IMPROVING
COLLABORATIVE FORECASTING PERFORMANCE
IN THE FOOD SUPPLY CHAIN

A thesis submitted for the degree of

DOCTOR OF PHILOSOPHY

by

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Abstract

The dynamic structure of the Food Supply Chain (FSC) distinguishes itself from other supply chains. Providing food to customers in a healthy and fresh manner necessitates a significant effort on the part of manufacturers and retailers. In practice, while these partners collaboratively forecast time-sensitive and / or short-life product-groups (e.g. perishable, seasonal, promotional and newly launched products), they confront significant challenges which prevent them from generating accurate forecasts and conducting long-term collaborations. Partners' challenges are not limited only to the fluctuating demand of time-sensitive product-groups and continuously evolving consumer choices, but are also largely related to their conflicting expectations. Partners' contradictory expectations mainly occur during the practices of integration, forecasting and information exchange in the FSC.

This research specifically focuses on the Collaborative Forecasting (CF) practices in the FSC. However, CF is addressed from the manufacturers' point of view, when they collaboratively forecast perishable, seasonal, promotional and newly launched products with retailers in the FSC. The underlying reasons are that while there is a paucity of research studying CF from the manufacturers' standpoint, associated product-groups decay at short notice and their demand is influenced by uncertain consumer behaviour and the dynamic environment of FSC. The aim of the research is to identify factors that have a significant influence on the CF performance. Generating accurate forecasts over the aforementioned product-groups and sustaining long-term collaborations (one year or more) between partners are the two major performance criteria of CF in this research.

This research systematically reviews the literature on Collaborative Planning, Forecasting and Replenishment (CPFR), which combines the supply chain practices of upstream and downstream members by linking their planning, forecasting and replenishment operations. The review also involves the research themes of supply chain integration, forecasting process and information sharing. The reason behind reviewing these themes is that partners' CF is not limited to forecasting practices, it also encapsulates the integration of chains and bilateral information sharing for accurate forecasts. A single semi-structured interview with a UK based food

manufacturer and three online group discussions on the business oriented social networking service of LinkedIn enrich the research with pragmatic and qualitative data, which are coded and analysed via software package QSR NVivo 9.

Modifying the results of literature review through the qualitative data makes it possible to develop a rigorous conceptual model and associated hypotheses. Then, a comprehensive online survey questionnaire is developed to be delivered to food manufacturers located in the UK & Ireland, North America and Europe. An exploratory data analysis technique using Partial Least Squares (PLS) guides the research to analyse the online survey questionnaire empirically. The most significant contributions of this research are (i) to extend the body of literature by offering a new CF practice, aiming to improve forecast accuracy and long-term collaborations, and (ii) to provide managerial implications by offering a rigorous conceptual model guiding practitioners to implement the CF practice, for the achievement of accurate forecasts and long-term collaborations.

In detail, the research findings primarily emphasise that manufacturers' interdepartmental integration plays a vital role for successful CF and integration with retailers. Effective integration with retailers encourages manufacturers to conduct stronger CF in the FSC. Partners' forecasting meetings are another significant factor for CF while the role of forecasters in these meetings is crucial too, implying forecasters' indirect influence on CF. Complementary to past studies, this research further explores the manufacturers' various information sources that are significant for CF and which should be shared with retailers. It is also significant to maintain the quality level of information whilst information is shared with retailers. This result accordingly suggests that the quality level of information is obliquely important for CF.

There are two major elements that contribute to the literature. Firstly, relying on the particular product-groups in the FSC and examining CF from the manufacturers' point of view not only closes a pragmatic gap in the literature, but also identifies new areas for future studies in the FSC. Secondly, the CF practice of this research demonstrates the increasing forecast satisfaction of manufacturers over the

associated product-groups. Given the subjective forecast expectations of manufacturers, due to organisational objectives and market dynamics, demonstrating the significant impact of the CF practice on the forecast satisfaction leads to generalising its application to the FSC. Practitioners need to avail themselves of this research when they aim to collaboratively generate accurate forecasts and to conduct long-term collaborations over the associated product-groups.

The benefits of this research are not limited to the FSC. Manufacturers in other industries can benefit from the research while they collaborate with retailers over similar product-groups having a short shelf life and / or necessitating timely and reliable forecasts. In addition, this research expands new research fields to academia in the areas of the supply chain, forecasting and information exchange, whilst it calls the interest of academics to particular product-groups in the FSC for future research. Nevertheless, this research is limited to dyad manufacturer-retailer forecast collaborations over a limited range of product-groups. This is another opportunity for academics to extend this research to different types of collaborations and products.

Key words: Food industry; Collaborative forecasting; Forecast satisfaction; External integration; Internal integration; Group forecasting; Forecasters; Information types; Information quality

Publications based on this research

Journal publications:

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Conference proceedings:

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Awards based on this research

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Declaration

I hereby declare that I am the only author of this thesis, and this thesis does not include any material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma in this or any other university.

I declare that the idea of exploring research problems and the development of this comprehensive thesis, namely *Improving Collaborative Forecasting Performance in the Food Supply Chain*, are entirely my own work. I also certify that the effort that has been put into through the review of literature, data collection and analysis, and reporting belongs to me. Therefore, the thesis does not infringe on copyrights of anyone nor violate any proprietary rights, including any ideas, techniques, quotations, or any other material from the work of other authors. Wherever contributions of other authors are involved in this thesis, a particular attention has been paid to indicating this in accordance with academic rules.

I also certify that all information shared in this thesis has been obtained and conveyed to the reader in conformity with ethical procedures.

Can Eksoz

LIST OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1: INTRODUCTION

1.1. Background of CPFR

Collaborative Planning, Forecasting and Replenishment (CPFR) is one of the efficient business practices that underpins the process management and information sharing activities between partners for better demand visibility in supply chains (Siefert, 2003). The history of CPFR dates back to 1996, when Wal-Mart and Warner-Lambert in the USA incorporated three sub-stages of planning, forecasting and replenishment in a joint project. Several reasons led to the development of CPFR, such as reducing inventory level, comparing sales and forecasts, taking timely decisions and providing homogeneity among supply chain members (Ireland and Crum, 2005).

A number of studies have been conducted on CPFR and its components in several industries (Sari, 2008; Småros, 2007; Danese, 2007; Aviv, 2007; 2002; 2001). However, case studies concluded that manufacturers and retailers cannot accomplish accurate Collaborative Forecasting (CF) for the long-term, for a period of one year or more, when time-sensitive and / or short-life product-groups are subject to collaborations in the Food Supply Chain (FSC) (Småros, 2007). In essence, FSC is a challenging platform for partners in terms of conducting long-term collaborations (Småros, 2003). Generating accurate forecasts becomes even more difficult when perishable, seasonal, promotional and newly launched products are taken into account (Adebanjo, 2009; Du *et al.*, 2009; Småros, 2007; Adebanjo and Mann, 2000).

Literature has attributed the failure to implement long-term and accurate CF to multiple reasons. Along with the dominance of retailers (Aviv, 2007; Småros, 2007), lack of trust and commitment between partners appeared as leading barriers (Vlachos and Bourlakis, 2006; Fliedner, 2006; 2003). Manufacturers' lack of confidence in generating sales forecasts, long lead-times and production plans, and their poor interdepartmental integration appeared to be other reasons too (Småros, 2007; Helms *et al.*, 2000), followed by inadequate information exchange between partners (Zhou and Benton Jr, 2007; Taylor and Fearne, 2006). Retailers' naive forecasting process, and reluctant and opportunistic behaviours during information sharing have likewise been considerable barriers to long-term collaborations (Taylor and Xiao, 2010; Taylor, 2006). By observing the European grocery sector, Småros (2007) emphasised the existing gap between theory and practice, and stressed the scarcity of empirical studies investigating manufacturers' role in CF for further insight into the academic field and practice.

1.2. Description of Collaborative Forecasting (CF) problems

In FSC, it is not apparent how manufacturers and retailers can sustain long-term collaborations (Du *et al.*, 2009; Småros, 2007; Vlachos and Bourlakis, 2006). There are hurdles preventing both manufacturers and retailers from benefiting from CF in the food industry, which has an uncertain environment and enables partners to merchandise products that have volatile demand (Du *et al.*, 2009; Aviv, 2007; Småros, 2007). Particularly, partners confront considerable barriers to foresee the demand for perishable, seasonal, promotional and newly launched products (Du *et al.*, 2009; Adebanjo, 2009; Ali *et al.*, 2009; Småros, 2007; Taylor, 2006).

FSC harbours the short shelf life of perishable and seasonal products that necessitate substantial care and effort in managing their freshness and shelf availability. This relies on partners' forecasting and operational practices, such as production, distribution and inventory management (Ahumada and Villalobos, 2009; Du *et al.*, 2009). In a similar vein, managing the demand for promotional products is difficult because of different duration and discounts offered, which, in turn, cause sales variability, inefficient production, excessive / deficient stocks, and deteriorating customer service (Ramanathan and Muyldermans, 2010; Adebanjo and Mann, 2000). Forecasting newly launched products is likewise a challenge for partners due to a lack of historical data, demand variability and uncertainty about consumer choices (Yan and Dooley, 2014; Småros, 2003; Bitran and Mondschein, 1997).

Studies in the FSC further focused on partners' unsteady forecast collaborations (Nakano, 2009; Danese, 2007; Småros, 2007) and supply chain integration (Van der Vaart *et al.*, 2012; Flynn *et al.*, 2010; Van der Vaart and Van Donk, 2008). Some studies considered demand management (Adebanjo, 2009; Taylor and Fearne, 2006; Taylor, 2006), the forecasting process (Danese and Kalchschmidt, 2011; Davis and

Mentzer, 2007; Zotteri *et al.,* 2005; Adebanjo and Mann, 2000) and information sharing between partners (Özer *et al.,* 2011; Sanders, 2008; Zhou and Benton Jr, 2007; Hill and Scudder, 2002). Literature suggests that conducting efficient CF is profitable for partners (Aviv, 2007; 2001). CF enables manufacturers to increase sales and cycle times and to reduce the inventory level and capacity building costs, while forecast accuracy and product flow are improved in collaborations (Fliedner, 2006). It likewise allows retailers to increase service levels and sales, to improve order response, and to reduce inventory levels as well as the volume of products that perish (Fliedner, 2003).

1.3. Research aim and objectives

By extending the study of Småros (2007), this research investigates CF over the dyad manufacturer-retailer collaborations in the FSC. The particular focus is manufacturers and their practices that occur throughout the integration of supply chain, the forecasting process and information sharing with retailers. In this regard, the aim of this research is:

- To identify factors that have a significant influence on achieving the *Collaborative Forecasting Performance* of manufacturers, when they collaboratively forecast perishable, seasonal, promotional and newly launched products with retailers in the FSC. Criteria of the *Collaborative Forecasting Performance* for manufacturers are (i) to improve the forecast accuracy of associated product-groups and (ii) to conduct long-term collaborations with retailers (one year or more).

Accordingly, the aim of the current research is translated into three core objectives. The primary objective is:

- To analyse the supply chain integration of manufacturers both externally and internally, in which external integration spans their relation with retailers and internal integration surrounds their interdepartmental relations.

The rationale of this objective encompasses partners' conflicting expectations that occur during their forecasting and information sharing practices which prevent long-term CF (Fang and Meng, 2010; Småros, 2007; Aviv, 2007; 2002). Hence, the literature needs further clarification about manufacturers' integration in the FSC, while they apply CF in conjunction with retailers. Following this, the second objective of this research is:

- To examine the forecasting process of manufacturers, when they generate the forecasts of related product-groups within their departments, and when they aggregate these forecasts with retailers' forecasts in group meetings.

The justification of this objective is connected with manufacturers' incoherent forecasts and their horizon, which are estimated within different departments with the aim being to achieve departmental objectives over different sources (Småros, 2007; Helms *et al.,* 2000). Manufacturers' multiple forecasts cause additional inventory and exacerbate internal-external conflicts that prevent them from coming to a consensus with retailers (Taylor and Fearne, 2006; Fliedner, 2006; 2003; Helms *et al.,* 2000). Given the evidence from the literature, it is reasonable to address manufacturers' forecasting process in this research and to shed light on their CF in practice. The final objective of this research is:

- To investigate manufacturers' information sharing, when they exchange various information sources with retailers, and when the quality of information shared plays a vital role in the forecast accuracy of associated product-groups.

The rationale of this objective is associated with manufacturers' unstructured information sharing process, which causes complexities not only between departments, but also with retailers (Zhu *et al.,* 2011; Chang *et al.*, 2007; Zhou and Benton Jr, 2007; Chen *et al.*, 2000). Further examination seems essential to clarify the way/s of sharing correct information in an adequate form by adding further insight into the debates about sharing correct information (Zotteri *et al.,* 2005). Considering the significance of information sharing in supply chains, practitioners need more implications to learn how they can benefit from information sharing in collaborations (Zhou *et al.*, 2014; Zhou and Benton Jr, 2007). Therefore, this research finally addresses the manufacturers' information sharing practice to broaden the knowledge on CF and to provide implications for practice.

1.4. Research questions

The research questions of this research are built upon the three major objectives that were addressed in the previous section. Each research question addresses the particular research theme of this research, and examines their impact on the CF of manufacturers in the FSC. In response to the first objective of this research, where the purpose is to analyse the supply chain integration of manufacturers both externally and internally throughout CF, the first research question is formulated as:

- R.Q.1: What factors in terms of manufacturers' supply chain integration influence their collaborative forecasts with retailers in achieving long-term and accurate CF?

To answer this research question, manufacturers' behaviours and operational practices in the chain as well as technological infrastructure for internal and external information exchange are scrutinised (Van der Vaart *et al.*, 2012; Stevens, 1989). Externally, forecasting and information sharing practices that are contrary to retailers' expectations are taken into account due to the negative impact of these conflicts on the long-term CF (Fang and Meng, 2010; Småros, 2007; Aviv, 2007; 2002). Internally, manufacturers' insufficient interdepartmental integration is considered which engenders conflicting and multiple forecasts, generated based on departmental objectives and harm collaborations with retailers (Fliedner, 2006; Helms *et al.,* 2000). In this respect, the first research question relies largely on manufacturers' internal and external coordination, and investigates associated factors to reveal their impact on the forecast accuracy and the duration of forecast collaborations.

The following research question represents the second objective of this research, where the intention is to examine the forecasting process of manufacturers. The forecasting process in this research is twofold. The first process involves manufacturers' internal procedures whereby associated department/s generates the forecasts of related product-groups. The second process refers to the group meetings, where manufacturers and retailers meet to aggregate their own forecasts and to have a consensus on a single forecast. In this respect, the second research question is formulated as:

- R.Q.2: What factors in terms of manufacturers' forecasting process influence their collaborative forecasts with retailers in achieving long-term and accurate CF?

In terms of the forecasting process of manufacturers, the forecasting literature becomes the focus of the current research to reveal a broad range of future research fields. However, in reply to the second research question, this research exhibits a selective attitude not only to extend the literature to rigorous contributions, but also to offer applicable implications to practice. Herein, in addition to manufacturers' incompatible departmental forecasts that exacerbate internal-external conflicts (Taylor and Fearne, 2006; Fliedner, 2006; 2003; Helms *et al.*, 2000), the horizon of forecasts is addressed (Småros, 2007; Aviv, 2002; 2001). By considering partners' group meetings, their overlapping expectations that prevent consensus on a single forecast are examined (Kerr and Tindale, 2011; Fliedner, 2006). The role of forecasters are also analysed due to their considerable impact on decisions given through CF and group meetings (Önkal *et al.*, 2012; 2011; Småros, 2007; Lawrence *et al.*, 2006).

Finally, the third objective of this research makes it possible to form the final research question. The final question addresses manufacturers' diverse information sources, which are likely to be beneficial in CF if they are shared with retailers. This question further interrogates the quality of these information sources in an attempt to add insight to the forecast accuracy of associated product-groups, due to their time-sensitive and / or short-life features in the FSC. The final research question is as follows:

- R.Q.3: What factors in terms of manufacturers' information sharing influence their collaborative forecasts with retailers in achieving long-term and accurate CF?

Information sharing is a key practice not only to enhance transparency, organisational performance and forecast accuracy, but also to build trustworthy collaborations in the FSC (Fischer, 2013; Barratt and Oliveira, 2001). However, manufacturers' unstructured information sharing process causes complexities between departments (Zhu *et al.*, 2011; Chang *et al.*, 2007) and accordingly prevents long-term CF with retailers (Småros, 2007; Aviv, 2007). Such information sharing related challenges become even more important since environmental uncertainties (e.g. promotions, advertising and seasonality) are subject to collaborations, which raise the importance of selecting relevant / correct information and controlling their quality in the FSC (Taylor and Fearne, 2006; Zotteri *et al.*, 2005). Given the scarcity of research in the literature closing this gap, manufacturers' different types of information sources should be examined to clarify what sort of data is beneficial in CF to be shared with retailers (Zotteri *et al.*, 2005). Having a clear understanding about which information and in which form it is beneficial is vital to generate accurate forecasts for perishable, seasonal, promotional and newly launched products due to their either short-life or high demand variability.

Furthermore, problems in terms of irregular information sharing, late responses and lack of Information Technology (IT) systems expand the existing gap (Sari, 2008; Taylor, 2006; Taylor and Fearne, 2006). Hence, this research considers the significance of agility in information sharing as a cornerstone of CF and Supply Chain Management (SCM) (Aviv, 2007; Li *et al.*, 2006; Aviv, 2001), and interrogates various benchmarks to maintain the quality level of information shared with retailers (Zhou *et al.*, 2014; Zhou and Benton Jr, 2007).

1.5. Food Supply Chain (FSC)

1.5.1. Supply Chain in the Food Industry

SCM is a considerable area for both academics and practitioners. Its popularity is apparent with an increased number of publications, conferences and courses devoted to it. By definition, it is "the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across business within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole" (Mentzer *et al.*, 2001, p. 18).

However, FSC distinguishes itself from other supply chains due to its complicated, dynamic and fragile environment, where the quality and availability of products are crucial, because the primary purpose of FSC is to "guarantee the provision of safe and healthy products that are fully traceable from farm to fork" (Bourlakis and Weightman, 2004, p. 2). FSC considers various interests in it such as quality, forecasting, logistics and IT, and it harbours various partnerships among suppliers, manufacturers and retailers. However, the shelf life of products and price variability emerge as significant concerns (Ahumada and Villalobos, 2009), while the types of information shared between partners are vital for forecasts due to the heterogeneous structure of FSC (Zotteri *et al.*, 2005), in addition to the supportive role of IT for the integration of partners (Devaraj *et al.*, 2007).

On the other hand, long lead-times and demand uncertainties have become important barriers for partners in conducting effective supply chain practices (Lowe and Preckel, 2004). For instance, Zhou and Benton Jr, (2007) addressed the product and process related uncertainties in supply chains, namely supply chain dynamism. Their empirical results revealed that uncertainties in supply chains encourage partners to enhance information sharing and supply chain practices while high level information exchange improves the efficiency of manufacturers' delivery operations. In this context, the vulnerable structure of FSC calls on manufacturers and retailers to build and maintain tight collaborations in an effort to have a competitive advantage in the market (Fischer, 2013; Perez *et al.*, 2010; Alvarez *et al.*, 2010). Further, in response to short-term and inaccurate CF practices in the FSC, it is essential that their long-reaching integration be built based on their continuous information sharing and forecasting practices (Van der Vaart *et al.*, 2012; Småros, 2007).

1.5.2. FSC in Europe and North America

The literature has documented how the food industry and its chain have an ascending trend in European countries in terms of conscious consumption, demand for fresh products and changing market structure (Ahumada and Villalobos, 2009). Regarding the CPFR practice that was developed based on the USA market (ECR Europe, 2002), the application of CPFR in North America, for instance, seems much easier than Europe due to retailers' engagement in forecasts and partners' adoption of large-scale collaboration (Småros, 2003).

In practice, due to the efficient collaboration of Heineken in North America forecast errors have been reduced by 15 percent and the lead-times have been reduced by half (Fliedner, 2006; Hill Jr and Mathur, 1999). However, observations in the European grocery sector have emphasised the CF challenges of partners, which, in turn, raises the importance of academic research into CF in the FSC of Europe and North America to close the gap between theory and practice (Småros, 2007). ECR Europe (2001) stressed the major differences between European and North American supply chains to clarify major requirements in applying CPFR, where these differences are presented in Table 1.1.

Table 1.1. Supply chain characteristics in Europe and North America

	European Supply Chains	North American Supply Chains
Geographic	*****Limited geographic area *****Consumers equally distributed throughout the area *****Shorter delivery distances	*Large geographic area *Consumers are fragmented throughout the area *Longer delivery distances
Marketplace	*****Heterogeneous, based on the cultural orientation in each country *****Wide variety of store formats	*Homogeneous *Limited amount of store formats
Promotions	*****High level promotional activities; multiple promotions within one outlet	*Everyday low price strategy and therefore lower level of promotional activities
Technology	*****Average utilisation of technology	*Sophisticated utilisation of technology
Cultural Habits	*****Reserved willingness to collaborate *****Conservative orientation	*Moderate willingness to collaborate

Source: ECR Europe (2001, p. 29)

FSC in Europe harbours a high product range and uncertainties connected with the environment, demand, price or the economy; it is therefore a requirement for partners to share responsibilities in collaborations (Ahumada and Villalobos, 2009; Aviv, 2007; Sanders and Manrodt, 2003; Mentzer *et al.*, 2000). High level promotions are a rather important concern in the heterogeneous European market, calling for close integration between partners (ECR Europe, 2001). However, the effort shown by manufacturers and retailers seems insufficient for long-term collaborations and accurate forecasts of time-sensitive products (Småros, 2007; 2003).

Particularly, manufacturers' internal conflicts are important concerns for reliable supply chain integration in collaborations (Flynn *et al.*, 2010). These internal conflicts (e.g. lack of data, poor IT systems and communication) that occur owing to poor organisational structure are more likely to occasion decayed perishable / seasonal products in the FSC (Vlajic *et al.*, 2012). For instance, while case studies in Europe have illustrated retailers' deficiencies in terms of forecasting, information recording and sharing (Taylor and Fearne, 2006; Småros, 2002), manufacturers' shortcomings related to a lack of interdepartmental integration and production capacity, and long lead-times (Småros, 2005). In North America, however, partners effectively manage such conflicts and IT related obstacles by building their collaboration over similar objectives and investing in IT systems (ECR Europe, 2001). Overall, these limited analyses are evidence that the literature needs additional clarification for successful CF between manufacturers and retailers by addressing partners' forecast collaboration in Europe and North America (Småros, 2007; 2005).

1.5.3. Environmental uncertainties in the FSC

Studies in the retail chain have hypothesised that environmental uncertainties have a causal impact on the structure of collaborations that partners build (Mentzer *et al.*, 2000). In other words, environmental uncertainties in the FSC are likely to motivate partners to develop more efficient and transparent collaborations. Related evidence also stressed the negative correlation between environmental uncertainties and supply chain performance (Zhou and Benton Jr, 2007). However, further understanding is required in terms of clarifying how environmental uncertainties influence the form of partnerships (Mentzer *et al.,* 2000).

It is clear that uncertainties differ based on market conditions, where relevant information collected from the market has a significant impact on forecasts (Sanders and Manrodt, 2003). Partners' forecasting process has a strong interconnection with unexpected external factors because of their impact on demand uncertainty (Davis and Mentzer, 2007). It has been argued that interpreting environmental issues and responding to them in the food industry encourage partners to improve their capability of dealing with demand uncertainties (Davis and Mentzer, 2007). On the other hand, although studies aimed to explore the factors that influence companies' choices on the application of forecasting methods, environmental uncertainties appeared to be one of the indicators. The underlying reason is environmental ambiguities that limit the amount of reliable information. This obstacle obliges companies to apply subjective information that involve rumours, such as competitors' events, and necessitate forecasters' interpretation based on judgmental adjustments rather than applying quantitative forecasting methods (Sanders and Manrodt, 2003).

Partners' organisational characteristics seem influential in integrating their supply chain (Van der Vaart *et al.*, 2012; Flynn *et al.*, 2010) and rapid information exchange with each other underpins their forecasting process in a heterogeneous market, causing ambiguities (Aviv, 2007). However, there are still mysteries with regard to environmental uncertainties, the forecasting methods employed and information that is obtained from such an uncertain environment (Sanders and Manrodt, 2003). Therefore, further studies need to be dedicated to partners' collaborative operations in the dynamic FSC. In this sense, examining the themes of supply chain integration, forecasting process, and information sharing, and then contextualising their relation with CF seem an attractive approach to extend the literature and to provide implications for practice (Van der Vaart *et al.*, 2012; Småros, 2007; Taylor and Fearne, 2006; Sanders and Manrodt, 2003; Mentzer *et al.*, 2000).

1.5.4. Time-sensitive and / or short-life product-groups in the FSC

In FSC, due to the short shelf life of perishable and seasonal products, substantial care needs to be shown to manage their freshness and shelf availability, with this effort relying on the practices of forecasting, production, distribution and inventory management (Adebanjo, 2009; Du *et al.*, 2009; Småros, 2007; Adebanjo and Mann, 2000). Managing demand for promotional products is another difficulty since several factors influence sales and provoke demand variability such as promotion types, duration and discounts (Ramanathan and Muyldermans, 2010; Adebanjo and Mann, 2000). On the other hand, collaboratively forecasting newly launched products is a challenge for partners due to a lack of historical information, demand variability and unpredictable consumer choices (Småros, 2003; Bitran and Mondschein, 1997). While environmental uncertainties accumulate with product based difficulties, estimating accurate forecasts and conducting long-term CF become a substantial challenge for practitioners (Ahumada and Villalobos, 2009; Småros, 2007; Taylor, 2006; Bourlakis and Weightman, 2004).

The literature is rich in studies that have been dedicated to particular product-groups such as perishable and seasonal products (Ahumada and Villalobos, 2009; Du *et al.*, 2009), promotions (Ramanathan and Muyldermans, 2010) or newly launched products (Yan and Dooley, 2014; Småros, 2003). However, comprehensive studies encapsulating multiple product-groups in an attempt to bring a new dimension to existing forecasting knowledge in the FSC are rare (Småros, 2007). To close this gap, this research involves multiple product-groups while CF is addressed from the manufacturers' point of view in the FSC. This approach is most likely to draw the attention of practitioners due to appealing implications for practice.

1.5.4.1.Perishable and seasonal products

Studies regarding perishable and seasonal products (e.g. milk, eggs, meat, cake, vegetables and fruits) have shown that these products' short shelf life and volatile demand, and uncertain weather conditions, along with the instant price changes that occur owing to deterioration, prevent efficient demand management in the FSC (Du *et al.*, 2009; Lowe and Preckel, 2004). Partners' inconsistent practices connected with distribution, production planning and information sharing and forecast decisions not only worsen demand management, but also reduce the quality and shelf life of products (Du *et al.*, 2009; Taylor and Fearne, 2006; Lowe and Preckel, 2004). For instance, Francis *et al.* (2008) observed the poor skills of UK based manufacturers in terms of production, processing, inventory and lead-time activities that negatively influence the shelf life of products.

Following this, case studies and related literature stressed the significance of production systems by manufacturers in addition to retailers' unsophisticated forecasting processes (Ahumada and Villalobos, 2009; Småros, 2007; Taylor and Fearne, 2006). On the other hand, survey based studies pointed out the importance of IT systems associated with preserving the quality of seasonal and perishable products in the FSC (Hill and Scudder, 2002). Given the analysis of empirical and pragmatic evidence, it seems that the capabilities and operational practices of manufacturers play an important role in collaboratively forecasting perishable and seasonal products with retailers. This brings into prominence the examination of these short shelf life product-groups, while manufacturers aim to collaboratively forecast them with retailers.

1.5.4.2.Promotional products

Despite valuable studies which aimed to improve forecast accuracy and to reduce the bullwhip effect in collaborations (Nakano, 2009; Danese, 2007), practitioners are yet to generate reliable forecasts when promotion and advertising related factors are taken into account (Chang *et al.*, 2007). In essence, the bullwhip effect is "the phenomenon of demand variability amplification along a supply chain, from the retailers, distributors, manufacturers, and the manufacturers' suppliers, and so on" (Lee *et al.,* 2000, p. 626). Partners' effective information sharing is an important determinant in terms of reducing bullwhip effect and easing CF with each other (Aviv, 2007). In practice, production surplus / shortage, inventory shortage and lack of customer service are some of the significant drawbacks of the UK based food manufacturers when they collaboratively forecast promotions with retailers (Adebanjo and Mann, 2000). It is clear that generating reliable forecasts for promotions is more complicated than forecasting non-promoted products, and companies have difficulties in understanding the underlying reasons for poor promotional forecasts (Barratt, 2004). Accordingly, this research uses this gap as an opportunity, and addresses promotional products in CF to provide implications for food practitioners (Adebanjo, 2009).

As regards the necessity of elaborating CPFR based on different products and market characteristics (Danese, 2007), promotions seem important opportunities to be analysed in the FSC, because these products significantly influence demand variability, and accordingly oblige partners to conduct stronger forecast collaborations (Taylor and Fearne, 2006). In the Greek FSC, Vlachos and Bourlakis (2006), for instance, identified the close relationships of manufacturers and retailers during promotions with the intention of further benefiting from collaborations. Related studies discussed how partners need to consolidate their information sharing over promotional, assortment and replenishment plans, and to make both technological and operational changes for better demand transparency (Du *et al.*, 2009; Taylor and Fearne, 2006; Småros, 2002). From a different viewpoint, judgmental adjustments have been discussed in the forecasting literature due to their good effort on intermittent demand, where demand is fast but arrives in a short period, like promotions (Syntetos *et al.*, 2009). Nevertheless, the literature needs more evidentiary studies demonstrating optimum ways of generating accurate forecasts for promotions while partners share information and generate forecasts collaboratively (Ramanathan, 2012; Ramanathan and Muyldermans, 2010).

1.5.4.3.Newly launched products

Observations in the European grocery sector uncovered the time-based forecast differences, when newly launched products were the focus of partners (Småros, 2007). Broadly, a retailer estimated a lower forecast than actual demand and the supplier's forecast for the first nine months of launching. However, while related products' sales were pursued for more than nine months, the retailer's forecast overtook the supplier's one because of accumulated historical information. For this reason, it was recommended that retailers apply the supplier's forecasts for efficient inventory levels during the first six months after product release, in which the supplier employed both quantitative forecasting methods and judgmental adjustments to produce forecasts through this period (Småros, 2007; 2002).

In addition, sharing historical information about subsequent products with manufacturers is beneficial in terms of generating more accurate forecasts (Småros, 2003). The underlying reason is that the demand variability of new products occurring through launching escalates price changes (Bitran and Mondschein, 1997). Taking into account the lack of information for new products, generating accurate forecasts becomes even more challenging for partners, necessitating the share of historical data (Helms *et al.,* 2000). In essence, retailers will indirectly benefit from sharing historical information with manufacturers due to the increased forecast accuracy of manufacturers' forecasts, which are recommended to be used by retailers when products are newly launched. Intrinsically, these practical outcomes further suggest that it is essential for practitioners not only to give importance to manufacturers' forecasts, but also to conduct rigid and regular meetings to be able to collaboratively forecast newly launched products.

However, it is indispensable to allocate a great deal of time and effort to forecasting meetings and to managing production capacity effectively (Småros, 2007). In practice, retailers' inadequate forecasting skills give rise to generate defective forecasts for new products (Adebanjo, 2009). These implications raise the importance of examining newly launched products in CF to be able to add additional insight to the forecasting literature and the forecasting practices of partners. By relying on rigid evidence and existing gaps in the literature, this research involves four different types of product-groups: perishable, seasonal, promotional and newly launched products. It also intends to bring more understanding to the CF practices of manufacturers, since these product-groups are the focus of their collaboration with retailers in the FSC (Småros, 2007).

1.6. Research approach and philosophy

In academic and business research, there are two major approaches, the inductive and deductive approach. The inductive approach is "a theory-building process, starting with observations of specific instances, and seeking to establish generalisations about the phenomenon under investigation". However, the deductive approach is "a theory testing process which commences with an established theory or generalisation, and seeks to see if the theory applies to specific instances" (Hyde, 2000, p. 83).

The methodological approach of this research is based on the deductive approach, which "begins with and applies a well-known theory" (Wilson, 2010, p. 7). The reasons behind following this approach are that this research, particularly, (i) focuses on the well-known CPFR practice, conducted between manufacturers and retailers, and (ii) aims to identify factors that have a significant influence on achieving the *Collaborative Forecasting Performance* of manufacturers in the FSC. To accomplish the aforementioned aim, the current research developed a comprehensive conceptual model and related hypotheses by systematically reviewing the literature on the research themes of CPFR, supply chain integration, the forecasting process and information sharing. This aspect accordingly calls for features of the deductive approach, necessitating the development of hypotheses relating to an existing theory and the design of a quantitative research strategy to test associated hypotheses (Ghauri and Grønhaug, 2005).

The inductive approach relies on a qualitative data collection strategy to develop a theory as an outcome of research. This is why it aims to gain more insight into the research context, and is more flexible, allowing changes through the research process (Wilson, 2010). This research benefits from these features of the inductive approach, and underpins its quantitative research strategy with qualitative sources. In other words, the methodological premise of this research relies on a mixed method. Mixed method is "the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g. use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the purposes of breadth and depth of understanding and corroboration" (Johnson *et al.*, 2007, p. 123). Above all, a mixed method enables this research to encapsulate philosophical developments that guide the direction of data collection and analysis process using a mixture of qualitative and quantitative approaches (Creswell and Plano Clark, 2011).

As far as the research philosophies are considered, the methodological literature offers diverse philosophies to develop concrete knowledge about a specific phenomenon, such as positivism and interpretivisim (Wilson, 2010). While these research philosophies adopt different paths to extend existing knowledge about a particular phenomenon, this research is built upon a positivist research philosophy. A positivist approach adopts an objective perspective. It necessitates empirical research that is built upon a deductive approach (Lee and Lings, 2008).

In summary, the current research focuses on the deductive approach to empirically test an associated conceptual model and hypotheses. Whilst the deductive approach of this research leads to explaining causal and hypothetical relationships in the conceptual model, gathering qualitative data from practitioners underpins the methodological rigour of this research by providing generalisable findings to the literature and for practice. Therefore, a mixed method directs the data collection and analysis process of this research. To offer unbiased and objective outcomes to the literature, a positivism research philosophy leads the research methodology of this research.

1.7. Research Strategy

Strategically, the data collection process of the current research is built upon an online survey method. However, the development of the online survey is based on systematic and grey literature review processes, and additional qualitative sources. The qualitative sources of this research involve the outcomes of a single semi-structured interview, conducted with a UK based food manufacturer, and three online group discussions, conducted over the business oriented social networking service of LinkedIn. The current research coded and analysed these qualitative data by using the QSR NVivo 9 qualitative software package, which made it possible to distil the crucial views of practitioners.

Given the requirements of the deductive approach and positivist philosophy, necessitating empirical validation, it is reasonable to adopt a quantitative strategy (Wilson, 2010). Quantitative data collection allows this research to “draw a large and representative sample from the population of interest, measure the behaviour and characteristics of that sample, and attempt to construct generalisations regarding the population as a whole" (Hyde, 2000, p. 84). On the other hand, a qualitative strategy is more connected with the inductive approach to develop a theoretical model (Wilson, 2010). It enables the researcher to gather detailed data on a limited number of individuals or groups (Patton, 1991). Considering the aim and objectives of this research, which relies on the CF practice and its complementary conceptual model, it is worth gathering additional qualitative data to generalise the empirical findings of research into the FSC. While the survey questionnaire is the most popular data collection strategy for a deductive approach (Saunders *et al.,* 2007), interviews, case studies, group discussions and observations are common ways to gather qualitative data in academic research (Wilson, 2010). In recent years, social media networks, such as Facebook, LinkedIn and / or Twitter, have also become attractive tools to reach target respondents through quantitative and qualitative data collection processes (Mirabeau *et al.,* 2013; Efthymiou and Antoniou, 2012).

Hence, the professional social media page LinkedIn contributed this research to reach the respondents of three online group discussions and an online survey, which also looked for respondents from online databases, websites of the food and beverage federations and the personal contacts of the author. The survey respondents of this research are food manufacturers, which are located in the UK & Ireland, North America and Europe. For data analysis, an exploratory approach, the Partial Least Squares (PLS) technique, was used to empirically test causal relationships and to validate the conceptual model of this research (Peng and Lai, 2012; Vinzi *et al.,* 2010). To justify PLS as the most appropriate technique for data analysis, Peng and Lai (2012)'s pragmatic assumptions became the baseline of the data analysis process. Overall, by following the mixed method paradigm (Creswell and Plano Clark, 2011), this research's structural strategy is sequential (Wilson, 2010; Saunders *et al.,* 2007), and is organised as follow:

Step 1 - involves the systematic review of literature on the research themes of CPFR, supply chain integration, the forecasting process and information sharing. This allowed the research to build initial propositions and a preliminary conceptual model based only on peer-reviewed academic journal articles.

Step 2 - relies on a single semi-structured interview that was conducted with a supply chain manager of a UK based food manufacturer. This step made it possible to distil the literature-based propositions and to modify the conceptual model for implications for practice.

Step 3 - focuses on the three online group discussions that were conducted over the professional social networking service of LinkedIn. Like the single interview, group discussions extended the purification process of the literature-based propositions to reinforce the validity of the research findings in practice.

Step 4 - involves the grey literature review process that was conducted over the associated research themes by focusing the research propositions, and in which it comprised related conference papers, business oriented reports and other related sources (Weintraub, 2000). This step aimed at developing the research hypotheses and the conceptual model by gathering further data from non-peer reviewed articles as an extension of the peer-reviewed articles.

Step 5 - comprises the development of the online survey based on the outcomes of the systematic and grey literature review processes and qualitative data.

1.8. Thesis outline

The current research consists of six chapters. The content of each chapter is briefly described as follows:

Chapter 1: Introduction - presents the background of CPFR as a core research theme, and outlines the major CF problems. The research aim and objectives are elaborated, followed by making explicit the research questions of the research and justifying their rationale as the representatives of research objectives. Then, further insights are added into the FSC in Europe and North America. Time-sensitive and / or short-life product-groups are subsequently clarified as the reason behind linking this research to the four product-groups, including perishable, seasonal, promotional and newly launched products. Finally, the research approach and philosophy, and the strategy are summarised to clarify the methodological approach of the current research.

Chapter 2: Literature Review – initially elucidates the systematic review methodology, and then a systematic review protocol is introduced. The process followed to analyse the systematic review and to extract related data is then described, followed by discussing the results of the systematic review process. The research themes of CPFR, supply chain integration, the forecasting process and information sharing are respectively elaborated as the outcomes of both systematic and grey literature review processes. In addition, alternative collaboration practices that are used in the FSC are discussed and compared to provide managerial implications for practice.

Chapter 3: Development of Hypotheses and Conceptual Model – clarifies the theoretical concepts considered through the hypothesis development process. The CF practice is then scrutinised along with its formative items to explain its domain concept as a contribution to theory. Following this, the hypotheses are critically discussed to make explicit the existing gap in the literature. Finally, the conceptual model of the current research is outlined.

Chapter 4: Research Methodology and Data Collection – adds clear insight to the methodological approach and philosophical perspective of this research. The rationale for the mixed method paradigm is then provided, followed by the explanation of the research design. Data collection process – mixed design is elucidated, where the qualitative and quantitative data collection processes are subsequently justified. Following this, the target population and sampling of the online survey is discussed, and this is followed by the description of the quantitative data collection stages. Finally, the research sample size and response rate are assessed to justify the reliability of usable samples and the data analyses technique chosen for the empirical analysis.

Chapter 5: Data Analysis and Findings – begins with the justification of the data analysis technique of PLS, followed by theoretically validating the development of a formative construct, namely the CF practice. Descriptive statistics of the survey are then discussed, which makes it possible to identify the significant contributions to the literature relating to particular regions and product-groups. The analysis of the non-response bias is then presented. Next, the data analysis process is amplified by presenting related analysis procedures, used to evaluate both the measurement and structural model of the current research. Finally, the findings and conceptual model are elaborated as the core contributions of this research, answering the research questions and closing the gap in the literature.

Chapter 6: Discussion and Conclusions – firstly addresses the scope of the research to clarify the way followed to accomplish the research aim and objectives and to respond to the research questions in a logical and justifiable manner. Secondly, the scope of each chapter is summarised to give an emphasis on the contributions offered to theory, methodology and practice. Thirdly, a particular attention is paid to theoretical and managerial implications. Key contributions to the theoretical knowledge are elaborated in an attempt to clarify how this research made it possible to narrow down the existing gap on the business initiative of CF in the FSC. Managerial implications for practice are propounded by interpreting the major contributions of the research. Finally, future research opportunities and the limitations of this research are addressed to open new research fields to the literature and to call the attention of academics towards particular research subjects.

CHAPTER 2: LITERATURE REVIEW

2.1. Overview

This chapter encapsulates the extensive literature review process of the current research, consisting of a systematic and grey literature review. To begin with, the systematic review methodology and the protocol of this research are explained. Then, the approach adopted to analyse and extract the systematically reviewed literature is discussed. The results of the systematic review are presented afterwards. The research themes of the current research are subsequently elaborated based on the outcomes of systematic and grey literature. This elaboration allows the research to critically filter relative contributions, future research suggestions and the limitations of past studies. Overall, this approach allows the research to:

- Systematically extend the body of the literature over the research themes of CPFR, supply chain integration, the forecasting process and information sharing.
- Enrich findings of the systematic review with grey literature, making it possible to draw further data from non-peer reviewed articles for managerial implications.
- Develop innovative connections between different research themes and critique their relation to uncover existing gaps in the literature.
- Provide a clear understanding about associated theories and terminologies relating to the CF practices of manufacturers.
- Be aware of the appropriate research methodologies in the literature, and choose the most appropriate one/s to generalise research findings in the FSC.
- Select the most pragmatic and theoretical factors that the literature has overlooked in terms of adding insight to the CF of manufacturers in the FSC.
- Identify a significant literature gap and create a solid platform in an attempt to form applicable hypotheses in response to the research questions of this research.

2.2. Systematic review methodology

The systematic review process of this research is guided by the research questions as recommended by Tranfield *et al.* (2003). The research questions of this research were previously elaborated in Section 1.4. Research questions. Systematic review requires a detailed article search, however; it brings additional transparency to the research field, and mitigates bias by providing a scientific approach (Cook *et al.,* 1997).

Tranfield *et al.* (2003, p. 207) define a systematic review as a process of "synthesising research in a systematic, transparent, and reproducible manner with the twin aim of enhancing the knowledge base and informing policymaking and practice". In essence, this definition implies that the review undertakes a guideline role for managers in making evidence-related decisions in practice. The three-stage approach of Tranfield *et al.* (2003), adapted from CRD (2001), is the baseline of the systematic review process of the current research. These stages consist of (i) planning; (ii) conducting, and (iii) reporting the review, and are presented in Table 2.1.

Table 2.1. The three-stage approach of systematic review

Stage I	Planning the review
Phase 0:	Identification for the need for a review
Phase 1:	Preparation of a proposal for a review
Phase 2:	Development of review protocol
Stage II	Conducting the review
Phase 3:	Identification of research
Phase 4:	Selection of studies
Phase 5:	Study quality assessment
Phase 6:	Data extraction and monitoring process
Phase 7:	Data synthesis
Stage III	Reporting the review
Phase 8:	The report and recommendations
Phase 9:	Getting evidence into practice

Source: Tranfield *et al.* (2003, p. 214); CRD (2001)

In the first stage of the systematic review (Stage I: Planning the review), the first step made it possible to identify the underlying reasons calling for systematic review of the CF problems of partners in the FSC. This step plays a vital role in terms of addressing diverse problems in the FSC that prevent partners from conducting accurate and long-term forecast collaborations over the time-sensitive and / or short-life product-groups. Associated CF problems were previously addressed in Section 1.2. Description of Collaborative Forecasting (CF) problems. The logic behind the review was then explained by the development of three research questions, focusing on the three research themes of supply chain integration, the forecasting process and information sharing. Following this, a proposal was generated for the rationale for a systematic review. Subsequently, a new review protocol was built to follow through the synthesis of the literature. This protocol is further clarified in the following section.

In the second stage (Stage II: Conducting the review), the review protocol was followed, which became the prospectus for the systematic review process in terms of identifying and selecting articles, and assessing their relevance. Through these steps, the research questions became the major guideline. This made it possible to ensure that associated articles contribute to the research by offering answers to the research question/s, and help to close the gap in the literature. The quality of associated articles was assessed based on the guidelines of Tranfield *et al.* (2003) and Eakin and Mykhalovskiy (2003). The quality assessment procedures of the review process are elaborated in Section 2.2.2. Analysis of systematic review and data extraction. Through the data extraction process, the outcomes of the review were coherently recorded. To enhance the clarity of data synthesis, this process was consistently monitored too.

In the final stage (Stage III: Reporting the review), this research reported the findings to explore existing literature gaps relating to the CF practices of manufacturers, preventing accurate forecasts and the implementation of long-term collaborations with retailers in the FSC. Accordingly, the research platform was built upon the systematic review, and it was then enriched by qualitative data obtained through the interview and three group discussions. After the qualitative data collection process, this research did not complete the review process, unlike the suggestion by Tranfield *et al.* (2003). Instead, the review continued based on the final form of the propositions to develop hypotheses and to build the final conceptual model.

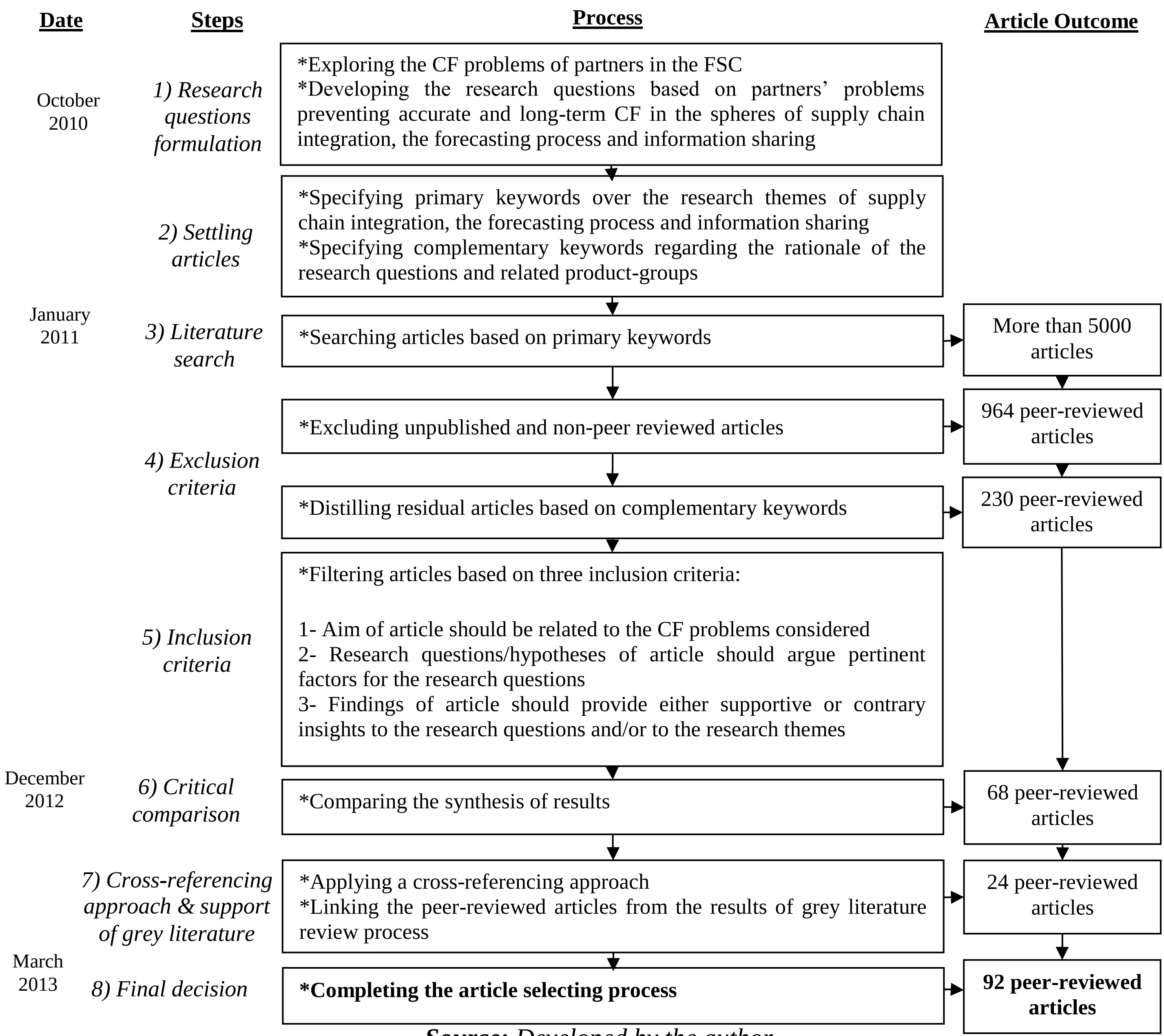
During the second phase of the literature review, the research rather followed a grey literature review. Grey literature "comprises newsletters, reports, working papers, theses, government documents, bulletins, fact sheets, conference proceedings and other publications distributed freely, available by subscription or for sale" (Weintraub, 2000, p. 54). While the systematic review enhanced the quality of the current research owing to the contributions of articles published in high-ranking academic journals, it adversely limited the research to peer-reviewed journal papers (Tranfield *et al.*, 2003). However, following the grey literature allowed this research to go beyond the peer-reviewed academic journals and to underpin research findings with non-peer reviewed articles (Thomé *et al.*, 2012). The logic behind conducting the grey literature is also to unveil a wide range of peer-reviewed articles contributing to the research, where a limited number of peer-reviewed articles contributing to the research questions were linked to the results of the systematic review.

