome their recession and adopt an approach that is a process in nature. This implies that that they must coordinate and cooperate to ensure success. These studies do not however examine uncertainties associated with demand and how supply chain management can be used to address such uncertainty.

2.7 Supply Chain Uncertainty

The term 'supply chain uncertainty' is sometimes used interchangeably with 'supply chain risk'. It is, however, worth noting that the two terms have different meanings. Although some authors argue that the terms 'risk' and 'uncertainty' have different meanings (Hillson, 2006), others argue that the distinction is so minor that it is not necessary to distinguish between the two (Li & Hong, 2007). In situations where a difference is suggested as apparent, however, the key reason is associated with the type of outcome to be expected. According to Hillson (2006), risk relates to only issues that may result in negative outcomes, whereas uncertainty is associated with both negative and positive outcomes. 'Supply chain uncertainty' therefore is broader than 'supply chain risk', and refers to uncertainties (risks included) that could arise at any point within the supply chain network (Simangunsong *et al*., 2011, p. 44). This definition fits with that given by van der Vorst & Beulens, who define it as 'decision-making situations in the supply chain in which those making the decisions do not know what to decide as they are indistinct with regard

to objectives, lack information or understanding of the supply chain and its environment, lack information processing capability, are unable to predict with accuracy the impact of possible control measures on supply chain behaviour or lack effective control measures'(Simangunsong *et al*., 2011).

Current published literature on supply chain management tends to be too broad or focused on other areas of supply chain management, such as supply chain flexibility or performance metrics (Simangunsong *et al*., 2011). Although a number of studies recently have modelled quantitative approaches to managing uncertainty in the supply chain, reviews that adopt a broader look into sets of approaches to management of supply chain uncertainty remain scarce. Moreover, although extensive research exists on the area of supply chain risk, this study does not include important contributions to the uncertainty in the literature. Moreover, studies that attempt to identify and understand the various sources of uncertainty and how these can be brought into line with management practices so as to enhance supply chain performance are also scarce. Instead, previous research has adopted a broad approach towards the concept of supply chain management, and has focused mainly on supply chain risks, rather than uncertainty (Li& Hong, 2007; Hult *et al*., 2010). Others have investigated supply chain uncertainty in general, without delving the specifics of the types of supply chain uncertainty (Lai *et al*., 2012; Flynn *et al*., 2010). Demand uncertainty is regarded as the most common and severe type of uncertainty, whereas studies specifically seeking how it can be mitigated are lacking.

Supply chain uncertainty, according to Simangunsong *et al*. (2011), is a problem with which every manager wrestles. According to these authors, this uncertainty derives from the increasing dynamic and complexity nature of global supply chain networks, and further includes potential

delays in delivery, as well as quality issues. They emphasise that such uncertainties are important and should be clearly understood. This article argues that, although extensive research has examined the specific sources of uncertainties that are supply chain-related with regard to internal manufacturing processes, demand-side issues or supplier-side processes, there are other distinct sources remaining that have not received sufficient attention. In this study, Simangunsong *et al*. (2011) conducted a literature review through which they identified 14 sources of supply chain uncertainty, including the bullwhip effect, which has received much attention in previous research and those lacking in sufficient research, such as parallel interaction, which was only discovered recently. The study also analyses approaches and strategies to managing these sources of uncertainty. It identified 10 approaches that look to reduce uncertainty at the source, and 11 approaches that seek to deal with it, and thereby minimise its effect on performance. The study uses concepts of contingency and alignment to build up a model of supply chain uncertainty, which uses concepts from the literature review to demonstrate alignment between sources of uncertainty and management strategies.

In their discussion of strategies for managing uncertainties, Simangunsong *et al* (2011) classify these strategies into two main categories; 1- reducing uncertainty strategies which include any uncertainty management approach that enables firms to reduce uncertainty at its source, such as applying a suitable incentive or pricing strategy could reduce customer demand fluctuation, and 2- strategies for coping with uncertainty; these include all those strategies that do not seek to alter or influence the source of uncertainty but rather try to identify ways of adapting and therefore minimise the impact of uncertainty on the firm's performance. For example, firms may develop advanced forecasting methods that enable them to make better predictions of customer demands and hence reduce forecasting errors. In this case, whilst demand uncertainty is not

altered, better forecasting enables firms to anticipate variations in customer demands and in so doing reduces the impact of the uncertainty (Simangunsong *et al*., 2011).

Simangunsong *et al* (2011) identify mitigation as the third concept managing uncertainty. Uncertainty mitigation is defined by Simangunsong *et al*, (2011) as any action that seeks to lessen the adverse effects of the outcome of activities associated with the supply chain. Mitigation is a common concept in risk management literature including Copacino (1997); Lie *et al*. (2012) and Luhman (2005). Simangunsong *et al*. (2011), assume that risk mitigation strategies are similar to coping with uncertainty strategies in their perspective, hence, categorised such approaches under the coping with uncertainty category. This study lists the following as some of the key uncertainty management strategies identified in existing literature; lean management, supply chain flexibility and agility, supply chain integration, and risk mitigation (see Figure 2.3 and 2.4).
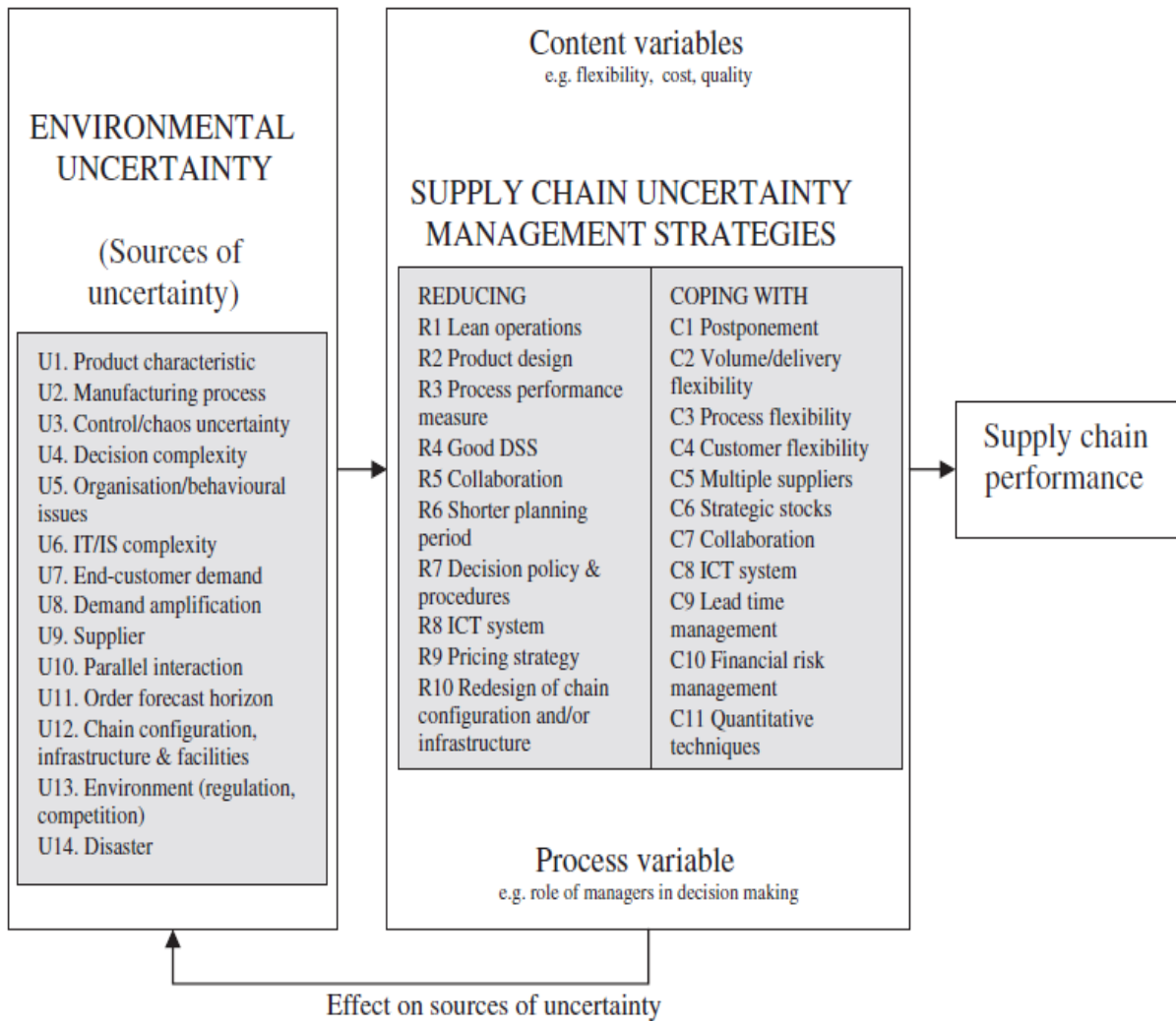
Figure 2.3: The Populated Model of supply chain Uncertainty, source adopted from (Simangunsong *et al.*, 2011)

The figure above provides a schematic representation of supply chain uncertainty, the models used to identify sources of uncertainty and ways of reducing and coping with uncertainty as developed by Simangunsong *et al*. (2011). In Figure 2.3, the authors identify the major ways of dealing with uncertainty as mentioned above. This figure is particularly important for this study as the mentioned reducing and coping strategies will be a key area in discussion of mitigation of demand uncertainty.
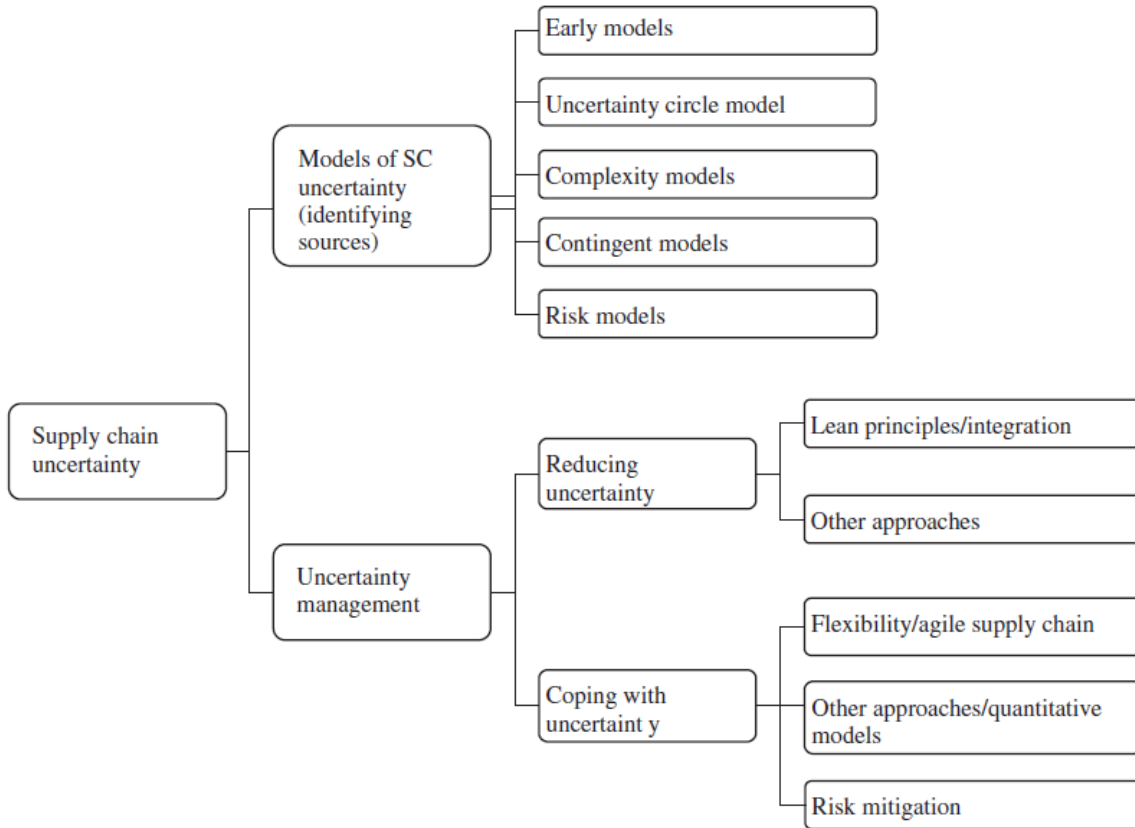
Figure 2.4: Models of supply chain uncertainty. Adapted from (Simangunsong *et al*., 2011)

Figure 2.4 above is an expansion of Figure 2.3 and provides a diagrammatic representation of the models used to identify sources of uncertainty in supply chains. Although this study is not interested in models of SC uncertainty, it considers them key as the mitigation strategy employed depends on the source of uncertainty. The authors identify the models as; early models, uncertainty circle model, complexity models, contingent models and risk models. These models are used to identify uncertainty sources which the authors categorise as supply, manufacturing processes and demand uncertainty.

With regard to sources of uncertainty, Simangunsong *et al*. (2011) identify three main sources from the literature, namely supply uncertainty, manufacturing processes and demand uncertainty.

The authors explain that supply and demand uncertainty influence manufacturing process uncertainty, which consequently affects the timely delivery of orders. Of the three types of uncertainty, Simangunsong *et al*. (2011) suggest that demand uncertainty, which stems from inaccurate forecasts or volatile demands, is regarded as the most severe. This suggestion is also supported by Lai *et al*. (2012). Simangunsong *et al*. (2011) split demand uncertainty into demand amplification and end-customer demand, giving rise to four sources of uncertainty. These authors further identify a fifth source from the literature as 'control uncertainty', which is seen to relate to the capability of a firm concerning information flows, as well as decisions that transform customer orders into raw material requirements and production plans. They point out that the supply chain uncertainty circle is made up of four quadrants: supply side, manufacturing processes, control systems and demand side. The model also suggests that reducing such uncertainties will lead to a reduction in costs. According to these authors, the reduction of uncertainties is achieved through an integrated supply chain, which is recognised as having minimal uncertainties in each of the four identified areas, and thus is a means of combating supply chain uncertainty. Another source of uncertainty—that of parallel interaction—is derived from the supply chain complexity triangle. This uncertainty is related to complexity, which results from the way in which customers interact with multiple potential suppliers (Simangunsong *et al*., 2011).

In a similar study, Burgess *et al*. (2006) also outline the supply chain complexity triangle as an effective means of studying, and subsequently controlling, uncertainties. This model introduces a sixth element: uncertainty arising from parallel interaction. This latter element paints a clear picture of the relationship that might exist between customers and a number of potential suppliers. Essentially, this fact increases supply chain uncertainty and can be notably detrimental

as it can have an adverse effect on the performance of the supply chain (Burgess *et al*., 2006). On the other hand, the micro/ macro model is presumed to be more efficient than other models in handling demand uncertainty by curbing supply chain uncertainty (Burgess *et al*., 2006). According to these authors, this model identifies more specific sources of uncertainties, and further outlines specific tactics of overcoming the uncertainties. A seventh element, which is decision complexity uncertainty, is incorporated into the model. These elements explain the existence of multiple goals emanating from multiple objectives, all of which need to be carried out in order to reduce demand uncertainty (Burgess *et al*., 2006). This emulates a complex triangle of events that can be solved by avoiding the indulgence of some of the presumed activities as it will increase the cost of production and subsequent time wastage (Burgess *et al*., 2006).

From the review of various models, Simangunsong *et al*. (2011) identify 14 sources of uncertainty: and uncertainties arising from the focal company (internal organisation uncertainty), which include manufacturing process, product characteristics, controls, decision complexity, organisational issues and IT complexity, internal supply chain uncertainty, which stems from within the area of control of the company in focus or its supply chain partners, and includes demand amplification, parallel interaction, end-user demand, order forecast horizon, supplier, and chain configuration, facilities and infrastructure; and (external uncertainties), which arise from factors outside of the supply chain and over which the company has no control, comprising competitor behaviour, government regulation, macro-economic issues and natural disasters, such as earthquakes, floods and hurricanes (Simangunsong *et al*., 2011).

2.8 Demand Uncertainty

Demand uncertainty is defined by various scholars as variations and fluctuations in demand (Chen & Paulraj, 2008; Lai *et al*., 2012). According to Lai *et al*. (2012), high demand uncertainty implies that manufacturers face an unpredictable market that is characterised by changeable demand and which reflects a lack of knowledge in relation to changing trends, as well as preferences. These authors explain that, under such conditions, managers may have to deal with a lot of ambiguous, contradictory and conflicting market information, making it challenging to decide on how process and product designs can be adjusted so as to meet customers' requirements. Demand uncertainty results from forecasting errors, variations in volume, and the composition of demand and changes in customer needs, as well as from irregular orders (Amit *et al*., 2005,; Lai *et al*., 2012). Lai *et al*. (2012) argue that an environment of demand uncertainty, external knowledge and knowledge transfer between specific supply chain partners becomes more valuable and even critical owing to the fact that such vital knowledge can reduce this uncertainty by promoting better preparation.

According to Liu *et al*. (2012), the mitigating effect of demand-side uncertainty depends on the ability of the company to meet the diversified needs of the customers. The research indicates that, as a result of the correlation between demand and supply-side uncertainty, there is need for companies to consider their management strategies in an effort to deal with both in these instances. Liu and his colleagues have also introduced the concept of production process uncertainty. Choi and Cheng (2011) are of the same perspective and argue that this concept is mainly influenced by the two other forms of uncertainty considered due to its role as a connecting point. They therefore come to the conclusion that it is necessary for companies to

consider these factors if they are to effectively adopt mass customisation. Liu *et al*, (2012) argue that demand uncertainty is a result of the variability concerning the needs of customers.

The study conducted by Liu *et al* (2012) is of great significance to the present study because it provides some direction in terms of identifying some of the measures that companies may undertake to improve their ability to mitigate uncertainties that are created by the differences in the orders that clients have requested. This is one of the factors cited as a cause behind demand uncertainty. The research by Liu *et al*. (2012) suggests the implementation of what is known as functional integration in the management of demand uncertainty. In this case, integration is aimed at increasing the amount of communication across the various departments. It also considers how this information may be better utilised to achieve the desired results of increased performance. Indicating that, in order for this to happen, there is a need for better integration (Liu *et al*., 2012). This follows previous discussions that have indicated the success of this method in the mitigation of demand uncertainty amongst firms (Copacino, 1997).

The study by Liu *et al*., (2012) provides a link that has been missing between the theoretical knowledge on mass customisation and functional integration and how these influence demand uncertainty. This contributes to the current study as it proves the theoretical framework that may be used in the development of the strategies involved in the mitigation of the effect experienced as a result of demand uncertainty on the performance of companies. The link was established by using large sample size data and accordingly utilising organisational information processing theory and the resource-based theory. The sampling was carried out across 266 firms, providing a large enough sample size (Liu *et al*., 2012). A different perspective on the issue is presented in the research, with the concept of competitive intensity presented, as well as how this is

interrelated with demand uncertainty. In their research, the scholars identified this as the competition that exists between companies with similar products. This indicates that competition affects the level of differentiation in the goods a customer is offered (Lai *et al.*, 2012).

According to Boyle *et al.*, (2008), demand uncertainty can be handled in three main ways. These uncertainties may be mitigated by implementing managerial strategies, such as the incorporation of appropriate insurance policies within the supply chain, which kerb the adverse effects of the detriments arising from the plethora of supply chain activities. This is implemented mainly when the sole objective is to prevent the occurrence of predicted supply chain risks: for example, environmental disruptions (Boyle *et al.*, 2008). The SME food industry throughout the Hajj season can greatly benefit from this approach. By applying the necessary insurance policies, the sector can disregard the probability of incurring huge losses due to various environmental risks, such as a lack of adequate rainfall prior to the Hajj season.

Alternatively, effective managerial strategies may be adopted so as to reduce demand uncertainty: for instance, establishing the best tactic to numb the fluctuation of customer demands (Braunscheidel & Suresh, 2009). The authors explain that a number of supply chains incorporate suitable pricing strategy in addition to other incentives in an effort to direct the attention of customers towards a specific preference, and thus decrease the margin of demand uncertainty in the market. Moreover, discrepancies caused by human errors in the supply chain are eliminated by incorporation of a bureaucratic decision-making managerial strategy or the use of automated processes to decrease supply chain uncertainties (Braunscheidel & Suresh, 2009). The SMEs food industry can immensely benefit by implementing this strategy throughout the

duration of the Hajj season or phenomenon since there is a huge preference of customer demands.

According to Amit *et al*. (2005) the uncertainty developed during the manufacturing process also can be reduced via implementation of total quality control measures. This ensures the manufacturing process is in accordance with the standards and guidelines stipulated, thus fully meeting the needs of customers. This is especially vital for the SMEs food industry since it is very sensitive owing to its potential to affect the health of consumers; if poor hygienic conditions are apparent during the manufacturing process, a huge number of lives might be lost (Amit *et al*., 2005). The authors further explain that organisations can also opt to collaborate with customers, which will enable them to reduce decision-making uncertainties and thus decrease demand uncertainty. They point out that this is because a seamless supply chain is created where there is effective communication upstream to suppliers and downstream to customers. Throughout this process, functional and internal integration will be achieved, resulting in the emanation of a systematic supply chain, which will have been managed to reduce control, process and supply, as well as demand uncertainty (Amit *et al*., 2005). This would prove very beneficial to the SMEs food industry, especially in the Hajj season, since it will not only enable its ability to curb demand uncertainties but also enable the steady growth of the industry.

Braunscheidel and Suresh (2009) further add that the uncertainties of the manufacturing process can be reduced by introducing a new design for the product being manufactured. This further meets most customer preferences, thereby reducing demand uncertainty. Moreover, demand, in addition to supply-related uncertainties, can be reduced by changing the design of the supply chain: for instance, by redesigning the configuration of the supply chain, including its facilities

and structures (Braunscheidel & Suresh, 2009). According to these authors, organisations can also redesign the control of the supply chain; that is; changing the strategic objectives, decisions and operation activities. In addition, the chain information system, as well as the governance and organisation of the supply chain, should be redesigned (Braunscheidel & Suresh 2009).

As displayed in Figure 2.5, Simangunsong *et al.* (2011) identify several strategies of reducing uncertainty; these include new product design, supply chain redesign, and total quality control (TQC). According to these authors, new product design and total quality control are effective in reducing process uncertainty, whilst supply chain redesign is effective in reducing demand and supply uncertainty. The authors identify elements of the supply chain that need to be considered for redesigning as chain control: 1- decision functions that are responsible for managing the execution of strategic objectives and operational activities; 2- chain information systems; 3- chain configuration, such as structures, members involved and facilities; and 4- chain organisation and governance, including authorities and responsibilities (Simangunsong *et al.*, 2011). Besides redesigning supply chain infrastructure and configuration, two other strategies are suggested for reducing uncertainty: collaboration with key customers and suppliers, which helps in breaking barriers between the various stages in the supply chain that may reduce the uncertainty associated with decision-making complexity within the firm; and limiting the role of humans in the supply chain process by utilising automated processes or simplifying bureaucratic procedures and decision-making policies (Simangunsong *et al.* 2011). According to these authors, this could reduce human-related uncertainty.

The concept of collaboration is important in the context of the current study, which seeks to explore supply chain integration as a possible management practice to mitigating demand

uncertainty. According to Simangunsong *et al*. (2011), this concept has been further examined by studies that propose that the 'seamless supply chain' in which every member and entity in the chain is highly integrated into the system and acts as one will result in reductions in supply, process, demand and control uncertainty. Integration strategy in this context implies extending management systems downstream to customers, and upstream to suppliers, having first attained internal and functional integration (Simangunsong *et al*., 2011).These authors discuss the 'well-trodden path' concept identified in existing literature as a systematic way of achieving a seamless supply chain, where control uncertainty is first reduced, along with process uncertainty, then together in combination with supply uncertainty and, finally, with demand uncertainty. According to the article, this process requires waste elimination through the use of lean strategies, in addition to the synchronisation of material flows across the supply chain. The authors further add that, in addition to a lean and agile supply chain, effective information sharing is a crucial aspect of the collaboration strategy, with organisations commonly relying on the application of Information and Communication Technology (ICT) for this purpose. They note that ICT solutions could provide a suitable decision-making support system; in turn, this may reduce control uncertainty by improving the process and overall quality of decision making. Conversely, the mismanagement of the information-sharing process, such as through inaccurate or delayed data, could cause difficulties in making the right decisions, hence increasing control uncertainty (Simangunsong *et al*., 2011).Accordingly, the authors recommend regular employee training and the regular testing and review of procedures, backup, logging and recovery procedures as ways of reducing ICT complexity related to uncertainty.

Simangunsong *et al*. (2011) also identify pricing/ incentives strategy as another approach to reducing demand uncertainty. Based on the reviewed literature, these authors argue that the

revising process or application of controlled marketing promotions is effective in reducing the bullwhip effect in particular. Responsive stock replenishment was also identified as an effective method. This strategy involves ensuring that the period of planning is much shorter than the forecast horizon in an effort to reduce the uncertainty associated with innovative products, which tend to have a short lifecycle and a wider range of products. In this vein, a study conducted in the food industry demonstrated that the application of a stock replenishment cycle, shorter than the minimum product lifecycle, enabled the case company to satisfy demand and have sufficient time to sell off excess stocks in the event of end-of-product-life. Lai *et al*. (2012) categorise the identified strategies as product design, lean operations, process performance measurement, shorter planning period, collaboration, ICT system, decision support system, redesign of chain infrastructure and configuration, and pricing strategy.

With regard to strategies for coping with uncertainty, Simangunsong *et al*. (2011) argue that supply chain flexibility is one of the most effective approaches for coping with the sources of uncertainty (see Figure 2.5). They argue that a transformation framework can be developed for flexibility by adapting the transformation system theory (processes, outputs and inputs). They further explain that an organisation can create input flexibility on the input stage by, for example, employing multiple suppliers; however, they note that this could increase supply risk, such as delivery reliability and quality issues, particularly when sourcing for critical items. They also add that the cost is higher when multiple suppliers are used; hence, the strategy needs a careful balance. These authors further explain that, at the process stage, machine and labour flexibility could be used to manage people, infrastructure and equipment uncertainty, whereas customer flexibility can be used at the output stage when customers are less sensitive to products or delivery dates. These authors also note that collaboration is included both as a strategy for

reducing uncertainty, as well as for coping with it, as it involves sharing supply chain information to reduce uncertainty and to address it when it arises unexpectedly.

Figure 2.5 below shows a schematic representation of the uncertainty mitigation strategies as presented by Simangunsong *et al*. (2011). This figure identifies supply chain inflexibility and lean principles as the key strategies to coping with and reducing demand uncertainty. These will be discussed later in the chapter under mitigation strategies.
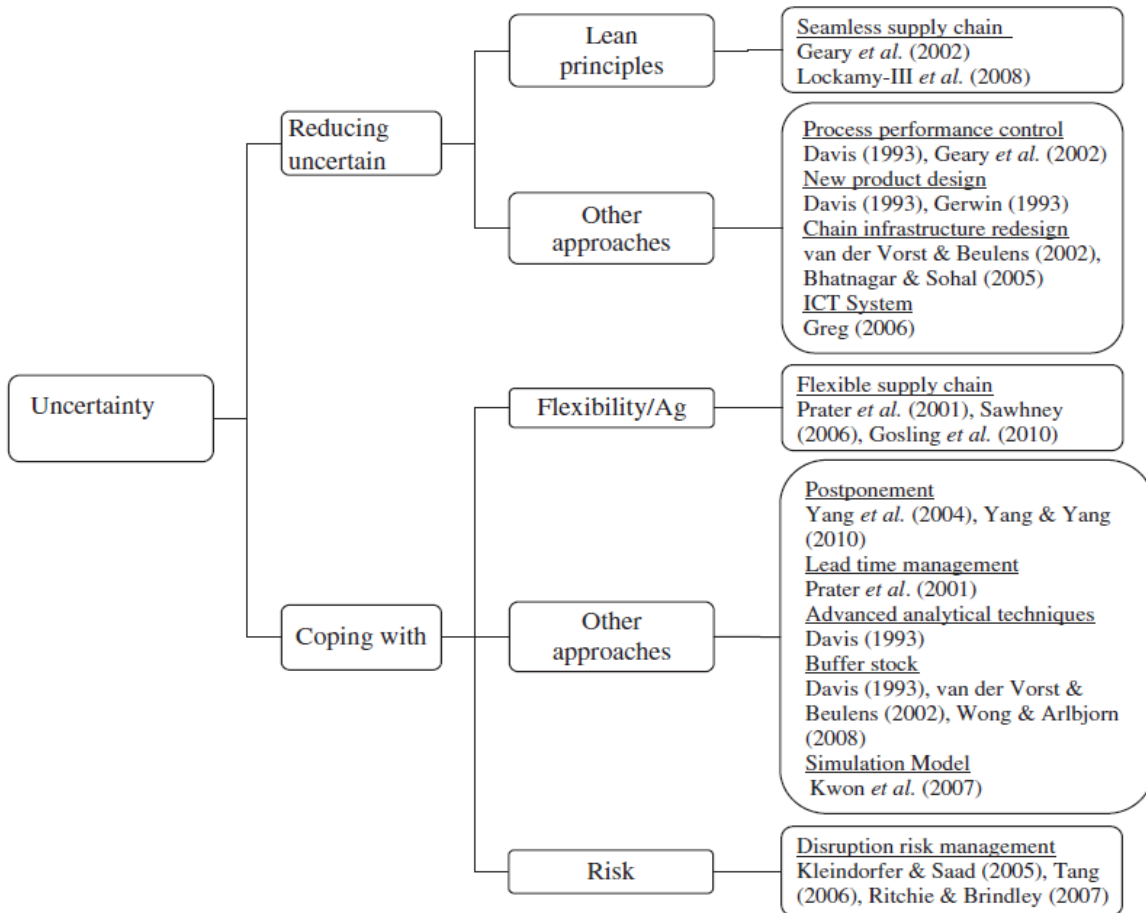
Figure 2.5: Uncertainty management. Adopted from: (Simangunsong *et al*. 2011)

2.9 Managerial Practices for Mitigating Demand Uncertainty

2.9.1 Supply Chain Integration (SCI)

In the present, intensely competitive business environment, many organisations have come to realise that the provision of the most excellent customer value at the lowest cost is not merely linked to the activities and processes within the organisation itself, but rather to the supply chain as a whole. According to Huo (2012), supply chain management has been afforded significant attention in recent years from both researchers and academicians. For this reason, scholars and authors suggest the need for an integrated relationship between manufactures and their supply chain partners. In support of this, Flynn *et al*. (2009) argue that intense global competition has caused a number of organisations to venture into systematic advance to supply chain integration (SCI). According to the study conducted by Mikkola and Larsen (2004), supply chain integration, which accelerates supply chain management, has received incredible attention in terms of designing and developing relationships between supply chain members.

Flynn *et al*. (2010) further point out that supply chain integration (SCI) continues to be considered a relatively new concept in research that has been defined in different ways by scholars. Although new, SCI has received much attention from researchers investigating supply chain relationships, and collaborative relationships between manufacturers and their suppliers or customers. Whilst some studies have focused on supply chain management as consisting of dynamic relationships between various supply chain partners, others have studied it as a single system rather than attempting to divide it into its different fragmented subsystems. Flynn *et al*. (2010) further point out, that although some supply chain integration definitions stress on flows of materials through the various parts, other definitions focus more on information, cash and

resource flow. Such descriptions, however, are considered too broad in focus, despite the fact they touch on many of the key elements of supply chain integration. These authors build their definition of supply chain integration from existing literature on the construct, which includes the manufacturer (internal integration), and extending it across both ends of the chain (supplier and customer integration). Furthermore, this is built upon existing gaps in literature to develop what they term as a 'parsimonious definition' of the term supply chain integration. Supply chain integration is therefore defined by Flynn *et al*. (2010) as the degree to which a manufacturing firm strategically collaborates with its partners in the supply chain and, accordingly, collaboratively manages inter and intra-organisation processes. Lai *et al*., (2012) further define it as the extent to which an organisation strategically works in partnerships with its supply chain partners and manages internal and external organisational processes with the aim of achieving effective and efficient flows of products, services, information, money and decisions, with the intent of delivering maximum value to its customers. According to Flynn *et al*. (2010), the goal of SCI, in this domain, is to realise effective and efficient flows of information, products and services, decisions and money in an effort to provide the customer with maximum value at low costs and without delays. Lai *et al*. (2012) also define integration as the extent to which the distinct internal functions of an organisation have the ability to be in partnership with one another, synchronise intra-organisational activities, make strategic decisions and accordingly devise cross-functional integral relationships. According to the authors, the integration mainly involves cross-functional harmonisation, joint decision-making and internal relationship management. Throughout the course of composing organisational activities into joint processes, the authors point out that it breaks down the traditional functional way of assisting the attainment and relocation of organisational knowledge into particular designs, processes and end products,

which eventually pave the way to a more connected and coordinated internal reaction to marketplace changes and distraction (Lai *et al*., 2012).

Organisations put processes in place intended to integrate suppliers, internal functional units and suppliers with the overriding aim of optimising the total performance of all those partners involved in the supply chain system. Rungtusanatham *et al*. (2003) state that customer and supplier integration is a valuable approach to getting external resources from suppliers and customers. When integration has been adequately completed, improvements in process, control, supply and demand, in the operations of the business, are witnessed (Towill & Christopher, 2002). This promotes information sharing across the supply chain, as well as the promotion of integrative inventory systems. It goes a long way in terms of improving quality service delivery and responsiveness to the dynamic market (Lambert & Cooper, 2000; Lee & Whang, 2005). In addition to customer and supplier integration, internal integration focuses on the development of products. This uses different terms, such as cross-functional teams and functional coordination (Vickery *et al*., 2003; Min & Mentzer, 2004). In the case of functional coordination, there is the measurement of collaboration and interaction within a given company (Kahn & Mentzer, 1996). Cross-functional teams, on the other hand, bring together issues of marketing, research and development, manufacturing and purchasing personnel. This is important in reducing the costly design of products and maintenance, and duplication (Chandra & Kumar, 2001). It improves product reliability and enhances customer satisfaction.

Information sharing, organisational coordination and product co-development are the main areas of interest in the mitigation of demand uncertainty effects. These three areas are important for empirical investigation because they are vital in the design and development of products.

Information sharing involves the sharing of production, inventory, marketing and technological information across all areas of the customer and supplier (Fisher, 1997; Ayers, 2001; Stock & Lambert, 2001). Supply chain integration also looks at product co-development, where customers, suppliers and internal functional units make joint efforts to develop products. This refers to the joint design of products, production operations and process engineering, with the collaboration of key customers and suppliers (Chandra & Kumar, 2001). In integrated product development, there is close internal coordination from the stage of product design and process development, through to production and product launch. Different authors have stressed the co-development of products with various stakeholders. Song *et al*. (2009), for example, stress the need to include customers in the process, whereas Min and Mentzer (2004) emphasise the need to involve all internal functions whilst completing product development.

According to Chandra and Kumar (2001) supply chain integration encompasses both product flow and demand flow and, as such, involves everyone from vendors and suppliers of raw material, manufacturers, distributors, retailers to the consumer as illustrated in Figure 6 illustrated below. This figure provides a schematic representation of the supply chain network and everyone that is involved. According to the diagram, everyone is important in ensuring efficient flow of products from the manufacturer to the end consumer. According to this figure, product development involves coordination and cooperation between suppliers, internal functional units and the consumers. In essence, Figure 2.6 illustrates that cooperation from both suppliers and consumers is key to product development.
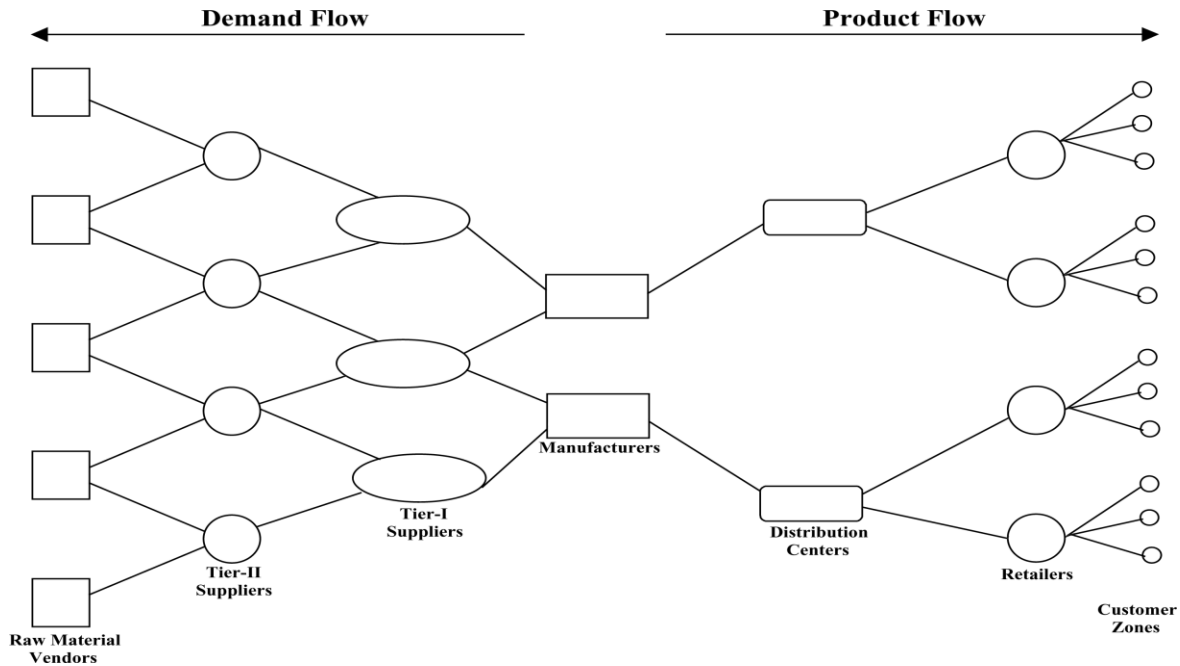
Figure 2.6: Illustration of Product and demand Flow in Supply Chain. Adopted from (Chandra and Kumar, 2001)

Some of the aspects of supply chain integration were studied and presented by Flynn *et al*. (2010), during which they considered the fact that previous studies on the subject were inconsistent when examining their inability to accurately define supply chain integration. The research sought to redefine this term, and thereby provide further insight on the subject. The writers contend that previous research only sought to establish the relationship between the supplier, end user and firm; they have done this to the detriment of the other internal factors that play a role in influencing the supply chain and, by extension, the integration of the supply chain (Flynn *et al*., 2010).

The research by Flynn *et al*. (2010) examined three individual aspects of the firm, and how these three aspects affect performance; these are supply chain, business performance and operational performance. The research applies a contingency approach, which uses hierarchical regression in

an effort to determine the effect of certain given aspects of supply chain integration on company performance. This statistical measure allows the study to explore the factors on the basis of importance (Gliner & Morgan, 2000). The scholars also use cluster analysis under the configuration approach in examination of the patterns in supply chain integration. The use of cluster analysis enables the researchers to analyse the structures within the company without the need to define a priori. In the case of the study by Flynn and his colleagues, a more informed analysis of the integration existent in the supply chain can be completed. This is because it allows for the study of the relationship apparent between these different factors (Neider & Schriesheim, 2007). These were done to try to develop a relationship between the supply chain and the performance of firms. Moreover, it also aimed at identifying the most effective strategy that could be used in improving firm performance (Flynn *et al*., 2010).

Studies also demonstrate that most firms in the food industry are not aware of the importance of supply chain management. Bourlakis *et al*. (2014) examined differences amongst firms (based on size) in sustainable performance in food supply chains in Greece. The study evaluated small, micro and medium-sized firms based on a set of sustainable performance measures (responsiveness, consumption, flexibility, product quality, and total SC performance). According to the study, firms in the food industry in the food supply chain do not fully understand the performance of their supply chain. In the study, only the small wholesalers seemed to perform slightly better in both firm's perceptions of its own supply chain performance and the firm's perceptions of market opinion regarding its supply chain performance. This is an indication that most firms in the food processing sector do not understand the importance of SC performance.

Despite the comprehensive nature of the research, the writers identify certain items that would require further analysis. One of these areas is centred on considering customer and firm integration from a longitudinal point of view; this would require creating a study to cover a greater period of time. There is also the consideration that the firms under examination were all Chinese, meaning there is a need to conduct a study that takes into account businesses from other geographical locations; this is from the consideration of the fact that different factors may come into play in different parts of the world. It should be noted, however, that the ideas presented in the research offer knowledge on various strategies that may be adopted in firms with different characteristics from those discussed. On the other hand, this provides a foundation upon which future studies of the issue of supply chain integration may be examined (Flynn *et al*., 2010).

Lai *et al*. (2012) identify the three basic forms of SCI as internal integration, supplier integration and customer integration. Internal integration stresses the integration of internal functions and processes, whilst supplier/ customer integration emphasises the importance of building long-term close and collaborative relationships with external partners (suppliers and customers) (Lai *et al*., 2012).

Gallear *et al*. (2015) took a different dimension towards examination of the importance of firm - supplier partnerships. These authors argue that it is important for managers to understand the risks related to supplier partnerships especially since investment in environmental and ethical behaviours has a mediating effect on these partnerships. These authors hypothesised that entering into a supply chain partnership with suppliers, in itself, does not imply that management appreciates the risk associated with the partnering and could even hinder such awareness. They argue that appreciation of this risk is made possible through corporate responsibility's

environmental and stakeholder management culture. The findings of this study confirmed the hypothesis and emphasised the value of developing internal awareness, monitoring as well as sharing best practice. These findings indicate that internal integration (through building of internal awareness and monitoring) has a positive effect on supplier integration and that supplier integration that is characterised by sharing of practice enhances mitigation of risks. The findings of the study by Gallear *et al*. (2012) also demonstrate internal awareness on corporate responsibility and monitoring of corporate responsibility performance is positively associated with the SC partnership approach. According to the study, creating awareness regarding corporate responsibility (CR) and monitoring it is key to the development of partnerships, particularly with suppliers. This study however warns against imposing of CR best practices upon the suppliers as it will impact negatively on the partnership. This study generally agrees that supplier integration is key.

The same sentiments are echoed by MacKerron *et al*. (2015) who argue that supplier performance management is key to the success of any business, particularly if it is engaged in outsourcing arrangements. This study investigated "the characteristics of an effective performance management framework for suppliers and how this contributes to the effectiveness and success of the outsourcing arrangement" (MacKerron *et al.*, 2015p. 150). The study was based on the outsourcing and performance management theory and using primary and secondary data, the authors found collected data on setting of objectives, measurement of performance and performance improvement in outsourcing projects. They used a modified version of the Balanced Scorecard known as Logic Scorecard as the measurement tool. They also suggest use of a service credit system as well as a continuous improvement schedule in enhancing supplier performance. Based on the findings, they developed a performance management framework which is crucial in

supply chain operations and provides guidance for effective implementation of performance management in outsourcing projects. The study considered the entire outsourcing lifecycle and proposed a 10-step framework that incorporates strategic propositions as well as how it can be implemented at an operational level (MacKerron *et al.*, 2015). This study highlights the importance of supplier management and evaluation of their performance. It provides a holistic framework that enables effective supplier performance management, particularly in outsourcing projects. According to these authors, performance management of suppliers enables firms to minimise risks of project failure and as a result ensure sustainable success of the outsourcing operations. Gallear *et al.* (2014) also explain that a properly designed measurement system is paramount to effective coordination and control as well as competitiveness of any firm. According to these authors, supply chain performance (SCP) measurement is an important aspect that determines how well an organisation can manage environmental uncertainty. This study identifies the limitations of many of the commonly used measurements and suggests use *of Data Envelopment Analysis* (DEA) as a solution to increasing effectiveness of SCP measurement. The study shows how DEA can be utilised in guiding supply chain improvements efforts by target setting and role-model identification in a way that takes into account the multiple dimensions and outcomes of the SC process and how the environmental conditions influence it. The study concludes that an externally linked performance measurement system which ensures that the firm is linked to its external environment is a key source of sustained competitive advantage as it enables the firm to effectively respond to environmental uncertainty.

2.9.1.1 Internal Integration:

In their expanded discussion of the types of SCI, Lai *et al*. (2012) describe internal integration as the degree to which the various internal functions and processes of an organisation collaborate with one another, strategically coordinate internal organisational activities and decisions, and accordingly form integral relationships across the different functions. Such integration mainly involves joint decision making, internal relationship management and cross-functional coordination. Kotcharin *et al*. (n.d) define internal integration as the extent to which an organisation can plan its organisational practices, procedures and behaviours into joint, synchronised and manageable processes, with the general aim of achieving customer desires and needs.

Lai *et al*. (2012), observe that such integration majorly comprises cross-functional coordination, collaborative decision-making and internal relationship management. The authors go on to argue that, by structuring organisational processes and activities into cooperative processes, internal integration disintegrates the normal functional silos to aid the acquisition, as well as the transfer of organisational knowledge into explicit final products, designs and processes; consequently, this leads to a more coordinated and connected internal response to customer and market place changes as well as disruptions.

Flynn *et al*. (2009) observe that, since internal integration breaks down functional barriers and brings about cooperation with the aim of meeting the requirements of customers, as opposed to operating within the functional silos related to traditional departmentalisation and specialisation, it is believed to be related to performance. These authors also point out that despite the fact manufacturers might sustain a functional organisation structure, orders from customers flow

across functions and activities. They further argue that, when an order is delayed, customers are not bothered which of the functions led to the delay, but simply that the order will be realised. Flynn and his colleagues go on to explain that such a scenario calls for an integrated customer order fulfilment process, through which all activities and functions are harmonised. Thus, it is concluded that information sharing, joint planning, cross-functional teams and collaboration are key elements of the internal integration process.

2.9.1.2 Customer Integration:

Supplier/ customer integration refers to the extent to which an organisation can partner with suppliers and customers to structure its inter-organisational practices, behaviours, processes and strategies into collaborative, manageable and synchronised processes in order to meet customer requirements (Lai *et al*., 2012).

Customer integration mainly involves customer partnership and the sharing of customer information, and the involvement of customers in product development and delivery (Flynn *et al*., 2010). Different research by Kotcharin *et al*. (n.d) defines customer integration in the same way. Chavez *et al*. (n.d) describe customer integration as the combined planning, partnership and synchronisation of processes with the presence of major customers to accomplish mutually beneficial goals. This research study has also worked to provide some direction in customer integration in that information sharing similarly has been looked upon as one more significant aspect of supply chain integration. According to the authors, information sharing refers to the determination to come up with tactical, strategic and operational information accessible to supply chain members. The scholars go on to provide examples: for instance, they point out that information sharing can comprise tactical information, including production tactics, performance

metrics of buyers and strategic information, such as sales forecasts from buyers. Consequently, information sharing can comprise operational information: for instance, inventory holding information, which, when shared, can be of assistance in an effort to tone-down information distortion from all members of the supply chain.

Lai *et al*. (2012) note that customer integration is important for manufacturers as it allows access to customer information, knowledge-sharing, the pursuit of joint development activities, speed up of decision-making processes, reduction of lead times, and improved process flexibility. According to this article, such integration is crucial to manufacturers; besides helping them to obtain information about customer needs, it also enables them to gain a better understanding of their preferences and requirements in terms of what they prefer and why.

Flynn *et al*. (2009) point out that customer integration is related to customer satisfaction, both directly and indirectly, based on its relationship of product development and innovation. The authors state that, in an integrated supply chain, growth of a strong strategic joint venture with suppliers will make their understanding and expectation of manufacturers' needs possible, with the aim of better meeting its dynamic requirements. Hence, this mutual exchange of information in regard to products, processes and schedules assists manufacturers in developing their production plans and ensuring the timely production of goods, thus improving performance on the delivery of goods (Flynn *et al*., 2009). Flynn *et al*. (2009), point out that, by developing a good understanding of the manufacturer's operations, suppliers realise a high level of customer service which, eventually, similarly assists manufacturers in improving their customer service.

2.9.1.3 Supplier Integration:

Supplier integration entails mainly supplier partnerships, supplier information sharing and the involvement of suppliers in product development (Lau *et al*., 2012). According to Flynn *et al*. (2010), developing close ties with suppliers enables service providers and manufacturers to gain better inputs from suppliers and accordingly to include their suggestions and recommendations into business operations. Lai *et al*. (2012) argue that a successful ongoing partnership between suppliers and manufacturers is mutually beneficial to both parties, as it helps them in achieving their strategic goals. Zhao *et al*. (2008) also emphasise that a closer business process alignment with a firm's suppliers also facilitates the smooth delivery of various raw materials and components on a timely basis, thus enabling the manufacturer to reduce total lead time for delivery of customised goods.

Lau *et al*., (2012) contend that closer binding with suppliers facilitates manufacturers in attaining better inputs from suppliers and integrating their recommendations and suggestions into business operations. The authors also point out that a closer business process association with suppliers encourages the smooth provision of numerous components of raw materials, ensuring timeliness in the process. Flynn *et al*., (2009) further suggest that supplier integration has been presumed as related to product development performance and supplier communications performance. Conversely, however, some scholars seem not to have found a significant relationship between supplier integration and operational performance.

Lai *et al*., (2010) suggest that suppliers also may grant familiar suggestions to manufacturers for product development in an effort to protect the value of their existing resources: for instance, knowledge concerning capacity and engineering. These authors argue that, by limiting

themselves to information obtained from current customers and suppliers, manufacturers might trim down their potentiality of coming up with extremely innovative products in a competitive environment.

Natour *et al*. (2011) also examined supply chain integration and collaboration. The authors observe that supply chain collaboration over the years has been studied from four distinct perspectives. They identify these perspectives as uncertainty reduction, transaction cost economics, resource-based view, learning and knowledge. In their study, these authors reviewed past studies that have applied stakeholder theory and the theory of constraints to advance joint relationships in the supply chain. Their analysis indicates that previous studies provide conflicting insights as there are no extensively agreed upon conceptualisations of supply chain integration and collaboration; this gap is holding back the progress of supply chain management research and practice. Despite this, positivist schools of thought, to a wider extent, have enlightened numerous conceptual frameworks proposed in the literature and the research efforts largely centred on structural integration.

According to these scholars, whilst 'joint' in the supply chain is at times referred to as a means of accomplishing this structural integration, the terms 'integration' and 'collaboration' are not only used interchangeably, but also are interpreted with terms similar to information-oriented lining with supply chain processes. For this reason, it may be concluded that there seems to be no generally accepted theoretical or conceptual foundation for informing supply chain integration and collaboration contributions. However, the authors seemingly argue that a few recent contributions have highlighted a more encompassing outlook of collaboration working on the soft aspects, such as goal congruence, decision synchronisation and incentive alignment, and the

traditional hard perspectives of resources and information sharing. Natour *et al*. (2011), however, emphasise a main concern: that the majority of theoretical aspects proposed in preceding studies are not able to effectively tackle the underlying behavioural aspects, namely relationships, trust, politics and power, all of which, at present, characterise the supply chain environment.

Koçoglu *et al*. (2011) extend this analysis by stating that supply chain integration has gained substantial attention with the transformation of manufacturing and supply strategies and intense globalisation. The scholars further argue that the theoretical groundwork of SCI may be traced back to Porter's Value Chain Model, emphasising the value-creating connections between chain members. They point out that, presently, the growing popularity of supply chain integration over the last decade has demonstrated the linking of all supply chain members, where the corresponding alignment of partners' objectives to move towards a shared structure of values is important for organisations to provide customers with excellent value (Koçoglu *et al*., 2011). Another positive fact is that the effective connection of various supply chain activities, without forgetting the internal functions of an organisation with the external operations of suppliers, customers and other supply chain members, is pivotal in enhancing accurate supply chain relationships and accordingly assisting in the coordination of information flows from supplier to manufacturer and customer, as well as in the backwards flow from customer to manufacturer and supplier (Koçoglu *et al*., 2011). Additionally, these authors suggest that appropriate supply chain relationships, with a view on strategic partnership with supply chain partners, influence the flow of timely, accurate and quality information. On the other hand, they note that, although definitions regarding supply chain integration make up the correspondence between integration and information sharing, implying that supply chain integration has an impact on the effective and efficient flow of information, very few empirical studies thus far have focused on the

influence of the power of supply chain integration on information sharing and decision making, with most having focused on supply chain performance.