2.2.1. Systematic review protocol

The aim of the systematic review protocol in this research is fourfold: Firstly, the review protocol aimed to provide a clear understanding of the existing CF problems of partners in the FSC. The reason behind having this insight is to identify in which processes manufacturers and retailers confront difficulties that prevent them from conducting accurate and long-term CF for the time-sensitive and / or short-life product-groups. This insight allowed the research to reveal three major research themes of supply chain integration, the forecasting process and information sharing as potential spheres that give rise to the conflicts of partners.

Secondly, the review protocol aimed to interrogate these three research themes. To accomplish this purpose, three research questions were developed, with each question focusing on a different research theme in an attempt to examine them thoroughly. In addition, particular keywords were selected to be searched for in the title, keywords and abstracts of articles. Thirdly, the current research was aimed to be conducted over these research themes to explore relevant articles offering answers to the research questions as the underlying reasons for CF problems. Finally, the intention of the protocol became to develop inclusion-exclusion criteria to limit the article selection process through the systematic review. The review protocol of this research is shown in Figure 2.1, while the keywords chosen by the protocol are presented in Table 2.2.

Figure 2.1. Systematic review protocol



Source: *Developed by the author*

Table 2.2. Primary and complementary keywords

Research themes	Primary keywords
Supply chain integration	Supply chain integration / collaboration / partnership, collaborative forecasting, CPFR, food industry / policy
Forecasting process	Forecasting, demand management
Information sharing	Information sharing / transfer / exchange
Research questions	**Complementary keywords**
RQ.1	Internal / interdepartmental, external, vertical, horizontal
RQ.2	Forecasting methods/techniques, quantitative/qualitative/statistical, judgment/adjustment, combination, group forecasting/decision, consensus, forecasters
RQ.3	Information systems, information type/s, quality, value, agility
Product-groups	Product / item, perishable / short-life, seasonal / seasonality, promotion / promotional, special event, new / newly launched

Source: *Developed by the author*

Through the review process, in addition to the forecasting process and information sharing themes that are the focus of CF (Småros, 2007), this research benefited from the wide-scale research theme of supply chain integration to conduct a well-rounded review process by using primary keywords. Supply chain integration is not limited to manufacturers' relationship with retailers and suppliers, it also involves diverse forecasting and supply chain practices as well as the flow of information and goods over strategic and operational collaborations (Flynn *et al.,* 2010; Mentzer *et al.,* 2000).

Hence, the systematic review process addresses the supply chain integration related literature by considering its link with CF, the forecasting process and information sharing. Thereby, the review process distinguishes itself from related systematic reviews regarding overall supply chain integration (e.g. see Fabbe-Costes and Jahre (2008) for a systematic review of supply chain integration). Following this, the complementary keywords were used to purify the results of the primary keywords and to uncover the rationale for the research questions and product-groups involved. The review analysed specific databases such as Scopus, Elsevier, Emerald, ABI Informs, Wiley, Taylor & Francis, Supply chain forum, EBSCO HOST, AJBR and JSTOR.

The search using primary keywords found more than 5000 articles from peer-reviewed journals and conference proceedings. To avoid possible duplication between journal and conference papers, the systematic review process was limited to peer-reviewed journals, which is common in systematic studies (e.g. Burgess *et al.* (2006)). The use of complementary keywords limited the research sample of papers from 964 to 230, which were examined based on the inclusion criteria (see Figure 2.1). As a result, 68 peer-review articles were extracted. In time, a cross-referencing approach and the outcomes of the grey literature review process made it possible to find additional relevant papers, which resulted in 24 more articles. Overall, the systematic review process was concluded with 92 articles. It is worth emphasising that academic studies that systematically review the literature can consider cross-disciplinary approaches or alternative ways to enhance the number of related papers (Tranfield *et al.*, 2003). In this case, cross-referencing is a common way of achieving this relevance (see e.g. Shukla and Jharkharia (2013)). However, in addition to the cross-referencing approach, one of the distinguishing features of this research was to conduct a grey literature review process. This approach made it possible to underpin the outcomes of a systematic review with additional peer-review journal articles, and to explore non-peer reviewed articles that support the research findings from practitioners' point of view.

2.2.2. Analysis of systematic review and data extraction

The articles identified through the systematic review process represent diverse areas and illustrate heterogeneous findings explored in different circumstances (e.g. the extent of collaboration, geography, different product-groups and industries). The current research adopted tables and graphical forms to illustrate the outcomes of the systematic review (Sargeant *et al.,* 2006; CRD, 2001). The analysis originates from three classes to extract evidence-related data, with the dimensions of classification for analysis being presented in Table 2.3. The first class was devoted to the "characteristic" of articles, which provides descriptive knowledge in terms of publication years, journals, methodology and country. The second class (feature) summarises the aim, research questions / hypotheses, and relevant findings of the articles. The article purification then aims to highlight the problem relevance in the associated research themes and to showcase evidence-related hypotheses. This approach followed through the analysis of the review accordingly led the research to maintain the rigour of the review process.

Table 2.3. Classification of systematic review analysis

Classes	Dimensions
1-Characteristic	Year, journal, methodology, country
2-Feature	Aim, research questions/hypotheses, findings
3-Problem relevance	Supply chain integration
	Forecasting process
	Information sharing

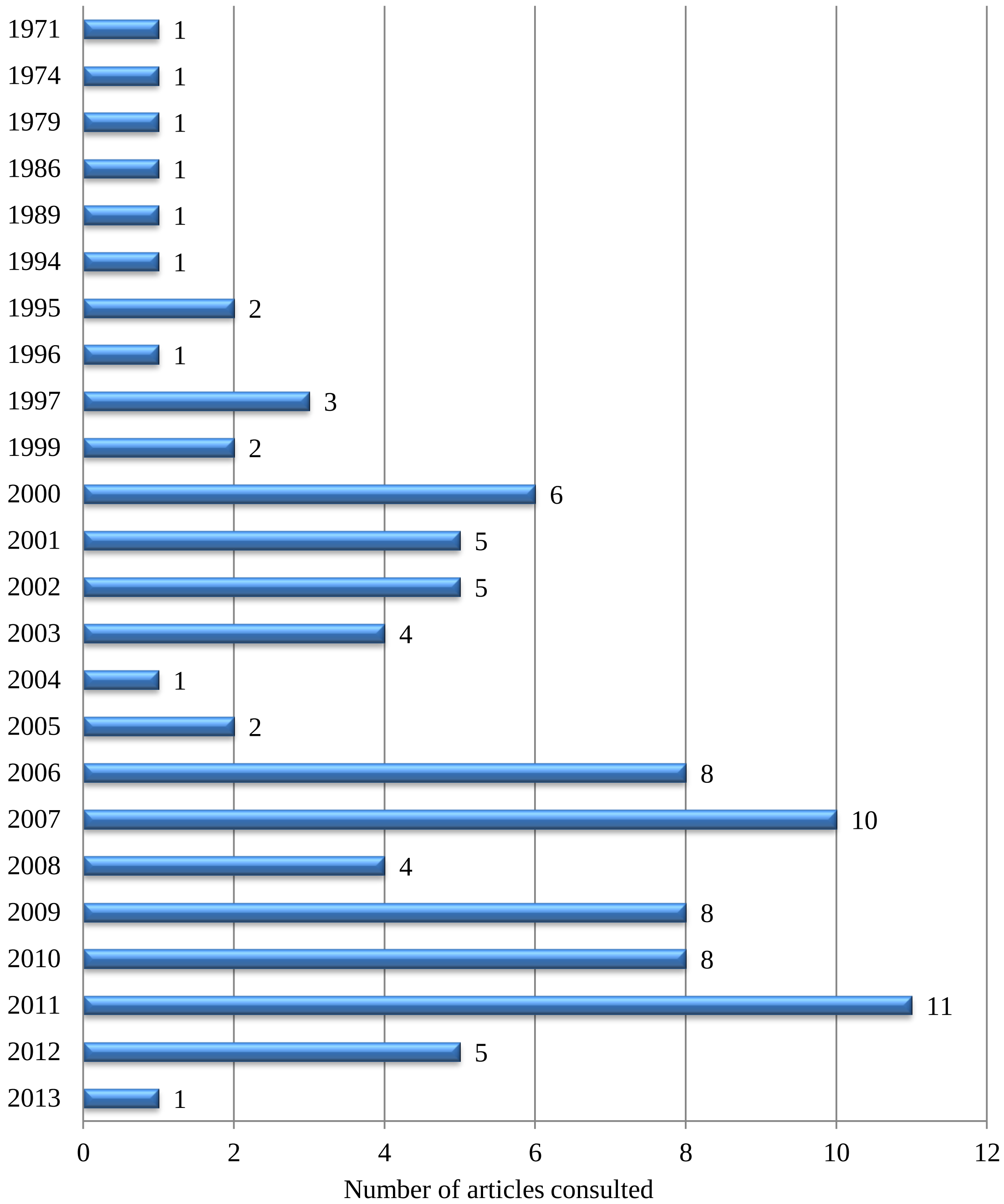
Source: *Developed by the author*

As far as the quality assessment of systematic reviews is concerned, this research initially appraised the quality of primary research through a review of specific procedures (Tranfield *et al.,* 2003; Popay *et al.,* 1998). Then, the review's internal quality was reinforced over the research questions, inputs of the author of this research to the review, an assessment of sampling and data collection, and judgment of the findings. This made it possible to convey the review process to the reader in a transparent and logical manner (Eakin and Mykhalovskiy, 2003), which, in turn, enhanced the quality of the data (Popay *et al.*, 1998). In this respect, the systematic review protocol was used to shed light on the judgment of sampling and the data collection process, with enhancing the reader's understanding of the conceptual model offered by this research.

2.2.3. Results of systematic review process

The systematic review process of the current research includes articles published from 1971 to 2013. However, the predominance of papers contributing to the review (67 out of 92) were published in the last decade (see Figure 2.2.). Through the review process, journals were separated based on their primary coverage topic areas as noted on their website. To enhance the understanding of journal classification, four different categories were concisely defined, with related journals presented in Table 2.4. Accordingly, Operations Management (OM) journals constituted 55.4 percent of the articles, followed by Forecasting and Decision-Making (F&DM) journals (21.7 percent), SCM and Logistics (SCM&L) journals (15.2 percent) and Information-Systems and Management (IS&M) journals (7.6 percent). This research incorporated three more journals under these classifications as well: the Academy of Management Journal was listed under the OM while the Journal of Retailing and Industrial Marketing Management were considered as part of the SCM&L.

Figure 2.2. Publication trend of systematically reviewed articles



Source: *Developed by the author*

Table 2.4. Classification of journals

No	List of journals	Primary focus	Number of articles considered
1	International Journal of Production Economics	OM	17
2	International Journal of Forecasting	F&DM	15
3	Management Science	OM	7
4	Supply Chain Management: An International Journal	SCM&L	6
5	Journal of Operations Management	OM	6
6	European Journal of Operational Research	OM	4
7	International Journal of Operations & Production Management	OM	5
8	OMEGA The International Journal of Management Science	OM	3
9	Expert Systems with Applications	IS&M	2
10	International Journal of Production Research	OM	2
11	Information & Management	IS&M	2
12	International Journal of Physical Distribution & Logistics Management	SCM&L	2
13	Journal of Forecasting	F&DM	2
14	Journal on the Practice of Operations Research, Interfaces	OM	2
15	Technological Forecasting & Social Change	F&DM	2
16	The Academy of Management Journal	OM	2
17	Alliance Journal of Business Research	OM	1
18	Applied Soft Computing	IS&M	1
19	Business Process Management Journal	OM	1
20	Decision Support Systems	IS&M	1
21	Industrial Management & Data Systems	IS&M	1
22	Industrial Marketing Management	SCM&L	1
23	International Journal of Logistics: Research and Applications	SCM&L	1
24	Journal of Behavioral Decision Making	F&DM	1
25	Journal of Retailing	SCM&L	1
26	Journal of Retailing and Consumer Services	SCM&L	1
27	Manufacturing & Service Operations Management	OM	1
28	Supply Chain Forum: An International Journal	SCM&L	1
29	The International Journal of Logistics Management	SCM&L	1

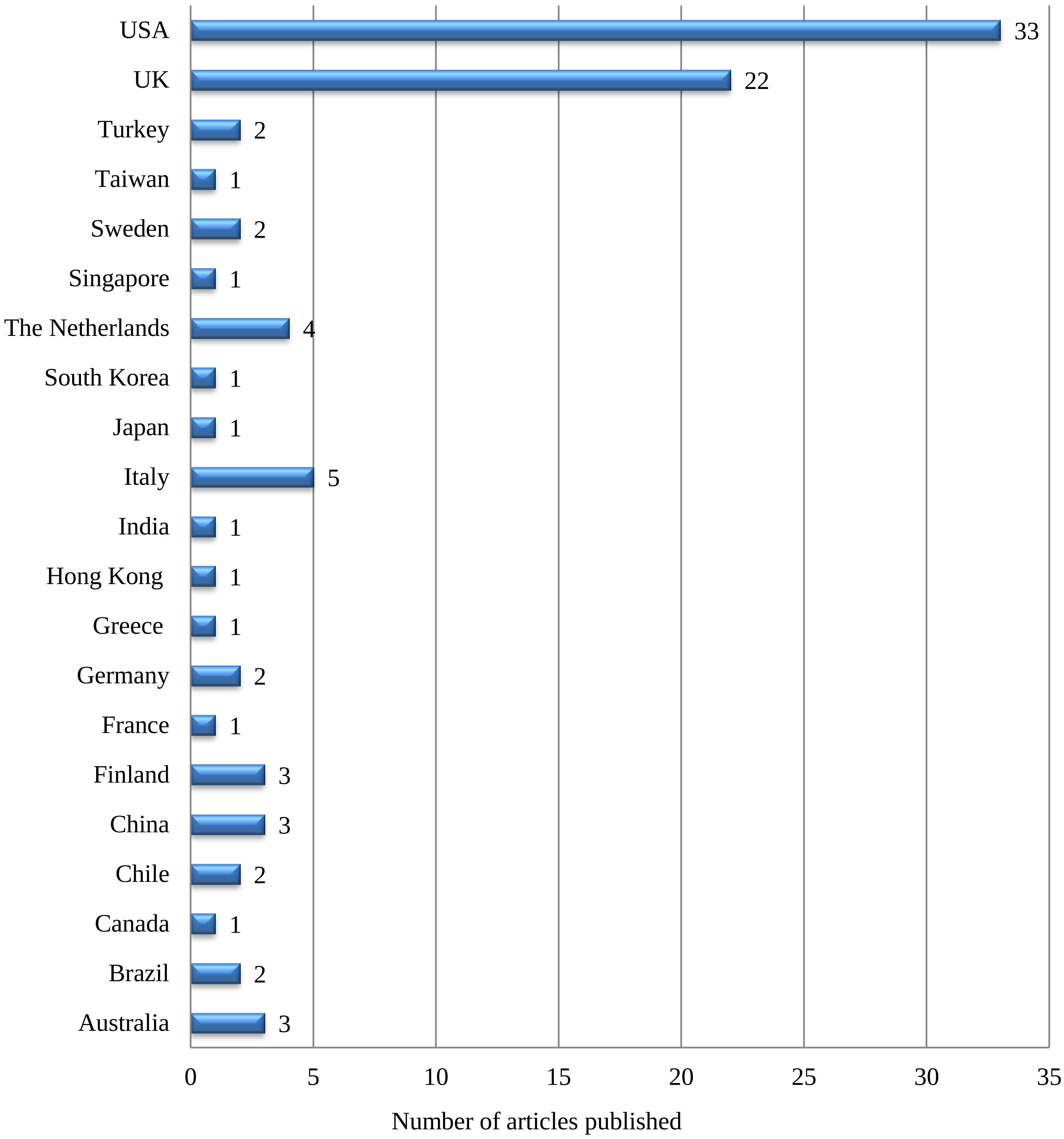
F&DM journals cover forecasting techniques, judgments, decision making and group decisions
SCM&L journals cover supply chain and logistics channel and retail practices
IS&M journals cover data management systems, soft computing and technologies
OM journals cover operational practices, production, service, marketing, economics, statistics and mathematics

Source: *Developed by the author*

In terms of geographical distribution (see Figure 2.3), based on the affiliation of the first author, the articles were predominantly published in the USA (35.9 percent) and in the UK (23.9 percent). US authors contributed primarily with surveys (27 percent) and experiments, where hypotheses are tested under particular conditions developed and controlled by researcher/s, (15 percent), whereas the UK based authors contributed mostly by experiments (36 percent) and case studies (32 percent).

Survey-related papers (20 articles), experiment-related papers (17 articles) and case studies (17 articles) prevailed in the sample of the review. However literature review (13 articles) and simulations (10 articles) contributed to the review too.

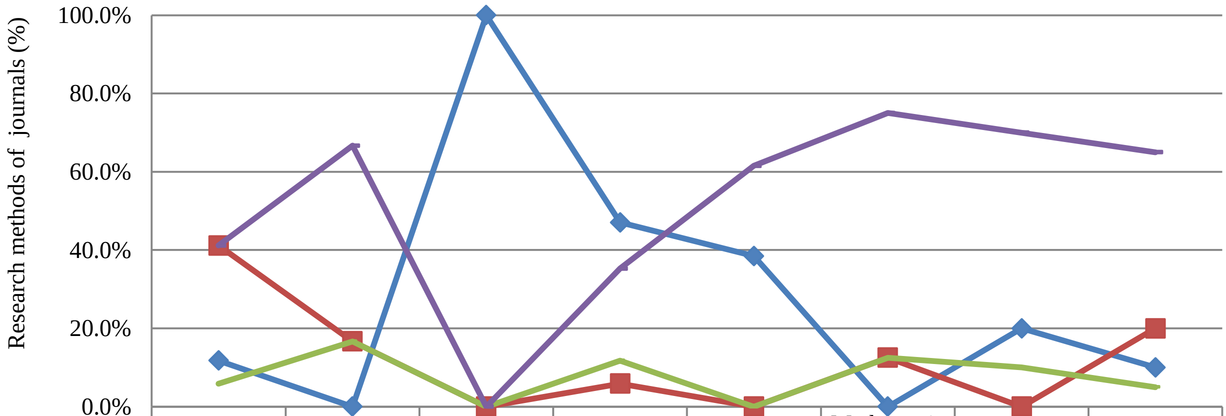
Figure 2.3. Geographical distribution based on the affiliation of the first author



***Source:** Developed by the author*

As far as the methodological contributions of the journals is considered, presented in Figure 2.4, overall 82.4 percent of case studies were published in SCM&L (41.2 percent) and OM (41.2 percent) journals. 66.7 percent of conceptual papers were offered by the OM journals, followed by SCM&L (16.7 percent) and IS&M (16.7 percent) journals. While context analysis was solely regarded by F&DM, these journals played a prominent role related to experiments by 47.1 percent, followed by OM journals (35.3 percent). Literature reviews were largely published in the OM journals with a 61.5 percent share, while the role of F&DM journals in the literature was considerable as well (38.5 percent). Like literature review, mathematical-modelling and simulation related publications largely featured in the OM journals 75 percent and 70 percent respectively. Only 20 percent of simulation related papers were published in the F&DM journals. OM journals provided a significant amount of survey based papers to the review with 65 percent, followed by SCM&L (20 percent) and F&DM (10 percent) journals.

Figure 2.4. Methodological contributions of journals

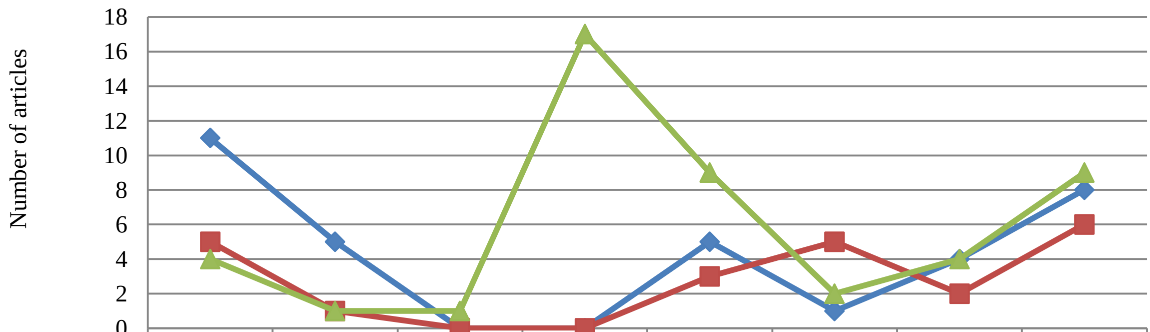


	Case Study	Conceptual Paper	Context Analysis	Experiment	Literature Review	Mathematical-Modelling	Simulation	Survey
F&DM	11.8%	0.0%	100.0%	47.1%	38.5%	0.0%	20.0%	10.0%
SCM&L	41.2%	16.7%	0.0%	5.9%	0.0%	12.5%	0.0%	20.0%
IS&M	5.9%	16.7%	0.0%	11.8%	0.0%	12.5%	10.0%	5.0%
OM	41.2%	66.7%	0.0%	35.3%	61.5%	75.0%	70.0%	65.0%

Source: *Developed by the author*

On the other hand, systematically reviewed articles rigorously extended the methodological knowledge of research themes, with the results illustrated in Figure 2.5. Experiments (17 articles), surveys (9 articles) and literature reviews (9 articles) heavily represented the issues that occur in the forecasting process, while difficulties in supply chain integration were largely subject to case studies (11 articles), followed by surveys (8 articles). Mathematical-modelling related articles (5 articles) addressed the information sharing based problems. Interestingly, the articles that related to partners' challenges in supply chain integration also provided further understanding about information sharing related difficulties by intimating the importance of information sharing in SCM.

Figure 2.5. Methodological contributions of articles



	Case Study	Conceptual Paper	Context Analysis	Experiment	Literature Review	Mathematical-Modelling	Simulation	Survey
Supply chain integration	11	5	0	0	5	1	4	8
Information sharing	5	1	0	0	3	5	2	6
Forecasting process	4	1	1	17	9	2	4	9

Source: *Developed by the author*

Regarding the product-groups of the current research, case studies addressed perishable, seasonal and promotional products in Europe. Experiments heavily analysed promotions in the UK, while newly launched products were largely subject to surveys in the USA. Partners' problems in terms of short-life products largely appeared through the integration of their supply chain. The reason behind this is that perishable and seasonal products in this review became subject to supply chain integration problems (82 percent and 50 percent respectively) in the SCM&L and OM journals.

Promotions were connected with the challenges that occur during supply chain integration (60 percent) and the forecasting process (40 percent) across several industries (according to the SCM&L and OM journals). This result accordingly uncovers partners' ongoing forecasting problems while they collaboratively forecast promotional products, in addition to the difficulties that occur during integration. Like promotions, partners' conflicts in the forecasting process (50 percent) and supply chain integration (56 percent) augmented while newly launched products were referred to in different industries via OM journals. The review also found that several articles focused on a number of industries and conducted research over multiple product-groups (particularly surveys and case studies).

Overall, the systematic review process builds a solid basis for the current research. The contributions of articles reviewed add further insight into the problems of partners that occur through supply chain integration, in the forecasting and information sharing processes. Addressing these problems over the associated product-groups is another important contribution of the review process. However, the findings are not limited to these outcomes. The review process uncovers the publication trend of articles and their region by extending the body of literature as a guideline for researchers. This enhances the understanding of academics over the trend and countries, conducting research on the related research themes connected with the CF problems of partners.

Further, the results extend the literature by providing a solid classification of the journals, as OM, F&DM, SCM&L and IS&M journals based on their primary coverage topic areas. Presenting these journals' methodological domain makes it possible to acquire a clear vision in terms of following appropriate methodologies for future research, with the aim being to publish in associated journals. The clarification of journals' methodological mission therefore exposes the existing methodological gap that needs to be filled by future research. In addition, to raise the awareness of product-groups and the importance of research themes in the FSC, the current research selected 28 articles from the results of the systematic review process. These articles are presented in Table 2.5.

The criteria for selecting these 28 articles are threefold. Firstly, these articles indispensably related to the food industry, while some of them involve additional industries, such as textiles, tourism and pharmaceutical. Secondly, the articles extend the body of literature to at least one of the three research themes: supply chain integration, the forecasting process, information sharing. Some articles also add insight into the multiple research themes by building a linkage between associated research themes. Finally, while these articles extend the body of knowledge in the food industry over at least one of three research themes, they also shed light on at least one of the four product-groups of this research.

Table 2.5. List of articles selected based on their contributions to the food industry, research themes and product-groups

Articles				Research themes			Industry		Product-groups			
No	**Articles**	**Country**	**Methods**	**Supply chain integration**	**Forecasting process**	**Information sharing**	**Food**	**Others**	**Perishable**	**Seasonal**	**Promotional**	**New**
1	Aburto and Weber (2007)	Chile	Mathematical-modelling		x		x				x	
2	Adebanjo (2009)	UK	Case study	x			x				x	
3	Ahumada and Villalobos (2009)	USA	Literature	x			x		x	x		
4	Ali *et al.* (2009)	Turkey	Experiment		x		x				x	
5	Alon *et al*. (2001)	USA	Experiment		x		x			x		
6	Bitran and Mondschein (1997)	Chile	Mathematical-modelling	x			x		x	x		
7	Ching-Chin *et al.* (2010)	Taiwan	Simulation		x		x	x				x
8	Danese (2007)	Italy	Case study	x			x	x			x	
9	Danese (2006)	Italy	Case study	x		x	x	x			x	
10	Davis and Mentzer (2007)	USA	Context analysis		x		x	x			x	x
11	Du *et al.* (2009)	China	Case study	x			x		x	x		
12	Fildes *et al.* (2009)	UK	Simulation & Mathematical-modelling		x		x	x			x	
13	Fliedner (2006)	USA	Conceptual paper	x			x	x	x		x	
14	Flynn *et al.* (2010)	USA	Survey	x			x	x				x
15	Francis *et al.* (2008)	UK	Case study	x			x		x			
16	Hill and Scudder (2002)	USA	Survey			x	x		x	x		
17	Nakano (2009)	Japan	Survey	x			x	x			x	
18	Paiva (2010)	Brazil	Survey	x			x	x				x
19	Ramanathan and Muyldermans (2010)	UK	Case study	x			x				x	x
20	Ramanathan (2012)	UK	Case study			x	x				x	
21	Småros (2003)	Finland	Case study	x			x				x	x
22	Småros (2007)	Finland	Case study	x			x		x	x	x	x
23	Taylor and Fearne (2006)	UK	Case study	x			x		x	x	x	
24	Taylor (2006)	UK	Case study	x			x		x	x	x	
25	Vijayasarathy and Robey (1997)	USA	Survey			x	x	x			x	
26	Vlachos and Bourlakis (2006)	Greece	Survey	x			x				x	
27	Vlajic *et al.* (2012)	The Netherlands	Conceptual paper	x		x	x		x	x		
28	Zotteri *et al.* (2005)	Italy	Mathematical-modelling		x		x			x	x	

Source: *Developed by the author*

2.3. Collaborative planning, forecasting and replenishment (CPFR)

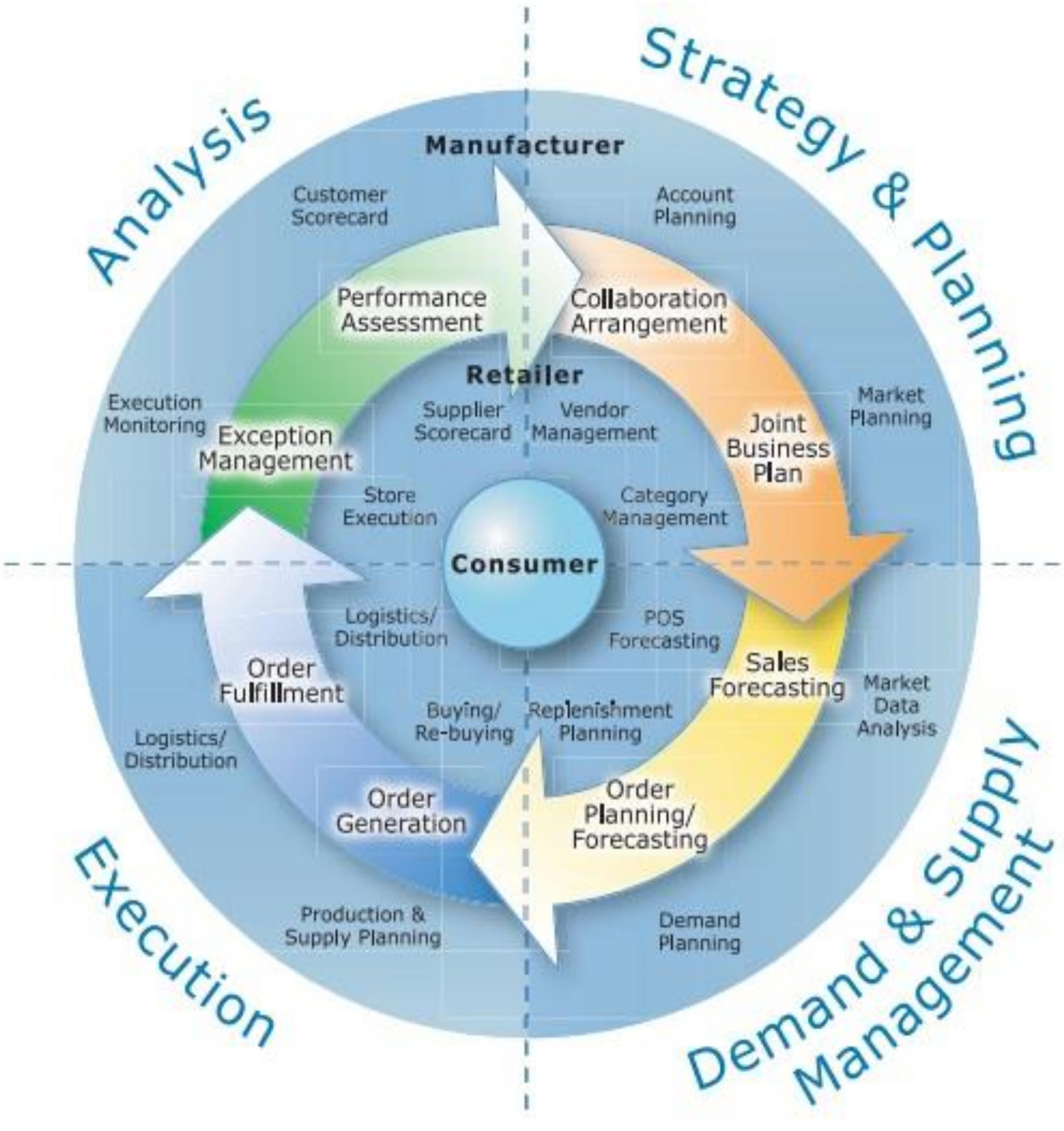
The Voluntary Interindustry Commerce Standards (VICS) Association defines CPFR as a "business practice that combines the intelligence of multiple trading partners in the planning and fulfilment of customer demand" (VICS, 2004, p. 5). In essence, CPFR plays a bridge role among partners' sales and marketing operations to enhance product availability and to reduce inventory and delivery costs, because the objectives of CPFR are to (VICS, 2002):

- Provide better supply-demand coordination through an effective information sharing
- Manage processes based on partners' exceptions, and
- Meet end customers' needs with a strong collaboration, which is organised well and lacking in restrictions

The history of CPFR dates back to the 1990s, when Wal-Mart and Warner-Lambert in the USA incorporated three sub-stages of planning, forecasting and replenishment in a joint project (Ireland and Crum, 2005). Important studies adopted CPFR and its components in various industries by revealing concrete contributions (Sari, 2008; Danese, 2007; Småros, 2007; Aviv, 2007). The CPFR framework appeals to buyer-seller relations in multiple industries, such as retail, textiles and consumer packaged goods. FSC is also a suitable domain for CPFR, which provides an excellent platform for partners in managing supply chain processes jointly, comparing sales and order forecasts, and taking timely decisions (Burnette, 2010; Ireland and Crum, 2005; Siefert, 2003).

The reason behind the benefits of CPFR in the FSC is that while partners confront difficulties in integrating their information sharing and forecasting processes, CPFR seems a strong solution due to its capability of not only jointly managing promotions but also underpinning interdepartmental synchronisation and minimising departments' multiple forecasts (Barratt and Oliveira, 2001; Sherman, 1998). Multiple forecasts are significant barriers to CF as they give rise to internal-external conflicts in collaborations (Helms *et al.*, 2000). CPFR is an effective practice for partners to reduce inventory costs and the waste of consumer goods over long-term partnerships (Lapide, 2010). The collaboration of Wal-Mart and P&G is a good example from practice, where they jointly developed forecasts and replenishment operations, and gained favour by improving information sharing and reducing the waste of consumer goods in the FSC (Attaran, 2004). The CPFR aspect consists of the three prime processes of planning, forecasting and replenishment. These processes constitute four important activities to improve the collaborative performance of manufacturers and retailers (see Figure 2.6) (VICS, 2004):

Figure 2.6. CPFR Model – Manufacturer and retailer tasks



Source: VICS (2004, p. 11)

- Strategy & Planning: Identify baseline rules for collaboration, and select product or product-groups merchandised by developing a joint business plan for a particular period
- Demand & Supply Management: Share Point-of-Sales (POS) data and additional sources to fulfil the forecasting and shipment requirements over the period
- Execution: Set orders, share delivery plans and consider the number of products in stock and on retail shelves. Then, record sales and make payment
- Analysis: Track the joint business plan in comparison with the execution progress made. Then, aggregate the results to measure performance parameters. Accordingly, share perceptions to improve the previously developed plan for continuous improvement in collaboration

Despite these activities as the guideline of CPFR, practitioners confront significant challenges through the implementation of CPFR. These challenges are primarily to (VICS, 2002):

- Choose collaborative partners and relevant products
- Set up a performance measurement policy between partners
- Settle partners' organisational approach, according to the CPFR approach, and
- Transform the organisational structure based on CPFR, if required

2.3.1. Steps of CPFR

The CPFR processes of planning, forecasting and replenishment link with each other, and each process needs to be adopted by partners to achieve the objectives of CPFR. This achievement relies on the nine consecutive steps of CPFR (Ireland and Crum, 2005; VICS, 2002). In this way, steps 1-2 represent planning while steps 3-8 entirely clarify the CF practice, whilst step 9 adds insight to the replenishment process of CPFR. Whilst these steps are interpreted below in accordance with Siefert (2003)'s elaboration, the CPFR process model is presented in Figure 2.7. Interpretations are also enriched with associated articles to add further insight into the problems that occur through CPFR.

STEP 1: Develop a collaboration agreement

- Develop CPFR mission statement: Establish a common rationale for cooperation, trust and availability of sources
- Determine CPFR goals and objectives: Identify attainable objectives and tasks that require agreement to measure performance. Define associated business activities and overall criteria connected with purchasing exceptions and order forecasting
- Discuss competencies, resources and systems: Show willingness and determination for required competencies, resources and systems to contribute to the CPFR process: "which department or functional groups are ready and able to contribute to the process long-term? which additional capabilities must be expanded or outsourced?"
- Define collaboration points and responsible business functions: Identify the extent of collaboration and responsibilities for both sides
- Determine information sharing needs: Clarify the types of information that are required for collaboration. Define how frequently and in which way information sharing will be conducted. Inform the partner company about how long a response time is acceptable before the request for information, and what forecasting methods are the base of forecasting
- Define service and ordering commitment: Structure the order and delivery commitments which need to be measured mutually to generate firm orders
- Determine resource involvement and commitments: Reciprocally identify sources that will be available through the CPFR processes (e.g. time and number of employees devoted to collaboration). Have an agreement on the ways of improving processes continuously
- Resolve differences between partners in the CPFR processes: Consult pre-established rules to solve disagreements and differences
- Regularly review cycle for CPFR agreement: Assess the process on a regular basis and evaluate success of the collaboration
- Publish front-end agreement: Initiate combined agreements. Update objectives and / or benchmark criteria for new demand and improvement, if required

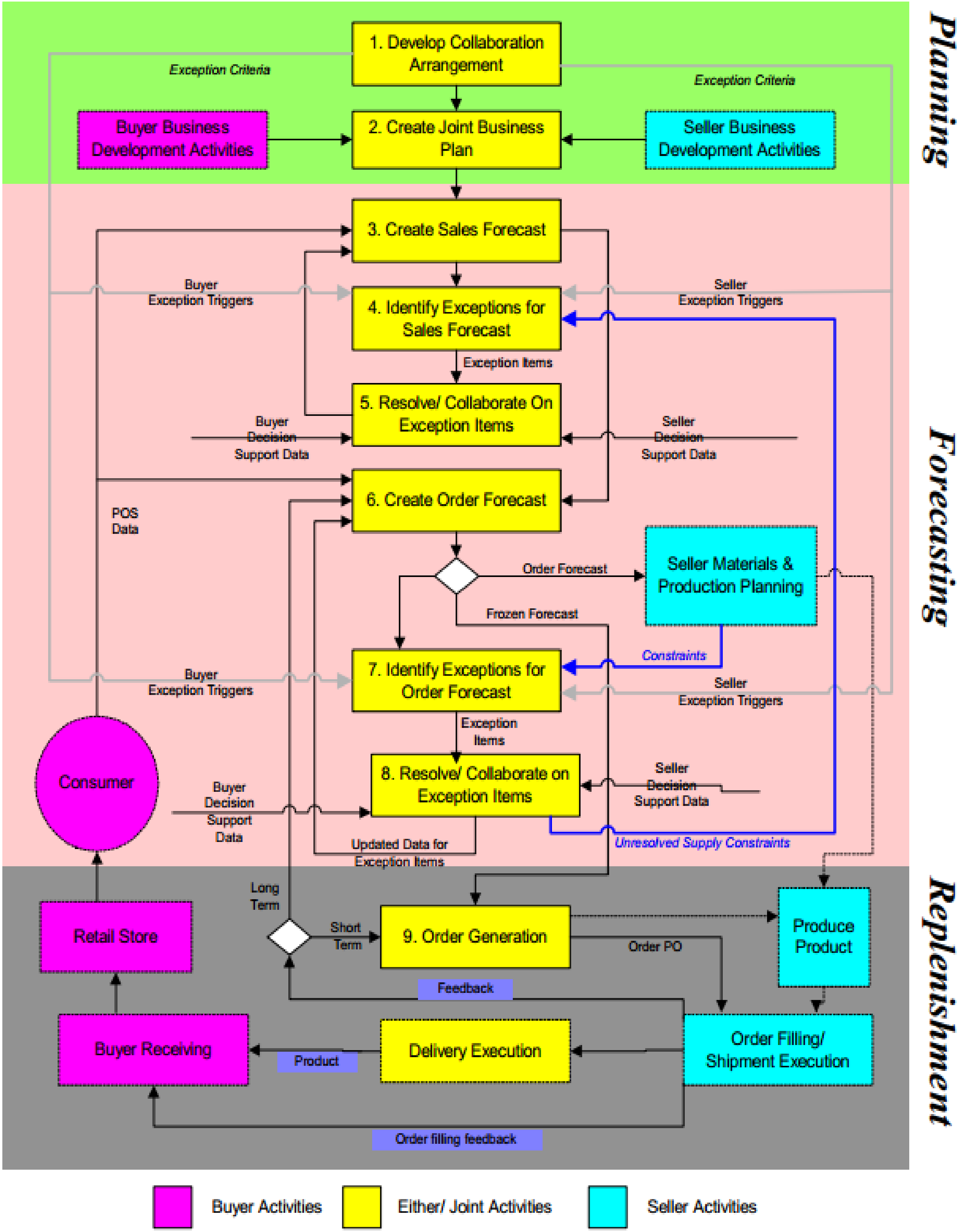
STEP 2: Create a joint business plan

- Engage corporate strategies in a single business plan
- Consider the experience of category management and business planning to identify roles and objectives in collaboration
- Regard the requirements of continuous product based information exchange (e.g. minimum order, required lead-time for orders and order frequency)

It is clear that partners need to follow the same vision to underpin their collaboration both internally and externally, where having a different organisational culture is likely to harm their agreement on a single business plan (Johnston *et al.*, 2004; Ireland and Bruce, 2000). Partners confront difficulties connected with building trust and commitment to each other, which in turn prevent them from proceeding with their agreements in CPFR (Fliedner, 2006). Building trust and long-standing collaborations relies upon their effective information sharing and continuous willingness given to build a positive memory / experience in the partner's mind (Fischer, 2013; Özer *et al.*, 2011).

Effective information sharing also underpins forecasts, and eases integration in supply chains (Ha *et al.*, 2011; Nyaga *et al.*, 2010). Nevertheless, there is a scarcity of empirical research blending partners' diverse practices in an attempt to offer clear guidance to know the way/s of commencing close collaboration and sustaining tight integration for long-term partnerships. Whilst the literature is limited to a number of case studies that address these challenges over a limited number of companies (Ramanathan and Gunasekaran, 2014; Småros, 2007), the current research is committed to closing the existing gap from the manufacturers' point of view. The following steps constitute the CF of partners, which is the focus of this research.

Figure 2.7. CPFR process model



Source: VICS (2002, p. 4)

STEP 3: Create sales forecasts

- Employ POS data and retailer’s promotional plan to generate sales forecasts, in which using these information sources enhances the reliability of forecasts

STEP 4: Identify exceptions for sales forecasts

- Define products that were accepted as exceptions to sales forecasts to have an agreement on forecasts. It is important to identify exception criteria for each product in STEP 1

STEP 5: Resolve / collaborate on exception items

- Jointly identify exceptions in an effective time period for stronger forecasts

STEP 6: Create order forecasts

- Link the POS data of the retailer to the manufacturer’s inventory strategy for separately estimated order forecasts
- Order quantity needs to be estimated based on “inventory target per product” and “the destination of product”
- Respond to the questions of “how much advance notice is necessary to transport the product to its destination? and does the order information reflect temporal differences?"
- Apply short-term forecasts for actual orders, and long-term forecasts for tracking the business plan which was developed jointly

STEP 7: Identify exceptions for order forecasts

- Identify the products entailing exceptions between partners to ease agreement on a single order forecast

STEP 8: Resolve / collaborate on exception items

- Commonly identify and clarify exceptions with efficient communication in a timely manner
- Reflect potential changes to forecast
- Enhance the speed of information sharing to make timely decisions for a reliable order forecast

STEP 9: Generate Order

- Generate order forecast as the actual order of the retailer
- Order generation can be managed by either retailer or manufacturer
- Managing the process of order generation depends on partners' forecasting skills, available information and access to information over appropriate IT systems

In essence, the CPFR steps, from 3 to 8, encapsulate partners' entire forecasting process to create a good platform for replenishment operations. Although the CPFR approach dedicates step 9 to partners' replenishment operations (Ireland and Crum, 2005; VICS, 2002), it rather represents the consensus step in terms of finalising the forecasting process and initiating the order replenishments between partners. Given the combination of these steps, from 3 to 9, it largely plots partners' continuous effort put into exchanging knowledge, generating timely forecasts within their departments, and most importantly meeting to solve exceptions occurring over the products that they collaborate on. Implementing these steps in a timely manner necessitates rigorous internal-external forecasting and information sharing, and an appropriate technological platform for continuous information exchange, yet these requirements appear to be substantial obstacles of partners (Fliedner, 2006; 2003).

There is as a broad consensus that partners' agreement on a single vision, joint business plan and willingness to solve exceptions are important facets that benefit from CPFR (Danese, 2007; McCarthy and Golicic, 2002; Ireland and Bruce, 2000). The literature is rich in views supporting the claim that partners need to have good IT systems to conduct timely information sharing, and to generate a single but reliable single forecast within their departments (Danese, 2006; Fliedner, 2003; McCarthy and Golicic, 2002; Helms *et al.,* 2000). However, a gap in practice appears with collaborations subject to time-sensitive and / or short-life products (Adebanjo, 2009; Småros, 2007; Taylor and Fearne, 2006). Hence, these product-groups are the major interest of this research. In addition, the literature has limited knowledge elaborating major internal-external forecasting practices and IT systems required for CF apart from clarifying the types of information which should be exchanged between partners (Fliedner, 2006; Danese, 2006; Barratt and Oliveira, 2001; Helms *et al.,* 2000). Generalising these practices based on the dynamic structure of the FSC and specific product-groups are a substantial contribution to extending the literature and to enlightening food practitioners (Ramanathan, 2013; Ramanathan and Muyldermans, 2010; Danese, 2007).

2.3.2. CF in practice

Since 1998, the processes of CPFR have been tested by more than three hundred companies across the world, and case studies have illustrated its benefits in terms of inventory reductions (10-40 percent) and product availability at stores (2-8 percent) (VICS, 2004). Partnerships between Unilever and Sainsbury's, Nabisco and Wegmans, Wal-Mart and Sara Lee Branded Apparel, as well as Kraft and Sainsbury's along with Lowes Home Improvement and Whirlpool are only a number of prominent examples that appear in practice (VICS, 2010; ECR Europe, 2001; Ireland and Bruce, 2000). For instance, the outcomes of the Wal-Mart and Sara Lee Branded Apparel collaboration were increased sales (45 percent) and market share (12 percent), while the Nabisco and Wegmans partnership led to sales growth (for nuts: 32 percent, for milk: 8 percent) and inventory reduction (18 percent) (Ireland and Bruce, 2000).

Although CPFR is a promising practice to improve supply chain, European-based practitioners often do not pay sufficient attention to it (Forslund and Jonsson, 2007). Despite valuable books and guidelines devoted to CPFR in terms of guiding practitioners (Ireland and Crum, 2005; Siefert, 2003; VICS, 2002), there is a significant gap with regard to the CF practices of partners in the dynamic FSC (Småros, 2007). The importance of this gap has further risen over time. The reason behind the lack of implementation of CPFR is more likely to hinge upon its unclear objectives perceived by practitioners. Whilst objectives of CPFR were to enhance supply-demand coordination, to manage exceptions, and to meet consumer demand (VICS, 2002), this objective, over time, has transformed to "add value to the supply chain by improving forecast accuracy" (Mello, 2013, p. 28).

In other words, improving forecast accuracy has come to the forefront of collaborations, whilst the literature is limited when it comes to guiding partners in generating accurate forecasts for time-sensitive and / or short-life product-groups in the FSC (Du *et al.*, 2009; Adebanjo, 2009; Ali *et al.*, 2009; Taylor, 2006). This shortage enhances the importance of this research, because it aims to increase the forecast accuracy of time-sensitive and /or short-life product-groups and the duration of collaborations between partners in the FSC. Småros (2007) studied four separate CF projects in the European grocery sector. These projects focused on a single retailer and four manufacturers, providing dairy, meat, confectionery and chemical products to the retailer. The current research discusses these time-sensitive product-focused CF projects, and reviews the findings and arguments of related studies below.

2.3.2.1.CF for perishable and seasonal products

The first project of Småros (2007) was dedicated to retailer-dairy manufacturer collaboration, and aimed to enhance the store level forecast accuracy as well as the efficiency of replenishment over twenty different products. Although partners' forecasts were adequately accurate at the supply chain level, similar results could not be accomplished at the store level. It is noteworthy that forecasts were on a centralised basis and were generated based on a top-down approach, and the retailer did not normally apply centralised forecasting approach. Because of this, unsuccessful forecasts at the store level prevented the project from being conducted long-term. In this respect, Småros (2007) argued that despite the retailer's reluctance to make costly technological investments for better demand management, the lack of investment in IT systems is not an obstacle for long-term CF.

The top-down approach is intrinsically an appropriate process for generating consensus forecasts in CF. In this approach, forecasters initially use aggregate data to generate aggregate forecasts, and these forecasts are then disaggregated to obtain the forecast of each product or item (Zotteri *et al.,* 2005). However, the bottom-up process, which was mostly used by the retailer, is a more independent forecast generation process, which does not seem appropriate to generate consensus forecasts (Fliedner, 2006). In this case, the retailer's unfamiliarity with a centralised forecasting approach seems to be one of the underlying reasons for generating inaccurate forecasts at the store level. In essence, this limited case study built upon a single retailer raises doubts on the forecasting skills of retailers in CF.

Considering the role of IT systems, McCarthy and Golicic (2002), for instance, stressed that costly technological investments are important barriers to CF when they examined the collaborations of three different manufacturers. Their outcome is in line with the study by Fliedner (2003), while Sari (2008) similarly emphasised that the necessity of IT systems limits partners adopting CPFR for a broad product range. Case studies in the UK FSC likewise supported this consensus when they illustrated that partners' different IT systems caused forecast errors and administrative costs (Taylor and Fearne, 2006; Taylor, 2006). Relying on these contradictory views and limited arguments, it seems that there is not a clear map guiding practitioners in generating accurate forecasts for perishable and seasonal products in CF. Therefore, it is worthwhile to interrogate the related literature and to explore the factors that play a vital role in the forecast accuracy of associated products.

2.3.2.2.CF for promotional products

The second project of Småros (2007) referred to the retailer-meat manufacturer collaboration, and aimed to improve the forecast accuracy of promotional products. To accomplish this intention, the partners started to estimate forecasts four weeks prior to promotions by using a newly developed forecasting tool. This tool considered the number of sales as before-during-after promotions, types of promotions and replacement of substitutions. However, a lack of historical information, wide product range of promotions and diverse promotion types directed partners to apply judgmental adjustments to statistical results. In this respect, lack of data, unsophisticated IT systems, and forecasters' lack of experience lowered the quality of promotional forecasts. The results of this observation illustrated retailers' limited forecasting skills and sources at the retailer-driven CF practice level, which, in turn, harmed partners' information sharing. Meanwhile, Småros (2007) asserted that similar problems are not likely to occur with manufacturer-driven CF practices,

The study by Ramanathan and Muyldermans (2010) expanded the observations of Småros (2007), and demonstrated that weather conditions, special days and product rank are strong indicators of promotional forecasts, apart from promotion type, duration and discounts. Considering the volatile demand for promotions, sustaining product availability on shelves depends on partners' usage of diverse types of information in forecasting (Cachon and Fisher, 2000). Owing to the impact of external factors on the demand, these data are likely to be representative of recent changes, such as weather conditions and special events. To benefit from these sources that are valuable temporarily, they need to be exchanged in a timely manner and in an adequate form (Li and Wang, 2007; Forslund and Jonsson, 2007). In other words, the quality and value of information should be sustained until promotional forecasts are generated, and are converted to actual orders. Whilst the literature reports contradictory views as to whether or not IT systems affect long-term CF (Sari, 2008; Småros, 2007; Fliedner, 2006), partners' different IT choices in practice caused delayed information exchange, which, in turn, worsened the demand management of promotions (Taylor, 2006). Although few studies have observed manufacturers' loss of data due to departments' lack of cross-functional communication (Småros, 2007), partners in the FSC confronted difficulties about maintaining data availability and sustaining real-time information exchange with each other (Taylor and Fearne, 2006).

A case study by Adebanjo (2009) brought a different dimension to promotional forecasts by emphasising the role of lead-times and limited flexibility in the demand due to consumers' habituation to particular promotions. This is to say, manufacturers' capabilities play an even more important role when promotions are subject to CF, whilst it is more problematic to forecast promotions compared to non-promoted products (Barratt, 2004). Accordingly, collaboratively forecasting promotions makes manufacturers liable to supply products to retailers on time and to be flexible so as to cope with volatile demand. Whilst manufacturers' long lead-times raise concerns about their skills of providing timely deliveries (Småros, 2007), promotions' short-time sales representing complex discounts are most likely to entail variability on sales and inventory levels, and to influence production efficiency (Ramanathan and Muyldermans, 2010). If manufacturers cannot match demand and supply, the quality of customer service will be reduced (Adebanjo and Mann, 2000), which will in turn worsen their collaboration with retailers. This, in turn, implies the importance of effective inventory management and delivery operations when manufacturers collaboratively forecast promotions with retailers. In this respect, interrogating manufacturer' operations, both at the internal and external level, which are likely to affect promotional forecasts and accordingly collaborations with retailers, is promising to extend the limited knowledge of case studies in the FSC.

2.3.2.3.CF for newly launched products

Through the third project of Småros (2007), when the manufacturer shared initial demand forecasts of newly launched confectionery products with the retailer, these forecasts were used by the retailer to evaluate both space on the shelves and the amount of replenishment in stores. At the end of second, fourth, sixth and eighth weeks of launching the products, the manufacturer had access to retailers' POS data, which enabled them to improve existing forecasts. Partners' strong communication at the distribution level underpinned forecasts with additional information, involving recent changes about logistics and category management. This effective information sharing enabled the manufacturer not only to rapidly react both to demand changes and stock-out, but also to enhance accuracy by 7 percent. However, the limitation of this project was to refer long-life new confectionery products. As far as the short-life newly launched product-groups are concerned, the literature is lacking in studies guiding practitioners in aligning the demand for and supply of such products in the FSC (Småros, 2007).

Despite long-life new products, the manufacturer's responsive production system became another contributor to reliable forecasts. Investing in a production system allowed the manufacturer to tailor production planning and scheduling against instant demand changes, and to enhance the delivery performance by 2.6 percent. It is also known that sharing POS data with manufacturers helps them to improve production planning (Goodwin, 2005). If the forecast data received from retailers include errors, it contrarily engenders over / under production and costs in terms of distribution and inventory (Thomassey, 2010). Whilst it can be argued that both manufacturers' production skills and retailer data are likely to be an indicator of matching the supply of and demand for new items, manufacturers have additional difficulties in combining production planning and forecasting (Nakano, 2009). It is known that POS data of retailers do not include uncertainties in sales, hence manufacturers need to evaluate potential uncertainty and then plan their production (Goodwin *et al.*, 2010). As far as newly launched products are concerned in CF, partners are more likely to confront fluctuating sales. This accordingly calls for manufacturers' skills of interpreting retailer data and matching forecasts and production, which is a common problem of manufacturers that gives rise to either excessive stock or stock out (Helms *et al.*, 2000). This problem calls for partners' mutual support and effective coordination to synchronise their forecasting and to sustain high quality information sharing through the collaboration on new items (Yan and Dooley, 2014).

Another observation by Småros (2007) was the long lead-times that harmed manufacturers' benefits from forecast updates, while partners' different planning horizons and preferences about aggregation levels inhibited them from obtaining better forecasts. Taking into account the dominance of retailers in Europe (Hogarth-Scott and Parkinson, 1993), Småros (2007)' observations not only remonetised the role of power in CF, but also raised the importance of lead-time management for manufacturers. This is because retailers' satisfaction from CF is associated with short replenishment times and high service levels, whilst manufacturers can benefit from replenishment operations during effective information exchange (Aviv, 2001). Exchanging information allows manufacturers to obtain further information with regard to the market and products, and then to improve their forecasts against demand variability (Chang *et al.*, 2007). These improved forecasts help retailers in managing inventory effectively against the fluctuating demand for newly launched products (Småros, 2003).

This conclusion adds further understanding to the observations of Småros (2007), in which the manufacturer showed desire for long-term CF and having access to POS data for better accuracy. The retailer, on the other hand, was concerned with the short lead-times for better inventory management, rather than focusing on forecast accuracy. Therefore, partners' different expectations from forecasts and collaboration seem to be one of the most significant barriers to long-term and accurate CF (Fliedner, 2006). This conflict calls for managerial commitment for internal-external transformation, trust to share knowledge and joint forecasts to achieve consensus (Barratt, 2004). The impact of power between partners is another issue, where the availability of data for retailers is likely to underpin their dominance in collaborations, which inversely affect information sharing and make long-term collaborations costly apart from reducing supply chain performance (He *et al.,* 2013). Instead of power, partners need to contribute to collaboration by sharing the relevant information about new item/s that are planned for launch (Yan and Dooley, 2014), which is an important gap in collaborations (Ramanathan, 2013; McCarthy and Golicic, 2002; Barratt and Oliveira, 2001).

The final project of Småros (2007) aimed to update forecasts for new chemical products. In this project, the lack of motivation of forecasters and long production intervals became an important barrier to forecast accuracy. Further, lack of interdepartmental communication caused a loss of POS data by manufacturers. While these limited observations imply that short production plans are better for accurate forecasts, manufacturers' lack of interdepartmental coordination seems to be a considerable indicator of forecasts and collaboration. The literature also stressed how a lack of internal coordination, communication and trust, and differing needs of the departments of manufacturers cause multiple forecasts, escalating internal-external conflicts (Barratt, 2004; Helms *et al.*, 2000; Ireland and Bruce, 2000). However, there is a paucity of empirical work addressing manufacturers' internal relation in CF. Interdepartmental relations became even more important when partners intend to collaboratively forecast newly launched products in the dynamic FSC (Småros, 2007; 2005). Given the benefits of interdepartmental coordination, easing process alignment and the success of partnerships (Barratt, 2004), the business practice of Sales and Operations Planning (S&OP) seems to be an option for manufacturers. S&OP "can be characterised as the long-term planning of production and sales relative to the forecast demand and the complementary resource capacity planning" (Olhager, 2013, p. 6839). For that reason, this practice is further elaborated in the following section.

2.4. Sales and Operations Planning (S&OP) and other practices in the FSC

S&OP began as an extension of Manufacturing Resource Planning (MRP), easing the coordination of internal information sharing for manufacturers (VICS, 2002). By definition, it is "a formal process led by Senior Management that on a monthly basis evaluates the time-phased rolling projections for new products, demand, supply and the resulting financials" (VICS, 2010, p. 6) (See Figure 2.8). Its objectives are to analyse the performance and objectives of relevant departments to ensure they proceed with a single outlook, and to align the company's demand forecast and supply-service practices via integrated business plans (VICS, 2002).

Figure 2.8. S&OP Process

Source: VICS (2010, p. 7)

S&OP starts with pre-established meetings of salespeople to build demand forecasts, referring to target sales rather than production. Then, forecasts are adjusted based on marketing plans, including advertisements, promotions, newly launched products and potential obsolescence. Afterwards, the operation department considers the forecasts of salespeople to generate inventory, supply chain and production plans over MRP to meet forecasts. Finally, the formal S&OP meeting is held with representatives of sales / marketing, operations and finance departments to finalise the future S&OP plan, and to identify the meeting cycle alongside responsibilities (Grimson and Pyke, 2007). Given the dynamic structure of FSC, manufacturers need to be more agile in the operations of information sharing, forecasting and production.

Building a good internal coordination with S&OP is likely to enhance their capability of rapidly reacting to instant demand changes (Nakano, 2009).

From the forecasting standpoint, S&OP aims to "develop a consensus-based set of forecasts and plans that include input from a number of functional areas, such as demand-side managers from sales, customer service, and marketing, and supply-side managers from manufacturing, logistics, and procurement" (Mello, 2013, p. 27). Regarding the manufacturers' multiple forecasts, because of a different outlook of departments and lack of cross-functional communication, causing loss of information (Småros, 2007; Fliedner, 2006; Helms *et al.*, 2000), S&OP is an alternative option to synchronise their internal-external relation in CF with retailers. S&OP seems to be a remedy for manufacturers to improve their forecasting skills in matching supply and demand. However, market uncertainties worsen information sharing with retailers, which obliges manufacturers to apply safety stocks (Mello, 2013). Safety stock is arguably not a good option for short-life products. In such a case, it is also beneficial for manufacturers to convey departments' cross-functional communication to an external level by linking S&OP and CF in collaborations with retailers (VICS, 2010).

The logic behind this is that S&OP is a decision making process to synchronise the strategic, operational and financial plans of a company in having a consensus on a single plan, in which such a plan comprehends overall risks, opportunities and the actions that should be done strategically in the long-term (e.g. 18 to 24 months). Whilst S&OP is more a planning focused internal approach, CPFR moves this practice to the external level by creating consensus between partners, where it further evolves partners' supply chain from a scanty push system to a more customer focused pull system systematically. Therefore, merging S&OP and CPFR can help partners to develop an integrated business plan, which, in turn, foster the management of supply chain and provides competitive advantage (VICS, 2010).

In practice, the collaboration of The Lowe's Home Improvement and Whirlpool is a good example of the combination of CPFR and S&OP. Partners initially worked on customer focused marketing strategies for better order forecasts and inventory levels.

Then, the focus became the alignment of sales and forecasting plans, which also helped them to be involved in promotions, launching new items and planning special events. Such a linkage of CPFR and S&OP enabled Whirlpool as a manufacturer to enhance sales growth by 12 percent, to reduce inventory costs by 5 percent and to improve timely deliveries by 3 percent along with increased flexibility and faster decision making (Smith *et al.*, 2010).

In case of having long production lead-times and seasonal products in S&OP, a long planning horizon is essential (e.g. 12 months) whilst a short horizon seems adequate for short lead-times and mature products (Grimson and Pyke, 2007). Given the benefits of long-term capacity management (e.g. timely deliveries, flexibility and cost), the long-term planning focused S&OP helps manufacturers to align production and forecasts, and to effectively manage production capacity (Olhager *et al.*, 2001). Studies concluded that formally conducted S&OP allows salespeople to share the logic behind decisions given to tailor forecasts. In detail, while salespeople deliberately inflate or deflate forecasts to meet corporate objectives (e.g. product availability or exceeding quotas), S&OP, in this case, enables consensus on forecasts by allowing upstream and downstream members to interpret forecasts at meetings (Byrne *et al.*, 2011). When partners make an effort to deal with market uncertainties, they should regularly revise responsibilities and improve S&OP by either adding additional processes to feed forecasts with new information or removing redundant ones to prevent duplicated forecasts (Nakano, 2009).

In the vulnerable FSC, partners not only confront external dynamics (e.g. economic conditions, unexpected events, seasonality and promotions) (Bourlakis and Weightman, 2004), but are also involved in internal dynamics that appear due to poor organisational structure (e.g. lack of data, poor information systems and communication). Such disturbances occasion decayed perishable / seasonal products, with settling these conflicts resting upon the extent to which partners integrate internally and externally (Vlajic *et al.*, 2012). Hence, inter-organisational interaction is important to manage demand against such shortcomings and product-related ambiguities (Davis and Mentzer, 2007). S&OP brings about the alignment of demand and supply through departments' cross-functional integration (Oliva and

Watson, 2011), and it eases the development of long-term plans for production, sales, demand forecasting and capacity management (Thomé *et al.*, 2012). This is why merging S&OP with the CF practices of manufacturers is most likely to remedy their internal conflicts, which will in turn enhance forecast accuracy and satisfaction for long-term collaborations. In addition to S&OP, the SCM literature has also paid close attention to the practices of Vendor Managed Inventory (VMI), Quick Response (QR) and Efficient Consumer Response (ECR), (Ramanathan, 2010; Choi and Sethi, 2010; Grimson and Pyke, 2007; Micheau, 2005; Kurt Salmon Associates, 1993). These practices are discussed to review the SCM literature.

2.4.1. Vendor Managed Inventory (VMI)

In the 1980s, VMI emerged as a pilot project conducted between Wal-Mart and P&G (Ramanathan, 2010). VMI is a partnership initiative that relies on "information sharing among the members in an attempts to match supply and demand as closely as possible" (Angulo *et al.,* 2004, p. 101). It aims to "provide the right product, to the right place, at the right time, in the right quantity, at the least cost" (ECR Europe, 2002, p. 83). Therefore, it gives responsibility to manufacturers through continuous replenishment operations (Sari, 2008). This initiative received strong attention in various industries. Nestle and Tesco (Watson, 2005), Boeing and Alcoa (Micheau, 2005) and Electrolux Italia (De Toni and Zamolo, 2005) as well as Glaxomithkline (Danese, 2004) are a number of leading companies that benefited from VMI.

During VMI, suppliers' responsibility is to replenish customers' inventory, where the inventory control is transformed from decentralised to centralised systems. Retailers need to share POS data with suppliers for better demand visibility and inventory management (Aviv, 2002). VMI enables retailers to focus on the management of spaces on shelves rather than managing inventory (Mishra and Raghunathan, 2004). VMI provides competitive advantage to retailers by sustaining product availability and reducing order and inventory costs (Waller *et al.,* 1999). On the other hand, manufacturers gain favour from it by reducing bullwhip effect (Disney and Towill, 2003). VMI not only helps partners to improve their logistics capabilities, but also to enhance the efficiency of coordination with each other to be more flexible against demand changes. Particularly, it links partners' logistics operations, and improves the delivery operations. This brings about the alignment of inventory and demand (Mason and Lalwani, 2006). This is why retailers gain competitive advantage while improved logistics skills of manufacturers helps them to be more responsive to demand.

Technological infrastructure is a requirement for VMI to conduct timely information sharing from retailers to suppliers, which, in turn, reinforces their replenishment operations (Sari, 2008). Earlier studies stressed that product tracking systems are important to estimate the timely product quantity required (Waller *et al.,* 1999). Case studies exemplified the low cost feature of VMI providing competitive advantage in the clothing industry (Chang *et al.*, 2009) while simulations revealed its capability in responding to demand volatility, which occurs due to discounts or price changes (Disney and Towill, 2003).

As opposed to long-term VMI partnerships in the USA, relevant literature documented different outlooks in the UK grocery sector with regard to over prices and inventory costs inducing lack of trust and short-term collaborations (Peck, 1998). There is a consensus that VMI limits the usage of retail information (Yao *et al.,* 2007; Angulo *et al.,* 2004; Aviv, 2002). In essence, retailers can reduce order costs, inventory monitoring operations and increase product availability, but VMI is not satisfactory during promotions (Ramanathan, 2010; Sari, 2008). For instance, the grocery chain Spartan Stores ceased the implementation of VMI with suppliers due to VMI's inadequate features of dealing with promotions (Simchi-Levi *et al.*, 2003).

The reason behind this limitation of VMI is that manufacturers make an effort to manage replenishment operations with limited data (Sari, 2008). In other words, retailers give responsibility manufacturers to manage their inventory, but share limited data, such as POS. Retailers' closeness to the market allows them to have additional data that represent consumer behaviours and external demand indicators (e.g. weather and market structure). Along with promotional data, these sources are important clues to react to instant demand changes (Aviv, 2002). Therefore, time-sensitive feature of promotions requires partners to share diverse information types in a timely manner (Forslund and Jonsson, 2007; Cachon and Fisher, 2000).

2.4.2. Quick Response (QR)

The history of QR dates back to the middle of the 1980s, when it was developed to cope with global difficulties of the clothing industry in the USA (Choi and Sethi, 2010) and to quickly react to demand changes with an effective inventory management (Iyer and Bergen, 1997). Its objectives are not only to align the chain of suppliers and buyers and to eliminate costs (ECR Europe, 2002), but also to reduce lead-times over effective replenishment operations, which accordingly leads to improving inventory turnover due to mitigated safety stock (Achabal *et al.*, 2000). The structure of QR relies on retailers' POS data, shared over Electronic Data Interchange (EDI) to produce demand forecasts and to schedule production alongside distribution (Choi and Sethi, 2010). EDI is "the computer to computer transmission of information between partners in the supply chain" (ECR Europe, 2001, p. 104).

Partners mostly favour QR because relevant products have a short shelf life and volatile demand, and because lead-time is long for replenishment operations (Choi and Sethi, 2010). Although QR originated in the USA, it is popular in European countries as well. Common challenges of QR are related to its practical utilisation and the adoption of EDI or related IT systems by practitioners (Fernie, 1994). For instance, practitioners in the UK grocery sector confronted stock management and lead-time-related difficulties, complementary to their poor partnerships. Staying in a long-term collaboration and regularly exchanging data seem to be remedy to these difficulties, with bringing about accurate forecasts as well as efficient replenishment and logistics practices (Whiteoak, 1999).

Conducting tight relationships and regular data exchange necessitates good IT infrastructure in collaborations (Fliedner, 2006; 2003). Given the importance of IT systems in QR, previous studies concluded that partners' technological barriers are related to adoption (e.g. overlapping managerial commitment and vision issues) and / or implementation (e.g. inadequate information, close collaboration and stationary business practices) (Fernie, 1994). Studies in the agricultural industry highlighted how partners need to conduct transparent information sharing and to use relevant information for better demand management, where the role of IT systems in collaborations escalates (Zhao *et al.*, 2010). In connection with partners' technological challenges, Fiorito *et al.* (1995) pointed out the necessity of having a clear understanding about responsibilities and required information, and frequency of delivery. According to Choi and Sethi (2010), exploiting QR depends on the partners' level of vertical integration, quality of information shared and forecasting methods used to align supply-demand as well as the IT systems used to exchange data. Previous studies stressed the role of inventory services, where manufacturers cannot benefit from QR whilst retailers can, in case of having larger than 50 percent inventory service (Iyer and Bergen, 1997).

In essence, because IT systems transformed over time, the popularity of QR has risen in the FSC, and it became a good option for retailers in responding to consumers not only to meet demand but also to compensate for complaints. For instance, studies found that retailers exploit QR to respond to consumer complains via discount coupons. In case of not accomplishing QR, it has been observed that retailers' loss at stores can rise to € 950,000 a year (Goudarzi *et al.*, 2013). Given the analysis of these studies regarding QR from the retailers' point of view, it is possible to say that retailers do not face IT related difficulties from a monetary point of view. The issue appears from the manufacturers' point of view whether they have a good IT infrastructure to align supply-demand, to conduct timely deliveries and to conduct tight collaborations with retailers (Choi and Sethi, 2010).

2.4.3. Efficient Consumer Response (ECR)

Kurt Salmon Associates (1993) introduced ECR as a logistics management practice in 1992. ECR considers the demand driven logistics approach of the clothing and motor manufacturing industries and it is in line with the objectives of Just-In-Time (JIT) and QR, where it was then applied in the grocery sector (Peck, 1998). ECR Europe (2002, p. 87) defines ECR as "a joint initiative by members of the supply chain to work to improve and optimise aspects of the supply chain to create benefits for the consumer e.g. lower prices, more choice variety, better product availability". ECR aims to minimize costs in supply chains and to meet consumer needs in connection with the processes of efficient replenishment, promotion, store assortment and product introduction (Alvarado and Kotzab, 2001; Robins, 1994).

Through these four processes, partners get benefit from a continuous replenishment programme and category management (Kurnia and Johnston, 2003).

The efficient product replenishment process aims to minimise replenishment times and costs, with manufacturers obliged to provide correct products to correct places in the correct amount and at the right time. This process relies on the implementation of a continuous replenishment programme in an attempt to minimise stock levels (Harris *et al.,* 1999). An efficient promotion process focuses on eliminating redundant promotions over new and alternative promotions. “Pay for performance” and “forward commit” are two alternative options that manufacturers apply in ECR. For instance, “pay for performance” is connected with rewarding retailers based on the number of products sold to customers and bought from manufacturers (Washburn, 1995). “Forward commit” is about delivering a single retailer order to multiple stores or warehouses. In this option, retailers gain favour from discounts given for a limited time of promotions by manufacturers (Martin, 1994).

As far as the store assortment process is concerned, this process is managed at the store level, and aims to enhance efficiency for better inventory and shelf management. Improving store assortment in ECR requires the close collaboration of manufacturers and retailers (Kurt Salmon Associates, 1993), as well as the good category management (Kurnia *et al.,* 1998). In the product introduction process, partners need to make good effort to develop new items, to launch them in the market and to mitigate associated costs collaboratively (Kurt Salmon Associates, 1993). As in the store assortment process, partners again focus on category management to monitor the performance of newly launched products in the market (Harris *et al.,* 1999).

In the USA, the interest of companies in ECR rose to cope with supply level difficulties, such as inventory and delivery practices, while their European counterparts used ECR for demand management (Fernie, 1994). Following this, long-term collaborations in the USA improved supply chain efficiency over the time-consuming face-to-face meetings. However, these meetings kept away a large number of small manufacturers from long-term collaborations (Peck, 1998). In spite of limited long-term collaborations, retailers gained benefits from service and reduced inventory levels alongside associated costs because of manufacturers' full responsibility for replenishments, forecasts and deliveries (Kurt Salmon Associates, 1993). In the UK, Tesco and Sainsbury's are good examples that earned competitive advantage via ECR. They, for instance, identified a number of obligations, in which manufacturers should fulfil them to conduct successful collaborations with retailers. They are (Fearne and Hughes, 2000, p. 765):

- Proactive relationships across all aspects of the business (moving away from exclusive buyer/account manager contact to multi-functional linkages across the business)
- Complete electronic integration (now accessible for even the smallest suppliers as costs have come down with time and experience)
- Information sharing (directed at improving and increasing existing business and inevitably drives exclusive / closed supply chains, which goes some way to offsetting the risk of sharing information with suppliers)
- Innovation (new product development, marketing, supply chain management)
- Ability to assist / shape customer's view of the category and its future development (strategic relationship)
- Customer specific products, services and investments (supply chain exclusively)
- Financial stability (retailers do not want to invest in key suppliers if they are going to go bankrupt!)
- Supply chain management (integrity and efficiency)
- Cost management (ability to measure and analyse them and take positive action – open book feasibility)
- Product range management (ECR related issues such as category planning and new product development)
- Promotion and merchandising (tends to be retailer led in fresh produce but supplier led in fast moving consumer good)

These obligations conclude that those manufacturers distinguishing themselves from others should primarily focus on long-term partnerships by following a single vision with retailers, and they need to be innovative by focusing new product development (Fearne and Hughes, 2000). In essence, ECR is more extensive than QR, and covers suppliers as well (VICS, 2002). It not only considers partners' internal practices (VICS, 2002), but also gives further emphasis to timely and accurate information sharing (Fiorito *et al.*, 1995). This necessity increases the importance of information sharing and its enabler IT systems for strategic partnerships. The aforementioned analyses and pragmatic views are clear evidence that manufactures have responsibilities at the operational and managerial level to satisfy retailers and to sustain long-term collaborations. Nevertheless, adequate attention has not been paid to their standpoint in the FSC, which necessitates future research to close this gap (Småros, 2007).

In summary, partners have alternative practices (e.g. S&OP, VMI, QR and ECR) to build promising partnerships in the FSC. Their objectives and benefits along with the required responsibilities of partners are summarised in Table 2.6 for managerial implications. Despite their different procedures, partners' challenges are common. For instance, S&OP eases internal integration and allows manufacturers to follow a single plan for supply-demand alignment, yet market uncertainties (e.g seasonality and promotions) escalate demand volatility. This calls for high quality information sharing (Mello, 2013). VMI limits diverse information exchange between partners, which in turn restricts its application for promotions (Sari, 2008). Similarly, IT related obstacles in QR require close internal-external integration and sophisticated forecasting processes, where exchanging quality information is non-ignorable too (Choi and Sethi, 2010). Diverse processes of ECR require manufacturers' continuous effort and innovation through promotions and new product development. It is therefore requisite to satisfy retailers by investing in IT and improving forecasting skills through long-term collaborations (Fearne and Hughes, 2000).

Table 2.6. Objectives and benefits of collaboration practices along with the role of partners in these collaborations

	Objectives	Benefits	Responsibilities of Manufacturers & Retailers	Relative References
S&OP	*To analyse the performance and aspect of relevant departments to ensure they proceed on a single outlook *To align company's demand forecast and supply-service practices via integrated company plans *To develop a consensus-based set of forecasts and plans	*Increasing profits rather than reducing costs *Improving interdepartmental integration *Matching demand-supply on an integrated plan *Easing internal consensus on a single forecast *Increasing sales growth *Reducing inventory costs *Improving delivery performance *Enhancing internal-external flexibility *Increasing speed of decision making	*Focusing on long planning horizon if production lead-time is long and products are seasonal *Focusing on short planning horizon if production lead-time is short and products are mature *Having a clear understanding about the impact of forecasts on the production, delivery plans and procurement *Continuously improving processes and eliminating redundancy *Cross-functionally sharing new and diverse information *Aligning forecasts and production by linking sales plans *Consistently improving sales and future plans (e.g. promotions and advertising) *Focusing on long-term and strategic collaborations	Baumann (2010); Byrne *et al.* (2011); Feng *et al.* (2008); Grimson and Pyke (2007); Mello (2013); Nakano (2009); Olhager (2013); Olhager *et al.* (2001); Oliva and Watson (2011); Smith *et al.* (2010); Thomé *et al.* (2012); VICS (2010; 2002)
VMI	*To match supply-demand as closely as possible *To provide the right product, to the right place, at the right time, in the right quantity, at the least cost	*Enhancing visibility on retailers' demand and inventory level *Utilising the logistics operations of partner to maintain product availability *Providing flexibility to conduct consistent collaborations *Providing competitive advantage in the market *Reducing order and operation costs for retailers along with increased product availability *Improving capability of responding to instant demand changes	*Replenishing inventory of retailers *Sharing POS data, promotional plans and external demand indicators (e.g consumer behaviours, market and weather conditions) with manufacturers *Investing in IT systems *Conducting timely and continuous information sharing *Following a single vision over prices and inventory costs *Showing mutual trust and commitment *Investing in product tracking systems for visible supply chain	Angulo *et al.* (2004); Aviv (2002); Chang *et al.* (2009); Danese (2004); Disney and Towill (2003); De Toni and Zamolo (2005); ECR Europe (2002); Mason and Lalwani (2006); Mishra and Raghunathan (2004); Peck (1998); Ramanathan (2010); Sari (2008); Simchi-Levi and Zhao (2003); Waller *et al.* (1999); Watson (2005); Yao *et al.* (2007)
QR	*To align the supply chain of partners *To eliminate supply chain and inventory costs *To reduce lead-times through effective replenishment operations	*Responding to instant demand changes *Effectively managing inventory and product availability *Easing the demand management of short shelf life products that have volatile demand *Becoming preference while lead-time is long for replenishment operations *Mitigating bullwhip effects *Accelerating the speed of delivery operations	*Sharing POS data with manufacturers *Investing in IT systems *Showing mutual trust and commitment *Linking forecasting, logistics and replenishment practices *Having a clear understanding about responsibilities, information shared and frequency of delivery operations *Conducting high quality information sharing *Employing product based effective forecasting methods *Focusing on long-term and strategic collaborations	Angulo *et al.* (2004); Achabal *et al.* (2000); Choi and Sethi (2010); ECR Europe (2002; 2001); Fernie (1994); Fiorito *et al.* (1995); Goudarzi *et al.* (2013); Iyer and Bergen (1997); Whiteoak (1999); Zhao *et al.* (2010)
ECR	*To eliminate supply chain and inventory costs *To meet consumer needs through efficient replenishment, promotion, store assortment and product introduction processes	*Reducing costs of product development and service *Enhancing product variety and availability at stores *Improving inventory and delivery practices *Easing demand management in case of having good IT systems *Being preferred for promotions and launching new items *Providing competitive advantage in the market	*Sharing POS data with manufacturers *Replenishing inventory of retailers *Managing delivery operations effectively *Investing in IT systems *Conducting timely and continuous information sharing *Conducting high quality information sharing *Showing mutual trust and commitment *Focusing on long-term and strategic collaborations *Investing in new product development and forecasting skills	Alvarado and Kotzab (2001); Angulo *et al.* (2004); ECR Europe (2002); Fearne and Hughes (2000); Fernie (1994); Fiorito *et al.* (1995); Harris *et al.* (1999); Kurnia and Johnston (2003); Kurnia *et al.* (1998); Kurt Salmon Associates (1993); Martin (1994); Peck (1998); Robins (1994); VICS (2002); Washburn (1995)

Source: *Developed by the author*

2.5. Supply chain integration

Supply chain integration is "the degree to which a manufacturer strategically collaborates with supply chain partners and collaboratively manages intra- and inter-organisational processes, in order to achieve effective and efficient flows of products and services, information, money and decisions, to provide maximum value to customers" (Flynn *et al.,* 2010, p. 58). The integration of manufacturers has been categorised into four stages in the literature. The first stage is more quick fix based, and there is not a tight integration or effective communication either between departments or with partners. Departments manage their processes independently, and only collaborate to solve potential crises. The second stage is more functional, and focuses on the flow of items. The intention at this stage is to reduce costs instead of improving supply chain performance. Manufacturers mostly use MRP systems to manage their short-term plans, but there is a lack of transparency about demand (Stevens, 1989).

At the third stage, there is high visibility from purchasing raw materials to delivering end products. Production and demand are well synchronised in the medium term plans, but the focus is more tactical than strategic. In other words, manufacturers aim to respond to demand instead of collaborating with retailers and / or suppliers. In the final stage, manufacturers' integration is transformed from product-based to consumer-based integration by extending their integration to the supplier and consumer level. Collaboration with partners commences at the early stage of product development, and focuses on strategic objectives. It involves high level IT systems for effective information exchange, and requires long-term commitment between partners (Mason and Lalwani, 2006; Stevens, 1989).

In essence, supply chain integration is a promising research field and therefore a plethora of research has been dedicated to it by examining manufacturers' relationships with either suppliers or customers. However, the study by Flynn *et al.* (2010) specifically extended the supply chain integration literature to manufacturers' interdepartmental relationships by bringing a new dimension to the field. Manufacturers' integration in the supply chain not only refers to external operations with suppliers and / or retailers, but also involves the internal functions of a company as an extension of external coordination over strategic and technological efforts (Sahin and Robinson Jr., 2005).

In this respect, the current research reviews the related literature as an extension of CPFR to be able to reinforce the integration of manufacturers both internally and externally through their CF practices with retailers. Van der Vaart *et al.* (2012) categorised the integration practices as "planning information", involving partners' information sharing to accomplish better supply chain plans, and "joint improvement", working collaboratively to modify supply chain processes for less cost and joint decisions. In other words, while timely and accurate data exchange play a vital role to implement effective supply chain plans (Devaraj *et al.,* 2007), CPFR creates a platform for partners to integrate their supply chain (Van der Vaart *et al.*, 2012). By focusing on Dutch and Spanish manufacturers, a survey by Van der Vaart *et al.* (2012) discovered that partners' IT infrastructure and organisational behaviours influence their integration whilst supply chain complexity is influential on supply chain performance by implying transparent planning. Underpinning these empirical results, the literature has stressed that IT systems, effective inventory management and building mutual trust during inter-intra organisational collaborations are the core elements to integrate in chains (Power, 2005; Handfield and Nichols, 1999; Akkermans *et al.*, 1999).

In consideration of manufacturers' strategic collaborations, Flynn *et al.* (2010) investigated relations between operational-business performance and supply chain integration. Their hierarchical regression based results revealed that manufacturers' interdepartmental relations are vital for operational and business performance. Customer integration has a significant impact on their operational performance, whilst competitive environment, the trust factor and organisational characteristics seem to be important factors for the integration practices of partners. These outcomes make it possible to argue that in addition to strong interdepartmental relations, manufacturers should give emphasis to integration with retailers for promising results in the supply chain. In this case, it is promising to interrogate this argument by considering the dynamic structure of FSC and partners' trust related challenges in collaborations (Vlachos and Bourlakis, 2006; Bourlakis and Weightman, 2004).

An exploratory study with a consumer electronics firm by Oliva and Watson (2011) revealed that although partners intend to sustain diverse needs of top managements, they are likely to integrate during collaboration. However, partners' planning processes play a vital role for the quality level of information exchanged and the alignment of demand and supply, which, in turn, hints at how partners' planning process is important for reliable information sharing and better forecasts. On the other hand, by relying on both interview and empirical results about the relations of e-procurement and supply chain performance, Chang *et al.* (2013) emphasised the major role of integration for supply chain performance compared to data exchange and to partners' mutual commitment in collaborations. They also demonstrated that information exchange has a positive impact on supply chain integration, and their results seem to be in line with the study by Van der Vaart *et al.* (2012). Overall, these strong discussions underline the necessity of critical elements for the internal and external coordination of manufacturers, which are imperative to be analysed in the FSC.

2.5.1. Barriers that prevent the integration of FSC

The food industry has been subject to various studies to identify the primary expectations of supply chain members on collaborations. Regarding the partners' different expectations from collaborations that limit large-scale CF (Småros, 2007), it is apparent that there are several determinants for effective supply chain integration in the FSC, such as trust, commitment, information sharing, category management and physical distribution. However, whether these elements have an impact on the length of collaborations is a considerable mystery in literature and practice (Småros, 2007; Vlachos and Bourlakis, 2006; Aviv, 2002). Practitioners still do not have a clear understanding about strategically forming their collaborations, which plays a key role in long-term partnerships (Ramanathan *et al.*, 2011; Barratt, 2004). Despite relevant propositions addressing long-term CF in the FSC (Eksoz and Mansouri, 2012), there is a scarcity of empirical research shedding light on the development of long-term collaborations (Ramanathan and Gunasekaran, 2014).

For manufacturers, trust is a building block of collaborations. On the other hand, retailers' initiatives rely on information exchange, physical distribution, category management and commitment, whilst they prefer multifaceted collaborations. These antecedents are likely to reduce agreement in relationships (Vlachos and Bourlakis, 2006), which in turn prevent the alignment of supply and demand. These misalignments may be excessive-few items, and errors related to timeliness, location or Stock-Keeping-Units (SKUs) (Simatupang and Sridharan, 2002). If manufacturers are capable of meeting retailers' expectations in connection with product availability, this will lead to get further benefit from collaborations (Aviv, 2007). In essence, a study by Gallear *et al.* (2012) brought an interesting dimension to collaborations by demonstrating the importance of monitoring corporate responsibility and of enhancing internal awareness about the partnerships, where adopting strong partnerships enhances corporate performance.

In other words, manufacturers should have a clear understanding about their internal and external responsibilities, which, in turn, plays a key role in collaborative performance. These blind sides of manufacturers are likely to be improved with the strategic initiative of S&OP. Whilst satisfying retailers depends upon product availability (Aviv, 2007) requiring timely alignment of demand and supply (Simatupang and Sridharan, 2002), S&OP can help manufacturers to generate timely forecasts through departments' cross-functional integration (Oliva and Watson, 2011). Given the forecasting benefits of S&OP, for high-volume and short-life products, it is a worthwhile option in forecasting perishable, seasonal, promotional and / or newly launched products in CF (Olhager, 2013). While manufacturers have a long-term strategic production and demand forecasting plans (Thomé *et al.*, 2012), their organisational structure becomes more transparent and efficient which ease the development of long-term collaborations with retailers. Therefore, it is reasonable to scrutinise this linkage between S&OP and CF to achieve long-term and accurate collaborative forecasts in the FSC.

Disagreements exacerbate when data flows between partners and when forecasts emanate within departments and / or in forecast meetings (Småros, 2007; 2002). In practice, manufacturers have a tendency to bind retailers over a plan for additional demand information, which is used to enhance forecast accuracy as opposed to long lead-times. Conversely, retailers give less importance to forecast accuracy due to short lead-times, and focus on managing store level demand instead of aggregating demand (Småros, 2007; 2005). Although manufacturers can obtain further benefits from retailers who have good forecasting skills, retailers' opportunistic behaviours about taking advantage of manufacturers limit information sharing with each other which, in turn, causes loss of trust (Taylor and Xiao, 2010).

Fundamentally, retailers' information leads manufacturers to reduce inventory levels and related costs in addition to increased supply chain performance (Lee *et al.,* 2000). Danese (2007), for instance, categorised the level of CPFR practices as basic, developing and advanced CPFR. While basic CPFR refers to simple information sharing, developing CPFR more deeply regards the exchange of demand, production related data, promotions and order planning. On the other hand, advanced CPFR stresses high level transparency through information sharing. However, it is still uncertain about what disruptions through information sharing influence partners' inventory regimen and products' quality (Li *et al.*, 2006), and to what extent partners need to integrate and to exchange information in collaborations (Devaraj *et al.*, 2007).

Partners are more likely to conduct closer collaborations through order processing and promotional activities compared to the practices in connection with business strategy and sales forecasts (Vlachos and Bourlakis, 2006). Collaborations that lack a single strategy seem to be very difficult to increase forecast accuracy. The reason is that conducting strong information sharing and preserving product availability rely largely on partners' joint business plan and agreement on a single consensus forecast (Ireland and Crum, 2005; Siefert, 2003). For instance, the cross-case analysis by Danese (2007) in Europe illustrated how although partners conduct simple information sharing, their joint business and sales forecast plans allow them to accomplish CPFR goals, which are to either reduce inventory costs or increase responsiveness against instant demand changes. Previous studies have already emphasised the importance of engaged business plans and tight partnerships to align demand and supply in chains (Simatupang and Sridharan, 2002). Adopting a single business plan leads partners to explore and manage potential events that affect demand and supply, such as promotions, changes in inventory, opening or closing new stores and launching new items (VICS, 2004).

Partners' power is likewise likely to affect their CF. Aviv (2007) stressed that if manufacturers dominate in supply chains, their forecast expectation increases and this, in turn, harms their forecasting skills when it comes to predicting retailers' demand correctly. Contrary views supported the idea that manufacturers play a leading role, because they decide wholesale prices whilst retailers are in a follower position (Zhu *et al.*, 2011). However, it was affirmed that retailers' leadership role makes CF more beneficial due to their closeness to market (Aviv, 2007). Observations in the FSC exacerbated these arguments relating to the power of partners. For instance, when Danese (2007) interviewed a manager who was representing a world-wide retailer, the manager claimed that generating joint promotional and sales forecasts with manufacturers does not provide a particular benefit, because they (the retailer) has enough power to collect the required information from the market without conducting close collaborations.

On the other hand, the recent study by Bourlakis *et al.* (2014) found that large manufacturers are the "sustainability performance champions" in the FSC, and efficiency, flexibility, responsiveness and product quality are important factors to manage sustainability. The authors also claimed that manufacturers need to play a pivotal role in meetings for sustainable FSC while He *et al.* (2013) advocated the restriction of power among partners for better information exchange and supply chain performance. Relying on these contradictory and limited studies that did not pay attention to partners' CF practices, interrogating manufacturers' responsibilities in the chain and their impact in the forecasting meetings will be an intriguing area to extend the literature.

2.5.2. Integration between manufacturers and retailers

Studies devoted to manufacturer-retailer relationships in the FSC have underlined the partners' substantial problems that occurred due to overlapping expectations throughout their information sharing and forecasting process (Fang and Meng, 2010;

Småros, 2007; Taylor and Fearne, 2006). Manufacturers' long lead-times, production plans, poor interdepartmental integration, different forecasting approaches and excessive information requests from retailers became the challenges of CF (Småros, 2007; Helms *et al.*, 2000). Retailers' naive forecasting process, and reluctant and opportunistic behaviours during information exchange were discussed as inhibitors of the long-term and accurate CF (Taylor and Xiao, 2010; Taylor, 2006; Småros, 2002). Despite adverse opinions, refusing the core contribution of IT systems to collaborations (Småros, 2007; Barratt, 2004), their costly investments seem to be a substantial barrier to not only long-term CF, but also the utilisation of CF in a broad range of product-groups (Sari, 2008; Fliedner, 2003; McCarthy and Golicic, 2002).

In practice, manufacturers and retailers endeavour to consolidate their relationships for operational planning, information sharing and forecasting practices in an attempt to enhance organisational profitability. For instance, when Mentzer *et al.* (2000) examined strategic and operational collaboration models, they found that while partners aim to achieve long-term objectives, they collaborate strategically, which enables them to develop new products and to enter new markets effectively. The underlying reasons for this success in the strategic collaborations are not only the technological infrastructure and expertise of manufacturers (Droge *et al.*, 2004), but also their strong interdepartmental coordination, which underpins strong communication with retailers as one of the core elements of long-term relations (Paulraj *et al.*, 2008).

These results add further insight into the attitudes of retailers in practice. Tesco and Sainsbury's, for instance, identified similar requirements for manufacturers to be able to conduct long-term collaborations, such as collaborating strategically, investing IT in systems and improving forecasting skills (Fearne and Hughes, 2000). Although collaborating operationally improves the performance of operational practices, it is not a permanent and consistent practice between partners. The underlying reason is that operational collaborations are based upon short-term decisions, which are made to improve corporate performance and operational efficiency, such as product quality, customer service, inventory levels and timely deliveries (Lambert and Stock, 1993). On the other hand, strategically collaborating partners gain possession of competitive advantage in the market owing to long-term decisions, which are made to conjoin their information sharing and forecasting processes (Mentzer *et al.,* 2000). Partners' strategic collaboration induces reciprocal trust, continuous information sharing as well as constructive discussions to cope with potential exceptions (Flynn *et al.,* 2010).

Empirical studies called for "openness, positive mutual understanding, honesty and respect" for effective information sharing (Ha *et al.,* 2011, p. 59). In a similar vein, when Spence and Bourlakis (2009, p. 293) examined the supply chain responsibility in the case study of Waitrose, they summarised the focuses of "power, partnership, supply chain integration, negotiation, honesty, openness and trust" for sustainable collaboration in the FSC. Building a mutual vision and improving organisational capability seem to be inevitable for partners to cope with uncertainties in the FSC. There is, however, a paucity of empirical studies investigating the impact of the aforementioned factors and the ways of building satisfactory collaborations based on particular market conditions, like in the dynamic structure of FSC (Bourlakis and Weightman, 2004; Mentzer *et al.,* 2000).

From a different point of view, Sanders (2008) devoted an empirical study to the computer industry in an attempt to clarify how IT influences buyer-supplier coordination. The author demonstrated that using IT for a "structured internal information sharing" is necessary to implement operational coordination, which provides operational benefits (e.g. fewer production costs and effective inventory management). However, conducting strategic coordination depends upon the usage of IT for an "unstructured internal information sharing", which provides strategic benefits (e.g. strong relationships and high sales volume). In the study by Sanders (2008), "structured internal information sharing" represents the old process of firms showing benefits in a short period. "Unstructured internal information sharing" rather focuses on new processes, and is more flexible yet its long-run benefits.

Whilst there are contrary views who argued that it is not necessary to invest in IT systems for the long-term integration of supply chains (Småros, 2007; Barratt, 2004), the usage of IT for partners' planning is the prerequisite for strategic coordination

(Sanders, 2008). These systems bring agility to information sharing, which is crucial for CF (Aviv, 2007) and support several manufacturer practices, such as production planning, inventory management and delivery (Thonemann, 2002). In reply to these opposed views, it is promising to analyse the uncertain role of IT systems over the integration of manufacturers in the FSC.

Fliedner (2006) argued that that when manufacturers increase the level of collaboration with retailers, it brings consistency to their production scheduling and inventory plans, with this consolidation engendering the supply of retailers' short-term demand. The author also highlighted the point that the high response rate of manufacturers reduces product obsolescence and stock level, while investing in IT systems makes it possible to conduct effective information sharing. Nevertheless, implementing such investments is costly, which not only restricts information exchange but also the implementation of long-term CF for a wide range of product-groups (Sari, 2008; Fliedner, 2003; McCarthy and Golicic, 2002).

There is further evidence in the literature that partners' overlapping forecasting approaches worsen the supply chain planning and collaborations (Fildes *et al.*, 2009; Sari, 2008; Fliedner, 2006; Mentzer *et al.*, 2000). The case study by Francis *et al.* (2008) compared the collaborative principles of the UK and Argentine beef foodservice sectors. The authors observed that lack of contracts, high prices and responsibilities of the UK based manufacturers are barriers to building long-term plans with retailers. Manufacturers' logistics, production, storage and lead-time-related problems have a significant impact on the shelf life of products. Despite the authors' remedy of a lean paradigm, the existing gap in the partners' supply chain operations became their keynote by calling further attention to manufacturers' operations and capabilities in the FSC.

When Van der Vaart and Van Dook (2008, p. 45) critically reviewed the survey based literature to analyse the relation between supply chain integration and its performance, they categorised SCM factors to three groups. They are "practices", including EDI, VMI and production planning, "patterns", such as supplier visits, face-to-face meetings and consistent performance evaluation of suppliers, and "attitudes", involving trust, commitment, long-term collaborations, joint decision making and share of responsibility. The authors additionally raised the question of whether practices, patterns and attributes have an impact on each other, and of the conditions that influence the partners' attitude in collaborations. Furthermore, the role of power and business conditions on supply chain integration appeared as other question mark, which await empirical answers from academics.

Past literature has demonstrated how partners' business and operational performance are important for competitiveness (Mentzer *et al.,* 2000) but there are different views about whether strong collaborations are more important than the collaborations that are conducted in a balance based on these performances (Flynn *et al.,* 2010). According to Du *et al.* (2009), to be one step ahead of competitors, partners should improve their information sharing and have sustainable decision making mechanisms, which are the omission of product-based collaborations, such as collaborations that are built upon perishable products (Mentzer *et al.*, 2000). The intrinsic reason behind these naive collaborations is that partners' relations in the FSC rely heavily upon the structure of markets and the products traded with each other (Duffy and Fearne, 2004). This outcome makes the investigation of partners' CF on particular product-groups more attractive and encouraging to add further insights into the managerial implications.