In the research by Huo (2012), it is argued that supply chain integration is vital to the success of organisations and supply chains. The author points out that, regardless of its significant influence, supply chain integration has not received the attention it deserves until recently. Huo further states that there are no commonly accepted sub-elements of supply chain integration, and the relationships between distinct supply chain integration dimensions are not consistently demonstrated in previous studies. Furthermore, Huo further recognises that there is very little empirical evidence demonstrating how distinct supply chain integration dimensions concurrently affect different types of organisational performance. This article also emphasises that several other studies bring out the sole roles of supplier integration or customer integration in improving performance when supplier integration or customer integration is considered separate, whereas the rest has centred on only the impact of internal integration on performance. On the contrary, Huo argues that various, recent studies take internal integration and external integration into account, which are recognised by such scholars as connected to performance. However, Huo states that these studies have limitations in the sense that they only consider one or two performance dimensions, with findings not seen to be in agreement. Moreover, they have afforded very little attention to the relationships between distinct types of performance and the mediating outcome between different types of supply chain integration and performance varieties.

According to Koçoglu *et al*. (2011), supply chain integration improves the extent of partnerships with external supply chain members, and in so doing, structures the organisation's strategies,

processes and practices into collaborative, synchronised, aligned activities in an effort to achieve inter-organisational information sharing. The study by Koçoglu *et al*., (2011) further explains that the ever-changing environment structure, as a result of the collaborative relationships between suppliers and buyers, improves the necessary technological and managerial resources to be implemented and utilised by multiple supply chain partners as competitive capabilities, as opposed to putting up with the cost of internalising these resources. Thus, supply chain integration leads all participating parties towards an expanded resource base in order to link core aspects from heterogeneous sources of information into a common platform and accordingly attain information sharing (Koçoglu *et al*., 2011).

According to Koçoglu *et al*. (2011), there seems to be some consensus in the literature that the eminent level of close relationships with supply chain partners brings about increased visibility of suppliers' operational activities, which eventually allows transparency and a platform through which the information can be communicated between participating parties. The argument above concludes that supply chain integration may be included in a firm's infrastructure for the strengthening of information sharing between supply chain members. Furthermore, the authors point out that supply chain integration improves information sharing through creating trust-based relationships. They further state that the deepening trust-based relationships between parties enhances the contract period between supply chain partners, and thereby attracts efficient conflict resolution, and encourages responsiveness of customers, flexibility and the flow of information through arousing the sense of belonging and determination to share (Koçoglu *et al*., 2011). This study defines trust as the degree to which an organisation believes that its partner, with whom an exchange occurs, is honest and generous, and is recognised as an outstanding safeguard of long-term stability and the success of inter-organisational relationships. The reason

behind this is that the growth of long-term secure relationships with important value-network members, which are significant to the functioning of the supply chain when considering the use of their power to affirm decisions, solutions and direct policies, is based on the level of confidence in relationships. In most cases, customers impact the manufacturer's decisions; similarly, the manufacturer looks for trust-based relationships with customers because, with the increase in the degree of trust, the determination of the parties to share physical, financial and information-based resources also improves (Koçoglu *et al*., 2011). These authors further recognise that SCI enhances the involvement of customers in supply chain activities and similarly enhances the effort of supply chain members when it comes to information sharing.

In addition, Koçoglu *et al*. (2011) further assert that supply chain integration provides organisations with the opportunity to focus on their core competencies and particular vicinity of expertise by aligning itself with other supply chain members with different resources, technological knowledge and expertise. According to these authors, it is presumed that supply chain integration refers to the implementation and exhaustion of collaborative and coordinating structures, processes, technologies and practices between supply chain members with the aim of building and, accordingly, maintaining a faultless channel for the accurate and timely flow of information, materials and, ultimately, finished goods (Koçoglu *et al*., 2011). Accordingly, this kind of structuring provides an option in cases where there is a lack of or restricted resources; this limits the cost of transaction and the ability to negotiate, hence paving the way for organisations to reap the benefits of utilising common resources and capabilities (Koçoglu *et al*., 2011). Furthermore, the parties involved have a better understanding of each other's business in an improved way, and can help each other through flows of correct information that is well-timed in the realisation of higher supply chain performance. Koçoglu *et al*. (2011) conclude that

SCI enhances increased specialisation, thereby allowing the flow of correct information in cases of need.

Drawing from the extended Resourse-Based View (RBV) of the firm, Lai *et al*. (2012), argue that all three types of supply chain integration (internal, supplier and customer integration) influence the development of mass customisation capability within a firm, with both internal and external integration promoting the strategic resources that are crucial for mass customisation capability development. According to these authors, internal integration, in particular, has established a platform for creating, assimilating and applying knowledge to product design. The article further explains that the synergistic effects of the joint efforts of various firm's functions and departments provide strategic resources in an effort to address the complexity associated with customisation. The authors further note that organisations can attain and deploy supply chain resources in addition to knowledge through integration with suppliers and customers. They further explain that firms are positioned to acquire the strategic resources they can use to improve the essential elements of mass customisation, such as cost, flexibility, efficiency, product quality, delivery and agility, by leveraging their capabilities and resources, and accordingly collaborating with external partners and achieving agility. Lai *et al*. (2012) further add that those forms that are endowed with better internal socialisation and coordination also have more capability to acquire resources from external partners. Internal integration therefore is regarded as a core strategic resource for enabling external integration in the development of mass customisation capability.

Lai *et al*. (2012) argue that demand uncertainty, together with competitive intensity, have contingent effects, and are the most important environmental conditions for the development of

mass customisation. According to these authors, empirical evidence exists to indicate that the effects of supply chain integration on a firm's operating capabilities are moderated by environmental context. The authors further explain that rapid changes in demand require manufacturers to attain new knowledge that will be pivotal in guiding customisation as existing experience and knowledge becomes invalid. On the other hand, however, when the extent of demand uncertainty is low, manufacturers can then develop their mass customisation capabilities through relying on the existing resources and knowledge to design, produce and provide customised products. However, this task becomes a challenge when demand uncertainty is so high that the changes required cannot be addressed in this manner. In such a case, the firm needs to create an exchange and accordingly acquire new knowledge, as well as resources, by collaborating with external partners.

Lai *et al*. (2012) further explain that combined effort by supply chain partners is necessary in order to deal with unpredictable demands and to develop customised products. This study provides an example by noting that a firm is able to attain accurate demand information on time by collaborating with customers; this leads to better decisions in making customised products to meet customer requirements. Through improving collaboration with its supplies, the organisation can identify ways of exploring and increasing the range of possible solutions for meeting customer needs and reducing costs and lead times by improving joint processes. Lai *et al*. (2012) emphasise that since challenges are more severe in uncertain environments, it is important for manufacturers operating in such environments to have closer collaboration with their external partners. They argue that since internal integration drives and enables external integration, manufacturers operating in an uncertain demand environment can increase the impact of internal integration on external integration, and consequently develop greater mass customisation

capabilities (Lai *et al*., 2012). This implies that supply chain integration and its dimensions (customer, internal and supplier integration) are related to mass customisation capabilities and may be effectively used in the mitigation of demand uncertainty.

2.9.2 Mass Customisation Capability (MCC)

Davis (1987) defines mass customisation as a process where manufacturers tailor-made products in order to satisfy individual customer needs at the same prices as those of mass-produced items. This can be approached from other perspectives. Mass customisation capability is considered as the ability of a company to come up with customised products on a larger scale but at a cost similar to those of non-customised goods. This method is very useful in dealing with demand uncertainty, which can plague a company. Responsiveness, volume effectiveness and cost effectiveness are some of the measures used to determine mass customisation capability (Dyer *et al*., 1998; Shabah, 2015). According to Shabah (2015) Mass customisation seeks to produce goods that are customised by allowing economies of scope at lower cost (to attain economies of scale) using various strategies including postponement and modularisation. Different sources point out that any firm can perfect its mass customisation capabilities by examining various elements; they include coordinating suppliers, postponing key steps in production and the implementation of modularity-based manufacturing (Salvador *et al*., 2004).

Lai *et al*. (2012) define MCC as the ability of a firm to offer a comparatively high volume of product alternatives for a comparatively large market that demands customisation without significant trade-offs in quality, cost or delivery. According to these authors, MCC can be discussed under four main aspects:1- customisation cost efficiency, which implies the ability to offer customised products at a price comparable to mass production; 2- high volume

customisation, which is the ability of a firm to aggregate the individual demands of customers into large-batch common production and deliver customised products at volumes similar to mass production; 3- customisation responsiveness, which is the ability of firms to implement measures that reduce total lead time for the delivery of customised products and to deal with customisation demands quickly; and 4- customisation quality, which is the ability of firms to guarantee and manage a consistent quality of all customised products.

It is important to understand the difference between customisation and mass customisation. Mikkola and Larsen (2013) describe customisation as a continuum that encompasses five different classes which include; pure standardisation, segmented standardisation, customised standardisation, tailored customisation, and pure customisation. The authors also identify four different approaches to customisation as; collaborative, adaptive, cosmetic and transparent. On the other hand, mass customisation involves customer co-design procedure of products and services, which satisfies the needs of all personal customers with consideration to specific product attributes. Consequently, its operations are carried out in a fixed solution space, exemplified by stable, flexible and responsive procedures (Can, 2008).

According to Can (2012), one of the success factors for mass customisation is that the products should be customisable. Modularity, continuous renovations and multi-purposefulness are some methods identified as capable of increasing customisability. The author, however, notes that some scholars argue that modularity is not necessary for mass customisation, but rather contributes to decreases in complexity and costs.

A different study conducted by Huang, Kristal and Schroeder (2010) investigated how effective mass customisation will be to a company by considering the influence of the processes that the

companies adopt. There are many different models that may be used within the strategy of mass customisation. These models have an influential aspect on the efficacy of mass customisation in mitigating demand uncertainty (Chandra & Kamrani, 2004). There are three aspects that Huang and his colleagues consider whilst looking at the mass customisation strategies that companies should adopt as part of their overall strategy. They have outlined these strategies as; flatness, employee multi-functionality and centralisation. Flatness refers to an organisational structure with a short chain of command due to limited managerial level, whilst centralisation refers to having decisions made at higher consolidated levels and is based on amassed knowledge and information (Chandra & Kamrani, 2004). Employee functionality, however, refers to the ability of employees to perform multiple functions due to various skills they possess. The paper approaches the issue from a contingency theory perspective, which is one of the theories that may be used in the analysis of management strategies (Markman & Phan, 2011). In their examination, Huang and colleagues consider two forms of customisation, which they state as full customisation and partial customisation (Huang *et al.*, 2010). The research paper has increased external validity as it was conducted using a great number of respondents. This respondent pool was taken from different manufacturing industries and from different regions. This allows for the generalisation of the recommendations and conclusion into other areas of the world.

In their presentation, Huang *et al*. (2010) present the various theories that are currently available in mass customisation. They use these theories to build upon the idea of mass customisation. They also present a number of real world situations where this strategy is applied. The advantage that is provided by this is by enabling for the examination of the extent in terms of applicability of mass customisation as a theory. This allows for an analysis of the issues companies face in their implementation of mass customisation (Chandra & Kamrani, 2004). Huang *et al* also point

out that most of the literature that is available on the subject of mass customisation has been limited to look at the structural, infrastructural and the implementation of strategies regarding mass customisation capability.

Huang and his colleagues point out that past researchers have not paid much attention to the effectiveness of given mass customisation strategies, which is what they sought to consider in their research (Huang *et al.*, 2010). They are also able to show that these researchers instead focused on the theoretical aspects of the study only. In their study, they analysed 167 manufacturing companies in order to gain a perspective in terms of the empirical evidence. This is able to fill the gap in terms of the empirical evidence in mass customisation and build a foundation that allows one to conduct an explorative research (Moser, 2006). The study has built on previous research on the subject of mass customisation. It has also been able to create links between organisation theory and operations management in the development of the conclusions and discussions which validate the study by Huang, Kristal and Schroeder. They indicated that to achieve the best results from mass customisation, companies needed to utilise organic structures. They indicated that this was effective though for companies that adopted full customisation as opposed to partial customisation. They also concluded that there are other internal structures that may have a negative effect on the benefits that would be obtained from mass customisation (Huang *et al*, 2010). The internal factors are however not discussed and this created an area that future research needs focus on.

In his discussion of factors that enable mass customisation, Can (2012) explains that very short reaction time that is order-based is essential for mass customisation, hence the logical flexibility is a key enabler of mass customisation. Physical flexibility is also viewed to be essential for a

more agile production system. This author identifies the concepts of modularity, expandability, re-configurability, reutilisation and scalability as higher level enablers of agility and flexibility. In his discussion, Can categorises flexibility as strategic flexibility which responds to changes in the firm's external environment and operational flexibility which responds to changes within the internal environment. Based on review of previous studies, Can argues that strategic flexibility, including product, mix, volume, production and expansion flexibility, enables the firm to respond in an agile way. Conversely, operational flexibility such as process, delivery, routing, programming, labour, and machine flexibility enables mass customisation. According to this author, the relationship between agility, flexibility and mass customisation is a strong one.

Efficiency is also another identified enabler of mass customisation. According to Can (2012), efficiency represents the mass side of the mass customisation. The different definitions of mass customisation state that it should be cost efficient or as efficient as mass production. Further review by Can reveals that previous studies have established agile manufacturing, lean manufacturing, customer-driven design and manufacturing, and supply chain management to be the processes and methodologies that enable mass customisation.

2.9.2.1 Modularisation:

Modularity is defined as the level of module application by minimum interaction between various modules. It is the utilisation of the portions of modules with well-defined few interactions amongst them whilst including one or few functional elements in each of the modules (Can, 2012). Figure 2.7 below illustrates how customers' involvement affects modularity. According to this figure, when there is low degree of customisation, manufactured components are standardised and repeatable whilst high degree of customisation calls for original

designs or alterations to the standard designs in order to meet customer needs. The diagram illustrates that customer involvement determines modularity types.

Point of Customer Involvement

High degree of customization

Low degree of customization

Production cycle

Design   Fabrication   Assembly   Use

Components are original designs or alterations to standard designs

Components are standardized and repeatable

Modularity Types

Component Sharing   Component Swapping

Cut-to-fit   Mix, Bus, Sectional
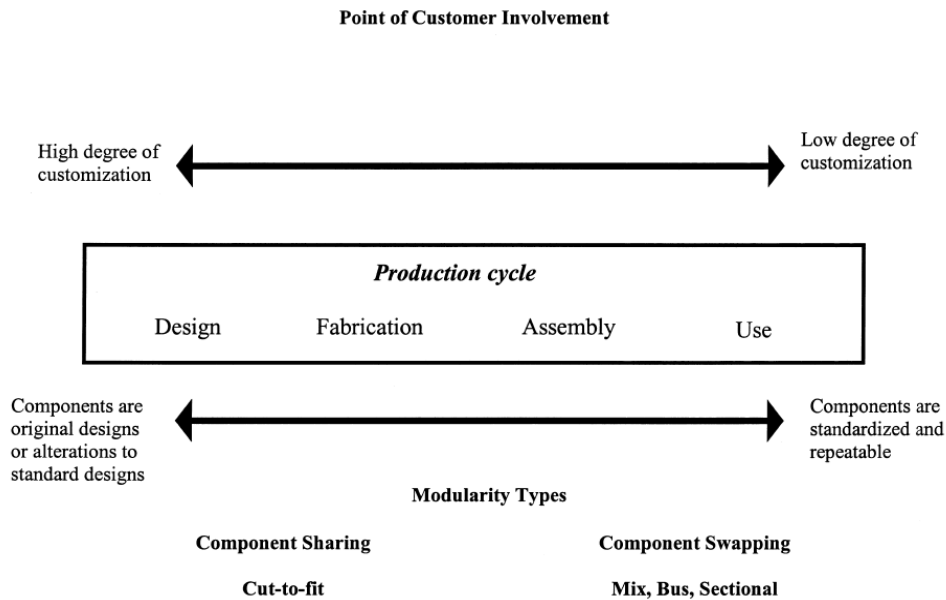
Figure 2.7: Customer involvement and the modularity in the production-cycle. Adopted from (Can., 2012)

Gershenson *et al*. (2003) identify various benefits associated with modularisation as; Products are easily updated owing to functional modules, a smaller set of components increases product variety, the use of components across product families increases component economies of scale, decreased lead time owing to the fewer components, the decoupling of product functions facilitates simple design and testing, the decoupling of product functions facilitates easy design and testing, and differential consumption increases ease of service (Gershenson *et al*., 2003). Moreover, modularisation is also characterised by some costs that need to be well managed, including: lack of performance optimisation as a result of the lack of smaller sizes and function-sharing, reverse engineering is easy, hence increased competition, the re-use of components can

result in static product architecture, and a lack of component optimisation can result in increased unit variable costs (Gershenson *et al*., 2003).

Research conducted by Brun and Zorzini (2009) sheds more light on the issue of mass customisation, in which the authors present some of the history by indicating that the onset of mass customisation may be traced back to Davis in the 1980s through his book titled *Future Perfect*. Davis defines mass customisation as the ability of a company to supply products to a customer that are tailored to the tastes of the individual, thus enabling each and every customer to get what they want. Notably, the process also would be carried out at a cost comparable to that of standard goods and services (Boër, 2013). Brun & Zorzin (2013) contend that, in so doing, agility, integration and flexibility are a component. They also contend that an element brought out in mass customisation increases cost; hence, companies will need to take this into consideration despite the need to ensure that there is no considerable increase in the price of final goods and services. Another point centres on optimum integration within the company, and how this influences the mass customisation capabilities of a company (Brun & Zorzini, 2009).

The research by Brun and Zorzini (2009) examined previous research, and from these has postulated two managerial methods that may be adopted in dealing with the issues arising from the adoption of mass customisation. These were modularisation and postponement techniques as evidenced in earlier discussions; these were the subject of previous researches, one of which was that written by Mikkola and Skjott-Larsen (2004). Modularisation is a technique mostly applicable in the automotive industry, with great success a representation of the diagrammatic flow shown after this paragraph (Doran, 2004). The research by Brun and Zorzini outlines that modularisation is product-focused, whilst postponement is a process-focused approach to

managing the supply chain. The analysis of these factors was based on the literature review writers presented on the subject; this provides some of the background knowledge needed to examine the issue of mass customisation (Brun & Zorzini, 2009).

However, the research considered these factors by examining 20 companies, all of which were based in Italy. Two basic limitations that are to be argued for the application of this method are as follows: firstly, a sample of 20 companies is too small to make any valid argument as regards the entire industry; and secondly, the sample size was selected from one geographical region. Both of these factors together limit the external validity of the data collected. As stated previously, there may be many differing elements potentially influencing the way in which companies perform prior to and following the application of the suggested strategies—a factor identified in many previous texts (Sanchez, 2008). Two areas that may determine the strategies to be applied by companies are complexity and customisation levels. Four main strategies were developed that were dependent on these two factors; these were identified as rigid, flexible, postponed and modularised structure. Despite the limitations of the study, however, the development of the theories in the research will be useful in the consideration of mass customisation (Brun & Zorzini, 2009).

Different research went into consideration of the history and various issues associated with mass customisation as an integral part of the company. The research by Fogliatto *et al*. (2012) examined some of the definitions identified in previous research, with the introduction of the research indicating some of the areas in which mass customisation as a strategy could be applied successfully so as to give companies a greater competitive edge. One such area was that of the food business. The research is an expansion of another study (Da Silveira *et al*., 2001), which

presents the developments that have gone into the development of strategies in mass customisation in the period spanning 2001–2010. The identification of these factors is indicative of how external environments have an effect on the internal strategies developed within the company (Fogliatto *et al*., 2012).

One aspect that was raised for consideration in the research was pertaining to the economics of mass customisation; categorising the economics of mass customisation into economies of integration and the difference between the price it takes to customise and the premium charged for the product. The research was able to build on previous research that had identified six areas from where the success of mass customisation could be achieved. These were in the areas of increasing customer demands, allowing for increased competitiveness in the market place, creating value in the supply chain, improvements in the technologies applied in the management of mass customisation, improvements in the tools used in mass customisation, and improvements in knowledge-sharing between customers and the company, which have created an increased awareness of customisation (Fogliatto *et al*., 2012). This is a factor that has been mentioned in other texts (Blecker, 2005).

The research contends that mass customisation as a strategy has become an integral part of the daily operations of most companies; nonetheless, there still remain certain issues that need to be addressed. The research emphasises increased technological capabilities for these changes in order for the utilisation of mass customisation to be effective. The issues raised lie in areas such as the web-based tools and models available, which move away from the theory to the practical application of mass customisation. As with many other researches already considered, the

research provides worthy areas where future research can be undertaken in (Fogliatto *et al*., 2012).

The study carried out by Lai *et al*. (2012), which sought to examine the way in which supply chain management integration is linked to mass customisation capability based on the resource-based view, significantly contributes to the mitigation of demand uncertainty through mass customisation and supply chain integration. This study examined two issues: the joint influence of internal integration, supplier integration, customer integration and the interaction amongst them on mass customisation capability development; and the moderating effect of environmental conditions (demand uncertainty and competitive intensity) on the impacts of supply chain integration on mass customisation capability (MCC) development. The authors used contingency and the extended resource-based view (ERBV) of the firm theories to develop a conditional indirect model, which they test using a dataset of 289 manufacturing firms from nine countries. According to Lai *et al*. (2012), today's modern-day business environment, which is characterised by fierce competition and rapidly changing customer needs has forced manufacturers to offer customised products in addition to services at prices that are reasonable and that do not vary significantly from those produced for mass production. These authors point out that mass customisation capability has become an essential competitive factor in meeting and satisfying customer requirements in a cost-effective manner. They note that finding ways of enhancing MCC therefore is of valuable interest to both practitioners and researchers. This study also did not look at the mitigation of demand uncertainty, nor identify it as an area into which specific future research should be conducted. The present study therefore is a response to this call.

Lai *et al*. (2012) explain that manufacturing firms can improve their mass customisation capabilities by improving practices whilst also integrating resources within the organisation's boundaries. The authors further emphasise that external interactions with suppliers and customers also can contribute significantly to mass customisation capability. They point out that, since mass customisation capability has been found to enable firms in attaining new and innovative forms and sources of competitive advantage, it has been regarded as an essential organisational capability. Lai *et al*. further suggest that, in order for firms to boost these capabilities, they need to find ways of building, integrating and reconfiguring internal as well as external resources so as to meet the rapidly changing requirements of the business environment. Therefore, the study examined how firms enhance mass customisation capability through resource integration and collaboration beyond their internal boundaries. The study draws from the knowledge-based view of the firm in terms of examining how collaboration and knowledge-transfer between buyers and suppliers play a role in the development of organisational capabilities.

Lai *et al*.(2012) point out that a number previous empirical studies have investigated methods of developing mass customisation capability by improving management practices and strategies such as customer involvement, postponement, modularity-based manufacturing processes, time-based manufacturing routines, organisational learning, sociotechnical work-design strategies, quality management and organisational structure design. These studies demonstrate that, in order for a firm to attain success in mass customisation availability, there must be complete understanding of the needs of customers and product availability, as well as the capability to manufacture products in an efficient and effective manner (Lai *et al*., 2012). This article further explains that there needs to be high levels of agility and flexibility in processes within a firm in

order for mass customisation capability to be successfully developed. This implies that mass customisation capability development requires organisation to have effective internal integration across all functions and accordingly to fortify its degree of integration with suppliers and customers in order to effectively respond to changing customer needs and market requirements.

2.9.2.2 Customer Order Decoupling Point:

Olhager (2003) defines Customer Order Decoupling Point (CODP), also known as order penetration point, as the point at which products are linked to a specific customer order within the manufacturing value chain. Different positions of CODP specify different manufacturing situations, including Make to Order (MTO), Engineer to Order (ETO), Make to Stock (MTS) and Assemble to Order (ATO) (Can, 2012,).

According to Rudberg and Wikner (2004), CODP is that point which separates the decisions made under certainty from those made under uncertainty regarding customer demand. In Figure 2.8, these authors represent the sequential approach to customer order decoupling point. According to the diagram, the position of CODP depends on both the supply and demand perspectives. The diagram also brings out the fact that CODP lies between moments of speculation (uncertainty) and that point where the manufacturer is certain and makes a commitment. It is apparent from the diagram that the manufacturer relies on information from both the supply end as well as consumer end. The different manufacturing situations are also illustrated.
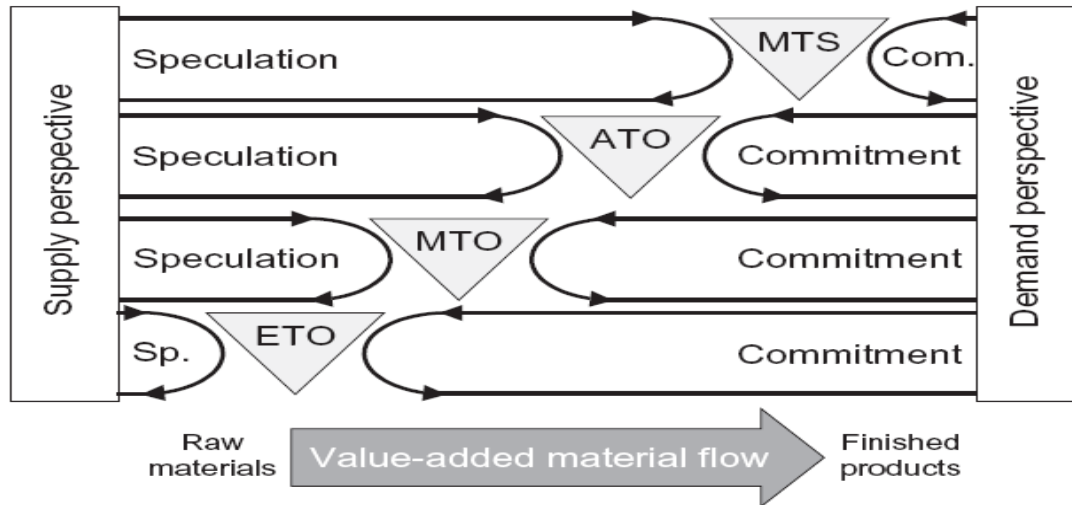
Figure 2.8: The typical sequential approach to the CODP concept. Adopted from (Rudberg & Wikner, 2004)

Rudberg and Wikner (2004) explain that in the figure above, the speculation parts indicate the forecast-driven activities concerning customer demand that are carried out under uncertainty. The commitment part shows the customer-order driven activities. Hence, the triangles between commitment and speculation point out the OCDP position in the value-added chain (Rudberg & Wikner, 2004). According to Yank and Burns (2003) the decoupling point is a critical element in the supply chain as how to position is an important decision in designing the supply chain. They describe OCDP as the point where the customer order and supply chain penetrates and that differentiates forecast from order-driven activities.

2.9.2.3 Mass Customisation and Customer Order Decoupling Point (CODP):

In order to analyse customer participation in mass customisation, customer order decoupling point is studied in two dimensions; that is, engineering and production (Can, 2008). The research goes on to state that the positioning of the customer order decoupling point in mass customisation entails recognising the optimal balance, linking the forces of productivity and

flexibility. Moreover, the shifting of CODP upstream in the flow of material makes the flexibility competitive and accordingly increases the customisation capability of the manufacturing system. Alternatively, when CODP is shifted downstream, there is much emphasis placed on overall productivity, and organisations advance in price competition. The author argues that, when it comes to positioning a customer order decoupling point, it ought to be taken into account that the marginal benefit from flexibility lessens as CODP is shifted more upstream, and the marginal benefit from productivity lessens as customer order decoupling point is shifted more downstream. For this reason, the author suggests that balance across these forces is vital in terms of attaining mass customisation. It is further recognised that the degree of customisation ought to be appropriate to customer requirements and existing capabilities, whilst simultaneously positioning the involvement of the initial customer.

2.9.3 Postponement

Across the world, postponement practice has been applied to a large extent. According to Yang (2009), the supply chain as a whole, ranging from product design and development, manufacturing and to end products, has been covered by postponement. The author goes on to state that postponement was initiated as a marketing strategy to lessen risk and uncertainty costs, which are linked to highly-dynamic demands by postponing the creation of time, place, form and ownership utilities. The research also emphasises that product designs could eventually be changed, not only to fasten the response to unexpected changes in demand but also in an effort to deal with supply matters comprising unexpected changes early on in the product cycle. For this reason, postponement could potentially provide the opportunity to alter the configuration of one

product at the very last likely minute lest there is existence of disruptions in supply of a component.

In this section, the research is aimed at examining the definition of postponement, the classification of the different types of postponement strategies, and providing an explanation on the way in which postponement is used as a tool for managing uncertainty mitigation.

Can (2008) further defines postponement as the process of delaying product finalisation in the supply chain until orders from customers are received with the aim of customising products, as opposed to performing those activities with the expectation of getting future orders. According to the author, this definition implies that organisations can delay production, distribution, packaging and assembling until they receive exact orders from their customers. The writer also cites that logistics postponement provides opportunities to locate inventory in any other place at any given time, which accordingly reduces the risk of being at fault. It can be concluded that, if the company delays the exact order for product distribution to local or international warehouses, the chances of decreasing risks become high in delivering products more than or less than needed. The writer asserts that the major intention of companies to apply postponement, in most cases, is to reduce the cost of distribution.

Can (2012) refers to postponement as a concept that combines the responsiveness of the agile concept and the efficiency of the lean concept. Postponement is defined as the delaying of activities in the supply chain up to that moment that customer orders are received with the intent of customising the products, as opposed to doing so in anticipation of future orders (Can, 2012). This definition implies that firms can delay the production, packaging, assembling, distribution

or even purchasing of raw materials until exact customer orders are received, as shown in Figure 2.9.
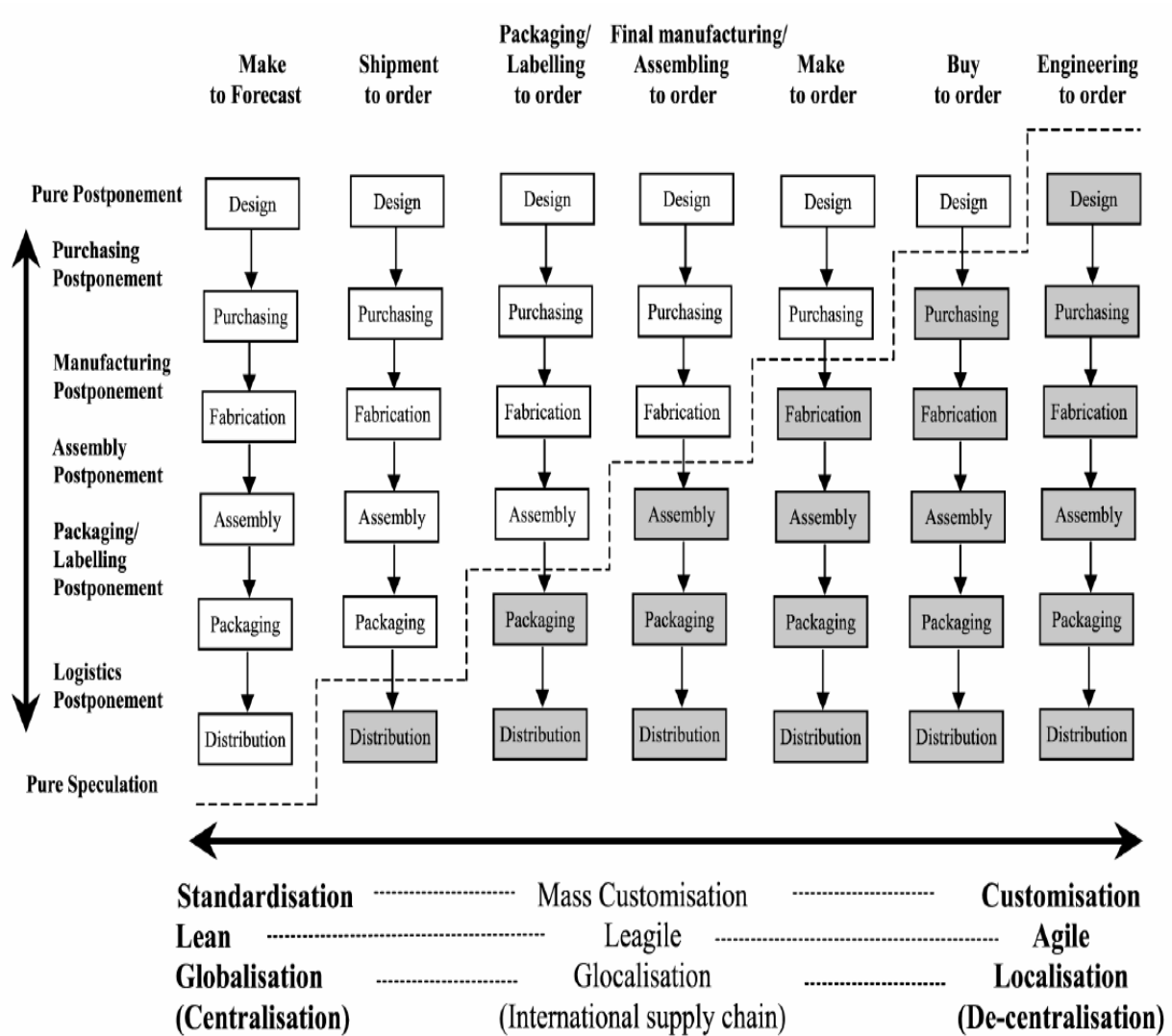
Figure 2.9: Speculation-postponement strategy and a continuum of standardisation-customisation. Source: (Yang *et al*., 2004)

The diagram in Figure 2.9 illustrates how postponement is interrelated with the concepts CODP, mass customisation, lean and the agile concepts. The figure indicates that the different types of

postponement rely on the different positions of CODP and all these require application of the agile concept so as to respond in time, as well as the lean concept which is key in ensuring efficiency.

According to the review conducted by Can (2012), simulation studies demonstrate that postponement results in decreased inventory levels and manufacturing lead times. The studies reviewed also identify a reduction in uncertainty, which stems from the short-term dynamics in the supply chain as another area of application of postponement strategy. According to Can, responsiveness is improved by the type of postponement used, rather than through delivery reliability. Further review of previous studies by Can (2012) emphasises that higher postponement application causes increased on time delivery performance, which, in turn, leads to lower operational cost. In his discussion of postponement as a strategy of uncertainty management, Can recognises that the postponement concept makes it easier for manufacturers to forecast aggregate demand as opposed to forecasting the demand of each finished product. Secondly, the delay period enables the manufacturer to obtain more accurate information with regard to time, quantity and place.

Yang *et al*. (2004) recognise that the principle of postponement can be placed in three categories; that is, form, time and place postponement. Form postponement involves delaying activities that decide the form and function of products in the chain until customer orders have been received. Time postponement refers to delaying the forward movement of goods until customer orders have also been received. The final generic type of postponement, as defined by the author, is place postponement, which refers to the positioning of inventories upstream in centralised

manufacturing or distribution operations in order to delay the forward or downstream movement of goods.

Different research by Hoi *et al*. (2007) recognises that the main concept of postponement is to pull and not push the process of manufacturing, and consequently shift inventory from finished goods to semi-finished goods and raw materials. These explain that purchasing postponement refers to when a large part of inventory comprises raw materials, whilst production postponement occurs when the majority of inventory consists of semi-finished products. Product development postponement, on the other hand, occurs when manufacturers do not design the products until they receive the order.

From his study, Can (2008) poses the argument that various research methods in the literature, such as surveys, cases and simulation studies, are used to analyse the benefits of postponement. In his review of simulation studies, the studies demonstrate that postponement led to a reduction in inventory levels and manufacturing lead times. The author's major finding when postponement was applied showed that postponement decreased the uncertainty due to short-term changes in the supply chain. Consequently, Can recognises that postponement improves responsiveness, but not delivery dependability. Can (2008) states that postponement is seen as one of the strategies for tackling uncertainty. The author suggests the postponement concept revolves around two major concepts: the first idea the author identifies is that it is straightforward to predict aggregate demand compared to predicting the demand of each end product; the second idea is that more accurate information, that is, place, time and quantity can be attained at some point in the delay period. As a result, he suggests that, by altering the business processes based on the postponement strategy, companies can obtain the missing

information, which is the cause of uncertainty. Moreover, the author points out that the relationship between postponement and uncertainty in the integration of supply chain has been investigated. The author inspected the relationship between postponement and uncertainty, and how uncertainty can be tackled. It was found that there are two levels of uncertainty, namely; the low level of uncertainty, which includes place and time utility of the customer order, and individual demand forecasts of the end products, and a high level of uncertainty, which involves the quantity and time utility of production and what needs to be produced.

Cavusoglu *et al*. (2012) evaluated the importance of the relationship between postponement and information sharing, and accordingly identified that there are two different strategies centred on decreasing manufactures' uncertainty regarding demands. The authors also point out that production postponement and information-sharing strategies may replace, harmonise or otherwise clash with one another, depending on the degree of the rise in the unit production costs during the period that production is postponed. The research suggests that demand uncertainty has encouraged manufacturers to devise diverse uncertainty reduction strategies. The authors provide an example of a Make to Order (MTO) strategy. Usually, a manufacture has to lower their price but postpones production until the demand uncertainty is tackled. Consequently, manufacturers might decide to cut-down demand uncertainty by acquiring information from other available sources. The writers argue that information can constitute an external entity: for instance, an agency that deals with marketing research inside the supply chain; thus, they suggest that the basis of large amounts of supply chain efforts have always involved sharing demand information between retailers and manufacturers. This is because it is believed that retailers release better information concerning customer demand than manufacturers.

Cavusoglu *et al*. (2012) extend their study by pointing out that both strategies of production postponement and information sharing constitute a similar aim of decreasing a manufacturer's uncertainty regarding demand. A noteworthy limitation in the research is that the literature on production postponement has investigated the influence of postponement strategies on retailers, whilst literature on information sharing has openly displayed retailers as not receiving direct assistance; in some cases, they get hurt when they provide their manufacturer with private information. Accordingly, it is concluded that, contrary to the notion that postponement and information sharing in most cases substitute one another since both strategies aim at reducing demand uncertainty, the research elaborates that, based on the relationship between the two strategies, postponement and information sharing can harmonise with each other or otherwise bring out conflicting sides. Consequently, the authors state that these two strategies, from a retailer's perspective, in most cases conflict with each other.

Min and Mentzer (2004) observed that products would tend to be differentiated when they approach the purchase point. Postponement is a value-added process concerning products, where the common requirements for processing are at a maximum. In postponement, the unique processing requirements for all product varieties delay as much as it allows the value-adding process. Song *et al*. (2009) also provide a discussion of this concept in the service industry. When management carries standards components and then accordingly moves customisation downstream, they result in flexibility in using the same materials to satisfy the needs of different customers. In this case, customisation is deferred to a later stage. In postponed manufacturing, there is the separation of product customisation from speculative manufacturing (Nyaga *et al*., 2010). Postponement confers dividends of a more responsive supply chain, which satisfies the needs of individual customers without the necessity of incurring higher costs in inventory and

production (van Hoek, 2001; van Hoek & Weken, 1998). In supply chain management, postponement helps in reduced cost obsolescence, lower overhead costs and short product development cycles (Feitzinger & Lee, 1997). Logically, additional information can be collected so as to reduce any uncertainty during the delay. Postponement, however, is only beneficial in unpredictable environments. Where there is predictability, postponement is not very useful. Towill and Christopher (2002) conclude this well by stating that the best method of coping with uncertainty is to ensure understanding of the major causes identified in the supply chain. Mason-Jones & Towill (1998) and Davis (1993) provide different sources of uncertainty, namely from the process side, the control side, the supply side and the demand side. Supply chain management using postponement therefore can be useful in dealing with the demand side of uncertainty.

As indicated, there are various industry-specific factors that influence the supply chain management techniques applicable to any particular industry (Ganeshan *et al*., 1999). The application of postponement in the food industry has been done to a lesser extent when compared to other industries. Previous research has shown this to be mainly in the packaging industries within the food industry. The limited adoption of postponement in the food industry has also been emphasised in the research written by Hoek (1999), which aimed at examining the application of postponement in the food industries. The research was undertaken in Netherlands, Belgium and Germany. The research focuses on the management of supply chains in the food industry, and begins by defining postponement as the delay in production until an order has been placed by a customer. He contends that it also may be applied to distribution and purchasing. Hoek further outlines the benefits of postponement as the ability to customise the products whilst

saving on the inventory and logistics costs; this is done with increased flexibility on the side of the company (Hoek, 1999).

Hoek's research (1999) sought to establish three things. It begins by providing an examination of the extent to which the current postponement techniques have been adopted by the food industry. This builds the foundation upon which the issue of postponement will be analysed. He also seeks to determine the extent to which the level of postponement affects the amount of outsourcing undertaken by the firm. There has been increasing thought that postponement, amongst other factors, has an influential role to play in outsourcing (Rushton & Walker, 2007). Hoek further seeks to establish the need for the reconfiguration of the supply chain if one is to gain advantages of postponement. The research uses empirical evidence from a research project titled 'World Class Logistics and Postponement in Europe'. The analysis was undertaken with consideration to four main sectors: food, electronics, automotive supply and clothing. This comparison allows for a wider analysis that presents a more complete picture of the application of postponement depending on the industry. This is also able to indicate the sector-dependent factors that influence the strategy applied in the managing of supply chains (Hoek, 1999).

A more in-depth analysis of postponement as a strategy, as undertaken in the research written by Yang &Yang (2009), aimed at improving understanding of postponement. Indicating that globalisation has created increased competitiveness in the market place, which reiterates that, concluded in numerous other studies, companies have been forced to identify better competitive edge-achieving methods. Yang & Yang argue that, due to certain factors, the implementation of these strategies may be limited. This is an area that also has been explored in previous texts (Kazmi, 2007). One of these factors is in the complexity of the management strategy, which

could increase the overall complexity of the company's operations. Yang and Yang further argue that there are also additional costs associated with the implementation of these strategies. Such additional costs, at times, may not be easily passed on to the consumer. In the long-term, this will limit the competitiveness of the company. The research further points out that the management of supply chains is largely a factor of the uncertainty that may stem from interruptions in the global supply chain (Yang & Yang, 2009).

In the analysis undertaken in the research, the writer's main focus was centred on analysing the supply chain through the use of accident theory. Accident theory is the proposition that the characteristics of a given system determine its proneness to accidents (Khosrowpour, 2006). In the research by Yang and Yang (2009), the main area of consideration was the uncertainty raised from disruptions in supply, and not that which is raised by variation in the demand of a good. They considered how postponement may be applied in this case in an attempt to mitigate this form of uncertainty. They also indicate that, similarly, this will have a greater influence on the operations of the company similar to that caused by demand uncertainty. One contribution made to the discussion through the work of Yang & Yang is that strategy postponement has been favoured in companies where Just in-Time manufacturing has been adopted (Yang & Yang, 2009).

Yang and Yang (2009) have considered the amount of interaction apparent between the company and those in other areas of the supply chain. This is to ensure that the communication that is necessary for the efficiency of the postponement strategy is well implemented. Communication already has been identified as an integral and important part of the adoption of both postponement and mass customisation in the supply chain (Kumar & Krob, 2005). In the

research written by Yang & Yang, the concept of what they refer to as 'modular design and interactive complexity' has been discussed, indicating that, in the implementation of postponement, companies would need to reduce the level of complexity existent in the supply chain. The end result is that there is an improvement in the economics of operations (Yang & Yang, 2009).

Despite the increased amount of information presented in the research, the focus may be limited to a certain degree. One of these limitations concerns the realisation that there are other areas of the supply chain that may be affected by postponement as a strategy. The research did not study these other areas. Another limitation is that, in the study, the data used was of a secondary nature. This was at the expense of empirical data that would have aided in affirming the theoretical knowledge presented. The knowledge presented in the research, however, does contribute to the discussions on postponement as a strategy, with the writers concluding that further research may be undertaken on the subject of complexity, with consideration to how this affects the performance of the company (Yang & Yang, 2009).

Different research by Yeung *et al*. (2007) continues to explore the concept of postponement, with special focus centred on the application of the concepts in the Chinese economy. In their examination, they are able to provide empirical evidence that seeks to confirm their postulations. The provision of empirical evidence also builds on the previous research by Yang &Yang (2009), where analysis was aimed at establishing the operational characteristics that would influence the application of postponement, as well as how these characteristics would do this.

The research by Yeung *et al*. (2007) indicates that, in the application of postponement, all levels of the supply chain will need to be considered; this is by analysing both the upstream and

downstream constituents of the supply chain. They also indicate the various ways in which the supply chain may be characterised. Furthermore, they are also able to give five classifications of postponements that are dependent on the characteristics explored in the research: manufacturer-dominated, customer-dominated, virtual supply chain, balanced structure with loose suppliers, and balanced structure with no customer information (Yeung *et al*., 2007). Balanced supply chain structure refers to a structure wherein all actors have equal powers, with neither party in the chain dominating the others. In balanced structure, where there is no customer information, there is no information sharing between customers and manufacturers, which means production based on order is difficult (Yeung *et al*., 2007). In the balanced structure with loose suppliers, the modularisation of products can occur, with no information sharing between the manufacturer and the suppliers. This requires raw material to be re-processed and kept in the work-in-process format (Yeung *et al*., 2007). In the customer-dominated arena, customers are very powerful, and manufacturers can customise their production processes to meet the requirements of their special customers. Manufacturers respond faster to orders and save costs by keeping inventory as raw materials rather than in finished goods format (Yeung *et al*., 2007)). The manufacture-dominated supply chain is where manufacturers are powerful and accordingly seeks to minimise costs and reduce risks through the postponement of production and ensuring inventories are kept in raw material format (Yeung *et al*., 2007). In the virtual supply chain, there is a highly developed information system that connects all parties in the supply chain. The manufacturer is able to postpone the design and production until the customer places an order. The manufacturer then outsources the production function for the order. The classification of postponement has not been considered by most of the previous studies on the subject, and therefore will be explored by the present study.
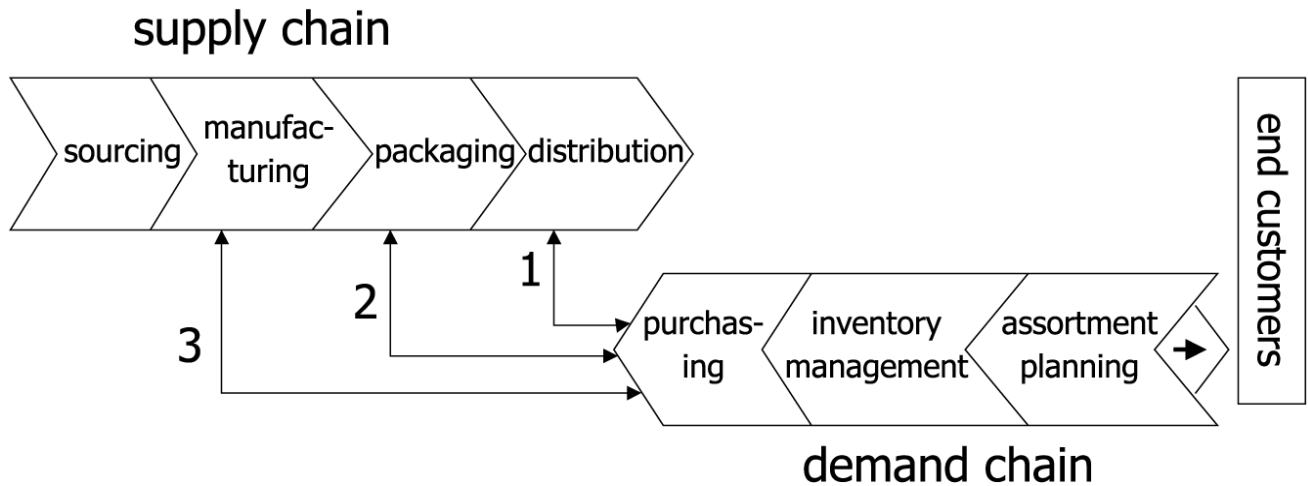
Figure 2.10: Supply (Upstream) and demand (downstream) supply chain. Adopted from (Jacobs, 2006)

Figure 2.10 is an illustration of all the parties in the supply chain. This diagram tries to point out the fact that product development requires consistent flow of information between the various parties so that it is developed efficiently and delivered as per specifications. This diagram is important in explaining the fact that postponement strategy requires involvement of all these parties as the manufacturer has to postpone production until the customer has placed an order from the demand side. It is at this point that the parties in the supply end are contacted so that manufacturing and distribution is done.

Despite the increased information provided in the research, the concern comes with the consideration that the research examined only a single economy; this may provide a biased point of view, where the information provided might not be applicable in other economies of the world. The research further analyses a limited number of companies (eight in total) of a given region, which further increases the bias in the findings (Yeung *et al*., 2007). These two factors determine the effectiveness of the results. A limited sample size and the use of a single country

to find the data needed in the study limited the diversity of the data and, as a result, the external validity of the conclusions drawn (Craig, 2005).

Another important study on the application of postponement practices to mitigate demand uncertainty is that conducted by Cholette (2009), who developed a mathematical model for postponing channel differentiation as a way of mitigating demand uncertainty in winery sales channels. The results obtained from solving the model demonstrated that holding considerable portion of production at the packaging and labelling levels significantly improved product profitability. Cholette further investigated how different product restrictions and configurations can affect the level and extent of the postponement strategy, and accordingly identified the strategy as suitable over a range of costs, demand probabilities and other considerations. This study therefore provides evidence in support of postponement as a suitable strategy for mitigating demand uncertainty in the food industry.

Cholette (2009) explains that, in spite of the postponement concept being introduced into management literature in the 1950s, it has received less attention by practitioners. According to Cholette, the actual usage of the postponement strategy has been documented mainly in the automotive and other high technology industries, which have achieved successful adoption compared to other verticals. The author notes that the agribusiness has considerably lagged behind other sectors in adopting postponement practices; however, he attributes the lag in the adaptation to a lack of capability to employ processes that support and facilitate postponement, such as information coordination technologies, as well as the general incapability to modularise product design for enhancing component commonalities. Cholette (2009) also acknowledges that a firm's ability to change processes to facilitate postponement-or to adjust the organisation's

mind-set to consider the employment of such techniques is an important issue that should not be ignored. The author identifies change management as an important barrier to the effective implementation of postponement. Cholette further concludes that, when well implemented, postponement can be an effective strategy in mitigating demand uncertainty, particularly in an intensely competitive and globalised market environment.

2.9.3.1 Postponement and Customer Order Decoupling Point (COPD)

According to these authors, Decoupling Point (DP) is strongly linked to postponement, and requires the manufacturer to be very careful about where the DP is to be located. The level of postponement is also related to DP. Information flow and material flow perspectives can both be used in explaining how postponement can be used to locate the DP (Yank & Burns, 2003).

According to Can (2012), the main reason firms postpone some of their operations is owing to a lack of customer order information. In his explanation, Can points out that, when needing to provide efficiency in utilising postponement as an uncertainty management strategy, some operations that require information about customer orders need to be moved downstream; in exchange, some of those that do not require customer order information or those that can be done in anticipation should be moved upstream. If not, the firm has to deal with high volumes of work in progress inventory, as well as long lead times, which might result in the stoppage of material flow. The point at which the customer order is linked to or seen to penetrate the system is CODP (Can, 2012). It is the point at which the missing information causing postponement is held. The relationship between postponement and COPD therefore is very strong. Supply (Upstream) and demand (downstream) supply chain with regards to information sharing as shown in, Figure 2.10.