Related case studies have concluded that although partners attribute the demand variability of perishable products to seasonality and unexpected events, their promotional plans obstruct effective demand management (Taylor and Fearne, 2006). Price changes and special events including Christmas, Easter and holidays likewise influence customers' buying behaviour (Zotteri *et al.,* 2005). Managing demand against these ambiguities therefore requires inter-organisational interaction, concerning the capabilities of interpreting vagueness on demand and then making correct decisions (Davis and Mentzer, 2007). It is known that partners' behaviours are the key promoter of supply chain performance, requiring willingness, commitment and flexibility in response to the complexities about long lead-times and high demand variability (Van der Vaart *et al.,* 2012). Whilst the first objective of this research is to examine the integration practices of manufacturers based on time-sensitive and / or short-life product-groups in CF, there is a consensus that calls for further investigation on the partners' product-based collaborations (Danese, 2007; Taylor, 2006; Taylor and Fearne, 2006). Therefore, this research is committed to closing this gap in the literature whilst CF is a promising practice to dedicate future research by considering the dynamic structure of FSC (Småros, 2007).

2.6. Forecasting process

When companies employ a decentralised forecasting process, where each department generates its own forecast separately, it leads forecasters to gain experience and to reduce potential bias (Moon *et al.*, 2003). However, overlapping forecasts are most likely to occur if relevant departments estimate different forecasts, and such conflicts pose a danger for partners' collaborations. To limit the likelihood of this happening, each department needs to employ the same information. In practice, different departments of manufacturers generate their own forecasts based on departmental objectives and sources (Helms *et al.*, 2000). These forecasts not only engender excessive inventory and loss of information, but also exacerbate internal-external conflicts that limit manufacturers reaching consensus with retailers (Taylor and Fearne, 2006; Fliedner, 2006; 2003; Helms *et al.*, 2000). The UK FSC also witnessed similar problems in retailers, where overlapping forecasts triggered forecast variability and provoked disagreements with manufacturers (Taylor and Fearne, 2006). It is important to recall that the major concern of the current research is manufacturers. Therefore, their internal conflicts have the precedence for the review of the forecasting literature, but the forecasting capabilities of retailers and their role in CF are concurrently matters to be scrutinised.

Although previous studies have highlighted the supportive role of retailers in CF (Aviv, 2002; 2001), their drawbacks in the forecasting process are apparent in the European grocery sector as the reason for diminishing accuracy and limited long-term CF, which imposed on partners' different planning horizons and data aggregation levels (Småros, 2007). For manufacturers, the underlying reason for multiple forecasts is linked to a lack of confidence in generating sales forecasts and to forecasters' diverse views. For instance, "marketing may use forecasts with an emphasis on trends occurring in the marketplace, while finance needs a forecast with an emphasis on budgeting. Sales may adapt a forecast based on sales quotas and production may create what they consider to be a better forecast based on their experience and production capacity and efficiency. Purchasing may also adjust a forecast to reflect their view points and experience and create what they consider to be a better forecast" (Helms *et al.*, 2000, p. 394).

In practice, USA based collaborative practices became a good example for Europe based companies to improve forecast collaborations due to the good infrastructure of USA based organisations easing collaborations, yet partners' business structure and forecasting processes are likely to differ from country to country (ECR Europe, 2001). The impact of organisational structure and forecasters seem other concerns for the choice of forecasting method and accuracy (Fildes *et al.*, 2009) while the product life cycle and lead-times have a significant impact on the productivity in the forecasting process (Fliedner, 2006). Partners are confronted with forecasting problems while uncertainties in terms of the environment and demand (e.g. seasonality and promotions) were handled in their forecasting process (Taylor and Fearne, 2006). Hence, it is reasonable to argue that apart from the manufacturers' organisational structures, which differ based on their region, the role of forecasters likewise seems to be a promising facet to be analysed for better CF in the FSC.

Previous studies have shown that partners' diversified capabilities in CF enhance accuracy. For instance, while a manufacturer attributes the demand variability to weather conditions and makes adjustments in this sense, a retailer can refer to promotional plans to mitigate uncertainty about demand. Accordingly, having a low relation between the influences of weather conditions and promotional plans increases the accuracy. However, if partners' adjustments on forecasts rely on the same basis, such as weather conditions or promotions, it negatively influences forecast accuracy (Aviv, 2001). In essence, this clarification further signifies the importance of forecasters, who have different approaches in forecasting meetings. This is the reason why forecasters' diverse and constructive conflicts enhance the reliability of forecasts and increase order response rates along with profitability by reducing the amount of deteriorated products (Fliedner, 2006). Taking into account the skills of forecasters seem to be an important matter for timely and reliable consensus forecasts, while jointly generating forecasts is already an a requirement for a transparent forecasting process (Taylor, 2006).

In CF, partners should primarily have an agreement on corporate objectives over a unified business plan, and relying on a mutual calendar with regard to the frequency and horizon of forecasts are necessary (Fliedner, 2006). Then, the forecasting process should be initiated within centralised information sharing by estimating independent forecasts and sharing them afterwards (Aviv, 2007; Siefert, 2003). Independently generated forecasts make it possible to provide transparency, share diverse information and have consensus on a single forecast, which are the building blocks of CF, yet these practices cannot be accomplished due to partners' different choices of forecasting method (Fliedner, 2006). Overall, the aforementioned evidence points to the need for future research for transparent CF (Småros, 2007), while diverse forecasting methods (Fildes *et al.*, 2009) , forecast meetings (Kerr and Tindale, 2011) and forecasters' role (Byrne *et al.*, 2011) become primary topics to be analysed in the FSC (Taylor and Fearne, 2006; Aviv, 2001).

2.6.1. Forecasting strategies

In the forecasting process, incorporating forecasting methods relies on four different approaches: model building, decomposition, forecast combinations and judgmental adjustments (Webby and O'Connor, 1996). Model building depends on judgments to choose variables, structure a model and define parameters in generating quantitative forecasts (Sanders and Ritzman, 2004). Decomposition separates historical series, forecasts them, and then composes separated forecasts (Lawrence *et al.*, 2006). Forecast combinations, however, approach individual forecasts irrespective of judgmental or quantitative forecasting, and combine them by taking their either simple or weighted averages, while judgmental adjustments are made after the generation of quantitative forecasts. The forecasting literature has emphasised the pragmatic and objective features of forecast combinations and judgmental adjustments (Webby and O'Connor, 1996). This is because, whilst the performance of combinations drew the attention of practitioners (Clemen, 1989; Lawrence *et al.,* 1986), adjustments became a strong alternative to them (Lawrence *et al.*, 2006; Webby and O'Connor, 1996).

In FSC, combining and / or adjusting forecasts within companies seem to be alternative solutions to multiple forecasts by departments, which not only increase the number of internal conflicts (Fliedner, 2006; Taylor and Fearne, 2006; Helms *et al.*, 2000), but also hamper the consensus with retailers (Hill, 1999). Furthermore, as a remedy to forecasters' lack of confidence over sales forecasts from manufacturers (Taylor and Fearne, 2006; Helms *et al.*, 2000), these strategies appear as exit roads in collaborations. For instance, McCarthy *et al.* (2006) documented that 53 percent of companies work cross-functionally to incorporate multiple forecasts of different departments whilst 54 percent employ CF. The literature has also manifested the benefits of combinations when the environment is uncertain, having fluctuating demand and diverse information sources, and when it is difficult to select appropriate forecasting method/s (Lawrence *et al.*, 2006; Sanders and Manrodt, 2003; Armstrong, 2001). Judgmental adjustments are the reassuring approach to increase forecast accuracy based upon contextual information, which is not used in quantitative forecasting methods, such as the influence of promotions or special days (Goodwin, 2002; Goodwin and Fildes, 1999; Webby and O'Connor, 1996).

For combinations, deciding whether to take a simple average or weighted average is still questionable. Some views consider that equal weighting of constituent forecasts is suitable (Sanders and Ritzman, 2004; Clemen, 1989). In essence, this approach makes it possible to improve forecast accuracy in proportion to the number of forecasts combined based on historical information (see Lawrence *et al.* (1986)). However, weighting forecasts based on demand variability is not negligible due to improved accuracy while judgment-based forecasting methods rely on contextual information (e.g. advertising, delivery, experience and environmental cues) (Sanders and Ritzman, 1995). Although the performance of combinations was attributed to the negative correlation of constituent forecasts, further insight is essential to understand the optimal way of combining quantitative and judgment-based forecasting methods (e.g. manager's opinion, jury of executive opinion and sales force composite) (Goodwin, 2002; Goodwin, 2000a).

On the other hand, judgmental adjustments consist of two steps. In the first step, decision should be made about whether the result of quantitative forecasting method needs changes. If it is necessary, the direction and size of adjustments should be evaluated as the second step of this forecasting strategy (Lawrence *et al.*, 2006). In fact, past literature claimed that statistical forecasts superior to judgmental adjustments (Angus-Leppan and Fatseas, 1986), yet the availability of contextual data, which can be obtained through either experience or from the environment, underpins the reliability of adjustments (Sanders and Ritzman, 1995). Although adjustments effectively improve accuracy over the contextual information (Goodwin, 2002; Goodwin and Fildes, 1999), their effort depends upon the accuracy of quantitative forecasting methods, implying the characteristics of series used (Webby and O'Connor, 1996). Goodwin (2000b) clearly showed its impact by considering the trend, seasonality and promotional influences on adjustments.

According to a survey by Sanders and Manrodt (1994), which relies on the view of 124 respondents, 57.3 percent of companies use judgment-based forecasting methods owing to forecast accuracy, difficulty of procuring information for quantitative methods, ease of use and cost. However, 44.7 percent apply judgmental adjustments (e.g. inflating or deflating statistical results) to add environment and product based information along with previous experiences. In essence, 70.4 percent of forecasters seem to prefer deflating forecasts, but organisational behaviours, per se, appeared to be the major reason for inflated forecasts. Furthermore, shortcomings in regards to lack of information, management support and training became the major barriers to estimating effective forecasts.

Following this, pertinent studies supported the idea that negative (deflated) and large (wide-range) adjustments are better than positive (inflated) and small (narrow-range) adjustments, when demand arrives instantaneously in a short period, such as promotions (Syntetos *et al.*, 2009; Fildes *et al.*, 2009). Despite the important role of direction and size made for adjustments, the role of forecasters (e.g. training level, confidence and bias) is a significant concern, and necessitates further clarification to contribute to the forecasting literature (Fildes *et al.*, 2009; Lawrence *et al.*, 2006). For instance, an experimental study by Önkal *et al.* (2013) has demonstrated the impact of advice and types of information on the direction of adjustments and forecasters' confidence. In detail, the size of adjustments decreased through forecasters' active information sharing in meetings compared to individually estimated forecasts. Having specific information also triggered forecasters to apply larger adjustments for consensus forecasts compared to individual forecasts.

In fact, generating consensus forecasts in meetings calls for forecasters' collective effort, responsibility and motivation to be able to have a consensus on a single forecast, while the information that they exchange with and / or offer to each other eases the estimation of consensus forecasts (Lawrence *et al.*, 2006). The aforementioned limited evidence supports the relation of information sharing, forecasters and forecasting strategies through the generation of accurate forecasts. However, the literature is lacking in knowledge shedding light on practitioners' forecasting process in CF. Empirical studies should close this gap by considering the role of information sharing on the forecasting strategies, as well as forecasters and forecasting meetings that affect consensus forecasts (Önkal *et al.*, 2013; Eksoz and Mansouri, 2012; Fildes *et al.*, 2009; Lawrence *et al.*, 2006).

Supporting the previously mentioned arguments, a survey by Fildes and Goodwin (2007) considered the views of 149 respondents and found that although companies from various industries largely adjust statistical results by 33.7 percent, a wide range of companies use only judgment-based, quantitative and a combination of forecasting methods by 25.1, 24.8 and 16.6 percent respectively. Promotions, price changes and special days further appeared to be the leading reasons that direct companies to apply judgmental adjustments. These outcomes intrinsically underline the necessity of urgent research on forecasting strategies and processes. It is also attractive to blend such research with the information sharing practices of partners, forecasters and the forecasting methods used. The underlying reason behind this proposition is that all the above-mentioned factors depend upon the environment, providing information, organisational behaviours and forecasters. Partners' forecasting processes in CF need to be clarified since the dynamic environment of FSC provides soft data (e.g. rumour or hearsay data), where forecasters' expertise and correct forecasting methods need to be employed (Önkal *et al.*, 2013; Småros, 2007; Lawrence *et al.*, 2006; Sanders and Manrodt, 2003).

2.6.2. Forecasting method selection criteria

Despite the fact that the aforementioned forecasting strategies have pluses and minuses in terms of their application, the criteria adopted to select appropriate forecasting methods are also fundamental to measure the forecasting performance. Zhao *et al.* (2002) formerly stressed the importance of forecasting method selection over the value of information shared and collaborations, which enables partners to save costs and to increase motivation for better regular information sharing. For instance, when Mentzer and Kahn (1995) previously surveyed the opinion of 207 forecasters, they identified the accuracy (92 percent), credibility (92 percent) and customer service performance (92 percent) as major parameters on the effectiveness of forecasting methods, and the preference of forecasters became regression analysis for product-groups and exponential smoothing for the product line, item level and item based location forecasts.

In addition to these findings, McCarthy *et al.* (2006) showed that the importance of accuracy for companies was reduced by 76 percent in all horizons that represent the anticipated demand for products for a particular period. This reduction was indeed more discernible for mid-term and long-term compared to short-term forecasts, which decreased by 7 percent and 9 percent respectively. The authors attributed this difference to a lack of familiarity with forecasting methods and training in addition to product assortments. Their results identified customer satisfaction and supply chain costs as important determinants for forecast accuracy. However, companies did not adopt them as primary criteria through the selection of methods.

These unclear relations between the horizon and preference of forecasting methods as well as ambiguous parameters that affect method selection criteria have engendered further research to reveal the underlying reasons that worsen accuracy within companies. Exploring the role of production postponement on the forecast accuracy is also an important matter (McCarthy *et al.,* 2006), which is an important factor for manufacturers. Partners' familiarity with forecasting methods, satisfaction with their results, ease of use, and application of methods are worth further clarification to extend the body of knowledge in the forecasting literature (Mentzer and Kahn, 1995).

By relying on the views of 322 expert forecasters, Yokum and Armstrong (1995) stressed that the timeline of estimating forecasts and cost savings over forecast decisions are significant for companies. They suggested that multiple criteria for choosing forecasting methods and determining forecasting performance (e.g. interpretation, flexibility, ease of using available information and ease of method use) be considered. None the less, the maintenance and development costs were interestingly not drawn attention to in their results, and constituted the blind side of their research. McCarthy *et al.* (2006) referred to a lack of training as a presumable reason for the effectiveness of methods. This requires development cost and studies in the FSC underlined the importance of maintenance and set up costs in terms of retailers' preference for forecasting methods (Ali *et al.*, 2009). Forecasting method choices do not only rely on the accuracy, partners' corporate objectives may also lead to taking additional parameters into account to be satisfied from forecasts. It is therefore worthwhile to expand the criteria options in the forecasting literature in an attempt to offer fresh and applicable implications for practice (McCarthy *et al.*, 2006; Mentzer and Kahn, 1995; Yokum and Armstrong, 1995).

2.6.3. Duration of forecasts

The studies by Mentzer and Kahn (1995) and McCarthy *et al.* (2006) referred to the same list of forecasting methods, but the choice of companies differed by forecast horizon. For short-term forecasts (less than 3 months), the study by Mentzer and Kahn (1995), for instance, recommended the jury of executive opinion, as a judgment-based forecasting methods, and simulation, life-cycle-analysis and expert systems, as quantitative forecasting methods, to be employed in the forecasting process. On the other hand, sales force composite as a judgment-based and moving average with life-cycle-analysis became the preferable quantitative methods of practitioners according to McCarthy *et al.* (2006). Even though similar preferences were found by both studies for the mid-term (4 months to 2 years), they stressed different forecasting methods for the long-term forecasts (more than 2 years). For instance, customer expectations, by Mentzer and Kahn (1995), and sales force composite, by McCarthy *et al.* (2006), emerged as considerably preferred judgment-based forecasting methods in the long-term. However, McCarthy *et al.* (2006) indicated straight-line-projection and box-Jenkins in response to the outcomes of

Mentzer and Kahn (1995) as neural network, box-Jenkins, decomposition and expert systems as quantitative forecasting methods for long-term forecasts.

It is apparent that the limited sample size of these studies (e.g. the sample size of the study by McCarthy *et al.* (2006): 86 and the sample size of the study by Mentzer and Kahn (1995): 186) limit the reliability of these comparisons. The forecasting literature offers forecast combinations in the case of confronting increased demand variability in the long-term (Armstrong, 2001). Short-term forecasts allow efficient purchasing and inventory management (Småros, 2002) whilst combinations bring competitive advantage too (Aburto and Weber, 2007). Regarding this conundrum on the duration of forecasts generated, it is promising to add further insights to the horizon of forecasts. As forecast duration plays a substantial role in the forecasting process (Zotteri and Kalchschmidt, 2007), partners' overlapping preferences cause contradiction with each other in CF (Småros, 2007; 2002).

Following this, estimating forecasts frequently has a vital impact on the accuracy (Aviv, 2001), which is a prerequisite along with a large amount of data for effective CF (Fliedner, 2006). To some extent, relevant surveys identified forecasting methods for a wide range of horizons, less than 3 months for short-term and over 2 years for long-term (McCarthy *et al.*, 2006; Mentzer and Kahn, 1995). Fildes and Goodwin (2007) stressed that forecasts are estimated on a monthly basis by 67.8 percent of companies from various industries, including the food sector. Their findings are in line with a study by Klassen and Fores (2001), who found that 38 percent of USA and Canadian firms update forecasts every month and 24 percent update quarterly. According to Fildes and Goodwin (2007), 21 percent update forecasts yearly while only 7 percent update forecasts on a weekly basis. This limited evidence neither takes in to account the forecasts of time-sensitive product-groups in the FSC nor focuses on manufactures' CF. This is why it is worth shedding light on the required forecast horizon of perishable, seasonal, promotional and newly launched products in the FSC (Småros, 2005).

From a different point of view, some studies have suggested the quantitative forecasting methods of neural network for short-term and fuzzy logic for long-term forecasts in the clothing industry (Thomassey, 2010). Whilst there is a paucity of work identifying appropriate methods based on forecast horizons, a combinations of methods is still questionable in connection with judgment-based forecasting methods (Sanders and Manrodt, 2003; Armstrong, 2001). The forecasting literature needs empirical studies that examine a broad range of forecasting methods and uncover their impact on information sharing and collaborations (Zhao *et al.*, 2002), as a supplementary contribution to forecast accuracy (Goodwin, 2002).

2.6.4. Comparison of forecasting methods

Regarding the methods that were mostly compared in the literature, Ali *et al.* (2009) compared the forecasting methods for promotional and short-life products. They found that machine-learning-regression-tree outperformed the traditional methods of exponential smoothing, regression analysis and the machine-learning-multiple-support-vector-regression. However, the limitations of this method include interpretation, high complexity and information preparation cost due to the large amount of information (e.g. advertising and price changes), based on mean absolute error. The suggestions of the authors were to adopt exponential smoothing in the short-term without promotions, and to employ machine-learning-regression-tree during promotions. This is because, the cost of maintenance and setup for these forecasting methods as well as data preparation are extant concerns in the FSC.

When Ching-Chin *et al.* (2010) offered a new forecasting system for newly launched tea, cosmetic and soft drink products, they found that exponential smoothing and sales index was superior for seasonal tree groups of tea products, when limited information was available. In addition, exponential smoothing and sales index were better than moving average for short-life cosmetic products having unstable demand. Exponential smoothing further outperformed moving average for soft drink products based on mean absolute percentage error. However, the limitations of these comparisons were their reliance on very little data and focus on sharp sales in a highly competitive market. The limitations of this study by Ching-Chin *et al.* (2010) were further to not consider judgment-based forecasting methods and product characteristics such as colour, style or design. These limitations in the forecasting literature await the attention of academics to estimate better forecasts for time-sensitive and / or short-life product-groups in the FSC.

A study by Alon *et al.* (2001) compared artificial neural network with winters exponential smoothing, box-Jenkins autoregressive-integrated-moving-average and multivariate regression analysis in the USA retail sector. Their comparisons were based on trend, seasonality and interaction of series. The findings of this study confirmed the superior role of artificial neural network, regardless of variability and forecast horizon. Winters exponential smoothing and box-Jenkins likewise worked well, but only for the stable demand. Nevertheless, the limitations of artificial neural network appeared to be the requirements for software, high expertise, much time and the difficulty of interpretation. Alon *et al.* (2001) recommended a comparison of these factors against the accuracy of forecasting methods, apart from comparing the performance of artificial neural network, multivariate regression analysis and traditional methods to extend the body of forecasting literature.

Interestingly, while Nikolopoulos *et al.* (2007) found the superior role of artificial neural network compared to multivariate regression analysis, the argument was the more acceptable role of multivariate regression analysis for adjustments as opposed to the speed of artificial neural network and ease of application. The choice of forecasting methods for the adjustment of forecasts seems to need further clarification for the forecasting literature and practice. It is tolerably reasonable to argue that making such comparisons generates more pragmatic contributions for practitioners while particular product-groups are subject to their forecasting process.

To reduce inventory levels and to improve replenishments in the FSC, Aburto and Weber (2007) addressed the combination of seasonal autoregressive-integrated-moving-average and artificial neural network by using promotional observations. In addition to the superior role of artificial neural network against autoregressive-integrated-moving-average, their combinations quantified external influences (e.g. special days, holidays, behaviour of customers) on the demand. Ease of understanding, non-risk of over-fitting, gaining explicit knowledge for complicated series emerged as the benefits of autoregressive-integrated moving average against the shortcomings of artificial neural network, including risks of over-fitting and training requirements. The implications of this study aided partners to have a competitive advantage in the short-term. Despite this, the authors stressed the necessity of comparing multivariate regression analysis with new forecasting methods, such as support vector machines, in the FSC (Aburto and Weber, 2007).

2.6.5. Accuracy measurement techniques

The wide range of studies that compared diverse forecasting methods used different techniques to measure their accuracy. In detail, some used mean absolute percentage error (Trapero *et al.*, 2012; Alon *et al.*, 2001; Sanders and Ritzman, 1995), especially for newly launched and short-life products (Ching-Chin *et al.*, 2010), while others referred to mean average error (Carbonneau *et al.*, 2008) for promotions due to a wide range of SKUs (Ali *et al.*, 2009). However, some adopted mean squared error (Nikolopoulos *et al.*, 2007) while others used both mean absolute percentage error and mean squared error (Chen and Boylan, 2008; Aburto and Weber, 2007). Although relevant surveys stressed the dominance of mean absolute percentage error with a usage of 52 percent (Mentzer and Kahn, 1995), the technique of percentage error played a prominent role with the usage of 45 percent in relevant studies (McCarthy *et al.*, 2006). The superior role of mean absolute percentage error with 44.3 percent of usage was also confirmed by Fildes and Goodwin (2007).

The mean average error is largely used in industry with a usage of 35.6 percent as an alternative to mean absolute percentage error (Fildes and Goodwin, 2007) while some studies showed mean error as a popular technique (Klassen and Flores, 2001). In addition to these techniques, there are alternative ways to measure accuracy for intermittent demand as well (Syntetos and Boylan, 2005). In fact, forecast errors occur when companies employ judgment-based forecasting methods and judgmental adjustments (Sanders and Manrodt, 2003). These errors negatively influence production capacity and scheduling, and the inventory levels of manufacturers. Therefore, it is promising to enrich the forecasting literature through empirical studies explaining how these techniques either individually or in combination influence the accuracy and supply chain (Thomassey, 2010; Kerkkänen *et al.*, 2009; McCarthy *et al.*, 2006).

2.6.6. Forecasting meetings

In CF, partners need to conduct regular forecasting meetings to compare their sales forecasts, to uncover / solve disagreements and to generate final order forecasts for associated product-groups (Siefert, 2003). These practices considerably facilitate the replenishment operations of manufacturers (Ireland and Crum, 2005). Forecasting meetings are an important phase for partners in CF, where "two or more individuals initially each have their own individual forecast(s) (and justifications) in hand, and the group's task is to aggregate them in some way in order to achieve a group forecast" (Kerr and Tindale, 2011, p. 16). Forecasting meetings can be managed by either retailers or manufacturers, and the experience and capability of forecasters along with having access to information over IT systems seem to be determinants for the estimation of better forecasts in meetings (Siefert, 2003).

There are several factors directing the performance of forecasting meetings, such as level of interaction, productive conflicts, structure of the meeting and number of forecasters, and these factors second-hand imply the techniques that are used by partners to meet (Kerr and Tindale, 2011; Graefe and Armstrong, 2011). Some authors have argued that the techniques used for forecasting meetings are not very important if forecasters have the same information (Sniezek, 1990). In forecasting meetings, partners need to aggregate their forecasts in a timely manner, and to have a consensus on a single forecast. This process becomes even more important when the aim is to generate forecasts for time-sensitive product-groups, such as promotions and newly launched products. Whilst partners' overlapping views prevent them from having a consensus on a single forecast in meetings (Småros, 2007; Fliedner, 2006; 2003), the literature offers a wide range of meeting techniques to be scrutinised in clarifying their impact on the forecasts generated for a dynamic market, such as in the FSC (Graefe and Armstrong, 2011; Lawrence *et al.*, 2006).

Partners' main intention in such meetings is to create a platform aggregating the forecasts of related products at the correct level to be able to generate accurate order forecasts in collaborations (Kerr and Tindale, 2011). When partners meet, they use diverse information sources, which differ based on existing market dynamics, the collaboration level and products (Ramanathan, 2013; Danese, 2007). Interpreting complex and dispersed data and then merging them to make forecasts is rather challenging work for forecasters. While this difficulty culminates with partners' forecasting related disagreements that harm consensus forecasts, partners' meetings gain even more importance in CF (Småros, 2007). This is why it is rational to examine various meeting techniques for managerial implications. The current research is committed to elaborating these techniques in an attempt to close this pragmatic gap for timely consensus forecasts in the FSC.

There are several techniques enabling forecasters to meet either face-to-face or via multimedia to generate better forecasts in collaboration. Face-to-face-meeting is one of the traditional ways of providing efficient interplay among forecasters and merging the latest information into forecasts (Kerr and Tindale, 2011). However, it is likely to cause bias in meetings due to its unstructured format. Therefore, forecasters need to spend a great deal of time and effort (Graefe and Armstrong, 2011). Although face-to-face-meeting is an expensive technique and is difficult to be scheduled for regular and long-run meetings because of managerial issues, it increases forecasters' satisfaction level on consensus forecasts (Graefe and Armstrong, 2011).

Nominal-Group is an alternative technique to face-to-face-meeting with its structured format that was developed by Van de Ven and Delbecq (1974; 1971). In the Nominal-Group, forecasters firstly estimate forecasts individually, and then discussions are made to debate individual forecasts. The results of discussions lead them to amend their forecasts. Afterwards, forecasters' final forecasts are aggregated to become the group's final order forecast, which they need to have consensus on (Graefe and Armstrong, 2011). Studies have found that Nominal-Group produces more accurate forecasts than face-to-face-meeting alongside being more satisfactory for forecasters, although it requires a great deal of time and effort like face-to-face-meeting (Graefe and Armstrong, 2011; Van de Ven and Delbecq, 1974). It also elucidates decisions owing to forecasters' increased participation, even though they cannot interact throughout individual and final forecast estimations (Graefe and Armstrong, 2011).

On the other hand, Delphi-Technique is a survey approach in which a number of rounds are conducted whilst forecasters share views on a unanimous and multimedia level platform (Kerr and Tindale, 2011). This feature of Delphi-Technique differentiates itself from the techniques of Nominal-Group and face-to-face-meeting. However, its structure is similar to Nominal-Group because of documentary level interactions (Graefe and Armstrong, 2011). A study by Rowe and Wright (2011) informatively addressed the Delphi-Technique to clarify the ways and conditions of applying it. Accordingly, forecasters' trust in and commitment to each other, experience and dominancy was appeared to be critical parameters in its efficiency. According to the laboratory experiments by Graefe and Armostrong (2011), face-to-face-meeting was superior to individual forecasts and staticised group, while Nominal-Group was inferior to staticised group, which leads forecasters to estimate consensus forecasts by taking the average of individual forecasts.

Notwithstanding the dominance of Delphi-Technique over staticised group technique, forecasters' interaction and experiences, forms of feedback and the structure of process followed at meetings are rather influential matters in its efficiency (Rowe and Wright, 1999). For instance, studies which addressed disperse partners in the European agri-food sector have found how Delphi-Technique is an effective initiative in terms of increasing participation and response rate while forecasters' motivation and small group size are important matters for less bias in meetings (Frewer *et al.*, 2011). Despite these necessities for Delphi-Technique, it increases communication and constructive discussions in easing consensus between partners (Graefe and Armstrong, 2011). Previously, Van de Ven and Delbecq (1974) had already confirmed its effectiveness in judgmental adjustments compared to face-to-face-meeting, with the amount of individual views and forecasters' satisfaction level from forecasts being major criteria for the effectiveness of Delphi-Technique in their research.

When environmental uncertainties and casual costs are taken into account, Prediction-Markets become a preferable approach for partners. This relies upon various contract models such as "Winner-takes-all, Index and Spread" (Wolfers and Zitzewitz, 2004, p. 3). The hallmark of Prediction-Markets allows partners to trade over contracts. For instance, if one side believes that forecasts are less (more) than expected, the other side is responsible for buying (selling) the products on-hand. Virtually, such contracts make both sides more active in meetings, and enable continuous information sharing due to price rolling in the uncertain market (Graefe and Armstrong, 2011).

However, compared to face-to-face-meeting it does not allow efficient communication (Kerr and Tindale, 2011), because contracts allow partners to make changes to final forecasts without making reasonable clarifications with each other (Graefe and Armstrong, 2011). Despite this, Wolfers and Zitzewitz (2004) supported the claim that Prediction-Markets are capable of estimating accurate forecasts by employing different types of information. Van Bruggen *et al.* (2010) likewise found a supportive result, with Prediction-Market overtaking individual forecasts in the heterogeneous market due to private information shared between partners. Nevertheless, it is less favourable than face-to-face-meeting and Nominal-Group for forecasters apart from its inferior role to face-to-face-meeting, according to Graefe and Armstrong (2011), who employed the same information for different groups.

In summary, despite the limited contributions of the aforementioned experimental studies, there is an important gap when it comes to collectively analysing partners' forecasting meetings in CF (Önkal *et al.*, 2012). In detail, less attention has been to the comparative performance of meeting techniques, to the role hierarchy (Graefe and Armstrong, 2011) and to the structure of meetings along with group size (Rowe and Wright, 2011; 1999). These ambiguities become even more important when the structure of markets is taken into account (Van Bruggen *et al.*, 2010). This is why it is necessary to clarify the interaction of information sharing and types of information shared (Önkal *et al.*, 2011; Van Bruggen *et al.*, 2010) along with understanding how information is utilised in meetings (Frewer *et al.*, 2011).

Given the second objective of this research, which focuses on the forecasting process of manufacturers both at the internal and external level, it seems promising to scrutinise the role of these meeting techniques in the CF of manufacturers and to offer new knowledge to the forecasting and SCM literature. This research also distils the strengths and weaknesses of the aforementioned meeting techniques, as presented in Table 2.7. This distillation has important implications for practitioners in choosing the appropriate technique/s based on the existing market structure, level of collaboration or product-groups that they forecast in meetings.

Table 2.7. Strengths and weaknesses of techniques used for forecasting meetings

	Strengths	Weaknesses	Relevant references
Face-to-face meeting	*Allowing efficient interaction between forecasters *Enabling merger of latest information into forecasts *Enhancing forecasters' satisfaction from consensus forecasts	*Having an unstructured format *Increasing bias of forecasters because of its unstructured format *Taking much time, effort and cost *Preventing scheduling of long-term consistent meetings	Graefe and Armstrong (2011); Kerr and Tindale (2011)
Nominal-Group	*Having a structured format *Generating more accurate forecasts than face-to-face-meeting *Enhancing forecasters' satisfaction from consensus forecasts *Providing further understanding of forecast decisions due to increased participation of forecasters	*Taking much time, effort and cost, like face-to-face-meeting *Not allowing forecasters to interact either at individual or at final consensus forecast estimations, unlike face-to-face-meeting *Generating less accurate forecasts than staticised group technique in limited conditions	Graefe and Armstrong (2011); Van de Ven and Delbecq (1974; 1971)
Delphi-Technique	*Having a survey based approach enabling unanimous decisions over a multimedia level platform, unlike Nominal-Group and face-to-face-meeting *Allowing documentary level (structured) interaction, like Nominal-Group *Generating more accurate forecasts than face-to-face-meeting, individual forecasts and staticised group technique *Increasing response rate and communication *Increasing interaction between forecasters *Showing better performance for judgmental adjustments compared to the face-to-face-meeting	*Requiring experience *Necessitating trust and commitment between forecasters *Escalating hierarchical problems between forecasters *Being negatively affected by form of feedback given between forecasters *Entailing generation of a specific structure based on partners' collaboration *Requiring high level motivation for forecasters *Causing bias in the case of having a large group size in meetings	Frewer *et al.* (2011); Graefe and Armstrong (2011); Rowe and Wright (2011; 1999); Van de Ven and Delbecq (1974)
Prediction-Markets	*Working effectively when the environment is uncertain and causes excessive costs *Allowing partners to trade over contracts *Increasing the participation of forecasters *Supporting continuous information exchange between partners *Allowing use of diverse information types, which supports forecast accuracy	*Not allowing efficient communication between forecasters, unlike face-to-face-meeting *Allowing partners to make changes to forecasts without making reasonable explanations due to types of contracts *Not satisfying forecasters adequately, unlike face-to-face-meeting and Nominal-Group *Showing lower performance than face-to-face-meeting in case of using same information	Kerr and Tindale (2011); Van Bruggen *et al.* (2010); Wolfers and Zitzewitz (2004)

Source: *Developed by the author*

2.6.7. Role of forecasters

The forecasting process is a very challenging phase for forecasters in producing timely and accurate forecasts, since managerial pressures, cultural impacts, limited times and external factors have a big impact on their performance (Fildes *et al.*, 2009; Davis and Mentzer, 2007). Having a consensus on a single forecast is rather an obstacle for CF due to partners' different forecasting approaches with regard to aggregation levels and forecasters' diverse opinions, involving the adjustments of statistical forecasts based on existing market conditions (Småros, 2007; Fliedner, 2006). Lack of reliable information, training and / or experience are also likely to increase their bias and / or confidence, and therefore influence their decisions during the adjustments of forecasts in meetings (Önkal *et al.*, 2013; McCarthy Byrne *et al.*, 2011; Syntetos *et al.*, 2009; Fildes *et al.*, 2009). Following this, the forecasting literature has stressed that generating accurate forecasts in meetings is largely associated with forecasters' relations and the structure of meetings (Sniezek, 1989), with the accuracy level varying between the forecasts that are generated individually and in meetings (Önkal *et al.*, 2011).

It is clear that the forecasting meetings of partners become more productive when they hosts multiple forecasters who share diverse opinions due to increased motivation and reduced forecast errors (Van Swol, 2011; Kerr and Tindale, 2011). Forecasters' advice given to each other is an important contribution to incorporating individually estimated forecasts (Lawrence *et al.*, 2006) while their feedback underpins both individually and jointly generated forecasts (Sanders, 1997). In collaborations, partners' cross-functional communication and forecasters' ownership seem to be more important than IT systems and information sharing processes in terms of increasing forecasting performance (Davis and Mentzer, 2007). In essence, all these discussions underpin the need to have diverse capabilities in CF for accurate results (Aviv, 2001).

Past studies have underlined how forecasters' motivation positively influences their judgmental adjustments (Webby and O'Connor, 1996), and the study by Fildes *et al.* (2009) confirmed this approach through the examination of adjustments and forecasters' bias. Småros (2007) observed how the lack of motivation in meetings influenced the forecast accuracy of newly launched products in the FSC. Overall, these outcomes strengthen the literature stressing the necessity for further scrutinising the role of forecasters in meetings (Fliedner, 2006; 2003).

Some authors have discussed the role of organisations in forecasters' motivation, such as reward strategies, cross-functional cooperation and performance measurement criteria (Davis and Mentzer, 2007). From a different point of view, the impact of advice on forecasts is linked to the advisor (Lawrence *et al.*, 2006) and the information, which triggers the advisor to advise (Yaniv, 2004). Accepting advice was found to be related to the level of confidence, trust and social interaction between forecasters (Van Swol, 2011). Despite the existing findings, the interaction of forecasters in meetings and their advice given to each other needs to be examined further to formulate a more rigid approach in terms of generating accurate consensus forecasts (Önkal *et al.*, 2012; Fildes *et al.*, 2009). Closing this gap in the literature will, accordingly, guide managers in managing the freshness and quality of products on the shelves of retailers due to timely consensus forecasts.

The literature involves different types of feedback (e.g. outcome, performance, cognitive process, task properties), which are given based on objectives and play an important role on the forecast accuracy (Lawrence *et al.*, 2006; Goodwin and Fildes, 1999; Sanders, 1997). The effect of feedback on the accuracy relies on the level of understanding, timing and presentation style (Lawrence *et al.*, 2006). It was found that forecasters' satisfaction from the forecasting process is related to their training and the feedback received while their seriousness of tackling problems depends upon their training, feedback exchange and knowledge used for forecasts, and training increases their motivation (McCarthy Byrne *et al.*, 2011). However, forecasters' bias and having similar perspectives are considerable drawbacks for accurate forecasts in meetings (Kerr and Tindale, 2011). Overall, to add further insight to these arguments, it is essential to clarify the role of forecasters in terms of their motivation, advice acceptance and feedback given to each other when they forecast products that have volatile demand over intermittent data, such as during promotions (McCarthy Byrne *et al.*, 2011; Van Swol, 2011; Davis and Mentzer, 2007).

Due to the fact that the lack of trust and commitment between partners is an explicit barrier to CF (Fliedner, 2006; Taylor and Fearne, 2006; Fliedner, 2003), there have been calls for building trust and commitment for transparent and long-term collaborations (Francis *et al.,* 2008; Vlachos and Bourlakis, 2006; Mentzer *et al.,* 2000). Commitment shows the "desire to maintain valued relationships" (Moorman *et al.,* 1992, p. 316), while trust provides "willingness to rely on exchange partner in whom one has confidence" (Moorman *et al.,* 1993, p. 82). Given that different dimensions of trust (e.g. affective trust and trust in competency) provide effective information sharing and decision making in the supply chain (Ha *et al.,* 2011), trust is key for generating a consensus forecast in meetings (Chang *et al.*, 2007). Accepting advice is also connected with trust, which correlated with the expertise of forecasters who advise (Van Swol, 2011; Mayer *et al.,* 1995). It is therefore worthwhile to clarify the role of trust and commitment between forecasters, whether they are likely to increase motivation in forecasting meetings (Flynn *et al.,* 2010; Davis and Mentzer, 2007) and to underpin long-term collaborations between partners (Vlachos and Bourlakis, 2006).

2.7. Information sharing

In collaborations, the role of information sharing was approached in several industries from different perspectives such as the types of information shared, its quality, IT systems and partners' response rate (Du *et al.,* 2009; Fliedner, 2006). Relevant studies clearly concluded that effective information sharing increases transparency, performance and profitability in supply chains (Zhou and Benton Jr, 2007; Taylor and Fearne, 2006).

In supply chains, partners conduct either centralised or decentralised information sharing. In centralised information sharing, partners share demand information at every level of the supply chain. This approach allows them to rapidly react to demand changes (Sari, 2008) and to reduce bullwhip effects. Through decentralised information sharing, due to limited data exchange, partners do not share demand information and generate their own forecasts over the actual demand (Chen *et al.,* 2000). The difficulties that partners confront in the European grocery sector are in terms of selecting relevant / correct information, designing their information systems and controlling the quality of data. In response to these challenges, Zhou and Benton Jr, (2007), for instance, offered three major principles: types of information shared, its quality and the IT systems used for data exchange between partners. The authors also argued that these elements are important to enhance transparency and response rate in addition to reducing forecast errors in supply chains.

From a different viewpoint, Zhu *et al.* (2011) compared the circumstances of no information sharing, bilateral information sharing and the usage of sole retailer forecasting data to reveal the impact of these scenarios on profitability and accuracy within a manufacturer-retailer relationship. With no information sharing, partners generate forecasts separately without sharing any forecast information. During the bilateral information sharing, they transfer forecast information reciprocally. In case of only using the retailer's forecast data, the manufacturer relies on the retailer forecast to predict demand, and then decide wholesale prices for the retailer. The results of this study found that while the manufacturer's forecast has higher variability than actual demand, the manufacturer has more profitability during bilateral information sharing compared to no information sharing. On the other hand, if the retailer's forecast has higher variance than the actual demand variability, both sides have higher profitability during bilateral information sharing compared to the case of only using the retailer forecast.

Essentially, the results of Zhu *et al.* (2011) suggest the benefits of bilateral information sharing to augment forecast accuracy and profitability, but their study does not consider environmental influences, where promotions, advertisement campaigns and unknown behaviour of consumers on the newly launched products have a vital impact on the demand. In FSC, these external impacts raise demand variability, which in turn necessitates close information sharing between partners (Taylor and Fearne, 2006). There is a paucity of studies regarding the role of information sharing (Fliedner, 2006) while promotions (Chen *et al.*, 2000) and uncertain market dynamics, providing recent information (Sanders and Manrodt, 2003), are considered in collaborations. Given the dynamic structure of the FSC, which provides a wide range of information over recent changes in the market, it is a promising platform to analyse information sharing practices of partners to close this gap in the literature.

The structure of the information sharing process is another important matter, and affects the way of sharing different types of information, with IT systems being the key enabler to maintain the value of information shared in a timely manner (Zhou and Benton Jr, 2007; Zotteri *et al.,* 2005; Thonemann, 2002). Retailers' effort is likewise important in updating and sharing the information required for manufacturers (Chen *et al.*, 2000). The underlying reason is that while only retailers' forecasts are considered, manufacturers encounter difficulties in generating timely forecasts, and it is imperative to use additional information in response to demand changes (Chang *et al.*, 2007). This is why reinforcing bilateral information sharing between partners provides transparent information exchange and increases the response rate of manufacturers against instant demand changes. This approach further increases visibility on future events and enhances the efficiency of production planning for manufacturers (Danese and Kalchschmidt, 2011).

It is known that employing diverse information sources in heterogeneous markets, involving a diverse product range and various customer expectations, enables partners to generate better forecasts (Zotteri *et al.,* 2005). An increased degree of information exchange between partners necessitates high level supply chain practices to use relevant information correctly. These practices include supply chain planning, JIT production and effective delivery operations of manufacturers (Zhou and Benton Jr, 2007). If partners have a willingness to share different types of information, they are likely to be in a win-win situation during CF (Aviv, 2001). Regarding the heterogeneous structure of FSC, in addition to the amount of information shared, exchanging various sources is beneficial for collaborations (Van Swol, 2011; Zotteri *et al.,* 2005). The literature has approached the information context based on its direction, whereby information flows from retailers to manufacturers or vice versa, and it constitutes company related diverse information sources (Zhou and Benton Jr, 2007). Although manufacturers and their information sharing with retailers are the main concern of this research, further understanding about retailer information is essential for objective and sustainable contributions to the literature. This is why the current research reviews the information sharing literature from both the manufacturers' and retailers' point of view.

2.7.1. Manufacturer-retailer information

2.7.1.1.Retailer information

The number of products that partners merchandise is significant for their information sharing process. According to Thonemann (2002), although sharing advance information makes it possible to increase supply chain performance and product availability, it conversely exposes manufacturers to confronting inventory level variability. While multiple product-groups are concerned in collaborations, sharing product-related particular information reduces demand variability and associated costs. Observations in the European grocery sector uncovered the different expectations of manufacturers and retailers with regard to information shared with each other (Småros, 2007). The literature has also stressed the inconsistent information sharing practices of partners due to lack of trust and commitment, which in turn lower the quality of CF (Fliedner, 2006; 2003). It is clear that partners confront difficulties in terms of maintaining a balance between reciprocal satisfaction from information sharing and organisational objectives, and this restricts them from exchanging a wide range of data with each other.

In FSC, manufacturers are more likely to lose retailer information due to poor internal relations between related departments. Their long production plans gave rise to lose the value of information in relevant case studies, in spite of retailers' timely sharing of POS data (Småros, 2007). Despite manufacturers' poor internal coordination, employing only retailer forecast information is not enough for better forecasts. Case studies, which were dedicated to increasing forecast accuracy for newly launched products, illustrated how partners' intense relation during the forecasting process is not generally viable. The suggestion was to give priority to sharing various information sources in CF such as POS data and forecasts, which in turn enables manufacturers to have access to accurate and timely information from retailers (Småros, 2003). It is clear that manufacturers estimate better forecasts when information sharing is bilateral (Zhu *et al.*, 2011). To put it differently, although retailers can generate better forecasts due to their closeness to customers (Sari, 2008;

Aviv, 2001), manufacturers' forecasts are, in the same manner, beneficial for reliable forecasts. Hence, these forecasts should be shared to strengthen the retailers' forecasts. However, manufacturers' forecast quality relies largely on the retailers' sources, which imposes on them a responsibility to sharing further data with manufacturers apart from forecasts (Lee *et al.*, 2000). Correspondingly, these arguments point to the necessity of mutual understanding and data exchange to cope with volatile demand for time-sensitive products in the FSC.

Sharing organisational information, such as price changes, assortments and promotional plans, leads partners to employ more rewarding CF with regard to inventory and forecasting performance (Taylor, 2006). Sharing promotional plans with manufacturers likewise helps them to provide short shelf life foods in a fresh manner (Du *et al.*, 2009), which is an important matter to satisfy retailers in CF due to their short replenishment requests from manufacturers (Småros, 2007). Obtaining these sources allows manufacturers to show further effort and spend more time in improving the accuracy rather than seeking correct information (Småros, 2002; Aviv, 2002). For instance, Småros (2003) exemplified how manufacturers spent less time on the forecasting process and generated more accurate forecasts when a European based retailer shared assortment changes, promotions, price changes and updated POS data in collaboration. Moreover, Småros (2003) stressed that sharing the aforesaid information sources leads partners to collaborate on planning rather than forecasts, which enhances visibility in supply chains and improves the ability to respond to demand changes.

A case study by Ramanathan (2013) examined two manufacturers' information requests from their buyers, and uncovered how the types of products influence manufacturers' information request from retailers. For instance, while sales and discount related data did not become the interest of a manufacturer, these sources became the main demand of another manufacturer, which was working on the forecasts of short shelf life textile products. Following this, promotional sources and competitors' information appeared to be other important sources that were requested by manufacturers in the case of Ramanathan (2013). In essence, these cases that considered a limited number of companies are in line with the forecasting literature (Fildes *et al.*, 2009; Syntetos *et al.*, 2009).

While these cases highlighted the importance of information types that change based on product characteristics, the forecasting literature stressed how contextual data increased forecast accuracy through judgmental adjustments where particular information was used for promotions (Fildes *et al.*, 2009; Syntetos *et al.*, 2009; Sanders and Ritzman, 1995; Sanders and Manrodt, 1994). Nonetheless, the literature needs more empirical work to generalise the role of information types, when manufacturers and retailers collaboratively forecast different types of product-groups (Ramanathan, 2013). Such research in the heterogeneous FSC, which hosts time-sensitive seasonal, perishable and / or promotional products, is more likely to enlighten practitioners (Danese, 2007). In this regard, it is important to recall the final research question of the current research, which interrogates manufacturers' information sharing for better forecasts of these time-sensitive and / or short-life products, in response to this gap in the information sharing literature.

Retailers' shelf information is an important source for product quality and availability. There is strong evidence in the UK FSC, which shows retailers' technological shortcomings that prevent timely tracking shelf information. This is also an obstacle to preserving product quality and availability (Taylor and Fearne, 2006). Recording retailer sources by updating them systematically and then sharing with manufacturers on time is vital for optimal forecasts alongside effective inventory, delivery and production operations (Taylor, 2006). Disseminating customer-related information within the supply chain helps partners to cope with demand variability as well (Sari, 2008).