2.9.3.2 Lean and Agile Supply Chain

According to Can (2008), the term 'leagility' refers to the combination of lean and agile concepts within the supply chain strategy by placing the decoupling point (DP) so that the organisation is best fit to respond to a volatile demand downstream whilst at the same time enabling level scheduling upstream from the DP. This simply involves efficiently producing customised goods in a manner that is similar to mass production. Agile supply chains are aimed to be market sensitive. According to Can, lean and agile SC increases the competitiveness of an organisation in the market. The leagility concept is illustrated in Figure 2.11 below.
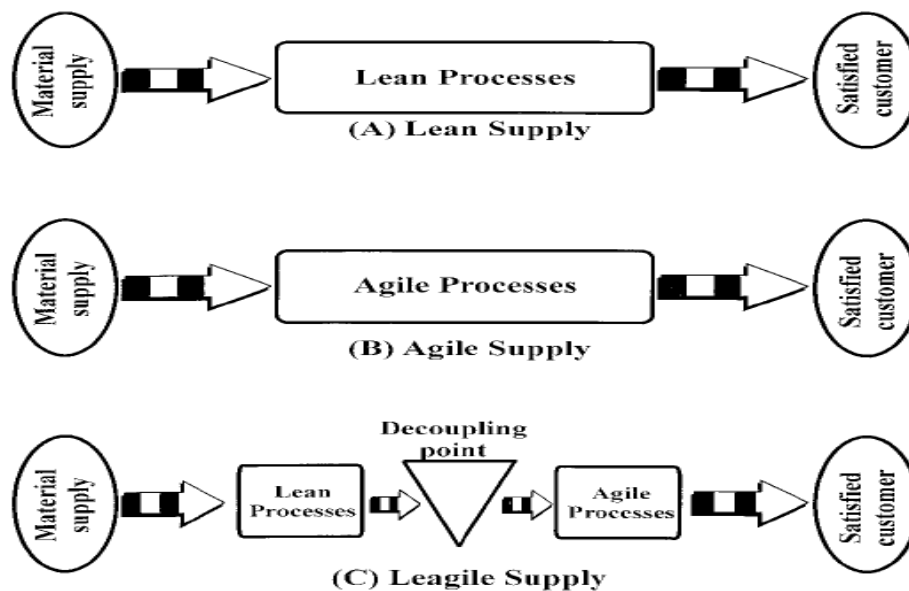
Figure 2.11: Lean, agile and leagile supply: Adopted from (Mason-Jones *et al*., 2000)

Figure 2.11 illustrates the leagility concept by combining both the lean and agile processes. According to this diagram, combination of the lean and agile concepts by placing the decoupling point in between them results in customer satisfaction by ensuring that the organisation effectively responds to customer needs in an efficient manner.

According to Can (2008), mass customisation, in nature, demonstrates a leagile SC, emphasising the importance of responsiveness and efficiency. Leagile SC essentially implies producing customised products in a manner that is efficient, as is done in mass production. The lean aspect of leagile supply demonstrates the mass aspect of mass customisation, whilst the agile aspect of leagile demonstrates the customisation aspect of mass customisation (Can, 2008).

With regard to postponement, it is argued that postponement is an important factor that contributes to the achievement of agility through its contribution to the customisation of services and products, cross-functional efforts, and the use of information on customer order through the SC. Postponement therefore is regarded as vital for any agile strategy, and since it works towards moving CODP downstream, it increases the overall effectiveness and efficiency of the SC. Postponement therefore is considered a concept that contributes to efficiency (lean) and responsiveness (agile) (Can, 2008).

Leagility is considered to be the link between mass customisation capability and postponement. MC naturally requires a leagile SC owing to the fact that both efficiency and responsiveness are the key principles for the success of the MC strategy. Postponement, however, has been identified as contributing to efficiency and responsiveness; therefore, Can (2008) argues that postponement plays a role in the leagile SC of mass customisation. The MC strategy therefore has the capability of producing a market winner in all competitive priorities, through customisation (product design), customer satisfaction through the various appropriate production systems (regarding cost, quality and delivery), which are associated with the MC strategy (Can, 2008).

2.9.3.3 Market Qualifier and Winner Regarding Lean and Agile SC

According to Mason-Jones *et al*. (2000), the lean production concept can be applied across the value stream in an effort to eradicate waste and accordingly provide customers with real value. They explain that profit maximisation results from cost minimisation, which, in turn, is a direct outcome of elimination. The lean system framework enables a firm to attain waste elimination by smoothing the demand, thus resulting in a level schedule. Market situation also may call for cost leadership; in which case, the criteria for winning an order is cost, or may be demand service leader, where the winning criteria is service level, or a combination of the two. As Figure 2.12 below illustrates, quality, service level and lead time are market qualifiers for the agility concept. However, cost, which could be a market qualifier for the agility concept, is also a market winner for the lean concept. The connection between the two order winning criteria centres on the fact that, whilst service level needs to maximised, cost needs to be minimal so as to improve performance across the supply chain (Mason-Jones *et al*, 2000). According to these authors, the application of the lean tool in the SC is to address the benchmark for the lean market winner. This cost comprises all distribution, storage and production costs in the SC. Service level—also a market qualifier under the lean concept—also turns out to be a market winner for the agility concept.

Figure 2.12: Market Qualifier and winner, regarding to Lean and Agile SC (Mason-Jones *et al*., 2000).

Figure 2.12 illustrates the market qualifiers and market winners for the lean and agility concepts. According to this diagram, cost, which is a market qualifier for agility concept, is also a market winner for the lean concept whilst service level, which is a market qualifier for the lean concept, is a market winner for the agility concept. This diagram basically shows how the two concepts are interrelated in terms of market winner and market qualifiers.

2.9.3.4 Lean Manufacturing

Lean manufacturing is a concept that seeks to reduce and eliminate waste (Chan, Kumar & Tiwari, 2012). According to these authors, the lean manufacturing concept was motivated by the Japanese strategy that seeks to ensure continuous improvement (Kaizen theory) and focuses on doing more with less resources, such as time, money, space and inventory in order to deliver products and services efficiently where demand is predictable and stable and the product variety is low. Lean aims at elimination of seven types of waste which include; waiting time, overproduction, time incurred in motion, inventory and transportation, over processing and defective units (Olivella *et al*, 2008). According to the study conducted by Manoj *et al*. (2013a), in which they analysed application of lean manufacturing, "critical success factors and its impact on the operational performance in food processing SMEs" (p. 156). The findings demonstrate application of lean manufacturing practices in food SMEs is not widespread but rather is still in its infancy. The study established that food processing SMEs emphasised more on food safety than they did on process improvement methods. Application of the practice was however found to improve operational performance, and in particular overall productivity.

Lean waste management identifies eight types of waste, each discussed below by Olivella *et al*. (2008). Notably, the eight wastes of lean management include over production, inventory,

waiting, defects, motion, transportation, over processing and, incorrect use of staff and their abilities. As shown in Table 2.1.

Over production refers to when a firm produces more than is required by the customer. Over-producing impacts process chains, inventory and transportation costs, results in waiting, increased defects, and motion.

Inventory motion waste occurs when quantity of parts in stock are not being utilised in production and therefore take up valuable space. They could become obsolete whilst in stock.

Defects usually result in the reworking, re-processing and scrap as a result of products that are defective and need to be disposed or otherwise reworked, which results in costly processes.

Waste due to waiting results when tasks in the manufacturing process upstream and downstream are delayed due to delays in information, materials, equipment and operators. These delays could accumulate and result in losses.

Excessive transportation waste; including the unnecessary movement of items, finished goods, materials, parts and information from one place to another, all of which waste resources, time and money.

Motion–unnecessary motion is associated with staff and, more specifically, operators moving about the work space wasting effort and time. This can be caused by poor practices, standards and process design.

Over processing involves taking unnecessary steps throughout the production/ manufacturing process. This wastes time, resources, materials and equipment.

Incorrect use of staff and their skills as well as abilities could result in missed improvement and learning opportunities. They should be used to eliminate the other aforementioned wastes.

	Type of Waste	Description	Example Within Manufacturing	Example Symptom
1	T: Transport	Products are moved to various locations and whilst the product is in movement, it is still unprocessed and thus adds no value to the consumer.	Raw materials are processed and assembled from different locations and then transported to a central site where a bulk intermediate product is made. This product is then moved for final processing as well as for customer use. This could be done at separate site or the same site where the raw materials were assembled.	Pallets of the intermediate product are moved around one site or between various sites. There is a lot of warehousing and continuous movement of the intermediate material and products on and off site rather than movement or storage of the final product.
2	I: Inventory	It is costly to store products, raw materials and intermediates.	The firm economically purchases raw materials in bulk which then sits in the warehouse for extended periods of time. Specific warehousing or segregation may be required for queued batches of intermediate material particularly if the lab analysis is incomplete or yet to be confirmed.	Large warehousing and keeping large buffer stock within the manufacturing facility and on the site is financially viewed as excessive use of working capital.

	Type of Waste	Description	Example Within Manufacturing	Example Symptom
3	M: Motion	Excessive movement of the people who work at the manufacturing facility is regarded as wasteful because it is regarded that they are not supporting the processing of the product whilst in motion. Excessive movement of information, decisions and data is also seen as wasteful.	People required moving from one point to another only when moving the product along the processing cycle. People should also only move when transporting documentation or samples. They should also only move work in progress, and to the warehouse and from it. People are required to meet with others to confirm key decisions regarding the supply chain process.	Operators moving all over the manufacturing unit but doing less activity within the unit.
4	P: People	Overusing or underusing the human resources.	Having insufficient staff to perform duties. Using people who are overqualified to perform certain duties. Using extra staff to assist processes that are fully automated.	Excessive over time. Senior managers working and manning activities at the manufacturing plant.
5	W: Waiting	As products, people or equipment are made to wait, it does not add any value to the customer.	By using storage tanks as product buffers that are awaiting processing by the next step. Intermediate product not being allowed to leave the site until completion and confirmation of lab tests and research work.	The large amount of 'Work In Progress' that is ongoing at the manufacturing plant is often viewed on the balance sheet as 'piles of inventory' at the site.

	Type of Waste	Description	Example Within Manufacturing	Example Symptom
6	O: Over Production	Product made without being ordered for and hence for no particular customer. Development of a product that adds no value.	Large batch campaigns and continuous manufacturing in large scale. Development of alternative process routes that are not utilised and which do not support the bottleneck. Redesign of standardised parts of the manufacturing facility, e.g. reactors.	The extent of space in the warehouse required and which put to use. Imbalance between development and production A process that is ever changing. Large engineering costs and time related to facility modifications.
7	O: Over Processing	When a certain process step adds no value to the product.	Certain design of unit operations can result in extended processing times and entail steps, which add no value. Duplication of any steps associated with the supply chain process, such as sampling or checking.	The reaction stage is usually complete within a short time the process is made to continue for hours or days. Possession of process controls which never indicate a failure. Delay of documents required to accompany finished product.
8	D: Defects	Errors occurring during the process and requiring either additional work or re-work.	Material that do not meet specification; incomplete batch documentation erroneous data and data. General miscommunication.	Missed and late orders. Excessive overtime. Increased costs of operation.

Table 2.1: Wastes of lean management: Adopted from (Erriah, 2013)

2.9.3.5 Summary of Literature Review

Subject	Authors
SCI in SMEs	Abdallah *et al*., (2014); Zhang *et al*., (2009); Bourlakis *et al*., (2014); Antonio & Richard (2010); Baofeng (2012); Simangunsong *et al*., (2012); Zhao *et al*., (2009); Govindan *et al*., (2011); Plaggenhoef (2007).
Postponement in SMEs	Yeung *et al*. (2007); Battezzati & Magnani (2000); Can (2012); Can (2008); Cholette (2009); Hoek (1999); Manoj *et al*., (2013a); Manoj *et al*., (2013b); Van Hoek (1999).
MCC in SMEs	Can (2012); Can (2008); Fogliatto *et al*., (2012); Rudberg & Wikner (2004); Zhang *et al*., (2015).
SME Development	Otsuki (pp.1–2), Shalaby (2012), Almosallam (2008), Bundagji (2005).
Development of SMEs in Saudi	Al-Awwaad (2007), Almosallam (2008).

Table 2.2: References relevant to SMEs.

Subject	Authors
Supply chain management	Shalaby(n.d.),Otsuki(2002).
Management Practices	Christopher (2005),Mentzer *et al*. (2004), Krajewski *et al*. (2007), Angerhofer *et al*. (2000), Kelton *et al*. (2003), Carvalho *et al*. (2012), Li & Schulze (2011),Vijayasarathy (2010).
Supply Chain Uncertainty	Wong *et al*. (2005), Cohen & Roussel (2005), Li *et al*. (2005), Bajpai (2011), Schermerhorn (2010), Qi *et al*. (2011), Koçoglu *et al*. (2011), Yao & Song (2001), Mikkola & Skjøtt-Larsen (2004).
Demand Uncertainty	Hillson (2006), Li & Hong (2007), Simangunsong *et al*. (2011), Li & Hong (2007), Hult *et al*. (2010), Lai *et al*. (2012), Flynn *et al*. (2010), Lie *et al*. (2012), Luhman (2005), Burgess *et al*. (2006).
Supply Chain Integration (SCI)	Chen & Paulraj (2008), Lai *et al*. (2012), Amit *et al*. (2005), Simangunsong *et al* (2011), Liu *et al*. (2012), Choi & Cheng (2011), Boyle *et al*. (2008), Braunscheidel & Suresh (2009), Amit *et al*. (2005), Burgess *et al*. (2006).

Mass Customisation Capability	Huo (2012), Flynn *et al*. (2009), Lai *et al*. (2012), Rungtusanatham *et al*. (2003), Towill & Christopher (2002), Song *et al*. (2009), Min & Mentzer (2004), Flynn *et al*. (2010), Zhao *et al*. (2008), Lau *et al*. (2012), Koçoglu *et al*. (2011), Huo (2012).
Modularisation	Davis (1987), Lai *et al*. (2012), Can (2012), Fogliatto *et al*. (2012).
Customer Order Decoupling Point	Can (2012).
Mass Customisation and Customer Order Decoupling Point	Olhager (2003), Can (2012), Can (2008), Rudberg and Wikner (2004).
Postponement	Can (2008), Yang (2009), Can (2008), Can (2012), Yang *et al*. (2004), Hoi *et al*. (2007), Cavusoglu *et al*. (2012), Song *et al*. (2009).
Postponement and OCPD	Can (2008), Yang (2009), Can (2012), Hoi *et al*. (2007),Cavusoglu *et al*. (2012), Nyaga *et al*. (2010), Hoek (1999), Yang & Yang (2009), Yeung *et al*. (2007),Cholette (2009).
Mass Customisation and Postponement	Yank & Burns (2003), Can (2012).
Lean and agile supply chain	Can (2008).
Contingency Theory and Its Application in SC	Donaldson (2001), Flynn *et al*. (2010), Huang *et al*. (2010), Lai *et al*. (2012), Flynn *et al*(2010), Simangunsong *et al*. (2011).
Resource Based View	Ambrosini *et al*. (2009),Vijayasarathy 2010), Pertusa-Ortega *et al*. (2010)

Table 2.3: References of the literature.

2.10 Conclusion

Although a host of literature about the causes and appropriate managerial strategies of mitigating demand uncertainty is available, it is evident that most of it is outdated and that there is need for new studies to explore this area in order to broaden updated knowledge on mitigation of demand uncertainty through supply chain management practices. This will increase knowledge in the

area which will be beneficial to practitioners, particularly on proper management of supply chains in order to counteract demand uncertainty which is key to a firm's performance, competitiveness and survival in the market. Research that pays particular focus on SMES operating in the food industry during the Hajj season will also be of great significance to the practitioners because of the need to satisfy the huge and varied customer needs and demands of the millions of pilgrimages, as well as the need to ensure quality and avoid the losses that could arise due to demand uncertainty that characterises the food industry.

In addition, further research will emanate from more empirical evidence to verify the facts elaborated in the available literature concerning demand uncertainty. In addition, further study will enable individuals to classify the available sources of the uncertainties as general in terms of managerial organisation or have an industrial context. In the same way, no literature review has incorporated the three categories of uncertainty as the cause of demand uncertainty, with studies on classification of postponement also scarce. Therefore, there is a need for contingency-based studies and research to be performed in an effort to determine whether such a scenario exists.

This study has fulfilled earlier calls for research with literature gaps, such as those made in the research responded to Simangunsong *et al*. (2011), which sought to determine a comprehensive understanding of the many sources of uncertainty and how these can be aligned with management strategies in an effort to improve supply chain performance, thereby developing theory in this area. Previous research has mainly focused on the theory of the SCM paradigm in general, supply chain risk, and on narrower aspects of uncertainty, including supply and demand uncertainty only. Conversely, this study seeks to address the identified gaps by exploring ways of mitigating demand uncertainty through the discussed management practices. Specifically, the

current research is a response to the call for future research by Lai *et al*. (2012) for future studies to examine how firms choose PP and MCC strategies to mitigate demand uncertainty when there is high competitive intensity. Moreover, this study reveals some complex relationships between SCI, PP and MCC. The mechanism of how SCI influences postponement practice and mass customisation strategies requires further investigation.

CHAPTER 3: THEORETICAL AND CONCEPTUAL FRAMEWORK

3.1 Introduction

This chapter seeks to discuss theoretical framework that will be used to guide this study and also develop a conceptual framework that shows the relationship amongst the study constructs. Various theories and frameworks from social sciences and economics have provided reasons for the formation of supply chain relationships as well as realisation of gains from such associations amongst trading partners (Vijayasarathy, 2010). Some of these theories include; the transaction cost analysis theory which suggests that the type of economic mechanisms used to coordinate the flow of goods and services between firms is contingent on coordination and production costs. Application of this theory can be understood as a governance mechanism formed by the supply chain partners and whose formation results in reduced costs, reduced uncertainty and improved performance (Vijayasarathy, 2010). The second theory is the resource dependency theory which proposes that inter-organisational relationships can arise from motivations to reduce the uncertainty that is associated with acquiring a key resource and to gain influence as well as power over firms that control these resources. Organisational dependence is key to shaping inter-organisational relationships and can promote cooperation and commitment amongst supply chain partners. The third theory is the resource-based view which provides another perspective of the supply chain and suggests that firms can obtain a sustainable advantage by developing and acquiring infrastructural resources as well as knowledge –based capabilities which are difficult to replicate by competitors (Vijayasarathy, 2010). This theory is normally used to explain the importance of a firm's quest for integration with its customers and suppliers and also to predict the benefits of such integration. The fourth most commonly used theory is contingency theory

which argues that a firm should match its strategies, practices and processes with its business environment (Flynn *et al*., 2010). This theory is usually used to explain how supply chain is managed by considering all the existing contingencies within a given operation which may include the sources of uncertainty in the environment.

This study will use the extended resource-based view approach and the contingency theory as its theoretical framework. These theories are suited for this study as they explain how firms can best manage their supply chains by acquiring unique capabilities and by considering all the existing contingencies within the given environment. The contingency theory is used to explain why food SMEs operating during Hajj should match their strategies, practices and processes such as SCI, PP and MCC to their business environment (demand uncertainty) or rather the effect of these managerial practices on demand uncertainty under high competitive intensity, while the extended RBV is used to explain why food SMEs in Saudi Arabia should integrate with their customers and suppliers through the various management practices (SCI, MCC and PP) in order to mitigate demand uncertainty. The two theories are applicable to the study because the firms to be studied operate in a high competitive environment. The extended resource-based view (ERBV) is referred to as the relational view or concept of dynamic capabilities, and makes the presumption that the resources required for internal usage can also be obtained from the external environment through collaboration and cooperation (Bohnenkamp, 2013). RBV therefore asserts that, although firms should focus on in-house activities, they should also consider environmental changes that require access to external resources (Barney, 2013). The results obtained by Lai et al. (2012) were found to be consistent with ERBV, as they demonstrated that internal integration has a significant direct impact on mass customisation capability and also plays a key and strategic role in developing customer and supplier integration. The study findings, however,

indicate that, whilst customer integration was found to improve mass customisation capability directly, the impact of supplier integration was found to be insignificant. Internal integration also was found to have a positive effect on MCC indirectly through customer integration. It was observed that the indirect effect was amplified with intense competition and demand uncertainty.

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The main papers that influenced development of the theoretical framework for this study include; Flynn *et al*., (2010); Huang *et al*., 2010; Lai *et al*. (2012) and Simangunsong *et al*. (2011) for the contingency theory while Vijayasarathy (2010), Simangunsong et al. (2011); Vijayasarathy (2010); and Pertusa-Ortega et al., (2010) are the authors that influenced the development and use of the resource-based theory.

This chapter is divided into four sections. The second section discusses the contingency theory in terms of its concepts, assumptions and application to supply chain management. It also discusses the contingency theory based-model of supply chain uncertainty and discusses contribution of this theory to management of uncertainty in supply chain research. The third section will discuss the resource-based view (RBV) theory, its main concepts, assumptions and contribution to SCM research. This section also discusses application of how to address demand uncertainty. The fourth section presents the conceptual framework and provides an in-depth analysis of the expected relationship between the various constructs. This section also discusses formulation of the study's hypotheses based on the expected relationship between the constructs in the model. The final section provides a summary of the chapter.

3.2 Contingency Theory and its Application in Supply Chain Management

One of the theories that have been widely used in the analysis of management practices contingency theory, which also will be used in the current study. Contingency theory asserts that an organisation should match its processes, strategies and practices to its business environment (Donaldson, 2001). In this vein, Donaldson describes this as a behavioural theory that argues there is no best way of managing, organising and leading a corporation or otherwise making decisions. Rather, it explains that the best course of action is dependent (contingent) on the internal and external situation. This theory maintains that the most effective organisational leadership or structural design involves the structure matching the contingencies. According to Flynn *et al*. (2010), this theory employs a reductionist approach, where the organisation is treated as an entity that can be decomposed into various independent elements. This theory has been

applied throughout the course of many empirical studies on management practices in the supply chain.

Due to its application in the variety of past research, such as that written by Huang, *et al* (2010), an examination of the contingency theory is required (Huang *et al*., 2010). Its study will also stem from the realisation of its importance in the study of the management of supply chains; this is in the analysis of the strategies that may be applied in supply chain management. The transaction cost theory may also be used (Plaggenhoef, 2007). An introduction into contingency theory is provided by the research written by Donaldson (2006), which defines the contingency theory as the management approach that looks at the most efficient way of managing the supply chain, taking into consideration all the contingencies that may be present within a given operation. He indicates that there are various challenges, which are both empirical and theoretical in nature, in the investigation of contingency theory and its application to the study of supply chain management. The research further presents the opportunities apparent in terms of contingency theory discussions (Donaldson, 2006).

Another study that applied this theory is that by Lai *et al*. (2012) through the examination of the effect of SCI on MCC. These authors point out those previous studies have demonstrated that the value of a firm's external resources increases in an environment that is dynamic and competitive. According to Lai *et al*. (2012), provide the example of when competitive intensity and/ or demand uncertainty is high, postponement, a key strategy that enables mass customisation to be employed to cope with variability in the end product. Other than having efficient coordination across the firm's internal functions, accurate and timely market-specific and component knowledge is also necessary when postponing differentiation. Improving internal integration and

attaining knowledge from supply chain partners was considered more vital in this case for postponement strategy and mass customisation capability development (Lai *et al*., 2012). These authors argue that supply chain integration therefore is very important for MCC development, particularly in a dynamic, competitive milieu.

Another important study that has applied this theory in the investigation of the impact of SCI on performance is that conducted by Flynn *et al*. (2010). In this study, the authors examine the relationship between three SCI dimensions. The study applied the contingency approach through the use of a hierarchical regression in an effort to establish the impact of individual SCI dimensions, namely internal, supplier and customer integration, and their interrelationships on firm performance. In their discussion of contingency approach to supply chain integration, Flynn *et al*. (2010) draw from the contingency theory, and accordingly explain that the processes and structures of an organisation are shaped by the environment within which it operates. Organisations therefore must match their processes and structures to their environment so as to maximise performance. These authors are quick to add that customers and suppliers form an important part of an organisation's (particularly manufacturer's) environment. These authors further mention structural contingency theory, which proposes that the success of how a firm performs depends on the degree to which the strategy it seeks to pursue matches or is aligned with the firm's design (Flynn *et al*., 2010). Literature on strategic management refers to this alignment between a firm's strategy and its performance as 'fit'. When applied to supply chain integration, this theory suggest that the individual types of SCI 'its dimensions, i.e. customer, internal and supplier integration' should be aligned for best performance in order to be achieved (p. 60).This study therefore will apply structural contingency theory in its investigation of how

demand uncertainty can be mitigated in the Saudi SME food industry during the Hajj season through supply chain management practices, including SCI, MCC and postponement.

Simangunsong *et al*. (2011) also applied this theory in their study. According to them, the manufacturing theory recognises that manufacturing strategy is significantly influenced by environmental uncertainty, which is also a key determinant of firm performance. These authors argue that this theory has been linked by various scholars to contingency theory; for that reason, it can be described as based on a contingency model. The contingency theory suggests that the most appropriate management strategy in a particular context depends on a set of contingency factors, possibly including the uncertainty of that environment (Simangunsong *et al*., 2011).

Simangunsong *et al*. (2011) argue that, given the applicability contingency and alignment theories, manufacturing strategy theory can be modelled so as to provide a strong theory to guide future research in supply chain uncertainty, which includes a broader set of sources of uncertainty than those considered by previous studies. These authors developed a contingency theory based model of supply chain uncertainty, which will be adopted in the present study, as shown in Figure 3.1 which will be adopted for the current study. Supply chain uncertainty management strategies employed depend on the source of uncertainty and significantly affect supply chain performance. This diagram is a model that seeks to illustrate application of the contingency theory in studying supply chain uncertainty and how to mitigate it. Figure 3.1
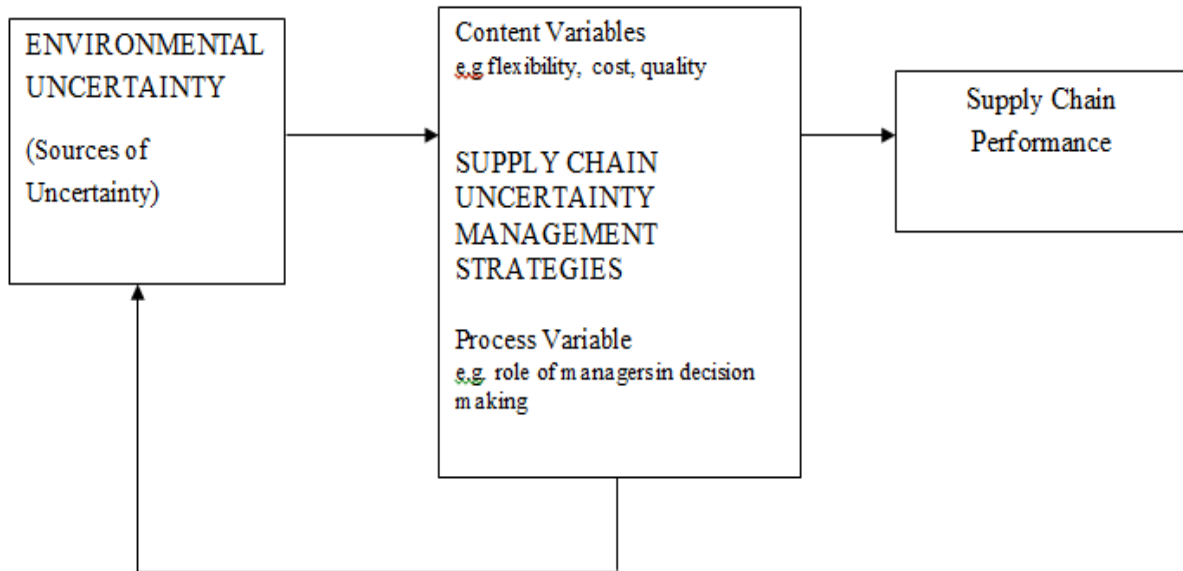
Figure 3.1: Contingency theory-based model of supply chain uncertainty Adopted from: (Simangunsong *et al*., 2011)

The contingency theory is used to explain why food SMEs operating during Hajj should match their strategies, practices and processes such as SCI, PP and MCC with their business environment (demand uncertainty) or rather the effect of these managerial practices on demand uncertainty under high competitive intensity, whilst the extended RBV is used to explain why food SMEs in Saudi Arabia should integrate with their customers and suppliers through the various management practices (SCI, MCC and PP) in order to mitigate demand uncertainty. The two theories are applicable to the study because the firms to be studied operate in a highly competitive environment.

3.3 Resource-Based View

In addition to the contingency theory, this study will use the resource-based view (RBV) theory, which asserts that, simultaneously, valuable, rare and non-substitutable and inimitable resources

can be effective sources of superior performance, which may enable enterprises to attain a sustainable competitive advantage (Ambrosini *et al*., 2009). This theory has been used extensively in research in an effort to explain managerial practices and strategies centred on enhancing organisational performance. Important studies on the mitigation of supply chain uncertainty, such as that by Simangunsong *et al*. (2011), also have applied this theory in their research. In this study, the theory will be used to explain the importance of a firm's quest for integration with its customers and suppliers and also to predict the benefits of such integration. The resource perspective will provide a basis for discussing formulation of strategies to address demand uncertainty such as; the current resources to be used for mass customisation as, which resources to be developed to ensure mass customisation as MCC development also requires application of external resources, and the type of firms integration links with to ensure internal and external integration.

According to Vijayasarathy (2010), the RBV theory is one of the perspectives most widely adopted in supply chain studies. From the perspective of RBV, it is suggested that firms can gain a sustainable advantage by developing and acquiring infrastructural resources as well as knowledge-based capabilities that are difficult for competitors to replicate. According to this author, this theory has been used by scholars to explain why organisations seek integration with their customers and suppliers, and also in predicting the rewards and benefits of such integration to organisations.

Wernerfelt (1984) explored the usefulness of analysing organisations from the resource perspective as opposed to the product perspective. The study suggests the application of concepts of resource–product matrices and resource position barriers in the development of entry barriers.

The study uses these tools in an effort to explain the new strategic options that can be used by firms in their supply chain and which are seen to naturally arise from the resource perspective. This study argues that both the resource and products from perspectives of the firm have been well addressed in strategic management literature. According to the study, the concept of strategy traditionally has been expressed in terms of the firm's resource position (its weaknesses and strengths), whilst most of the existing formal economic tools function based on the product-market side. This author further explains that, although the two perspectives ultimately produce the same insights, it is expected that the insights yielded differ in ease depending on the point of view adopted. Wernerfelt (1984) argues that the resource point of view provides the basis tackling of a number of issues that are keys in the formulation of strategy for diversified firms:

a) Which of the firm's current resources should be based on diversification?

b) Which of the firm's resources should be advanced through diversification?

c) In which markets and sequence should diversification occur?

d) What type of firms are desirable for acquisition?

Pertusa-Ortega *et al.* (2010) refers to 'resource' as anything that is regarded as strength or a weakness of a particular organisation (Pertusa-Ortega *et al.*, 2010). They define a firm's resources as those assets (tangible and intangible) which are semi-permanently attached to the firm. Examples include in-house technological knowledge, skilled personnel, machinery, brand names, efficient procedures, capital, and trade accounts amongst others. Wernerfelt (1984) suggests 'customer loyalty' as one of the attractive resources a firm can have (Pertusa-Ortega *et al.*, 2010). With regard to customer satisfaction, Wernerfelt explains that the nature and characteristics of the market for the resource creates the resource position barrier. He notes that it

is much easier to initiate a position (be the pioneer) than to replace a person who already has it. In replacement, buyers pay higher prices than in pioneering. He cites first mover advantages in access to raw materials or gaining government contracts as some of the related examples (Pertusa-Ortega *et al*., 2010).

The study conducted by Pertusa-Ortega *et al*. (2010) applied the RBV theory in examining the relationship between organisational structure, firm performance and competitive strategy. This study emphasises that strategy determines the structure of a firm. In their review of literature, Pertusa-Ortega *et al*. (2010) note that modern-day firms operate in a rapidly changing business environment that is characterised by volatile customer preferences and technological developments that transform business scenarios. They argue that, in such a context, the RBV is based placed on explaining the sources of competitive advantage for such firms. They further emphasise that the definition of a business firm with regard to the internal resources it possesses, as well as its capabilities, offers a better and more durable strategy than one based on the requirements and needs the business firms seeks to satisfy. These authors argue that, although the contingency theory suggests that external business environment and strategic decisions impact a firm's organisational structure in its successful implementation, RBV stresses a firm's internal attributes and, accordingly, allows researchers to reconstruct the relationships between structure and strategy by evaluating the organisational structure as a precious resource and an important source of competitive advantage. In this study, Pertusa-Ortega *et al*. (2010) use the RBV theory to demonstrate that the organisational structure influences the amount and type of information that a firm can obtain and distribute, the knowledge created, and the adoption of strategic decisions; all of these affect the configuration of the strategy with which the enterprise competes in the market. According to the findings of the study, RBV complements the contingency

approach in the explanation of organisational performance. This study concludes that RBV is adequate in management decisions concerning strategies for improving firm performance. As such, it is appropriate for guiding the current study.

The extended resource-based view (ERBV) is referred to as the relational view or concept of dynamic capabilities, and makes the presumption that the resources required for internal usage also can be obtained from the external environment through collaboration and cooperation (Bohnenkamp, 2013). RBV therefore asserts that, although firms should focus on in-house activities, they should also consider environmental changes that require access to external resources (Barney, 2013). The results obtained by Lai *et al*. (2012) were found to be consistent with ERBV, as they demonstrated that internal integration has a significant direct impact on mass customisation capability and also plays a key and strategic role in central in developing customer and supplier integration. The study findings, however, indicate that, whilst customer integration was found to improve mass customisation capability directly, the impact of supplier integration was found to be insignificant. Internal integration also was found to have a positive effect on MCC indirectly through customer integration. It was observed that the indirect effect amplified with intense competition and demand uncertainty.

The ERBV view of the firm develops from the traditional resource-based view of the firm. The core principle of the ERBV is that strategic resources as well as knowledge are derived not only from within the boundaries of the organisation but also from outside (Lai et al., 2012). This is different from RBV which only focuses on those resources found within the firm's boundaries. ERBV demonstrates that the over strategic capability of an organisation may be embedded in a wider network of inter-firm exchange relationships. ERBV thus also argues that the firm must

integrate both its external and internal resources in order to develop organisational capabilities. Moreover, this view asserts that sustainable competitive advantage is created by the organisation's strategic resources while developing internal capabilities and can increase a firm's ability to attract and exploit external resources (Lai *et al*., 2012). According to Bohnenkamp (2013), ERBV has also been described as the relational view of dynamic capabilities, and makes the presumption that the resources required for internal usage also can be obtained from the external environment through collaboration and cooperation. ERBV therefore holds that whereas firms should focus on in-house activities (as asserted by RBV), they should also consider environmental changes that require access to external resources. This study will therefore extend RBV to extended RBV as the second theoretical approach.

3.3.1 Extended Resource Based View Versus Resource Based View of the Firm

The ERBV view of the firm develops from the traditional resource-based view of the firm. The core principle of the ERBV is that strategic resources as well as knowledge are derived not only from within the boundaries of the organisation but also from outside (Lai *et al*., 2012). This is different from RBV which only focuses on those resources found within the firm's boundaries. ERBV demonstrates that the over strategic capability of an organisation may be embedded in a wider network of inter-firm exchange relationship. ERBV thus also argues that the firm must integrate both its external and internal resources in order to develop organisational capabilities. Moreover, this view asserts that sustainable competitive advantage is created by the organisation's strategic resources whilst developing internal capabilities can increase a firm's ability to attract and exploit external resources (Lai *et al*., 2012). According to Bohnenkamp (2013), ERBV has also been described as the relational view of dynamic capabilities, and makes

the presumption that the resources required for internal usage also can be obtained from the external environment through collaboration and cooperation. ERBV therefore holds that whereas firms should focus on in-house activities (as is asserted by RBV), they should also consider environmental changes that require access to external resources. This study will therefore extend RBV to extended RBV as the second theoretical approach.

3.4 Relationship Between the Various Constructs

3.4.1 the Relationship Between Internal Integration (II), Customer Integration (CI) and Suppler Integration (SI)

According to Zhao *et al*. (2011), the relationship between internal integration and external integration (SI and CI) remains unlimited, as most studies have discussed only the relationship conceptually without providing details of empirical evidence. However, most studies demonstrate that II positively impacts external integration, which is made up of SI and CI as its sub-dimensions through information sharing and product development. Lai *et al*. (2012) explain that II facilitates the two sub-dimensions (SI and CI) of external integration (EI). According to these authors, resources encapsulated within the organisation provide a platform and a foundation for the acquisition of external resources. This argument proposes that II may help an organisation facilitate EI with its suppliers and customers (Lai *et al*., 2012). In their discussion of the relationship between internal integration (II) and external integration (SI and CI), Zhao *et al*. (2011) argue that, from the point of view of organisational capability, a firm with a high level of

internal coordination and communication capabilities is better positioned to attain a high level of EI with its suppliers and customers. They further explain that a company with a high level of absorptive capability is seen to have the ability to recognise the importance and value of new external information, and to incorporate and apply it to its commercial needs. A company that is able to interpret, disseminate, apply and evaluate new knowledge obtained from external customers and suppliers will be better able to understand their businesses, hence facilitating external integration (EI).

The effect of II on EI (SI and CI) can also be explained from the three major features of SCI: strategic cooperation, working together and information sharing (Zhao *et al*. 2011). With regards to information sharing, it is obvious that a firm cannot share information with its external partners and integrate the data as well as share it with its internal functions and units effectively if it does not have internal processes and systems such as ERP systems (Natour *et al*., 2011). Well established internal processes, systems and capabilities therefore enhance effective and timely information sharing with suppliers and customers (Yang & Yang, 2009). They also facilitate integration and sharing of information across the firm's internal units. The same can be said of working together with external suppliers and customers as well as in development of strategic alliances and cooperation. II therefore facilities CI and SI and thus we hypothesise the following:

> **H10**: *Internal Integration in food SMES has significant and direct effect on their customer integration during Hajj.*

> **H11**: *Internal integration in food SMES has significant and direct effect on their supplier integration during Hajj.*

3.4.2 the Relationship Between Supply Chain Integration (SCI) With Postponement

Practice (PP)

The relationship between the various forms of SCI (II, CI and SI) with postponement is discussed from the perspective that information sharing is key to production postponement. According to Cavusoglu *et al*. (2012), production postponement and information-sharing tactics may complement conflict or substitute one another depending on the degree of the increase in cost of unit production when production is postponed. Can (2008) defines postponement as the process of delaying product finalisation in the supply chain until orders from customers are received; this has the aim of customising products, as opposed to performing those activities with the expectation of gaining future orders. Postponement basically is dependent on II, CI and SI owing to the fact that information is required from the various partners so as to establish when to hold production and when to continue. SCI therefore enables firms to effectively implement postponement.

Therefore, we hypothesise the following:

H12: Internal integration of food SMEs in Hajj has significant and indirect effect on postponement practice through customer integration.

H13: Internal integration of food SMEs in Hajj has significant and indirect effect on postponement practice through supplier integration.

3.4.3 Relationship Between Supply Chain Integration (SCI) and Mass Customisation Capability (MCC)

According to Lai *et al* (2012), internal integration links various functions allowing firms to establish strategic resources. According to these authors, manufacturers use cross-functional coordination as well as alignment to integrate resources across the firm and to deploy them in a systematic manner. Inter-functional relationship management also makes certain that the process is cooperative and that any conflicting departmental interests are resolved. It provides a platform for different departments functions and departments to merge their opinions as well as suggestions and to integrate all resources through cooperation and working together (Lai *et al*. 2012). The integrated procedures and operational routines in turn facilitate creation and utilisation of resources and improve problem- solving which then creates and increases organisational capability. According to Can (2008), effective internal integration therefore enables a firm to respond swiftly to customisation needs of its customers and effectively address the challenges associated with product complexity, flexibility, variety as well as costs related with development of MCC.

As a supply chain management technique, integration has been most useful in cases where mass customisation is used (Abdelkafi, 2008). Mass customisation is a management technique whose application is mainly in areas where there is need to limit demand-side uncertainty (Abdelkafi, 2008). Zahg *et al*. (2012) conducted a study that sought to consider two issues as regards integration and mass customisation. The first study sought to examine how mass customisation was influenced by integration of the suppliers, customer integration and internal integration whilst the second sought to establish whether certain environmental factors limited the effect of

the integration of the supply chain. These authors provide insight and knowledge about mass customisation. They also consider its inclusion as a supply chain management technique (Zahg *et al*., 2012). Zahg *et al*. (2012) contend that increase in competition amongst various industries and companies has necessitated the need for customisation of products in order to successfully compete. This is regarded to be a differentiated strategy (Carneiro, 2012). According to this author, companies have to do this with minimal cost to improve their performance. In their paper, Zahg *et al* (2012) have pointed out that in order for companies to gain a competitive advantage, they must consider integration and reconfiguration of both external and internal resources. They contend that the implementation of the steps outlined in these two strategies will need to be undertaken in a way that adapts to the changing business environment (Kew & Stredwick, 2005). They used what they termed as the extended resource based view to develop a model that was used to study the economics of mass customisation and the integration of the supply chain (Zahg, *et al*., 2012).

Zahg *et al*. (2012) were able to demonstrate in their study how internal and external integration may be utilised to achieve greater capabilities by companies. These thoughts contribute to the thinking of how mass customisation capabilities (MCC) may be effectively achieved by companies. Zahg and his colleagues are able to indicate that internal integration and customer integration created the greatest effect on MCC. These authors came to the conclusion that the application of integration on the supply side has minimal effect on MCC according to their examination, whether directly or indirectly. They also show that the uncertainty in the demand in addition to the intensity of the competition may work towards negatively affecting the ability of the company to benefit from mass customisation. Even though there were limitations in the undertaking of the research, the paper still provides knowledge that is valuable in the

examination of supply chain integration and its effects on mass customisation strategy (Zahg *et al.*, 2012).

Lai *et al* (2012) point out that although II facilitates management of internal resources, successful MCC development also requires application of external resources which can be obtained through supplier and customer integration. Information sharing with customers and suppliers particularly enables the manufacturer to gain knowledge regarding the demand, raw materials, the market as well as components. Close relationship and engagement with suppliers and customers during product design incorporates their knowledge and voices into the manufacturing process therefore leading to more efficient and effective customisation (Mikkola & Skjott-Larsen, 2013). Based on this discussion, it can be concluded that internal integration, customer integration and supplier integration all affect MCC in a positive manner. Therefore, we hypothesise the following:

> ***H14****: Internal integration of food SMEs in Hajj has significant and indirect effect on mass customisation capability through customer integration.*

> ***H15:*** *Internal integration of food SMEs in Hajj has significant and indirect effect on mass customisation capability through supplier integration.*

3.4.4 the Relationship Between Internal Integration (II) and Postponement Practice (PP)

Internal Integration (II) involves mainly joint decision making, internal relationship management and cross-functional coordination. Kotcharin *et al*. (n.d) refers to II as the extent to which an organisation can plan its organisational practices, procedures and behaviours into joint, synchronised and manageable processes with the aim of achieving customer desires and needs.

As such, it has a direct effect on postponement, enabling the organisation to make the correct decisions regarding when to hold production and when to continue after receiving orders from the customers. Therefore, we hypothesise the following:

H1: Internal integration in food SMES is significantly and directly associated with their postponement practice during Hajj.

3.4.5 the Relationship Between Internal Integration (II) and Mass Customisation (MCC)

According to Lai *et al*. (2012), the ERBV proposes that manufacturers can utilise internal and external resources towards capability development. The authors also mention that manufactures should incorporate both types of resources in an effort to come up with a hierarchy in which the extent of knowledge and resources is expanded as it shifts up the hierarchy. Therefore, the resources summed-up within the organisation create a foundation for the attainment of external resources. Lai *et al*. (2012) further argue that internal integration could possibly assist an organisation in facilitating external integration with both consumers and suppliers. The authors also mention that internal integration can increase the intensity of the capability and assist a manufacturer in creating a cohesive platform that breaks down internal subdivisions, tackles conflicts and reduces the obstacles facing supplier and customer participation. In this way, internal integration is presumed to have an indirect influence on MCC by enhancing external integration (Lai *et al*. 2012). Internal integration therefore indirectly affects MCC through customer integration and supplier integration, and directly by enabling the firm to quickly respond to the customisation needs of its customers and effectively address the challenges associated with product complexity, flexibility and variety, and the costs related to the development of MCC. Therefore, we hypothesise the following:

> **H2**: *Internal integration in food SMES is significantly and directly associated with their mass customisation capability during Hajj.*

3.4.6 the Relationship Between Customer Integration (CI) and Postponement Practice (PP)

Customer Integration (CI) mainly involves customer partnership, the sharing of customer information, and ensuring customers are involved in product development and delivery. According to Lai *et al*. (2012), customer integration is important for manufacturers as it allows access to customer information, knowledge-sharing, the pursuit of joint development activities, the speeding up of the decision-making processes, a reduction in lead times and improved process flexibility. This integration has a direct impact on postponement as it provides firms with timely information concerning customer orders, needs, preferences and requirements, meaning they only go on with production when they need to (once they have the orders) and then produce customised goods. According to Mikkola *et al*. (2013), postponement involves delaying the timing of crucial processes such that end products assume their specific features, identities and functionalities. According to these authors, such a means of customisation happens after key information is obtained regarding customers' requirements and specific needs. Delay of customisation of the end products requires that information regarding customers' specific needs and requirements is captured quickly and most importantly, accurately. This is where customer integration (strategic alliance, collaboration and information sharing between a focal firm and its customers with the objective of improving visibility and enabling joint planning) comes in. it can therefore be concluded that customer integration is central to postponement. Therefore, we hypothesise the following:

> *H3: Customer integration in food SMES is significantly and directly associated with postponement practice during Hajj.*

3.4.7 the Relationship Between Customer Integration (CI) and Mass Customisation Capability (MCC)

CI mainly involves customer partnership, sharing customer information as well as customer involvement in design and delivery of products (Flynn *et al*. 2010). CI enables manufacturers to access customer information, share this knowledge, speed up decision-making processes, improve process flexibility, reduce lead times and pursue joint development processes and activities (Lai *et al*. 2012). CI is therefore important as it enables manufacturers to acquire information regarding customer requirements and also gain a better understanding of customer needs and preferences. According to Lai *et al* (2012) management of internal resources and successful MCC development requires application of external resources which can be obtained through supplier and customer integration. Information sharing with customers enables the manufacturer to gain knowledge regarding the demand and time of delivery. Close relationship and engagement with customers during product design incorporates their knowledge and voices into the manufacturing process, therefore leading to effective customisation (Mikkola & Skjøtt-Larsen, 2013). Therefore, we hypothesise:

> **H4**: *Customer integration in food SMES is significantly and directly associated with mass customisation capability during Hajj.*

3.4.8 the Relationship Between Supplier Integration (S) and Postponement Practice (PP)

Supplier Integration (SI), on the other hand, entails mainly supplier partnerships, supplier information sharing and the involvement of suppliers in product development (Lai *et al*., 2012). According to Flynn *et al*. (2010), developing close ties with suppliers enables service providers

and manufacturers to gain greater input from the suppliers and also to include their suggestions and recommendations into business operations. SI has a direct effect on postponement, facilitating the smooth delivery of various raw materials and components on a timely basis, thereby enabling the manufacturer to reduce total lead time for the delivery of customised goods once orders are in place. Postponement refers to delaying of execution of tasks until reliable and complete information is obtained. Full postponement involves use of the make-to-order concept in manufacturing. Upstream postponement also means putting on hold ordering of raw materials from the suppliers until the customer order is received (Yeung *et al*., 2007). All this requires close collaboration with the suppliers. According to Cavusoglu *et al* (2012), information sharing is key to postponement. Additionally, this information should not only come from customers but also from suppliers. This is good, especially in ensuring that there are no delays and that products are delivered right on time to the customers. Therefore, we hypothesise the following:

H5 Supplier Integration in food SMES is significantly and directly associated with postponement practice during Hajj.

3.4.9 Relationship Between Suppler Integration (SI) and Mass Customisation Capability (MCC)

SI mainly entails supplier partnerships, the sharing of information with suppliers, and involving them in product development (Lai *et al*., 2012). This integration enables manufacturers to gain greater inputs from suppliers, and also to include their suggestions and recommendations within their business operations. This further facilitates the smooth and timely delivery of a variety of raw materials and components for mass customisation. Application of external resources which can be obtained through supplier integration is key to effective implementation of MCC

(Mikkola & Skjott-Larsen, 2013). Information sharing with suppliers enables a manufacturer to gain knowledge regarding raw materials, the market as well as components. Close engagement with suppliers during product design incorporates their knowledge and voices into the manufacturing process, therefore leading to more efficiency (Mikkola & Skjott-Larsen, 2013). Therefore, we hypothesise the following:

H6: Supplier Integration in food SMES is significantly and directly associated with mass customisation capability during Hajj.

3.4.10 Relationship Between Mass Customisation Capability (MCC) and Postponement (PP)

According to Can (2008), the resolution to successfully deal with mass-customising involves postponing the role of distinguishing a product for a particular customer to the level of the most recent possible point in the supply network, which includes the supply chain, manufacturing chain and distribution chain of an organisation. Consequently, the author states that, in order for mass customisation to be enhanced effectively and a sustainable response garnered, organisations ought to incorporate product designs, manufacturing and logistics procedures, and supply network. For this reason, it is assumed that, for postponement in the differentiation of mass customisation to take place, suitable product design, processes and supply network are relevant. On the other hand, however, the connection between mass customisation and postponement can be referred to by the concept of leagality; as defined by Can, this is a combination of the lean and agile paradigm in a total supply chain strategy, positioning the decoupling point with the objective to best suit the necessity for responding to a volatile demand downstream, whilst simultaneously presenting level scheduling upstream from the decoupling point.

According to Can (2008), postponement has been classified as a significant approach for determining the realisation of agility: for instance, in the course of its involvement in products and services customisation, as well as its involvement in customer order information through the supply chain, it can be concluded that postponement is viewed as a concept promoting both lean and agile factors in an organisation, hence helping address demand uncertainty. Therefore, we hypothesise the following:

> **H7:** *Postponement practice by food SMEs has significant and direct relationship with their mass customisation capability during Hajj.*

> **H16**: *Postponement practice by food SMEs in Hajj has a significant and indirect effect on demand uncertainty mitigation through mass customisation capability.*

3.4.11 the Relationship Between Supply Chain Integration (SCI), Postponement Practice (PP) and Mass Customisation Capability (MCC) With Demand Uncertainty Mitigation (DUM)

Drawing from the extended RBV of the firm, Lai *et al*. (2012) argue that all three types of supply chain integration (II, SI and CI) influence the development of MCC within a firm owing to the fact that both internal and external integration promote the strategic resources considered crucial to MCC development. The authors also mention that II can increase the intensity of capability and thereby assist a manufacturer in creating a cohesive platform that is able to break down internal subdivisions, tackle conflicts and reduce the obstacles regarding supplier and customer participation. In this way, II is presumed to have an indirect influence on MCC by enhancing external integration (SI and CI).

II, SI and CI also have been identified as having a direct effect on postponement, particularly through information sharing. Postponement is defined as the delaying of activities in the supply chain up to the moment customer orders are received with the intent of customising the products, as opposed to doing so in anticipation of future orders (Can, 2012). According to Flynn *et al*. (2010), postponement basically is dependent on II, CI and SI, owing to the fact that information is required from the various partners in order to establish when to hold production and when it can be continued. Cavusoglu *et al*. (2012) evaluated the importance of relationships between postponement and information sharing through II, SI and CI, and found that they are different strategies to decrease manufactures' uncertainty regarding demands.

According to Can (2008), postponement is also directly related with MCC as it explains that mass-customising involves postponing the role of distinguishing a product for a particular customer to the level of the most recent possible point in the supply network, which includes the supply chain manufacturing chain and the distribution chain of an organisation. Therefore, we hypothesise the following:

> *H8: Postponement practice by SMEs has a significant and direct effect on mitigating demand uncertainty of food during Hajj.*

> *H9: Mass customisation capability by SMEs has a significant and direct effect on mitigating demand uncertainty of food during Hajj.*

3.4.12 Contingent Effects of Demand Uncertainty (DU) and Competitive Intensity (CPI)

Demand uncertainties, in addition to competitive intensity, are presumed to be key environmental conditions designed for MCC. Lai *et al*. (2012) assert that there is empirical

evidence to suggest that the influence of supply chain integration towards operating capabilities possibly could be moderated by the context of the environment. For instance, when there is a rapid shift in demand, manufactures require new knowledge to control customisation owing to the fact the existing experience swiftly becomes invalid. However, when there is low level of demand uncertainty, manufacturers create their MCC through designs, productions, and the delivery of customised products, all of which depend on existing resources and knowledge (Lai *et al*., 2012). Tackling demands that are unpredictable and subsequently developing customised products requires the united efforts of the partners in the supply chain, such as by working together with customers. Therefore, when firms increase collaboration with their suppliers, the organisation is positioned to explore and improve the variety of possible solutions for tackling customers' needs and accordingly lowering costs and lead times through improvement in joint processes (Lai *et al*., 2012). With this noted, it is concluded that, in an environment characterised by demand uncertainty, manufactures can improve the influence of internal integration on external integration and, consequently, can develop and improve MCC. Based on this, it is argued that demand uncertainty increases the indirect impact of II on MCC through customer and supplier integration. Based on this discussion, the following hypotheses are formulated;

H17: Competitive Intensity significantly enhances the indirect effect of internal integration on postponement practice of food SMEs in Hajj through supplier integration.