In a volatile market, historical and the latest information are furthermore requisite, with historical information referring to retailers' long-term and product-related old information and the latest information involving recent activities, such as environmental events, competitor-related information and rumour (Sanders and Manrodt, 2003). In spite of the fact that the source of recent information is important from the point of view of reliability (Flynn *et al.*, 2010; Sanders and Manrodt, 2003), the uncertain market provides such information at an unexpected time, which implies recent demand changes. These sources are unable to be used in statistical forecasts due to limited time, and need to be merged with forecasts afterwards. The importance of such sources was also revealed in the textile and packaging industries (Ramanathan, 2013). In addition, if newly launched and / or seasonal products are subject to the forecasting process, the antecedent sales of pertinent products or substitutions are valuable cues for forecasters (Sanders and Ritzman, 2004; Småros, 2003).

In general, willingness and the understanding of retailers with regard to exact information required for manufacturers is an important matter for satisfying information sharing between partners (Aviv, 2002). Given this posture of retailers in CF and the closeness to customers making it possible to have a wide range of information (Sari, 2008), initiating information sharing from retailers makes collaborations more beneficial in managing purchasing, production, inventory and replenishment operations (Fang and Meng, 2010; Fliedner, 2006). Partners' behaviour of sharing these information sources and recent environmental factors are rather important factors in collaborations (Flynn *et al.*, 2010; Sanders and Manrodt, 2003). There are still questions awaiting answers from academics to comprehend the role of diverse information sources in the accuracy, forecasting process and methods used by partners (Fildes *et al.*, 2009; Sanders and Manrodt, 2003). From a different viewpoint, forecasters are further curious in terms of which information is most critical, which will guide them in making correct decisions for forecasts while the environment that provides additional data should be considered through these analyses (Van Swol, 2011; Sanders and Manrodt, 2003).

2.7.1.2.Manufacturer information

Larsen *et al.* (2003) theoretically presented the different information sharing practices of partners based on their level of integration in CPFR. For instance, it was stressed that exchanging sales orders and inventory levels of products seems adequate for partners, which implement basic CPFR practices. The case studies by Danese (2007; 2006) then illustrated the different level of information sharing based on the level of CPFR implementation.

In detail, some partners exchanged limited data without synchronising their business plan at the basic level CPFR while others jointly made decisions over sales and order forecasts at the limited and full level of CPFR. The full CPFR distinguishes itself from the basic and limited CPFR practice by conjoining partners' business and forecast plans, where this synchronisation is to a certain extent at the limited level CPFR. To get benefit from full CPFR, conducting extensive information sharing based on market characteristics and products involved are essential (Danese, 2007). Despite the level of collaboration, sharing information rests upon partners' willingness, which seems one of the significant barriers to CF (ECR Europe, 2001) and necessitates mutual trust (Danese, 2006), which is another concern of this research.

Regarding the implementation of developing (or limited) or advanced (or full) CPFR process, manufacturers should share their production and capacity plans with retailers apart from sharing product-related information, such as inventory data and the lead-times of newly launched products. These sources are important to enrich retailers' forecasts when they share promotional plans, inventory level and POS data with manufacturers (Larsen *et al.,* 2003). The underlying reason is that partners focus largely on integrating their supply chains during developing CPFR due to the limited number of SKUs involved. Partners in advanced CPFR integrate both internally and externally to get full benefit from collaborations, and they apply advanced IT systems as well (e.g. Enterprise Resource Planning (ERP) and production planning) (ECR Europe, 2001).

Studies support the idea that sharing procurement related information helps retailers to maintain the freshness of short shelf life foods (Du *et al.*, 2009). Production planning and delivery related information likewise eases product tracking in supply chains and reduces forecast errors (Zhou and Benton Jr, 2007). Sharing these sources and inventory related data with retailers brings about manufacturers' effective internal-external integration when they follow a single business plan (ECR Europe, 2001). While manufactures' forecasts rely largely on their production, it is important to share production related data and sales forecasts with retailers, because such data enable retailers to clearly understand for what purpose forecasts are used by manufacturers (Zotteri and Kalchschmidt, 2007). In addition to these information sources, ECR Europe (2001) classified the types of information, which should be shared within the company and between partners based on the three different CPFR practices, as shown in Table 2.8.

Table 2.8. Requirements for manufacturers and retailers for CPFR implementation

	CPFR models				
	Basic	***Developing***		***Advanced***	
Partners' willingness to collaborate	No	Yes		Yes	
Partners' departments involved in collaboration					
		Company	Trading Partner	Company	Trading Partner
Sales / purchasing	Yes	Yes	No	Yes	Yes
Logistics	Yes	No	No	Yes	Yes
Marketing	Yes	Yes	No	Yes	Yes
Production	Yes	No *(Not for retailers)*	No	Yes *(Not for retailers)*	Yes
Demand / materials planning	Yes	Yes	Yes	Yes	Yes
Scope of collaboration					
Promotion planning	Yes	Yes		Yes	
Sales forecast	One of the two	One of the two		Yes	
Order forecast				Yes	
Replenishment	Optional	Optional		Yes	
Manufacturers' information exchange with retailers					
Inventory	Optional	No / Distribution centre level		Distribution centre / POS level	
Shipments to distribution centre	Yes	Yes		Yes	
Shipments from distribution centre to store	Optional	Yes		Yes	
Sales at distribution centre level	Optional	Optional		Yes	
POS data	Optional	No		Yes	
Retailers' information exchange with manufacturers					
Inventory	Optional	No/Distribution centre level		Distribution centre / POS level	
Shipments to distribution centre	-	Yes		Yes	
Shipments from distribution centre to store	Yes	Yes		Yes	
Sales at distribution centre level	Yes	Optional		Yes	
POS data	Optional	No		Yes	

Source: ECR Europe (2001, p. 54)

In FSC, sustaining visibility on demand and securing product availability at stores are vital entailments (Bourlakis and Weightman, 2004). Ahumada and Villalobos (2009) pointed out the negative impact of unclear production, delivery and marketing information on the shelf life of perishable and seasonal products because of manufacturers' lack of production and distribution plans. Products that have a short shelf life, such as vegetables and fruits, are likely to decompose during production and / or delivery. These deteriorated products not only reduce the retailers' satisfaction in terms of providing good quality products on the shelves, but also reduce manufacturers' profit. Given the major expectations of retailers (e.g. short lead-times, availability of high quality and fresh products and low inventory levels) (Småros, 2007), satisfying retailers in collaborations and increasing profitability reside in manufacturers' capability of effectively scheduling production and timely delivering products to either stores or the distribution centres of retailers (Chen *et al.*, 2009).

This is why sharing production scheduling and stock levels of related products with retailers eases partners' agreement on collaborative planning, prevents excessive stocks and reduces associated transportation and inventory costs (Arshinder *et al.*, 2008; Chen and Paulraj, 2004; Karoway, 1997). Further, this information exchange helps manufacturers to clearly understand and meet short-term demand, which will accordingly lead them to reduce their surplus capacity (Fliedner, 2006). Observations in Europe have already clarified the negative impact of long production plans while partners' collaboration hinged on newly launched products (Småros, 2007). Hence, further research is essential to elucidate the ways of using correct information (Ahumada and Villalobos, 2009) as well as the role of manufacturers during information sharing with retailers (Småros, 2007).

Such an investigation in the FSC becomes even more important when manufacturers have difficulty of responding to instant demand changes. Manufacturers are likely to have long lead-times with regard to production and / or the purchasing of raw materials, with these delays accordingly dissatisfying retailers in collaboration (Kaipia, 2008). As a remedy, relevant case studies that considered agricultural products in the FSC modified the CPFR framework with collaborative transportation management to provide more effective delivery practices. It has been found that sharing delivery information and transportation schedules are very beneficial in CPFR. This is because, such an information exchange enables companies to reduce their inventory level and improve delivery practices (Du *et al.*, 2009).

When Zhou and Benton Jr, (2007) empirically examined manufacturers' information sharing and supply chain practices in North America, they raised the importance of various information sources that underpin collaborations. These sources consist of production capacity, orders, delivery schedule, the lead-time of relative products and recent changes in delivery. In essence, these diverse studies offer a wide range of information to be shared based on either product characteristics, level of collaboration or market structure. When time-sensitive products (e.g. milk, eggs and meat) are taken into account, their quality and freshness are likely to deteriorate due to any recent changes, such as long deliveries and bad weather conditions. In these situations, the importance of recent information that represents the latest changes becomes even more important for accurate CF. In practice, when Wal-Mart and Warner-Lambert, for instance, implemented their pilot CPFR, they exchanged weather related data and similar supportive recent information with each other, which brought about their consensus on a single but reliable forecast (Danese, 2007).

Through reviewing the literature, Arshinder *et al.* (2008) stressed that partners can easily coordinate their supply chain by sharing different types of information, such as demand, inventory, lead-time, production scheduling, capacity and cost related data. From a different standpoint, it has been argued that although partners are in an agreement about sharing diverse information, regular information exchange may not add extra value to their information sharing. Such a data exchange only leads to check forecast errors, while logistic operations and IT systems are vital for satisfying information sharing (Kerr and Tindale, 2011). For integration, technological investments and managerial agreements are requisite, whilst a lack of IT systems limits the application of CF for a wide range of products (Aryee *et al.*, 2008; Sari, 2008; Fliedner, 2006). It is likewise clear that generating accurate forecasts for different products hinges on different information types that represent product characteristics and / or markets (Ramanathan, 2013). In response to these conflicting and limited analyses, it is crucial to analyse diverse information types, and to clarify in what way related information should be shared (Danese, 2007; Zhou and Benton Jr, 2007; Taylor and Fearne, 2006). This substantial gap gives more value to the final objective of current research due to its interest in different information types and the way of sharing such sources for reliable forecasts in the FSC.

2.7.2. Quality level of information

According to the literature, the quality level of information gauges the extent to which partners are satisfied with each other when they exchange different types of information (Petersen, 1999). Related studies have ascribed the quality level of information to several parameters, such as availability, accuracy, timeliness, external-internal connectivity, completeness, relevance, accessibility and frequency (Zhou and Benton Jr, 2007; Vijayasarathy and Robey, 1997; Neumann and Segev, 1979). It is also known that such parameters determine partners' gratification as to whether data are exchanged at the expected time and in a requested form in collaborations (Zhou and Benton Jr, 2007).

In FSC, partners' disagreements through information sharing were attributed to inaccurate data, timeliness, inconsistency, technology related obstacles and lack of information, which obstruct managing demand, production and shelf availability (Taylor and Fearne, 2006; Taylor, 2006). In response to this, studies have revealed that making information available and sharing relevant information not only provides reliable information, but also increases forecast accuracy and delivery performance. Moreover, partners can be satisfied from information sharing, while cross-functional communication improves in their departments, and they reciprocally share updated information frequently (Zhou and Benton Jr, 2007). Interestingly, a recent study by Zhou *et al.* (2014) has added a valuable dimension to the quality of information by offering practitioners to align their level of practices in supply chains based on the level of data quality for better business performance (e.g. companies' revenue and profitability). In CF, sharing different information types frequently not only underpins partners' forecasts, but also improves inventory management for related products (Aviv, 2007; 2002; 2001).

Following this, while partners bilaterally share adequate information in an accurate form, it improves their motivation to generate reliable forecasts in addition to their desire to sustain regular information sharing with each other (Du *et al.,* 2012; Webby and O'Connor, 1996). Therefore, it can be asserted that conducting high quality information sharing relies upon the type and / or amount of information shared. Besides that it is connected with the extent to which partners follow the same vision as well as show trust and interdependence with each other. This approach puts emphasis on partners' willingness to invest in IT systems for a satisfactory information sharing in collaborations (Zacharia *et al.,* 2011; Li and Lin, 2006; Simatupang and Sridharan, 2002).

Furthermore, benefiting from information sharing relies largely upon partners' assimilation of received information, so it is vital to share relevant information on time to respond to demand changes and to manage related supply chain operations effectively (Hartono *et al.*, 2010). For instance, Wal-Mart and suppliers exchanged the stock levels of related products that they collaborated on. Despite unexpected changes in demand, this helped Wal-Mart to give timely orders to suppliers. The retailer secured its competitive position in the market and reduced stock related costs while suppliers underpinned the loyalty of the retailer to brands in addition to reduced stock levels (Simatupang and Sridharan, 2002).

Forslund and Jonsson (2007) demonstrated that manufacturers who did not have access to retailers' forecast information resorted to safety stock for end products to meet demand. On the other side, manufacturers that had access to retailers' information effectively met the demand of retailers. Case studies in the FSC revealed that manufacturers' access to POS data led them to rapidly react against stock-out and to increase forecast accuracy (Småros, 2007). However, only having access to retailers' information is not sufficient for manufacturers due to the importance of information quality for time-sensitive products. The reason behind this aspect is that manufacturers' interpretation and usage of relevant information rely largely on its quality (Forslund and Jonsson, 2007). Maintaining information quality then hinges on partners' top management investing in IT systems and creating a platform for long-term forecast collaborations (Hartono *et al.*, 2010). Thereby, the value of information is sustained for accurate forecasts (Moon *et al.,* 2003).

Effective inventory management for promotional products primarily depends upon the product-related data that need to be shared frequently between partners (Aviv, 2002), as such frequent information sharing allows manufacturers to timely replenish products for retailers, and to be more responsive against unexpected changes in demand (Aviv, 2001). Expeditious information sharing is more rewarding for accuracy compared to partners' active supply chain practices (Aviv, 2007). Information that is updated according to early sales figures in specific periods, such as weekly, has a noteworthy role in improving forecast accuracy (Småros, 2002). For instance, Fisher (2000) recorded increased forecast accuracy, from 45 percent to 92 percent, in the clothing industry, while partners updated initial forecasts on a weekly basis. Relying on the short shelf life and newly launched products (Ahumada and Villalobos, 2009; Småros, 2007), partners need to use related and reliable information to produce accurate forecasts. This action underpins their responsiveness to instant demand changes (Danese, 2007; Taylor and Fearne, 2006; Taylor, 2006).

Overall, it is worth summarising that recording information regularly and sharing it with partners in an adequate form as well as in a timely manner improves forecast accuracy. In FSC, manufacturers and retailers, however, do not have these treatments (Taylor and Fearne, 2006). Despite the fact that retailers' instant price changes are influential in forecasts (Taylor, 2006), manufacturers' information is valuable too, enabling retailers to have a clear understanding about the purpose of manufacturers' forecasts (Zotteri and Kalchschmidt, 2007). In this respect, the body of the information sharing literature should be extended further to offer rigorous benchmarks over the information quality, which will, in turn, enhance forecast accuracy as well as partners' satisfaction from information sharing (Zhou *et al.*, 2014; Zhou and Benton Jr, 2007; Li and Lin, 2006).

2.7.3. Role of Information Technology (IT) systems in CF

Studies in the FSC have emphasised the role of IT systems, as technology evolves each passing day and diverse IT systems are offered for partners for either internal or external information sharing (Taylor, 2006). In practice, this technological transformation and partners' diverse preferences decelerate information exchange, increase associated costs and pose risks of having forecast errors (Taylor and Fearne, 2006). Given the size of partners, IT systems become one of the poor cycles of collaborations due to investment costs and related risks (Sari, 2008; Mentzer *et al.*, 2000). In fact, when environmental uncertainties and demand variability are considered, these systems further strengthen communication and interaction between departments alongside the effective information sharing of partners. For instance, the study by Aryee *et al.* (2008) demonstrated that IT systems (e.g. EDI and web-based interchange) significantly increase the organisational and financial performance of companies. The criteria of the study by Aryee *et al.* (2008) for organisational performance involved production life cycle, new product time to market and percentage of obtaining forecast / demand data, while financial performance was based on return on investment, sales growth and market share. In other words, the benefits of investing in IT systems are not limited to data exchange and integration, it also raises companies' profitability.

Even though some views do not advocate the necessity of IT systems for long-term collaborations between partners (Småros, 2007), these systems underpin partners' interdepartmental relation in collaborations (Sanders, 2008). In manufacturers, IT systems not only connect production, logistics, and purchasing, but also increase transparency and enable them to measure lead-times based on real-time information (Arshinder *et al.*, 2008). For instance, case studies in the textile and packaging industry observed that making investment in IT systems enhances forecast accuracy due to increased transparency during information transfer between partners. It should not be overlooked that manufacturers' ability to use the required information is an important matter. Otherwise, it is likely to make information sharing more complicated, requiring further investment in IT (Ramanathan, 2013). In essence, whilst this outcome is contrary to the case of Småros (2007), it is in line with the case study by Danese (2006). By relying on multiple case studies, Danese (2006) proposed the necessity of sophisticated IT systems when partners proceed from basic to advanced (or full) CPFR owing to the obligation of collaborating on a single plan and consensus forecasts. These contradictory and limited case studies further raise question marks on the IT systems not only about effectively integrating partners' supply chain, but also about utilising different information types in a timely manner for accurate forecasts.

Previously, it was stressed that IT systems in CF enable agile information transfer, and improve flexibility in the supply chain (Fliedner, 2006). Relevant evidence further showed how partners could utilise these systems in joint forecasts to synchronise their decisions and to generate better forecasts, where partners exchanged demand, production, purchasing and inventory related information with each other (Kerr and Tindale, 2011). Some case studies noted that even though IT systems are not a key barrier for successful collaborations, its investment with the skills of manufacturers, including responsiveness and flexibility, provides a sustainable advantage for communication (Ramanathan *et al.*, 2011). Such an investment substantially improves partners' satisfaction as well, owing to having a responsive supply chain against instant demand changes (Ireland and Crum, 2005) and sustaining information quality (Ramanathan *et al.*, 2011). These improvements, in turn, improve the accuracy of forecasts too (Forslund and Jonsson, 2007). In essence, there are several technological applications used by practitioners in the food industry, some of which are EDI, ERP and Statistical-Control-Cards. So, it is worthwhile to review these applications concisely to refresh existing knowledge on the IT systems.

In FSC, EDI helps partners to facilitate their integration throughout collaborations. For instance, a study by Hill and Scudder (2002) demonstrated that firm size, sales volume and number of employees play a key role in the usage of EDI in response to the ineffectual role of organisational characteristics, product range and competitiveness. These results, per se, hint that there is no limitation for partners in using EDI when they collaborate over various product-groups. According to Hill and Scudder (2002), partners' size is an important factor in using EDI, with this outcome underpinning some views that stressed the limited application of CF for a broad range of product-groups due to the necessity of costly IT investments (Sari, 2008; Fliedner, 2003; McCarthy and Golicic, 2002). In this respect, it seems reasonable to claim that small size manufacturers can still conduct basic collaborations with limited information sharing. When they intend to expand the implementation of CF to time-sensitive product-groups, there will then be a requirement for them to make investments in IT systems as was illustrated by several case studies (Ramanathan *et al.*, 2011; Danese, 2007; 2006).

Although EDI enhances partners' efficiency in the supply chain, it further improves manufacturers' coordination with suppliers compared with retailers. The reason here is that EDI is primarily used by manufacturers in an attempt to share warehouse and purchasing orders with suppliers rather than sharing promotions, delivery information and / or production plans with retailers (Hill and Scudder, 2002). EDI leads partners to reduce expensive paperwork and human errors during information sharing, according to Hill and Scudder (2002). Additionally, it reduces lead-times, increases transparency, and provides better order tracking performance in collaborations (Aviv, 2002). Past literature has documented how EDI is an effective tool for strategic collaborations due to its benefit of enabling partners to quickly respond to instant demand changes. Following this, EDI enables partners to accelerate information sharing and to reduce costs in terms of operations and inventory management (Bamfield, 1994). In other words, even though EDI was found to be more supplier oriented IT system in few studies, it also underpins manufacturers' collaboration with retailers due to reduced lead-times, which is one of the most significant challenges of CF practice (Småros, 2007). Because retailers' satisfaction rests upon short replenishment and delivery practices (Kaipia, 2008), reducing lead-times with EDI is an important contribution to the CF practices of partners in the FSC.

From a different viewpoint, empirical studies in the IT industry have explored how EDI has had more attention from USA companies compared to European companies (Mendelson and Pillai, 1998). Past studies that considered the UK grocery and fashion industry documented how retailers increase their profit with EDI due to close partnerships while manufacturers on the other hand claim that they cannot gain satisfactory benefits from EDI due to retailers' different IT systems and insistence on pursuing short lead-times (Bamfield, 1994). In essence, these outcomes are in line with the observations of Taylor and Fearne (2006), who stressed the overlapping IT preferences of partners in the UK FSC, which reduced the speed of information exchange in addition to higher administration costs. In this respect, although the literature has highlighted the benefits of IT systems in supply chains, it is promising not only to clarify their role and performance in the FSC, but also to add insight into partners' organisational characteristics and preferences about IT systems (e.g. EDI) (Hill and Scudder, 2002).

On the other hand, ERP technologies are the "packaged software systems using database technology and a single interface to control all the information related to a company's business-including customer, product, employee, and financial data" (ECR Europe, 2001, p. 104). ERP systems are one of the main IT systems that are used to increase integration between departments in terms of partners' internal processes. They further assist companies to share demand forecasts, and to optimise different departments' cross-functional planning activities (Fliedner, 2006). For instance, ERP in CF enables manufacturers to manage their production and delivery practices effectively based on retailers' demand (Paula *et al.*, 2003). According to VICS (2002), ERP is one of the indispensable systems that one of the partners has to have, if they want to gain benefits from CPFR.

Contrary to this view, studies in the European grocery sector illustrated how manufacturers' ERP systems are likely to prevent quantifying forecast accuracy throughout CF when the production cycle is longer than the expected time for newly launched products (Småros, 2007). In a similar vein, unsuccessful ERP applications appeared to be in the pharmaceutical industry (Motwani *et al.*, 2002). In essence, this is an opportunity for academics to pay further attention to these unsuccessful IT applications. Analysing the role of diverse IT systems for manufacturers seems a promising response to the aforementioned contradictory views, and to shed further lights on the application of these systems in collaborations (Chang *et al.*, 2007).

Finally, CPFR related studies have emphasised the existing labour-intensive operations and poor forecasting processes of retailers in collaborations. To resolve such challenges, Statistical-Control-Cards have become an alternative solution for practitioners. The underlying reason is that Statistical-Control-Cards have a good capability of showing actual and forecast sales to partners simultaneously, which is important when POS data and / or sales information is exchanged between partners. In addition, case studies in the FSC illustrated how Statistical-Control-Cards enabled manufacturers to monitor mature products' demand, which, in turn, eased information sharing between partners by reducing retailers' responsibility for sharing related information in CF (Småros, 2002). When the short shelf life of products is considered in CF, partners then need more rigorous applications that will lead them to not only provide transparent information sharing but also rapidly react to demand changes. Therefore, the aforementioned arguments show the need for future research on the IT systems of manufacturers in the FSC.

2.8. Summary

This chapter has comprehensively reviewed the literature on CPFR and the related research themes of supply chain integration, the forecasting process and information sharing. The findings, limitations and future research suggestions of related studies were emphasised to be able to identify new research areas for the CF practices of manufacturers in the FSC. In this respect, this research made it possible to identify gaps between theory and practice about manufacturers' practises that require further research for achieving long-term and accurate CF. The key areas that require future research are summarised below.

Regarding the CPFR practice, the literature is rich in successful CF practices of manufacturers and retailers in several industries, mostly in North America. Nonetheless, European based practitioners could not obtain sustainable benefits from CF in the FSC due to their overlapping expectations, which mostly appear during their supply chain integration and the processes of forecasting as well as information sharing. Conducting accurate and long-term CF becomes even more challenging when collaboration is built upon perishable, seasonal, promotional and newly launched products. Whilst existing knowledge in the literature is scant in relation to

CF, it is promising to examine partners' CF in Europe and North America to create a pragmatic roadmap, guiding them in conducting long-term and accurate CF for associated product-groups in the FSC.

When it comes to integrating partners' supply chain in the FSC, partners' interdepartmental integration needs to be very efficient to convey this integration at an external level. Although manufacturers' poor internal integration gives rise to conflicts in CF, there are not adequate empirical studies addressing both internal and external integration from the manufacturers' point of view. Such empirical work would be of great value in the literature and for practice. In detail, manufacturers' supply chain integration has mysteries with regard to their departmental communication, internal forecasting process and related infrastructure along with IT investments to collaborate with retailers. The research theme of supply chain integration requires further investigation to clarify what the key facets of integration practices are that manufacturers should adopt in the competitive food industry.

Adding further understanding to partners' level of integration with each other will be another intriguing contribution to extend the body of knowledge in the SCM literature. The reason behind this is that the role of organisational characteristics, objectives and top management vision are still important areas of interest when partners tend to integrate externally. These factors are likely to influence partners' CF, requiring further empirical analysis over these parameters. The level of commitment, trust and loyalty between partners and their flexibility in the volatile FSC are rather important elements that should be examined, while few studies considered their impact on the long-term collaborations.

On the other hand, partners' forecasting process is very important for CF. It is worthwhile to put further emphasis on their forecasting strategies. Particularly, examining the role of judgmental adjustments and forecast combinations in collaborations seems an interesting opportunity due to their pragmatic approach and ambiguous impact on the CF. Whilst time-sensitive product-groups are in the focus of forecasts, getting benefit from these strategies becomes an important remedy for volatile demand. In addition, few case studies explored partners' different approaches in terms of the horizon and frequency of forecasts. Despite the fact that there are conflicting views that presumed partners' agreement on these forecasting practices, partners' different preference on the forecast horizon and frequency arguably reduces forecast accuracy and prevents long-term CF. This ambiguity and the limited evidence call for urgent research to shed light on the forecasting literature. The literature also includes a wide range of studies addressing several forecasting methods and their selection procedures. When time-sensitive and / or short-life products are subject to forecasts, it appears that there is not a strong guideline for forecasters to choose appropriate methods. Comparing different forecasting methods based on product characteristics will provide attractive contributions for practitioners. Such research can also be extended by clarifying the impact of accuracy measurement techniques in CF, when specific forecasting methods are used for forecasts.

When partners meet to aggregate their forecasts in meetings, they confront several difficulties due to their disagreements on varying factors. The forecasting literature has identified several reasons and group forecasting techniques that are likely to influence partners' meetings and the attitude of having a consensus on a single forecast. Given the lack of empirical evidence on this topic, further research is needed to add more understanding on partners' meetings for consensus forecasts in CF. The role of forecasters and their behaviours are another enigma for CF. Several studies previously confirmed their impact on the forecast accuracy, collaborations and group meetings. When the dynamic structure of FSC is of concern, forecasters need more understanding about major attitudes and / or skills that influence the forecasts of time-sensitive and / or short-life products. Questioning the role of forecasters in CF will bring a new dimension to collaboration practices by conveying integration from the organisational-level to the personal-level.

Finally, it is clear that partners' limited information sharing is one of the significant barriers to their CF. Specifically, exploring correct / relevant information that should be shared between partners is rewarding when partners collaborate over particular product-groups. The reason behind this is that information that is exchanged between partners significantly influences their satisfaction and forecast accuracy. It is apparent that partners in the FSC still have disagreements in terms of transferring information in a timely manner and in an adequate form. Examining diverse information types based on product characteristics will be an important contribution to the information sharing literature.

Another paradox is the necessity of investments to create a sustainable platform for information sharing within and between partners. While some case studies have argued that IT systems are not essential for long-term CF, others illustrated its importance for the forecast accuracy and the application of CF for a wide range of product-groups. In reply to these limited studies and overlapping views, it is beneficial to clarify how investing in IT systems influences their CF and forecast accuracy. On the other hand, several studies have examined the quality level of information and uncovered diverse parameters that measure the satisfaction level of partners. Despite this, the literature lacks empirical studies that explain what benchmarks are vital for partners to be able to be satisfied by information sharing when they collaboratively forecast specific product-groups in the FSC.

CHAPTER 3: DEVELOPMENT OF HYPOTHESES AND CONCEPTUAL MODEL

3.1. Overview

Through reviewing the systematic literature, evidence from a plethora of research confirmed the existing gap relating to the CF of manufacturers in the food chain, concerning how they cannot conduct long-term collaboration with retailers (see Chapter 2). This is connected with unsatisfactory forecasts when they gravitate to collaborate with retailers over perishable, seasonal, promotional and newly launched products. The absence of a solid remedy to this problem allowed the current research to build literature-based propositions and a conceptual model. Data that were gathered through the qualitative data collection process of the current research validated existing CF challenges in practice.

This pragmatic evidence purified the propositions and conceptual model of the current research for reliable implications for practice. Reviewing the grey literature then elicited a vast body of samples and diverse views supporting the necessity for academic research to close the extant gap in this field. In this respect, empirically examining CF from the manufacturers' point of view based on associated product-groups became the main interest of the current research for accurate forecasts and long-term collaborations in the FSC. The existing propositions of this research were transformed to hypotheses under the frame of the theoretical prospectus of Whetten (1989) to offer rigorous and applicable contributions to the literature and the food industry. This chapter therefore to:

- Gives a rationale for the hypothesis development process of the current research based on a theoretical frame in the academic field.
- Identifies major hypotheses through the interrogation of vital problems that appear in the supply chain integration, forecasting process and information sharing of manufacturers.
- Discuss the rationale of hypotheses in response to research questions which aim to achieve long-term and accurate CF in the FSC.

- Conceptualise hypotheses under a single model as a development process of a rigid conceptual model.
- Structure the causal relationships of hypotheses on the conceptual model to display associated causalities that will be tested empirically.

3.2. Theoretical background and hypothesis development

The current research follows the theoretical concepts of Whetten (1989) to offer rigorous contributions to theory. Whetten (1989, p. 490) focused on three major questions that require clarification in terms of theory development and theoretical contribution in the academic fields. These questions are:

- What are the building blocks of theory development?
- What is a legitimate value-added contribution to theory development?
- What factors are considered in judging conceptual papers?

In response to the aforementioned questions, Whetten (1989) offered four theoretical concepts as a guideline for academics. These concepts consist of “what, how, why and the combinations of who, where and when”. In this context, the hypothesis development process of the current research is based on these four theoretical concepts.

Firstly, regarding the first theoretical concept of “what”, it relies on the selection of variables and constructs that have logical explanations in their consideration of the conceptual model. In other words, the first concept is with regard to identifying core factors, which are likely to remedy the existing CF problems of manufacturers and to enhance long-term and accurate CF in the FSC. Associated factors in this research represent the hypotheses offered to be tested empirically. Variables are the representatives of associated factors (or hypotheses) in reality. To put it differently, variables are key clues that can be observed in practice, and are perceived as the creator of associated factors. To identify these constructs and associated variables, the comprehensiveness and parsimony criteria of Whetten (1989) were employed.

The comprehensiveness criterion considers the relevance of variables and constructs in the associated research fields. In detail, the major research fields that offer associate constructs (or hypotheses) are the focus of this phase. The relation between constructs and their variables are questioned in related research fields. In practice, the comprehensiveness criterion represents the major processes of manufacturers who confront difficulties in achieving long-term and accurate CF with retailers. Through an extensive review of the literature, the current research has identified major constructs and associated variables in three major research themes. These themes are supply chain integration, the forecasting process and information sharing, and are interrogated by the three research questions of the current research separately.

The criterion of parsimony helps to make concrete decisions on whether it is essential to eliminate related variables due to their limited contribution to the model. The parsimony criterion of the current research comprises the purification processes of systematic literature-based propositions. Reviewing the literature systematically made it possible to identify a large number of propositions as a remedy to the CF problems of manufacturers. Pragmatic data that were obtained from a single semi-structured interview and three online group discussions guided the current research to limit the number of propositions based on their pragmatic importance in the field. Then, the review of the grey literature offered additional sources as a guideline to complete the second proposition elimination process. This screening process was conducted in relation to the propositions that were rationalised based on the qualitative data of this research. In doing so, the parsimony criterion was satisfied, and the hypotheses of the current research were formulated.

Secondly, the theoretical concept of “how” aims to add more insight into the relation between the constructs and variables selected beforehand. This concept makes it possible to clarify the direction of arrows between hypotheses, which leads to adding causality to the hypothetical relationships and to constructing the complete form of a conceptual model. Through the analyses of the systematic review, qualitative data and the grey literature, the current research built hypothetical relationships based on a new CF practice. This CF practice constituted of a number of major variables that form its entire structure, aiming to achieve long-term and accurate CF for manufacturers. Enhancing long-term and accurate CF in the FSC became the two performance criteria for this practice. The CF practice was further hypothesised to be the predictor of manufacturers' forecast satisfaction when they forecast perishable, seasonal, promotional and newly launched products along with retailers.

The logic behind considering the satisfaction factor / construct (or hypothesis) as the outcome of the CF practice relies on manufacturers' subjective objectives in the FSC. Given the fact that organisational objectives vary based on a wide range of factors, such as position in the market, target sales and future strategies, manufacturers' satisfaction from forecasts is likely to change in parallel with organisational objectives. To generalise the practicability of CF in the food chain, the current research has formulated a hypothetical relationship between this practice and the forecasts satisfaction of manufacturers in relation with the seasonal, perishable, promotional and newly launched products. The current research then formulated hypotheses to identify factors having an impact on this CF practice. These factors and their variables were extracted from the research themes of supply chain integration, the forecasting process and information sharing. Until this point, combining the theoretical concepts of "what" and "how" made it possible to develop hypothetical relationships and to organise the domain aspect of the conceptual model.

Thirdly, the theoretical concept of "why" looks for reasons not only to justify the selection of constructs and variables, but also to add more insight into the underlying causality between hypotheses in the conceptual model. In this phase, related studies dedicated to the related research themes were analysed. This analysis exploited not only contributions and suggestions for future research, but also limitations that were not taken into account in the associated prior studies. Through the comparative investigation of associated studies, a vast body of research findings and research opportunities were identified. When evaluations were then synchronised with the results of the qualitative data analysis, rigorous evidence was obtained, with such evidence making it possible to explain the logic behind the hypothetical relationships in a rational way.

In this sense, when the "why" concept was regarded along with the theoretical concepts of "what" and "how", it created a solid opportunity for this research to empirically verify associated hypothetical relations and to improve the reliability of the conceptual model. This approach enhanced the value of the theoretical contributions rather than only offering empirical findings to the literature. This is why the reader can easily judge the posited hypothetical relationships in terms of how compelling and rational the contributions of the current research are to extend existing knowledge. Food practitioners can also interpret how the conceptual model of this research enhances long-time and accurate CF when perishable, seasonal, promotional and newly launched products are subject to their collaborations.

Finally, Whetten (1989)'s unified theoretical concept of "who, where and when" was considered. This concept theoretically intends to put limitations onto the conceptual model. In other words, this aim here is to demonstrate the hypothetical relationships in a particular domain, and to validate the conceptual model in a certain circumstance. Therefore, the current research is limited to dyadic manufacturer-retailer collaborations in the FSC that were built upon time-sensitive and / or short-life product-groups (e.g. perishable, seasonal, promotional and newly launched products). The foremost focus is restricted to food manufacturers that are located in the UK & Ireland, Europe and North America.

In doing so, the hypotheses development process was completed based on the theoretical concepts of Whetten (1989). This theoretical approach brought additional clarity to the hypothesised relationships and the boundaries of the conceptual model. The limitations of the current research, in turn, generated an opportunity to recommend a broad range of future research opportunities. The following section addresses the new CF practice and discusses its rationale by outlining associate hypotheses.

3.2.1. The CF practice

CF is a forecasting practice, "in which the knowledge and information that exists internally and externally is brought together into a single, more accurate, forecast that has the support of the entire supply chain" (Helms *et al.*, 2000, p. 395). This practice constitutes one of the three phases of CPFR, which is a nine-step "business practice that combines the intelligence of multiple trading partners in the planning and fulfilment of customer demand" (VICS, 2004, p. 5). However, to propose a concrete and applicable CF in practice, the current research pays careful attention to the major obstacles that impede manufacturers from employing long-term and accurate CF with retailers (Ramanathan and Gunasekaran, 2012; Nyaga *et al.*, 2010; Småros, 2007).

The literature has identified a wide range of reasons for the failure to implement long-term and accurate CF in dyadic manufacturer-retailer collaborations. While the dominance of retailers appeared to be one the most important reasons for unfortunate forecast collaborations (Aviv, 2007; Småros, 2007), their unsophisticated forecasting process, reluctance and opportunistic behaviour during information sharing with manufacturers escalated conflicts in collaborations (Taylor and Xiao, 2010; Taylor, 2006). Correspondingly, while a lack of trust and commitment had a negative impact on joint operations, such as in the forecasting process (Vlachos and Bourlakis, 2006; Fliedner, 2006; 2003), unsophisticated information sharing between partners and their departments became another cause of unsatisfactory forecasts (Zhou and Benton Jr, 2007; Taylor and Fearne, 2006). Relying on manufacturers' organisational characteristics, lack of confidence in generating sales forecasts, long lead-times and production plans as well as limited interdepartmental integration comprised the principal obstacles that prevent them from conducting long-term and accurate CF with retailers (Småros, 2007; Helms *et al.*, 2000).

Because the European grocery sector witnessed non-productive forecast collaborations over the perishable, seasonal, promotional and newly launched products (Småros, 2007), it is inevitable to put these product-groups at the forefront of CF. The logic behind this is that preserving the freshness and shelf availability of short shelf life of perishable and seasonal products requires the substantial effort of partners. This effort calls for partners' collaborative effort in the processes of forecasting and information sharing (Fliedner, 2006; 2003). Manufacturers' competence in production, distribution and inventory management is essential to be able to maintain the quality of these short-life products (Ahumada and Villalobos, 2009; Du *et al.*, 2009).

Managing demand during promotions is another challenge as promotions differ due to the different durations and discounts offered, which, in turn, exacerbate sales variability (Ramanathan and Muyldermans, 2010). In a similar vein, forecasting newly launched products in a collaborative effort is problematic owing to a lack of historical information and variety of consumer choices (Småros, 2003; Bitran and Mondschein, 1997). In addition to these product based CF challenges, the study by Småros (2007) illustrated the existing gap between theory and practice, and reported the paucity of empirical research addressing CF from the manufacturers' point of view for long-term and accurate CF. The current research is therefore committed to closing this substantial gap by offering a new CF practice to the field. To create such a rigid and theoretical approach, enhancing long-term and accurate CF became the two foremost performance criteria, which are united under the construct of *Collaborative Forecasting Performance* in this research.

From the forecasting point of view, the literature supports the criterion of accuracy as the representative of forecast efficiency. Accuracy is already one of the two performance criteria for the new CF practice. Nonetheless, companies in practice value additional factors such as customer service, ease of use, interpretation and inventory turns (McCarthy *et al.*, 2006; Yokum and Armstrong, 1995; Mentzer and Kahn, 1995). In this sense, to generalise the reliability of the research findings from the practitioners' point of view, the satisfaction factor was additionally identified as an important outcome for the CF practice, in addition to *Collaborative Forecasting Performance*. The *Forecast Satisfaction* of manufacturers in this research is based on the forecasts of perishable, seasonal, promotional and newly launched products. These forecasts are estimated in meetings along with retailers, and represent the consensus forecasts of partners' CF. Consequently, both *Collaborative Forecasting*

Performance and *Forecast Satisfaction* are posited as the primary outcomes of the CF practice, and are hypothesised as follows:

- **H1a.** The CF practice of manufacturers has a significant and positive influence on *Collaborative Forecasting Performance*
- **H1b.** The CF practice of manufacturers has a significant and positive influence on their *Forecast Satisfaction* for associated product-groups.

To be able to increase the *Collaborative Forecasting Performance* and *Forecast Satisfaction* of manufacturers, the CF practice in this research began with the combination of a number of variables that build its core. It is important to emphasise that these variables are not the representative of this approach. Because each variable has a unique feature and adds different value to this approach, they formulate the characteristics of the CF practice. These variables were identified through the widespread examination of the literature review, and then supported by qualitative data. The reasons behind the selection of these variables are discussed below.

3.2.1.1.Trust and commitment

In collaborations, trust represents "the willingness of a party to be vulnerable to the actions of another party based on the exception that the other will perform a particular action important to be trustor, irrespective of the ability to monitor or control that another party" (Mayer *et al.,* 1995, p. 712). Commitment then "refers to an implicit or explicit pledge of relational continuity between exchange partners" (Dwyer *et al.,* 1987, p. 19). In other words, the quality of relationships between manufacturers and retailers depends upon the effort they put into building trust and commitment to satisfy each other, which in turn conveys permanence to their collaboration (Fischer, 2013). Previously, the literature stressed that trust and commitment are the major constraints to accomplish strategic objectives in the long-term collaborations (Mentzer *et al.,* 2000).

In FSC, partners' unwillingness to share information seems to be a fundamental reason for missing trust and commitment, and collaborations that lack these attitudes are not expected to survive in the long-run (Fliedner, 2006; Vlachos and Bourlakis, 2006; Crum and Palmatier, 2003). This limited information sharing between partners engenders the hazard of misusing information, and accordingly worsens forecasts, so this shortage calls for the development of trust for accurate forecasts (Gulati, 2011). From a different perspective, the study by Fischer (2013) confirmed that partners' effective communication is the key enabler to build trust in the European agri-food sector. These results are in line with an experimental study by Özer *et al.* (2011), who demonstrated that partners' continuous interaction and exchange of forecast information rely on trust. By relying on these diverse studies, it is reasonable to infer that while partners' poor information exchange worsens forecasts and dependability on each other, continuous information sharing is the enabler of building trust in collaborations. In other words, there is a reciprocal influence between sharing information and building trust between partners.

Since studies have clarified how the success of collaborative supply chains relies on a high level commitment between partners (Simatupang and Sridharan, 2002), it is timely to recall the necessity of trust and commitment in the forecasting meetings of partners (Van Swol, 2011; Flynn *et al.*, 2010; Davis and Mentzer, 2007). Because the dynamic structure of FSC brings volatility to demand, it is essential for partners not only to be flexible and join their forecast decisions, but also to show commitment to and trust in each other (Van der Vaart *et al.*, 2012; Ha *et al.*, 2011; Taylor and Fearne, 2006; Johnston *et al.*, 2004). In fact, trust not only raises commitment and brings about joint plans, but also brings reliability to partnerships in the long-term (Nyaga *et al.,* 2010; Barratt, 2004; Barratt and Oliveira, 2001).

For instance, Vlachos and Bourlakis (2006) in the Greek food sector have found that trust and commitment are the leading requirements for reliable collaborations, and Småros (2007) in Europe observed manufacturers' eagerness for additional data from retailers causing loss of trust in collaborations. Knowing that the underlying reasons for unfortunate collaborations rest upon the absence of trust and commitment (Nyaga *et al.,* 2010; Småros, 2007; Fliedner, 2006; Vlachos and Bourlakis, 2006), it is rational to build partners' CF in the frame of trust and commitment. This is why trust and commitment are the two foremost formative variables for the CF practice of the current research.

3.2.1.2.A joint business plan

The current research regards the development of a joint business plan as the key antecedent of the CF practice. Joint business plan is a collaborative task of partners that must happen along with collaborative arrangement (VICS, 2004). Linking plans is the second step of the CPFR process, where partners engage in strategies and share experiences to create a basis for continuous product based information sharing (Danese, 2006; Siefert, 2003; ECR Europe, 2002). Although Ramanathan and Gunesakaran (2014) found that collaborative planning is not a significant factor for future collaborations, Nyaga *et al.* (2010) argued that joint planning and decision making build trust in the long-term collaborations. In this regard, it is worth remembering that lack of trust and commitment is one of the most crucial problems of partners that worsen their collaboration (Vlachos and Bourlakis, 2006; Fliedner, 2006; 2003). While recalling that this blockage adds further insights to the arguments of Nyaga *et al.* (2010), it offers a prudent response to the results of Ramanathan and Gunesakaran (2014). In this manner, it is reasonable to claim that linking the business plans of partners is essential for CF in the FSC.

Synchronising partners' business plans enables them not only to improve communication, but also to solve exceptions on the joint sales forecasts, which are the leading barriers of CF (Danese, 2007; Fliedner, 2006; 2003). Synchronisation of plans allows partners to jointly manage operational activities and to generate more accurate consensus forecasts (Danese, 2007; Larsen *et al.*, 2003). This joint effort that improves collaboration is, per se, likely to support long-term CF, where partners can get maximum benefit from the CPFR process (Noekkentved, 2000). In practice, Levi Strauss & Co is a good example to support these arguments, since this company successfully conducted its replenishment operations over a single plan with partners, and explored exceptions in order forecasts (Aviv, 2001). Therefore, linking business plans of partners has become the basis of the CF practice in this research.

3.2.1.3.Consensus-based internal forecasts

In manufacturers, multiple forecasts, which are generated based on departments' diverse objectives and information, are another obstacle to CF (Helms *et al.*, 2000). In collaborations, reaching agreement on retailers' orders and then conducting timely replenishment operations are largely related to the manufacturers' forecasts that are generated by their departments. This is because partners' consensus forecasts that represent retailers' orders are generated through the aggregation of those forecasts that are evaluated within partners' departments (Ireland and Crum, 2005; Siefert, 2003). In other words, retailers' orders involve the combination of retailers' and manufacturers' different forecasts. This procedure adds further value to manufacturers' interdepartmental relations and forecasting.

Due to the significant role of interdepartmental relations in these forecasts, this conflict not only causes additional inventory and loss of information, but also exacerbates internal-external disagreements, which limit manufacturers having consensus with retailers (Taylor and Fearne, 2006; Fliedner, 2006; 2003; Helms *et al.*, 2000). If partners cannot generate consensus forecasts in a timely manner, this will cause delays to delivery and prevent shelf availability. Consequently, retailers will not be satisfied with CF, and there will be no reason to conduct long-term collaborations (Kaipia, 2008; Småros, 2007; Simatupang and Sridharan, 2002). For instance, according to McCarthy *et al.* (2006), 53 percent of USA firms work cross-functionally to incorporate departmental forecasts whilst 54 percent employ CF. In the European grocery sector, Småros (2007) also illustrated how manufacturers' poor interdepartmental relations harmed CF for newly launched products.

When demand is uncertain, the literature suggests cross-functional integration through information sharing and the forecasting process for satisfactory and accurate forecasts (Oliva and Watson, 2011; Nakano, 2009; Davis and Mentzer, 2007; Sanders and Ritzman, 2004; McCarthy and Golicic, 2002). This necessitates departments' agreement on a single forecast (Lawrence *et al.*, 2006; Sanders and Manrodt, 2003). Given manufacturers' multiple forecasts, which are estimated based on related departments' different objectives and give rise to internal-external conflicts (Helms *et al.*, 2000), they, in the first instance, should be satisfied with their own forecasts before meeting with retailers. Further, they need to agree on a single forecast to foster the process of evaluating consensus forecasts with retailers. By relying on the aforementioned evidence and arguments, the current research identifies the consensus-based internal forecasts of manufacturers as one of the backbones of the CF practice.

3.2.1.4.Sharing of order forecasts

In CPFR, while manufacturers generate sales forecasts by relying on retailers' POS data, they exchange these forecasts with retailers to reveal potential product based exceptions (CPFR: Step 3 and 4, please see Section 2.3.1. Steps of CPFR for details). When product based disagreements are fixed on the sales forecasts, these forecasts represent partners' order forecasts. Afterwards, manufacturers synchronise their inventory strategies and order forecasts to evaluate order quantity based on "inventory target per product" and "the destination of product" (CPFR: Step: 5 and 6) (VICS, 2004; 2002). In this step, production capacity and delivery operations are managed based on the forecast that is formed through the combination of order forecasts and inventory strategies (Danese, 2007). For efficient production and delivery management, manufacturers look for answers to the questions of "how much advance notice is necessary to transport the product to its destination? and does the order information reflect temporal differences?". Then, they apply short-term forecasts for actual orders, and long-term forecasts to track the joint business plan with retailers (Siefert, 2003, p. 38).

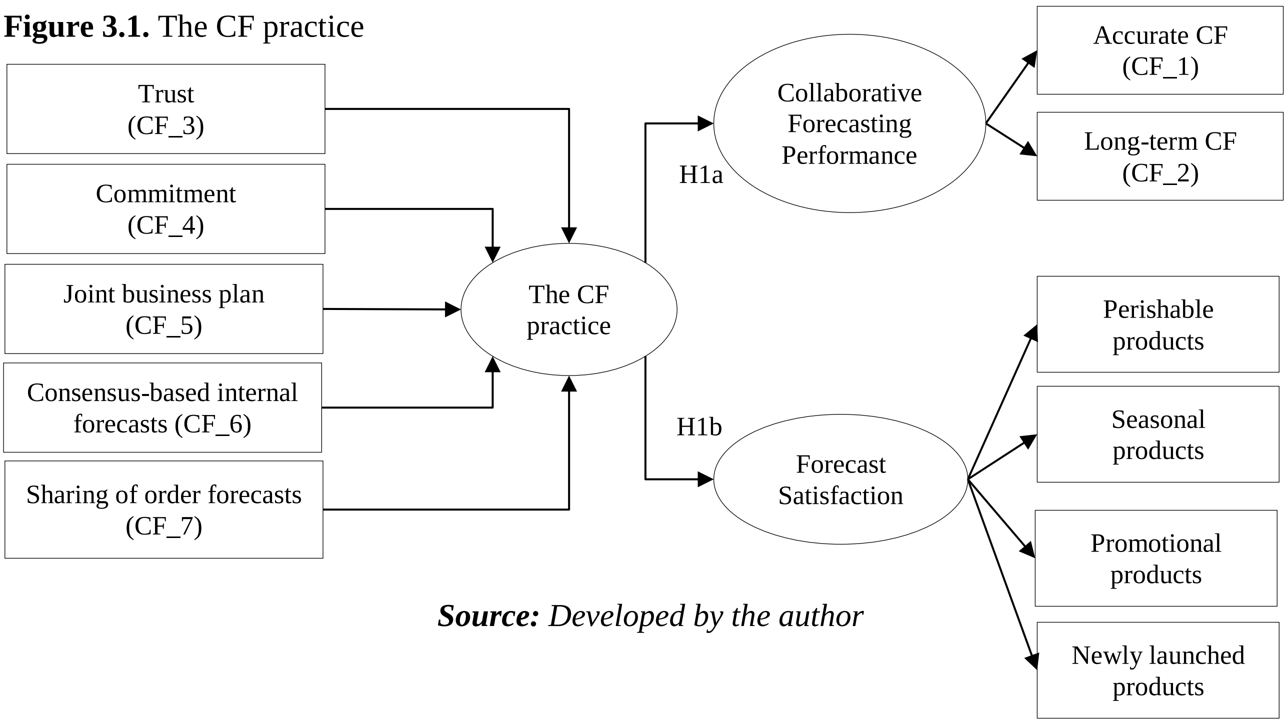
While manufacturers improve their order forecasts based on inventory strategies to manage production and delivery, retailers' order forecast, on the other hand, do not include such modifications. From the retailers' point of view, these changes cause a lack of visibility on the orders and delivery operations of manufacturers (VICS, 2002). When partners meet to solve exceptions and to aggregate these distinct order forecasts (CPFR, Step 7 and 8), they confront challenges (Fliedner, 2006; 2003), due to overlapping views on aggregating order forecasts at different levels (Ireland and Crum, 2005; Zotteri *et al.*, 2005; Siefert, 2003). For that reason, manufacturers need to share order forecasts before meeting with retailers to clarify the changes that were made to manage production and delivery. Sharing these modified order forecasts will allow retailers to clearly understand for what purpose order forecasts are used by manufacturers (Zotteri and Kalchschmidt, 2007). Otherwise, partners will confront disagreements in the meetings, and will not be able estimate consensus forecasts in a timely manner. If partners cannot solve disagreements in collaborations that are based upon time-sensitive / or short-life products, it will give rise to inaccurate forecasts, delays in replenishment operations and consequently absence of products on shelves. Overall, this drawback becomes a significant barrier to long-term and accurate CF (Småros, 2007; Helms *et al.*, 2000). Given the importance of forecasting meetings and forecasters' role in generating consensus forecasts (Graefe and Armstrong, 2011; Van Swol, 2011; Davis and Mentzer, 2007), it is rational to share order forecasts with retailers before the forecasting meetings. Thus, the final antecedent of the CF practice in this research involves the sharing of order forecasts for manufacturers. Relevant references for variables constituting the domain of the CF practice are presented in Table 3.1, and Figure 3.1 exhibits the CF practice along with its formative variables and the expected outcomes of *Collaborative Forecasting Performance* as well as *Forecast Satisfaction*.

Table 3.1. Relevant references of formative variables constituting the CF practice

Formative variables	Codes	Relevant references
Trust	CF_3	Akkermans *et al.* (1999); Barratt (2004); Chang *et al.* (2013); Crum and Palmatier (2003); Davis and Mentzer (2007); Du *et al.* (2012); Fischer (2013); Fliedner (2006; 2003); Flynn *et al.* (2010); Francis *et al.* (2008); Gulati (2011); Ha *et al.* (2011); Johnston *et al.* (2004); Mayer *et al.* (1995); Mentzer *et al.* (2000); Moorman *et al.* (1993); Özer *et al.* (2011); Sinkovics *et al.* (2011); Taylor and Xiao (2010); Taylor and Fearne (2006); Van der Vaart *et al.* (2012); Van Swol (2011); Van der Vaart and Van Dook, (2008); Vlachos and Bourlakis (2006)
Commitment	CF_4	Akkermans *et al.* (1999); Chang *et al.* (2013); Chang *et al.* (2007); Crum and Palmatier (2003); Davis and Mentzer (2007); Du *et al.* (2012); Dwyer *et al.* (1987); Flynn *et al.* (2010); Johnston *et al.* (2004); Lockamy III and McCormack (2004); Mentzer *et al.* (2000); Moorman *et al.* (1992); Simatupang and Sridharan (2002); Van der Vaart *et al.* (2012); Van der Vaart and Van Dook, (2008); Zhao *et al.* (2011)
A joint business plan	CF_5	Aviv (2001); Danese (2007; 2006); ECR Europe (2002); Fliedner (2006; 2003); Ireland and Crum (2005); Larsen *et al.* (2003); Mentzer, *et al.* (2000); Nyaga *et al.* (2010); Ramanathan and Gunesakaran (2014); Siefert (2003); Simatupang and Sridharan (2002); VICS (2004)
Consensus-based internal forecasts	CF_6	Davis and Mentzer (2007); Fliedner (2006; 2003); Helms *et al.* (2000); Ireland and Crum (2005); Kaipia (2008); Lawrence *et al.* (2006); McCarthy and Golicic (2002); Nakano (2009); Oliva and Watson (2011); Sanders and Ritzman (2004); Sanders and Manrodt (2003); Siefert (2003); Simatupang and Sridharan (2002); Småros (2007); Taylor and Fearne (2006)
Sharing of order forecasts	CF_7	Chang *et al.* (2007); Danese (2007; 2006); Davis and Mentzer (2007); Fliedner (2006; 2003); Helms *et al.* (2000); Ireland and Crum (2005); Paula *et al.* (2003); Siefert (2003); Småros (2007; 2003; 2002); Van Swol (2011); VICS (2004; 2002)

Source: *Developed by the author*

Figure 3.1. The CF practice



Source: *Developed by the author*

3.2.2. Integration of manufacturers

Supply chain integration not only encapsulates supplier (or upstream) integration and customer (or downstream) integration (Frohlich and Westbrook, 2001), but also involves "horizontal integration within the firm since the various internal functions comprising a company are as much a part of the supply chain as are the company's suppliers and customers" (Vickery *et al.*, 2003, p. 524). Accordingly, the current research considers a supply chain integration that embraces partners' organisational behaviours, characteristics, operational practices and technological infrastructure at both the external and internal level (Van der Vaart *et al.*, 2012; Stevens, 1989).

In other words, the outlook of this research towards supply chain integration refers to manufacturers' external coordination with retailers as well as interdepartmental functions as an extension of external coordination over strategic and technological efforts (Flynn *et al.,* 2010; Sahin and Robinson Jr., 2005; Vickery *et al.*, 2003). This distinctive feature of the current research also earns the support of the literature, as "external collaboration looks at relations with suppliers and customers in terms of the length of trading, technology transfer between trading partners, and risk sharing, amongst others". On the other hand, "internal collaboration examines the linkages, relationships, organisational structure, and training within the single organisation" (Aryee *et al.,* 2008, p. 563). By relying on the academic evidence, integration practices in this research therefore encompass manufacturers' *External Integration* with retailers as well as *Internal Integration* of their departments.

3.2.2.1.External integration

Partners' different expectations through information sharing and in the forecasting process constitute the blockages that prevent long-term and accurate CF (Fang and Meng, 2010; Småros, 2007; Aviv, 2007; 2002). As retailers adopt information sharing, efficient delivery and multifaceted collaborations, manufacturers on the other hand look for trust in collaborations (Vlachos and Bourlakis, 2006). Manufacturers' intention to increase forecast accuracy triggers an additional information request from retailers, and their long lead-times and different forecasting outlook seem to be contrary to retailers' priority of short lead-times and store level demand (Småros, 2007; Helms *et al.,* 2000).

Småros (2007) argued that IT systems are not a major barrier to long-term CF, and this view is in line with Barratt (2004), who supported the idea that it is not necessary to build collaborations upon technologies. However, due to the fact that IT systems are costly investments, they hinder partners from applying CF for a wide product range in the long-run (Sari, 2008; Fliedner, 2003; McCarthy and Golicic, 2002). Regarding the size of organisations, investing in IT systems will be another drawback for small-scale manufacturers (Mentzer *et al.,* 2000), and retailers in practice (e.g. Tesco and Sainsbury's) insist upon complete electronic integration for long-term collaborations (Fearne and Hughes, 2000). IT systems direct managers towards relevant information and accelerate their decision making in collaborations (Mendelson and Pillai, 1998). It is clear that technology evolves each passing day and offers new IT systems to the industry. Incompatible different systems that are chosen by partners give rise to reduce the speed of data exchange and to increase errors as well as administration costs (Taylor and Fearne, 2006). In fact, agile information sharing is essential for CF (Aviv, 2007), and this puts pressure on partners to collaboratively invest in IT systems for longer CF (Fliedner, 2003; McCarthy and Golicic, 2002).

If partners integrate over the IT systems, it will allow them to access data from the partner organisation in a timely manner, and to lay the basis of trust-based relationships (Sinkovics *et al.*, 2011). This approach, which allows the spreading of information in the entire supply chain, will underpin manufacturers' production planning, inventory management and delivery plans (Thonemann, 2002). Related case studies have also illustrated how investing in IT systems has enhanced efficiency through data exchange, which in turn underpinned manufacturers' inventory management and production process. Such an investment is most likely to increase the quality of information due to improved transparency about the information exchanged (Ramanathan *et al.*, 2011).

This is why, having mutual agreement on the IT based information exchange will enhance partners' desire for a constructive forecasting process, and this will increase forecast accuracy as well (Taylor and Fearne, 2006; Mentzer *et al.,* 2000). In practice, the IT systems of Sony, for instance, enabled the company to regularly track customers' sales for better customer service and to be more responsive to demand (Zhou and Benton Jr, 2007). Dell Computers, similarly, integrated with its partners over the business-to-business IT systems to obtain inventory and order information on a daily basis, which increased transparency in their collaborations (Sinkovics *et al.*, 2011).

For long-term partnerships, strategically collaborating based on long-term objectives is important, but this requires partners' tight integration, both during information sharing and in the forecasting process (Mentzer *et al.*, 2000). To accomplish such an integration, partners need to show interdependence with each other (Du *et al.*, 2012; Zacharia *et al.*, 2011; Hong *et al.*, 2005; Chen and Paulraj, 2004), whilst their top management pursues the same vision to invest in IT systems (Li and Lin, 2006; Barratt, 2004; Mentzer *et al.*, 2000). For instance, one of the oldest and most successful relationships, H.J. Heinz Ltd and Oshawa foods partnership, was built upon the same vision of top managements in the 1990s (Crum and Palmatier, 2003). To cope with unexpected situations (e.g. demand variability and long lead-times), partners likewise need to act in a compatible manner by adopting a reciprocal willingness and commitment to be flexible and to improve performance in complex supply chains (Van der Vaart *et al.*, 2012; Ha *et al.*, 2011; Ireland and Crum, 2005; Johnston *et al.*, 2004).

Furthermore, showing openness, honesty and mutual understanding are important attitudes for transparent information sharing and accurate forecasts in collaborations (Ha *et al.*, 2011; Spence and Bourlakis, 2009; Taylor and Fearne, 2006). In essence, the reason behind calling for such as an effortful and integrative CF depends largely on the heterogeneous structure of FSC, escalating information distortion and hosting a wide range of time-sensitive and / or short-life product-groups that have fluctuating demand. Supporting this argument of the current research, by considering the results of ten case studies, Danese (2011) illustrated how supply chain complexity and product variety influence the partners' business areas that they integrate, such as planning, information sharing and forecasting. Given the benefits of increased responsiveness against instant demand changes when partners closely integrate in supply chains (Danese *et al.*, 2013), it is reasonable to argue that manufacturers should externally integrate with retailers by exhibiting continuous effort to counter potential challenges. Accordingly, the next hypothesis of the current research is as follows:

- **H2a.** *External Integration* has a significant and positive influence on the CF practice of manufacturers

3.2.2.2.Internal integration

In FSC, a manufacturer's poor interdepartmental integration is an important problem that causes inefficient use of demand / forecast data along with loss of information (Småros, 2007). Multiple and inconsistent forecasts by manufacturers that are generated based on departmental objectives and resources are likewise significant obstacles to accurate CF. These multiple forecasts do not only exacerbate internal conflicts (Fliedner, 2006; 2003; Helms *et al.*, 2000), but also prevent consensus with retailers (Hill, 1999). Forecasters' lack of confidence in sales forecasts, inconsistent data recording, and lack of IT systems in manufacturers appear to be major reasons for these shortcomings (Taylor and Fearne, 2006; Helms *et al.*, 2000). In response to these difficulties, improving *Internal Integration* will allow manufacturers to react to instant demand changes and to enhance performance in business (e.g. growth in sales, profit and market share, and return on sales and investment) as well as in operations (e.g. timely launching new products, on time deliveries and short lead-times) (Flynn *et al.*, 2010). Accordingly, there will be no reason for manufacturers to do not have a competitive advantage in the market (Davis and Mentzer, 2007).

The *Internal Integration* of manufacturers involves transparency from purchasing to delivery, rapid information exchange to support external ties with retailers and also responsiveness to demand changes (Stevens, 1989). In essence, these capabilities are already expected by retailers in sustaining product availability on shelves (Ramanathan *et al.*, 2011). For instance, a survey based study by Williams *et al.* (2013, p. 545) demonstrated that organisations' *Internal Integration* is strongly related to their responsiveness in supply chains, with responsiveness here representing the external flexibility to respond to changes that occur in dynamic markets, such as in the food industry. Following this, the authors have interestingly found that *Internal Integration* not only enhances visibility about the demand (e.g. customers' POS data, promotions and inventory as well as forecasts), but also improves supply chain visibility, which is defined as "access to high quality information that describes various factors of demand and supply". According to another survey based study by Schoenherr and Swink (2012), when partners externally integrate in collaborations, their interdepartmental integration shows a moderating effect on the delivery performance (e.g. delivery performance to commit data, fill rate, perfect order fulfilment and order fulfilment lead-time) and flexibility (e.g. production flexibility, cash-to-cash cycle time, asset turns and inventory days of supply).

By considering this evidence, it is possible to argue that if manufacturers improve integration between their departments, outcomes will not be limited to the operational and / or financial benefits, they will also develop a broad vision and visibility in the market to invest in the future. It should, however, not be forgotten that improving integration at the internal level requires partners to adopt a common culture in CF by synchronising internal practices as an extension of external operations (Fliedner, 2006). In this respect, effectively managing inventories and having proper internal IT systems for timely information sharing seem to be the foremost requirements for integrating both internally and externally in the FSC (Taylor and Fearne, 2006; Power, 2005; Stevens, 1989).

As the FSC is highly vulnerable compared to other chains, it causes external dynamics (e.g. economic conditions, unexpected events, seasonality and promotions) (Bourlakis and Weightman, 2004). Because these external factors are likely to affect manufacturers' internal dynamics (e.g. lack of data, poor information systems and communication), it becomes very challenging to sustain the quality and freshness of perishable and / or seasonal products in collaborations, and settling these conflicts rests upon the extent to which partners integrate both internally and externally (Vlajic *et al.*, 2012). Therefore, it is worthwhile for manufacturers to record the production and delivery related data regularly, and then to share them with retailers in an attempt to improve forecasts and to facilitate the management of inventory, delivery and production (Taylor, 2006). This is because inter-organisational interaction plays an important role in managing demand against internal-external dynamics and product-related ambiguities (Davis and Mentzer, 2007).

The benefits of cross-functional integration between marketing and production departments, for instance, are already apparent due to increased flexibility, product quality and timely deliveries (Paiva, 2010; Lockamy II and McCormack, 2004). Because manufacturers' skills in delivery practices are the key enabler of flexibility (Kaipia, 2008), integrating a large number of departments is most likely to underpin manufacturers' integration with retailers as well (Braunscheidel and Suresh, 2009; Gimenez and Ventura, 2005; Drog*e et al.*, 2004). In other words, as long as manufacturers have strong integration between their departments, there is no reason for them to confront difficulties through the integration with retailers (Zhao *et al.*, 2011)

When the concern is to find a way to build such a comprehensive and continuous integration among several departments, S&OP seems a robust candidate for manufacturers. This is because S&OP not only improves cross-functional communication between the departments of marketing, production, finance and supply chain, but also synchronises their diverse sources and identifies departmental responsibilities (Grimson and Pyke, 2007). It is timely to recall that manufacturers' multiple forecasts, which represent departments' diverse objectives, cause disagreements and delays in generating consensus forecasts with retailers (Fliedner, 2006; 2003; Helms *et al.*, 2000). As a remedy, the strategic feature of S&OP, for instance, can eases the alignment of departments' different objectives (Oliva and Watson, 2011). This alignment expedites the generation of a single consensus-based forecast in manufacturers (Mello, 2013). Accordingly, they can generate consensus forecasts with retailers in a timely manner (Olhager, 2013; Thomé *et al.*, 2012).

Considering the necessity for manufacturers to link business plans with retailers in CF (VICS, 2010), S&OP likewise helps manufacturers to combine their operational and strategic objectives in a single business plan with retailers (Thomé *et al.*, 2012). Given that FSC is highly dynamic and S&OP has the capability of adopting market uncertainties, merging S&OP with the CF of manufacturers will most likely to remedy their internal conflicts (Nakano, 2009). Therefore, the current research recommends the S&OP practice for manufacturers to improve their *Internal Integration.* To underpin this offer, it is worthwhile to recall the successful collaboration of The Lowe's Home Improvement and Whirlpool, who combined their CPFR and S&OP practices (Smith *et al.,* 2010). Furthermore, by relying on the aforementioned arguments and diverse analyses, the current research argues for the importance of *Internal Integration* as a significant element in manufacturers' CF in the FSC. By extending this argument, this research claims that *Internal Integration* is also a prerequisite for better integration with retailers at the external level. Therefore, the following hypotheses are formulated:

- **H3a.** *Internal Integration* has a significant and positive influence on the CF practice of manufacturers
- **H3b.** *Internal Integration* has a significant and positive influence on *External Integration* during the CF practice of manufacturers

3.2.3. Forecasting process

Manufacturers' forecasting process is non-negligible in CF. Forecasting challenges are not limited to departments' incompatible multiple forecasts that trigger internal-external conflicts (Taylor and Fearne, 2006; Fliedner, 2006; 2003; Helms *et al.,* 2000). There is a divergence between the literature and practice in terms of the *Forecast Horizon* preferences of partners in CF. Some simulation-based studies have presumed that partners collaborate on the same *Forecast Horizon* (Aviv, 2002; 2001), yet partners' disagreements on planning horizons worsened CF in practice (Småros, 2007). It is clear that there is a substantial gap in the literature about whether partners have such disagreements on *Forecast Horizon*. Further to that, the literature is limited to scant knowledge in terms of the required horizon in forecasting the time-sensitive and / or short-life products in the FSC. There are only a limited number of studies addressing the horizon of forecasts by considering longer periods, such as from three months to two years (McCarthy *et al.*, 2006; Mentzer and Kahn, 1995). Whilst there are contrary views that defended shorter time periods such as a month (Fildes and Goodwin, 2007; Klassen and Flores, 2001), the literature is lacking in comprehensive empirical work that particularly examines the *Forecast Horizon* of perishable, seasonal, promotional newly launched products in the FSC.

Partners' overlapping expectations through forecasting meetings are another obstacle for consensus forecasts, and forecasters play a critical role in these meetings too (Van Swol, 2011; Småros, 2007; 2003). In meetings, forecasters use a wide range of information to generate consensus forecasts. It requires substantial effort to aggregate different information in a timely manner, and forecasters' disagreements already cause delays in generating these forecasts (Småros, 2007; Fliedner, 2006). Given the managerial pressures, limited times and external factors that are likely to affect forecasters' performance (Fildes *et al.*, 2009; Davis and Mentzer, 2007), this process becomes even more important when the requirement is to forecast time-sensitive and / or short-life products. Potential delays and / or inaccurate forecasts engender time lags in replenishments, stock-out and absence of product availability on shelves, and all these shortcomings then harm partners' profit and therefore collaboration. Whilst the literature has considered different types of meeting techniques and forecasters' disagreement in meetings are apparent, it needs to be extended further by offering alternative solutions to these challenges (Önkal *et al.*, 2012; Graefe and Armstrong, 2011; Lawrence *et al.*, 2006). Therefore, the argument of the current research on the forecasting process is based on manufacturers' *Forecast Horizon*, *Group Forecasting* with retailers and *Forecasters' Competence* required in meetings.

3.2.3.1.Forecast horizon

When simulation studies have aimed to improve performance in supply chain through CF, it was presumed that partners have an agreement on the same *Forecast Horizon* for long-life products (Aviv, 2002; 2001). However, when short-life and / or newly launched products became subject to collaborations, retailers showed a tendency to short-term forecasts for purchasing and store level demand in response to manufacturers' long-term forecasts due to long lead-times and production plans (Småros, 2007; 2003).

While prior literature has surveyed a wide range of forecasting methods over *Forecast Horizon* to reveal the change of forecasting management over twenty years, the horizons of short-, mid- and long-term forecasts referred to "less than three months', 'four months to two years' and 'over two years' respectively (McCarthy *et al.*, 2006; Mentzer and Kahn, 1995). On the other hand, Fildes and Goodwin (2007) stressed that organisations' forecasts are monthly in several industries, which corroborates the work by Klassen and Fores (2001). Furthermore, McCarthy *et al.* (2006) showed worsened forecast accuracy in all *Forecast Horizon* for product-based forecasts in time, while incoherent forecasts were more discernible for the mid-term and long-term forecasts, so it is worth adding more insight to *Forecast Horizon* for product-based forecasts.

Although combining multiple long-term forecasts that have a high variability increases accuracy (Lawrence *et al.*, 1986) and enhances competitiveness in the market (Aburto and Weber, 2007), short-term forecasts lead to managing purchasing and inventory effectively (Småros, 2003). This dilemma thereby causes another challenge in deciding on the correct horizon based on product characteristics and organisational objectives in CF. A limited number of case studies exemplified how the partners' different preferences about the *Forecast Horizon* of newly launched products causes conflicts (Småros, 2007; 2003). Simulations, however, conjectured partners' similar approach to *Forecast Horizon* for long-life products (Aviv, 2002; 2001).

Given the contradictory findings of these studies that considered a limited number of product-groups, it is worth adding further understanding to the role of *Forecast Horizon* for particular product-groups, such as perishable, seasonal, promotional and newly launched products. Whilst *Forecast Horizon* has a substantial role in the forecasting processes (Zotteri and Kalchschmidt, 2007), elaborating *Forecast Horizon* in manufacturers' CF will provide further implications to the forecasting process of partners. Therefore, the next hypothesis of the current research is:

- **H4.** *Forecast Horizon* has a significant and positive influence on the CF practice of manufacturers

3.2.3.2.Group forecasting

In CF, partners conduct regular *Group Forecasting* meetings to generate demand forecasts and to identify / resolve exceptions over the item level forecasts. Then, they generate order forecasts, and re-identify / resolve exceptions for consensus over a single order forecast (Ireland and Crum, 2005). During these meetings, partners' cross-functional teams make critical decisions through generating / adjusting forecasts, evaluating the impact of seasonality, promotions and / or external factors. All such decisions are made based on the pre-established procedures that are identified through front-end agreement and highlighted in a joint business plan (Siefert, 2003). In meetings, manufacturers' forecasts focus on production plans and lead-times, while retailers' forecasts consider inventory levels, which causes conflicts in having consensus on a single forecast (Småros, 2007; 2003).

On the other hand, the *Group Forecasting* techniques are vital to structure meetings for consensus between partners' cross-functional teams (Kerr and Tindale, 2011; Graefe and Armstrong, 2011). For instance, face-to-face-meeting is an effective way of merging the latest information with forecasts (Kerr and Tindale, 2011). However, despite forecasters' satisfaction from forecasts, its unstructured format causes bias and hierarchical pressures, and necessitates spending substantial time, effort and cost, which militate against scheduling regular meetings (Graefe and Armstrong, 2011). Partners' *Group Forecasting* in CF relies largely on the pre-scheduled meetings and decision making procedures (Ireland and Crum, 2005).

Therefore, Nominal-Group is an alternative to face-to-face-meeting with its structured format (Van de Ven and Delbecq, 1974; 1971). In Nominal-Group, forecasters individually estimate forecasts before debating results, and then have a consensus on the aggregated final forecast. Nominal-Group outperforms face-to-face-meeting and is more satisfactory, although it requires a great deal of time and effort, like face-to-face-meeting. Nominal-Group makes it possible to elucidate decisions owing to forecasters' increased participation, enabling effective usage of information in *Group Forecasting* (Graefe and Armstrong, 2011), which is essential for CF (Ireland and Crum, 2005; Aviv, 2001).

Whilst the literature stresses the benefits of having different opinions for constructive discussions in meetings (Kerr and Tindale, 2011; Davis and Mentzer, 2007; Aviv, 2001), a survey approach of Delphi-Technique reinforces communication between forecasters on a unanimous and multimedia level platform. These features distinguish Delphi-Technique from Nominal-Group and face-to-face-meeting, and make it superior to face-to-face-meeting (Graefe and Armstrong, 2011). Although its structure is similar to Nominal-Group because of documentary level interactions (Graefe and Armstrong, 2011), it requires additional information sharing between forecasters to add more understanding to the changes made to order forecasts for consensus (Helms *et al.,* 2000). Thus, the performance of Delphi-Technique relies on both forecasters and the structure of meetings (Rowe and Wright, 2011; 1999). For instance, case studies in the European agri-food sector illustrated increased participation and response rate, and motivation and small group size became essential to avoid bias for the Delphi-Technique (Frewer *et al.*, 2011).

Nevertheless, it is not possible to overlook partners that collaborate over different contract models. The *Group Forecasting* technique of Prediction-Markets seems to be appropriate for these partners to cope with environmental uncertainties and casual costs (Wolfers and Zitzewitz, 2004). Prediction-Markets give a chance for partners to merchandise over different types of contracts and to conduct continuous information sharing, but their drawback is to allow one of the partners to change the final forecasts without having confirmation from the other partner (Graefe and Armstrong, 2011). This shortcoming makes Prediction-Markets inferior to face-to-face-meeting (Kerr and Tindale, 2011). On the other hand, this technique makes it possible to exchange the different types of information among partners (Wolfers and Zitzewitz, 2004), and this feature is a noteworthy ingredient to keep in the heterogeneous FSC. Overall, in view of the aforementioned diverse and non-transparent analyses, it is indispensable to analyse *Group Forecasting* (Önkal *et al.,* 2012; 2011). This is why the next hypothesis of the current research is formulated:

- **H5.** *Group Forecasting* has a significant and positive influence on the CF practice of manufacturers

3.2.3.3.Forecasters' competence

Producing timely and accurate forecasts is a challenge for forecasters due to managerial pressures, limited times and / or external factors (Fildes *et al.*, 2009; Davis and Mentzer, 2007). Past literature stressed forecasters' motivation in terms of effectively adjusting forecasts (Webby and O'Connor, 1996) while case studies in the FSC implied how scant motivation in *Group Forecasting* influences the forecasts of newly launched products (Småros, 2007). These implications confirm the literature stressing the conflict of forecasters in *Group Forecasting* (Fliedner, 2006; 2003).

Prior literature clarified how forecast accuracy over the relationship of forecasters and / or cross-functional teams relies on the structure of meetings (Sniezek, 1989). In a later study, Önkal *et al.* (2011) demonstrated varying performance between individual and group forecasts. Although the role of organisations is important in motivating forecasters to generate better forecasts (Davis and Mentzer, 2007), their personal knowledge that is gained through experience seems an important driver for accurate forecasts (Sanders and Ritzman, 2004). Particularly, if this knowledge is based on specific product-groups, it becomes even more valuable for forecasts (Edmundson *et al.*, 1988). At the same time, overlapping experience on the particular product-groups is likely to worsen consensus in collaborations (Van Swol, 2011). This is why it is promising to generalise the role of experience in terms of judging market dynamics and adjusting statistical forecasts based on the latest information in *Group Forecasting* (Lawrence *et al.*, 2006; Rowe and Wright, 1999).

The influence of advice on forecasts relies on the forecaster who advises and the information that triggers him / her to give advice (Lawrence *et al.*, 2006). Accepting advice, however, depends on forecasters' confidence, trust, commitment and interaction with each other (Van Swol, 2011; Rowe and Wright, 2011). It should not be forgotten that unreliable information, lack of training and / or experience are likely to engender either bias or overconfidence, which can in turn ruin forecasters' adjustments in meetings (Önkal *et al.*, 2013; McCarthy Byrne *et al.*, 2011; Syntetos *et al.*, 2009; Fildes *et al.*, 2009). This is because overconfidence, for instance, is likely to trigger bias in *Group Forecasting* (Kerr and Tindale, 2011; Bolger and

Wright, 2011; Sanders and Ritzman, 2004). Such interrelated attitudes of forecasters make their role in CF and *Group Forecasting* more conspicuous.

Following this, although variant feedback between forecasters improves accuracy (Lawrence *et al.*, 2006; Goodwin and Fildes, 1999; Sanders, 1997), its effect relies upon the level of understanding, timing and presentation (Lawrence *et al.*, 2006). Satisfaction from *Group Forecasting* likewise relates to forecasters' training and feedback, and tackling relevant problems depends on the knowledge of using forecasts alongside training and feedback (McCarthy Byrne *et al.*, 2011). Conducting successful collaboration between partners is largely associated with their cross-functional teams' training, common understanding of organisational expectations and the forecasts generated during *Group Forecasting* (Ireland and Crum, 2005).

It is clear that lack of trust and commitment inhibits partners from collaborating in the long-run (Fliedner, 2006; 2003) while trust improves their information sharing and decision making (Ha *et al.*, 2011). Accepting advice between forecasters is also related to trust (Van Swol, 2011), which calls for further research on advice (Önkal *et al.*, 2012). Trust and commitment are likely to increase forecasters' motivation in *Group Forecasting* (Flynn *et al.*, 2010; Davis and Mentzer, 2007) and to mediately underpin long-term collaborations (Vlachos and Bourlakis, 2006). Therefore, the aforementioned analyses are the arguments for attributing the competence of forecasters to both CF and *Group Forecasting* in the following hypotheses:

- **H6a.** *Forecasters' Competence* has a significant and positive influence on the CF practice of manufacturers
- **H6b.** *Forecasters' Competence* has a significant and positive influence on *Group Forecasting* during the CF practice of manufacturers

3.2.1. Information sharing

In collaborations, information sharing is a key practice for partners to enhance transparency, performance and forecast accuracy (Zhu *et al.*, 2011; Zhou and Benton Jr, 2007). It becomes even more important when time-sensitive and / or short-life product-groups are subject to collaborations. Taking into account these products in the forecasting process raises the importance of selecting relevant / correct information and controlling their quality (Taylor and Fearne, 2006; Zotteri *et al.*, 2005). In the European grocery sector, case studies exemplified the importance of information for better forecasts of perishable, seasonal, promotional and newly launched products (Småros, 2007). There are a number of studies that emphasise the different types of information that need to be exchanged in CF (Danese, 2007; 2006) while the quality of information has been the interest of a plethora of research (Hartono *et al.*, 2010; Li and Lin, 2006; Li *et al.*, 2006).

The focus in the literature, however, became the information that flows from retailers to manufacturers, such as promotions, inventory data and POS data (Ramanathan, 2013; Williams *et al.*, 2013; Chang *et al.*, 2007; Taylor and Fearne, 2006). There is a paucity of research addressing the types of information that flow from manufacturers to retailers (Småros, 2007). Hence, the literature needs to be further extended to guide partners about what sort of information should be shared with retailers for better forecasts (Ramanathan, 2013; Barratt and Oliveira, 2001). Following this, partners' disagreement during information sharing mostly occur due to inaccurate data, timeliness, inconsistency and lack of information, which obstruct managing demand, production and shelf availability (Taylor and Fearne, 2006; Taylor, 2006).

These shortcomings highlight the necessity of maintaining the quality of information in collaborations, which is essential for the forecasts of time-sensitive and / or short-life product-groups. Although studies addressed a number of benchmarks to measure the quality of information (Zhou *et al.*, 2014; Zhou and Benton Jr, 2007), there is not a rigid benchmark, particularly, evaluating the quality of information that belongs to food manufacturers and is used in CF for perishable, seasonal, promotional and newly launched products. Hence, the hypothesis development process of the current research is based on the different *Information Types* of manufacturers and *Information Quality* for better CF in the FSC.

3.2.1.1.Information types

Whilst supply chain performance is dependent on the information being shared in terms of types, time and the way it is shared (Holmberg, 2000), forecast accuracy pertains to the characteristics of information (Ramanathan, 2013). These characteristics can be classified into supplier, manufacturer, customer, retailer and distribution information (Zhou and Benton Jr, 2007). It is clear that there is a contradiction between the literature and practice, on whether retailers' proximity to customers provides better forecasts (Aviv, 2002; 2001) or if they do not add additional value to CF (Småros, 2007). The literature is rather lacking in empirical studies examining the relation between forecast accuracy and bilateral information sharing between partners in uncertain markets, for instance during promotions (Zhu *et al.*, 2011).

The benefits of mutually sharing information in collaborations were clearly uncovered by mathematical models (Zhu *et al.*, 2011). In addition, the literature previously emphasised how partners' bilateral information exchange enhances the benefits of CF during promotions (Fliedner, 2006; Aviv, 2001). This supports the claim that in response to retailers' information (e.g. price changes, historical data and promotional plans) that strengthen manufacturers' forecasts (Taylor, 2006; Småros, 2003; Aviv, 2002), manufacturers need to share information with retailers to enhance forecast accuracy as well as visibility in the supply chain. For instance, sharing production plans of relevant products not only enhances transparency and reduces forecast errors (Flynn *et al.*, 2010; Zhou and Benton Jr, 2007), but also enables manufacturers to conduct timely replenishment operations in addition to increased supply chain performance (Ramanathan and Gunasekaran, 2014; 2012; Lee *et al.*, 2000). Following this, when the primary focus of forecasts is production for manufacturers, sharing production related information will allow retailers to understand the reasons behind the forecasts, which will in turn increase the accuracy of collaborative forecasts (Zotteri and Kalchschmidt, 2007).

In FSC, perishable products (e.g. vegetables and living animals) typically decay through production and delivery, and this corrodes their quality and reduces retailers' satisfaction and manufacturers' revenue. These shortages accordingly give rise to the importance of production scheduling and the delivery skills of manufacturers, enabling them to settle effective production, timely deliveries and to minimise transportation costs (Chen *et al.*, 2009). Therefore, sharing the stock level and production schedule of relevant products brings about collaborative planning between partners, and reduces inventory levels along with the associated costs (Arshinder *et al.*, 2008; Chen and Paulraj, 2004; Karoway, 1997). In doing so, manufacturers can accurately understand retailers' short-term demand needs, which makes it possible to reduce their capacity requirements (Fliedner, 2006).

In response to retailers' historical information, when manufacturers share recent information (e.g. environmental factors, weather conditions, product / company related data and past experience), forecasts become more reliable for partners (Sanders and Ritzman, 2004). Notwithstanding that the provision of the latest information is important (Sanders and Manrodt, 2003), sharing such information provides time-based forecast improvement for retailers, as well as making it possible to generate more accurate consensus forecasts in partners' meetings (Lawrence *et al.*, 2006). The above arguments lead to the following hypothesis:

- **H7.** Sharing various *Information Types* with retailers has a significant and positive influence on the CF practice of manufacturers

3.2.1.2.Information quality

Quality of information is one of the major determinants in revealing the extent to which information transfer meets partners' expectations through collaborations (Petersen, 1999). The information sharing literature measured *Information Quality* by considering several dimensions, such as accuracy, credibility, timeliness and currency, which represents the partners' level of satisfaction from the information that they exchange (Zhou and Benton Jr, 2007; Vijayasarathy and Robey, 1997; Neumann and Segev, 1979). Nevertheless, partners in the FSC are not satisfied through CF due to inaccurate and inadequate data, lack of timeliness, inconsistency and technological obstacles, in which these difficulties worsen their information sharing process (Småros, 2007; Taylor, 2006; Taylor and Fearne, 2006).

Because *Information Quality* appears to be a significant performance metric when partners jointly make decisions through information sharing and in the forecasting process (Ramanathan *et al.*, 2011; Forslund and Jonsson, 2007), partners, as a remedy, ought to share accurate and relevant information frequently to feed their forecasts with reliable information in a timely manner (Zhou and Benton Jr, 2007). In essence, the underlying reason for this requirement is the necessity of aligning partners' supply chain practices based on the quality level of information that they exchange for better profitability in collaborations (Zhou *et al.*, 2014).

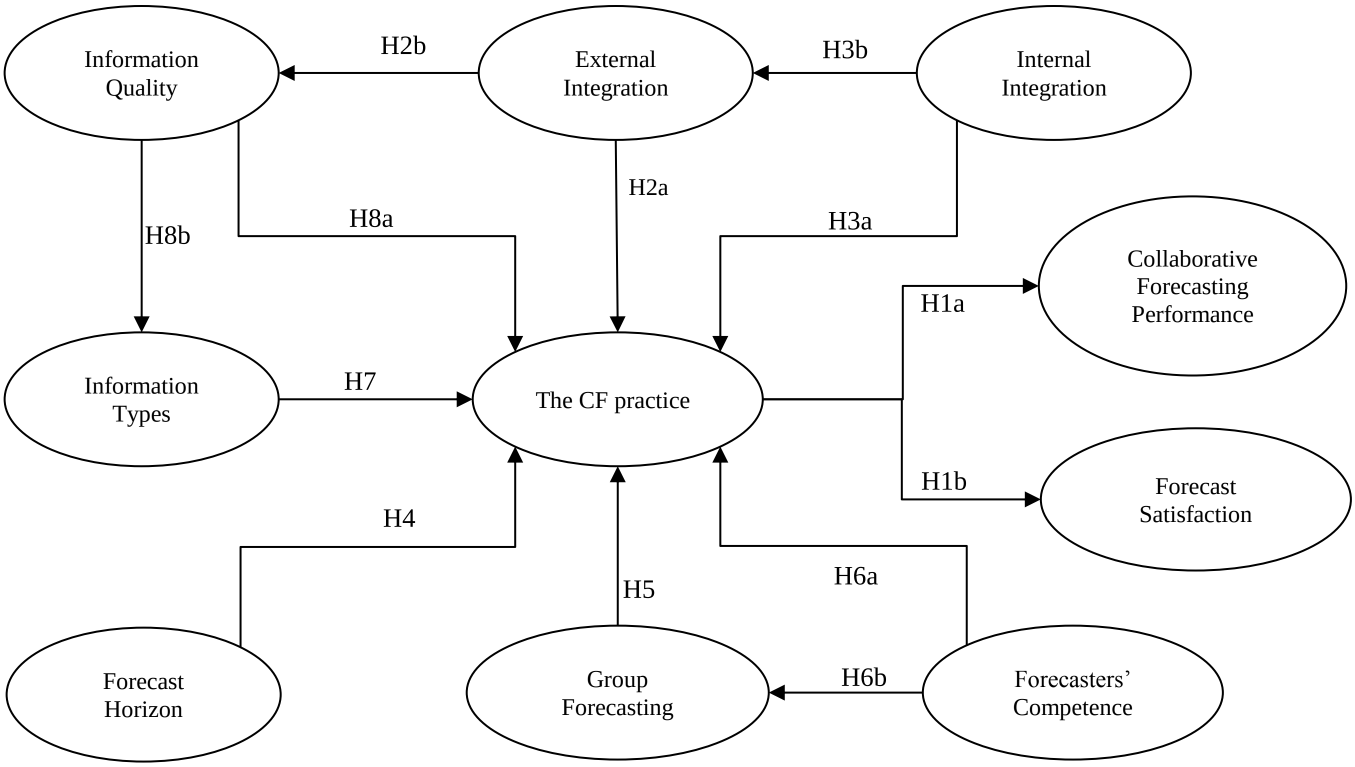
The literature clearly stressed how frequent information exchange improves forecasts and eases inventory management (Aviv, 2007; 2002; 2001). Because adequate and timely sharing of accurate information enhances partners' motivation to generate reliable forecasts, these practices, per se, show partners' willingness to share further information (Du *et al.*, 2012; Webby and O'Connor, 1996). Benefiting from information sharing likewise relies largely upon partners' assimilation of the information received, but sharing relevant information in a timely manner is the foremost necessity to react to market dynamics and to take required actions in supply chains (Hartono *et al.*, 2010). For instance, when suppliers in the USA shared the stock level of relevant products with Wal-Mart, it enabled the retailer to place timely orders in response to rapid demand changes. This in turn enabled Wal-Mart to have a competitive price advantage and to reduce inventory costs as well as loss of sales, and suppliers reduced stock-out and enhanced brand loyalty in the market (Simatupang and Sridharan, 2002).

Sharing quality information not only relates to the type of information, but also it is related to partners' collaborative relation, which is built upon the same vision, trust and interdependence as well as the willingness to invest in IT systems (Zacharia et al., 2011; Sinkovics *et al.*, 2011; Li and Lin, 2006; Simatupang and Sridharan, 2002). The support of top managements is also another vital factor in terms of enhancing *Information Quality* between partners (Hartono *et al.*, 2010), and among departments (Ireland and Crum, 2005). Correspondingly, if the time-sensitive feature of perishable, seasonal, promotional and newly launched products is considered (Ahumada and Villalobos, 2009), the forecasting process needs to be fostered with various information sources frequently and consistently to generate accurate forecasts and to become more responsive to rapid demand changes (Danese, 2007; Taylor and Fearne, 2006). Based on this evidence it is promising to posit that sustaining quality information sharing between partners is vital for CF. Further, *Information Quality* is important for sharing various information sources. In this respect, manufacturers' *External Integration* with retailers seems to be a preceding step for maintaining *Information Quality* in CF. Consequently, the current research finally formulates the following hypotheses:

- **H2b.** *External Integration* has a significant and positive influence on *Information Quality* during the CF practice of manufacturers
- **H8a.** *Information Quality* has a significant and positive influence on the CF practice of manufacturers
- **H8b.** *Information Quality* has a significant and positive influence on various *Information Types* during the CF practice of manufacturers

The conceptual model is presented in Figure 3.2, and Table 3.2 summarises the hypotheses and relevant references underpinning the arguments of the current research.

Figure 3.2. Conceptual Model



Source: *Developed by the author*

Table 3.2. Relevant references of hypotheses

Hypotheses	Relevant references
Collaborative Forecasting Performance	Danese (2011; 2007); Fliedner (2006; 2003); Fischer (2013); Ramanathan and Gunasekaran (2014; 2012); Nyaga *et al.* (2010); Noekkentved (2000); Småros (2007; 2003); Vlachos and Bourlakis (2006)
Forecast Satisfaction	McCarthy *et al.* (2006); Mentzer and Kahn (1995); Yokum and Armstrong (1995)
External Integration	Adebanjo (2009); Akkermans *et al.*(1999); Arshinder *et al.* (2008); Aryee *et al.*(2008); Aviv (2007; 2002); Barratt (2004); Barratt and Oliveira (2001); Chang *et al.* (2007); Chen and Paulraj (2004); Danese *et al.* (2013); Danese (2011; 2007; 2006); Devaraj *et al.* (2007); Droge *et al.*(2004); Fischer (2013); Frohlich and Westbrook (2001); Flynn *et al.* (2010); Fliedner (2006; 2003); Gimenez and Venturea (2005); Ha *et al.* (2011); Handfield and Nichols (1999); Hill and Scudder (2002); Helms *et al.* (2000); Hong *et al.* (2005); Ireland and Crum (2005); Johnston *et al.* (2004); Li and Lin (2006); Mason and Lalwani (2006); Mentzer *et al.* (2000); McCarthy and Golicic (2002); Nakano (2009); Power (2005); Ramanathan *et al.* (2011); Olhager (2013); Olhager *et al.* (2001); Oliva and Watson (2011); Ramanathan and Gunasekaran (2014; 2012); Sanders and Manrodt (2003); Sari (2008); Schoenherr and Swink (2012); Småros (2007; 2003); Sinkovics *et al.* (2011); Spence and Bourlakis (2009)Taylor and Fearne (2006); Taylor (2006); Thomé *et al.* (2012); Van der Vaart *et al.* (2012); Van der Vaart and Van Donk (2008); Vickery *et al.* (2003); Vlachos and Bourlakis (2006); Vlajic *et al.* (2012); Yan and Dooley (2014); Zacharia *et al.* (2011); Zhao *et al.* (2011); Zhou and Benton Jr, (2007)
Internal Integration	Adebanjo (2009); Akkermans *et al.* (1999); Aryee *et al.* (2008); Barratt and Oliveira (2001); Braunscheidel and Suresh (2009); Chang *et al.* (2007); Chen *et al.* (2000); Danese *et al.* (2013); Danese (2007; 2006); Davis and Mentzer (2007); Droge *et al.*(2004); Fliedner (2006; 2003); Flynn *et al.* (2010); Francis *et al.* (2008); Kaipia (2008); Handfield and Nichols (1999); Helms *et al.* (2000); Hill and Scudder (2002); Lockamy II and McCormack (2004); Mason and Lalwani (2006); Mentzer *et al.* (2000); Nakano (2009); Olhager (2013); Olhager *et al.* (2001); Oliva and Watson (2011); Paiva (2010); Paulraj *et al.* (2008); Power (2005); Ramanathan *et al.* (2011); Ramanathan and Gunasekaran (2014; 2012); Sari (2008); Schoenherr and Swink (2012); Småros (2007; 2003); Stevens (1989); Taylor and Fearne (2006); Taylor (2006); Thomé *et al.* (2012); Van der Vaart *et al.* (2012); Vickery *et al.* (2003); Vlajic *et al.* (2012)Williams *et al.* (2013); Yan and Dooley (2014); Zhao *et al.* (2011)
Forecast Horizon	Aburto and Weber (2007); Aviv (2002; 2001); Fildes and Goodwin (2007); Klassen and Fores (2001); McCarthy *et al.* (2006); Mentzer and Kahn (1995); Småros (2007; 2003); Thomassey (2010); Zotteri and Kalchschmidt (2007)
Group Forecasting	Aviv (2001); Davis and Menter (2007); Frewer *et al.* (2011); Graefe and Armstrong (2011); Helms *et al.* (2000); Ireland and Crum (2005); Kerr and Tindale (2011); Lawrence *et al.* (2006); Önkal *et al.* (2012; 2011); Rowe and Wright (2011; 1999); Siefert (2003); Småros (2007; 2003); Van Bruggen *et al* .(2010); Van de Ven and Delbecq (1974; 1971)
Forecasters' Competence	Aviv (2001); Bolger and Wright (2011); Davis and Menter (2007); Edmundson *et al.* (1988); Fildes *et al.* (2009); Fliedner (2006; 2003); Flynn *et al.* (2010); Ireland and Crum (2005); Goodwin and Fildes (1999); Ha *et al.* (2011); Kerr and Tindale (2011); Lawrence *et al.* (2006); McCarthy Byrne *et al.* (2011); McCarthy *et al.* (2006); Moon *et al.* (2003); Oliva and Watson (2011); Önkal *et al.* (2013; 2012; 2011); Rowe and Wright (2011; 1999); Sanders and Manrodt (1994); Sanders (1997); Sanders and Ritzman (2004); Småros (2007); Sniezek (1989); Syntetos *et al.* (2009); Van Swol (2011); Vlachos and Bourlakis (2006); Webby and O'Connor (1996)
Information Types	Ahumada and Villalobos (2009); Arshinder *et al.* (2008); Aviv (2002; 2001); Barratt and Oliveira (2001); Chang *et al.* (2007); Chen *et al.* (2009; 2000); Chen and Paulraj (2004); Danese (2011; 2007; 2006); Danese and Kalchschmidt (2011); Du *et al.* (2009); Fliedner (2006); Flynn *et al.* (2010); Holmberg (2000); Karoway (1997); Larsen *et al*. (2003); Lee *at al.* (2000); Nakano (2009); Ramanathan and Gunasekaran (2014; 2012); Ramanathan (2013; 2012); Sanders and Ritzman (2004); Sanders and Manrodt (2003); Sinkovics *et al.* (2011); Småros (2007; 2003); Thomé *et al.* (2012); Thonemann (2002); Taylor and Fearne (2006); Taylor (2006); Van Swol (2011); Vlajic *et al.* (2012); Zacharia *et al.* (2011); Zhu *et al.* (2011); Zhou and Benton Jr, (2007); Zotteri *et al.* (2005); Zotteri and Kalchschmidt (2007)
Information Quality	Aviv (2007; 2002; 2001); Barratt and Oliveira (2001); Cachon and Fisher (2000); Danese (2007); Du *et al.* (2012); Du *et al.* (2009); Fischer (2013); Fliedner (2006); Forslund and Jonsson (2007); Hartono *et al.* (2010); Kerr and Tindale (2011); Li and Lin (2006); Li and Wang (2007); Mendelson and Pillai (1998); Neumann and Segev (1979); Oliva and Watson (2011); Özer *et al.* (2011); Peterson (1999); Ramanathan *et al.* (2011); Ramanathan, (2012); Simatupang and Sridharan (2002); Småros (2007; 2003); Taylor and Fearne (2006); Taylor (2006); Thonemann (2002); Vijayasarathy and Robey (1997); Vlajic *et al.* (2012); Webby and O'Connor (1996); Zhao *et al.* (2002); Zhou and Benton Jr, (2007); Zhou *et al.* (2014); Zotteri *et al.* (2005)

Source: *Developed by the author*

3.3. Summary

In conclusion, this chapter has elaborated the theoretical concepts of Whetten (1989). The theoretical concepts of “what, how, why and the combinations of who, where and when” enabled the current research to construct the CF practice and to build associated hypothetical relationships on a conceptual model in a legitimate and theoretical way. For instance, the concept of “what” guided this research to select constructs (or factors / hypotheses) and their variables in a logical way by adding further insight into their impact on the CF problems of manufacturers, which prevent long-term and accurate CF in the FSC. Then, by following the concept of “how”, the aim became to add more understanding to the relation between constructs and variables. Thus, the current research provided further understanding of the hypothesised relationships discussed, and then built the complete form of the conceptual model, which indicates the direction of the arrows between hypotheses.