H18: Competitive Intensity significantly enhances the indirect effect of internal integration on postponement practice of food SMEs in Hajj through customer integration.

H19: Competitive Intensity significantly enhances the indirect effect of internal integration on mass customisation capability of food SMEs in Hajj through supplier integration.

H20: Competitive Intensity significantly enhances the indirect effect of internal integration on mass customisation capability of food SMEs in Hajj through customer integration.

H21: Competitive Intensity significantly enhances the indirect effect of internal integration on demand uncertainty mitigation of food SMEs in Hajj through mass customisation capability.

H22: Competitive Intensity significantly enhances the indirect effect of internal integration on demand uncertainty mitigation of food SMEs in Hajj through postponement practice.

3.5 Overview Conceptual Framework

According to Luhmann (2005), the competitive intensity of any organisation is affected by several supply chain factors; such factors help in demand uncertainty mitigation. Under supply chain integration, there is customer integration, supplier integration and internal integration ((Lai *et al*., 2012). All of these are seen to affect the postponement practices and mass customisation capability. In turn, these help in the mitigation of demand uncertainty. These relationships are illustrated in Figure 3.2 below which presents the conceptual framework for this study. The figure demonstrates that supply chain integration which constitutes of II CI, and SI is key in demand uncertainty mitigation which can be achieved through postponement practices and mass customisation.
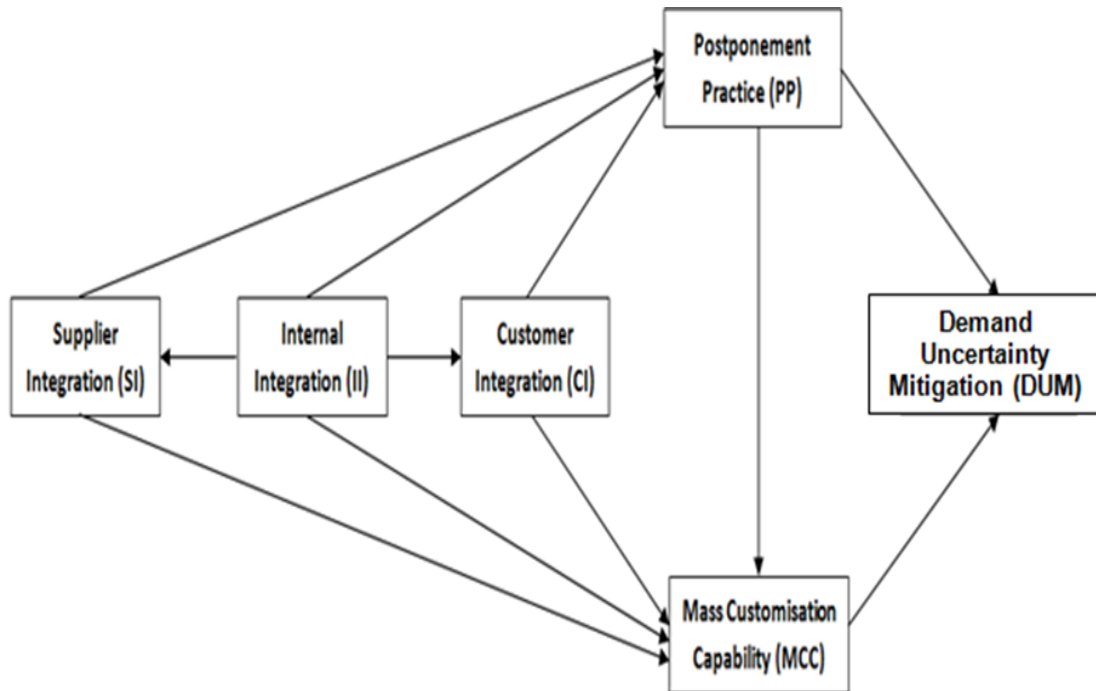
Figure 3.2: Conceptual framework used in the current study, adapted from (Lai, Zhang, Lee and Zhao, 2012)

A total of 22 hypotheses discussed above (an additional six hypotheses will be discussed in Chapter 5) are tested in an effort to understand how demand uncertainty can be mitigated in high season of customer demand:

H1: Internal integration in food SMES is significantly and directly associated with their postponement practice during Hajj.

H2: Internal integration in food SMES is significantly and directly associated with their mass customisation capability during Hajj.

H3: Customer integration in food SMES is significantly and directly associated with postponement practice during Hajj.

H4: Customer integration in food SMES is significantly and directly associated with mass customisation capability during Hajj.

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H5: Supplier Integration in food SMES is significantly and directly associated with postponement practice during Hajj.

H6: Supplier Integration in food SMES is significantly and directly associated with mass customisation capability during Hajj.

H7: Postponement practice by food SMEs has a significant and direct relationship with their mass customisation capability during Hajj.

H8: Postponement practice by SMEs has a significant and direct effect on mitigating demand uncertainty of food during Hajj.

H9: Mass customisation capability by SMEs has a significant and direct effect on mitigating demand uncertainty of food during Hajj.

H10: Internal Integration in food SMES has a significant and direct effect on their customer integration during Hajj.

H11: Internal integration in food SMES has a significant and direct effect on their supplier integration during Hajj.

H12: Internal integration of food SMEs in Hajj has a significant and indirect effect on postponement practice through customer integration.

H13: Internal integration of food SMEs in Hajj has a significant and indirect effect on postponement practice through supplier integration.

H14: Internal integration of food SMEs in Hajj has a significant and indirect effect on mass customisation capability through customer integration.

H15: Internal integration of food SMEs in Hajj has a significant and indirect effect on mass customisation capability through supplier integration.

H16: Postponement practice by food SMEs in Hajj has a significant and indirect effect on demand uncertainty mitigation through mass customisation capability.

H17*: Competitive Intensity significantly enhances the indirect effect of internal integration on postponement practice of food SMEs in Hajj through supplier integration.*

H18: *Competitive Intensity significantly enhances the indirect effect of internal integration on postponement practice of food SMEs in Hajj through customer integration.*

H19: *Competitive Intensity significantly enhances the indirect effect of internal integration on mass customisation capability of food SMEs in Hajj through supplier integration.*

H20: *Competitive Intensity significantly enhances the indirect effect of internal integration on mass customisation capability of food SMEs in Hajj through customer integration.*

H21: *Competitive Intensity significantly enhances the indirect effect of internal integration on demand uncertainty mitigation of food SMEs in Hajj through mass customisation capability.*

H22: *Competitive Intensity significantly enhances the indirect effect of internal integration on demand uncertainty mitigation of food SMEs in Hajj through postponement practice.*

3.6 Conclusion

The study seeks to determine how SMEs in Saudi's food sector in Hajj can mitigate demand uncertainty against larger firms operating in the sector through the adoption of managerial strategies, including supply chain integration, postponement, and mass customisation capability by developing a conceptual model framework of demand uncertainty mitigation based on integrating the perspectives of the contingency and the resource based view theories. Moreover, the model investigates how mass customisation capabilities enable mitigation of demand uncertainty through mediation effects of supply chain integration and postponement practices.

This study has developed hypotheses by defining expected relationships between the components of supply chain integration (CI, II and SI) with postponement and mass customisation capability during Hajj, in addition to the interactions between integration of external integration, and between postponement and mass customisation capability and with demand uncertainty for food during Hajj, on how postponement practice and mass customisation capability mitigate demand uncertainty for food during Hajj, on how competitive intensity affects postponement practice, mass customisation capability as well as on demand uncertainty mitigation of SMEs in Hajj through CI, II and SI. According to the hypotheses, the constructs are all positively related to each other and PP and MCC mitigate demand uncertainty through SCI practices.

Drawing from the assertions of the contingency theory, this study will inspect how the processes and structures of an organisation are shaped by the external integration (customers, and suppliers) within which it operates and how SMEs in Saudi's food industry can succeed by matching their strategies to the firm's design. This alignment between a firm's strategy and its performance is referred to as 'fit' and this study seeks to apply it to examining how firms can align their SCM practices to successfully mitigate demand uncertainty. The study will also apply RBV theory in explaining managerial practices and strategies that are centred on enhancing organisational performance in terms of reducing demand uncertainty. The resource perspective of theory will provide a basis for discussing formulation of strategies to address demand uncertainty such as; use of current resources for mass customisation (as mass customisation development requires application of external resources) and for integration with suppliers as well as customers as well as postponement practice.

The conceptual framework provides insight on the potential relationships between the constructs (supply chain integration, postponement practice and mass customisation) and on how each impact on mitigation of demand uncertainty. The model suggests that implementation of supply chain integration dimensions (II, CI and SI) are likely to be associated with postponement as well as with mass customisation capability and also have a direct effect on mitigation of demand uncertainty. The model further suggests that postponement practice has direct effect on demand uncertainty mitigation but also requires implementation of SCI. Lastly; the model demonstrates that MCC affects demand uncertainty mitigation and by the mediation of postponement and SCI practices.

CHAPTER4: METHODOLOGY

4.1 Introduction

The systematic and standardised approach that is followed in a research study to achieve the outlined targeted goals or objectives is termed a 'research methodology'. Considered the substratum for conducting any research, research methodology supplies general principles that guide the researcher in a synchronised fashion (Dawson, 2002). A research study is considered a logical approach to systematically resolving a problem or issue, where the research methodology determines the logic and reasoning behind applying the methods necessary for conducting the research. Logically, it analyses why a particular method or technique has been selected by the researcher (Kothari, 2004). Research methodology plays an important role in establishing the outcome of the research, and comprises basic parameters, namely philosophy, approach, strategy and data collection methods. Identifying the correct principle in each parameter is essential for securing accurate and unbiased results.

Chapter 4 introduces the essentiality of the research methodology and accordingly highlights the research fundamentals connecting the theoretical paradigm of the study with its practical implications. The chapter brings forth the philosophical assumption that structures the study, the research strategy that outlines the nature of the relation between research logic, theory and practical materialisation of the study, and the methods used to collect and analyse the data for the study. Information on the planned procedures for conducting the study and extracting relevant results is provided in the subsequent sections of Chapter 4.

Section 4.2 details the research philosophy used in the study. Whilst various philosophies are outlined and discussed, this section justifies the research philosophy used in the present study using valid resources. In a comparable vein, Section 4.3 highlights the three types of research approach and justifies the use of a mixed-methodology approach. Section 4.4 focuses on the research strategy and validates the use of abductive strategy. Section 4.5 reflects different types of research design, and validates the use of multiple research designs to achieve the study's objectives. Section 4.6 significantly focuses on the data collection methods, procedures and data analysis techniques for collecting primary data. Section 4.7 stresses on the ethical considerations followed in the current study, whilst Section 4.8 stresses on the role of theory in current research. Chapter 4 subsequently concludes in Section 4.10.

4.2 Research Philosophy

Research philosophy is the underlying proposition focusing on the researcher's assumption and the manner in which the world is viewed. Research philosophy can be comprehended as the process of acquiring knowledge to resolve certain prominent issues or problems to understand the social world in a better manner (Matthews & Ross, 2010). It establishes a relationship between the researcher's description and explanation of reality, and the acquired and developed knowledge (Saunders *et al.*, 2009). The researcher's perception of the world and reality produces a certain set of beliefs, which dictate the form and reality for completing the study. The philosophy underpins the research strategy and outlines the methods for conducting the research. Importantly, it is crucial to understand the research problem and choose the right philosophy (Bryman & Bell, 2011).

Research paradigms can be fundamentally categorised into three main groups: ontology, epistemology and methodology (Guba & Lincoln, 1994; Saunders *et al.*, 2009). *Ontology* focuses on the nature of reality and defines the role of social actors. Social actors can either be objective or subjective. Thus, objectivism and subjectivism are two forces of ontology, highlighting the independency of social actors from the outlined social phenomenon (as in the case of objectivism) or the dependency of social actors from the outlined social phenomenon (as in the case of subjectivism). In subjectivism, social phenomenon is created as a result of the interaction of various social actors. *Epistemology* defines the relationship between the researcher and social phenomenon. Moreover, it defines the plausible nature of the study's outcomes (Saunders *et al.*, 2009). *Methodology* focuses on various methods the study needs in order to collect and analyse the data and accomplish the set goals and objectives (Creswell, 2009).

Each of these research paradigms are built on certain fundamental assumptions, which function as a basic set of beliefs of alternative inquiry to the study's issues or problems. The four assumptions are positivism, post-positivism, critical theory and constructivism. The following table provides a brief outline of the four philosophical assumptions and their corresponding ontological, epistemological, and methodological paradigm (Guba & Lincoln, 1994).Table 4.1.

		Philosophical Assumptions			
		Positivism	**Post-positivism**	**Critical Theory**	**Constructivism**
Research Paradigms	**Ontology**	Naïve realism- 'real' reality, but easily discernible	Critical realism- 'real' reality, but only imperfectly and selectively discernible	Historical realism- 'virtual' reality shaped by values over time. Values include socio-political, cultural, economic and gender	Relativism- constructed reality based on local and specific discerning
	Epistemology	Dualist/ objectivist; outlines true findings	Modified dualist/ objectivist; criticises tradition/community; outlines probable findings	Transactional/ subjectivist; outlines value-mediated findings	Transactional/ subjectivist; outlines created-findings
	Methodology	Experimental, verifies hypothesis, quantitative in most cases, easily manipulative through interventions	Modified experimental, falsifies hypothesis, includes quantitative methods in most cases, manipulative and follows critical multiplism	Dialogic/ dialectic	Hermeneutical/ dialectical

Table 4.1: Four philosophical assumptions and corresponding ontological, epistemological, and methodological paradigm. Source (Guba & Lincoln, 1994)

A dominant assumption in the past 400 years (Guba & Lincoln, 1994) suggests that *positivism* elucidates naïve reality, where reality is observed and is easily discernible in its originality. The social phenomenon is studied in an objective manner, and is further recognised as independent of social actors. Studies based on positivism search for consistencies and casual relationships, and accordingly focus on the deductive principle to accomplish the study. Dependent on an existing theory, positivism develops and tests the hypothesis, and is experimental and manipulative in nature. The verification of hypotheses through quantitative methods (which test the facts acquired in the study) produces true findings and further develops the existing theory (Bryman & Bell, 2011; Saunders *et al*., 2009).

The principle underlying *post-positivism* lies in positivism itself; however, it adopts critical realism as its ontological assumption. In critical reality, 'real' reality is observed, albeit through imperfect and selective discerning (Guba & Lincoln, 1994).Whilst the existence of reality is seldom disputed in this philosophical assumption, it accepts the presence of differences in objects across different contexts. Post-positivism's philosophical assumption follows a modified dualism or objectivism, and observes the study's phenomenon with criticality and outlines probable findings (Guba & Lincoln, 1994; Bryman & Bell, 2011). Thus, post-positivism follows modified experimental methods for data collection, focuses on falsifying a study's hypotheses, and, in most cases, includes quantitative methods. It is manipulative and follows critical multiplism (Guba & Lincoln, 1994), in which multiple stakeholders are involved to critique the research subject and questions in an effort to achieve the targeted results in an unbiased manner (Coward, 1990).

Critical theory, however, hand goes against positivist assumption. Based on virtual reality, a reality defined by values such as socio-political, cultural, and economic and gender over time, effectuates the definition of social phenomenon and establishes a causal relationship between cause and effects within the boundaries of the social phenomenon in the critical theory philosophy. Human behaviour is explained based on theories (Bryman & Bell, 2011), and an interactive relationship is made apparent between the researcher and social actors/ subjects of the phenomenon assessed. The research, as based on critical theory, is accomplished through dialogic/ dialectic understanding, and the findings thus are value-mediated, given the presence of high subjectivity in this philosophical assumption (Guba & Lincoln, 1994).

Constructivism is based on local and specific discerning of the social phenomenon, and reality is 'constructed' in this assumption. Subjectivism principle is shared with critical theory and, unlike critical theory; the relationship between the researcher and social actors/ subjects of the assessed social phenomenon is interactively linked to the created findings. The methods for conducting the study are hermeneutical/ dialectical in nature, whilst constructivism is invariably linked with the local and specific values of the researcher and the subjects involved in the study (Guba & Lincoln, 1994).

Each philosophical assumption attempts to conduct the research study in accordance with the three major research paradigms: ontology, epistemology and methodology. The current study is conducted in lieu with post-positivistic assumptions. Post-positivist research has four crucial characteristics: a- research is broad; b- theory and practice cannot be separated and theory cannot be ignored merely in an effort to obtain facts (Ryan, 2006); c- motivation for conducting the research is central and crucial for the enterprise or sector or phenomenon under investigation; and d- the idea of conducting research with the use of only a correct techniques and the subsequent categorising of information is inadequate (Schratz & Walker, 1995).

The main aim of the study is centred on addressing the phenomenon of demand uncertainty mitigation through management practices in order to ensure all customers who perform the Hajj at Makkah are satisfied, which in turn leads to leveraging SMEs' performance in Saudi Arabia. The research study is broad since it interconnects the macro-economic and social endeavours of empirical research studies. Demand uncertainty mitigation, of itself, is a broad subject, the theory of which is understood to practically satisfy all Hajj pilgrims' food supply through management practices. Mitigating demand uncertainty is invariably central to the government since

uncertainty in demand could cause a crisis to the food industry during a peak period. In Saudi Arabia, the Hajji attracts different people from all over the world, which could be a cause of crisis if demand is not reliably predicted. Additionally, Saudi SME food suppliers need to understand the gross and subtle aspects of SCI in order to ensure their performance in the Hajj season is improved since they thrive under critical and complex competitive conditions. Given that the concept of uncertainty reflects both subjective and objective natures (Campos *et al.*, 2007) the idea of conducting research only with subjective or objective techniques is inadequate.

Considering these aspects, post-positivist research philosophy is apt for this study, where reality is critical of positivism (Eriksson & Kovalainen, 2008) and is established through social actors. Research findings are probable and are based on modified objectivism, with the research methodology focusing on elements in their natural settings. Research based on this philosophy is conducted to explain the research phenomenon, and the logic and purpose of the actions of the elements in the social setting (Guba & Lincoln, 1994). The following section focuses on the research approach in lieu with the post-positivistic research philosophy.

4.3 Research Approach

Whilst four distinct research philosophies are identified, research studies identify two common research approaches in an effort to clarify the research methodology or philosophy of methods: quantitative and qualitative (Eriksson & Kovalainen, 2008). A general distinction between the two approaches is provided in the below 4.2 table.

Point of Comparison	Quantitative Approach	Qualitative Approach
Ontology or Nature of Reality	Objective	Subjective
Research Strategy	Deductive	Inductive
Research Design	Exploratory	Descriptive
Types of Data	Quantitative	Qualitative
Data Collection Methods	Experimental and Survey	Interviews, case studies, ethnography, grounded theory, narrative
Sample Size	Large Sample Size	Small sample size

Table 4.2: General distinction between quantitative and qualitative approaches. Adopted from (Saunders *et al*., 2009)

The above (Table 4.2) reflects the general distinction to be made between the two research approaches, where the following arguments can be made in this regard. Quantitative approach has its fundamentals embedded in positivistic philosophical assumption, and the qualitative research approach has its fundamentals in interpretivism or constructivism (Bryman, 2006). The research approach in positivistic philosophy is usually applied across large samples, where both quantitative and qualitative approaches are used. However, positivistic philosophy commonly deploys quantitative methods to collect the required data and achieve the objectives. The research approach in the interpretivism paradigm is usually applicable across small sample sizes, and in-depth investigations are conducted to collect qualitative data (Guba &Lincoln, 1994; Saunders *et al*., 2012).

From the structural arguments, it can be deduced that the nature of reality in the quantitative approach is objective, and a deductive research strategy is followed. The relationship between variables is measured in this approach, with the research design exploratory in nature. Numerical data is collected using experimental or survey methods across a large sample size using quantitative measures for data collection and analysis. Conversely, the nature of reality in a qualitative approach is subjective, and an inductive research strategy is followed. The context of

the study or social phenomenon is discerned in this approach, and the research design is descriptive in nature. Non-numerical data is collected using interviews, case studies, ethnography, grounded theory and narrative, and suitable analysis is conducted across a small sample size (Saunders *et al*., 2009).

Adding further, quantitative research approach is guided by a linear model that begins with a theoretical position, states hypothesis, and then progresses through the steps of the research design, measures the concepts, selects the site for carrying out research, selects the sample, and administers the instrument. Commonly, this instrument is used as a survey or questionnaire for the study (Easterby-Smith, 2003), with data usually analysed through the use of statistical techniques (parametric and non-parametric). The analysed data leads to findings and conclusions, and the researcher reverts to the theoretical position at the initial phase of the research and accordingly verifies its validity. This feedback loop, which subsequently leads the researcher back to the theoretical perspective, shows both deductive and inductive elements, and is 'indicative of the positivistic foundations of quantitative research' (Bryman & Bell, 2007).

The characteristics of quantitative research can be outlined in an effort to understand the intricacies involved in this approach. Quantitative approach includes: a- a design that is determined before the project commences; b- the application of a single method or a combination of methods; c- a consistent approach, and d- the involvement of either a cross-sectional or longitudinal approach. Quantitative approach attempts to establish the 'precise measurement of something, such methodologies answer questions related to how much, how often, how many, where and who. Although the survey is not the only methodology of the quantitative researcher, it is considered a dominant one' (Cooper & Schinder, 2008). To summarise, quantitative studies

need and elicit quantitative information in mind of studying the particular phenomenon, and involves the usage of numbers and figures (Blumberg, Cooper & Schindler, 2005) to record the frequency of responses. They are highly objective and fail to gather the subtle nuances of subjectivism, which is apparent in qualitative design.

A qualitative design is at the opposite end of the continuum and is contradictory to the quantitative approach. It seldom focuses on numbers but rather employs a research approach that may evolve or adjust as the research progresses, and commonly uses multiple methods on a simultaneous basis. Qualitative design usually consists of longitudinal approaches, and generally is not concerned with consistency (Cooper & Schindler, 2008). The sample size in a qualitative design is usually small. A definition of a qualitative research, written in the last century, is still actively applied:

> 'Qualitative research is multi-method in its focus, involving an interpretive, naturalistic approach to its subject matter. This means that qualitative researchers study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them' (Denzin & Lincoln, 1994, pp.1–17).

Qualitative research design employs qualitative techniques or methods such as interviews, participant observation and diary/ journal methods (Easterby-Smith *et al.*, 2002) and case studies for the completion of the research. In some cases, the qualitative research approach is synonymously viewed with the case study approach (Gall, Gall & Borg, 2009). According to Gall *et al*. (2009), a case study research 'emphasises the fact that qualitative research focuses on the study of cases rather than of populations and samples' (p.31). Yin (1989) defines a case study as 'an empirical inquiry that investigates a contemporary phenomenon within the real-life

context, when the boundaries between phenomenon and context are not clearly evident, and in which multiple sources of evidence are used' (p. 23). Thus, these qualitative techniques provide a range of different techniques that attempt to 'describe, decode, translate and otherwise come to terms with the meaning, not the frequency, of certain more or less naturally occurring phenomena in the social world ' (Van Maanen, 1983, p.9).

Whilst qualitative approach attempts to gather data at a deeper level than the quantitative approach, the chances of a researcher's personal involvement with the sample is relatively high. This can serve as a disadvantage to the study. A small sample size does not achieve research generalisability, which acts as an impediment to the application of research studies across different sectors of SME in the study context. Based on these arguments, it is clear that, rather than employing a single approach, combining both quantitative and qualitative approaches will ensure the initiation and expansion of certain research frameworks and constructs (Creswell & Plano Clark, 2011).

Additionally, the post-positivist research philosophy enables the researchers to investigate their own epistemology, take up learning rather than a testing role, value problem-setting as opposed to problem-solving, focus on the specific findings rather than overall truth, and use critical multiplism and quantitative and/ or qualitative methods to achieve the study's objectives (Ryan, 2006). Considering these assertions, the current study follows a mixed methodology to address the phenomenon of demand uncertainty mitigation through management practices in order to satisfy all customers who perform the Hajj at Makkah, which, in turn, leads to leveraging SMEs' performance in Saudi Arabia. In this vein, mixed methodology is essential for this study for the following reasons.

Mixed methodology has emerged as a third methodological paradigm (Creswell & Plano Clark, 2007), and involves both quantitative and qualitative approaches for the collection, analysis, interpretation and presentation of the data (Teddlie & Tashakkori, 2009). A common approach applied in business and management studies (Saunders *et al.*, 2012), mixed methodology departs from the central assumption of conducting a study either on the basis of qualitative or quantitative constructs only. The central focus in mixed methodology is the combination of various methods and techniques (Wheeldon & Ahlberg, 2012) to extract the benefits of both quantitative and qualitative approaches (Creswell, 2009).

The research process in mixed methodology is guided by several key principles: 'using fixed and/ or emergent design; identifying a design approach to use; matching a design to the study's problem, purpose, and questions; and being explicit about the reason for mixing methods' (Creswell & Plano Clark, 2011, p.54). Each of these key principles is elaborated in the following paragraphs: in fixed-mixed-methods, the use of qualitative or quantitative methods and techniques is predetermined and planned at the beginning of the research study. Contrariwise, in emergent-mixed-methods, the use of qualitative or quantitative methods and techniques emerge when conducting the research process (Creswell & Plano Clark, 2011).

There are multiple approaches to the design of a mixed-methods approach, where two categorical constituencies can be identified in this regard: a typology-based approach and a dynamic approach. In the case of the typology-based approach, mixed methods are classified, and a particular design is adapted in lieu of the study's purpose and questions/ objectives. In the dynamic approach, multiple components of the design are interrelated, aside from the research questions. Whilst research questions constitute as a central focus of adopting a design, other

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components, namely conceptual framework, methods and validity, are interconnected in this type of approach (Creswell & Plano Clark, 2011).

In a typology-based approach, mixed methodology is classified using various logical foundations (Creswell *et al*., 2004; Tashakkori & Teddlie, 2003; Greene, 2007; Teddlie & Tashakkori, 2009; Morse & Neihaus, 2009; Leech & Onwuegbuzie, 2007). However, given the simplicity of Leech & Onwuegbuzie's (2007) typological model, the current study adopts the mixed-methods process model of Leech and Onwuegbuzie (2007). Through this typology, three dimensions are present: the *first layer* identifies whether the study consists of fully or partially-mixed methods design; the *second layer* identifies the timing of data collection in terms of whether it follows a concurrent or sequential pattern; and the *third layer* identifies whether each approach should be given equal or dominant status, considering their intensity of the application and use in the research process. Thus, choosing the relevant mixed-research approach invariably connects the design chosen with the research problem, purpose and questions.

Whilst mixed methods have received wide attention in recent years, given their dynamicity, Wheeldon & Ahlberg's (2012), explicitness regarding the purpose or logic behind mixing methods is essential in order to effectively use the time and resources. The reasons for choosing a mixed-methodology approach fall under one of these categories: triangulation, complementarity, development, initiation and expansion. Whilst triangulation corresponds to and corroborates the results using different methods, complementarity elaborates, enhances, illustrates and differentiates the results from one method with another. Development uses the results from one approach to develop the other approach, and is commonly employed to develop measurement instruments and accordingly implement sampling and implementing techniques.

Initiation discovers new paradoxes and frameworks, and expansion aims at extending the horizon of the study's inquiry with the use of different methods for different components of inquiry (Greene *et al*., 1989). Additionally, mixed- methodologies are used to obtain greater validity (triangulation), offset, completeness, process, different research questions, explanation, unexpected results, instrument development, sampling, credibility and context (Bryman, 2006).

With this as the theoretical foundation for the mixed-methodological research approach, the current study follows a mixed-methods approach and across-stage mixed method model, where qualitative and quantitative methods are predetermined and planned prior to conducting the research (Creswell & Plano Clark, 2011), with mixed methods applied across different research stages (data collection and analysis) (Johnson & Onwuegbuzie, 2004). A typology-based approach and partially-mixed sequential dominant status design is applied in this study. In partially-mixed concurrent design, the quantitative and qualitative phases are independent of one another, and are mixed only in the interpretation stage; however, they are conducted one after the other. The dominant status to the mixed-methods approach can provide high importance to either the quantitative or qualitative approach; the current study assigns dominant status to the quantitative approach, considering its objectivity and ease of data analysis and use (Wheeldon & Ahlberg, 2012; Saunders *et al*., 2009). In the current study, qualitative methods are employed first, followed by quantitative methods. A sequence exists in the methodological approach. Additionally, a quantitative approach is given dominant status, considering the post-positivist philosophy applied in the study. In a post-positivist philosophy, the study depends on a quantitative approach, and the addition of a qualitative approach benefits most research. Thus, the current study is *QUAN+QUAL* in nature (Johnson *et al*., 2007). The research design is

aligned with the study's purpose and questions, with relevant research designs drafted, as explained in Section 4.5.

The reasons for mixing methods in the current study are expansion and completeness. The current study aims at validating a theoretical model based upon the extended resource-based view (ERBV) of the firm, and contingency theory, which establishes the effect of Supply Chain Integration (SCI), postponement (PP), Mass Customisation Capability (MCC), on Mitigating Demand Uncertainty (DUM) under high Competitive Intensity (CI). The study attempts to expand and further add to the existing literature on demand uncertainty under high competitive intensity, using the case of the Saudi SME food suppliers and Hajj season. A novel research in this context, the study adopts a mixed methodology in an effort to achieve completeness, where comprehensives in the area of inquiry are obtained using both qualitative and quantitative measures (Bryman, 2006).

4.4 Research Strategy

Research strategy can be defined as logics of enquiry, based upon which the research questions are answered (Blaikie, 2007). Whilst research philosophy and approach guide the researcher in conducting the research, they cannot be considered separate entities; rather, they belong to the multi-dimensional set of a continuum. However, debates persist regarding the appropriate identification and application of research philosophy and approach, which is aptly resolved in choosing the appropriate research strategy (Saunders *et al.*, 2012). Whilst the positivists elucidate inductive or hypthetico-deductive process to explain patterns of behaviour, interpretivists emphasise establishing motivations that lead to the patterns of behaviour (Baker & Foy, 2008). Most social researches follow either inductive or deductive logic, from theories to

patterns of observations, and vice versa (Trochim, 2006) to meet their objectives. Thus, choosing appropriate research strategy is crucial to navigate across the research study in a smooth and non-confusing manner.

On common grounds, two key reasons can be identified as strategies guiding the research philosophy and approach: 'inductive and deductive reasoning' (Blaikie, 2007; Onwuegbuzie & Leech, 2005). In the inductive method (qualitative), inductive logic is applied. The researcher 'begins with observations, seeks patterns in those observations, and generates tentative conclusions from those patterns' (Rubin & Babbie, 2009, p.39). In the deductive method (quantitative), deductive logic is applied. The researcher 'begins with a theory, then derives hypotheses, and ultimately collects observations to test the hypotheses' (Rubin & Babbie, 2009, p.40). The following Figure 4.1, identifies the process involved in each of these approaches.
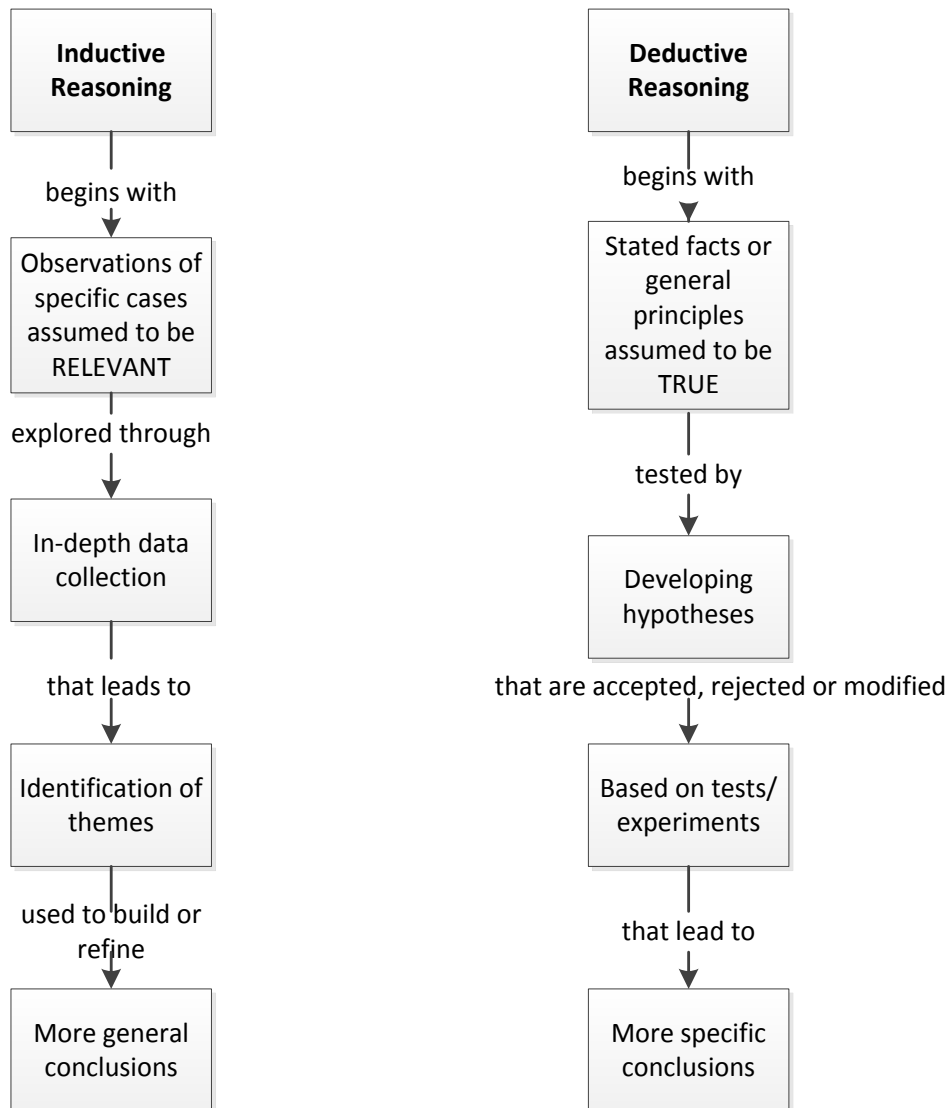
Figure 4.1: Overview of inductive and deductive reasoning. Adopted from (Wheeldon & Ahlberg, 2012)

As shown in Figure 4.1 above. In the inductive strategy, ideas available in the literature or otherwise through discourse from individuals are used to create new theory or concepts. Developed from the observation of facts on specific constructs or cases, inductive logic is more focused on exploratory research design and divulges in collecting in-depth data in an effort to explain the social phenomenon in question. Inductive reasoning reflects the attributes of the qualitative approach, and themes are identified from the collected data, which is used to build or

refine generalised conclusions (Collis & Hussey, 2009; Blaikie, 2007; Bryman & Bell, 2007; Remenyi *et al*., 1998).

In the deductive strategy, theoretical constructs available in the literature are tested using a relevant hypothesis framework. Specificity plays an important role in deductive strategy, where a top–down approach is used to test the hypothesis with relevant data. Data collection, in this strategy, is quantitative in nature, and the study is deeply rooted in existing theories. More specific conclusions are effectively extracted from empirical study (Collis & Hussey, 2009; Blaikie, 2007; Trochim, 2006). Whilst these two strategies commonly guide the research philosophies, another important strategy or reasoning known to have emerged with mixed methodology is abductive strategy.

Abductive reasoning is another crucial research strategy utilising the benefits of both qualitative and quantitative approaches to test or validate the research objectives. Based on the expertise or intuition of the researcher, abductive strategy is commonly applied in mixed methodology; when this is done, abductive reasoning provides the research study with new extensiveness to comprehensively conduct the study in a robust manner (Wheeldon & Ahlberg, 2012). The following Figure 4.2 below provides an overview of abductive reasoning.
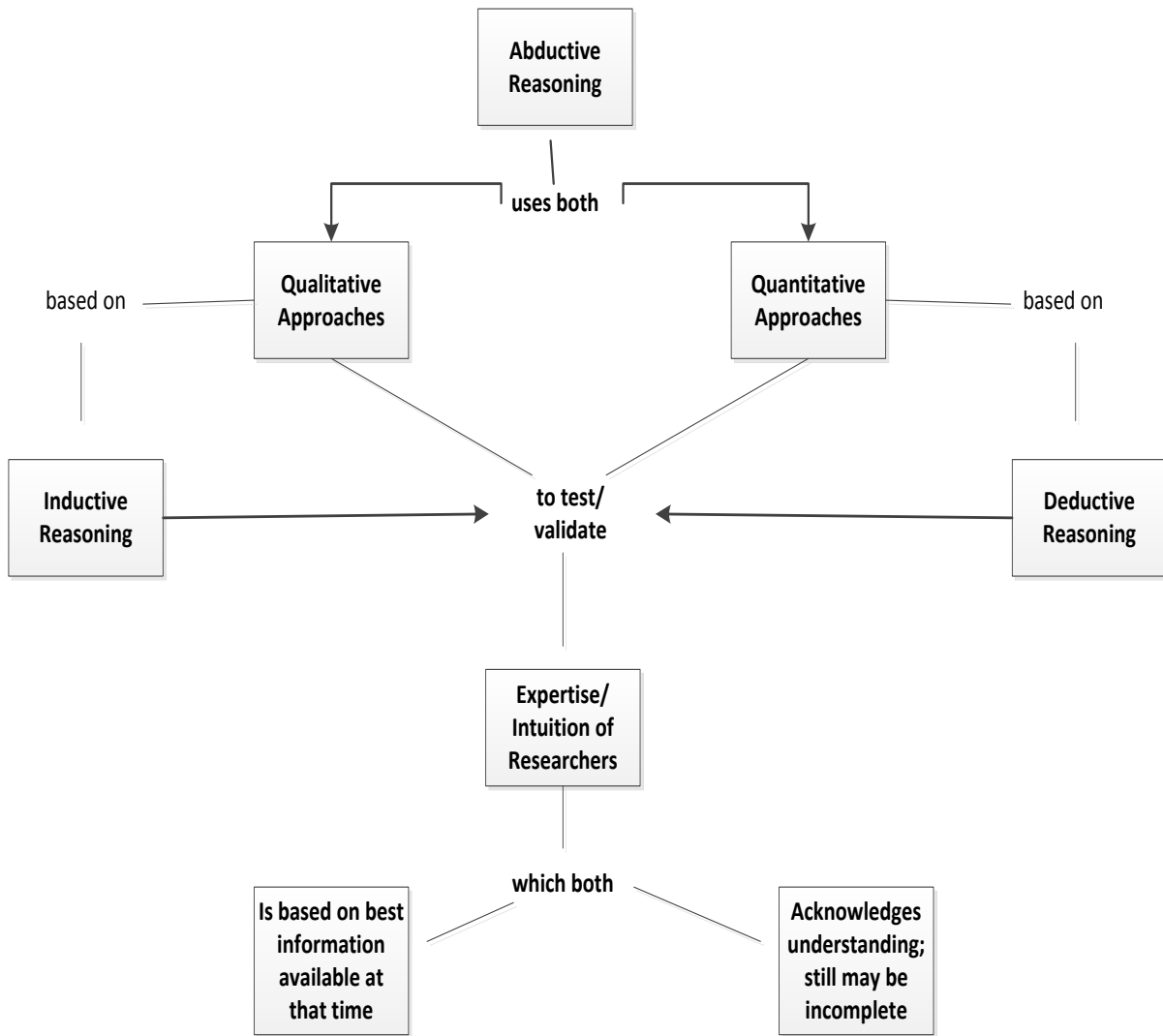
Figure 4.2: Overview of abductive reasoning. Adopted from (Wheeldon & Ahlberg, 2012)

Given the application of mixed methodology, the current study uses abductive reasoning. The mixed method research design and abductive strategy divides the current study into two stages: (1) the exploratory stage, where both qualitative interviews and quantitative surveys are conducted to explore aspects pertinent to the processes of strategy formulation, implementation and evaluation; and (2) the hypotheses-testing stage, where quantitative surveys will be conducted to examine research hypotheses on the relationship between Supply Chain Integration (SCI), postponement (PP), and Mass Customisation Capability (MCC), and Mitigating Demand

Uncertainty (DUM) under high Competitive Intensity (CI).Thus, data for this study is both primary and secondary in nature, and will be collected using both qualitative and quantitative methods.

4.5 Research Designs

Research designs are 'procedures for collecting, analysing, interpreting, and reporting data in research studies' (Creswell & Plano Clark, 2011, p. 53). As the name suggests, research designs outline the structure for investigating the research study, acting as building blocks for organising the research study and report (Easterby-Smith *et al*., 2008). They function as models for conducting the research and supply the following: a- the procedures and directions for research methods; and b- logic for interpreting the results (Creswell & Plano Clark, 2011). Research designs ultimately validate the logic behind using, a- particular method/s of data collection, b-source of information, and c- sample within the set time-constrained limits (Easterby-Smith *et al*., 2008). Thus, choosing the relevant research design enables the researcher to materialise the blueprint into a valid study. Research designs can be classified based on various constructs: methods of data collection, time, researcher participation and purpose of study (Blumberg *et al*., 2008). Considering that the commonly used classification is based on 'purpose of the study', the current study uses this construct of classification. Accordingly, there are three types of research design based on the purpose of the study: exploratory, descriptive and explanatory (Chisnall, 2001). The following table provides a general comparison of the three different research designs in literature. General comparison of the three different research designs is in Table 4.3.

Research Designs	Description	Approach and Strategy	Data Collection Methods	Source
Exploratory Research	Focuses on discovering new insights and ideas and is usually conducted when study phenomenon has received less or no attention or information on the study phenomenon is very little or non-existing. Lack of previous literature on any particular study phenomenon demands exploratory research	Usually qualitative with inductive approach	In-depth literature review, interviews with subject matter experts and brainstorming using panel of expert interviews	(Sekaran & Bougie, 2009; Hair, Babin, Money & Samouel, 2003; Saunders *et al*., 2009).
Descriptive Research	Focuses on elaborating on any particular phenomenon and is usually conducted on the basis of previous literature. This type of research design is applied when information about the characteristics of the study phenomenon is required to either ascertain specific facts or add further information to the existing theory	A specific set of scientific methods are used. Usually quantitative with deductive approach. Statistical techniques are typically used to conduct analysis	Mainly cross-sectional studies are conducted and raw data is obtained through surveys	(Collis & Hussey, 2009; Blaikie, 2007; Hair *et al*., 2003; Malhotra & Varun, 1998).
Causal Research	Focuses on identifying the cause-effect relationship between the study's variables. The primary focus of the study is to test whether one cause has any effect on the other	Usually quantitative and statistical techniques are typically used to conduct analysis and summarise the data	Experiments	(Wilson, 2010; Hair *et al*., 2003).

Table 4.3: General comparison of the three different research designs

From the general comparison of the three different research designs, it can be deduced that exploratory design generally is used when a study's issue or phenomenon lacks prior knowledge and requires further insight to the idea under investigation. Descriptive design is commonly applied when prior knowledge on the study's issue or phenomenon exists, and where the main focus of the study is centred on describing the study phenomenon in an in-depth manner. Casual or explanatory design focuses on establishing and accordingly explaining the casual relationship

between the study variables. Given the subtle boundaries between these three study designs, a research study either can base itself on one of these designs or otherwise combine two or more designs in an effort to satisfy its purpose.

The current study aims at addressing the phenomenon of demand uncertainty mitigation through supply chain management practices in order to satisfy all customers who perform the Hajj at Makkah, which in turn leads SMEs' performance in Saudi Arabia to be leveraged. Resultantly, the research design is divided into two phases; each phase is crucial to resolving the research problem and validating the relationship of the impact of Supply Chain Integration (SCI), postponement (PP), and Mass Customisation Capability (MCC) on mitigating Demand Uncertainty (DUM) under high Competitive Intensity (CI). Exploratory design is used in the first phase by completing a literature reviewing and conducting interviews to clarify concepts regarding aligning sources of uncertainty with supply chain strategies in order to improve supply chain performance. Descriptive-explanatory design is applied in the second phase, which obtains in-depth information on the impact of Supply Chain Integration (SCI) on manufacturing strategies, such as postponement practice (PP) to mitigate Demand Uncertainty (DUM) via cross-sectional sample survey.

The process flow of the current study's research design is indicated in the following figure.
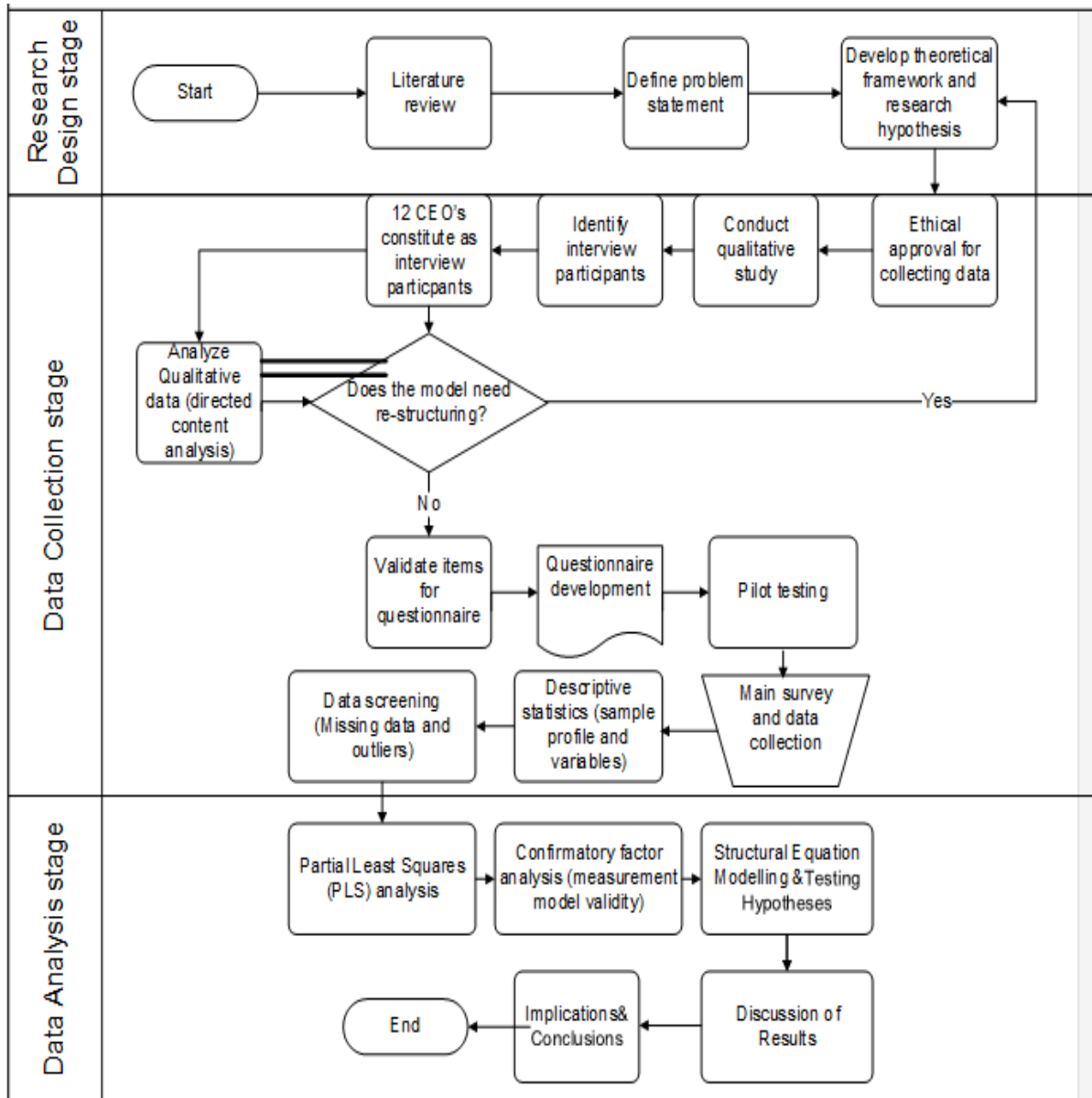
Figure 4.3: The process flow of the study's research design. Created by the researcher

4.6 Data Collection

The question of the research methods appears following the definition of the research paradigm, its approach, strategy and design. The process of collecting evidence or information on a particular subject or phenomenon in order to validate the study's assertion or accordingly generate new ideas or theoretical constructs is defined as data collection (Olsen, 2011). Thus,

data collection methods—otherwise considered research methods—are techniques adopted by the researcher to generate, extract and analyse the data (Blaikie, 2007; Hussey & Hussey, 1997). A crucial stage of research, data collection, involves techniques centred on collecting primary and secondary data. The data is 'collected afresh and for the first time, and thus happen to be original in character' (Kothari, 2005, p.95), and is termed primary data. Primary data can be collected using numerous interactive methods. It can be collected either by quantitative method/s, qualitative method/s, or as a mixture of both quantitative and qualitative method/s. A few important primary data collection methods are as follows:

'(i) observation method (ii) interview method (iii) through questionnaires (iv) through schedules, and (v) other methods which include (a) warranty cards; (b) distributor audits; (c) pantry audits; (d) consumer panels; (e) using mechanical devices; (f) through projective techniques; (g) depth interviews, and (h) content analysis'(Kothari, 2004, p.96).

The data collected from various sources, such as journals, books, articles and credible websites, is considered secondary data. In the current study, primary data is collected using qualitative and quantitative techniques. The qualitative and quantitative primary research methods used in this study are discussed in sections 4.6.1 and 4.6.2, and secondary data used in the study are detailed in the 'Reference' section of the study.

4.6.1 Qualitative Data Collection

Qualitative data can be collected using three primary methods: interviews, observations and written documents. Interviews provide data and knowledge from the respective participants in

regard to their opinions and views concerning the study phenomenon. Direct quotations of the participants serve as primary data. In the observation method, the researcher adorns the role of observer, with the various aspects of the study phenomenon considered. Primary data in this method is obtained in the form of programme records, publications, reports and so on (Patton, 1990). Interview is another crucial primary data collection method, during the course of which the researcher personally communicates with the participants via telephone or face-to-face, or impersonally through telephone, email or any computer-mediated communication. Interviews may be structured, semi structured or unstructured. The three interview types are differentiated on the basis of the structure of interview questions: if, for example, the questionnaire follows a structured pattern and the interviews generate quantifiable data, they are considered structured. There is limited interaction between the researcher and participants in the case of structured interviews, which are standardised and produce standard data. In semi-structured interviews, there is a unique mixture of structured and unstructured interview methods. Semi-structured interviews are flexible and commonly used by researchers (Dawson, 2002). Necessary probing questions will be used using the questionnaire tool, with new dimensions on the topic collected through this method (Saunders *et al*., 2009). Unstructured interviews lack any structure or questionnaires to collect data, with focus on obtaining in-depth information and opinions of the participants of the research study. These are usually carried out when the researcher aims at investigating matters or issues that have not undergone in-depth research. This approach is time consuming and can deviate from the phenomenon under examination in the study (Saunders *et al*., 2009).

Although structured interviews are standardised and commonly used in the quantitative approach, semi-structured and unstructured interviews are non-standardised and commonly used

in the qualitative research approach. The researcher uses a tool (questionnaire) with a set of questions to navigate across the interview process; however, the interviewer is privileged to modify and channel the interview if new information is obtained during the process (Saunders *et al*., 2012).

In the current study, the interviews function as a qualitative approach and serve a dual purpose: whilst they are used to acquire primary data for the study and supply direct quotations, they are also used as an effective means to validate the research model and items used in the questionnaire. They are used to achieve face and content validity for any research study. The semi-structured interviews serve as a means for supplying qualitative primary data for this study.