The theoretical concept of “why” then played a guideline role not only in justifying the selection of constructs and variables, but also in adding more insight into the underlying causality between hypotheses in the conceptual model. Therefore, the current research advocates hypothetical relationships in a rational way, and allows the reader to judge how compelling and rational the contributions are to extend the existing knowledge in the literature. Further to this, following a rigid theoretical approach consolidates the argument on the conceptual model that aims to enhance long-term and accurate CF as well the forecast satisfaction of manufacturers. Thereby, food practitioners can interpret how the conceptual model will enhance long-time and accurate CF when perishable, seasonal, promotional and newly launched products are subject to their collaborations in the FSC.

Finally, the theoretical concept that combines "who, where and when” represents the limitations of the current research. In other words, the research contributions will be generalised under the particular circumstances that made it possible to build hypothetical relationships and the conceptual model. For instance, the findings will be based on dyadic manufacturer-retailer collaborations in the FSC. The conceptual model offered is limited to the point of view of manufacturers, who are located in the UK & Ireland, Europe and North America. The conceptual model therefore does not represent the opinion of retailers in CF. Arguments of the current research are likewise restricted to the time-sensitive and / or short-life product-groups (e.g. perishable, seasonal, promotional and newly launched products). These limitations in turn open new research fields for the academic field to be able to extend the body of the literature.

As far as the CF practice offered in this research is considered, it has been built upon the two major performance criteria. They are (i) to guide manufacturers to conduct long-term CF with retailers, and (ii) to improve the forecast accuracy of perishable, seasonal, promotional and newly launched products that partners collaborate on. It is, however, clear that organisations in practice have different strategic and operational objectives, and this pragmatic vulnerability is likely to influence the reliability of the aforementioned accuracy criterion. In other words, when manufacturers collaborate with retailers, forecast accuracy may not be the primary objective of collaboration. Instead, partners are likely to aim at increasing supply chain performance and / or reducing inventory costs. Therefore, the current research has built a new construct that represents manufacturers' forecast satisfaction with perishable, seasonal, promotional and newly launched products. This approach not only enhances the reliability of this CF practice from practitioners' point of view, but also brings a new dimension to the forecasting literature by offering a new benchmark for evaluating the value of forecasts.

The CF practice for manufacturers has been constructed of five preconditions that form its complete domain. They are (i) trust, (ii) commitment and (iii) joint business plan as well as (iv) consensus-based internal forecasts along with (v) sharing of order forecasts. By relying on the plethora of prior research conducted in the field, trust and commitment became the two major variables of the CF practice. The reason behind these variables is to sustain manufacturers' willingness to contribute to information sharing and the forecasting process with retailers, and committing to this continuity is most likely to build permanent partnerships in CF. Then, linking the business plan with the retailers' plan has been the following prerequisite for this CF practice. The logic here is to synchronise partners' strategic objectives in a single business plan to be able to ease the front-end agreement process in CF. In doing so, partners will be able to conduct forecast collaborations in a transparent way by knowing the decisions should be made beforehand.

As regards the consensus-based internal forecasts, this has been another antecedent of the CF practice as a remedy for manufacturers' lack of cross-functional integration between their departments. Given the departments' multiple forecasts, which cause internal-external disputes in CF, this variable assists manufacturers to generate a single consensus-based forecast before initiating the collaborative forecast process with retailers. This single forecast, which has the full support of all departments, is most likely to underpin consensus forecasts with retailers. Finally, the CF practice involves the variable of the sharing of order forecasts, which aims to enhance transparency on the forecast objectives of manufacturers. While manufacturers improve their order forecasts based on inventory strategies to manage production and delivery, retailers' order forecasts are lacking in such modifications. This disconnection gives rise to conflicts when partners meet to aggregate their order forecasts. Because partners' order forecasts represent different objectives, they aim to aggregate forecasts at a different level. Whereas, in case of informing retailers about the changes made on forecasts, they will have a clear understanding of why the manufacturers modified the forecasts. Thereby consensus forecasts will be generated without having disagreements in meetings. This is the main logic behind instructing manufacturers to share order forecasts with retailers based on the CF practice.

To be able accomplish this aforementioned CF practice in the FSC, the current research has developed its arguments on the three research themes: supply chain integration, the forecasting process and information sharing. These research themes made it possible to offer a wide range of hypothetical relationships and to defend their impact on the CF of manufacturers in a reasonable way. For instance, by relying on the research theme of supply chain integration, the hypothetical argument not only encapsulated manufacturer's external relation with retailers, but also extended the discussion to the internal level by considering their interdepartmental relation as an extension of external relations with retailers. Externally, manufacturers' relation with retailers was debated based on their flexibility and dependency on collaborations. These determinants seem to be essential to cope with market dynamics and unexpected conflicts in collaborations. Technological difficulties between partners were then considered, in which such challenges in practice worsen information sharing and therefore negatively affect partners' CF. It was essential to highlight the role of top management, as they play a vital role in creating a promising platform to get full benefit from CF.

Internally, the focus of the current research involved manufacturers' capability to exhibit effective delivery operations and inventory management. Due to their long lead-times in production and / or replenishment operations, manufacturers need to improve these skills to rapidly react to the instant demand changes of time-sensitive and / or short-life products. Improving cross-functional communication between departments via effective IT systems was then highlighted to enhance visibility in their information sharing process. Given the fact that the European grocery sector witnessed manufacturers, who lost information within their departments, it is also necessary to record related data within manufacturers to feed forecasts with transparent information. Apart from these arguments, the current research stressed the benefits of S&OP as an alternative solution for better integration between the departments of manufacturers. Although this subject has not been in a hypothetical relationship, the current research rationally discussed the benefits of linking S&OP to manufacturers' CF by relying on academic research and pragmatic evidence, such as collaborations between Lowe's and Whirlpool.

Regarding the theme of the forecasting process, the current research has addressed the horizon of forecasts for associated product-groups, partners' group meetings and the competence of forecasters that is required in these meetings. While simulation studies presumed that there is not a challenge between partners for the horizon of forecasts for long-life products, case studies illustrated partners' disagreements about the forecast horizon of short-life products. Although a number of past studies addressed this issue when different forecasting methods were compared, the results did not seem beneficial due to the long-time periods that were involved for the horizon of forecasts, such as from three months to two years. A limited number of studies revealed that the horizon of forecasts are on a monthly basis in several industries, but there is a scarcity of research addressing the horizon of forecasts in the FSC. The current research therefore encapsulated the forecast horizon of time-sensitive and / or short-life products from manufacturers' point of view.

It is apparent that partners' forecasting meetings involve several conflicts and disagreements that prevent consensus, such as their irregular meetings, uncertain decision making procedures and the impact of hierarchy, as well as inefficient discussions along with incompetent data usage in meetings. The importance of these conflicts escalates when time-sensitive and / or short-life products are the subject of meetings. Whilst the literature offers a wide range of meeting techniques, this research addressed these techniques as a remedy to partners' disagreements. This is the reason behind the argument of the current research in advocating the impact of forecasting meetings on the CF of manufacturers. When the focus is forecasting, it is imperative to consider the competence of forecasters in meetings. In addition to their market based experience of the products involved in CF, their reciprocal behaviours are crucial for both forecast accuracy and consensus in meetings. These behaviours that were taken into account by the current research capture their advice and feedback given to each other, motivation and willingness to have a consensus as well as having confidence in each other along with being satisfied with final order forecasts.

Finally, the current research extended the discussions to manufacturers' information sharing based on the different types of information that are required for CF as well as their quality. Unlike prior studies, the focus here became the analysis of different types of information that flow from manufacturers to retailers. There is a surfeit of research highlighting the necessity of diverse information types, but all associated sources belong to retailers, such as promotions, inventory and POS data. There is not solid empirical work that addresses the value of manufacturer information for CF. To close this gap in the literature, the current research pointed to the impact of inventory, production planning and scheduling related information along with the data that involve recent internal-external changes in terms of manufacturers.

The quality of associated information types became another interest of the current research. It is clear that sharing diverse information without losing its value is a vital factor for accurate forecasts of time-sensitive and / or short-life products. It is also known that partners' satisfaction from information sharing is related to the value of the information shared. This engenders further prominence for the current research due to its intention of exploring the ways of satisfying partners through information sharing for promising CF. This is the logic behind the fact that current research interrogated how manufacturers' CF can be better when relevant and accurate information is shared frequently and in an adequate form. Further to this, this research debated manufacturers' effective response rate, when on time and consistent information sharing takes place between partners.

CHAPTER 4: RESEARCH METHODOLOGY AND DATA COLLECTION

4.1. Overview

To be able to theoretically validate the hypothetical arguments that were presented previously, this chapter explains the research methodology in-depth. Because the research philosophy adopted plays an important role on the methodological approach for academic research, reasonable discussions are provided on the philosophical stance of the current research. In particular, both the research approach and the epistemological paradigm embraced are clarified in a justifiable way. Discussions then encapsulate existing research strategies, as it is important to follow a solid strategy to achieve the research aim and objectives. Further clarification is brought to the research design that was followed to complete the research process in a logical way.

This chapter portrays the strategic research process in a flowchart and provides transparency to the data collection process. Because alternative data collection strategies are addressed, the intention, then, becomes to justify the logic behind following a mixed design (triangulation). Presenting the structural and chronological data collection process provides further transparency to the research. Justifications also involve the benefits of the social networking sites used for the data collection process. In this way, this chapter addresses the qualitative data collection process and explains the motives for employing the associated qualitative data collection methods along with the data analysis procedures. The qualitative data collection process was also discussed to provide awareness of the impact of qualitative data on the research. Consequently, this chapter;

- Explains the quantitative data collection process and rationale for the employment of an online survey questionnaire along with the clarification of the survey questionnaire design.
- Provides a rationale for the target population and sampling frame, explains the sampling technique and sample size, and elucidates the stages followed to collect quantitative data.

- Assesses the sample size and response rate, and justifies their validity based on data characteristics, comparison analyses and alternative data analysis techniques.
- Validates the cohesiveness of the associated data analysis technique by comparison with the alternative techniques used by prior studies.

4.2. Rationale for research methodology

4.2.1. Research approaches and philosophies

There is a broad consensus that it is legitimate for any academic research to describe research approaches and philosophies beforehand in an attempt to bring clarity to its methodological stance in the field (Wilson, 2010; Lee and Lings, 2008; Bryman and Bell, 2007). Regarding the foremost objectives of academic studies, which are to contribute to knowledge, methodology and to practice, it is worth describing the research as a way of “generating knowledge about what you believe the world is” (Lee and Lings, 2008, p. 6). Nevertheless, the way of generating knowledge rests upon the approach and the assumption that the research assimilates over the methodology that it follows.

The nature of research embraces two diverse approaches: deductive and inductive approaches (Wilson, 2010; Creswell, 2003). While the deductive approach “begins with and applies a well-known theory”, the inductive approach, in contrast, is a “theory building process, starting with observation of specific instances, and seeking to establish generalisation about the phenomenon under investigation” (Hyde, 2000, p. 83). Unlike the inductive approach, the deductive approach is a process of building conclusions through logical and rational arguments and extending knowledge over a particular theory (Lee and Lings, 2008; Ghauri and Grønhaug, 2005). This is because the deductive approach “is concerned with developing hypothesis (or hypotheses) based on existing theory, and then designing a research strategy to test associated hypotheses” (Wilson, 2010, p. 7). This principle of the deductive approach gives the researcher responsibility to argue hypothetical relationships in a persuasive way and to justify causalities based on quantitative data (Saunders *et al.*, 2007).

If research is based on an inductive approach, its process commences from observations by looking for opportunities to generalise a particular theory (Lee and Lings, 2008). This perspective involves the qualitative research strategy, unlike the deductive approach (Bryman and Bell, 2007). By relying on qualitative research, the inductive approach allows the researcher to gain more insight into the research context, and to be flexible by allowing changes through the research process (Wilson, 2010). This flexibility is most likely to expand through the progress of research, and makes it possible to realise that research is only a part of the research process. The deductive approach, however, needs a more structured approach, and gives priority to focus on the samples on the target population to be able to generalise findings (Saunders *et al.*, 2007). The distinctive features of these two research approaches are presented in Table 4.1.

Table 4.1. Major differences between deductive and inductive approaches to research

Deduction emphasizes	Induction emphasizes
*Scientific principles	*Gaining an understanding of the meanings humans attach to events
*Moving from theory to data	
*The need to explain causal relationships between variables	*A close understanding of the research context
*The collection of quantitative data	*The collection of qualitative data
*The application of controls to ensure validity of data	
*The operationalization of concepts to ensure clarity of definition	
*A highly structured approach	*A more flexible structure to permit changes of research emphasis as the research progresses
*Researcher independence of what is being researched	*A realization that the research is part of the research process
*The necessity to select samples of sufficient size in order to generalize conclusions	*Less concern with the need to generalize

Source: Wilson (2010, p. 7); Saunders *et al.* (2007)

While these research approaches guide the researcher to generate knowledge in a legitimate way, the philosophical stance then sheds further light on the knowledge generation process (Lee and Lings, 2008). There are two major research philosophies, also called paradigms, which add insights into the nature of knowledge from the researcher's standpoint (Wilson, 2010; Mangan *et al.*, 2004). In detail, research philosophy is dependent upon the researcher's views, which guide him / her to decide the way of generating knowledge for academic research (Wilson, 2010). To have a clear understanding about how the researcher will conceive the research, it is imperative to understand research philosophies. For instance, Easterby-Smith *et al.* (2002) highlighted three fundamental reasons why research philosophies need to be understood clearly.

Firstly, because research philosophies make it possible to have a clear understanding of how the research should be designed. In other words, the researcher develops a clear wisdom about what sort of evidence is required, what the way to collect the associated evidence is and how evidence should be inferred. Secondly, because research philosophies clarify which research design is the best. To put it in another way, the researcher identifies the way of choosing the correct method/s to collect rigorous evidence and to interpret it in a justifiable way. Finally, because research philosophies guide the researcher to build and adopt correct research design based on a theory or phenomenon that is the focus of research. In this way, the researcher has a philosophical insight into choosing a proper research design based on the phenomenon of interest.

There are four different world-view elements that add further understanding to the research philosophies, perception and values of the researcher and way/s of conducting the research. They are epistemology, ontology and axiology as well as methodology (also called research strategy) (Wilson, 2010; Lee and Lings, 2008). To start with, epistemology relates to the nature of knowledge. The major question that epistemology asks is "what is acceptable knowledge?" (Wilson, 2010, p. 10). Epistemology wants to know "whether or not the social world can and should be studied according to the same principles, procedures and ethos as the natural sciences" (Bryman and Bell, 2007, p. 16). Consequently, epistemology involves two different research philosophies / paradigms: positivism and interpretivism, which are compared in Table 4.2. (Wilson, 2010; Lee and Lings, 2008).

Table 4.2. Epistemological research philosophies / paradigms

	Positivism	Interpretivism
Research approach	*Deductive	*Inductive
Ontological stance	*Objective / objectivism	*Subjective / subjectivism
Axiological value	*Value free	*Biased
Science	*Scientific	*Social / Humanistic
Focus of researcher	*Facts *Causality *Hypothetical relationship	*Meaning / perception *Understand the logic behind in detail *Development of rational ideas
Methodology	*Quantitative research	*Qualitative research

Source: This table was constructed by purifying diverse information from: Easterby-Smith *et al.* (1991); Hussey and Hussey (1997), Lee and Lings (2008), Mangan *et al.* (2004) and Wilson (2010)

The research philosophy of positivism is largely objective, and the researcher has minimum interaction with the participants of the research. These participants are likely to be interviewees, group attendees and / or respondents to the survey (Bryman and Bell, 2007). This philosophical stance therefore prevents the researcher from adding personal bias into the research process. Therefore, it relies on the empirical research to enhance the reliability of the findings, and research should be conducted in a structured format by adopting the deductive approach, called the quantitative data collection strategy (Wilson, 2010).

On the other hand, interpretivism is "an epistemology that supports the view that the researcher must enter the social world of what is being examined" (Wilson, 2010, p. 11). The researcher that adopts an interpretivist stance is fully subjective, and interacts with the participants of the research. Contrary to positivism, interpretivism therefore allows the researcher to contribute to the research processes with personal bias. This is because the researcher needs to embrace the inductive approach, which relies on the qualitative data collection strategy (Lee and Lings, 2008). The epistemological approach of interpretivism requires a high level interpretation, hence it is likely to cause problems with regard to the reliability of findings. Because the inductive approach is considered, the objective of interpretivism is not to generalise findings. It is rather interested in illustrating the subjective judgments of the researcher based on research findings (Wilson, 2010).

The second world-view element, ontology, is about the nature of reality. Based on ontology, the researcher has to make a decision whether s/he considers "the world is external to social actors, or the perceptions and actions of social actors create social phenomena" (Wilson, 2010, p. 11). The physiological logic behind ontology is to understand how the researcher perceives the social world. Therefore, ontology asks "what the world we are studying actually is" (Lee and Lings, 2008, p. 11). The researcher will decide whether s/he will adopt a subjective or an objective stance in the research process. While the subjective stance is dependent upon the research philosophy of interpretivism, the objective stance, in contrast, relies on positivism, which is truly objective (Wilson, 2010). Subjectivism encourages the researcher to understand the logic behind subjective ideas and attitudes, and therefore the researcher has a responsibility to interact with participants of the research. On the other hand, the ontological stance of objectivism assumes that the social phenomena are associated with external reality. This is because objectivism relies on the research philosophy of positivism and is based on high level reality (Wilson, 2010).

Regarding the world-view element of axiology, it is related to the aim of the research, and clearly asks: "What are you trying to do? do you try to explain and predict the world or are you only seeking to understand it? can you even do one without the other?" (Lee and Lings, 2008, p. 11). This definition of axiology shows the concern about the perceptions of the researcher. Because axiology is about the nature of value, the researcher's value plays an important role through the research process. If the researcher is positivist, his/her value is not influential in the research process owing to its ontological stance of objectivism, representing the positivist research philosophy. If the researcher is interpretivist, his/her value is important and should be linked to the research. This represents the ontological stance of subjectivism that is associated with the epistemological paradigm of interpretivism. Accordingly, the researcher needs to show enormous effort not only through the data collection, but also during the interpretation of results to present valid findings to the theory (Wilson, 2010).

The final world-view element is methodology. Methodology asks; "how you are going to go about your research" (Lee and Lings, 2008, p. 12). The answer to this question relies largely on the aforementioned research philosophies and the ontological stance of the researcher as well as the axiological value, which clarifies whether or not the values of the researcher will be related to the research. There are two alternative research methodologies that can be followed: qualitative and quantitative methodologies (Wilson, 2010). Nevertheless, there is a broad agreement that whichever research philosophy and stance is adopted in the research, the researcher has to generate knowledge in a rational and justifiable way and to rigorously argue the validity of the findings (Wilson, 2010). This requirement consequently raises the importance of triangulation or mixed design (Creswell and Plano Clark, 2011), which is "the combination of qualitative and quantitative approaches in the methodology of a study" (Tashakkori and Teddlie, 1998, p. ix). This strategy, mixed design, is further elaborated in the following section.

In summary, by relying on the aforementioned rationalisations, the current research is built upon the deductive approach. The logical justification for embracing this approach is fourfold. Firstly, the current research focuses on the well-known CF phenomenon to improve *Collaborative Forecasting Performance* from the manufacturers' point of view in the FSC. Hence, findings are based on the existing theory, and the intention is to generate new knowledge by extending the extant literature dedicated to CPFR. In other words, the current research moves from theory to data (Wilson, 2010; Saunders *et al.*, 2007). Secondly, the contributions of this research are associated with the hypothetical relationships, in which causalities among the hypotheses are portrayed in the conceptual model (Jick, 1979).

Thirdly, although qualitative information was gathered through the hypothesis development process, hypothetical relationships are validated as a result of the quantitative research strategy, which requires a sufficient sample to generalise findings for the target population. This necessity, therefore, enables the current research to follow a highly structured data collection process (Hyde, 2000). Finally, this research is fully objective and the bias of the author is precluded from the research process. The reason behind that is that during the quantitative data collection process, there was minimum interaction between the participants and the author of the current research (Wilson, 2010).

As far as the philosophical stance is concerned, due to the fact that the deductive approach is followed, this research's epistemological paradigm is based on positivism. The reason behind embracing this research philosophy relies on the research's quantitative research strategy, which involves highly structured empirical research employed to generalise findings for the target population. In doing so, contributions are presented in an objective way by reflecting the results of empirical analyses (Lee and Lings, 2008). Following this, the author of the current research perceives that the research phenomenon of CF is dependent upon external factors. To put it another way, the ontological stance of the author is objectivism. The author purposed to conduct an objective study and to generalise findings about the specific phenomenon of CF, rather than merging subjective views and attitudes in the results of the research (Wilson, 2010). This is the logic behind the contributions of the current research being accurately presented in a rational way.

In parallel to the research philosophy and the ontological stance, the value of the author is absent from the research process. The author's personal attitudes and beliefs were omitted from the research process. Thereby, the axiological value of the current research is value free, and research findings are objectively conveyed to the reader in a persuasive way (Wilson, 2010; Bryman and Bell, 2007). Finally, the research methodology in this research involves both qualitative and quantitative research strategies. This attitude makes it possible to capture a wide range of data and to provide rigorous contributions to theory, methodology and practice (Creswell and Plano Clark, 2011; Mangan *et al.,* 2004; Hussey and Hussey, 1997). The methodological aspect of the current research is summarised in Table 4.3, and the research strategies are further justified in the following section.

Table 4.3. Methodological aspect of the current research

Aspect	Type	Rationale
Approach	Deductive	*Moving from the CF phenomenon to quantitative data *Contributing to knowledge based on hypothetical relationships *Conducting a truly objective and quantitative data collection process *Testing hypotheses based on empirical analysis *Generalising research findings for the target population
Epistemology (Research philosophy)	Positivism	*Embracing the deductive approach *Building a highly structured data collection and analysis process *Sustaining a minimum interaction with the participants of the research during the quantitative data collection process *Omitting the personal bias of the author from the research process
Ontology	Objectivism	*Adopting the research philosophy of positivism *Conducting a truly objective quantitative data collection process *Precluding the subjective views of the author from the research process *Accurately presenting the research findings by relying on empirical analyses
Axiology	Positivist	*Having the ontological stance of objectivism *Excluding the personal value of the author from the research process *Following a truly objective and quantitative data collection process *Objectively conveying the research findings to the reader without adding the subjective judgements and / or beliefs of the author
Perspective	Critical	*Developing the preliminary research propositions through the systematic review of literature *Limiting the number of propositions through the critical analysis of the single semi-structured interview *Delimiting the number of propositions through the critical analysis of the three online group discussions *Developing the research hypotheses over the residual propositions through the critical review of grey literature
Design	Descriptive	*Focusing on a particular research phenomenon of CF *Reviewing the literature over the research themes of: -Supply chain integration -Forecasting process -Information sharing *Developing both quantitative and qualitative research strategies *Contributing to theory by way of objective and explanatory findings
Level	Organisation	*Focusing on the food industry *Investigating dyadic manufacturer-retailer forecast collaborations *Analysing forecasts collaborations from the manufacturers' point of view *Examining forecast collaborations for perishable, seasonal, promotional and newly launched products
Explanation	Systematic	*Systematically reviewing the literature over the research themes of: -Supply chain integration -Forecasting process -Information sharing *Conducting a systematic and sequential data collection process *Conducting a systematic and sequential data analysis process *Conveying the research process and the findings of the research to the reader in a systematic and sequential way
Abstraction	Empirical	*Empirically analysing the hypothesised relationships of the research *Statistically demonstrating the reliability of the conceptual model *Empirically contributing to the forecasting and SCM literature

Source: *Developed by the author*

4.2.2. Research strategies and triangulation

The preceding section scrutinised major differences between two diverse research approaches as well as research philosophies. In addition, the concomitant stances of the ontology and axiology were elaborated while two different research strategies were remarked on in relation to these approaches and philosophies. This elaboration, in essence, intended to add further understanding to the philosophical stance of the current research. To shed light on the methodological strategy, it is worth remarking that the deductive approach and the positivist research philosophy are linked to the quantitative research strategy to test theory-based hypotheses (Wilson, 2010; Creswell, 2003). Conversely, the inductive approach and the interpretivist research philosophy are connected with the qualitative research strategy to generalise a new theory (Wilson, 2010; Bryman and Bell, 2007).

The quantitative research strategy is based on numerical analysis to validate findings. This is because, "quantitative studies emphasize the measurement and analysis of causal relationships between variables, not processes" (Denzin and Lincoln, 2000, p. 8). Given the major objective of quantitative research is generalising findings from a target population (Wilson, 2010), the researcher needs to designate the common characteristics of the target population rather than focusing on details. To accomplish this, it is essential to "draw a large and representative sample from the population of interest, measure the behaviour and characteristics of the sample, and attempt to construct generalisations regarding the population as a whole" (Hyde, 2000, p. 84). Therefore, a survey questionnaire seems to be the most common quantitative data collection method to arrive at the sample of the target population (Wilson, 2010).

On the other hand, the qualitative data collection strategy comprises qualitative methods that put an emphasis on words instead of numbers, unlike quantitative methods (Bryman and Bell, 2007; Creswell, 2003). This is because qualitative research is more about analysing the social world and its participants from the perspective of the researcher, which requires the subjective interpretation of research findings (Bryman and Bell, 2007). Contrary to quantitative research, qualitative research focuses on details and scrutinises the underlying reasons behind the logic (Näslund, 2002). Hence, qualitative researchers need to stay close to the research participants, such as by using interviews and observations (Wilson, 2010). The associated data collection methods of these research strategies are presented in Table 4.4.

Table 4.4. Data collection methods of research strategies

Method	Methodology	
	Quantitative research	**Qualitative research**
Observation	*Preliminary work, e.g. prior to framing questionnaire	*Fundamental to understanding another culture
Textual analysis	*Content analysis, i.e. counting in terms of researchers' categories	*Understanding participants' categories
Interviews	*'Survey research': mainly fixed-choice questions to random samples	*'Open-ended' questions to small samples
Transcripts	*Used infrequently to check the accuracy of interview records	*Used to understand how participants organize their talk and body movements

Source: Silverman (2010, p. 123; 2006, p. 19)

Overall, both qualitative and quantitative research strategies have strengths and weaknesses; however, their weaknesses have engendered a general contradiction in the academic field. For instance, the subjective perspective of the qualitative research strategy appeared to be its blind side in the academic field. Particularly, given the bias of the researchers, which occurs due to his/her subjective judgments on qualitative findings, such research is lacking in objective contributions (Bryman and Bell, 2007). Therefore, it becomes problematic not only to generalise findings for a particular population (Creswell and Plano Clark, 2011), but also to replicate similar research due the restrictions of scrutinising reality (Bryman and Bell, 2007). Following this, although qualitative research makes it possible to gather detailed data, owners of data consist of a limited number of individuals (Patton, 1991) and diverse views of individuals are not representative of target population, which limits the reliability of findings (Silverman, 2010).

On the other hand, quantitative research is criticised in terms of neglecting details and excluding individuals from the social world (Wilson, 2010). It is argued that following such a superficial process limits the understanding of the social world (Payne and Payne, 2004). Another criticism was raised due to the lack of context in quantitative research, where participants of such research can be neither observed nor heard in the research process (Creswell and Plano Clark, 2011). This, in turn, omits such research from exploring details and taking into account personal attitudes, while excluding the subjective bias of the researcher inhibits the research from uncovering complexity in the social world (Bryman and Bell, 2007).

Therefore, the general paradox over these research strategies gave raise to disagreements between researchers and theorists, and these strategies were adopted as completely diverse paradigms (Bryman and Bell, 2007; Tashakkori and Teddlie, 1998). While this divergence seemed to be “considerable blurring” by some others (Hussey and Hussey, 1997, p. 47), some authors labelled it as a “paradigm war” (Tashakkori and Teddlie, 1998, p. 11). Apart from these arguments, there are authors who disapproved of such a distinction between qualitative and quantitative strategies (Tashakkori and Teddlie, 1998). As a remedy, Howe (1988) offered the paradigm of pragmatism, arguing that the quantitative and qualitative research strategies need to be brought together. Based on the pragmatic paradigm, researchers are “free to choose the methods, techniques, and procedures of research that best meet their needs and purposes” (Creswell, 2003, p. 12).

This paradigm allows the researcher to use both quantitative and qualitative methods in a single study, and this combination constitutes the notion of triangulation or mixed methods (Creswell and Plano Clark, 2011; Tashakkori and Teddlie, 1998). In time, a wide variety of definitions has developed for mixed methods. For instance, former literature defined this triangulation as “the combination of methodologies in the study of the phenomenon” (Denzin, 1989, p. 234). Creswell and Plano Clark (2011, p. 2) then provided a stronger description, and defined mixed methods as “those that include at least one quantitative method (designed to collect numbers) and one qualitative method (designed to collect words), where neither type of methods is inherently linked to any inquiry paradigm”. There is a broad consensus that a mixed method is very beneficial to gather reliable and diverse information to provide rigorous contributions to the literature and practice (Mangan *et al.,* 2004; Deshpande, 1983; Jick, 1979; Webb *et al.,* 1966).

In essence, a mixed method draws its strength by joining the strengths of the qualitative and quantitative research strategies, and answers questions that cannot be answered by only quantitative or qualitative research (Creswell and Plano Clark, 2011). Because of the fact that qualitative and qualitative research strategies convey the power of diverse philosophical stances, the mixed method seems a rigorous research strategy to close gaps in management research. By relying on the paradigms of positivism and interpretivism (also called phenomenology), Mangan *et al.* (2004, p. 568) explained this rationale as follows: “positivism is relevant for getting an overview and for considering the board structure of decisions, whereas phenomenology is useful for finding out the microlevel about the behaviour of the decision maker.”

Jick (1979) supported the idea that using a mixed method makes it possible to explore unforeseen sides of a particular phenomenon and to augment the implications of findings. By advocating the benefits of mixed methods, Webb *et al.* (1966, p. 3) likewise stressed that “the most persuasive evidence comes from a triangulation of measurement processes”. Given the fact that qualitative research strategy embraces the bias of the researcher (Wilson, 2010), Hussey and Hussey (1997) defended the reliability of mixed methods, since triangulation of both qualitative and quantitative methods is more likely to mitigate bias compared with a single method. From the logistics and SCM perspective, Näslund (2002) argued that mixed methods are the most appropriate strategy if the aim is to build rigorous research in logistics.

In a similar vein, Mangan *et al.* (2004) highlighted the benefits of mixed method, and described its application to a study, dedicated to the Irish logistics sector. These authors also encouraged researchers to triangulate qualitative and quantitative research strategies for multifaceted contributions to management research. A study by Evangelista *et al.* (2013) is another example for the mixed method. When these authors aimed to explore the role of IT systems on the logistics process of small and medium sized third party logistics providers, the combination of survey questionnaire, focus groups and case studies constituted their triangulation research strategy. Providing a guideline to researchers for the usage of mixed methods also became one of the important contributions of their study. Nevertheless, there are considerable challenges for the employment of mixed methods. In detail, it requires "certain skills, time, and resources for extensive data collection and analysis" (Creswell and Plano Clark, 2011, p. 13).

Easterby-Smith *et al.* (1991) added further clarification to the triangulation strategy, and identified four types of triangulation. These are (i) data triangulation, (ii) investigator triangulation and (iii) methodological triangulation as well as (iv) triangulation of theories. To start with, "data triangulation" is a mixed method that focuses on data, and the researcher collects different types of data at different times and / or from different sources. In other words, this triangulation type is data based, and aims to triangulate both qualitative and quantitative data of a single phenomenon. Unlike data triangulation, "investigator triangulation" is researcher oriented, and multiple researchers independently collect data that relate to a single phenomenon. Then, researchers compare the results of autonomously collected data.

On the other hand, "methodological triangulation" relies predominantly on the data collection methods. The researcher uses both qualitative and quantitative methods to gather numbers and words about a single phenomenon. The combination of these sources accordingly constitutes the domain of research. Finally, "triangulation of theories" distinguishes itself from other triangulation methods by building a bridge between different research disciplines. The researcher here works on a theory from one discipline in an attempt to explain the other theory or phenomenon from another discipline. Based on the foregoing comparative analyses and arguments, the current research reasonably claims that its strategy is based on the mixed design that triangulates both qualitative and qualitative research (Creswell and Plano Clark, 2011). In detail, the triangulation strategy here consists of "data triangulation" and "methodological triangulation". The logical justification for embracing the triangulation strategy in this research is fourfold.

Firstly, this research developed hypothetical relationships for the phenomenon of CF by agreeing on the deductive approach. Therefore, it is essential to develop a quantitative research strategy to empirically test hypotheses (Wilson, 2010).

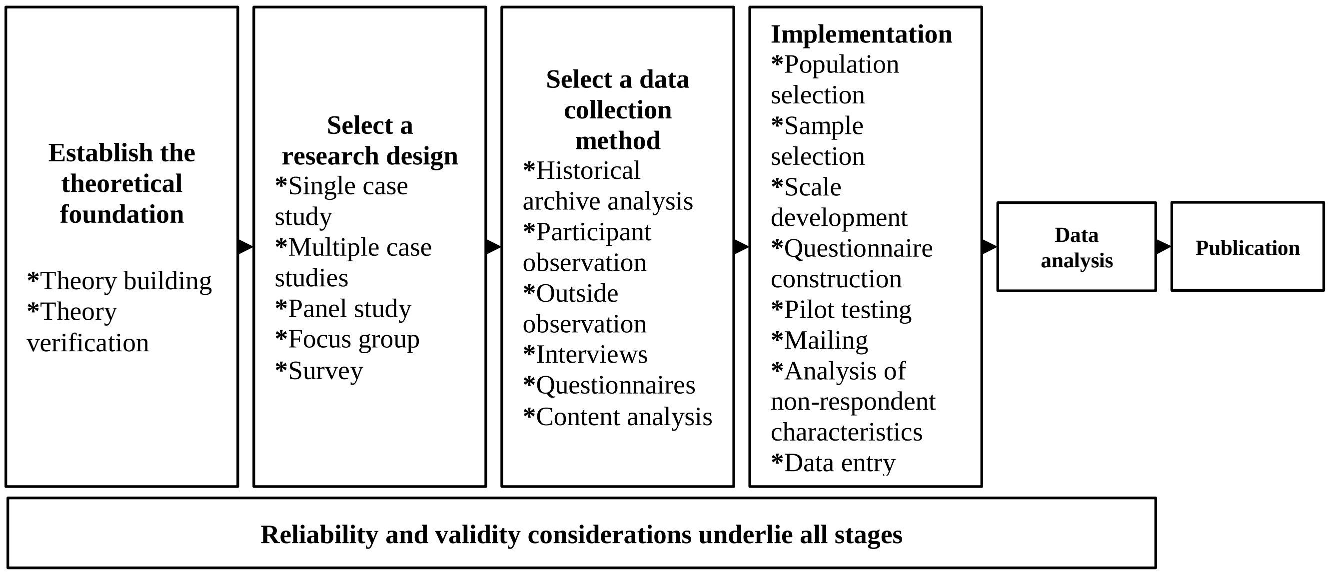
However, “qualitative research can be employed in the task of generating rich, unstructured information in order to develop hypotheses, or measurements, to be later quantified” (Lee and Lings, 2008, p. 380). This is because the research strategy consists of two phases. The first phase is the hypothesis development phase that involves systematic review, qualitative research and the review of grey literature respectively and provides qualitative data. The second phase is the hypothesis testing phase that contains an online survey questionnaire conducted to gather quantitative data. Secondly, the expertise of practitioners in the hypothesis development phase provides a pragmatic value to the hypotheses developed (Bryman and Bell, 2007). In other words, the hypotheses of the current research are not only based on the review of broad literature, but they are also the representative of expert views that matter in the fields of SCM and forecasting.

Thirdly, given the fact that this research is based on qualitative and quantitative data including words and numbers, triangulation involves both data and methods. This strategy leads to reducing any personal bias that emerges from qualitative data (Hussey and Hussey, 1997), and also to accentuating pragmatic details which are difficult to be obtained from quantitative methods and data (Wilson, 2010). Therefore, the findings found from quantitative data can represent the outcomes of qualitative data (Bryman and Bell, 2007; Creswell, 2003; Jick, 1979). Finally, this research responds to the consensus among authors that encourages the employment of triangulation in the fields of information sharing, SCM and logistics (Evangelista *et al.,* 2013; Mangan *et al.,* 2004; Näslund, 2002). Given the interest of research that relies on the FSC, triangulating qualitative and quantitative methods and data is a promising way to offer pragmatic contributions to the literature. Research design, methods and data collection strategies are further explained in the following sections.

4.3. Research design

Before explaining the qualitative and quantitative research strategies, this research explains the research design, where the intention was to construct a time-based plan that clarifies the research process in a logical and chronological way to answer research questions (Wilson, 2010; Bryman and Bell, 2007). The point of origin for this research was therefore to adopt the systematic approach offered by Flynn *et al.* (1990). This approach, which is presented in Figure 4.1, also made it possible to generalise findings to be able to produce valuable publications as a contribution to the research field.

Figure 4.1. Systematic approach of research



Source: Flynn *et al.* (1990, p. 254)

Although this research employed both qualitative and quantitative methods to capture a wide range of data, the focus is on the phenomenon of CF. Hence, the research is predominantly descriptive, and followed the guidelines of Blumberg *et al.* (2005), Rowley (2002) and Wilson (2010) to design a strategic research process (please see Figure 4.3), which involves the following steps respectively;

- Identification of research problems in CF through the review of the literature
- Development of research questions in response to research problems
- Design of a triangulation research strategy for a rigorous data collection process

When the triangulation research strategy was developed based on the research problems and research questions, the focus then became to develop and test the hypotheses through the implementation of following phases:

Phase 1: Hypothesis development phase

- Systematic review of literature
- Development of preliminary propositions and a conceptual model
- Interview with a supply chain manager who works for a leading UK based food manufacturer
- Coding and critical analysis of the transcript of the interview via QSR NVivo 9
- Modification of propositions and the conceptual model
- Completing of three online group discussions via LinkedIn business groups
- Coding and critical analysis of the transcripts of the group discussions via QSR NVivo 9
- Modification of propositions and the conceptual model
- Critical review of grey literature
- Development of hypotheses and finalisation of the conceptual model

Phase 2: Hypothesis testing phase

- Design of an online survey questionnaire and delivery to the manufacturers located in the UK & Ireland, Europe and North America
- Statistical analysis of the hypotheses via PLS

At the beginning of the research process, the most common way of exploring existing research problems, which is the literature review, guided the research to complete the process from the identification of research problems to the development of research questions (Wilson, 2010). As was justified in the previous section, this research benefits from the triangulation research strategy, which consists of two phases, hypothesis development and hypothesis testing phases (Creswell and Plano Clark, 2011; Bryman and Bell, 2007; Jick, 1979).

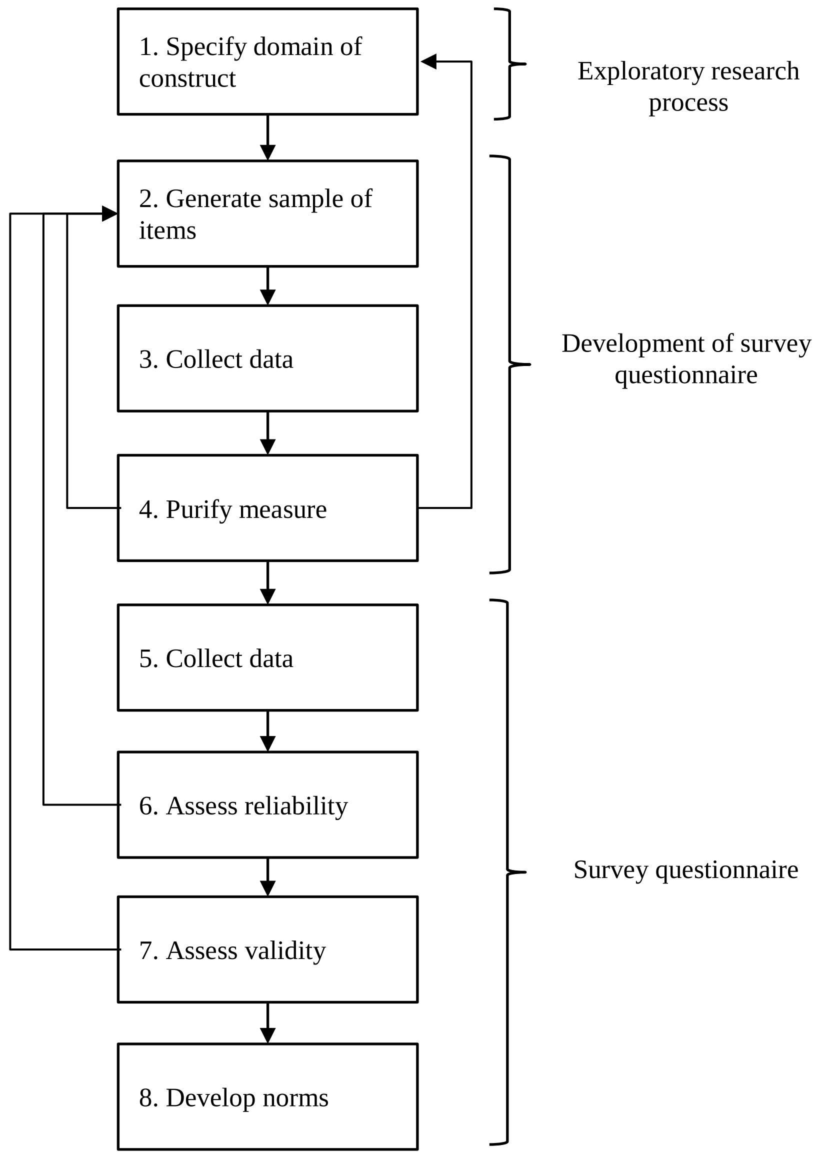
The hypothesis development phase (phase 1) involves three consecutive data collection processes: systematic review, qualitative data collection and the review of grey literature. The processes of systematic review and the critical review of grey literature were previously explained in Chapter 2. Literature review. Therefore, the intention here is to clarify the qualitative data collection process. This process includes the single semi-structured interview and three online group discussions. These exploratory methods made it possible to gain further insight into the application of CF in practice (Zikmund, 2003). Although this research conducted a single semi-structured interview, coding and analysing the interview transcript with the software package QSR NVivo 9 brought about exploring pragmatic variables and enriching the value of hypotheses for practice (Bazeley, 2007; Jick, 1979). Then, based on the outcomes of the interview, the literature-based propositions and the conceptual model were modified correspondingly (Wilson, 2010).

As regards the group discussions, this research benefited from the business oriented social networking service LinkedIn, and conducted three online group discussions at SCM and forecasting oriented business groups. Given the fact that LinkedIn is predominantly a business oriented platform (Mirabeau *et al.*, 2013), valuable information was gathered from senior- and medium-level managers who are employed in the fields of SCM and forecasting around the world. Similar to the interview, the transcripts of group discussions were analysed via QSR NVivo 9, and the outcomes were used to modify the propositions and conceptual model of this research (Bazeley, 2007). Continuing the review of grey literature then made it possible to underpin propositions with additional evidence and to develop hypotheses along with the finalisation of the conceptual model. The single semi-structured interview and three group discussions are further clarified in the following section.

The hypothesis testing phase (phase 2) involves the online survey questionnaire, which is the most common method for descriptive research in collecting accurate information from the sample of the target population (Wilson, 2010). In this phase, by purifying the results of the literature review based on the qualitative data, the measurement items that represent the constructs (hypotheses) in the conceptual model originated. In order to enhance the reliability of the measurement items, the multi-items scale development procedure guided this research, as was suggested by Churchill Jr, (1979).

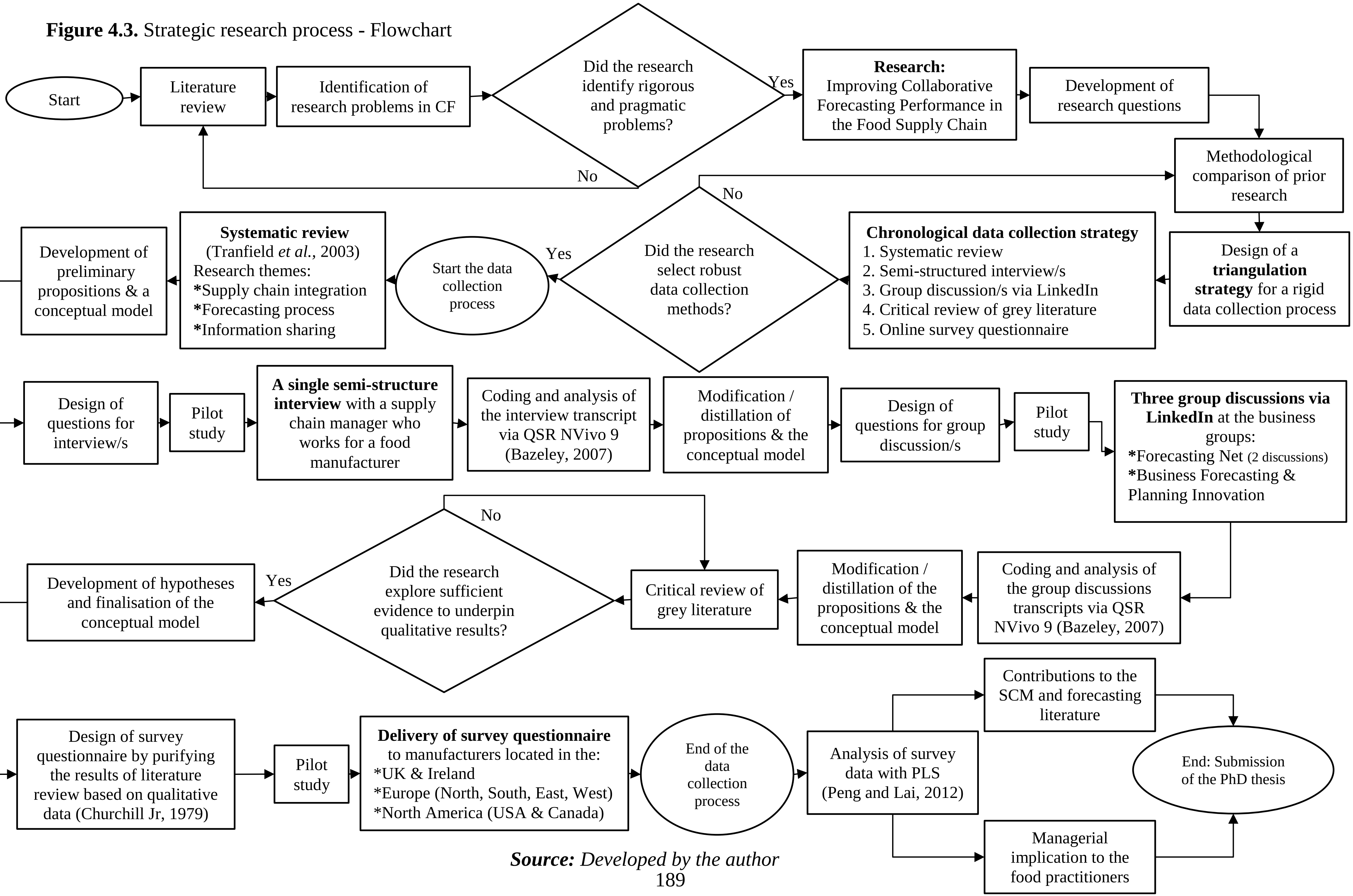
This procedure, presented in Figure 4.2, underpinned the research design due to the suggestions of conducting an exploratory study as a preliminary step to developing measurement items. Further to that, the suggestion of Churchill Jr, (1979) about developing multiple items as the representative of constructs (hypotheses) also enhanced the reliability. The online survey questionnaire was then delivered to the manufacturers located in the UK & Ireland, Europe and North America. Under the guideline of Peng and Lai (2012), this research employed the quantitative data analysis technique of PLS to test the hypotheses.