4.6.1.1 Elaboration on Semi-Structured Interviews and the Justification of Their Application

Interviews can be defined as purposed conversations (Burgess, 1984), and are commonly built around the rationale of garnering in-depth information on a particular subject in order to collect and analyse data, and thereby develop meaningful constructs (Mason, 2002). In semi-structured interviews, general interview protocols provide a framework for conducting the interviews (Recker, 2011). A questionnaire tool with checklist of issues or questions guides the researcher (Bryman & Bell, 2007). This data collection method has numerous benefits: for example, semi-structured interviews encourage two-way communication and are less intrusive (Recker, 2011), and also provide sufficient flexibility for the researcher to respond to participants' information and accordingly steer the interviews in line with the predetermined questionnaire (Bryman, 2004). Whilst semi-structured interviews can be used to confirm existing logic, the flexibility provided to the researcher during the interviews provides an opportunity for learning and

producing new ideas. This non-structured nature of semi-structured interviews allows the researcher to discuss sensitive issues in a guided manner (Recker, 2011). The order of the questions in any semi-structured interview is predetermined; however, given its flexible nature, the interviewer is permitted to clarify any ambiguity in the questionnaire and use multiple probes if required in an effort to encourage the participants to provide more information (Berg, 2009).

In semi-structured interviews, two types of question are present: structured and open-ended. Whilst structured questions collect factual data, open-ended questions collect actual or supplement data for the study (Stone & Collin, 1984). Open-ended questions allow the interviewer to supply unique responses and experiences in an in-depth manner (Wilkinson, Joffe & Yardley, 2004). However, the questionnaire prevents the interviewer from making any unnecessary deviations. Thus, conversations in this type of questionnaire are neither free nor highly structured. Considering the numerous benefits of semi-structured interviews, the current study considers this form of qualitative interviewing process most apt for this study.

The following section covers the requirements of the semi-structured interviews and the manner in which the requirements are fulfilled in the current study.

4.6.1.2 Semi-structured Interview Requirements

The effectiveness of semi-structured interviews is based on various factors, including the number of participants, the length of the interviews, the questionnaire tool and the role of the interviewer in facilitating the interviews.

4.6.2 Number of Participants for Qualitative Data

In the current study, 12 CEOs belonging to various SMEs across Saudi Arabia constitute as the participants of the semi-structured interviews. In order to obtain a reasonable number, depending on the sample pool size, the researcher set out to collect the participants for semi-structured interviews with the idea of 12, through the adoption of a snowball sampling technique. The size of the sample pool in qualitative interviews depends on time and resource availability. A total of 12 interviewees are reasonable for collecting qualitative data since this sample size provides the researcher with the 'experience of planning and structuring interviews, conducting and partially transcribing these, and generating quotes for their research' (Adler &Adler, 2012).

Snowball sampling can be defined as the selection of research subjects through referrals (Morgan, 2008). In the case of snowball sampling technique, study participants are recruited on the basis of the subjects' social network. The participants may refer to other possible participants; thus, depending on their willingness to participate and the relevance of the study (Burns &Burns, 2008), interview participants are recruited. With the idea of identifying a total of 12 participants, the researcher used social connections to get approval from four CEOs. The researcher informed the four CEOs (with whom the researcher maintains a good relationship) of the need and importance of the study, where the social network generated the remaining eight participants for the study. Thus, the snowball technique is used aptly in this study to generate the sample pool for qualitative interviews. Informed consent is obtained through letters, and face-to-face interviews are conducted. Interviews are recorded through audio-recording devices, with the offices of the 12 participants located in Makkah and Jeddah City constitute as locations for conducting the interviews.

4.6.3 Interview Protocol

4.6.3.1 Length of the Interviews

Selecting the appropriate length of interview is crucial when seeking to maintain the flow of interviews and accordingly prevent the participants and interviewer from losing focus of the research topic. From a general perspective, the length of one interview is between 45 minutes and 60 minutes (Eriksson & Kovalainen, 2008). The length of interviews in the current study is 60 minutes. Recording devices are used to record the interviews, aside from written notes after obtaining required consent from each participant.

4.6.3.2 Interview Questions

The interview questions for the semi-structured interviews used in the current study are divided into two sections, namely Section A and Section B, serving a dual purpose by providing primary data and validating the content of the questionnaire. In order to build good rapport and make the participants feel at ease, each participant was asked to give information regarding their respective company's background. The structured questions in the current study are the first four questions of Section A, which are concerned with collecting factual data.

The following questions were posed regarding the subjects' company, constituting as Section A of the study:

[1] What kind of business does your company carry out?

[2] How many employees are there in your company?

[3] How many suppliers does your company have at this moment?

[4] In which countries are your suppliers based?

[5] In general, what do you think about supply chain integration? Do you value the idea of having a close and good business relationship with your suppliers and customers?

[6] Do you have issues/ problems with demand uncertainty mitigation during the Hajj season in regard to food provision? How you can mitigate it?

[7] What strategies are currently used by your company to mitigate demand uncertainty during the Hajj season regarding food provision?

[8] In general, what are the alternative activities and mechanisms that may be employed to deal with demand uncertainty mitigation during Hajj?

Section B focuses on the conceptual framework of the study and further attempts to validate the study's conceptual framework. Moreover it aims at establishing face validity and content validity. The model below is shown to the participants, who are asked to comment certain specific open-ended questions.
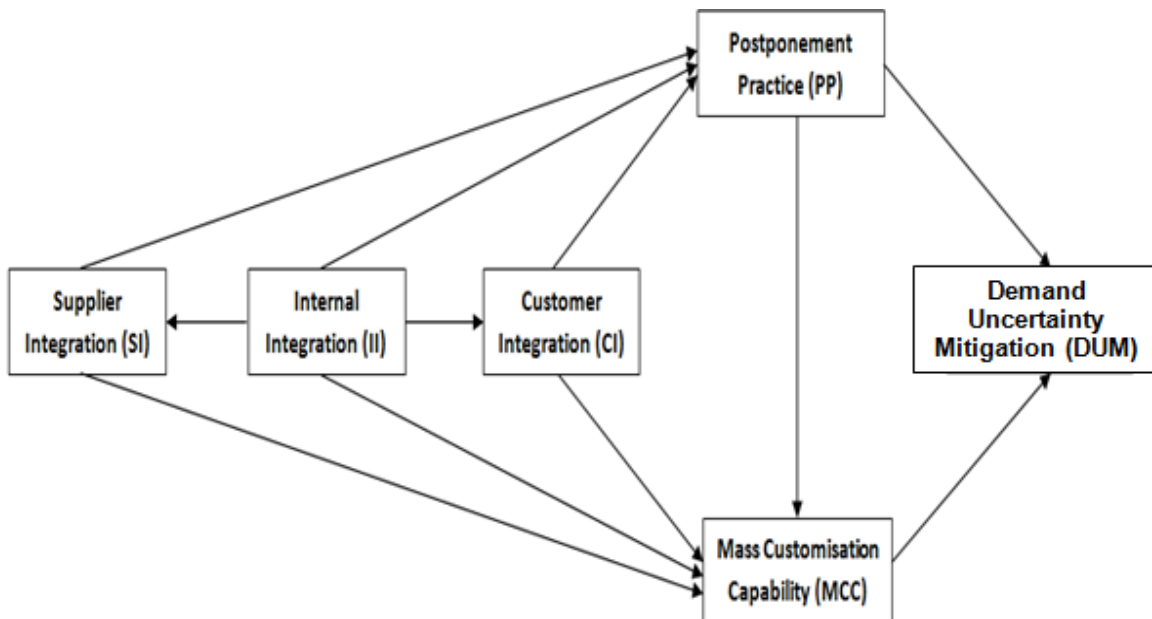
Figure 4.4: framework of the study.

[1] Do you agree with the linkages between the four constructs? If not, please can you comment further?

[2] What do you think about the impact of supply chain integration on postponement practices? Please comment.

[3] What do you think about the impact of supply chain integration on Mass Customisation Capability? Please comment.

[4] What do you think about the impact of supply chain integration on demand uncertainty? Please comment.

[5] What do you think about the impact of postponement practices on mass customisation capabilities? Can you give an example?

[6] What do you think about the impact of postponement on demand uncertainty? Please comment.

[7] What do you think about the impact of mass customisation capabilities on demand uncertainty? Please comment.

[8] What would you think if supply chain integration or customisation capabilities or postponement was to be taken out of this model? How can firms mitigate demand uncertainty during the Hajj season when providing food to pilgrims?

4.6.3.3 The Role of the Interviewer

The researcher performed the role of interviewer in the current study. Since semi-structured interviews involve CEOs of SMEs manufacturer, SMEs of food suppliers, Hajj campaigns (Hamllah) and firms related to food SMEs in Hajj, maintaining a high level of professionalism whilst extracting relevant information was a crucial aspect. However, the questionnaire tool added sufficient leverage to break the ice between the participants, and the interviewer's enthusiasm and non-biased attitude ensured the high and equal participation of all CEOs (Bryman, 2008).

4.6.3.4 Data Preparation

Data preparation is essential in qualitative studies. Data preparation paves the way for data analysis, where data preparation in the current study refers to the process of translation. The audio-recorded interviews are translated from Arabic to textual data. A direct translation method is used to translate the textual data from Arabic to English (Bernard & Ryan, 2010). Audio-recorded interviews are subjected to verbatim and word-to-word transcription, where the researcher played the role of transcriptionist in the current study. It is argued that oral-to-written translations reconstruct the data rather than producing a direct copy (Kvale, 1996; Fog, 2004). Considering this, the current study follows certain guidelines in an effort to ensure authenticity and accordingly maintain the representativeness of the transcribed data. All interviews are transcribed two days following the interview in order to indicate the subjective nuances projected or collected from interviews, aside from remembering and maintaining the identities of participants. Additionally, word-to-word written translation is believed to improve the general representativeness of the audio/ oral recordings. Nevertheless, care was taken not to reveal the identities of the participants in the translated data. With this noted, the participants are identified as partici1, partici2, partici3 and so on in the transcribed data. The translated data is saved in Word documents, along with each participant's code of identification.

4.6.4 Data Analysis of Qualitative Data

Data analysis in a qualitative study is synonymous with content analysis, and three major approaches can be outlined in this regard: conventional content analysis, directed content analysis and summative content analysis. Conventional content analysis is based on observation, where codes are defined during data analysis. The source of codes in this analysis is the data

itself. In the case of directed content analysis, the study begins with the defining of theory and codes before and during the data analysis. The source of codes in this analysis is the study's theory or research findings. In summative content analysis, the study begins with relevant keywords, which are identified before and during the data analysis phase, whilst keywords are extracted from the literature review stage (Hsieh & Shannon, 2005).

Qualitative data analysis in the current study is accomplished using the direct content analysis method. Given that the study is based on theoretical concepts and conceptual framework, codes are based on Supply Chain Integration (SCI), postponement (PP), Mass Customisation Capability (MCC), Mitigating Demand Uncertainty (DUM) and high Competitive Intensity (CI). Any text failing to fall into these categories will be assigned a new code in the analysis. The coding process for the current study is discussed in the following section.

4.6.4.1 Coding Process

The process of coding the collected data is essential in order to ensure simple analysis. The process labels the collected data (Saunders *et al*., 2012), where three types of code are generally used in qualitative data: structural, themes and memos. Whilst structural codes focus on the features of the interview, thematic codes are centred on the collected text, and memos provide notes about the codes themselves (Bernard & Ryan, 2010). In the current study, a coding process is followed, based on thematic guidance for the literature on coding.

Thematic codes are developed based on the conceptual model; in this case, data is classified based on the study's variables of Supply Chain Integration (SCI), postponement (PP), Mass Customisation Capability (MCC), mitigating Demand Uncertainty (DUM) and high Competitive

Intensity (CI). The interview transcripts are read, and textual content is segregated from the mass data using discretion and understanding. The resulting data or units of data are in the form of sentences or paragraphs, which are coded based on the study's variables. The available data then is ready for analysis (Bryman & Bell, 2011; Saunders *et al*., 2012).

4.6.4.2: Limitations of Semi-structured Interviews and Directed Content Analysis

Limitations in the data collection can be attributed to two aspects: limitations in conducting semi-structured interviews and directed content analysis. Semi-structured interviews exhibit common limitations of any form of interview: wrongful representation of participants, lack of common and convenient time, meeting and location for all participants and lack of planning and good organisation of group meetings (Malhotra & Birks, 2003). The lack of active participation from all members and the control of discussion by one single participant or few participants is another limitation of interviews (Eriksson & Kovalainen, 2008). In directed content analysis, the researcher is inclined to obtain supportive evidence rather than non-supportive evidence of the study's theories, with overemphasis on a particular theory potentially limiting the research study's focus to one particular phenomenon (Hsieh & Shannon, 2005).

4.6.5 Quantitative Data Collection

Quantitative data collection involves two methods of data collection, namely experiments and surveys. Whilst experiments are commonly used in explanatory studies, surveys are applied in exploratory and descriptive studies (Saunders *et al.*, 2012).Experiments aim at examining the cause and effect between two variables in a controlled setting, and are limited to the number of variables in the study. Commonly conducted in laboratory settings, experiments do not effectuate

the generalisation of a study's results (Blumberg *et al*., 2008; Saunders *et al*., 2012). Given the exploratory and descriptive nature of the current study, surveys with a questionnaire tool are used to collect primary quantitative data. The survey is a 'system for collecting information from or about people to describe, compare, or explain their knowledge, attitudes, and behaviour' (Fink, 2003). A close-ended questionnaire survey is designed for this study.

4.6.5.1 Questionnaire Development

Questionnaires, for the current study, are developed from the completion of a relevant literature review and validated using interviews with 12 CEO's of SME in food sectors. Additionally, a pilot study and purification measures validate the equivalence of the questionnaire tool. A questionnaire for the current study is developed using a dual process. In the first step, the specification and operationalisation of constructs is achieved. Following, scale and type of questionnaire is decided, with the questionnaire then developed. Each of these aspects is discussed below:

4.6.5.2 The Specification and Operationalisation of Constructs

The specification of constructs refers to the definition of the study's constructs. The current study comprises six constructs, namely customer integration, internal integration, supplier integration (SCI), postponement practices, mass customisation capability, and demand uncertainty mitigation. Each of these constructs is elaborated on in the literature review.

The operationalisation of constructs refers to the translation of concepts to measurable indicators (Saunders *et al.*, 2012). Measurable indicators are obtained from a relevant literature review, and accordingly validated using a panel of experts consisting of academics, in addition to interviews

of 12 CEOs of SME's. Measurable items of each construct and their corresponding codes are outlined below.

4.6.5.3 Customer Integration

Supplier/ customer integration refers to the extent to which an organisation can partner with suppliers and customers in an effort to structure its inter-organisational practices, behaviours, processes and strategies into collaborative, manageable and synchronised processes so as to meet customer requirements (Lai *et al*., 2012). The items for this construct are extracted from the studies conducted by Zhao, Huo, Flynn &Yeung (2008), Flynn, Huo & Zhao (2010), Swink, Narasimhan & Wang (2007), Narasimhan & Kim (2002), Swink & Nair (2007) and Cousins & Menguc (2006). The measurement items for assessing customer integration are mentioned below.

- **CI1:** We are in frequent, close contact with our customers.
- **CI2:** Our customers are actively involved in our product design process.
- **CI3:** The customers involve us in their quality improvement efforts.
- **CI4:** We work as a partner with our customers.

4.6.5.4 Internal Integration

Internal integration can be understood as the degree to which the various internal functions and processes of an organisation strategically coordinate and collaborate with one another's activities and decisions, and thus form integral relationships across the different functions (Lai *et al*., 2012). The items for this construct are extracted from the studies carried out by Huang, Kristal & Schroeder (2008), Zhao, Huo, Selen & Yeung (2011), Flynn, Huo & Zhao (2010), Braunscheidel

& Suresh (2009), Dröge, Jayaram & Vickery (2004), Koufteros, Vonderembse & Jayaram (2005) and Swink, Narasimhan & Wang (2007). The measurement items for assessing internal integration are as follows:

- **II1:** The functions in our plant are well integrated.

- **II2:** Our plant's functions coordinate their activities.

- **II3:** Our top management emphasises the importance of good inter-functional relationships.

- **II4:** Management works together well on all important decisions.

4.6.5.5 Supplier Integration:

Supplier integration mainly entails supplier partnerships, supplier information sharing and the involvement of suppliers in product development (Lau *et al*., 2012). The items for this construct are extracted from the studies carried out by Zhao, Huo, Flynn & Yeung (2008), Flynn, Huo & Zhao (2010), Swink, Narasimhan & Wang (2007) and Cousins & Menguc (2006). The measurement items for assessing supplier integration are mentioned below:

- **SI1:** We maintain cooperative relationships with food suppliers.

- **SI2:** We maintain close communications with food suppliers in regard to quality considerations and design changes.

- **SI3:** Our firm key food suppliers provide input into our product development projects.

- **SI4:** We strive to establish long-term relationships with food suppliers.

4.6.5.6 Postponement Practice:

Postponement can be defined as the process of delaying product finalisation in the supply chain until orders from customers are received with the aim of customising products, as opposed to performing those activities with the expectation of achieving future orders (Can, 2008).The items for this construct are extracted from the studies completed by Can (2008), Yang & Burns (2003), Hoek (1999) and Cholette (2009). The measurement items for assessing internal integration are as follows:

- **PP1:** Our firm postpones final product assembly activities until customer orders are received.
- **PP2:** Our firm postpones final product-labelling activities until customer orders are received.
- **PP3:** Our firm postpones final packaging activities until customer orders are received.
- **PP4:** Our firm postpones the forward movement of goods.

4.6.5.7 Mass Customisation Capability:

Mass customisation is a process where manufacturers tailor-make products to satisfy individual customer needs at the same prices as those of mass-produced items (Davis, 1987). The items for this construct are extracted from the studies completed by Kristal, Huang & Schroeder (2010), Feitzinger & Lee (1997), Rungtusanatham & Salvador (2008), Huang, Kristal & Schroeder (2008), Liu, Shah & Schroeder (2006), Tu, Vonderembse & Ragu-Nathan (2001), Kristal, Huang & Schroeder (2010), Duray, Ward, Milligan & Berry (2000), Ismail, Reid, Mooney, Poolton &

Arokiam (2007), Kotha (1995) and Da Silveira, Borenstein & Fogliatto (2001). The measurement items for assessing mass customisation capability are:

- **MCC1**: We are highly capable of large-scale product customisation.

- **MCC2:** We can easily add significant food product variety without increasing costs.

- **MCC3:** We can easily add product variety without sacrificing quality.

- **MCC4:** We can customise food products whilst maintaining high volume.

- **MCC5:** Our capability for responding quickly to customisation requirements is very high.

4.6.5.8 Demand Uncertainty Mitigation:

Demand uncertainty can be defined as variations and fluctuations in demand (Chen & Paulraj 2008; Lai *et al*., 2012), and the process of mitigating demand uncertainty can be comprehended as demand uncertainty mitigation. The items for this construct are created by the researcher, where no items in the literature were found to measure demand uncertainty mitigation, and thus, items of this construct are partially adapted and transformed from the study conducted by Zahra & George (2002). The measurement items for identifying demand uncertainty mitigation measures are:

- **DUM1:** Demand uncertainty is mitigated by providing our customers with products consistent with their nominated product specification.

- **DUM2:** Demand uncertainty is mitigated when our customers place orders consistent with their nominated delivery lead time.

- **DUM3:** Demand uncertainty is mitigated when our customers provide reliable forecasts as to their demands.

- **DUM4:** Our customers place orders consistent with their nominated delivery lead time.

- **DUM5:** We can provide products to our customer consistent with their nominated product specification.

- **DUM6**: Our customers provide us reliable forecasts on their demands.

4.6.5.9 Competitive Intensity:

Competitive intensity refers to the extent to which an organisation faces competition in the market in which it operates (Lai *et al*., 2012). The items for this construct are extracted from the study completed by Zahra & George (2002) and Jaworski & Kohli (1993). The measurement items for assessing competitive intensity are:

- **CPI1:** We are in a highly competitive industry.

- **CPI2**: Our competitive pressures are extremely high.

- **CPI3:** We do not pay much attention to our competitors.

- **CPI4:** Competitive moves in our market are slow and deliberate, with long time gaps between different companies' reactions.

4.6.5.10 Scale and type of Questionnaire:

Questionnaire scale refers to the rating indicator assigned to the measurement items in any given questionnaire. Whilst scales such as Thurstone scale, Likert scale, Semantic differential scale and Guttman scale (Chisnall, 2001) are applied widely and used in operational management studies, 7 Likert scale is used in the current study. Likert scale generally consists of points spanning 4–7

(Saunders *et al*., 2012). Whilst a four-point scale allows the participants to express their attitudes and beliefs either from a positive or negative perspective, a five-point scale, on the other hand, allows participants to express neutral feelings towards the measurement items (Malhotra & Birks, 2003). Considering this, a seven-point scale ranging from 'strongly disagree' to 'strongly agree' is used in the current quantitative survey questionnaire.

The type of questionnaire for any given study is dependent on the mode of communication between the researcher and participants (Churchill, 1995). There are three types of questionnaires: self-administrated, personal and telephone interviews (Blumberg *et al*., 2008); these can be used to collect quantitative data through the survey method. The self-administrated questionnaire refers to data collection through an electronic medium (email or web-based) or hand delivered (delivery and collection questionnaire) or mail questionnaire (Blumberg *et al*., 2008; Churchill, 1995; Saunders *et al*., 2012). Telephone questionnaires refer to data collected via telephone calls (Churchill, 1995). Personal interview questionnaires refer to data collected via face-to-face conversation (Churchill, 1995). By comparing the types of questionnaire, it was found that telephone interviews are costly and limited in length (Blumberg *et al*., 2008). Whilst personal interviews provide a high response rate, they are costly, and both personal and telephone interviews are subjected to interviewer bias (Churchill, 1995; Saunders *et al*., 2012). Considering the low cost and minimal research involvement in self-administrated questionnaires (Blumberg *et al*., 2008), an electronic medium is used, with data collected via email in the current study. The questionnaire is sent to the respective firms after identifying the relevant sample through the sampling process.

4.6.5.11 Sampling:

The sampling process can be understood as the process of extracting a representative sample from the study population (Johnson & Christensen, 2010; Gravetter & Forzano, 2012). The sampling process is a systematic and sequential five-fold process facilitating the research methodology. It includes: defining the study population; identifying the sampling frame; selecting the sampling technique to identify the sample elements; determining the sample size; and collecting the data from the elements (Burns & Burns, 2008).

4.6.5.12 Population Definition and Sampling Frame:

Population—otherwise considered as Universe—is the total group of people, objects or events from which the researcher obtains information. A sample, on the other hand, represents a larger population in the research study. It consists of a set of individuals from the population that guarantees the data for the study (Gravetter & Forzano, 2012). When the population is large, measuring each and every individual, object or event becomes a costly, tiresome and cumbersome process. In such situations, a sample is drawn. The representative sample is a relatively small set of the study population, and is a characteristic representation of the original population on all demeanours (Johnson & Christensen, 2010). Accordingly, generalisability is achieved. Accurate inferences based on the subset of individuals' opinions, attitudes and behaviours can be drawn, without any biased view of the researcher. Statements on the population can be made based on the sample data (McCormack & Hill, 1997; Johnson & Christensen, 2010). Employees belonging to food manufacturing and suppliers SMEs across Saudi Arabia, which supply food to Hajj pilgrims, constitute the population for the current study. Sampling frame is a physical representation/repository of the study population, in its entirety,

from which the sample is drawn (Sekaran & Bougie, 2009). Whilst it is difficult to identify all SMEs supplying food to Hajj pilgrims, given the lack of data consolidation and comprehensiveness of the Saudi food industry, SMEs across Saudi Arabia constitute the sampling frame of the study. A lack of appropriate sampling frame necessitates thoughtful process in selecting the relevant sampling technique.

4.6.5.13 Sampling Technique:

The process of selecting a sample is achieved using various techniques termed as sampling techniques. Sampling techniques can be categorised into two groups: probability and non-probability sampling. In probability sampling, each element in the population is given equal chance of being selected and the contrary is true in the case of non-probability sampling (Churchill, 1995). Four types of probability sampling methods are available in research methodology literature. They are: simple random sampling, systematic sampling, stratified random sampling, and cluster sampling. Three types of non-probability sampling can be outlined, based on available literature: convenience sampling, quota sampling and snowball sampling (Bryman and Bell, 2011).

Given the non-availability of the sampling frame, the current study applies convenience sampling to obtain relevant sample size for quantitative data collection (Malhotra, Agarwal and Peterson, 1996; Saunders *et al*., 2012). Considered as the most frequently used non-probability sampling technique, convenience sampling is easy and less time and energy consuming. However, its inability to accommodate all possible participants from the population is its potential drawback (Churchill, 1995; Saunders *et al*., 2012). Nevertheless, its ability to select

samples from the available population renders convenience and snowball sampling is the apt technique for the current study.

4.6.5.14 Sample Size

Sample size refers to the number of participants in the quantitative research study. Dependent on various factors such as size of target population, sampling error, confidence level and statistical techniques, choosing the relevant sample size is important to validate and test the research hypotheses (Saunders *et al.*, 2012). The current study is based on PLS-SEM to validate the relationship between the study's constructs. The sample size based on PLS-SEM is dependent on five crucial factors. The study's assumptions are tested using multivariate analysis. Estimation technique is identified to estimate the sample size. Model complexity is analysed and data is screened for missing data and outliners. Average error of variance is estimated using SPSS (Hair *et al.*, 2010). A sample size of 200 is recommended for the complicated model (Kline, 2005). However, a sample size of 300 is also recommended (Hair *et al.*, 2010). Given the complexity of the current study, the number of sample size was 245 and after excluding the six outliers, a sample size of 239 is obtained for data collection.

4.6.7 Language, Translation and Cultural Considerations

Oxford English dictionary defines language as, '*method of human communication, either spoken or written, consisting of the use of words in a structured and conventional way'* (Oxford, 2014). Language is the manner through which people observe and describe the world around them. It creates ideas in the minds which invariably ensure communication and interaction with the world around. Thus, language effectuates the origin and distribution of judgements which is critical in

conducting any research study (Usunier, 1998). Since the study is conducted in Saudi Arabia and gathers the opinion and views of Saudi Arabians, the demand for Arabic language as primary language for the questionnaire is obvious. Given that the native language of Saudi Arabians is Arabic, the questionnaire is translated from English to Arabic.

Having established the need for translation, an overview of the different approaches for translation will enable the study to choose and justify the relevant translation approach. Direct translation, back translation, parallel translation and mixed technique are four common approaches for translation. In direct translation, the questionnaire is translated to the target language directly from its source (Usunier, 1998). In back-translation, the translated form is translated back to the source language. The translated form is compared with the source language, and is assessed and corrected appropriately (Harkness, 2003). In parallel translation, two or more versions of the source language translations are compared to create a final version, and, in mixed technique, back translation is conducted by two or more translators and the resulting versions are compared to create a final version (Usunier, 1998).

Direct translation is undoubtedly the easiest approach; however, slight modifications may exist due to syntax differences between the source and translated language. Similarly, back translation can showcase slight differences between the source and translated language; however, it will highlight lexical equivalency rather than content equivalency (Usunier, 1998). Additionally, back translation requires efficient translator skills and expert to assess the extent of likeness between the two versions (Harkness, 2003). Parallel translation can assure equanimity in questionnaire working; however, it is lengthy, costly and time consuming. Similarly, whilst mixed technique guarantees accuracy, it is costly, since it demands two or more translators (Usunier, 1998).

Given its simplicity, ease of application and inexpensiveness, direct translation approach is the most commonly used translating approach. Whilst each approach has its benefits, the current study employs direct translation as the translating approach, given its simplicity and cost effectiveness (Green and White, 1976). Additionally, decentring procedure is used in the current study whilst conducting direct translation. In decentring, the goal is to obtain a final version, which focuses on meaning or content rather than the syntax of the language. The resulting version is equivalent to the source language (Prieto, 1992). Considering the cultural differences present between English and Arabic languages, any ambiguity in the questionnaire is explained and simplicity is maintained across the questionnaire. Additionally, direct translation assesses the equivalence of the questionnaire and ensures the reliability of the study's questionnaire (Punnett & Shenkar, 2004).

4.6.8   Pilot Study and Purification of Measurement Items

Pilot study, also referred to as feasible studies, can be defined as small versions of the actual study. An important construct of research methodology, pilot study is crucial to the researcher and fulfils a range of functions (van Teijlingen & Hundley, 2002). The purpose of pilot study revolves around quantitative data collection instruments. Pilot studies assess: a- the clarity of questionnaire instructions, b- the presence of biased questions c- aptness of questionnaire layout and, d- length of time required to complete the questionnaire. Pilot studies also assess the reliability and appropriateness of the translated questionnaire (Punnett and Shenkar, 2004) and eventually assess the equivalence of the study's questionnaire.

Considering the importance of pilot study, a pilot study is carried in this study on a sample of 50 subcontractors, Hajj campaigns, pilgrimages' institutions and food suppliers. With the sample

size of 50, the required guideline for pilot study sample size is met; given that, the minimum number in the sample size for any pilot study is 10, and between 100 and 200 for large sample-sized surveys (Saunders *et al.*, 2012). The pilot study respondents appreciated the non-ambiguous nature of the survey questionnaire. However, most participants expressed confusion regarding demand uncertainty mitigation questions, given the role of demand uncertainty in the questions. Thus, the study questions under 'demand uncertainty mitigation' construct are respectively modified from: our customers' place orders consistent with their nominated delivery lead time, we can provide products to our customers consistent with their nominated product specification and our customers provide us reliable forecasts on their demands, so *we mitigate demand uncertainty when our customers place orders consistent with their nominated delivery lead time, we mitigate demand uncertainty by providing products to our customer consistent with their nominated product specification, and we mitigate demand uncertainty when our customers provide us reliable forecasts on their demands.*

Apart from pilot study, purification of measurement items is essential to ensure the operability and clarity of the questionnaire (Bryman and Bell, 2011). *Purification of measurement items* can be defined as the process of assessing the face validity, content validity and reliability of the measurement items in the study (Saunders *et al.*, 2012). Given that, the measurement tool in the current study is questionnaire, face and content validity and reliability is tested on the survey questionnaire, which is used to collect quantitative data. Prior to the pilot study, face and content validity of the study's questionnaire is established: a- using a group of academic experts and b- via the opinions of 12 CEOs through semi-structured interviews. Face validity defines the appropriateness of the instrument's measurement values and confirms whether the scale used in the questionnaire measures the relevant qualities which it is intended to measure. Face validity

decides the actual completion of the questionnaire by the intended participants, and clarifies whether the used measurement items are relevant for the questionnaire or not (Todd and Bradley, 2013). Content validity can be defined as comprehensiveness of the measurement tool in the study, and it can be assessed using a panel of experts. The panel of experts assess the appropriateness of the study's questions to its corresponding constructs (Mitchell, 1996; Saunders *et al.*, 2012). In the current study, the group of academic experts, validated the survey questionnaire's questions and 12 CEOs validated the relativity of the study's constructs, the structure and wording of the questionnaire; which is post, the pilot study is conducted.

Whilst the validity of the questionnaire is established before the pilot study, reliability of the measurement tool is established after the pilot study (Churchill, 1979). Reliability refers to the consistency of the measurement tool and repeatability of the measures (Trochim, 2006). Reliability in the current study is measured using Cronbach's alpha test, inter-item correlations, and item-to-total correlation. The consistency of the whole questionnaire scale is assessed using Cronbach's alpha test and correlation amongst items are measured using inter-item correlations. Item-to-total correlation assesses the correlation of questionnaire's items to the overall summated score (Hair *et al.*, 2010). A combination of the three tests is a great procedure for establishing reliability. Establishing correlation amongst items is crucial for partial least square analysis, which is not dependent on a single measure. Thus, the three tests are used in this study to purify the items of the questionnaire. Additionally, in Cronbach's alpha test, the resulting value is dependent on the number of items in the questionnaire scale, which can produce misleading results (Field, 2005). Resultantly, correlations are applied to the results of the pilot study. If the total correlation value is >0.3, then the items in the questionnaire scale are considered reliable as per the inter-item correlation and item-to-total correlation tests (Field, 2005), and if the

Cronbach's alpha test value exceeds 0.7 (Hair *et al*., 2010; Kline, 2005), or 0.5 or 0.6 in some cases, items in the questionnaire scale are considered reliable (Churchill, 1979; Nunnally, 1978). Post purification, some items from each scale is removed to increase reliability. The corresponding questions under each study construct accompanied with their respective codes are provided in the following Table, 4.4.

Customer Integration CI1: We are in frequent, close contact with our customers. CI2: Our customers are actively involved in our product design process. CI3: The customers involve us in their quality improvement efforts. **Supplier Integration** SI1: We maintain cooperative relationships with food suppliers. SI2: We maintain close communications with food suppliers about quality considerations and design changes. SI3: Our firm key food suppliers provide input into our product development projects. **Internal Integration** II1: The functions in our plant are well integrated. II2: Our plant's functions coordinate their activities. II3: Our top management emphasises the importance of good inter-functional relationships. **Postponement Practice** PP1: Our firm postpones final product assembly activities until receiving customer orders. PP2: Our firm postpones final product-labelling activities until receiving customer orders. PP3: Our firm postpones final packaging activities until receiving customer orders.	**Mass Customisation Capability** MCC1: We are highly capable of large-scale product customisation. MCC2: We can easily add significant food product variety without increasing costs. MCC3: We can easily add product variety without sacrificing quality. **Demand Uncertainty Mitigation** DUM1: We mitigate demand uncertainty by providing products to our customer consistent with their nominated product specification. DUM2: We mitigate demand uncertainty when our customers place orders consistent with their nominated delivery lead time. DUM3: We mitigate demand uncertainty when our customers provide us reliable forecasts on their demands. **Competitive Intensity** CPI1: We are in a highly competitive industry. CPI2: Our competitive pressures are extremely high. CPI3: We do not pay much attention to our competitors.

Table 4.4: Corresponding questions under each study construct accompanied with their respective codes

4.6.9   Data Analysis of Quantitative Data

Quantitative data analysis, in comparison with qualitative data, is highly comprehensive and complex. Given the array of methods and procedures, and software for conducting various tests, quantitative data analysis in the current study follows a two-step process. In the first step, data is cleaned and prepared for analysis and in the second step, actual analysis is conducted. In the current study, data cleaning involves checking for any blank data and outliers using SPSS software. Descriptive statistics measures are used by numerically describing the variables, followed by mean and standard deviations (Saunders *et al.*, 2012). The actual analysis conducted in the second step involves partial least square (PLS) analysis. The analysis strategy, the measurement model and structural model of the current study are covered in the following sections.

4.6.9.1 Analysis Strategy

Partial least square is one of the important structural equations modelling (SEM) technique. It is considered as second-generation modelling technique and performs dual function. It functions as a measurement model and assesses the quality of the research constructs. It also functions as structural model and assesses the relationship between the outlined constructs (Fornell & Brookstein, 1982). It is applied in numerous information systems (Gefen & Straub, 2005), management (Cording, Christmann & King, 2008), marketing (McFarland *et al.*, 2008) and operational management studies (Braunscheidel & Suresh, 2009; Cheung, Myers &Mentzer, 2010). SEM is an integral representation of large number of statistical models that use empirical data to validate the substantiality of theoretical constructs. An extension of general liner modelling (GLM), SEM is used to study the relationships between latent constructs indicated by

multiple measures. Applied on experiential and non-experiential data and used in cross-sectional and longitudinal studies, SEM is a confirmatory, hypothesis-testing approach that stipulates casual relations for multiple variables in multivariate analysis. It involves two models, measurement model and structural model, whose evaluation determines whether the theoretical model is consistent with the collected data. Whilst the measurement model is evaluated through Confirmatory factor analysis (CFA), structural model models the structural relationships between observed variables (vs latent variables) are modelled (Lei and Wu, 2007). The evaluation of each of these models in the current study is discussed in the following sections.

4.6.9.2 Measurement Model

Confirmatory factor analysis (CFA) is conducted using PLS-SEM to assess the reliability and validity of the multiple-item scale. Reliability, convergent validity and discriminant validity tests are conducted in lieu with the 1981 guidelines of Fornell & Larcker. Item reliability and composite reliability tests, which are superior to Cronbach's alpha, are conducted in quantitative analysis since these tests consider actual factor loadings rather than assigning assumed equal weight for each item. Average Variance Extracted (AVE) is used to assess convergent validity, and discriminant validity is assessed in the following process. The square roots of the AVE of each construct are compared with correlations between the focal construct and each construct. Discriminant validity thus is established when a square root is higher than the correlation with other constructs (Fornell & Larcker, 1981).

4.6.9.3 Goodness of Fit

Regarding goodness of fit, PLS-SEM unlike CB-SEM does not require overall goodness-of-fit measures as its key goal is different from that of CB-SEM (Hulland, 1999; Hair *et al*., 2011b). Although CB-SEM comprises parametric estimation approaches that are seeking to reproduce, as closely as possible, the observed covariance matrix, the key goals of PLS-SEM are centred on reducing the error or otherwise improving the variance described in endogenous variables measured by R^2(Hulland, 1999). A number of academics in the field provide a goodness-of-fit criteria, including the Bentler-Bonett fit index (Bentler & Bonett, 1980), as well as the global criterion for goodness of fit (Tenenhaus *et al*., 2004). This work does not deliver goodness-of-fit measures owing to the lack of appropriateness of the goodness-of-fit measures to PLS-SEM, particularly where some constructs are measured with the use of single measures.

4.6.9.4 Heterogeneity

Evaluating the observations' heterogeneity is a fundamental stage in assessing the structural mode. Not completing an evaluation of data heterogeneity could mean the validity of the PLS-SEM results are potentially damaged owing to the fact that different parameter estimations could be secured for different subpopulations (Hair *et al*., 2011a). A number of instruments have been devised in PLS-SEM in mind of evaluating the unobserved heterogeneity, including FIMIX-PLS (Ringle *et al*., 2010; Tenenhaus *et al*., 2004). Dissimilar to CB-SEM, in this case, there is generally no goodness-of-fit measure, with the key goals of PLUS-SEM recognised as different to those of the CB-SEM (Hulland, 1999; Hair *et al*., 2011b). Such measures are however not widely acknowledged, with some holding the view that it is inconsistent with PLS-SEM objectives and assumptions (Hulland, 1999; Hair *et al*., 2011b).

4.6.9.5 Structural Model

A hierarchical procedure is applied to test the hypotheses after assessing the validity of the measurement model. Specific relationships amongst constructs are indicated. The analysis thus shifts itself from CFA to SEM to test the hypotheses. The analysis stage moves from the mere specification of a relationship between the latent constructs and measured variables to advanced level, where the nature and strength of relationships between constructs are established and determined (Hair *et al.*, 2010).

4.6.10 Overview of the PLS-SEM Method and Justification for its use in the Current Study

The PLS technique is slowly integrating itself into several research contexts and studies. PLS is also considered a variance-based SEM method, where its complementary approach, covariance-based SEM 'CB-SEM', as the name suggests, is based on covariance-based SEM method (Henseler *et al.*, 2009). Numerous operational management studies have adopted covariance-based SEM 'CB-SEM' methods. However, the advantages of Smart-PLS software may be understood by understanding the functionalities of its popular counterpart CB-SEM (Peng & Lai, 2012), and software, such as LISREL and AMOS, which are the popular statistical software packages for CB-SEM. Comparison functionalities are applied in the current study to justify the use of PLS.

Developed by Wold (1975), PLS is a statistical technique based on dual processes. In the first process, the latent variable scores are computed using PLS algorithm, which is followed by the second process of applying PLS regressions on the computed latent variable scores to estimate structural equations. The first process is accomplished in two steps: outside approximation and

inside approximation. In the case of outside approximation, the latent scores for the variables are calculated based on the weight of indicators using simple or multiple regressions. In inside approximation, the obtained latent scores are combined with neighbouring latent variables to obtain a proxy estimate. A conventional stopping technique stops the variables from converging, and the minimisation principle is applied to the residual variance with respect to the subset of estimated parameters (Chin, 1998).

The PLS approach has its own advantages: for example, it relies on the data and is exploratory in nature (Chin & Newsted, 1999), meaning the focus of PLS approach lies in summarising and making predictions rather than explaining the covariance of measurement items (Chin, 2010). This attitude matches the study's predetermined objectives. Furthermore, PLS does not mandate normal data and functions with small sample size (Chin & Newsted, 1999).

In the CB-SEM approach, the covariance matrix is developed based on a specific set of structural equations, with focus on estimation. The central focus of estimation lies in minimising the difference between the two matrices: theoretical covariance and estimated covariance (Rigdon, 1998). CB-SEM requires a specific set of assumptions without which the analysis cannot be accomplished. The multivariate normality of data and minimum sample size are two examples of such assumptions (Diamantopoulos & Siguaw, 2000). The research objective and outcome is confirmatory in nature rather than prediction-based in the CB-SEM approach, which is the central objective of PLS. The PLS-SEM outlines the robust estimates of the structural model (Wold, 1982; Reinartz *et al*., 2009).

Additionally, PLS is different from LISREL-type SEM since it is purely dependent on the predictive power of independent variables (Chin, 1998). This can be capitalised in such a way so

as to explain complex relationships, and subsequently may be used to build theory (Lohmoller, 1988). A component-based approach PLS problems associated with inadmissible solutions and factor indeterminacy can be avoided using PLS (Fornell & Brookstein, 1982). PLS also functions better than LISREL and AMOS since it does not require the assumption of normal data distribution (Gefen & Straub, 2005; Chin, 1998). Under the conditions of non-normality, PLS is capable of executing its functionalities. Whilst the LISREL-type SEM provides goodness-of-fit indices, PLS estimates path loadings and R^2 values; they do not provide goodness-of-fit indices. Whilst path loadings identify the strength of the relationship between independent and dependent variables, R^2 measures the predictive power of the variables. R^2 values measure the degree of variance present in the independent variables (Gefen & Straub, 2005).

Whilst the above comparisons provide a general overview between SEM-based method (PLS) and CB-SEM, and the PLS method and LISREL-based SEM, the actual justification of using PLS can be obtained by drawing a comparison with AMOS. Given the use of CFA in the quantitative analysis, a comparison between Smart-PLS and AMOS software for CFA highlights the benefits of using Smart-PLS software.

Peng and Lai (2012) emphasise that justification for using PLS should not be sample size only but rather model complexity. According to these authors, the overall complexity of the model being used in the research does not have a direct influence on sample size adequacy in PLS whilst the effect is dire in CB-SEM. The model becomes complex particularly if it involves mediation and moderation analyses which can increase the number of parameter estimates and lead to convergence and model identification issues in CB-SEM. PLS applies iterative algorithm in solving blocks of the measurement model and consequently estimates the structural

coefficients separately which is not possible with CB-SEM (Peng & Lai, 2012). The estimation procedure used by PLS enables researchers to estimate models that are highly complex as long as the sample size is adequate to enable estimation of the most complex relationship in the model. PLS is also appropriate in testing the magnitude of moderation effects. As such, it will be employed for this study which is based on a research model that is relatively complex.

4.6.10.1 PLS-SEM Software

AMOS is one of the popular statistical software for CB-SEM (Hair *et al.*, 2011).This is commonly used when the research objective is to test a theory, confirm a theory or compare alternate theories. If the formative measures in the measurement model are limited to specified rules and require additional specifications, such as co-variation, then AMOS based on CB-SEM is used. If the structural model is non-recursive, then AMOS is used. If requirements with regard to model specification, non-convergence, data distribution assumptions and identification are met as per CB-SEM, then AMOS software is used. Additionally, if the study requires global goodness-of-fit criteria and a test for measurement model invariance, then AMOS is the best software for conducting analysis (Hair *et al.*, 2011). However, when the research objective is to predict the key driver amongst constructs, and if the structural model has many constructs and numerous indicators, then Smart-PLS is used. If the data obtained is based on the sound approximation of the distributional assumptions and is considered non-normal, then Smart-PLS is apt. additionally, if latent variable scores are required to conduct subsequent analysis, then Smart-PLS is the best software for conducting analysis (Hair *et al.*, 2011).

Nonetheless, a number of alternative software solutions are now available for selection, including PLS-GUI, Visual-PLS, PLS-Graph, Smart-PLS and SPAD-PLS (Temme *et al.*, 2010).

Furthermore, all software packages are known to comprise different features in regard to ease of use, methodology, options and requirements (Temme *et al*., 2010). The current study utilises both Warp-PLS and Smart-PLS, with all of the software packages each having their own distinctive characteristics. The most recently available of these is Warp-PLS (Kock, 2011), which is able to provide various features that are, in the main, lacking across the majority of the other PLS-based SEM packages available at the current time (Kock, 2011):

1. It provides the automatic prediction of the *p* values for path coefficients rather than providing merely standard errors or *t* values, and allows the user to determine the *p* values.

2. It predicts a number of model fit indices, which have been designed in a way to be valuable in the context of PLS-based SEM analyses.

3. There is the automatic creation of the indictors' product structure underlying moderating relationships, which provides further expansion in this regard. It emphasises moderating relationships, associated path coefficients and associated *p* values in a model graph.

4. It enables the use of scatter plots pertaining to all of the links amongst latent variables, together with the regression curves that are most suitable for such relationships, where such plots are saved as .jpg files for inclusion in reports.

5. Variance Inflation Factor (VIF) coefficients are calculated in mind of the latent variable predictors linked with each latent variable criterion. This enables users to determine whether various predictors need to be removed as a result of multicollinearity (where such a feature is recognised as notably valuable with latent variables that are measured in line with only one or several indicators). Notably, however, the inclusion of tools centred on evaluating predictive relevance, such as blindfolding approaches, or otherwise

unobserved heterogeneity (including FIMIX-PLS) is not included in Warp-PLS. Such

instruments are incorporated within the Smart-PLS software. Accordingly, this was

applied in the present work in mind of cross-checking the findings garnered by Warp-

PLS and the application of both the FIMIX-PLS and blindfolding methods.

Considering the several considerations associated with the data and research model, the PLS

technique is used in this study. Smart-PLS 2.0 M3 software is used for analysis to identify the

measurement and structural model. Bootstrapping estimation procedure is used to identify the

significance of scale factor loadings and path coefficients of measurement model and structural

model, respectively (Gefen & Straub, 2005).

4.6.9.8 Coefficient of Determination (R^2)

Coefficient of determination (R^2) is the leading criterion applied in the assessment of the inner

framework, and is known to represent the amount of variance described of the endogenous latent

variable (Hair *et al*., 2011b). Nonetheless, establishing which R^2 level is high differs across all

disciplines, as highlighted by Hair *et al*. (2011a).

A component-based approach, as introduced by Lohmoller (1988), is Smart-PLS, where

problems linked to inadmissible solutions and factor indeterminacy may be circumvented

through the use of Smart-PLS (Fornell & Brookstein, 1982). Moreover, Smart-PLS further works

better than AMOS and LISREL owing to the fact there is no need to make the assumption

pertaining to normal data distribution (Gefen & Straub, 2005; Chin, 1998). In consideration to

the various non-normality conditions, PLS has the ability to execute functionalities. Although

LISREL-type SEM delivers sound goodness-of-fit indices, Smart-PLS predicts R^2 values and

path loadings. Importantly, they do not provide goodness-of-fit indices. Although path loadings are able to establish a relationship's strength in regard to dependent and independent variables, the predictive power of the variables is measured with the use of R^2, which measure the degree of variance present in the independent variables (Gefen & Straub, 2005). When considering CFA adoption in the quantitative analysis, a contrast between AMOS and Smart-PLS for CFA, the advantages of utilising Smart-PLS may be highlighted.

It is clear that one of the most commonly implemented statistical software for CB-SEM is AMOS (Hair *et al*., 2011).This approach is commonly implemented when the aim of a study is centred on theory testing, theory confirming or otherwise drawing a comparison between theories. Should the measurement model's formative measures be restricted to the specific rules and additional criterion, including co-variation, then AMOS centred on CB-SEM is applied. Should the structural framework be non-recursive, then the application of AMOS would be opted for. Should requirements with regard to framework specifications, non-convergence and data distribution identification and assumptions be fulfilled as per CB-SEM, then AMOS software is applied. Moreover, if a global goodness-of-fit criteria is required in the study, with measurement model invariance to be tested, then AMOS would be most valuable for completing such analyses (Hair *et al*., 2011).

4.7 Ethical Considerations

Research ethics are 'norms for conduct that distinguish between acceptable and unacceptable behaviour' (Resnik, 2011). The ethical code of conduct of any research reflects the behavioural character of the personnel involved in the study, the researcher and research participants (Sekaran, 2003). Whilst ethics project the in-depth and perceptive values of each individual's

life, research ethics or code of ethics, as articulated by the American Educational Research Association (AERA), perform a multi-dimensional function. The code provides principles and guidelines for researchers to cover professional situations, educates the researchers and other personnel involved in the research about the benefits of conducting research in an ethical manner, and inculcates and percolates ethical behaviour from the academic perspective into the professional and personal life of the people involved in the study (AERA, 2011). Thus, numerous values, such as honesty, confidentiality, privacy and integrity, are crucial values that define the research ethics (Shamoo & Resnik, 2003).

Considering this, 'honesty' in the research study is elucidated across the various phases of the study; definition of research aims and objectives, primary and secondary data collection, data analysis and presentation and implicating conclusions. The current study's aims and objectives are not plagiarised from any academic research. A sense of freshness is present from the inceptive stages of the study. Secondary data, used for the literature review, is extracted from credible references—detailed information gained from the reference section. Primary data is qualitatively collected from the CEOs of SMEs, and quantitatively from 239 participants belonging to various SMEs across Saudi Arabia. Objectivity is maintained when defining the research methodology and conducting the analyses. Given the post-positivist philosophy and mixed-methodological nature of the study, the room for bias, unlike the qualitative approach, is minimal or altogether absent. The literature review provides a basis for extracting hypotheses, which are tested with valid primary data collection via surveys and a questionnaire tool. Content validity and reliability is established prior to and following the pilot study. The questionnaire, as a tool, enables unbiased data collection, where data analysis is conducted using appropriate

descriptive statistics measures, details of which are presented in the findings and appendix section.

In order to maintain the semblance of research ethics, this study confines itself to the boundaries of confidentiality, privacy and integrity. The confidentiality, privacy and integrity of the research participants are maintained in this study. Informed consent is obtained via email or personally from participants before conducting the study, where the names or any personal information relating to the participants is not disclosed at any cost. The survey data will be maintained for a period of one year, after which the data will be deleted in an effort to ensure the confidentiality, privacy and integrity of the research participants are ensured. In this manner, the research study not only adheres to the ethical considerations from the report-writing perspective, but also from the research participants' perspective. Issues pertaining to copyright and plagiarism are tested prior to submission, with the research content free from any contamination.

4.8 Conclusion

This chapter summarises the research methodology applied in the current study. The current study addresses the phenomenon of demand uncertainty mitigation through management practices in an effort to satisfy all customers performing the Hajj at Makkah, which, in turn, leads to leveraging SMEs' performance in the context of Saudi Arabia. A theoretical model is used to establish the effects of Supply Chain Integration (SCI), postponement (PP), Mass Customisation Capability (MCC), on Demand Uncertainty (DUM) under high Competitive Intensity (CI).

The research follows the post-positivism philosophy since reality in this philosophy is critical in positivism research, and is established through social actors. Research findings are probable, and are based on modified objectivism and research methodology. Based on this philosophy, the research study is usually conducted to explain the research phenomenon, and the overriding logic and purpose of the actions of the elements in the social setting. Therefore, this philosophy stresses the importance of qualitative and quantitative methods.

Accordingly, the current study follows a mixed-methodology approach. Various theoretical aspects of the mixed methodology are assessed, whilst fixed-methods approach and across-stage mixed method model is applied in this study. A typology-based approach is used and partially-mixed sequential dominant status design is applied in this study. The current study is QUAN+QUAL in nature, and given the application of mixed methodology, the current study uses abductive reasoning. Abductive reasoning utilises both qualitative and quantitative approaches based on inductive and deductive reasoning in an effort to test and accordingly validate the research objectives in line with the information available at the time. In this study, data comprises both primary and secondary, and will be collected using both qualitative and quantitative methods.

Resultantly, the research design is divided into two phases: an exploratory design is used in the first phase by reviewing the literature and conducting interviews to clarify concepts regarding aligning sources of uncertainty with supply chain strategies in order to improve supply chain performance; a descriptive-explanatory design is applied in the second phase, obtaining in-depth information on the impact of Supply Chain Integration (SCI) on manufacturing strategies, such as postponement practice (PP) to mitigate Demand Uncertainty (DUM) through a cross-sectional

sample survey. A total of 17 hypotheses are tested in an effort to understand how demand uncertainty can be mitigated in a high season of customer demand.

Direct translation, accompanied with the decentring process, is used in this study, and a pilot study is carried out across a sample of 50 subcontractors, Hajj campaigns, pilgrimage institutions and food suppliers in an effort to test the validity and reliability of the study's questionnaire.

Primary and secondary data are collected in this study. The panel groups serve as a means for supplying qualitative primary data. A total of 12 CEOs belonging to various SMEs across Saudi Arabia constitute the participants of the interviews. A questionnaire tool is used in the current study, serving dual purpose: it provides primary data and also validates the content of the questionnaire. It aims to establish content validity.

Surveys are used to collect quantitative primary data for the study. Employees belonging to SMEs across Saudi Arabia that supply food to Hajj pilgrims constitute the population for the current study. Given the non-availability of the sampling frame, the current study applies convenience sampling so as to obtain a relevant sample size for quantitative data collection. Secondary data used in the study are detailed in the 'Reference' section of the study. Qualitative data analysis in the current study is accomplished using the direct content analysis method. Quantitative data analysis in the current study follows a two-step process. In the first step, data is cleaned and prepared for analysis; in the second step, actual analysis is conducted. In the current study, data cleaning involves checking for any blank data and outliers. The actual analysis carried out in the second step involves partial least square (PLS) analysis. Structural equation modelling is applied in an effort to validate the measurement and structural model. The analysed

data is presented for logic connections, and validation between the study's constructs and relevant conclusions can be extracted.

CHAPTER 5: ANALYSIS AND FINDINGS

5.1 Introduction

This chapter covers examination data analysis, findings and discussions of the research. The study collected qualitative, quantitative and secondary data.

Qualitative data was collected using semi-structured interviews with were administered face-to-face with CEOs from various food SMEs across Saudi Arabia. Snowball sampling technique was used to obtain the sample. The size of the sample pool in qualitative interviews depends on time and resource availability. A sample size of 12 interviewees was considered reasonable for providing the required data because the CEOs have the required experience as well as knowledge on the topic under investigation, hence are information-rich and would provide the required information. Each of the interviews lasted about 60 minutes and were digitally recorded. The researcher also took notes during the process. The questions sought were divided in two sections.

The first section pursued to obtain general information about the companies run by the CEOs as well as on the respondent's thoughts regarding supply chain integration, whether their firms face issues relating to demand uncertainty mitigation during the Hajj season in regard to food provision and the strategies they use to mitigate it, as well as on any alternative activities and mechanisms they may have employed to deal with demand uncertainty mitigation during Hajj. Whereas the second section focused on the conceptual framework of the study and sought to establish the face and content validity by showing it to the respondents who were then asked to comment based on open-ended questions that sought to determine whether they agreed with the linkages in the constructs, their thoughts on; impact of supply chain integration on postponement

practices, on mass customisation capability and on demand uncertainty mitigation, impact of postponement practices on mass customisation capability, and on demand uncertainty and impact of mass customisation capability on demand uncertainty mitigation, finally on their thoughts regarding how firms can mitigate demand uncertainty during the Hajj season when providing food to pilgrims. Data was analysed using thematic analysis which involved simple coding of data based on the themes in the conceptual model (variables of supply chain integration (SCI), postponement (PP), mass customisation capability (MCC), mitigating demand uncertainty (DUM) and high competitive intensity (CPI)). The findings are presented through prose as data collected was in text form.

Quantitative data on the other hand was collected using a survey questionnaire that was developed using information from completed reviews of literature and analyses of qualitative data from the CEOs. The questionnaire contained items based on the following operationalised constructs; customer integration, internal integration, supplier integration, postponement practices, mass customisation capability, and demand uncertainty mitigation. The questionnaire was based on a seven-point Likert scale ranging from 'strongly disagree' to 'strongly agree'. The data was collected from 245 employees of SMEs across Saudi Arabia who were selected using convenience sampling because of unavailability of a sampling frame. The final sample size was, however, 239 after exclusion of outliers. Data was analysed using descriptive statistics to describe variables and involves partial least square (Smart-PLS) analysis to test the hypotheses.

Secondary data was collected through literature review of existing studies on the topic and their findings. These were obtained by developing key search words and using them to obtain relevant

articles from online libraries. The study mostly used information from peer reviewed journals. The findings are also presented through prose as data collected was in text form.

The first section of this chapter centres on qualitative data collected using semi-structured interviews and explains validation of the conceptual framework through interviews. The second section of this chapter centres on the data analysis and data screening, which explains the way in which data are analysed and applied in order to test the structural links hypothesised between the different constructs. This needs to include an explanation of how missing values underwent examination and the way in which outliers were identified. The third section provides the subjects' demographic information; in other words, details of their company location, education levels of each CEO's, occupation and work experience. The subsequent section provides the findings of the control variables, including firm age, firm production type and firm size. The fifth section provides descriptive statistics, in addition to the approaches applied in testing the study constructs' normality. The following section includes the structural model evaluation processes and measures and the testing of the hypotheses through the application of the PLS-SEM. The seventh section provides a representation of the nomological validity, discriminant validity, multicollinearity, cross validation (CV) communality and cross validation (CV) redundancy measures, Goodness of Fit, Heterogeneity, and path coefficients of the constructs included in the theoretical model of the study and predictive relevance. The following section provides the findings on the hypothesised link between the various constructs, in line with the path coefficients, and their significance level. Finally, managerial implications are provided.

5.2 Validation of the Conceptual Framework Through Interviews

Analysis of data collected from the interviews reveals the following:

All 12 participants agreed that there is a strong relationship between supply chain integration and postponement practices. They all explained that postponement practice is basically dependent on II, CI and SI as it requires information from customers, suppliers and the firm's internal in order to know when to hold and when to go on with processing of an order. Seven of them indicated that internal integration and customer integration were the most important variables of SCI that have the strongest impact on postponement

Nine of the participants agreed that there is a strong relationship between supply chain integration and mass customisation capability. The respondents noted that for firms to effectively customise orders to meet customer needs in a manner that is effective and efficient, they need to integrate suppliers, customers as well as the internal functions so as to obtain the required information. Supplier and customer integration were mentioned as having the strongest impact on mass customisation capability of a firm.

All 12 participants agreed that there is a strong relationship between supply chain integration and demand uncertainty. The CEOs emphasised that SCI was the most important factor that improved performance of food SMEs during Hajj season. They, however, emphasised more on internal integration and customer integration than they did on supplier integration. They pointed out that demand uncertainty requires firms to work with its customers, as customer information is a key source. Only 5 out of the 12 respondents identified the importance of supplier integration. These five argued that supplier integration is important as suppliers are required to ensure that they deliver the required supplies on time to meet customer needs.

Seven of the participants agreed that there is a strong relationship between postponement practices and mass customisation capabilities. Most of the respondents did not however divulge much on why they stated that the two were strongly correlated. Four of them however explained that the two constructs are related because they require same strategies and processes for them to be effectively implemented. They explained that mass customisation involves postponement.

All 12 participants agreed that there is a strong relationship between postponement and demand uncertainty. Postponement was in fact seen as one of the most effective ways of mitigating demand uncertainty mitigation since it ensured that there was no wastage as food was only prepared once customers placed orders.

All 12 participants agreed that there is a strong relationship between mass customisation capabilities and demand uncertainty mitigation. The respondents explained that mass customisation of orders in a timely manner ensured that orders were only processed based on demand rather than speculations and thus mitigated demand uncertainty.

All 12 participants agreed that supply chain integration, customisation capabilities and postponement are all key management practices to mitigating demand uncertainty during the Hajj season and should not be taken out of the model. The conceptual framework was therefore validated by the CEOs through the interviews.

Regarding how firms can mitigate demand uncertainty during the Hajj season when providing food to pilgrims, the answers provided by the CEOs varied. Seven of the 12 emphasised that the most important variables regarding the Hajj context are supplier integration and customer integration and that these two variables of SCI have a strong impact on postponement and mass

customisation capability of SMEs in the industry whilst the other five emphasised the importance of internal integration and customer integration. hese CEOs added that firms that were able to achieve efficient internal and customer integration through coordination of internal functions within the firm and efficient communication with customers were the most successful.

Eight respondents also assured that postponement practice and mass customisation capability were highly dependent on the level of the firms' customer and supplier integration.

5.3 Preliminary Screening of Data

5.3.1   Data Analysis and Screening

The study of Hair *et al*. (2010) provides the suggestion that all researchers carry out a process of examining the data prior to completing analysis. Moreover, the study of Tabachnick & Fiddell (2007) considers the examination of data as being concerned with the approach of identifying and overcoming outliers and values, and accordingly testing the normality assumption of the data. Accordingly, this section considers the processes adopted in examining and screening the data, which includes missing data analysis, the various methods applied in order to identify outliers, and the techniques adopted in testing the normality of the data. Although, as mentioned on Chapter 4, that smart-PLS functions better than LISREL and AMOS since it does not require the assumption of normal data distribution (Gefen & Straub, 2005; Chin, 1998). Under the conditions of non-normality, PLS is capable of executing its functionalities.

5.3.2 Missing Data Analysis

Missing data are further broken down into other categories, namely ignorable and non-ignorable missing data (Hair *et al*., 2010). Although ignorable missing data are not required to undergo

changes, non-ignorable data, necessitate the making of adjustments by the researcher. In this instance, when there is data missing below 10%, the suggestion is made that it cannot be ignored (Hair *et al*., 2010). The present study adopts the SPSS software in an effort to clarify the occurrence of missing data and to identify outliers and the missing data for all variables, hence those that are ignorable. In the view of Hair *et al*. (2010), when missing data is seen to be between 10% and 15%, the researcher is required to delete various variables as the modification approach for decreasing biasness. Nonetheless, the findings of the SPSS analysis for the missing data did not reach such a percentage, meaning deletions do not need to be made.

Furthermore, upon analysing missing data, it is essential for the researcher to establish whether or not the data is missing at random (MCA) or missing completely at random (MCAR), (Graham, 2009). In an effort to identify systematic errors or establish missing data patterns, the MCAR test, as devised and used by Hair *et al.*, (2010) was applied through the use of SPSS software, utilising as test variables the standard deviation, Chi-square, and significance level and *p* values. The null analysis of the test showed that the missing data are missing completely at random, with the test results through the application of little's MCAR *(Standard deviation = 8.626; Variance = 74.410; sg. 1; P > 0.05)* emphasising that the present study comprises no systematic errors. Accordingly, the missing data can be treated by the researcher, with the mean used as a substitute for values that were missing in line with the suggestions made by Tabachnick & Fidell (2007), centring on the fact that substituting the mean is the most common and appropriate approach to imputing for missing values.

5.3.3 Detecting Outliers

Outliers are recognised as observation points, which are distant from the remaining observations that stem from measurement variability or experimental errors (Hair *et al*., 2010). Although it may be that outliers arise accidentally, it remains that their presence suggests either the existence of a measurement error or otherwise that the distribution of the study population is heavy-tailed (Cousineau & Chartier, 2010). In the instance that outliers arise following measurement error, it is suggested that researchers implement statistical tests centred on identifying outliers or otherwise achieve their complete removal (Cousineau & Chartier, 2010). In contrast, those outliers that arise following a heavy-tailed distribution of the study population provide some insight into the distribution with high kurtosis needing careful handling, particularly when adopting statistical tools that assume that there is normal data distribution (Cousineau & Chartier, 2010).

Because faulty values can be indicated by outliers, incorrect study approaches or invalid theories need to be removed, corrected or retained depending on their levels of magnitude (Leys *et al*., 2013). Nonetheless, a researcher cannot make decisions pertaining to how outliers can be managed and handled without identifying their presence (Leys *et al*., 2013). Moreover, failure to establish and correct outliers could mean the statistical testing approach could be distorted, meaning all data analysis, along with its results is compromised (Larson-Hall, 2009). Accordingly, in an effort to improve reliability and validity in the present work, the researcher needs to test for both the univariate and multivariate outliers. In the view of Leys *et al*. (2013), there is the identification of univariate outliers through changing all data into standardised scores with the use of a standard deviation of either 2 or 2.5 around the mean, depending on the

research situation and stance adopted by the researcher (Leys *et al*., 2013). In the present study, owing to the fact that the sample size is larger than 80 and would warrant a standard deviation exceeding 2.5, a standard deviation of 3 was used (Hair *et al*., 2010).

In contrast, multivariate outliers were identified using Mahalanobis D^2 analysis, which was applied with the use of SPSS regression analysis. Cases were considered as multivariate outliers if the results of the D^2 probability were found to be lower than or equal to 0.001 ($D^2 \leq 0.001$). In the view of Tabachnick and Fidell (2007), data were gathered from a sample comprising a wide range of characteristics, meaning it is able to yield multivariate outliers. In the present work, it was expected that multivariate outliers would be identifiable owing to the fact that the data were gathered from firms of varying age, production types and size.

As mentioned earlier, there are various approaches to managing outliers, including correcting, removing or retaining (Leys *et al*., 2013). Moreover, Larson-Hall (2009) recommends that outliers need to be retained unless they seriously deviate from the normal or fail to represent the population. In this study, some outliers were retained whilst others were removed based on SPSS and data analysis method used; PLS-SEM which does not emphasise on normality of data. PLS is a soft modelling approach to SEM that does not make any assumptions regarding data distribution and has minimal demands on sample size, measurement scales, and residual distributions (Hair *et al*., 2010). This tool provides for statistical modelling to proceed without being restricted to the normality assumptions of large sample size (this study used a relatively small sample size), multivariate normality of data, and strong underlying theory (as the theoretical model for the present study is complex and still underdeveloped). Based on these situations (small sample size and complexity of the model being tested), PLS-SEM was the best

alternative to CB-SEM which is the most commonly used approach but which requires various assumptions to be satisfied including large sample size and multivariate normality of data.

5.3.4 Basic Demographic Information

The online survey, in addition to the semi-structured interview approach, queried the subjects in providing basic data pertaining to both themselves and their business.

The 12 interviewees were asked to state the type of food industry their firms operate. 16% were found to be wholesalers, 17% run restaurants, whilst another 17% run fast food chains, dairy product firms and retail outlets. 8% were found to run firms that supply other firms with raw materials whilst another 8% run beverage firms.

Food Industry	Frequency
Wholesalers	2
Restaurants	2
Fast Food Chain	2
Beverage Firm	1
Dairy Products Firms	2
Retail Outlet	2
Processing And Packaging	1
Supplier Of Raw Products	2
Total	**12**

Table 5.1: CEOs and their type of Food Industry
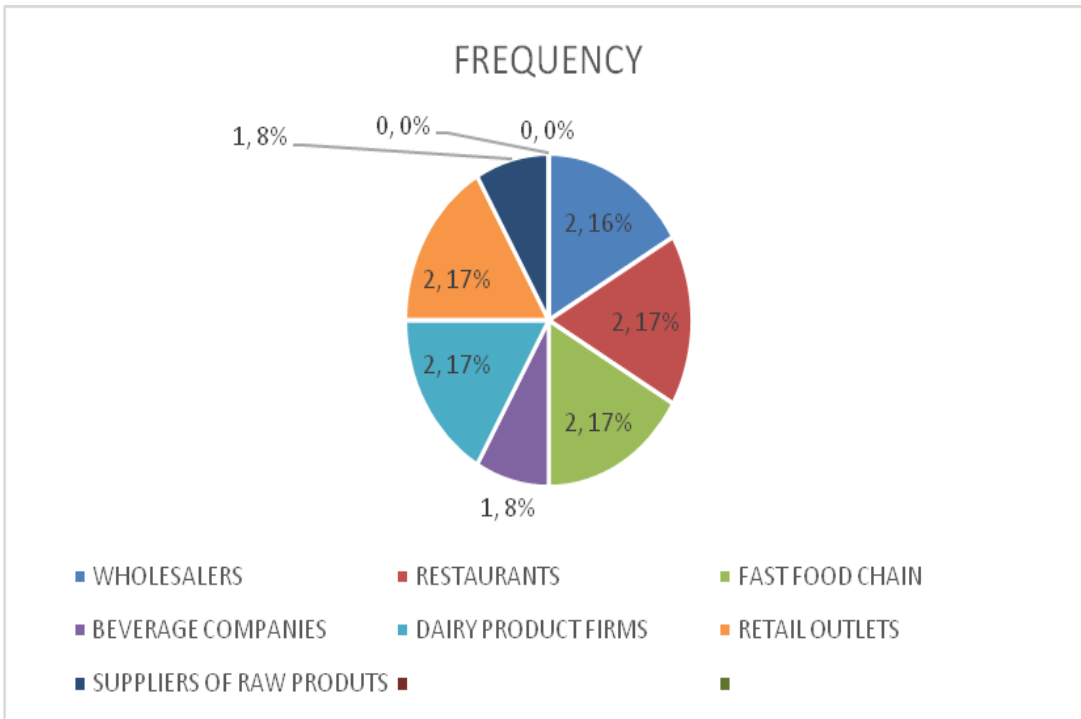
Figure 5.1: CEOs and their type of Food Industry

The semi-structured interview approach, queried 12 CEO's of various SMEs operating in the Saudi food industry to provide basic data pertaining to both themselves and their business. The total of 12 subjects accepted to be interviewed, 8.3% were seen to have acquired high school education, whilst almost half (50%) had been educated up to Bachelor's degree, 4(8.3%) had a Master's degree, whilst one (8.3%) had a PhD, as detailed in the following table.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High School	1	8.3	8.3	8.3
	Bachelor Degree	6	50.0	50.0	50.0
	Master Degree	4	33.3	33.4	33.4
	PhD	1	8.3	8.3	8.3
	Total	12	100.0	100.0	

Table 5.2: Educational level of CEOs

The CEOs were further asked to detail the duration for which they had been in the role, with most (5) of the participants emphasising they had worked in their current business for 10–20 years (41.7%), 25% for 1-10 years, another 25% for 20-30 years and just one (8.3%) had been managing the current firm for over 30 years. In consideration to the firms' locations, the majority (58.3%) stated that their offices were based in Makkah, with the remaining 47.1% stating they were based in Jeddah. The tables below display all of this data.

How long have you been working with the Company as CEO?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-10	3	25	25	25
	10-20	5	41.7	41.7	41.7
	20-30	3	25	25	25
	Over 30	1	8.3	8.3	8.3
					100.0
	Total	12	100.0	100.0	

Table 5.3: Experience of CEOs

Where Is Your Firm Located?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Makkah	7	58.3	58.3	100.0
	Jeddah	5	41.7	41.7	100.0
	Total	12	100.0	100.0	

Table 5.4: Location of the SMEs Participating

A total of 239 subjects completed the survey. Of these, 3.3% were seen to have acquired high school education, whilst almost two-thirds (65.7%) had been educated up to Bachelor's degree, a

quarter (28.5) had a Master's degree, and the remaining 2.5% had a PhD, as detailed in the following table.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High School	8	3.3	3.3	3.3
	Bachelor Degree	157	65.7	65.7	69.0
	Master Degree	68	28.5	28.5	97.5
	PhD	6	2.5	2.5	100.0
	Total	239	100.0	100.0	

Table 5.5: Educational level of participants

Moreover, the subjects were asked to emphasise their present job positions, with the findings recognising that the vast majority of the participants, notably equating to (87.9%) were highlighted as CEO, 4.2% were Vice Presidents, and 7.9% were Operations Managers.

The subjects were further asked to detail the duration for which they had been in the role, with the participants emphasising most (40.6%) had worked in their current business for 10–15 years, 18% for 15–20 years, 14.2% for 5–10 years and another 14.2% for 20–25 years. Importantly, only seven of the subject participants (2.9%) had worked for 1–5 years, and only one (0.4%) had been employed by their current firm for in excess of 30 years. In consideration to the firms' locations, the majority (89.1%) stated that their offices were based in Makkah, with the remaining 10.9% stating they were based in Jeddah. The tables below display all of this data.

Which Of The Following Best Describes Your Role In Your Organisation?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	CEO	210	87.9	87.9	87.9
	Vice president	10	4.2	4.2	92.1
	Operation manager	19	7.9	7.9	100.0
	Total	239	100.0	100.0	

Table 5.6: Managerial level of participants

How Long Have You Been Working With Your Current Employer?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-5	7	2.9	2.9	2.9
	5-10	34	14.2	14.2	17.2
	10-15	97	40.6	40.6	57.7
	15-20	43	18.0	18.0	75.7
	20-25	34	14.2	14.2	90.0
	25-30	23	9.6	9.6	99.6
	Over 30	1	.4	.4	100.0
	Total	239	100.0	100.0	

Table 5.7: Experience of Participants

Where Is Your Firm Located?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Makkah	213	89.1	89.1	89.1
	Jeddah	26	10.9	10.9	100.0
	Total	239	100.0	100.0	

Table 5.8: Location of SMEs Participating

5.3.5 Control Variables

In an effort to better understand the hypothesised links, three different control variables were considered including firm age, firm production type and firm size. The size of the firm was

established in line with the number of individuals employed by the entity. Moreover, the scores recorded by the organisations were examined in mind of establishing the number of employees of a firm. Moreover, the age of the firm was established through consideration to the year of registration, where the subjects were also asked to state when the business began its operations. Finally, firm production category was established in consideration to the type of food made by the establishment. Accordingly, there was the incorporation of three different categories, namely fresh meals, pre-cooked, and raw material. The participants were asked, through the online survey, to detail the number of employees in their respective organisations. (Control variables will be analysed later on this chapter)

What Is Number Of Employees?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	36-37	19	7.9	7.9	7.9
	70-80	17	7.1	7.1	15.1
	50-52	37	15.5	15.5	30.5
	25-29	6	2.5	2.5	33.1
	81-90	34	14.2	14.2	47.3
	35	2	.8	.8	48.1
	38	2	.8	.8	49.0
	45-49	22	9.2	9.2	58.2
	40	1	.4	.4	58.6
	42	1	.4	.4	59.0
	44	1	.4	.4	59.4
	91-100	24	10.0	10.0	69.5
	53	1	.4	.4	69.9
	55	3	1.3	1.3	71.1
	54	38	15.9	15.9	87.0
	60	1	.4	.4	87.4
	62-69	30	12.6	12.6	100.0
	Total	239	100.0	100.0	

Table 5.9: Number of employees

The online surveys generated data, which subsequently was grouped and analysed, with the results detailed in the following Figure 5.2. In line with these results, it was found that 3% of the subjects were employed by firms with 25 and up to 30 staff members; 20% were from businesses with 30–50 employees; 33% were from organisations with 50–70 employees; 34% were employed by firms with 70-90 employees, whilst the remaining 10% came from businesses with 90-110 employees. (Additional discussion will in Chapter 6)
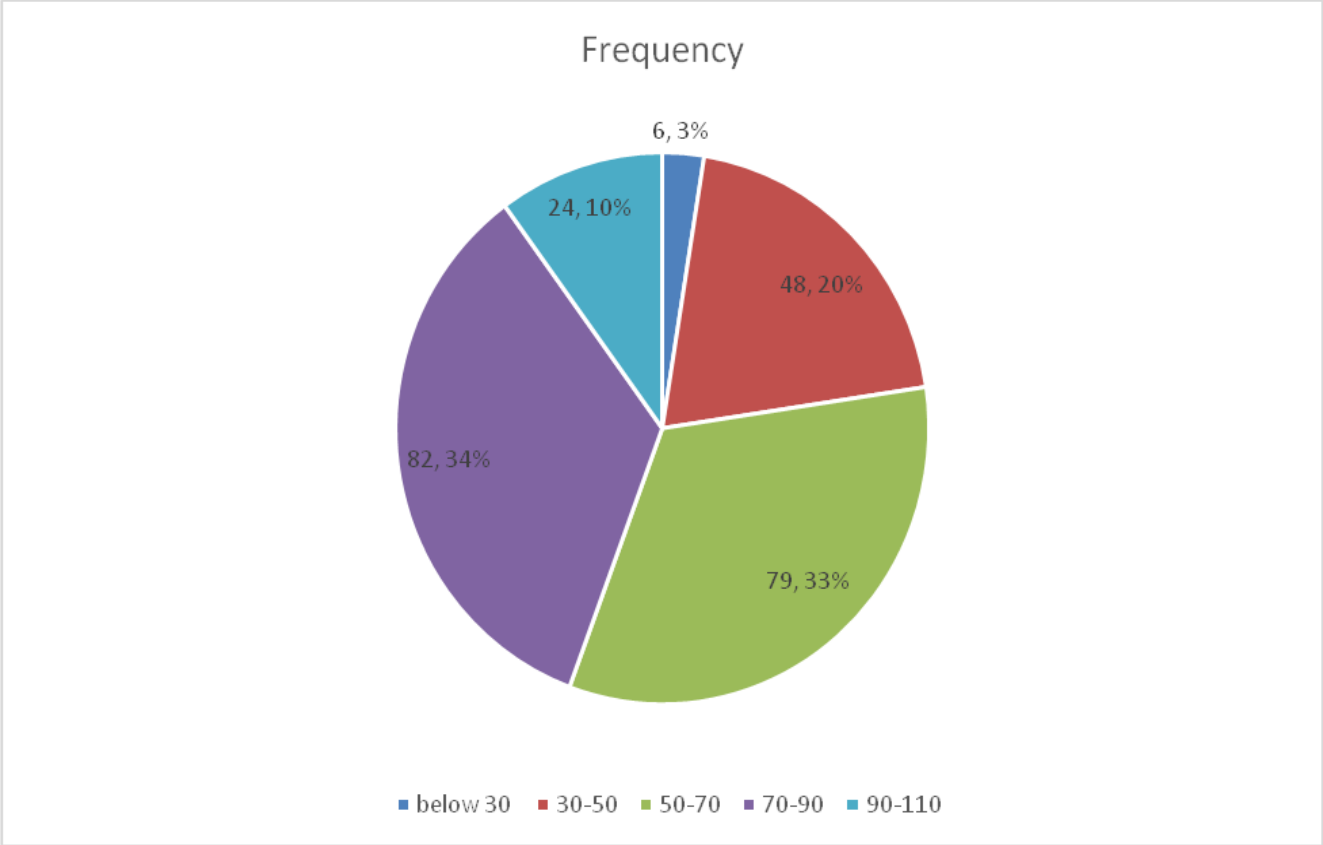
Figure 5.2: Number of Employees of Participating SMEs

5.3.6 Descriptive Statistics

In an effort to secure insight into the key elements that may be applied in order to eradicate demand uncertainty mitigation (DMU), the measurement framework highlights five important considerations, namely internal integration (II), supply integration (SI), customer integration (CI), postponement practice (PP) and mass customisation capability(MCC). As discussed earlier, the theoretical framework has been concerned with authentication the link and identifying the effects supply chain integration (SCI), postponement (PP), and mass customisation capability (MCC) (independent variables) on eradicating demand uncertainty mitigation (DUM) (dependent variable) in a situation of high competitive intensity (CPI). For all of these aspects, a number of indicators were derived in mind of measuring their dimensions and links. As can be seen displayed in Table 5.6, the hypothesised variables' descriptive statistics were used to measure the ways in which internal integration, supplier integration, customer integration with their relationship with postponement practice and mass customisation capability could be applied in an effort to mitigate demand uncertainty.

The key aspects and their corresponding values were found to score above average, as shown through the descriptive statistics above. Items SI2 was found to be the lowest variable (we ensure close communications with food suppliers is maintained in regard to various quality considerations and design changes), which was found to have derived a score of a mean of 4.26 out of 7. CPI2 (competitive pressures are extremely high) was found to be the second least variable, scoring a mean of 4.29 out of 7. The third least was CPI3 (little attention is directed towards our competitors), the score of which was found to be 4.56 out of 7, with CPI1 (we operate in an industry that is highly competitive) closely following, whose score was 4.75 out of

7. It can be seen through these findings that all competitive intensity-related items were seen to be variables with lower scores.

The remaining variables were seen to be applicable in the following order: SI3 (our business key food suppliers provide input in relation to our projects of product development), establishing a score of a mean of 4.82 out of 7; II2 (the functions adopted by our plant are aligned with its activities) scored a mean of 5.15 out of 7; PP3 (our organisations postpones final packaging activities until the customer is in receipt of their order 5.18 out of 7; SI1 (cooperative relationships with food suppliers are maintained) scored a mean of 5.21 out of 7; and II3 (top management highlights the importance of good inter-functional relationships) scored a mean of 5.23 out of 7.

When considering the descriptive statistics, we can see that demand mitigation uncertainty was found to have an average score with DMU2 (we mitigate demand uncertainty when our customers place orders consistent with their nominated delivery lead time), scoring 5.36 out of 7, DMU1 (we mitigate demand uncertainty by providing products to our customer consistent with their nominated product specification) scoring 5.48 out of 7 and DMU3 (we mitigate demand uncertainty when our customers provide us reliable forecasts on their demands) scoring 5.48 out of 7.

Although the numerous other elements of mass customisation capacity were carried out much better, MCC2 (we can easily incorporate significant food product variety without the need to increase costs) scored 5.52 out of 7. In contrast, the internal integration variable II1 (there is sound alignment between the functions in our plant) were seen to perform much better when compared with the remainder, scoring a mean of 5.59 out of 7. The postponement practice

variables PP1 (our firm postpones final product assembly activities until receiving customer orders) and PP2 (our firm postpones final product-labelling activities until receiving customer orders) were found to score relative higher than PP3,demonstrating a mean score of 5.67 out of 7 and 4.86 out of 6, respectively.

In a comparable vein, the variables of customer integration demonstrated sound performance with three of its variables, positioning it at the top five variables with the highest scores. CI2 (our customers are actively involved in our product design process) achieved a score of a mean of 4.91 out of 6, MCC3 (we can easily add product variety without sacrificing quality) scored a mean of 5.91out of 7; CI3 (the customers involve us in their quality improvement efforts) scoring 5.93 out of 7; and CI1 (we are in frequent, close contact with our customers) scoring a mean of 6 out of 7. When considering the highest of the score, the variable MCC1 (we are highly capable of large-scale product customisation) was found to have a mean of 6.1 out of 7. Table 5.10 below details these statistics.

Table 5.6 presents descriptive statistics of the operational constructs and their indicators. The findings indicate that the respondents are confident about adoption of the various management practices and their impact on mitigating demand uncertainty. All the operational constructs (supply chain practices) factors have an average score higher than the average score of the measurement scale (which is 3).Table 5.6 however demonstrates that on average, the most commonly used practice towards mitigating demand uncertainty is MCC with mean value of 6.1 (out of 7) as most of the respondents reported that they are highly capable of large-scale product customisation. Moreover, customer integration (CI3) seems to be the second most appreciated and used practice with a mean value of 5.9 (out of 7). This is an important observation as it supports the importance of mass customisation capability as well as customer integration in mitigating demand uncertainty (Hair *et*

al., 2010). Although, Smart-PLS, does not required an assumption of date normality, we provide an examination of the skewness and kurtosis of the various supply chain constructs and individual associated indicators indicated in the last two columns of Table 5-6 demonstrate that there was no serious violation of the normality of the data to test factor's loadings. All factors as well as indicators have skewness and kurtosis values less than 3.29 (p < .001) as recommended by Hair *et al.* (2010).

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
CI1	239	3	7	6	1.051	0.157	-0.812
CI2	239	2	6	4.91	1.177	0.157	-0.091
CI3	239	4	7	5.93	1.103	0.157	-0.051
II1	239	3	7	5.59	1.306	0.157	-1.074
II2	239	2	7	5.15	1.31	0.157	-0.881
II3	239	2	7	5.23	1.251	0.157	-0.735
SI1	239	1	7	5.21	1.448	0.157	-0.345
SI2	239	1	7	4.26	1.453	0.157	-0.783
SI3	239	1	7	4.82	1.529	0.157	-1.326
PP1	239	3	7	5.67	1.242	0.157	-0.893
PP2	239	1	6	4.86	1.082	0.157	-1.402
PP3	239	2	7	5.18	1.275	0.157	-0.936
MCC1	239	4	7	6.1	1.034	0.157	-0.264
MCC2	239	4	7	5.52	0.703	0.157	-0.325
MCC3	239	4	7	5.91	1.129	0.157	0.629
DUM1	239	2	7	5.48	1.371	0.157	-0.119
DUM2	239	2	7	5.36	1.242	0.157	-1.095
DUM3	239	2	7	5.48	1.371	0.157	-0.567
COMP1	239	1	7	4.75	1.568	0.157	-0.164
COMP2	239	1	7	4.29	1.779	0.157	-1.16
COMP3	239	1	7	4.56	1.436	0.157	-1.001

Valid N (listwise)	239						

<p align="center">**Table 5.10: Descriptive Statistics**</p>

5.4 Structural Model Assessment and Testing

5.4.1 Structural Model

The present work is centred on the SEM, with the application of the PLS-SEM method in mind of validating the link between the constructs of the study. Viewed as second-generation modelling, SEM is known to carry out a dual function: it operates both as a measurement model and as a structural model. In the case of the former (outer model), its functions are concerned with evaluating the overall quality of the individual study constructs. In the case of the latter (inner model), the SEM evaluates the link between the various constructs (Fornell & Brookstein, 1982). The sample size is established in line with SEM and is dependent on various critical aspects. The assumptions of the study are tested with the adoption of multivariate analysis. An estimation approach is identified in order to predict the sample size. Model complexity is examined, with the data screened in mind of missing data and corresponding outliers. The estimation of average variance error is performed (Hair *et al.*, 2010).

In the view of Chin (1998), more conventional significance testing approaches are not considered suitable for PLS-SEM, as they are seen to take on a variance that is distribution-free. Accordingly, the PLS-SEM models need to be evaluated in line with the use of measures that are prediction-centred and non-parametric as opposed to with the use of measures of fit (Chin, 1998). Emphasising the arguments of Chin (1998), the work of Hair *et al*. (2011) suggests the adoption of the Stone-Geisser test, path coefficient and coefficient of determination (R2) as the most suitable approaches to evaluating the PLS-SEM structural model. They further recognise

that the resampling approaches, including bootstrapping and jackknifing, may be applied in evaluating not only the significance but also the overall stability of path coefficient evaluations (Hair *et al*., 2011).

In the case of PLS-SEM, the bootstrapping approach is for 500 and was used in assessment of the significance of path coefficient. Although goodness-of-fit index is an appropriate method for determining discrepancies between observed values and expected values in a model in question, it was not applied in assessment of the inner model because goodness of fit measures are inappropriate to the PLS-SEM particularly since most of the constructs were measured using single measures (Henseler & Sarstedt, 2013). Cronbach's alpha, which is the most commonly, used method for assessing inner consistency was applied in this study together with the composite reliability measure to ensure that the measures are satisfactorily reliable (Bagozzi & Yi, 1998). The present work used the Smart-PLS software and applied path coefficients and coefficient of determination (R^2) for assessing heterogeneity in unobserved data and testing the hypotheses. Although path loadings are recognised as establishing the overall strengths of the links between dependent and independent variables, the predictive power of variables is measured with the use of R^2. In this vein, R^2 values measure the degree of the independent variables' variance. The software introduced by Ringle *et al*. (2005), namely Smart-PLS 2.0 M3, is adopted in an effort to establish the structural and measurement model. Furthermore, when evaluating the model, it is essential to consider the possibility of the classification of data when assessing not only the observed but also the unobserved heterogeneous variables. Structural model assessment in this study was conducted using the methods which are explained in the next sections together with the findings.

5.4.2 Exploratory Factor Analysis

This approach is applied for establishing variables and accordingly recommending dimensions (Churchill, 1979; Field, 2005), and identifies the inter-correlation amongst the measurement items, which then are accordingly grouped into sets known as factors. Subsequently, through the use of theory, these factors will correspond to a concept (Hair *et al.*, 2010). Hair *et al.* (2010) details two key objectives associated with factor analysis: to identify the structure of both respondents and variables, and to complete data reduction/ summarisation and the selection of variables. The data are summarised by EFA, through defining variables' structure through positioning them in groups, and accordingly providing variables identification for subsequent analysis and data reduction. The key objective associated with completing exploratory factor analysis (EFA) for this work is data reduction and summarisation. Through the completion of three steps, the exploratory factor is carried out (Pallant, 2010): the first evaluates the overall data suitability for EFA in line with the size of the sample and the inter-correlations between items. In regard to the size of the sample, the ratio between the cases and the number of items is larger than 5:1 (Hair *et al.*, 2010: 87). Moreover, the size of the sample in the present work is recognised as adhering to the threshold outlined by Tabachnick and Fidell (2006, pp. 33-38), who argue that *'it is comforting to have at least 300 cases for factor analysis'.* In regard to the present work's variables, the inter-correlation amongst items is greater than 0.3, as detailed through the correlation matrix. The Measure of Sampling Adequacy (MSA) provides quantification of the inter-correlations between the variables, with values ranging from 0 to 1. Those variables found to have values of 0.5 or more are sound variables, estimated through other variables without errors; whereas those falling below 0.5, on the other hand, need to be disregarded (Hair *et al.*, 2010). In the present work, all of the MSA values for all items are seen

to be greater than 0.5, suggesting a good inter-relation between items. Moreover, there has been the adoption of two statistical approaches in order to evaluate data factorability: Bartlett's Test of Sphericity and Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy (Pallant, 2010). The Test of Sphericity is concerned with establishing the significance of the correlation matrix, where the presence of sufficient correlations between variables is signified by a significance level of <0.5. KMO can be described as the ratio between the sum squared of correlations and the summation of sum squared correlations and the sum of squared partial correlations. EFA appropriateness requires a minimum value of 0.6 (Tabachnick & Fidell, 2006). The KMO findings, as well as those derived from the Barlett test, are detailed in Table 5.11, highlighting the significance of the Bartlett test ($p<$ 0.05) and the exceeding of KMO index above the minimum value of 0.6; thus suggesting the factorability of data.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.853
Bartlett's Test of Sphericity	Approx. Chi-Square	3840.791
	df	105
	Sig.	0.000

Table 5.11: The KMO and Barlett's test

5.4.3 CFA Analysis

With the use of Smart-PLS, CFA analysis was carried out with the objective to evaluate the overall validity and reliability of the multiple-item scale. Considering the overall reflective nature of the measurement scale, there was the examination of the composite reliability, average variance extracted (AVE), outer loadings and square roots. Discriminant validity, convergent validity and reliability tests were all carried out in consideration to the guidelines provided by

(Fornell & Larcker, 1981). Moreover, composite reliability and indicator reliability tests, recognised as superior to Cronbach's alpha, are carried out in quantitative analysis because such tests consider actual loadings as opposed to assigning assumed equal weight to all items (Fornell & Larcker, 1981). Indicator reliability is concerned with the square root of outer loadings, with a value of 0.70 or greater validating the indicator reliability (Hulland, 1999). Accordingly, there is a need to establish internal consistency reliability if the composite reliability is seen to be 0.70 or greater (Bagozzi & Yi, 1988).When considering that the composite reliability ranges 0.–9317-0.9754, which is recognised as larger than the suggested 0.70 value, there was the establishment of internal consistency reliability.

The study questionnaire's overall reliability was determined following the completion of the pilot study, with content validity identified also before the pilot study (Churchill, 1979). Although face and content validity of the study's questionnaire was determined in various ways—through a- consideration to academic experts, and b- through the views of 12 CEOs in the completion of semi-structured interviews—construct validity subtypes, including convergent and discriminant validity, can be identified through Smart-PLS analysis. Average Variance Extracted (AVE) was also used for evaluating convergent validity, with the evaluation of discriminant validity in subsequent processes. The presence or absence of convergent validity was established through AVE values. The AVE values should be equal to or greater than 0.5, and then the convergent validity would be determined (Baggozz & Yi, 1988). When considering that the AVE values are greater than the suggested value of 0.5 (spanning 0.8206–0.9295), as detailed in Table 5.8, and the outer model loadings are larger than the 0.70 values, there is the establishment of convergent validity. Moreover, as a result of the t-statistics as shown in Table 5.11, and the result of factor loadings as shown in Table 5.8 and 5.9, were found to exhibit significance at $p<0.01$, in

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addition to that, communalities >0.500, as shown in Table 5.15, which clearly established convergent validity as well (Hair *et al.*, 2010).

	CI	II	SI	PP	MCC	DUM	CPI
CIQ1	0.9442						
CIQ2	0.9549						
CIQ3	0.9377						
IIQ1		0.9678					
IIQ2		0.9654					
IIQ3		0.9592					
SIQ1			0.9620				
SIQ2			0.9138				
SIQ3			0.9339				
PPQ1				0.9073			
PPQ2				0.9605			
PPQ3				0.9687			
MCCQ1					0.9627		
MCCQ2					0.8768		
MCCQ3					0.9292		
DUM1						0.9396	
DUM2						0.8056	
DUM3						0.9643	
CPI1							0.9635
CPI2							0.9648
CPI3							0.9411

Table 5.12: Outer Model Loadings (Factor Loadings).

Note: Outer model loadings or factor loadings are extracted to conduct the CFA analysis.

Item **	Loading	T-Value *	C.R	AVE	
Customer Integration					**(Reliability)**
CI1	0.9442	34.4739	0.9621	0.8942	
CI2	0.9549	30.0859			**Indicator Reliability**
CI3	0.9377	22.4917			
Internal Integration					Square each of the outer loadings to find the indicator reliability Value. **0.70 or higher** is preferred. If it is an exploratory research, 0.4 or higher is acceptable. (Hulland, 1999).
II1	0.9678	36.8457	0.9754	0.9295	
II2	0.9654	36.3637			
II3	0.9592	30.4638			
Supplier Integration					**Internal Consistency Reliability**
SI1	0.9620	27.3363	0.9561	0.8780	Composite reliability should be **0.7 or higher**. If it is an exploratory research, 0.6 or higher is acceptable. (Bagozzi and Yi, 1988).
SI2	0.9138	17.3004			
SI3	0.9339	19.4477			
Postponement Practice					
PP1	0.9073	26.6386	0.9624	0.8947	
PP2	0.9605	32.6321			**(Validity)**
PP3	0.9687	48.7413			
Mass Customisation Capability					**Convergent validity**
MCC1	0.9627	44.4393	0.9456	0.8530	It should be **0.5 or higher** (Bagozzi and Yi, 1988).
MCC2	0.8768	21.2575			
MCC3	0.9292	29.7281			
Demand Uncertainty Mitigation					**Discriminant validity**
DUM1	0.9396	18.2925	0.9317	0.8206	Fornell and Larcker (1981) suggest that the "**square root**" of AVE of each latent variable should be greater than the correlations amongst the latent variables.
DUM2	0.8056	15.2333			
DUM3	0.9643	33.7083			
Competitive Intensity					
CPI1	0.9635	29.1807	0.9701	0.9150	
CPI2	0.9648	32.2481			
CPI3	0.9411	23.2297			
COMPANY SIZE	1.0000	n.a	n.a	n.a	

COMPANY AGE	1.0000	n.a	n.a	n.a
COMPANY PRODUCT	1.0000	n.a	n.a	n.a

Table 5.13: CFA Analysis

Note: CR- composite reliability; AVE-average variance extracted; * all item loadings are significant at the P<0.01 level; n.a: not applicable for single-item construct. ** Please refer to the appendix for all descriptions for the item.

5.4.4 Discriminant Validity

Discriminant validity undergoes evaluation through the contrasting of the square roots of each construct's AVE alongside the links between the focal construct and all other constructs. Therefore, the establishment of discriminant validity is achieved upon there being a greater square root than the correlation with other constructs (Fornell & Larcker, 1981). Table 5.10 provides clear indication as to the inter-construct correlation values of the diagonal of the matrix. On the diagonal, a contrast between the AVE square roots and the correlation values suggests discriminant validity. Note that Square root of AVE is written in bold on the diagonal of the table.

	SI	II	CI	PP	MCC	DUM	CPI	SIZE	AGE	PRODUCT
SI	**0.9370**									
II	0.5105	**0.9641**								
CI	0.5166	0.3797	**0.9456**							
PP	0.3971	0.4184	0.5755	**0.9458**						
MCC	0.5004	0.3716	0.5145	0.4674	**0.9235**					
DUM	0.4617	0.3440	0.5330	0.4336	0.6017	**0.9058**				
CPI	0.2725	0.2375	0.4827	0.4528	0.3940	0.4211	**0.9585**			
SIZE	0.7621	0.0557	0.0201	0.0820	0.0016	0.1575	0.2541	**n.a**		
AGE	0.0720	0.0521	0.0616	0.0053	0.0605	0.0165	0.0053	0.7621	**n.a**	
PRODUCT	0.0123	0.0521	0.0616	0.0053	0.0605	0.0165	0.5106	0.0123	0.2383	**n.a**

Table 5.14: Correlation between Constructs

	T-Statistics
CI -> MCC	3.9314
CI -> PP	4.9302
II -> CI	7.2749
II -> MCC	2.702

II -> PP	2.959
II -> SI	8.6952
MCC -> DUM	4.1138
PP -> DUM	5.4187
PP -> MCC	6.0013
SI -> MCC	1.6011
SI -> PP	4.2084

Table 5.15: T-Statistics of Path Coefficients

As shown in Figure 5.11, via a two-tailed t-test by means of a significance level of 5%, the path coefficient will be significant if the T-statistics is larger than 1.96 (Hair *et al*., 2011). All of the T-statistics are larger than 1.96 so the outer model loadings are highly significant.

In Table 5.12 below, *p* Value of correlation between constructs providing support for the prediction that such constructs are linked with one another, where these relationships are recognised as sound:

	SI	II	CI	PP	MCC	DUM	COPI	Size	Age	Product
SI	1	<0.001	0.013	0.011	<0.001	<0.001	0.809	0.015	0.758	<0.001
II	<0.001	1	0.05	0.327	0.037	<0.001	0.134	0.142	0.655	0.922
CI	0.013	0.05	1	0.1	0.002	<0.001	0.272	0.271	0.957	0.687
PP	0.011	0.327	0.1	1	0.014	<0.001	0.011	0.636	0.103	<0.001
MCC	<0.001	0.037	0.002	0.014	1	<0.001	0.776	0.541	0.696	0.201
DUM	<0.001	<0.001	<0.001	<0.001	<0.001	1	0.578	0.182	0.496	0.085
COPI	0.809	0.134	0.272	0.011	0.776	0.578	1	<0.001	<0.001	0.492
Size	0.015	0.142	0.271	0.636	0.541	0.182	<0.001	1	0.031	0.145
Age	0.758	0.655	0.957	0.103	0.696	0.496	<0.001	0.031	1	0.86
Product	<0.001	0.922	0.687	<0.001	0.201	0.085	0.492	0.145	0.86	1

Table 5.16: p Value of Correlation between Constructs.

5.4.5 Multicollinearity

Multicollinearity stems from the links identified between at least two predictors comprised in the tested framework. The most valuable situation for a research is to garner high correlations between the dependent and independent variables, but a minor degree of correlation between the independent variables (Hair *et al*., 2010). A high degree of multicollinearity is recognised as a threat to the overall validity of the results garnered as a result of utilising the tested model as this can result in incorrect predictions pertaining to the regression coefficients, and also its sign (Hair *et al*., 2010). As highlighted by Hair *et al*. (2010), 'As multicollinearity increases, the total variance explained decreases (estimation). Moreover, the amount of unique variance of independent variable is reduced to levels that make estimation of their individual effects quite problematic (explanation)'.

One approach to evaluating multicollinearity is to determine the correlation matrix between the independent variables. The presence of high correlations between independent variables (recognised as 0.90 or more, overall) provides some insight into an issue in multicollinearity (Hair *et al*., 2010). In the present work, the correlation matrix between independent variables (as detailed in Table 5.13) has been analysed, which suggests no high correlation between the independent variables (where the correlation matrix maximum is seen to be 0.6017).

	SI	II	CI	PP	MCC	DUM	CPI
SI	**1**						
II	0.5105	**1**					
CI	0.5166	0.3797	**1**				
PP	0.3971	0.4184	0.5755	**1**			
MCC	0.5004	0.3716	0.5145	0.4674	**1**		
DUM	0.4617	0.3440	0.5330	0.4336	0.6017	**1**	
CPI	0.2725	0.2375	0.4827	0.4528	0.3940	0.4211	**1**

Table 5.17: Correlation between Independent Variables

Coefficients^a

Model	Unstandardised Coefficients		Standardised Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	2.131	.379		5.625	.000		
CI	.374	.070	.346	5.344	.000	.751	1.332
II	.019	.061	.020	.308	.758	.735	1.360
SI	.190	.053	.239	3.617	.000	.724	1.382

a. Dependent Variable: PP.

Coefficients^a

Model	Unstandardised Coefficients		Standardised Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	2.565	.260		9.867	.000		
CI	.400	.048	.474	8.334	.000	.751	1.332
II	.075	.042	.102	1.777	.077	.735	1.360
SI	.134	.036	.214	3.699	.000	.724	1.382

a.   Dependent Variable: MCC

Coefficients^a

Model	Unstandardised Coefficients		Standardised Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	.806	.431		1.873	.062		
PP	.372	.064	.350	5.816	.000	.754	1.326
MCC	.460	.082	.339	5.633	.000	.754	1.326

a. Dependent Variable: DUM

Table 5.18: Variance Inflation Factors (FIV's)

Additionally, in the present work, the independent variables' VIFs (see Tables 5.14), have the largest VIF value at 1.382. Such findings of the correlation matrix and VIFs give overall assurance that there are no concerns in regard to the study's overall multicollinearity.

VIF is determined as '1/Tolerance'. Generally speaking, there is a need to garner a VIF equating to 5 or lower (i.e., Tolerance level of 0.2 or higher) in order to ensure the collinearity issue is circumvented (Hair *et al*., 2011).

Q_2 values (Stone-Geisser value that is an important measure that is usually used in assessment of the predictive relevance in a mode) of 0.02, 0.15 and 0.35 provide indication as to an exogenous construct with a small, medium and large predictive relevance for an endogenous latent variable respectively (Hair *et al*., 2011). Although the measurement model's quality can be measured through CV-communality, CV-redundancy, on the other hand, is measured through consideration to the structural model's quality (Tenenhaus *et al*., 2005). Overall, there is the recommendation of CV-redundancy in evaluating the overall predictive relevance of PLS-SEM, as this is known to utilise both the structure model's and measure model's estimates in mind of data prediction (Hair *et al*., 2011a). Overall, a predictive relevance of a model is indicated by $Q_2 > 0$, whilst $Q_2 < 0$ suggests a complete lack of predictive relevance in a model (Chin, 1998). In specific regard to the present work, both CV-redundancy and CV-communality statistics have been calculated with the use of the blindfolding approach in the application of the Smart-PLS software. The findings of the CV-redundancy and CV-communality statistics (detailed in Table 5.15) suggest a positive Q_2 value across all constructs, thus implying an estimated relevance for the framework tested in this work. These findings suggest that the tested model's proposed structural relationships are not only restricted to the present data set, but also may be applied in mind of estimating the endogenous latent variables through the use of other sets of data.

Stone-Geisser's (Q2) values		
Cross-validated Communality and Redundancy		
Construct	CV-Communality	CV-Redundancy
CI	0.7374	0.1506
II	0.7053	0.1345
SI	0.9235	0.1832
PP	0.8887	0.3109
MCC	0.8534	0.3776
DUM	0.6279	0.2811
CPI	0.7702	0.1632

Table 5.19: Stone-Geisser's (Q2) Value

For the reason that PLS-SEM makes no distribution assumption for the data applied in the analysis, evaluating the structural framework requires the evaluation of its overall ability to estimate the endogenous latent variables (Hair *et al*., 2011a). One of the key measures applied in evaluating the predictive relevance in a framework is the Stone-Geisser Q2 value (Geisser, 1974; Stone, 1974).

5.4.6 Nomological Validity

To verify the nomological validity of constructs, the study has provided a theoretical support using findings from prior research on the proposed relationships between the various constructs in the theoretical framework chapter. This was done to ensure that there is theoretical explanation to enhance understanding of the proposed construct relationships and also to ensure that the correlations between the constructs as proposed in the measurement theory are sensible. In addition, the nomological validity has been analysed based on the correlation matrix, as suggested by Hair *et al* (2010). The correlation matrix presented in Table 5.10 and the P values

of correlations presented in Table 5.12 support the prediction that the various constructs are correlated and these correlations seem right and add up.

5.5 Path Coefficients

According to Hair *et al.* (2010), standardised beta coefficients or ordinary least square regressions can be used in interpretation of the individual path coefficient of the Smart-PLS model. Regression coefficient represents the estimated change that will occur in the dependent variable for every unit change in the independent variable (Hair *et al*., 2010). These authors further explain that the estimated regression coefficient signifies the type as well as the strength of the relationship between the dependent and the independent variables and its sign specifies whether the relationship is positive or negative. The value of the coefficient indicates the degree to which the dependent and the independent variables are associated, providing whether the regression coefficient is statistically significant. According to (Kock, 2011), significance of path coefficients can be assessed using the t-test and the calculated *p* value for each of the coefficients as a way of testing the proposed relationship between the variables in the SEM (Hair *et al*., 2010).

This study used bootstrapping resample method which was applied to 500 samples. The PLS-based SEM software however provides *p* values associated with path coefficients directly enabling one to determine the strength of the relationship between the variables as well as the power of the test which increases as the sample size increases. Examination of the structural model was carried out through Smart-PLS, with the various outlined hypotheses subjected to testing. A basic model with key effects was primarily created and tested, the findings of path coefficients are superimposed on the path diagram in Figure 5.3 below. As seen from this

depiction, the DUM shows a 34% variance (R^2), 33% in PP and 46% in MCC, 20% SI, and 15% CI. (More explanation will be provided later in this chapter).
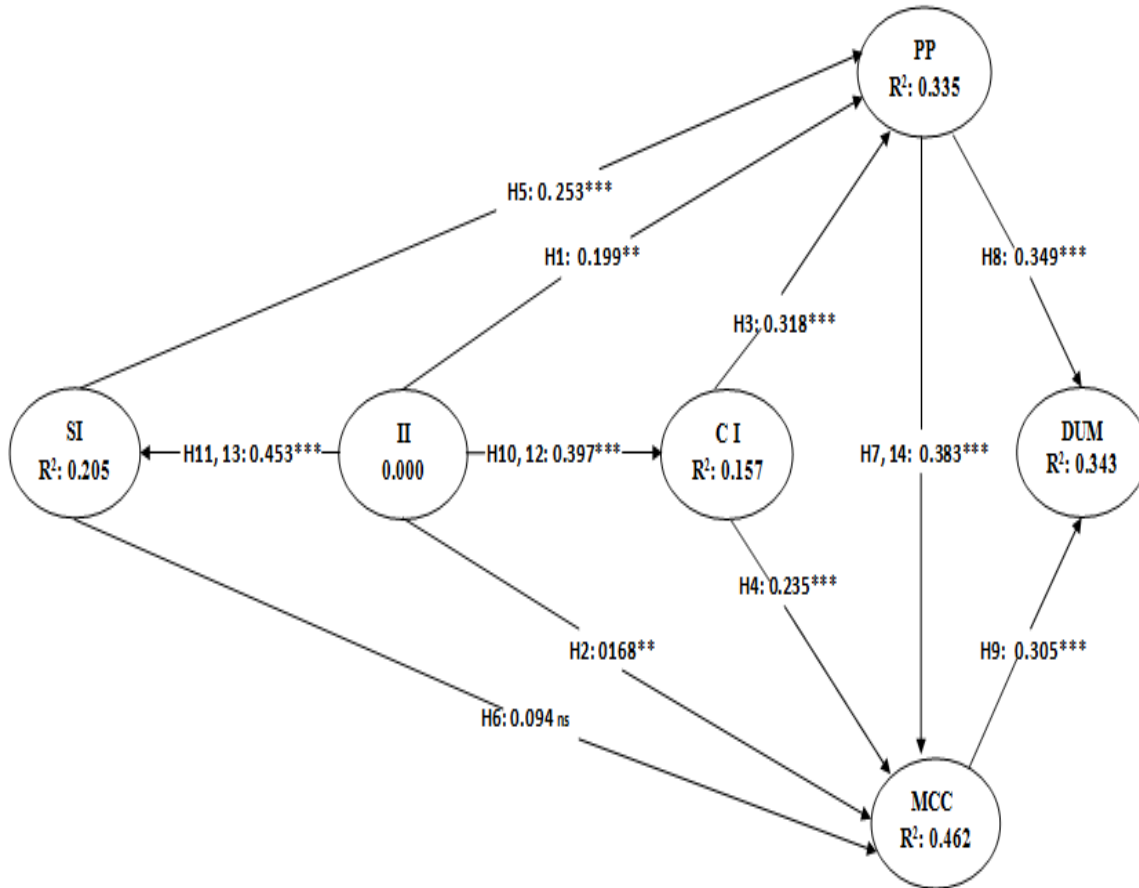
Figure 5.3: Structural Model with Path Coefficient Estimates

5.6 Relationship Between Various Constructs

The present work has provided the hypothesis that supply chain integration not only has a notable indirect and direct effect on mass customisation capability and postponement practice, but also adopts a key role in the implementation of postponement practice as a fundamental strategy, empowering mass customisation capability to mitigate demand uncertainty.

In an effort to establish the link between the numerous hypothesised constructs, these centre on the link between internal integration (II) and external integration (SI and CI); the link between the various forms of SCI (II, CI and SI) and postponement practice (PP); the link between various supply chain integration (SCI) and mass customisation capability (MCC); the link between internal integration and postponement practice; the link between internal integration (II) and mass customisation capability (MCC); the link between customer integration (CI) and postponement practice (PP); link between customer integration (CI) and mass customisation capability (MCC); the link between supplier integration (SI) and postponement practice (PP); the link between supplier integration (SI) and mass customisation capability (MCC); the link between mass customisation capability (MCC) and postponement practice (PP); the contingent effects of demand uncertainty and competitive intensity; and the link between internal integration, supplier integration, customer integration, postponement practice, and mass customisation capability with demand uncertainty mitigation (DUM).

5.6.1   Direct Effects

These models' derived values may be applied in order to establish the indirect and direct effects of the constructs of the study on one another. Direct effects are garnered in mind of validating the link between each supply chain integration and postponement practice type. In line with the path coefficients, internal integration (0.199, p < 0.01), customer integration (0.318, p < 0.001) and supplier integration (0.253, p < 0.001) are seen to have a direct effect on postponement. This validates H1: *Internal integration in food SMES is significantly and directly associated with their postponement practice during Hajj*, H3: *Customer integration in food SMES is significantly and directly associated with postponement practice during Hajj,* and H5: *Supplier Integration in food*

SMES is significantly and directly associated with postponement practice during Hajj, with validation.

Direct effects are used to validating the link between each SCI and MCC type. In line with the path coefficients, internal integration (0.168, p < 0.01), customer integration (0.235, p < 0.001) are seen to have a direct effect on mass customisation capability, thus validated H2: *Internal integration in food SMEs is significantly and directly associated with their mass customisation capability during Hajj*, and H4: *Customer integration in food SMEs is significantly and directly associated with mass customisation capability during Hajj* with validation, whilst supplier integration has no significant effect on it (0.094, ns), therefore *H6: Supplier Integration in food SMEs is significantly and directly associated with mass customisation capability during Hajj* is rejected. *H6* was rejected because supplier integration was found not to have a significant effect on MC. A value of 0.094 was found hence regarded not to be significant, thus the rejection.

Furthermore, the direct impact of PP on MCC confirmed by the path coefficient (.383, p > 0.001) and validated H7: *Postponement practice by food SMEs has significant and direct relationship with their mass customisation capability during Hajj.*

The direct impact of PP on DUM is also validated by the path coefficient (0.349, p > 0.001). In addition to the direct impact of MCC on DUM is validated by the path coefficient (0.305, p > 0.001). Thus, H8: *Postponement practice by SMEs has significant and direct effect on mitigating demand uncertainty of food during Hajj*, and H9: *Mass customisation capability by SMEs has significant and direct effect on mitigating demand uncertainty of food during Hajj are* validated.

As it appeared from Figure 5.3, internal integration has a positive and direct effect on both CI and SI and confirmed by the path coefficient (0.397, p > 0.001) and by the bath coefficient (0.453, p> 0.001) respectively, and validated both, H10: *Internal Integration in food SMES has significant and direct effect on their customer integration during Hajj,* and H11: *Internal integration in food SMES has positive and direct impact on their supplier integration during Hajj.*

5.6.2 Mediating Indirect Effect

In order to establish whether or not external integration (customer integration and supplier integration) mediate the effect of internal integration on postponement practice, the indirect effects were calculated through the multiplication of path coefficients from internal integration through to external integration (a), as well as from external integration (customer integration and supplier integration) through to postponement (b). The indirect effect associated with customer integration is 0.397× 0.318= 0.126, (p > 0.001); the indirect effect of supplier integration is 0.453× 0.253= 0.114 (p > 0.001). Therefore, as detailed in hypotheses, H12: *Internal integration of food SMEs in Hajj has significant and indirect effect on postponement practice through customer integration,* and H13: *Internal integration of food SMEs in Hajj has significant and indirect effect on postponement practice through supplier integration* are validated.

In order to know whether the effect of internal integration to mass customisation capability is mediated by external integration, the indirect effects were calculated through multiplying the path coefficients from integration through to external integration (a), as well as from external integration through to mass customisation capability (b), where the customer integration indirect effect was found to be 0.397× 0.235= 0.093, (p > 0.05) and the indirect effect of supplier

integration was $0.453 \times 0.094 = 0.042$, $(p > 0.001)$. Accordingly, H14 *Internal integration of food SMEs in Hajj has significant and indirect effect on mass customisation capability through customer integration,* and H15: *Internal integration of food SMEs in Hajj has significant and indirect effect on mass customisation capability through supplier integration*, are validated.

In order to establish whether the effect of postponement practice to demand uncertainty is carried out by mass customisation, the indirect effects were calculated through multiplying the path coefficients from postponement practice to mass customisation capability (a) and from mass customisation capability to demand uncertainty (b), where the indirect effect of postponement practice was found to be $0.383 \times 0.305 = 0.116$, $(p > 0.05)$. Thus, H16: *Postponement practice by food SMEs in Hajj has significant and indirect effect on demand uncertainty mitigation through mass customisation capability i*s validated.

5.6.3   Moderating Effect

In order to complete the testing of the moderating effects relating to competitive intensity in regard to the internal integration's indirect effects through external integration on both mass customisation capability and postponement practice, there was the building of conditional indirect models, adhering to the process detailed by (Iacobucci, 2008) as shown in Figure 5.4.
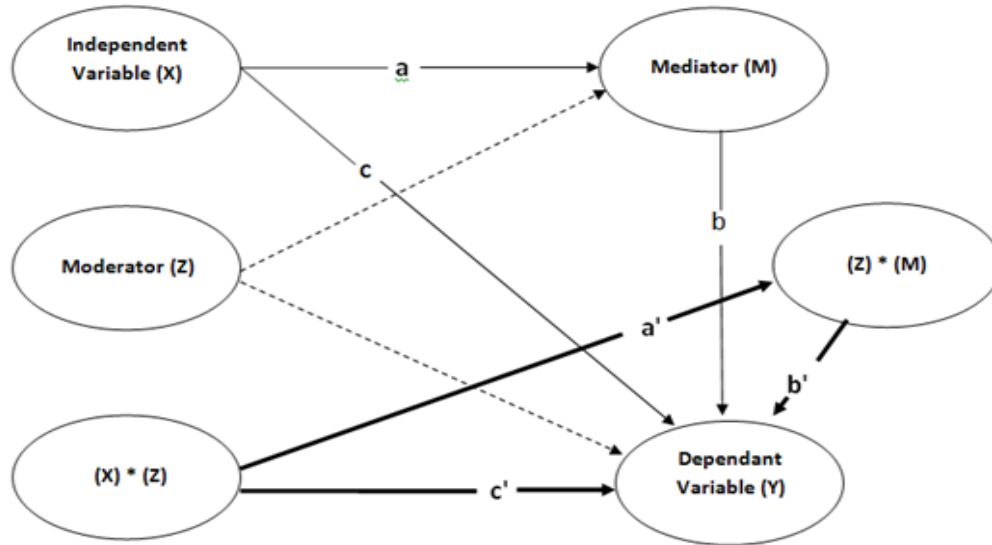
Figure 5.4: Basic model of moderated mediation effects on study's variables. Adopted from (Iacobucci, 2008)

In an effort to create the conditional indirect models, moderator and four interaction terms were incorporated as follows:

Two interaction terms for postponement practice side (Internal integration $\times$ moderator and supplier integration $\times$ moderators), and (Internal integration $\times$ moderators and customer integration $\times$ moderators), two interaction terms for mass customisation side (Internal integration $\times$ moderator and supplier integration $\times$ moderators), and (Internal integration $\times$ moderators and customer integration $\times$ moderators) to the basic model. The interaction terms were computed by cross multiplying the standardised items of each construct. If path a' is significant, then path a (in the moderation model) is significantly moderated, but the moderator, and the same rule is applied to b' and c'. If path a' $\times$ b' is significant, then the indirect effect of a $\times$ b is significantly moderated by the moderator. It should be noted that when interpreting the conditional indirect effect, the bold path (i.e., a', b', and c') alone should be examined. Other paths were also added to the

model, but they are used as controls and should not be interpreted from any perspective, as suggested by Iacobucci (2008). In adherence to this particular approach, the moderated results, as detailed in the following figures 5.4, 5.5, 5.6, and 5.7, were obtained.

As displayed in Figure 5.4, the moderating effects of competitive intensity on the path from internal integration to supplier integration is negative and significant (β = - 0.171; $p < 0.01$). Moreover, the moderating effects of competitive intensity on the path from supplier integration to postponement practice is significant (β = 0.129; $p < 0.01$). The products a' $\times$ b' (-0.171 $\times$ 0.129 = -0.022) is negative and significant at the $p < 0.05$ level. Hence, H17: *Competitive Intensity enhances significantly the indirect effect of internal integration on postponement practice of food SMEs in Hajj through supplier integration* is validated.

Figure 5.5: Conditional indirect effect (moderation estimation of competitive intensity on the path from internal integration to supplier integration and on the path from supplier integration to postponement)

As seen in Figure 5.5, the moderating effects of competitive intensity on the path from internal integration to customer integration is negative and significant (β = -0.185; p < 0.01), moreover, the moderating effects of competitive intensity on the path from customer integration to postponement practice is significant (β = 0.5; p < 0.01) . The products a' × b' (-0.185 × 0.05 = 0.009) is very weak and not significant. Accordingly, as shown in Appendix I, H18: *Competitive Intensity enhances significantly the indirect effect of internal integration on postponement practice of food SMEs in Hajj through customer integration* is rejected. This hypothesis was rejected because the moderating effect of competitive intensity on MC was found to be very weak as a value of 0.009 was found and the effect regarded as insignificant, hence the rejection.

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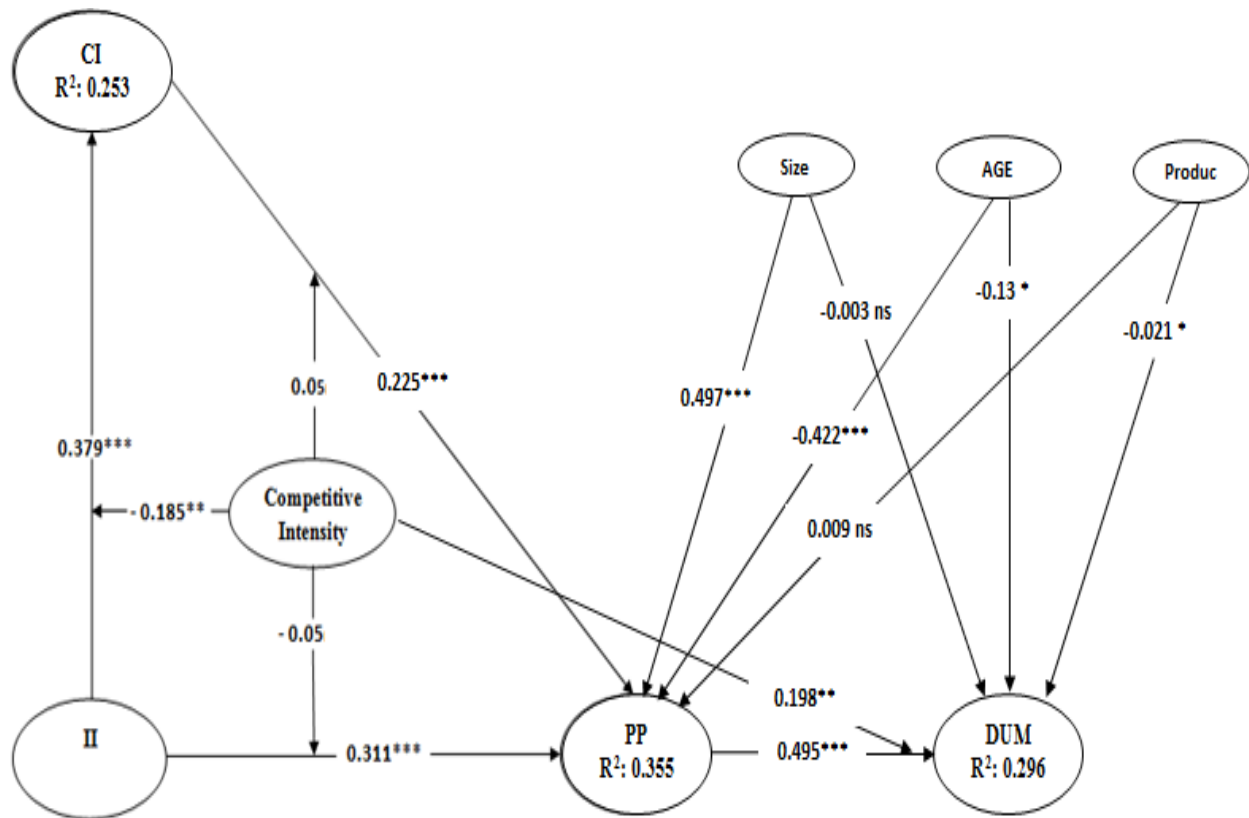
Figure 5.6: Conditional indirect effects (moderation estimation of competitive intensity on the path from internal integration to customer integration and on the path from internal integration to postponement)

As detailed in Figure 5.6, the moderating effects of competitive intensity on the path from internal integration to supplier integration is negative and significant (β = -0.171; $p < 0.01$). The moderating effects of competitive intensity on the path from supplier integration to mass customisation capability is significant (β = 0.166; $p < 0.01$). The products a' × b' (-0.171×0.166 = - 0.028) is negative and significant at the $p < 0.05$ level. Accordingly, H19: *Competitive Intensity enhances significantly the indirect effect of internal integration on mass customisation capability of food SMEs in Hajj through supplier integration* is validated.
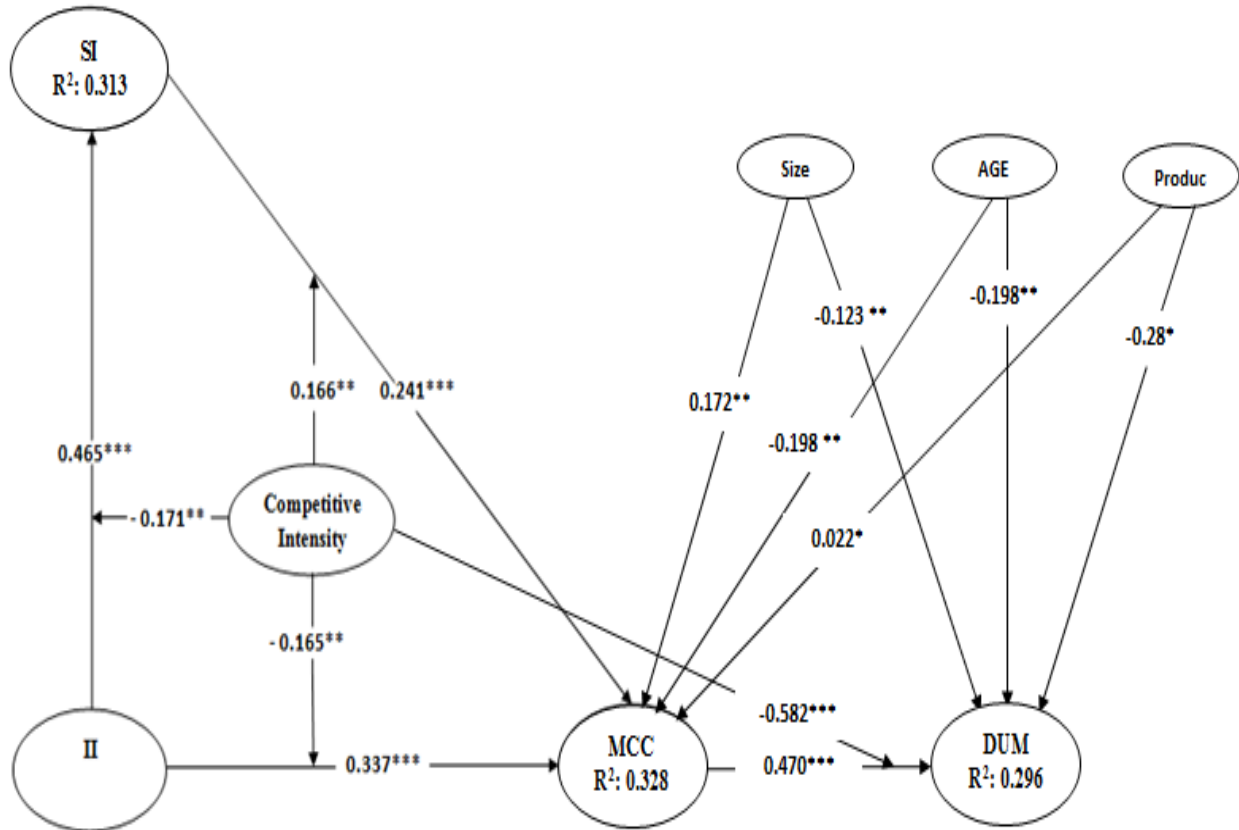
Figure 5.7: Conditional indirect effects (moderation estimation of competitive intensity on the path from internal integration to supplier integration and on the path from internal integration to mass customisation capability)

As seen in Figure 5.7, the moderating effects of competitive intensity on the path from internal integration to customer integration is significant ($\beta = 0.185$; $p < 0.01$). The moderating effects of competitive intensity on the path from customer integration to mass customisation capability is negative and significant ($\beta = -0.40$; $p < 0.01$). The products a' × b' (0.185×-0.40 = - 0.074) is negative and significant at the $p < 0.05$ level. *H20: Competitive Intensity enhances significantly the indirect effect of internal integration on mass customisation capability of food SMEs in Hajj through customer integration* is validated.

Accordingly, these results provide validation for H17, H19 and H20, therefore they are accepted, despite the fact that H18 is rejected.
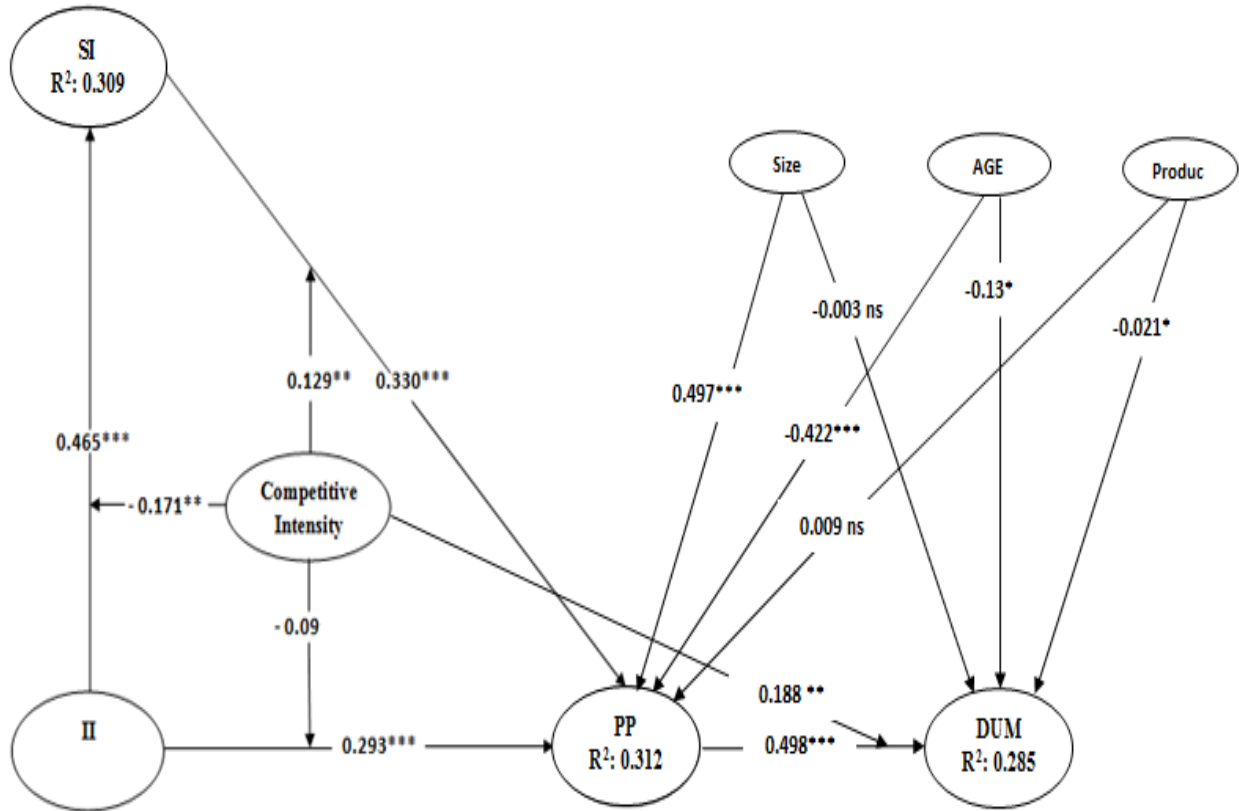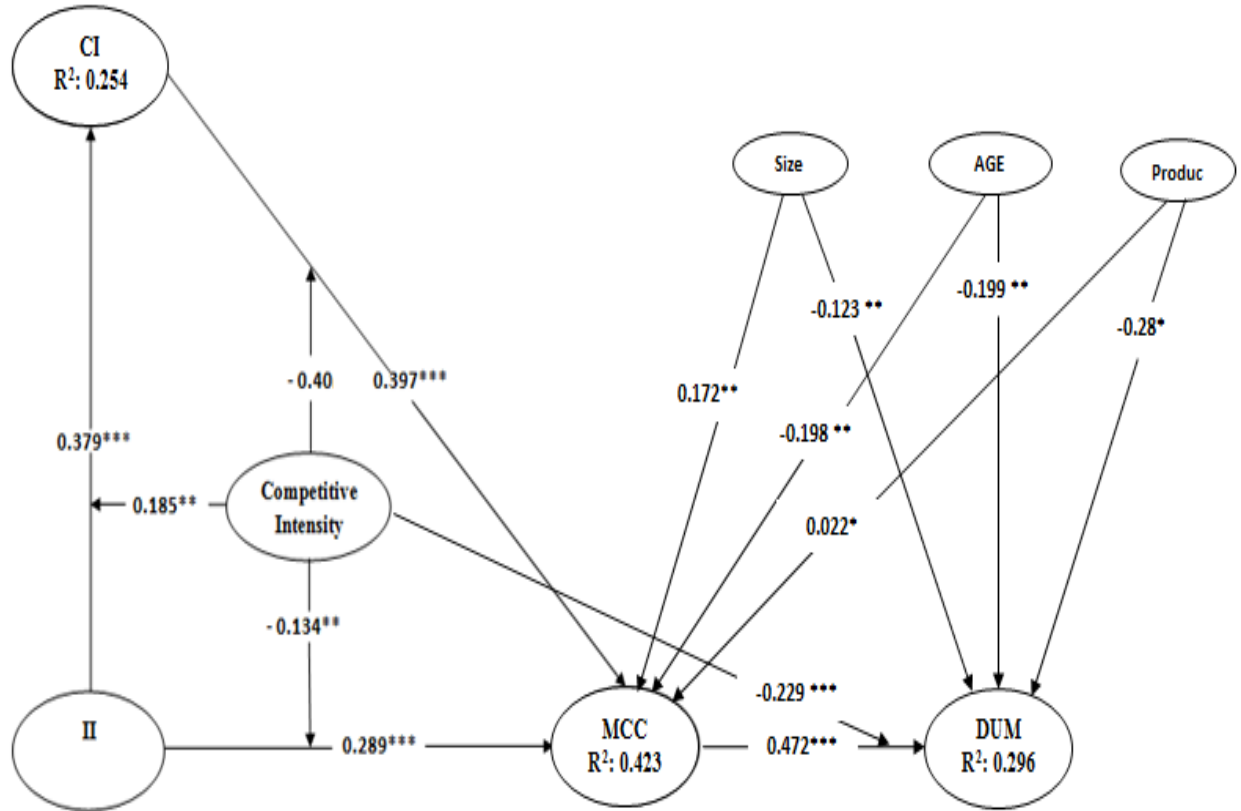

Figure 5.8: Conditional indirect effect (moderation estimation of competitive intensity on the path from internal integration to customer integration and on the path from customer integration to mass customisation capability)

As detailed in Figure 5.8 the moderating effects of competitive intensity on the path from internal integration to mass customisation capability is negative and significant ($\beta = -0.165$; $p < 0.01$). The moderating effects of competitive intensity on the path from mass customisation capability to demand uncertainty mitigation is also negative and significant ($\beta = -0.582$; $p < 0.01$). The products a' × b' (- 0.165 × -0.582 = 0.096) is significant at the $p < 0.05$ level.

On the other hand, as detailed in Figure 5.7, the moderating effects of competitive intensity on the path from internal integration to mass customisation capability is negative and significant (β = - 0.134; p < 0.01). Furthermore, the moderating effects of competitive intensity on the path from mass customisation capability to demand uncertainty mitigation is negative and significant (β = - 0.229; p < 0.01). The products a' × b' (- 0.13 4× -0.229 = - 0.030) is significant at the p < 0.05 level. Consequently, H21: *Competitive Intensity enhances significantly the indirect effect of internal integration on demand uncertainty mitigation of food SMEs in Hajj through mass customisation capability* is validated.

In a comparable vein, we can derive from Figure 5.4, that the moderating effects of competitive intensity on the path from internal integration to postponement practice is negative and significant (β = - 0.09; p < 0.01).The moderating effects of competitive intensity on the path from postponement practice to demand uncertainty mitigation is significant (β = 0.188; p < 0.01). Thus, the products a' × b' (- 0.09×0.188 = -0.0169) is negative and significant at p < 0.05 level.

Additionally, it can be derived from the Figure 5.5, that the moderating effects of competitive intensity on the path from internal integration to postponement practice is negative and significant (β = - 0.05; p < 0.01).The moderating effects of competitive intensity on the path from postponement practice to demand uncertainty mitigation is significant (β = 0.198; p < 0.01). The products a' × b' (-0.05×0.198 = 0.0099) is significant at p < 0.05 level. Thus, H22: *Competitive Intensity enhances significantly the indirect effect of internal integration on demand uncertainty mitigation of food SMEs in Hajj through postponement practice*, is validated.

5.6.4 Summary of the Hypotheses Based on the Results

In this section we summarised all hypotheses results as follows:

Hypotheses	Accept or reject
H1: Internal integration in food SMES is significantly and directly associated with their postponement practice during Hajj.	Accepted
H2: Internal integration in food SMES is significantly and directly associated with their mass customisation capability during Hajj.	Accepted
H3: Customer integration in food SMES is significantly and directly associated with postponement practice during Hajj.	Accepted
H4: Customer integration in food SMES is significantly and directly associated with mass customisation capability during Hajj.	Accepted
H5: Supplier Integration in food SMES is significantly and directly associated with postponement practice during Hajj.	Accepted
H6: Supplier Integration in food SMES is significantly and directly associated with mass customisation capability during Hajj.	**Rejected**
H7: Postponement practice by food SMEs has significant and direct relationship with their mass customisation capability during Hajj.	Accepted
H8: Postponement practice by SMEs has significant and direct effect on mitigating demand uncertainty of food during Hajj.	Accepted
H9: Mass customisation capability by SMEs has significant and direct effect on mitigating demand uncertainty of food during Hajj.	Accepted
H10: Internal Integration in food SMES has significant and direct effect on their customer integration during Hajj.	Accepted
H11: Internal integration in food SMES has significant and direct effect on their supplier integration during Hajj.	Accepted
H12: Internal integration of food SMEs in Hajj has significant and indirect effect on postponement practice through customer integration.	Accepted
H13: Internal integration of food SMEs in Hajj has significant and indirect effect on postponement practice through supplier	Accepted

integration.	
H14*: Internal integration of food SMEs in Hajj has significant and indirect effect on mass customisation capability through customer integration.*	Accepted
H15: *Internal integration of food SMEs in Hajj has significant and indirect effect on mass customisation capability through supplier integration.*	Accepted
H16*: Postponement practice by food SMEs in Hajj has significant and indirect effect on demand uncertainty mitigation through mass customisation capability.*	Accepted
H17: *Competitive Intensity significantly enhances the indirect effect of internal integration on postponement practice of food SMEs in Hajj through supplier integration.*	Accepted
H18*: Competitive Intensity significantly enhances the indirect effect of internal integration on postponement practice of food SMEs in Hajj through customer integration.*	**Rejected**
H19*: Competitive Intensity significantly enhances the indirect effect of internal integration on mass customisation capability of food SMEs in Hajj through supplier integration.*	Accepted
H20*: Competitive Intensity significantly enhances the indirect effect of internal integration on mass customisation capability of food SMEs in Hajj through customer integration.*	Accepted
H21*: Competitive Intensity significantly enhances the indirect effect of internal integration on demand uncertainty mitigation of food SMEs in Hajj through mass customisation capability.*	Accepted
H22*: Competitive Intensity significantly enhances the indirect effect of internal integration on demand uncertainty mitigation of food SMEs in Hajj through postponement practice.*	Accepted

Table 5.20: summary of tested hypotheses

5.6.5 Control Variables

The analysis comprised various control variables, through which plant size was measured by querying respondents to indicate the number of employees in a firm. In line with previous studies, scores were computed and utilised as the size variables (Swamidass & Kotha, 1998). Furthermore, dummy variables were also included to control for firm age effects. Moreover, firm production type (fresh meals, pre-cooked, raw material wholesale) was evaluated.

As shown in Figure 5.4 and Figure 5.5 firm size has a positive significant effect on postponement practice (β= 0.497; $p < 0.01$).There are negative effects stemming from firm age on postponement practice β= -0.422; $p < 0.01$). The product type has no significant effect on postponement practice β= 0.009. However, firm age and firm product type have a significant effect in regard to demand uncertainty mitigation, β=-0.13, β=-0.021, respectively, however firm size has no significant effect on demand uncertainty mitigation β= -0.003.

As shown in Figure 5.6 and Figure 5.7, firm size has positive significant effects on mass customisation capability (β= 0.172; $p < 0.01$). Moreover, a negatively significant effect is seen to stem from firm age on mass customisation capability (β= -0.198; $p < 0.01$). Product type also has significant effect on mass customisation capability (β= 0.022; $p < 0.01$). Furthermore, firm size, age and product type have negative significant effect on demand uncertainty mitigation, β = -0.123, β= -0.198, β= -0.28 ($p < 0.01$) respectively.

5.7 Conclusion

In this chapter, empirical data collected using semi-structured interviews as well as through the survey questionnaire were screened, analysed and the findings presented. The interviews were

analysed using thematic content analysis and were used to validate the conceptual framework developed for the study. CFA was conducted using PLS-SEM to assess the reliability and validity of the multiple-item scale. Discriminant validity was used to determine correlation between the various constructs. The descriptive statistics of all the constructs used in the study are also presented. The sections also describe how the hypotheses were tested using the partial least square (PLS) analysis. As a result, the relationship between the various management practices supply chain integration, postponement and mass customisation capability and how they affect demand uncertainty mitigation was established.

CHAPTER 6

DISCUSSION AND IMPLICATIONS

6.1 Introduction

The previous chapter covered testing of hypotheses and presentation of the results. This chapter provides an in-depth discussion of the results to enable answering of the research question and achieving the aim as well as objectives of this study. In particular, this sections explains, based on the findings presented in the previous chapter, how demand uncertainty can be mitigated through adoption of supply chain strategies by food SMEs in Saudi Arabia during Hajj. The chapter provides a candid and more detailed discussion by assessing the information gathered through secondary research in the literature review and from primary data collected through interviews and the survey. It provides synthesis of the information that is gathered through primary and secondary data collection with the aim of attaining the objectives of this study. This chapter is centred on explaining how SMEs in the food sector can mitigate uncertainties in demand by using supply chain strategies including supply chain integration (SCI), postponement (PP) and mass customisation capabilities (MCC). In essence, this section will explore the hypotheses that focus on the relationships between the various constructs (SCI, PP, MCC and DUM) as identified in the primary data and literature review and then go on to discuss the implications of the findings on research and practice.

This chapter is divided into subsections that are aimed at helping the reader comprehend the discussion made, clearly understand the justification for the opinions formed, the recommendations made and the conclusions that the researcher makes. In essence, this section

analyses all the information from the literature review and data collected and seeks to synthesise the information to justify the opinion and the conclusion that the researcher makes regarding the research questions. The first part of the chapter gives an introduction and background of information about the Hajj season, demand uncertainty during Hajj, and introduces the managerial strategies that are recommended to mitigate demand uncertainty for Saudi's SMEs in the food industry. The second section gives a synthesis of the information gathered through literature review, interviews and online survey for each of the managerial strategies that is recommended by this research. The aim of this section is to identify the ability of the managerial strategy recommended in mitigating demand uncertainty with specific emphasis on Saudi's food industry SMEs. In addition, the summary section will give a brief overview of the discussion chapter and the recommendations made. Finally, the study provides recommendations on areas that future research can focus on so as to improve the practice mitigating demand uncertainty during Hajj season through SCM practices.

6.2 Demand Uncertainty During Hajj

As identified in the literature review, Hajj is very important to all Muslims globally. Hajj is a yearly pilgrimage to the city of Makkah which all Muslims are required to visit at least once in their lifetime provided they have the financial ability to do so (Currie & Shalaby, 2012). As a result of its religious significance, the Hajj pilgrimage experiences numerous visitors annually with most of those coming for the pilgrimage predominantly being foreign (Long, D, 2012). In addition to the pilgrimage, there are also massive population of foreign and local visitors who come to Makkah for the mini pilgrimage, which constitute a visit to just the Grand mosque or is called Umrah (Currie & Shalaby, 2012).

During the six-day pilgrimage, or the lesser pilgrimage, most of the visitors who come for the pilgrimage are foreigners and the demand for consumer goods rises sharply (Turban *et al.*, 2015). In essence, consumer goods retailers are faced with a huge challenge of providing all the consumer goods required and in quantities and at a quality that will satisfy all the pilgrims. This is quite complicated, especially because it is difficult to predict the exact demands and product tastes of the pilgrims (Turban *et al.*, 2015). These uncertainties are rife amongst the SMEs that supply to the pilgrims who go to Makkah to take part in the pilgrimage. Mitigating these problems is central to all prudent SMEs which not only wish to avoid losses but also seek to satisfy their consumers. Uncertainties in demand and tastes have adverse effects on the performance of these SMEs as would be the case for all businesses. On the other hand, to adequately satisfy the needs of the pilgrims would have a very huge effect on not only the utility of the pilgrims but also on the Saudi Arabia economy that benefits a lot from the pilgrimages to Makkah.

6.3. The Impact of Demand Uncertainty on the Saudi Arabian Food Industry

Simply put, when an organisation cannot adequately predict the quantity of its products that are demanded by its consumers, it becomes difficult for the organisation to manage its supply chains (Liu *et al.*, 2010). Prudent organisation aims at minimising incidences where they run out of stock whilst simultaneously trying to avoid the additional costs that the business would incur for holding stock. This would be done by adopting stock management practices that ensures that the firm is neither overstocked nor under stocked at any given time (Waters & Rinsler, 2014). On one hand, holding less stock would essentially lead to stock out and consequently the firm would forgo the profit it would have gained from making the sales (Pirim *et al.*, 2014). On the other

hand, holding excess stock would have a cost implication and may even lead to losses arising from the need to dispose the excess stock that is held. The cost implications of holding excess stock arises from the direct costs such as the costs of warehousing, whilst the additional losses of disposing the excess stock would arise if the firm disposes the stock through discounted sales or if the stock that is not bought goes bad (Golinska, 2014).

Undoubtedly, therefore, firms facing such uncertainty have to look for a middle ground through the adoption of proper supply management practices. The conventional supply management practices such as economic order quantities may not be appropriate for a situation where the demand is not certain as is the case here. Without being able to adequately predict the exact quantity demanded, it would be impossible to calculate the exact quantity that a firm should hold. However, models such as just in-time inventory where the firm orders small quantities more frequently can be adopted by a firm (Everhart *et al*., 2012). Similarly, such a supply management strategy would also face a myriad of challenges and would depend on the ability of the retailer and supply to share demand information seamlessly. Further, there is still the risk of stock outs when the demand rises sharply and quickly and would only work effectively if the supplier is able to avail the stock on short notice (Waters & Rinsler, 2014). It would not work if the goods to be supplied cannot be manufactured and availed to the retailer on short notice.

With specific emphasis on the food industry in Saudi Arabia, the problem of sharp demand rises and seamless sharing of demand data between the supplier and the retailer would be the most significant problem. In fact, most of the food retailers that retail to Hajj pilgrims have already adopted the just in time model of inventory management but, still suffer from stock outs and excess stocks presented by demand uncertainties (Wilson, 2015). The inability to seamlessly

share information between the retailer and the supply regarding demand movement would lead to a situation known as a bullwhip effect. According to Harrison *et al.* (2014), this is a phenomenon where lack of adequate information or distortion of information, as it goes through a multiple chain of communicators, leads to massive inefficiencies. This implies that the just in time inventory management approach would not be an adequate cure for the underlying problems in the Saudi Arabia food industry during the Hajj pilgrimage. The problems created by demand uncertainty are still profound in the Saudi Arabia food industry and can be identified by the continued high costs of production amongst most of SMEs in the industry (Harrison *et al*., 2014; Shalaby, 2012).

This situation necessitates more advanced methods of managing the food supply chain in order to mitigate the problems that result from uncertainty in demand (Simangunsong *et al*., 2011). In essence, the appropriate model would be that which builds on the already adopted just in-time inventory management but still eradicate or minimises the inherent shortcomings of the model. The management strategies should essentially streamline information sharing, reduce the time between when an order is placed and the time the order reaches the retailer, does not have adverse implications on the price of product supplied and retains the quality of services that are offered. The exact supply chain management strategies that are proposed for in the current research study include; supply chain integration (SCI), postponement practice (PP) and mass customisation capability (MCC).

The need for effective management of Saudi Arabian food supply SMEs is made profound for multiple reasons. First, effective management of the SMEs in the food industry directly influences the experiences of the pilgrims who come to Saudi Arabia for the important events to

all Muslims (Long, 2012). This would in turn be of very great importance to the whole of Saudi Arabia which benefits immensely from the success of the pilgrimages (Currie & Shalaby, 2012). Saudi Arabia benefits from both the revenues that accrue from the visitors who tour during the pilgrimage and also socially by providing an environment that inspires and strengthens the belief in Islam, a factor that is very central to the Kingdom. With specific emphasis on the economy, effective management of SMEs in the Saudi Arabian food industry has had a very significant influence, especially before the exploration of oil, and will continue to have such an influence in the future (Mason, 2015).

With an increasing population that is expected to reach 30 million by 2020 and a labour force totalling 8.8 million, it is very important for Saudi Arabia to find ways of providing gainful employment and opportunities for its predominantly young population. One such avenue that can act as a good platform for employment creation is providing products and services to the massive numbers of pilgrims who come to the country for important religious events. In fact, Mason, (2015) noted that there has been a growing interest in the business sector in the last decade following the liberalisation of the Saudi economic policies. Bearing in mind that 90% of the Saudi Arabia's private enterprises fall within the small and medium enterprises scale and that tourism, especially religious pilgrimages, plays a big role in the growth of the economy, especially after oil, it is vital to implement measures that ensure SMEs in the food industry not only survive but also thrive. The need to eradicate the inefficiencies in the industry, especially for SMEs, formed the motivation for conducting the current study. In essence, the causes of the inefficiencies range widely in scope. However, the current study specifically emphasis on mitigating demand uncertainty amongst the SMEs.

6.4. Attaining the Research Objectives

As elaborated earlier, the aim of the current research study is to identify how SMEs in the Saudi Arabian food industry can mitigate demand uncertainty against the larger companies in the industry by adopting better supply management strategies. The aim of this study is concerned with exploring how SMEs in the food sector can mitigate demand uncertainty in an effort to increase their sustainability and competitiveness against large firms operating in the sector through managerial strategies by identifying the relationship, and accordingly examining and validating the impact of supply chain integration (SCI), postponement practice (PP) and mass customisation capability (MCC) on demand uncertainty mitigation (DUM). This was achieved by assessing the available information on the inefficiencies experienced by the Saudi Arabia food SMEs and assessing the merits of the proposed supply management strategies in greater depth through an evaluation of available information in scholarly literature. In addition, primary data was collected through interviews with the aim of connecting the theoretical model of the research to the practical situation. This study synthesis the information based on the conventions of the resource based view and contingency theories which essentially asserts that an organisation should benefit from sources within and out if it, and should match its processes, strategies and practices as already elaborated in the theoretical framework. The research places a lot of emphasis on mitigating demand uncertainty.

The research was mostly centred in establishing the viability of the strategies recommended for mitigating demand uncertainty amongst SMEs in the Saudi food industry. The literature review provided an in-depth understanding of the viability of these strategies whilst the semi-structured interviews and online survey's provided practical information that would validate the inclusion

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of the managerial strategies to attain the merits already identified in the literature review. The data collected from 12 CEOs of various SMEs in the Saudi food industry provided was qualitative in nature whilst the information provided by 239 other respondents in the food sector provided a quantitative foundation for the research. The following sections provide a synthesis of the information from the documents review and the subsequent primary data collection.

6.5 Effects of Supply Chain Integration (SCI) on Demand Uncertainty Mitigation (DUM)

Supply chain integration is a strategy that has gained a lot of traction amongst most businesses today. In essence, supply chain integration accelerates the sharing of information and data between the supplier, the firm and its customers, and the interaction between all supply chain members (Lainez-Aguirre & Puigjaner, 2014). Even though supply chain integration has not been widely adopted by many businesses, its advantages to the businesses that have already adopted the model are profound (Ramanathan, 2013). The model works by streamlining the flow of information and material across the entire supply chain. The current study assesses supply chain integration from an information perspective as elaborated by Flynn *et al*., (2010). Based on this convention, integration of the supply chain under supply chain integration would imply the synchrony between the different partners in the supply chain. Lai *et al*. (2012) define integration as the extent to which the distinct internal functions of an organisation have the ability to be in partnership with one another, synchronise intra-organisational activities, make strategic decisions and accordingly devise cross-functional integral relationships (Lai *et al*. 2012).

As such, supply chain integration (SCI) would be a critical model for managing SMEs in the Saudi Arabian food industry and even more specifically during the visits to Makkah for Hajj. In essence, demand uncertainty could be adequately controlled if the SMEs could adequately share

information with suppliers within the just in time delivery model or within other effective inventory methods (Everhart *et al*., 2012). Implementing SCI would be a very appropriate way of enhancing this flow of information and decision across the whole supply chain according to Flynn *et al*. (2010). SCI enhances the ability of firms within a supply chain to not only share information and decision making but also the ability to work in partnership, maintain a synchrony of intra-organisation activities, make strategic decisions and devise cross-functional integral relationship. The relevance of SCI in enhancing the efficiency of Saudi food industry SMEs cannot be overstated (Shao *et al*., 2015). There is a clear need for the SMEs to work closely with their suppliers in order to enhance efficiency and reduce the adverse implications of uncertainty in demand during Hajj.

Supply chain integration would essentially enhance the capability of the firms to hold just enough stock and vary the stock adequately to reflect to the changes in demand during Hajj. Enhanced integration and improved capability to share information and decision making amongst firms in the supply chain can greatly decrease the time from when a firm orders for products to the time the products are delivered to the organisation. The primary data collected tested the level of integration of SMEs in the Saudi food industry with their customers, internally and with the suppliers. Customer integration refers to the extent to which an SME is in partnership with its customers regarding inter-organisational practices, behaviours, processes and strategies to create manageable and synchronised processes that meet the requirements of its customers (Huo & Zao, 2010). However, internal integration refers to how an SME has integrated internal functions and processes to coordinate and collaborate with one another's activities and decisions across different functions within the organisation. In this study, SME's integration of functions within the plant, managerial emphasis on inter-functional relationships

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and the ability to work collectively on all important decisions was tested. Finally, Supplier integration refers to the partnerships between the SMEs and their suppliers, the ease of sharing information between the SMEs and their suppliers and the level of involvement that the SMEs have in the development of the products (Swink, *et al*., 2007; Cousins & Menguc, 2006). The study tested the firm's level of cooperation with their suppliers. The ease with which the firms communicate with the suppliers in regards to design and quality of the products to be supplied was also tested.

From the primary data collected through online surveys, sharing information between food industry SMEs interviewed and their suppliers was found to be low. For instance, the lowest variable was S12 which tested how close the SMEs maintained communication with their suppliers regarding quality consideration and design changes scoring a mean of (4.26 out of 7). The respondents also scored the lowest (4.29 out of 7) on the item that sought to establish the extent to which the firms ensured that close communications with food suppliers is maintained (4.82 out of 7) on the item that sought to determine the extent to which the input of the key food suppliers was sought in relation to the firms' projects of product development and a mean of (5.21 out of 7) on the item that assessed whether cooperative relationships with food suppliers are maintained. This implies that SMEs in Saudi's food sector are not keen on supplier integration, a fact that was also captured from the interviews with SME CEOs. This generally implies that enhancing the level of communication between the SMEs and their suppliers is one of the aspects that SME managers in the Saudi food industry can leverage on to enhance their efficiency in mitigating demand uncertainty. Other aspects of supply chain integration that were tested also showed that more could be done to enhance integration within the firm and between the firm and its suppliers and customers. Specifically, in regards to integration with the suppliers,

it is evident that the suppliers put efforts in the SME product development at mean score (4.82 out of 7) whilst cooperative relationships with the suppliers had a mean score of (5.21 out of 7).

With regard to internal integration, data from the survey questionnaire indicates that most of the firms ensure that functions adopted by the plants are aligned with its activities (scored a mean of 5.15 out of 7). The analyses also indicate that there is high customer integration as the respondents scored high on items that sought to determine the effect of CI on mitigation of demand uncertainty. Most of the respondents agreed that they are able to mitigate demand uncertainty when their customers place orders consistent with their nominated delivery lead time (scoring 5.36 out of 7), that they mitigate demand uncertainty by providing products to our customer consistent with their nominated product specification (scoring 5.48 out of 7), that they are able to mitigate demand uncertainty when their customers provide them reliable forecasts on their demands (scoring 5.48 out of 7), and most importantly, that they are in frequent, close contact with their customers (scoring a mean of 6 out of 7). The findings indicate that Saudi SMEs in the food industry understand the importance of customer and internal integration and are able to apply these practices effectively to mitigate demand uncertainty during the peak season of Hajj. The findings indicate that customer integration and internal integration have a strong positive impact on mitigating demand uncertainty. The findings also indicate that internal integration and customer integration should be used to enhance supplier integration. These findings are similar to those found by Lai *et al.* (2010) and Zhao *et al.*, (2011).

Analyses of the interviews indicate that integration is the key enabler of business performance in the Hajj industry, a finding that is supported by Flynn *et al*. (2010). Customer integration and internal integration were also found to significantly contribute to improvement in the mitigating

demand uncertainty. A majority of the interviewees identified internal and customer integration as a bigger factor than supplier integration as far as mitigation of demand uncertainty is concerned. However, this does not imply that supplier integration is irrelevant; whilst it may not have a direct effect on business performance, it enhances the positive effect of customer integration on mitigating demand uncertainty (Zhao *et al*., 2011). The findings from the interviews imply that firms that have strong relationships with their customers have a strong SCI and are able to successfully mitigate effects of demand uncertainty and perform better than those who do not. These findings are supported by Zhao *et al*. (2011). However, there is need for the SMEs in Saudi's food sector to put in more effort in ensuring supplier integration. The interviews also reveal that SCI has a positive effect on MCC of firms as well as on postponement practice. The interviewed CEOs noted that processing customised orders in mass and delaying the customisation process until the customer has placed an order requires coordination between the firm's internal functions, the customers and the suppliers. Based on the responses from the CEOs, supply chain integration therefore has a positive effect on MCC as well as postponement practice of firms and essentially on mitigating demand uncertainty.

6.5.1 Correlation Between Supply Chain Integration (SCI) and Demand Uncertainty Mitigation (DUM)

It is quite evident that SCI would have a positive impact in mitigating demand uncertainty in general. The question then would be whether SCI would be appropriate for the Saudi Arabian food SME during peak season of Hajj. The appropriateness was tested in the primary research where data regarding aspects of integration between the different players in the supply chain was collected from relevant respondents. In essence, the importance of sharing information between

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stakeholders in any business setting can never be overstated. The importance is even more profound for the Saudi Arabian food industry's SME due to the need for agility in response during demand spikes and uncertainty during Hajj. As indicated previously in Chapter 1, there is still a gap to be filled in regards to integration between the supplier and the SMEs. For instance, communication and cooperation on product development seems to be mostly one way from the supplier to the SMEs, rather than two-way cooperation where the SMEs also play a part in determining the quality of the products developed and their design.

Data from the interview indicates that supply chain integration is key to demand uncertainty mitigation. The findings indicate that mitigation of demand uncertainty greatly depends on customer and internal integration. Most of the respondents indicated that they mitigate demand uncertainty when customers place orders consistent with their nominated delivery lead time (scored 5.36 out of 7) they mitigate demand uncertainty by providing products to customers consistent with their nominated product specification (scored 5.48 out of 7) and that they mitigate demand uncertainty when customers provide them with reliable forecasts on their demands (scoring 5.48 out of 7). According to these findings, customer integration aspect of SCI is the most important factor in mitigating demand uncertainty. Findings of the interviews conducted with the managers also reveal the significance of supply chain management in mitigating demand uncertainty. All the interviewed CEOs emphasised that there is a strong relationship between supply chain integration and demand uncertainty. They particularly stated the importance of creating strong relationships with customers and ensuring that there is coordination amongst internal functions of the firm. According to the interview findings, supply chain integration is a key aspect for SMEs in Saudi's food industry in mitigating demand uncertainty and achieving high performance during Hajj season. These findings are similar to

those found by Seo and Dinwoodie (2014), who explain that customer integration is key because it leads to more precise as well as rapid responses to customer needs and, as such, enables firms to reduce risks associated with demand uncertainties. It is however noteworthy that in addition to enhancing communication between the customers and the SMEs, other aspects of integration should also be enhanced. Specifically, the SMEs should enhance partnerships with their suppliers and customers alike and should align their internal operations to ensure that there is cooperation between internal functions in order to enhance internal integration (Koçoglu *et al*., 2011). In essence, supply chain integration is an appropriate approach for mitigating demand uncertainty for Saudi's food industry SMEs. This assertion is based on the merits of the strategy as identified from information already available in the literature review and the situation on the ground as can be identified from the data collected in the primary research of Saudi food industry SMEs.

6.6. Effects of Postponement (PP) on Demand Uncertainty (DUM)

From the literature review, Postponement (PP) is identified as a managerial strategy that can help an SME to mitigate demand uncertainty. In essence, postponement is not a new strategy in the business world today and has been implemented in numerous sectors (Yang 2009). Can (2008) defines postponement as "the process of delaying product finalisation in the supply chain until orders from customers are received with the aim of customising products, as opposed to performing those activities with the expectation of getting future orders". Postponement works by the response time to unexpected changes in demand for a product (Harrison, Lee & Neale, 2015). Essentially, the strategy reduces the risks inherent to a business and the costs that are associated with the risks and uncertainty by postponing the creation of time, place, form and ownership utilities. This part of the research will assess postponement as a management strategy

of mitigating demand uncertainty based on the synthesis of secondary information from the literature review conducted with the primary data collected. It will provide a discussion of the appropriateness of PP in mitigating demand uncertainty for SMEs in line with the research objectives and the conventions of the research's theoretical framework.

Postponement can essentially mitigate demand uncertainty amongst SMEs food industry by reducing the chances of a firm to understock or overstock (Yang & Yang, 2009). However, as Can (2012) pointed out, postponement is predominantly used to also reduce the cost implication of holding stock and distribution (Can, 2012). In its simplest form, a firm that implements PP delays the supply of its products up to the time when the client will make an order for a product rather than by speculating the potential demand. Such an approach is essentially very appropriate for the Saudi food industry case, especially those that predominantly supply to Hajj pilgrims (Long, 2012). In essence, despite the ability to speculate the number of pilgrims that would come for Hajj with a relatively small margin of error, it is quite difficult to effectively identify demand, given that the pilgrims come from very diverse societies and hence their range of demand would also be very vast and difficult to predict.

Postponement practice would make Saudi's food industry SMEs very responsive to changes in demand whilst simultaneously making the businesses very efficient in line with agility and lean concepts (Can, 2012). Depending on specific qualities that are inherent in an SME, the business may implement delays at various stages of the supply chain to attain efficiencies and be agile (Ross, 2015; Can, 2012). In this current study, primary data research with survey questionnaire tested firms' adoption of implementation of postponement practice strategy. The firms were also ranked based on intrinsic factors such as size with the number of employees being the

determining factor, age based on the date of the business registration and the firm category based on the type of food made. The findings indicate that implementing postponement practice as a strategy of supply chain managerial strategy has a positive correlation to mitigating demand uncertainty in the Saudi food retail industry. The result corresponds to the kind of information gathered in the literature review from studies by Yang & Yang (2009); Can (2012): The findings from the survey questionnaire demonstrate that majority of SMEs in Saudi Arabia's food industry adopt the postponement practice during the Hajj season. It was found that a good number of the firms' 1- postpone final packaging activities until the customer orders are received (mean score of 5.18 out of 7), 2- postpone final product assembly activities until they receive customer orders (mean score of 5.67 out 7) and 3- postpone final product-labelling activities until customer orders are received (demonstrating a mean score of 4.86 out of 6). These scores are relatively high and indicate that these firms are able to reduce some of the risks that are associated with demand uncertainty as complete processing of the orders is only carried out once the firms are in receipt of orders from the customers. The results of the data collected also indicated an average scoring for firms that mitigate demand uncertainty when their customers order consistent with their nominated delivery lead time. This provides an indication that adjusting delivery lead time through postponement strategy can mitigate demand uncertainty. Adjusting delivery times has an even bigger impact on demand uncertainty than having a reliable forecast of the customers demand based on the research findings. Essentially, PP's effect on demand uncertainty is multifaceted. In addition, the primary data results regarding Saudi's food industry SMEs postponement strategy indicate that more can be done in the implementation of the strategy. Specifically, despite the fact that the mean score for the polled SMEs indicate that most of the firms postponed final packaging of the products until the customers receive their

order, the mean score is still relatively low at 5.15 out of seven. However, the firms ranked relatively better in regards to postponing labelling and assembly of the final products before the customer receives the order. According to the research findings, SMEs in Saudi's food industry have recognise the need for delaying processing of orders until that time customer orders have been received. Ferreira *et al*. (2015) point out that delaying product processing and differentiation to the point in which demand is precisely known is an effective strategy to ensuring that orders produced are exactly what the customer needs which reduces cost as well as time. Postponement enables firms to reduce demand uncertainty by ensuring that the products are only moved once a customer order is received. This finding is also reflected by the findings from the interviews with the CEOs as all 12 agreed that that there is a strong positive relationship between postponement and demand uncertainty. The postponement strategy was in fact highlighted as one of the most effective ways of addressing demand uncertainty by firms operating in the food industry since it ensured that there was no wastage as food was only prepared once customers placed orders. The findings of this study reflect those obtained by Cholette (2009), who concluded from their study that a substantial portion of production should be held at the labelling as well as packaging level until customers' orders are received, and that this practice results in significant improvements in product profitability. This study found that postponement is an advisable strategy against various demands probabilities as well as costs and other considerations.

6.6.1 Correlation Between Postponement Practice (PP) and Demand Uncertainty Mitigation (DUM)

As identified above, postponement has a positive impact in mitigating demand uncertainty for SMEs. This part assesses the exact implications of PP on the supply chain that would add up to create the mitigating effect for a business. First, demand uncertainty has a cost implication to the firm, a factor that may impact the business's competitiveness and or the actual cost paid by the client. In regards to the impact on a firm's competitiveness, demand uncertainty increases a firm's cost of production by increasing the cost implication of overstocking (Brun & Zorzini, 2009). In most cases, this cost of implication will be passed to the customer, essentially leading to uncompetitive pricing and, by extension, lack of competitiveness for the firm. Implementing PP as a managerial strategy would mitigate demand uncertainty because it would enable a firm to better manage its supply chain and improve ability to forecast supply lead times (Ross, 2015). Availing the products in the right quantity at the right time has the best chance of improving the efficiency of a Saudi food supply SME.

The impact of implementing PP as a supply management strategy to mitigate demand uncertainty in the Saudi's food industry context is profound according to the results of the study. The positive implications that PP would have on the SMEs has been greatly elaborated in the literature review conducted above. In addition, the primary review indicates that more can be done in regards to using the postponement strategy as a way of mitigating demand uncertainty for the SMEs (Cavusoglu *et al*., 2012). Granted, there is adequate evidence that PP is used to mitigate demand uncertainty by SMEs in the Saudi Arabian food industry. However, the mean scores results indicate that more can be done. PP would work for the SMEs by reducing the costs

inherent in holding excess stock and consequently influence the competitive ability of the SMEs as elaborated in the literature review section above.

6.7. Effects of Mass Customisation Capability (MCC) on Demand Uncertainty Mitigation (DUM)

Mass customisation refers to the process where a firm makes products that suit the specification of each customer's needs at a relatively similar price as the price offered for mass-produced products (Davis, 1987). In essence, producing mass customised products keeping the prices at the same level with those that are mass produced is a bit complex. However, if successfully implemented, Mass Customisation Capability (MCC) has a high chance of mitigating demand uncertainty. According to Dyer *et al.* (1998), MCC can be identified from a firm's agility, volume effectiveness and ability to keep costs as low as possible. Further, Salvador *et al* (2004) argued that a firm can optimise its mass customisation capabilities through effective coordination of suppliers, postponing key steps until clients order for products and implementing a modularity-based manufacturing. Implementing this strategy holds much potential for Saudi Arabian food industry SMEs especially during the pilgrimage to Makkah. This section of the research synthesis the information available in the literature review regarding MCC with the data collected in the primary research. Similarly, the aim of this section is to validate MCC as a managerial strategy that has the capability to mitigate demand uncertainty for Saudi Arabia's food retail SMEs in line with the research's research objective.

As stated, it is quite difficult to produce customised products for the masses and yet charge the same prices for the products that are customised compared to mass-produced products. However, according to Lai *et al*, (2012), MCC can be achieved by attaining customisation cost efficiency,

making high volume customisations, customisation responsiveness and meeting customer's quality needs (Kull, 2015). To be effective, however, the product supplied by an organisation should be customisable in the first place. In this case, the product under review in the study context is food. In essence, food as a product can be customised to the tastes and need of the customers. This managerial strategy of mitigating demand uncertainty is, therefore, applicable to this study context. For this study, the correlation between MCC and DUM was tested using an empirical measurement that synthesised the relationship between MCC and DUM.

Before identifying the correlation between MCC and DUM, it is also worth noting that integration of supply chains through better flow of information between the supplier and firm is also critical in mitigating demand uncertainty (Koçoglu *et al*., 2011). Such integration involves both internal and external aspects of the whole supply chain. MCC, therefore, is effective when implemented in conjunction with other managerial strategies such as postponement and supply chain integration (Kull, 2015). To identify the appropriateness of implementation of MCC as a managerial strategy of mitigating demand uncertainty in the Saudi food industry this research synthesis the information acquired in the literature review section with the data from the interviews and online survey from the primary data. The following section makes this evaluation and provides a discussion into the appropriateness of MCC for the Saudi context.

From the primary data collected for this study, the ability of the SMEs to make mass customisation was profound. In fact, the capability of the SMEs to conduct large-scale product customisation ranked the highest at a mean score of 6.1 out of 7 as the respondents indicated that they are highly capable of large-scale product customisation. However, this shows just the capability but not the adoption of the strategy and capability to mitigate demand uncertainty by

the SMEs. In addition, the firms also polled a mean score 5.91 out of 7 in regards to their ability to add product variety without compromising on the quality of the products they offer. However, the ability of the SMEs polled to affect mass customisation capability and maintain the prices of mass-produced products is not as high as other mass customisation capability parameters polled. Specifically, the primary data collected ranked the ability of the firms to easily incorporate significant food product variety without the need to increase the costs of the product at 5.52 out of 7. The effect of mass customisation capability on demand uncertainty mitigation is also clearly explained by the CEOs through interviews as they all agreed that there is a strong relationship between mass customisation capabilities and demand uncertainty. The respondents explained that mass customisation of orders in a timely manner ensured that orders were only processed based on demand rather than speculations and thus helped mitigating demand uncertainty. The respondents did not however provide much information on how they are able to achieve mass customisation in their business. However, they all agreed that mass customisation together with postponement practice are the most effective strategies to gaining economies of scale in the business without affecting quality. These findings are partly supported by Zhang *et al*. (2015) who found that mass customisation capability helps reduce demand uncertainty by improving product innovation capability of the firm. Similar sentiments are echoed by Lai *et al*. (2012) who explain that mass customisation capability enables firms to attain new and innovative forms of competitive advantage. These authors however argue that for MCC to be effective in mitigating demand uncertainty there must be collaboration as well as resource integration beyond the firm's internal boundaries. This implies that supply chain integration is a mediating factor in the relationship between MCC and mitigation of demand uncertainty. Qi *et al*. (2014) also established that the mass customisation capabilities of a firm are enabled by

coordination practices of the supply chain. According to these authors, MCC enables firms to respond to survive in today's markets that are characterised by heterogeneous and ever-changing customer demands. These sentiments are also echoed by the CEOs who were interviewed as they emphasised that SCI has a strong impact on MCC as firms need to integrate customers as well as suppliers in their processes for them to effectively customise orders to meet customer needs in a timely and efficient manner. Primary data from the survey questionnaire and the interviews indicate that MCC has a strong positive impact on demand uncertainty mitigation but is mediated by other factors and, in particular, supply chain integration and postponement practice. These findings are supported by Lai *et al*. (2012); Qi *et al*. (2014); Kull (2015); and Zhang *et al*. (2015).

6.7.1 Correlation Between Mass Customisation Capability (MCC) and Demand Uncertainty Mitigation (DUM)

Implementing mass customisation capability as a managerial strategy for mitigating demand uncertainty in the Saudi Arabian food industry would also greatly impact the efficiency and competitiveness of the SMEs (Rudberg & Wikner, 2004). In essence, a mass customisation capability allows the organisation to place a lot of emphasis on the customer and their inherent needs. To be effective in mitigating demand uncertainty, a firm that implements MCC to manage its supply chain has to create an environment where an optimal balance between productivity and flexibility is attained (Thallmaier, 2014). In essence, from the data collected about the SMEs polled, this is not an issue of concern. The SMEs polled showed great capability in implementing aspects of mass customisation without impacting on quality and prices significantly. This can be attained by evaluating the balancing point between flexibility and productivity for a firm.

The relevance of implementing MCC as a supply chain management strategy for Saudi food industry SMEs is profound. In essence, identifying the balancing point helps a firm to identify what decisions can be under certainty and those under uncertainty with regards to customer demand according to (Rudberg & Wikner, 2004). The CODP model elaborates the activities that a firm can undertake as forecast driven initiatives regarding customer demand when carried under uncertainty and the activities that are purely driven by the customer's order. It also helps in identifying the speculation point (Umeda *et al.*, 2015). Identifying all these parameters is of significant importance to businesses and even more so to SMEs in the Saudi's food industry.

6.8 Conclusion

The findings of both primary data and literature review of this study indicate that SMEs in Saudi's food sector in Hajj can mitigate demand uncertainty against larger firms operating in the sector through the adoption of managerial strategies, including supply chain integration (SCI), postponement practice (PP), and mass customisation capability (MCC).

The findings obtained from the quantitative data also resulted in all the formulated objectives being accepted apart from *H6: Supplier Integration in food SMES is significantly and directly associated with mass customisation capability during Hajj and H18: Competitive Intensity enhances significantly the indirect effect of internal integration on postponement practice of food SMEs in Hajj through customer integration.* With regards to hypothesis 6, a majority of the respondents identified internal and customer integration as more of a factor than supplier integration in enhancing mass customisation capability (SI was found to be insignificantly corrected with MCC) whilst, with regards to H18, the effect of competitive intensity on internal

integration and therefore postponement practice of food SMEs in Hajj through customer integration was found to be insignificant.

Supply chain integration is found to be critical in managing demand uncertainty in SMEs in Saudi Arabian food industry. It was established that SMEs can effectively control demand uncertainty if they adequately and effectively share information with suppliers in the just in time delivery mode and establish high levels of integration with their customers. It was found that SMEs in Saudi Arabia's food industry have strong customer and internal integration mechanisms but need to put more effort in improving customer integration. SCI was found to have a positive impact in mitigating demand uncertainty and the study suggested that it would be an appropriate strategy for the Saudi Arabian food SMEs during peak season of Hajj.

Regarding postponement, the study's findings established that implementing postponement practice as a strategy of supply chain managerial strategy has a positive impact on mitigating demand uncertainty in the Saudi food retail industry. It was found that postponement practice can mitigate demand uncertainty amongst SMEs food industry by reducing the chances of a firm to understock or overstock. The study established that postponement practice would make Saudi's food industry SMEs very responsive to changes in demand whilst simultaneously making the businesses very efficient in line with agility and lean concepts.

Both the primary data and literature review indicate that mass customisation capability as a managerial strategy has the capability to mitigate demand uncertainty for Saudi Arabia's food retail SMEs. The relationship between mass customisation capabilities and demand uncertainty mitigation was however found to be mediated by other practices such as supply chain integration and postponement. It was concluded that implementing mass customisation capability as a

managerial strategy for mitigating demand uncertainty in the Saudi Arabian food industry would also greatly impact the efficiency and competitiveness of the SMEs.

The results of the study correspond to the expectations of the research study and validate the hypothesis made. From the secondary research conducted in the literature review section, there are numerous ways proposed by existing scholarly journals on how demand uncertainty can be mitigated. In essence, effective and efficient supply chain management has been significantly explored in the past, a fact that basically provides a good platform that forms the foundation for this research. This study recommended SCI, PP and MCC as adequate managerial supply models for mitigating demand uncertainty for SMEs operating in the food industry in Saudi Arabia. In essence, a comprehensive study of the available information identifies the merits of the models and the impacts that these models would have from a theoretical perspective. However, theoretical appropriateness does not always imply actual appropriateness in a practical perspective. The capability of the SMEs to implement the strategies, a test of the level of adoption of the strategy already on the ground and the possible impacts that the models would have practically is also tested in the data analysis section of this research.

As detailed in greater depth in the discussion chapter, and after a synthesis of the information obtained from both the primary and secondary reviews, it is quite evident that the models proposed would have a significant influence in mitigating demand uncertainty with specific emphasis on the case of Saudi Arabian food industry SMEs. The main shortcomings that were previously identified and validated during primary data analysis are lack of adequate integration of SMEs to the supply chain, communication deficiencies, and the inefficiencies in the predominant just in-time delivery model that is vastly adopted by the SMEs. Implementing SCI,

PP and MCC would have a positive impact on the mitigating demand uncertainty. In fact, each strategy has a positive correlation with mitigating demand uncertainty even with specific emphasis on this study context. Cumulatively, therefore, the impact of adopting all these strategies to mitigate demand uncertainty is profound. The justification for recommending implementation of all or part of these strategies is based on the fact that each model compliments the others and implementing them collectively will have a multiplier effect in mitigating demand uncertainty.

The result of the synthesis of the information from the literature review and from the data collected are a clear indication that supply chain integration (CSI), postponement (PP) and mass customisation capabilities (MCC) are effective supply managerial strategies for mitigating demand uncertainty. Further, it is clear that these strategies can be effective for this specific study context of the SMEs in the Saudi food industry, especially during Hajj. In essence, the Saudi food industry during Hajj is a very unique case where the demand for food spikes tremendously for a short period of time. Further, it is quite complicated to focus the exact products that will be demanded during the spike in demand due to the fact that the Hajj pilgrims are unique visitors with potentially different needs.

Such uncertainty greatly leads to inefficiencies and competitiveness of the Saudi Arabian SMEs which operate within the food industry. The inefficiencies results from either the opportunities lost as a result of under stocking or the excess costs arising from holding excess stock. Given the importance that the Hajj festival holds to the Kingdom of Saudi Arabia both economically and religiously, a great need of mitigating the inefficiencies and competitiveness of the SMEs within the food industry exists. It is this ideal that formed the motivation for seeking ways to identify

managerial strategies that would mitigate demand uncertainty, especially during the Hajj season. In the discussion section, this research study synthesised the information from the literature review and the primary data collected in order to validate the managerial strategies that are recommended for this specific case and form an informed opinion regarding the research question.

In conclusion, the strategies recommended for mitigating demand uncertainty for this specific study context are appropriate and would have a significant impact. In essence, each of the strategies identified can mitigate demand uncertainty and in fact have a positive correlation. However, it would be prudent for SMEs to implement the strategies collectively with small variation to suit the business characteristics. This would essentially enable the firm to benefit from the multiplier effect of collective implementation of the strategies. The limitation of the scope of the study is also identified above. The following are areas that future researchers can explore. It is worth noting that the recommendations for future research are based on the limitations of the scope of this research.

CHAPTER 7: CONCLUSIONS

7.1 Introduction

This chapter serves to reaffirm the statements made in this study, provides a brief description of the findings made by the research, elaborates how the researcher arrived at the findings and conclusions made, describes the potential influences and limitations of the research and identifies areas that further researchers can focus on. Specifically, the current research study sought to identify how SMEs can mitigate demand uncertainty through supply chain strategies using SMEs in the Saudi food industry during the Hajj pilgrimage as the context. It sought to identify ways how SMEs in the Saudi Arabian food industry can mitigate demand uncertainty during the Hajj season using supply management strategy. The rationale for conducting the study was based on the fact that proper inventory management directly influences the profitability and success of a business but even more profoundly for SMEs. There are multiple methods and management strategies that can help a business manage its inventory to ensure it does not carry excess stock and does not lose opportunities due to stock running out (Field *et al*., 2006). However, for the case of Saudi Arabian SMEs which operate in the food industry, holding optimal stock is complicated by demand uncertainty, specifically during major festivities such as the Hajj pilgrimage. This chapter provides an outlook on the results achieved and how the researcher attained the results and provides recommendations regarding the application of the results and opportunities for further analysis.

Furthermore, the motivation for conducting the study was to identify ways of mitigating demand uncertainty by food industry SMEs in Saudi Arabia. Hajj refers to the pilgrimage that all Muslims with the ability are required to undertake at least once in a lifetime. Demand for food

during Hajj is extremely difficult to predict. The primary reason that creates demand uncertainty is the fact that the pilgrims who come and other pilgrimages in Saudi Arabia are from very diverse backgrounds and from different parts of the world; a factor that complicates predicting the exact kinds of food that they will demand. This phenomenon essentially hinders SME's ability to predict the amount of optimum inventory and predisposes them to inefficiencies arising from cost implications of holding stock or opportunity lost due to lack of adequate inventory. Hajj is a critical event for Saudi Arabia due to its religious value and the economic impact.

7.2 Key Findings

The specific research objective was to investigate how SMEs in the Saudi food sector could mitigate demand uncertainty in order to enhance their sustainability and increase their competitiveness against the major food companies. The research proposed the use of managerial strategies such as supply chain integration (SCI), postponement practice (PP) and mass customisation capabilities (MCC) (Can, 2012). The researcher then embarked on a review of available literature in order to verify the viability of the proposed managerial strategies in not only mitigating demand uncertainty, but also mitigating demand uncertainty with specific emphasis on Saudi Arabia's food industry SMEs during Hajj.

The literature review section of the current research study explored major aspects of the study in great depth, with the aim of justifying SCI, PP, and MCC as the most viable models of mitigating demand uncertainty in the context of the Hajj season. From the review, it is evident that major impediments to effective determination of the quantities as well as quality of food demanded in Saudi Arabia exist, especially during the Hajj pilgrimage. First, there were major constraints by the Saudi government's policy against exportation of perishable foods into the country. This

constrained the availability of major food supplies, such as fruits, dairy products, and water amongst others that are in great demand during the Hajj festivities. Another factor that greatly impedes the ability of SMEs to effectively focus demand is with regard to the diversity and numbers of visitors. For instance, from the literature that was evaluated, hundreds of thousands attend the pilgrimage to Makkah from all over the globe. Forecasting the food needs and demand for such a diverse crowd is often very difficult and especially more so for SMEs as was identified in the literature review.

The research also explored how the proposed management strategies would impact demand uncertainty in general. This was done by reviewing literature on supply chain integration, postponement practice and mass customisation capabilities on demand uncertainty mitigation. The primary aim of adopting supply chain management strategies as the ideal methods of addressing demand uncertainty for this case was based on the belief that better management of the food supply chain would enhance the ability of SMEs to mitigate the effects of demand uncertainty (Baofeng, 2012). The goal was to identify management strategies that would link the chain of networks in the supply chain, enhance communication and cooperation along the chain and enhance the upstream and downstream linkages within the supply chain.

In addition to the literature review, this study also conducted a number of interviews with the primary aim of verifying the information collected from the literature review and in identifying the appropriateness of the proposed managerial strategies for this specific case. Semi-structured interviews were conducted with twelve CEOs of various SMEs operating in the Saudi food industry. The goal of the interviews with the CEOs was to gather qualitative data about the status of the food industry in Saudi Arabia, especially for SMEs during Hajj. In addition, the interviews

also sought to validate the information from the literature review by providing a quantitative assessment based on six constructs; customer integration, internal integration, supplier's integration, postponement practices, mass customisation capabilities and demand uncertainty mitigation.

From the synthesis of the information from both the secondary data collected through the literature review and primary data, the impacts of the proposed managerial strategies in mitigating demand uncertainty in the Saudi food industry is profound. Specifically, supply chain integration, postponement practice and mass customisation capability were identified as valid methods of mitigating demand uncertainty, especially during Hajj with the aim of enhancing the SMEs competitive intensity (Laiinez-Aguirre & Puigjaner, 2014). The control variables were the firm age, size and production type. Essentially, with an efficient supply chain where the retailers, producers and all the other players within the food supply chain shared information perfectly, the just in time delivery model can effectively mitigate the impacts of demand uncertainty (Cavusoglu *et al*., 2012). However, the primary review indicated that the Saudi food supply chain was not as it should be integrated and that most of the SMEs had not properly adopted postponement and mass customisation strategies as demand uncertainty mitigation tools.

The results of the literature review and primary data collected validate the use of SCI, PP and MCC as tools for mitigating demand uncertainty (Can, 2012; Field *et al*., 2006). From the findings, SCI, PP and MCC are viable management strategies for mitigating demand uncertainty, especially based on the results of the primary review which indicate a lack of accurate integration within the supply chain, a lack of use of perfect postponement and mass customisation in mitigating demand, hence validating the researcher's recommendation of the

strategies in mitigating demand uncertainty (Al-Awwaad, 2007). Customer and supply integration initiatives will enhance the efficiency and agility of the Saudi food supply chain and consequently enhance the ability of the SMEs to adopt inventory management strategies, such as just in-time delivery, better which would adequately mitigate demand uncertainty.

However, adopting postponement would enable the SMEs to overcome the cost implications of holding excess stock by delaying product finalisation until the time when the products are required by customers. The cost of holding excess stock and or disposing it is an issue of major concern and greatly impedes the ability of food SMEs to become efficient and effective. Postponement, therefore, would enhance the competiveness of the SMEs by directly reducing inefficiencies in holding inventory. Finally, mass customisation capabilities would enhance the SME's agility, diversity, volume effectiveness and enhance their ability to keep the costs as low as possible (Kull, 2015).

To achieve maximum effectiveness, the researcher proposed the adoption of the three strategies together. In essence, each of the strategies proposed addresses major aspects of the Saudi food supply chain that inhibit the ability of the SMEs to mitigate demand uncertainty and the collective adoption of all the strategies would complement the effectiveness of each other. For instance, supply chain integration eradicates the inefficiencies in the supply chain through enhanced communication with the producers and the end consumers. However, postponement and mass customisation capabilities enhance SME's agility and responsiveness and enable them to attain supply cost and volume effectiveness (Laiinez-Aguirre & Puigjaner, 2014).

Although the results indicate that food SMEs in Saudi Arabia apply management practices, it is not clear how well they have adopted and implement these practices. Studies show that most of

them rarely implement management practices in full. Manoj *et al*. (2013b), for example, examined the status of food quality management systems in food SMEs in Europe to determine the factors that motivate or hinder successful implementation of these systems. The study established that food SMEs do not implement quality management systems in spite of the fact that these systems are associated with low production costs and increased productivity. Lack of training and knowledge were identified as the main factors that hinder implementation of quality management systems in food SMEs (Manoj *et al*., 2013b).

7.3 Significance and Contribution of the Research

7.3.1 Theoretical Contribution

The research centred on investigating and examining the link between external and internal integration, and its interaction with the postponement practice and mass customisation capability to mitigate demand uncertainty amongst SMEs during the period of the Hajj season and contributes significantly to the body of knowledge on demand uncertainty in SMEs context as well as theory. The findings from the present work show that SCI has a significant effect on postponement practice, where the interlink between the SCI types have shown to mitigate demand uncertainty. First, a direct and positive effect on postponement is seen as a result of internal integration, which is a finding seen to be aligned with various works, all of which highlight the value of internal integration to postponement (Waller *et al*., 2000; Towill *et al*., 2000). Through breaking down and dividing conventional silos and accordingly inspiring and sanctioning learning across a wealth of various firm functionalities and asset combination, the activities pertaining to internal integration encourage and facilitate the use of inside firm assets and are proficient in such a way that they can efficiently ensure postponement and mass

customisation capability (Towill *et al.*, 2000). This finding is recognised to be in support of the RBV theory. In the KSA, it is therefore recognised that SMEs are required to coordinate, collaborate and cooperate with their varied processes, resources, equipment and people in the preparation, packing, processing, preserving and storing of foods throughout the season of Hajj. All SMEs need to examine a number of different aspects of postponing activities, and accordingly make the decision as to when, where and how they can integrate postponement within their internal functionalities.

Secondly, a direct and positive effect on postponement and mass customisation capability is recognised as a result of customer integration, which further supports the results from crucial studies that validate the effects of customer integration on postponement as well as mass customisation capability (Towill *et al.*, 2000). A number of pivotal competencies and skills required in the business domain can be picked up by producers through ensuring the coordination of both outer and inner assets from production network accomplices, particularly from customers, thus providing the ERBV with experimental validation. Such a finding is recognised as reliable in line with the administration predominant rationale that suggests there is a need for the producer to assume network partners adopt the role of asset integrator and concrete esteem (Vargo & Lusch, 2008). When considering that the supply chain aim is concerned with the management of customer requirements in terms of fulfilling their needs and accordingly assessing market characteristics, it then may be seen that customer integration adopts a pivotal role in business success (Stevens, 1989). When considering that there is much dependence of postponement practice on the input of customers in the fabrication of an organisation's processes and products, Saudi-based SMEs in the food sector should carry out market research centred on reviewing and analysing historical data concerning the Hajj pilgrims' food preferences and

nationalities which express the use of mass customisation capability strategy. This can be achieved through the use of cross-sectional data collection from travel agencies or otherwise through KSA's Department of Tourism. For example, when considering the cross-sectional data, SMEs will be well positioned to choose to assemble raw materials that are based on the market input and built to stock; these are then accordingly assembled by the firm in order to create the final product (Ogawa & Piller, 2006) in line with the needs and preferences of the customer.

Third, a positive and direct effect on postponement is witnessed as a result of supplier integration, which again is seen to be in line with past works carried out in the context of the supply chain (Feitzinger & Lee, 1997; Van Hoek, 1998) and also in alignment with a number of works by Fine & Freund (1990), Vesanen (2007), Kumar (2007), Mikkola & Skjott-Larsen (2004), Prasad *et al*. (2005) and Yang *et al*. (2005) in the domain of supplier integration, which emphasise the advantages and role adopted by supplier integration in the field of supply chain networks.

A supplier network is considered fundamental to effective postponement application when it is able to supply administrations and parts. Accordingly, suppliers could also be included in item improvement as a sound, strong information supply unit in the arena of modules and parts. Combining the three tiers of the supply chain, the conclusion may be drawn that SCI has a direct and positive impact on postponement. In the Kingdom of Saudi Arabia, it is necessary for SMEs to establish strong links with their individual suppliers in an effort to ensure a consistent supply of raw materials and/ or food products is maintained, which can be achieved through trust and loyalty. Through gaining insight into the relationships with suppliers, SMEs also can position their varied requests in relation to their postponements and also may outline their needs across

different suppliers, without affecting their own and their supplier's performance, and accordingly managing customers and the bullwhip at one time.

Fourth, internal integration is recognised as having a positive effect on supplier and customer integration, which also is seen to be in support of past evidence and literature (Zhao *et al*., 2011; Braunscheidel & Suresh, 2009; Koufteros *et al*., 2005). Moreover, the findings garnered by the study suggest that there is a significant, indirect effect on postponement as a result of internal integration, which is seen through the improvement of supplier and customer integration. This provides clear insight to the fact that the supply chain integration foundation is initiated through internal integration. This further ensures that effective supply chain integration, without significant efforts directed towards establishing strong buyer–supplier relationships, are restricted and of very limited value, or otherwise may be wasted.

Fifth, in the present study, the incorporation of the contingent factor of competitive intensity has proven that, through supplier integration, there is a significant and indirect effect of competitive intensity from internal integration on postponement practice. These results show that, through supplier integration, competitive intensity improves organisations' operational levels and further allows the internal functions of the business to be integrated, thus helping to create the necessary effects in regard to the postponement practice. The supply chain literature emphasises that SMEs located in Saudi Arabia are better able to focus on supplier integration as opposed to customer integration; postponement practices, however, depend on competitive intensity. Such aspects highlight the conclusive role adopted by competitive intensity in supply chain integration, postponement practice and mass customisation capability, as illustrated during the stage of hypotheses development in the present work.

Sixth, a direct and positive effect on demand uncertainty is apparent as a result of postponement and mass customisation capability. This is in line with past works, which have highlighted postponement practices and mass customisation capability; applicability in regard to management uncertainties (Koh *et al*., 2007), and eventually removes uncertainties (Taylor, 2004). Pivotal in insulating upstream supply chain aspects from final customer demand, fundamental interventions in the types and tiers of supply chain are induced through postponement as well as mass customisation capability, which mitigate or otherwise completely eradicate uncertainties (Waters, 2007).

7.3.2 Managerial/ Practical Implications

This study has significant practical implications as it provides more insight on how the efficiency and ability of the Saudi food industry SMEs in the Hajj can be enhanced to improve their competitiveness and performance. Since the role that SMEs plays in Saudi Arabia and the religious and economic significance of Hajj to Saudi Arabia cannot be overstated, the results of this study can be used as a reference for enhancing the efficiency of SME in the food industry and other related consumer good supply sectors.

The findings of the current research are pivotal to those SMEs operating in the food sector overall, as well as those specifically affected by seasonal events such as Hajj, which are distinguished by their large number of options, short lead times and uncertain levels of demand. This is because they empirically validate use of SCI, PP and MCC as viable managerial strategies of mitigating demand uncertainty in the food industry. These findings can be used as a reference on how SMEs in the Saudi food industry can mitigate demand uncertainty during Hajj by effective supply chain strategies. In addition, the study results can be adopted for other SMEs

supplying consumer goods during the Hajj festival. However, further investigation and studies can focus on other methods that can be adopted to mitigate demand uncertainty in the same industry, or how the proposed strategies can be adopted to mitigate demand uncertainty by SMEs in the other consumer goods industry during Hajj.

7.4 Limitations of the Study

It is, however, worth noting that this study was limited in scope both in regards to the recommendations provided for mitigating demand uncertainty and in the target businesses. Specifically, the research only recommended the adoption of SCI, PP and MCC in mitigating demand uncertainty. The rationale for restricting the research scope to these managerial strategies was to reduce the ambiguity of the recommendations and was based on the specific problems that created demand uncertainty in the Saudi food industry. The recommendations were based on the contingency theory that asserts the need for an organisation to align its processes and strategies to its environment and the resource-based view theory which asserts that a business's competitive advantage is held in its efficient application of both its tangible and intangible resources. There are multiple other strategies that can be used to mitigate demand but the recommended strategies are the most viable given the general circumstances. The adaptability of the findings of the current study are, to the same extent, limited to the case of Hajj and more information may be needed before adopting the recommendation to cases other than the one used in this research. Similarly, it is vital to also do more research before adopting these strategies for firms in the same industry that do not fit into the description of a small and medium size Enterprise (SME). It is worth noting that the current research study also did not use a representative sample and as such the findings may suffer from statistical errors.

7.5 Directions for Future Research

The information that is currently available about mitigating demand uncertainty in general and for SMEs and now how managerial strategies, such as supply chain integration, postponement, and mass customisation capabilities can help a firm to mitigate demand uncertainty is vast. However, there are still so many aspects of the study that can be explored further. This section of the research recommends the areas that future research will address the subjects of mitigating demand uncertainty, using the managerial strategies recommended to mitigate demand uncertainty amongst other areas that fell beyond the scope of this research.

During the Hajj season, it is not only the demand for food that is uncertain. In fact, this problem is experienced by all providers of consumer that are predominantly used during the season. Granted, most of the dynamics of operations may vary slightly making it possible to better focus demand. However, the problem of demand uncertainty is still rife and SMEs in these subsectors may be inefficient due to the huge costs of holding stock or suffer from lost opportunities. Further research can be done on how SCI, PP and MCC can be adopted for the varying situations in different industries, especially those that provide consumer goods to Hajj pilgrims.

As identified in the weakness section, the current research is limited in scope to SMEs in Saudi Arabia's food industry. Further research can be done to identify how the supply chain management strategy can be applied to different scenarios. For instance, studies can be conducted on how the same strategies can be adopted by larger firms operating in the same industry. Further, study also recommends the analysis of the effectiveness of these research findings to other SMEs that supply consumer goods other than food during the Hajj season.

7.6 Conclusion

In conclusion, this study has validated the use of SCI, PP and MCC as viable managerial strategies of mitigating demand uncertainty in the Saudi Arabian food industry during Hajj. The food demands during the Hajj pilgrimage are unique primarily due to the diversity of the people who come for the pilgrimage. In addition, mitigating demand uncertainty during Hajj especially by pilgrims is often difficult due to lack of an integrated supply chain and inability of SMEs to adopt efficient supply management techniques. As already shown, adopting SCI, PP and MCC would significantly eliminate these inefficiencies and consequently enhance the ability of the SMEs in the industry to compete effectively with larger companies. As recommended, the strategies should be adopted collectively in order to enhance their complementarity and because they are targeted at specific problems in the supply chain.

The study can be used as a reference on how SMEs in the Saudi food industry can mitigate demand uncertainty. In addition, the study results can be adopted for other SMEs supplying consumer goods during the Hajj festival. However, further investigation and studies will focus on other methods that can be adopted to mitigate demand uncertainty in the same industry, or how the proposed strategies can be adopted to mitigate demand uncertainty by SMEs in the other consumer goods industries during Hajj.

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APPENDIX (1): INTRODUCTORY LETTER AND QUESTIONNAIRE

<u>**Demand Uncertainty Mitigation through Management Practices to Improve Supply Chain Performance;**</u>

<u>**The Case of SMEs Food Industry in Hajj Season**</u>

Dear Participant,

I am a doctoral study researcher at the University of Brunel, faculty of business in the UK. I am currently conducting a study of demand uncertainty mitigation to boost supply chain performance. As part of my thesis, I am preparing a survey to discover how producers, supplier, and manufacturers can cope with demand uncertainty through supply chain strategies and practices. I am aware that your time is extremely valuable. In return for your help, I will provide you with the summary of my findings. I undertake to maintain complete confidentiality and anonymity.

Through this study, I am interested in identifying your personal perception, experience and practices process in the area of choosing supply chain integration, postponements, mass customisation capability to mitigate demand uncertainty in case of SMEs food industry in Hajj season.

Your participation is voluntary and you have the right to withdraw at any stage of the study. All information provided by you will be treated as strictly confidential and will only be used for the purposes of scientific research.

The questionnaire is designed to be user-friendly. There is no "right" or "wrong" answers. It will take only 7 to 10 minutes to be completed. I hope you can answer all questions honestly and clearly, as the cooperation with me in completing this study will contribute to its success.
If you have any concerns or questions about the survey or require further details, please contact me at**:**

Mohammed.Nashar@brunel.ac.uk

Accept my sincere thanks and gratitude for the precious time that you participated in this study.

Yours Sincerely,

Mohammed Nashar

PhD Researcher
Brunel Business School,
Brunel University
London
UK

SECTION 1. Personal Information:

Please tick the relevant box and answer the following questions

1. Gender ☐ Male ☐ Female
2. Age …………………………………….
3. Education level ☐ Vocational/technical college ☐ Bachelor's degree
☐ Master's degree or equivalent ☐ PhD or equivalent ☐ Other, please specify ……………………………………….
4. Nationality
☐ Saudi ☐Other, please specify …………………………………………
5. Place of Residence
☐ KSA ☐Other, Please specify …………………………………………….
6. Your current job position
☐ CEO ☐ Vice Presidents ☐ Productions' manager ☐ Campaigns' president ☐ Other, please specify ……………..
7. How long have you been in your current position? ………………………………………. Years

8. How long have you been working with your current employer? ………………………… Years

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SECTION 2.Organisation Details:

1. What is the type of your business organisation?
☐ Multi-National Corporation (MNC) ☐ Large Local Enterprises
☐ Small and Medium Enterprises (SME) International ☐ Small and Medium Enterprises (SMEs) National

2. What sector does the organisation belong to? ☐Hajj Campaign☐ Food Manufacturer ☐ Food Provider ☐ Other, please specify ……………………………………….
3. Where is your office located? ☐ Headquarter/Head Office☐ Subsidiary/Branch☐ Other, please specify………………………………………………

SECTION 3. Managerial Strategies:

1. Has your organisation considered supply chain integration as strategy to mitigate demand uncertainty?
☐ Yes ☐ No (If No please specify your Strategy or Practice) ……………………………………….
2. Has your organisation considered postponement practices as strategy to mitigate demand uncertainty? ☐Yes ☐
No (If No please specify) ……………………………………….
3. Has your organisation applied mass customisation capability to mitigate demand uncertainty?
☐ Yes ☐ No (If No please specify) ……………………………………….

4. Has your organisation involved in Hajj Operation for food provision?
☐ Yes ☐ No

7. What is the definition or the concept of the following in your organisation?

Customisation:
………
…… .

Postponements:
………
……..

Supply Chain Integration:
………
………..

Demand Uncertainty Mitigation:
………
………..

SECTION 4.Customer Integration:

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Disagree	Agree	Strongly Agree

#		Strongly disagree	Disagree	Neutral	Agree	Somewhat Disagree	Agree	Strongly Agree
1.	We are in frequent, close contact with our customers.	1	2	3	4	5	6	7
2.	Our customers are actively involved in our product design process.	1	2	3	4	5	6	7
3.	Our customers involve us in their quality improvement efforts.	1	2	3	4	5	6	7
4.	We work as a partner with our customers.	1	2	3	4	5	6	7

SECTION 5. Internal Integration:

#		Strongly disagree	Disagree	Neutral	Agree	Somewhat Disagree	Agree	Strongly Agree
1.	The functions in our plant are well integrated.	1	2	3	4	5	6	7
2.	Our plant's functions coordinate their activities.	1	2	3	4	5	6	7
3.	Our top management emphasises the importance of good inter-functional relationships.	1	2	3	4	5	6	7
4.	Management works together well on all important decisions.	1	2	3	4	5	6	7

SECTION 6. Supplier Integration:

#		Strongly disagree	Disagree	Neutral	Agree	Somewhat Disagree	Agree	Strongly Agree
1.	We maintain cooperative relationships with food suppliers.	1	2	3	4	5	6	7
2.	We maintain close communications with food suppliers about quality considerations and design changes.	1	2	3	4	5	6	7
3.	Our key food suppliers provide input into our product development projects.	1	2	3	4	5	6	7
4.	We strive to establish long-term relationships with food suppliers.	1	2	3	4	5	6	7

SECTION 7. Postponement practices: Until customer orders have been received,

#		Strongly disagree	Disagree	Neutral	Agree	Somewhat Disagree	Agree	Strongly Agree
1.	Our firm postpones final product assembly activities.	1	2	3	4	5	6	7
2.	Our firm postpones final product-labelling activities.	1	2	3	4	5	6	7
3.	Our firm postpones final packaging activities.	1	2	3	4	5	6	7
4.	Our firm postpones the forward movement of goods.	1	2	3	4	5	6	7

5. SECTION 8. Mass Customisation Capability:

#		Strongly disagree	Disagree	Neutral	Agree	Somewhat Disagree	Agree	Strongly Agree
1.	We are highly capable of large-scale product customisation.	1	2	3	4	5	6	7
2.	We can easily add significant food product variety without increasing costs.	1	2	3	4	5	6	7
3.	We can customise food products whilst maintaining high volume.	1	2	3	4	5	6	7
4.	We can add food product variety without sacrificing quality.	1	2	3	4	5	6	7
5.	Our capability for responding quickly to customisation requirements is very high.	1	2	3	4	5	6	7

SECTION 9. Demand Uncertainty Mitigation:

#		Strongly disagree	Disagree	Neutral	Agree	Somewhat Disagree	Agree	Strongly Agree
1.	Our forecasted demand volume consistent with our customers place orders.	1	2	3	4	5	6	7
2.	Our customers place orders consistent with their nominated delivery lead time.	1	2	3	4	5	6	7
3.	We can provide products to our customer consistent with their nominated product specification.	1	2	3	4	5	6	7
4.	Our customers provide us reliable forecasts on their demands.	1	2	3	4	5	6	7
5.	We are committing with our customers demand forecasts.	1	2	3	4			
6.	Our forecasts are consistent with our customers' actual demands.	1	2	3	4	5	6	7
7.	We are confident about our ability to respond to sudden change in demand to our products.	1	2	3	4	5	6	7

SECTION 10. Competitive Intensity:

		Strongly disagree	Disagree	Neutral	Agree	Somewhat Disagree	Agree	Strongly Agree
1.	We are in a highly competitive industry.	1	2	3	4	5	6	7
2.	Our competitive pressures are extremely high.	1	2	3	4	5	6	7
3.	Competitive moves in our market are slow and deliberate, with long time gaps between different companies' reactions.	1	2	3	4	5	6	7
4.	We do not pay much attention to our competitors.	1	2	3	4	5	6	7

Thank you for taking part in completing the questionnaire

If you have any further comments or suggestions about the survey, please contact <u>Mohammed.Nashar@brunel.ac.uk</u> or indicate them below:

……

………

………

………

………

INTERVIEW QUESTIONS

Company Name:

Participant name and job title:

SECTION A: BASIC COMPANY INFORMATION

In order to help the participants feel at ease, the interviews will begin by enquiring about his or her company's background.

Q1: What kind of business does your company do?

Q2: How many employees are there in your company?

Q3: How many suppliers does your company have at this moment?

Q4: In which countries are your suppliers based?

Q5: In general, what do you think about supply chain integration? Do you value the idea of having a close and good business relationship with your suppliers and customers?

Q6: Do you have issues/Problems with demand uncertainty mitigation during Hajj season regarding to provide food? How you can mitigate it?

7: What strategies are currently used by your company to mitigate demand uncertainty during Hajj season regarding food providing?

Q8: In general, what are the alternative activities and mechanisms that may be employed to deal with demand uncertainty mitigation during Hajj?

SECTION B: RESEARCH FRAMEWORK

In order to validate the conceptual framework, the interviewer shows the model to the participant and asks him/ her to comment on it.
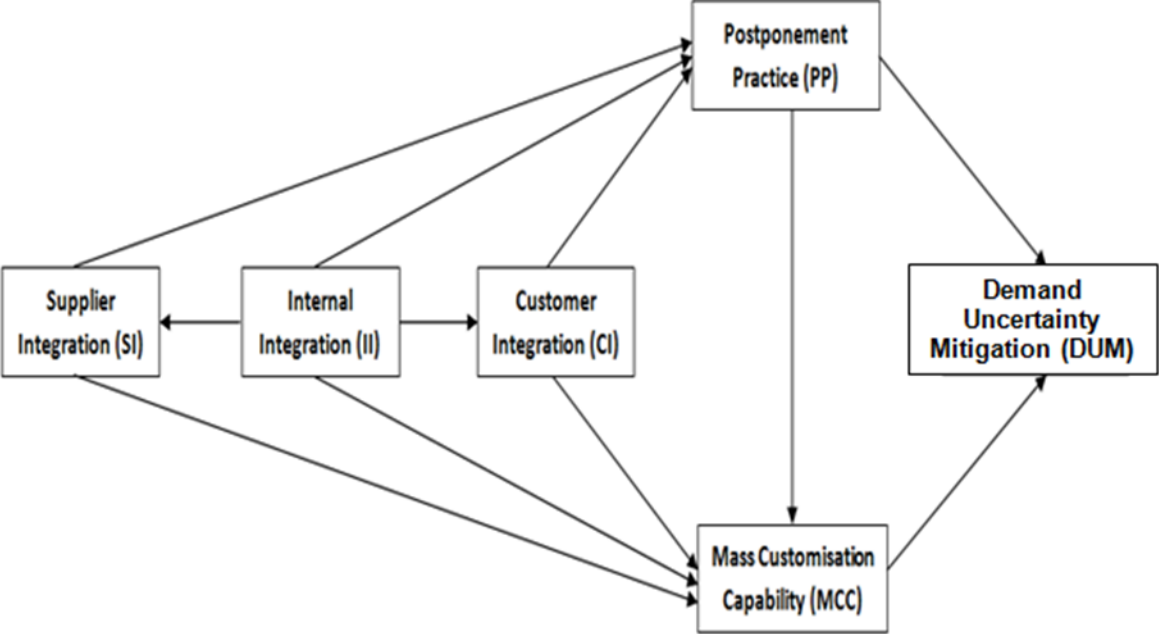
Q1: Do you agree with the linkages between the four constructs? If not, please can you comment further?

Q2: What do you think about the impact of supply chain integration on postponement practices? Please comment.

Q3: What do you think about the impact of between supply chain integration on mass customisation capability? Please comment.

Q4: What do you think about the impact of between supply chain integration on demand uncertainty? Please comment.

Q5: What do you think about the impact of postponement practices on mass customisation capabilities? Can you give an example?

Q6: What do you think about the impact of postponement on demand uncertainty? Please comment.

Q7: What do you think about the impact of mass customisation capabilities on demand uncertainty? Please comment.

Q8: What do you think if supply chain integration, or customisation capabilities, or postponement is taken out form this model, how firms can mitigate demand uncertainty during Hajj season when providing food to pilgrims?

Thank you very much for your time and your input. Your confidentiality is guaranteed.