Figure 4.2. Multi-items scale development procedure



Source: Churchill Jr, (1979, p. 66)

Figure 4.3. Strategic research process - Flowchart



Source: *Developed by the author*

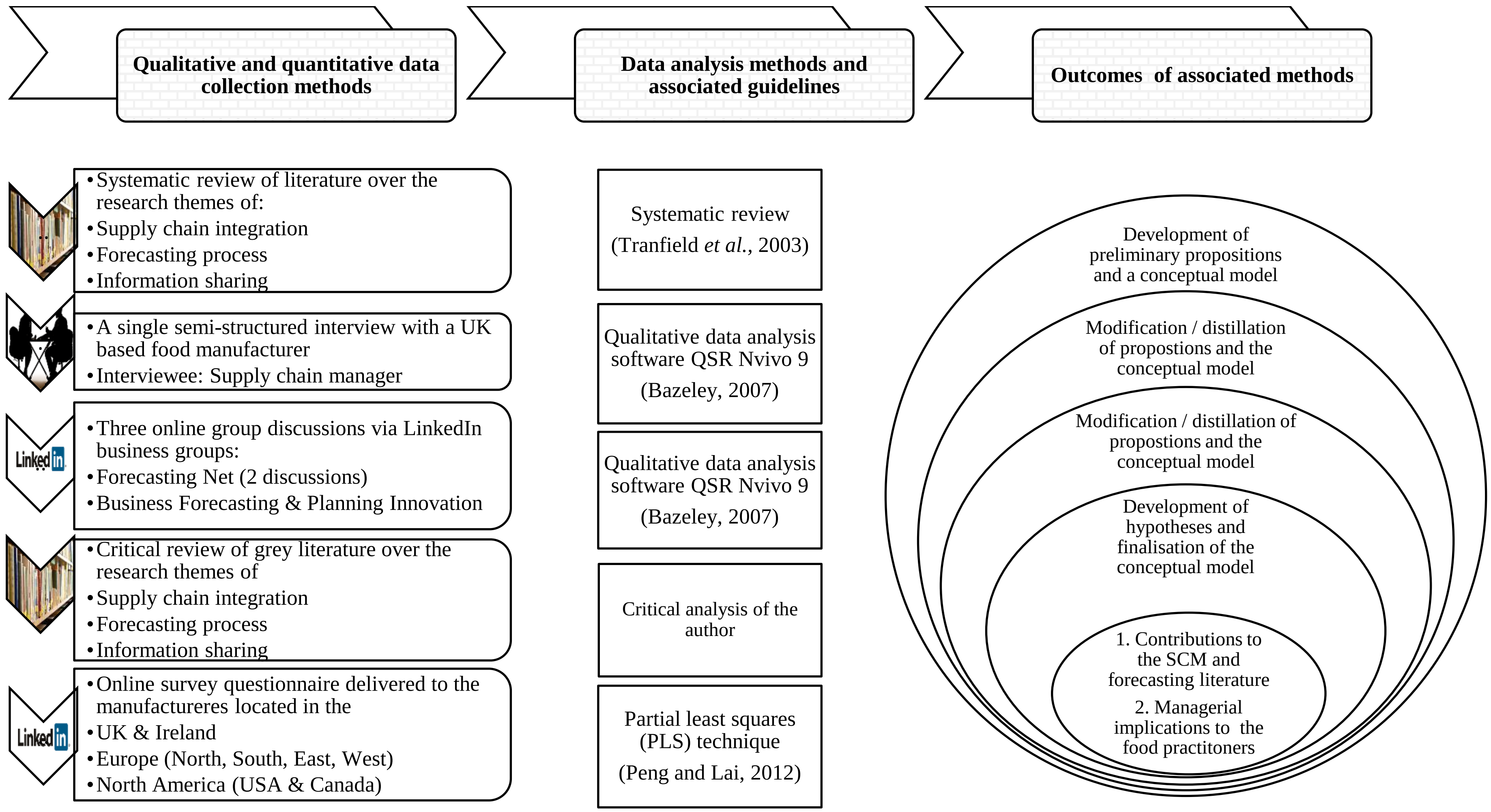
4.4. Data collection process – mixed design

Developing a wide-scale research strategy at the early stages of any research brings further transparency to the research process in terms of deciding which method/s will be used and why as well as understanding the relation between method/s, paradigm/s and target population (Silverman, 2010; Mason, 1996). By embracing the triangulation research strategy, this research conducted both a qualitative and quantitative data collection process. However, the qualitative data collection process here is the preceding step of the quantitative process, and aimed to provide an in-depth understanding about the CF of manufacturers in the FSC.

While the qualitative data collection process of the current research consisted of the single semi-structured interview and three online group discussions (Creswell and Plano Clark, 2011; Silverman, 2010), the quantitative data collection process purely embraced the online survey questionnaire method (Wilson, 2010; Lee and Lings, 2008). The structural and chronological data collection process of this research is presented in Figure 4.4. This research distinguishes itself by extensively exploiting the social media networking sites during the qualitative and quantitative data collection process.

In detail, social media sites are highly appealing to academic and business researchers (Boyd and Ellison, 2007), and relevant networks such as Facebook, LinkedIn and Twitter are attractive tools as a way of reaching the respondents for any qualitative and qualitative research (Mirabeau *et al.,* 2013). This research, hence, benefited from the business oriented social networking service LinkedIn not only to contact the participants of group discussions, but also to reach the respondents of the online survey questionnaire. The following section further scrutinises the role of social network sites to offer a rationale for the usage of the social networking site LinkedIn and to encourage researchers to benefit from associated sites in academic research.

Figure 4.4. Structural and chronological data collection process



Source: *Developed by the author*

4.4.1. Rationale for using social networking sites for academic research

To be able to generate promising contributions for any business oriented academic research, the priority must to be reaching participants from the target industry and capturing reliable information first hand. Cycyota and Harrison (2006) stressed that senior managers and executives are not only the main participants of research conducted in the field of management, but also they are the main sources to obtain vital research variables. Nevertheless, there are two substantial barriers in front of the academic researchers. The first challenge is to find relevant participants based on the research area of interest. The second challenge is to convince them to devote time and to contribute to the research (Miles and Huberman, 1994).

Interestingly, while Mirabeau *et al.* (2013) reviewed the management-related literature, they highlighted the researchers' lack of interest in getting benefit from social networking sites in an attempt to reach target respondents. Yet, there is a steadily ascending trend about the popularity of social networking services in recent years (Efthymiou and Antoniou, 2012). These services seem to be a good candidate for researchers in reaching potential respondents for academic research (Fielding *et al.,* 2008). Boyd and Ellison (2007, p. 211) define the social network sites as "web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share connection, and (3) view and traverse their list of connections and those made by others within a system." The American Psychology Association puts forward the role of social media in academic research as an opportunity, and exemplifies how psychological researchers utilise social media sites to reach survey participants, particularly to undergraduates (Phillips, 2011).

As a matter of fact both paper-based techniques and Internet-based services serve same objective in terms of reaching respondents for any research that conducts interviews, surveys or other data collection methods (Mirabeau *et al.,* 2013; Fielding *et al.,* 2008). However, there are some risks and handicaps as well in employing social networking sites for academic research. For instance, losing the control of delivering research information and / or focusing on irrelevant respondent segments are matters for the reliability of research findings (Picazo-Vela *et al.,* 2012). Taking into account the limited interest of senior managers or organisations that do not use the social networking sites, researchers may not achieve a sufficient sample size. If researchers also regard only their personal network through the data collection process, their results are most likely to be biased (Mirabeau *et al.*, 2013). Each networking site has different rules and procedures that researchers need to take into account. For instance, researchers cannot use the social networking sites of the American Psychology Association, such as Facebook and Twitter, to contact the participants of the association (Phillips, 2011). Hence, it is important to have a clear understanding about the ways of benefiting from social networking sites properly.

Regarding the social network sites such as Facebook, Twitter and Myspace, LinkedIn differentiates itself from some ordinary networking sites that people tend to socialise on in a daily life. For instance, Harwood (2013) provided a distinctive description about LinkedIn, and stressed that "LinkedIn is not merely a social network aimed for business users. Rather, it should be viewed as an online network of influential people all over the world". The author also emphasised that if LinkedIn is utilised properly, it can result in building very good connections and discussions with chief executives and senior managers. Whilst LinkedIn seems such a good candidate to reach managers, academic researchers, on the other hand, confront difficulties in improving the response rate of data collection methods. For instance, when Cycyota and Harrison (2006) analysed the response rate of studies that surveyed executives and were published in high-ranking journals, the questionnaire response rate of these studies appeared to be approximately 24 percent. Furthermore, the authors warned that if academic researchers do not look for new data collection ways, there is an expectation that they will have only 4 percent response rate by 2050.

According to recent statistical work, LinkedIn had 300 million users, and two new members enrol on the site per second. LinkedIn also hosts members from 200 different countries that use 20 different languages, and has 3 million business pages that had been used by companies to launch 1.2 million products / services since the foundation of LinkedIn (Smith, 2014). These statistical results are valuable testimonials to the fact that LinkedIn has a strong potential not only to increase the sample size of any survey, interview or group discussions, but also to expand the geographical scope of academic research in any field. In a similar vein, social networking sites are more persuasive for participants and are likely to increase their willingness to participate in surveys, as they make it possible to conduct an anonymous data collection process compared with the usage of email surveys (Fang *et al.,* 2014).

Another promising feature of LinkedIn is that it has a very comprehensive search tool whereby researchers can reach a wide range of senior managers by using keywords, which in turn helps to check candidate respondents' profile and to decide whether they are appropriate candidates for the research area of interest (Mirabeau *et al.,* 2013). In detail, the researcher can filter the number of potential candidates for surveys based on their country, seniority level, industry, company size and relevant business groups, and this feature enables the researcher to develop a promising sampling frame in the data collection process. LinkedIn has 2.1 million business groups, and a vast number of managers discuss 200 different organisational problems per minute, such as manufacturing, supply chain and forecasting (Smith, 2014). Joining such discussions makes it possible to be involved with business problems that managers confront in daily life. To be able to initiate group discussions for a particular research area, it is however important to join the most relevant group/s to be able to contact appropriate participants and to capture promising sources. When group discussions are initiated and a participant adds his/her comments on the discussion panel, the researcher receives instant notification from LinkedIn, which feature makes it possible to track the progress of group discussions (Harwood, 2013).

Overall, the aforementioned justifications and statistical results are the motivation of the current research in exploiting the business oriented social networking site LinkedIn through the data collection process. LinkedIn was initially used for the qualitative data collection process, and three online group discussions were commenced in the SCM and forecasting oriented business groups. This made it possible to capture in-depth information about the CF practices of organisations in practice and to build reliable connections with senior managers around the world.

Expanding the network with associated participants then underpinned the quantitative data collection process. This is because the online survey questionnaire looked for respondents from LinkedIn as well. Through the quantitative data collection process, this research also benefited from the online databases, a vast number of food and beverage federations and personal contacts of the author who have managerial positions in the food manufacturing companies. The data collection stages of this research are elaborated in Section 4.6.4. Quantitative data collection stages.

4.5. Qualitative data collection process

The qualitative data collection process of this research came before the quantitative data collection process. The main intention here was not to rely on interpretivist philosophy and then form the complete context of the research based on qualitative data, but, instead, to (Creswell and Plano Clark, 2011; Zikmund, 2003; Deshpande, 1983; Jick, 1979; Churchill Jr., 1979):

- Have a clear understanding about the employment of CF phenomenon in practice
- Gain an in-depth insight into the role and responsibilities of manufacturers in CF
- Explore the role of perishable, seasonal, promotional and newly launched products in CF
- Seek an opportunity to find out new research area/s that had not been explored in the literature
- Use past experience and personal beliefs of participants in terms of CF
- Appraise the relevance and rigour of the research questions in a real environment
- Capture the foremost pragmatic variables to screen the results of the systematic review
- Purify the literature-based propositions
- Modify the conceptual model and develop hypothetical relationships
- Obtain rigorous information to generate measurement items for the scales of the online survey questionnaire
- Enhance the validity of the research findings in practice, and

- Enrich the value of managerial implications by toning the outcomes of qualitative and quantitative data analyses

Based on the aforementioned objectives, this research found an opportunity to conduct a single semi-structured interview with a leading UK based food manufacturer and three online group discussions on the business oriented social media service LinkedIn.

4.5.1. A single semi-structured interview

4.5.1.1.Rationale for employing semi-structured interview

Interviewing is the most common technique in qualitative research. The reason why researchers habitually prefer this technique relies on its flexibility, as the structure of interview considered and time dedicated differ based on research questions and respondents (Lee and Lings, 2008). There are different types of interview techniques, such as unstructured, semi-structured and structured. While unstructured interviews are in-depth and allow interviewees to discuss subjects in an open manner, structured interviews, in contrast, rely heavily on inflexible questions that demand concise answers from interviewees (Wilson, 2010). This research adopted a moderate attitude and embraced the semi-structured interview technique. In this direction, the interview proceeded based on a number of structured questions, but also the interviewee had an opportunity to scrutinise key points during the interview. Further, conducting a face-to-face interview enabled the author of this research to follow a flexible approach and to link the verbal and non-verbal communication of the interviewee during the interview.

The semi-structured interview technique similarly became the choice of prior studies that were dedicated to the SCM and forecasting phenomena. Apart from studies that followed only qualitative research, quantitative research oriented studies likewise preferred this technique for the development of survey questionnaires. Danese (2011; 2007; 2006; 2004), Småros (2007), Ramanathan (2013; 2012) and Ramanathan *et al.* (2011) are only a few of numerous studies that conducted semi-structured interviews for their qualitative research. McCarthy Byrne *et al.* (2011), Nakano (2009) and

Vlachos and Bourlakis (2006) as well as Zhou and Benton Jr, (2007) alike embraced this technique in their survey based studies.

Vlachos and Bourlakis (2006), for instance, interviewed key decision makers in the Greek food sector as a preceding step to testing their survey questionnaire. When Zhou and Benton Jr, (2007) wanted to analyse the information sharing and supply chain practices of manufacturers in the USA, they similarly conducted in-depth interviews to validate their survey questionnaire. From the forecasting perspective, to examine the motivation of sales people in the forecasting process, McCarthy Byrne *et al.* (2011) employed in-depth interviews alongside reviewing the literature. Thereby, these authors captured valuable information to identify the variables of the survey questionnaire. These studies are good examples that used interviews in quantitative research, and therefore support the perspective of the current research in using the semi-structured interview as the early step of the quantitative data collection process.

This research took the opportunity of interviewing the supply chain manager of a leading UK based food manufacturer. The company operates in several European countries, and owns more than ten brands along with a vast number of product-groups in the industry. In general, because of well-known food brands, the company has close partnerships with several retailers in the UK and Europe. The company generally conducts CF with retailers involving perishable, seasonal, promotional and newly launched products. For confidentiality reasons, the name of the company and the supply chain manager cannot be shared. Before the interview, the current research developed the interview questions based on the results of systematic review, with some questions relying heavily upon the preliminary propositions and the conceptual model. The author of this research then conducted three pilot-tests with researchers from the fields of operations management and SCM. Based on the feedback obtained from the pilot-tests, the quality and clarity of the interview questions were improved before the interview (Silverman, 2010). The interview questions are presented in APPENDIX-I.

4.5.1.2.Process of the semi-structured interview

Overall, the interview consisted of two meetings. During the first meeting, the author and the supply chain manager met to introduce each other and to exchange general knowledge about the research and the company. The research aim and objectives were clearly conveyed to the manager, and the CF practices of the company with retailers and associated product-groups also became subject of the meeting. Then, the second meeting date was adjusted to conduct the semi-structured interview.

The second meeting was primarily dedicated to the semi-structured interview. The interview was completed in about one and half hours, and the note-taking method was used to make the interview transcript. The interview proceeded in the form of question and answer; however, the manager was encouraged to share in-depth information on critical questions. This is a common way of uncovering vital clues about the research questions (Wilson, 2010). During the interview, the preliminary propositions and the conceptual model of the research were introduced to the manager. His general views were then requested to be able to learn from his experience and to assess the reliability of the conceptual model and propositions in practice. At the end of the interview, the manager was further encouraged to share his suggestions in terms of considering specific variables to be reviewed in the literature.

4.5.1.3.Qualitative analysis of the semi-structured interview

This research favoured the qualitative data analysis software package QSR NVivo 9 to analyse the transcript of the interview. NVivo is a software package that was developed by QSR International. It guides researchers to organise unstructured qualitative data and to analyse them in a structured form (QSR, 2013). It is very promising software for pattern analysis, theory testing and theory building. NVivo is likewise preferred for description, comparisons and evaluation of a wide range of qualitative data (Bazeley, 2007).

This software has five prime features that improve the process of analysing qualitative data. Firstly, it has the solid ability of managing any unstructured data. Published articles and any documentary sources can also be reviewed in a structured form, in addition to the transcripts of interviews, questionnaires, group discussions and observations (Bazeley, 2007). NVivo allows the uploading of word and pdf documents, videos and pictures, spreadsheets along with web data (QSR, 2013). Secondly, researchers can systematically manage ideas. Complex ideas that are generated through the analysis of qualitative data can be recorded in an organised form (Bazeley, 2007). Thirdly, the software has a widespread search feature, and any subject and / or word can be found within complex qualitative data. Then, each search can be recorded to effortlessly arrive them afterwards (QSR, 2013). Fourthly, NVivo has graphical features. It helps researchers to structure hypothetical relationships and to build and / or modify conceptual models. Associated ideas that represent hypothetical relationships can be linked to conceptual models. This, in turn, makes it possible to have a clear understanding of complex causalities in conceptual models (Silverman, 2010). Finally, NVivo has a reporting feature, and the outcomes of qualitative data analysis can be reported in a structured form. Reports can also be exported as a word or pdf document (QSR, 2014; 2013; Bazeley, 2007).

To be able to get benefit from the aforementioned benefits of this software, the interview transcript was uploaded to QSR NVivo 9 as a word document. For the analysis process, the principles of Patton (2002), who suggested identifying, codifying and categorising, then classifying and labelling the qualitative data, were embraced. These principles earned the support of Easterby-Smith *et al.* (2002) as well when the intention is to test hypothetical relationships. For the utilisation of QSR NVivo 9, the guidelines of Bazeley (2007) and Lewins *et al.* (2011) were considered during the analysis process, and this made it possible to distil vital variables from the transcript of the interview. When the results of qualitative data analysis were explored, the research modified the literature-based conceptual model and propositions by benefiting from the graphical feature of QSR NVivo 9.

4.5.1.4. Outcomes of the semi-structured interview

The results of the interview analysis provided an in-depth understanding about the foremost CF problems that occur in the real environment. Particularly, outcomes strongly validated the existing challenges that prevent partners from conducting long-term and accurate CF in the FSC. For instance, by confirming the literature, the interview findings exemplified how manufacturers confront difficulties in conducting long-term CF with retailers. This outcome relies on the manager's comment, where he stressed; "*Collaborative forecasting works well in a short period, like 9 weeks, but the same performance cannot be obtained in the long-term period, I mean for 52 weeks*". In a similar vein, findings showed that manufacturers mostly do not satisfy from the forecasts during CF. The outcome that made it possible to validate inaccurate forecasts in CF lies in the manager's comment; *"The accuracy of collaborative forecasting is satisfied close to the delivery time of products; however, at the beginning of the forecasting period it is not satisfied. It changes unexpectedly*". These results not only confirm that manufacturers confront difficulties in conducting long-term and accurate CF in the FSC, but also suggest the impact of fluctuating demand in CF. Evoking the aim of the current research, which is to achieve long-term and accurate CF in the FSC, the outcomes of this single interview enrich the value of the research for practice.

There was further support for the idea that trust and commitment are two important determinants in CF. The manager, for instance, remarked; "*Trust and commitment are weak in the long-term. We are satisfied in the short-term (9 weeks), but not in the long-term. We really need further attention and commitment of retailers to generate better forecasts in the long-term (52 weeks)*". This outcome has been one of the core origins in developing the CF practice for manufacturers. It is important to remember that the CF practice in this research encapsulates the literature-based five formative variables, two of which are trust and commitment. The significance of trust and commitment accordingly receives the support of pragmatic views in addition to the literature. When this research identified the variable of "willingness" during the analysis of interview transcript, this outcome made it possible to interpret that both the company and its partners have willingness to pursue collaborations. For instance, the manager stressed that; "*I believe that retailers are happy to conduct* *collaborative forecasting with us. They have a willingness to pursue collaborations, like us*".

In essence, this subjective belief gives rise to contradictions on the willingness factor. The reason is that while the manager expected further trust and commitment from retailers in the long-term, on the other hand, he confirmed both sides' willingness to conduct CF. In the literature, the commitment is to show "desire to maintain valued relationships" (Moorman *et al.*, 1992, p. 316). However, trust is to provide "willingness to rely on an exchange partner in whom one has confidence" (Moorman *et al.*, 1993, p. 82). In collaborations, trust is also known as, "the willingness of a party to be vulnerable to the actions of another party based on the exception that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party" (Mayer *et al.*, 1995, p. 712). Commitment then "refers to an implicit or explicit pledge of relational continuity between exchange partners" (Dwyer *et al.*, 1987, p. 19).

The perception of the manager on willingness seems to capture the happiness of retailers in sustaining collaborations. According to the literature, it is reasonable to describe the willingness factor as an observed outcome of trust representing the vulnerability and rapid action of partners in pursuing confidentiality. This, per se, suggests that despite the existing willingness of partners to sustain CF, they cannot be satisfied in terms of rapidly reacting to expectations in CF. While this single interview is limited to highlighting the sensibility of manufacturers, retailers' views are still uncertain. Based on these paradoxical and limited outcomes, it seems that empirically analysing the importance of trust and commitment in CF will offer promising contributions to the literature and practice.

Externally integrating with retailers also appeared to be a necessity in CF. Increasing the frequency of communication and agreeing on a single plan seem critical determinants to utilise CF. The company successfully fulfils these requirements and achieves its objectives in CF. In detail, the company and its partners communicate almost on a daily basis, and joint business plans. While partners' yearly plans allow the company to pursue its strategic objectives, weekly plans then make it possible to respond to instant demand changes and to satisfy retailers in CF. This finding supports the case study by Danese (2007). This is because the author exemplified how partners' effective information sharing and joint business plan allowed them to accomplish CPFR goals, which were to reduce inventory costs and to increase responsiveness against instant demand changes.

There is a broad consensus that partners need to conduct CPFR by adopting a single vision and linking their business plans, if they want to take advantage of this business initiative (Danese, 2007; McCarthy and Golicic, 2002; Ireland and Bruce, 2000). Therefore, this qualitative finding not only solidifies arguments on the partners' integration, but also brings pragmatic value to the CF practice of this research, which embraces the join business plans as a notable necessity for long-term and accurate CF in the FSC.

Another important outcome was about the IT systems. The qualitative analysis revealed that IT systems are vital for CF. The company has an advanced IT system to share information internally and externally. Their access to retailers' systems further improves agility and transparency through information sharing. In doing so, the company obtains reliable information on a regular basis. Nonetheless, it appears that different IT systems in CF cause time to be spent in the forecasting process. For instance, the manager remarked that; "W*e don't have any problem with IT systems…we have an advanced system…the only issue is that some retailers have different IT systems from us, and we spend time to convert the retailer data and to utilise them in our system. This issue is time-consuming, and negatively affects our information sharing and forecasting within the company*."

This outcome is in line with case studies that illustrated partners' different IT systems that engendered forecast errors and administrative costs in the UK FSC (Taylor and Fearne, 2006; Taylor, 2006). The arguments of Småros (2007) exacerbate the paradox on the IT systems, as the author claimed that investing in IT systems is not essential for large-scale CF. It can be inferred that the finding of this interview implies the importance of IT systems for timely and accurate forecasts, differently from Småros (2007). Barratt (2004) previously argued that technology is not necessary in collaborations, though the literature is rich in opposing views (Fliedner, 2006; McCarthy and Golicic, 2002; Ireland and Bruce, 2000). This is because the discussions of the current research on the IT systems have gained more importance, as the necessity of these systems has been advocated for effective integration in CF.

Manufacturers' interdepartmental integration also came into prominence based on the qualitative outcomes of the interview. The company does not have any difficulty in terms of integrating departments in CF, since there is a robust awareness that communication among departments is crucial and it influences the practices of production, forecasting and the supply chain. Associated remarks of the manager clearly indicates the importance of communication between departments, because he mentioned that; "*The communication between the forecasting and production departments is crucial, since the forecasting department transfers information to production, and then the production department develops supply chain and production plans*." In essence, this view of the manager adds further understanding to the observations of Småros (2007), who clearly illustrated how the lack of integration between the departments of a manufacturer caused to loss of information and this in turn negatively influenced the CF of manufacturer in the FSC. Therefore, it can be inferred that cross-functional communication is an important factor to improve integration between the departments of manufacturers.

In the meantime, it is worth mentioning that the company effectively employs S&OP and extends this practice to its CF with retailers. This is a good example to support the strategic feature of S&OP, as it makes it possible to align departments' different objectives (Oliva and Watson, 2011) and to generate a single consensus-based forecast in manufacturers (Mello, 2013). While the literature emphasised manufacturers' multiple forecasts that worsen CF with retailers (Helms *et al.*, 2000), studies, on the other hand, clarified how S&OP enabled manufacturers to generate consensus forecasts with retailers in a timely manner (Olhager, 2013; Thomé *et al.*, 2012). There is also broad agreement that cross-functional integration between departments enhances flexibility, product quality and timely deliveries (Paiva, 2010; Lockamy II and McCormack, 2004). Regarding this qualitative finding that is in line with broad views, the CF practice of the current research gains a pragmatic meaning due to its assumptions that defend the necessity of consensus-based single forecasts in manufacturers. Therefore, the arguments of this research on the interdepartmental integration of manufacturers make further sense.

Regarding the production capacity, the qualitative data analysis allowed the research to infer that there are difficulties in balancing forecasts and production. Particularly, when forecasts outweigh the capacity, it causes additional stocks and accordingly inventory costs. Therefore, manufacturers' ability to plan and schedule production seems an important matter in CF. Supporting this, the manager commented that; "*when forecasts are over the capacity, it obliges us to make stock, so it causes high inventory costs. We would like to balance production capacity and forecasting to mitigate inventory costs.*" It is interesting that Småros (2007) similarly observed the difficulties of manufacturers in effectively managing production capacity in the European grocery sector. Knowing that partners' order forecasts are influential on manufacturers' production planning and delivery operations (Danese, 2007), manufacturers' capability of planning and scheduling production gains more importance in CF. For that reason, this research discussed the role of production planning and scheduling when manufacturers' interdepartmental integration was taken into account during the hypothesis development process.

Finally, the lack of regular forecasting meetings between partners appeared to be an important outcome of this interview. In detail, the reluctance to dedicate time and conduct regular meetings in CF caused conflicts between the company and retailer partners. The frequency of meetings conducted between the company's collaborative team and retailers change based on the extant situation. These meetings could be on a monthly or weekly basis. It appears that there is instability in conducting regular forecasting meetings in CF. On the other hand, the forecasting literature lacks a pragmatic contribution, and needs to be enriched with further knowledge to be able to add further insight into the partners' forecasting meetings (Önkal *et al.*, 2012; 2011). Accordingly, arguments have been improved on the forecasting meetings of partners to extend the forecasting literature.

Overall, although the analysis of the aforementioned single interview implies important clues for the CF of manufacturers, results are limited to the views a single interviewee. To elucidate qualitative findings, it is essential to conduct empirical analysis. Therefore, the outcomes of the interview made it possible to reduce the number of the literature-based propositions and to modify the conceptual model in this regard. It is worth mentioning that by relying on the results of this single interview, Eksoz and Mansouri (2012) and Eksoz *et al.* (2012) offered valuable propositions to the SCM and forecasting literature.

4.5.2. Three online group discussions

4.5.2.1.Rationale for employing online group discussions

In the literature, group discussions are also known as focus groups (Wilson, 2010). The focus group is "a form of qualitative data collection which involves the simultaneous participation of a number (usually around five to eight) of respondents, along with a moderator or facilitator" (Lee and Lings, 2008, p. 221). This qualitative method requires continuous effort on the part of the researcher to attract suitable participants to contribute to the research and to keep them interested during the group discussions (Wilson, 2010). Despite the effort that needs to be put into the data collection process, group discussions have concrete strengths that allow researchers to interact with the group participants and to obtain data beyond a single response. Focus group discussions focus on "a particular topic, and should be used because the researcher wishes to explore the way that topic is discussed or constructed by the group, not as a set of individuals" (Lee and Lings, 2008, p. 221). Discussions can be conducted in the forms face-to-face, telephone and online applications (Curry *et al.,* 2009; Rezabek, 2000; Murray, 1997).

Previously, Zikmund (1997) highlighted a vast number of strengths for this method. For instance, group discussions allow researchers to gather a wide range of information compared to interviews. Differently from other qualitative methods, the interaction of participants accumulates new ideas about a single topic. These interactions in groups, moreover, reduce the pressure of participants that they frequently experience during interviews. According to Zikmund (1997), this method helps researchers to collect more data in a shorter period compared to interviews.

This research conducted online focus group discussions on the business oriented social networking service LinkedIn, which is a promising way to contact senior managers (Smith, 2014; Harwood, 2013; Mirabeau *et al.*, 2013). The rationale for conducing online group discussions on LinkedIn was justified in Section 4.4.1., It is, however, worth further clarifying the online version of focus group discussions due to the fact that they can be conducted synchronously or asynchronously (Rezabek, 2000; Murray, 1997)

A number of studies considered group discussions, yet their choice generally differed between face-to-face and online applications. For instance, Ramanathan (2013) conducted face-to-face group discussions with seven representatives of textile and packaging manufacturers separately to elaborate the impact of different types of information on the forecast accuracy. Similarly, while Oh *et al.* (2012) aimed to analyse the impact of IT systems on retailers' selling activities, they conducted face-to-face focus group discussions with retail participants and consumers. On the other hand, Picazo-Vela *et al.* (2012) favoured online group discussions to discuss the role of social networks on government portals, and these authors' discussions interestingly attracted 250 public servants.

Stewart and Williams (2005) also employed online group discussions over two different research projects, and then discussed the difference between synchronous and asynchronous online group discussions. Identically, Fox *et al.* (2007) focused on the online group discussions, but these authors further discussed the role of synchronous discussions on a research that addressed the appearance concerns of young people, who have chronic skin conditions. Clarifying these different types of online group discussions, synchronous discussions are live and participants contribute to the discussions in the same period. Its structure is similar to face-to-face discussions, but it is faster moving (Stewart and Williams, 2005). Asynchronous online discussions are not live and rely on comments. Participants can contribute to the discussions whenever they want within a specific period of time (Murray, 1997). Emails, news or business groups are the common ways of conducting asynchronous online discussions, whilst synchronous discussions tend to be conducted in chat rooms or in the form of online conferencing / webinars (Rezabek, 2000).

There are arguments that conducting online group discussions gives rise to challenges for researchers. In detail, during the synchronous discussions, researchers are likely to confront ethical, personal or pragmatic difficulties (Fox *et al.*, 2007). For instance, Stewart and Williams (2005, p. 412) claimed that conducting group discussions on an online platform raises question marks on the "epistemology, empiricism, authenticity authority, (re)-representation and ethics." In addition, these authors argued that although synchronous discussions allow researchers to capture information in an oral form and to exchange information, ethical issues may affect the data collection process due to its real-time feature. It is likewise challenging to attract participants to join a real-time platform. On the other hand, asynchronous online discussions allow researchers to earn in-depth understanding over the subject of interest and to increase the number of participants (Tates *et al.*, 2009). This is because asynchronous online discussions accumulate discussions and / or ideas, and are not live, so participants can add comments within a limited period of time (Stewart and Williams, 2005).

Apart from these arguments comparing asynchronous and synchronous online group discussions, they seem to be more preferred compared with other traditional offline group discussions. The reason is that the online group discussions are inexpensive and allow the researcher to reach a vast number of relevant participants on an online platform (Edmunds, 1999). Online group discussions mitigate hierarchy and underpin group dynamics. They are likely to improve relationships between the researcher and participants from different regions (Fox *et al.*, 2007). Researcher can expedite the data collection process and capture a wide range of information on a single subject (Fielding *et al.*, 2008). Overall, these comparison analyses between online and offline group discussions are the reason why the online group discussions are suitable for the qualitative data collection process. Preferring the asynchronous online discussions likewise seems a reasonable preference of the current research. Whilst their narrative feature allows researchers to have an in-depth understanding of the subject of interest, they do not cause any ethical consideration, unlike synchronous online group discussions (Tates *et al.*, 2009; Stewart and Williams, 2005).

4.5.2.2. Process of the online group discussions

According to recent statistics, the business oriented social networking service LinkedIn has 2.1 million business groups, and 200 conversations appear in those groups per minute (Smith, 2014). In general, each business group focuses on a number of business topics. To be able to access group discussions, it is essential to be a member of the associated group, and the owner or board of the group needs to ratify the membership. When the membership is confirmed, the LinkedIn member also becomes a member of that group. This gives access to any discussion by adding comments and initiating a new discussion to learn the views of associated group members. Group members can likewise initiate polling. For instance, the group member asks a single question on the page of a business group, and then offers a number of different options for participants to vote on the best option based on their personal belief / experience. In addition to voting, partners can add their comments to give a rationale for their vote or to contribute to discussions with additional knowledge.

When the SCM and forecasting related business groups were searched amid the LinkedIn groups, it was found that there were 1,808 SCM[1] and 452 forecasting[2] oriented business groups. However, to be able to choose the most appropriate business groups, the research identified three criteria. Firstly, the author of this research needed access to the business groups beforehand. The logic behind the first criterion was to save time and to commence the discussions in the shortest time. Given the fact that having access to a group depends largely on the initiative of the group owner, it was reasonable to choose groups that already allow the author to commence discussions. Secondly, the author should choose a business group that not only allows discussions about forecasting and SCM, but also has close professional relationships with the members of associated groups. While selecting SCM and forecasting related business groups is likely to increase the response rate of participants, having good past experience between the author and core members of any group will most probably encourage the rest of the group members to contribute to the discussions. Finally, the author needed to choose at least two different

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[1] Website: https://www.linkedin.com/vsearch/f?adv=true&trk=federated_advs
Keyword search: Supply chain management
[2] Keyword search: Forecasting

business groups to commence online discussions. This approach, thereby, enabled the author to expand discussions to more participants and to accumulate diverse views from different business groups.

Based on these three criteria, the research commenced two asynchronous online group discussions with the LinkedIn business groups of “Forecasting Net” and “Business Forecasting & Planning Innovation”, also called Big Data / Analytics / Strategy / FP&A / S&OP / Strategic Planning / Predictive & Business Analytics, in March 2012. Table 4.5 presents the detailed information about the online group discussions of the current research. The author of this research published the same abstract to these two business groups, and then requested the opinion of group members. The abstract introduced the aim and objectives of the research, and offered the literature-based vital promotions to gather the comments of practitioners.

The intention here was to assess the existence of literature-based propositions in practice and to encourage participants to share their experience of the associated propositions. By doing so, the research aimed to narrow down the literature gap and to focus on propositions that have pragmatic value in the field. The online discussion in the group of “Forecasting Net” took forty-eight days and attracted interest of two participants, who provided fifteen comments. On the other hand, the online group discussion with the “Business Forecasting & Planning Innovation” group ended in seventeen days, and it captured the comments of four participants, who had different positions in the industry and provided ten comments to the discussion.

In December 2012, the research commenced the third online group discussion with the business group of “Forecasting Net”. Differently from the previous discussions, this online group discussion was polling oriented. Instead of publishing an abstract, a single question was asked and then a number of options were offered by requesting the votes of group members. This final online group discussion particularly focused on the promotional products and asked about the critical factors that influence the forecast of promotions in practice. To be voted on by participants, the research offered four literature-based options to participants: (i) forecasting method, (ii) forecasters’ knowledge about the market and (iii) forecasters’ knowledge about product/s as well as (iv) old promotional data about product/s. While polling obtained twelve votes, this discussion gathered twelve comments from three participants. It is worth stressing that LinkedIn allows group members to vote only one option and once for polling oriented discussions. This, in turn, suggests that the final discussion of the current research received twelve votes in total from twelve different participants, while only three participants decided to add additional comments apart from their votes. Associated abstracts and the questions that were published for the online group discussions are presented in APPENDIX-II.

Table 4.5. LinkedIn-based online group discussions

		LinkedIn business groups		
		Forecasting Net	**Business Forecasting & Planning Innovation**	**Forecasting Net (Polling)**
Period of time	**Start**	21st March 2012	26th March 2012	20th December 2012
	End	8th May 2012	12th April 2012	28th December 2012
	Duration	48 days	17 days	8 days
Number of	**Group members**	1,360	99,997	1,360
	Participants	2	4	3
	Comments of participants	15	10	12
	Total comments	28	19	22
	Votes	-	-	12
Position of participants who added comments to the discussions		*Marketing & business development director *Academic Researcher	*Financial planning & analysis manager *Supply chain senior consultant *Loyalty marketing director *Interim supply chain manager	*Marketing & business development director *Strategic resource planning manager *Logistics manager
Country of participants		UK and Europe	UK and USA	UK, USA and Europe

Source: *Developed by the author*

4.5.2.3.Qualitative analysis of the group discussions

Similar to the analysis of the interview transcript, the qualitative data analysis software package QSR NVivo 9 guided the research to analyse the transcripts of the three online group discussions. The only additional effort was made to give further emphasis to the position and the region of the participants. Consequently, apart from codifying, categorising and analysing the unstructured qualitative data (Patton, 2002), the classification process was extended to the participant level. This allowed the research to gain further insight into the seniority level of the participants and their region. During the analysis process, the guidelines of Bazeley (2007) and Lewins *et al.* (2011) assisted the research to enhance the quality of the data analysis. By exploiting the graphical features of QSR NVivo 9, the research modified the conceptual model and propositions based on the results of qualitative analysis (QSR, 2014; 2013; Bazeley, 2007).

4.5.2.4.Outcomes of the online group discussions

The first online group discussion that was commenced with the business group of "Forecasting Net" did not attract the interest of a large number of members. Only two members added valuable comments to the discussion. However, the seniority level and experience of the participants in the field made it possible to capture valuable clues for the research. The research primarily encouraged the members to discuss trust, forecasting methods and frequency, and the forecasting capabilities of partners as well as manufacturers' production capacity along with promotion types and associated risks. Interestingly, trust and commitment factors attracted participants in the CF of manufacturers. Thus, their arguments predominantly related to these determinants.

As far as the trust factor is considered, this factor in practice seems to be one of the most significant entailments for long-term CF between manufacturers and retailers. For instance, one of the participants commented that; "*It was to be expected that trust is one of the most important factors of success between manufacturers and retailers…, my common sense says that in the absence of mutual trust any collaboration is bound to fail in a short period of time.*" This statement shares similar idea with the literature, and solidifies arguments on trust. The reason is that while literature argued that partners' lack of information sharing was a vital reason for limited trust and commitment, these factors also engendered short-term collaborations (Fliedner, 2006; Vlachos and Bourlakis, 2006; Crum and Palmatier, 2003).

Along with the partners' trust problems, the commitment factor was a subject of the discussion. Based on the comments of the participants, it is reasonable to deduce that commitment is just as important as trust, and is a necessary parameter in CF. The following comment supports this argument; "*At least in my mind is the level of commitment in the different parts of the value chain. This can either be enforced as a contractual obligation or just be a mutually agreed way of doing business to improve predictability and competitiveness in the value chain. I can't help by remembering the concept of Just in Time in Japan involving a high level of commitment between the different parts of the value chain resulting in smaller inventory levels based on better communication and improved forecasting accuracy in both the demand and supply sides*".

In essence, this outcome not only validates the positive impact of commitment on collaborations bringing competitive advantage, but also offers evidence to support its influence on the forecasting accuracy. It is apparent that partners' collaborative effort in sharing information and jointly investing in relationships improves trust and commitment, and this in turn brings confidence in sustaining long-term collaborations (Nyaga *et al.*, 2010; Barratt, 2004; Barratt and Oliveira, 2001). Nonetheless, the role of commitment in the forecast accuracy is not as transparent as it is in the information sharing (Nyag*a et al.*, 2010). The argument that was reinforced by the case of the JIT production system further enriches the value of commitment in improving both information sharing and forecast accuracy. The literature discussed the necessity of trust in improving partners' limited information sharing (Gulati, 2011), while the study by Fischer (2013) confirmed partners' effective communication as the premise of building trust in the European agri-food sector. Accumulating these analyses and the qualitative outcomes of this discussion provides a rigid rationale for the research in defending the role of trust and commitment as two of the foremost antecedents of the CF practice.

Partners' conflicts on the horizon of forecasts also became subject of this discussion, whilst the literature reported contradictory views on whether partners agree on the same horizon in generating forecasts (Småros, 2007; Aviv, 2002; 2001). By considering the comments of the participants, the qualitative analysis made it possible to advocate the existence of conflicts on the horizon of forecasts. Supporting this, one of the participants commented that; "*The time buckets of forecasting often differs between the retailer and manufacturer, however* *manufacturers who are more heavily engaged in collaborative forecasting are more likely to adapt their forecasting to match. This may involve generating monthly statistical forecasts and then breaking into weeks, making the necessary adjustments for special events (e.g. promotions) and then comparing these with the retailers' weekly forecasts…, also important is the forecasting horizon where the retailer only needs to forecast in the short term for the purpose of replenishment whereas the manufacturer has a longer lead time of production. The manufacturer's focus is on planning production and as such the horizon is longer. As such it may be impractical to forecast weekly in the medium term and hence monthly buckets are used."*

This comment first endorses the observations of Småros (2007), who illustrated retailers' short-term forecasts for inventory level demand compared to manufacturers' long-term forecasts due to long lead-times. Second, it qualitatively supports the demonstrations of Fildes and Goodwin (2007), who stressed organisations' monthly forecasts by corroborating the work by Klassen and Fores (2001). These evaluations thereby justify the arguments of the current research, where the intention has been to shed further light on the horizon of forecasts in the FSC.

The second group discussion of the research, which was conducted with the group of "Business Forecasting and Planning Innovation", attracted the interest of four senior managers. During this discussion, the participants commented on a wide range of subjects. However, the leading interest of participants related to retailers' IT systems, information types and third parties in collaborations, which provide additional data and undertake logistics responsibilities. Given the fact that the focus of this research is manufacturers, the outcomes that were captured on these subjects were not taken into account. Nonetheless, there were motivating outcomes that were related to manufacturers' inadequate IT systems and poor forecasting capabilities. The comment that stressed this issue was; "*The number of UK food manufacturers who have no systems and indeed little expertise in managing demand and supply is quite staggering."* This comment necessarily evokes the case study by Francis *et al.* (2008). These authors gave examples of the UK based manufacturers' insufficient capabilities in terms of production, inventory and lead-time activities that negatively influenced the shelf life of products and relationships with retailers.

Supporting these arguments, another participant reinforced the shortcomings of manufacturers in promotions and commented that "*I have also seen many instances though of lack of communication between the commercial function and the supply chain function. This can and does lead to issues related to promotions in particular - just recently I saw a promotion that had been agreed at commercial level but then the retailer supply chain function were found to know nothing about it... However, it is also very clear that manufacturers are also lacking in some key aspects of supply chain management: - not understanding what their safety stocks should be, not having forecasting or planning solutions, not understanding the difference between planning and scheduling, not understanding the difference between forecasting and demand management, not having mrp functionality*." In the same line with this qualitative outcome, claiming the shortcomings of manufacturers based on the experience of participants, Francis *et al.* (2008) called further attention to manufacturers' operations by stressing their extant shortcomings. Therefore, examining CF from the manufacturers' point of view has become more valuable for this research.

Furthermore, the trust factor, one more time, appeared as an important element along with the adoption of similar objectives and sharing of different types of information. One of the participants commented that "*We must be careful however not to assume that merely collecting more and more data such as POS data will solve the problems. The UK retail market is highly promotional, has very high SKU turnover so that true collaboration involves more than just data sharing - it involves trust building and honest sharing of intentions.*" It is clear that the current research has captured invaluable information from these discussions that are in line with the literature and encourage the empirical analysis to generalise findings in the field.

Unlike previous online group discussions, the final discussion of the current research invited participants to a poll at the group of "Forecasting Net". The research asked the question "which factor is most critical in estimating the forecast of promotions?"

Then, the literature-based alternative options were offered; (i) forecasting method, (ii) forecaster's knowledge about the market and (iii) forecasters' knowledge about product/s, and (iv) old promotional data about product/s. By considering the votes of twelve participants, the polling revealed that forecasters' knowledge about the market (33 percent) and old promotional data of product/s (33 percent) are the most critical elements for promotional forecasts. Participants interestingly did not favour forecasters' knowledge about product/s (9 percent) while forecasting methods (25 percent) seemed to be a considerable factor. Regarding the experience of forecasters, this outcome seems to be in line with the forecasting literature. This is because, when judgmental adjustments and bias became subjects of the literature, forecasters' experience appeared to be an important matter for forecasts in addition to their training and sharing of information (Önkal *et al.,* 2013; McCarthy Byrne *et al.,* 2011; Syntetos *et al.,* 2009; Fildes *et al.,* 2009). However, market based experience, interestingly, seems superior to product based experience, according to this group discussion. Overall, these outcomes have supported the arguments of the current research on the role of forecasters in forecast accuracy and encouraged further research when partners collaboratively forecast promotional products in CF.

4.6. Quantitative data collection process

The quantitative data collection process is the main methodological procedure of the current research. The goal here is to gather numerical data from a sufficient sample of the target population with the method of online survey questionnaire. This research constructed the hypothesised relationships based on the existing phenomenon of CF with the help of rational justification from prior research, conducted in the fields of supply chain integration, the forecasting process and information sharing.

Because of the deductive approach and the epistemological paradigm of positivism, it is essential for this research to generalise the hypothesised relationships in the FSC (Saunders *et al.,* 2007). This in turn requires reaching a sufficiently large sample from the population of food manufacturers, where the survey questionnaire is the most prevalent way of accomplishing this intention (Wilson, 2010; Hussey and Hussey, 1997; Pinsonneault and Kraemer, 1993). The following section provides the rationale for the employment of a survey questionnaire in gathering quantitative data for empirical analysis.

4.6.1. Rationale for employing online survey questionnaire

The survey questionnaire is "a method of data collection that comprises a set of questions designed to generate data suitable for achieving the objectives of a research project" (Wilson, 2010, p. 148). The survey questionnaire is an accustomed method for quantitative research (Lee and Lings, 2008). It provides solid advantage for research in an effort to reach the target population in a quick and inexpensive manner (Zikmund, 2003).

According to Pinsonneault and Kraemer (1993), there are three major objectives to be able to employ the method of survey questionnaire. Firstly, a survey questionnaire is an appropriate method if the research aims to test hypothetical relationships based on a particular subject or phenomenon. Secondly, this method is eligible if the research needs to collect quantitative data by asking questions about the pre-defined measurement items. Finally, a survey questionnaire is applicable if the research aims to generalise findings to the whole population based on the characteristics of a sufficient sample. In response to the first objective of Pinsonneault and Kraemer (1993), this research examines the CF phenomenon through the analysis of hypothesised relationships that were interlinked in the conceptual model, it is therefore necessary to test associated causalities amid the hypotheses (Wilson, 2010). In this context, the first objective is matched by this research to be able to employ the survey questionnaire method.

Regarding the second objective, which requires pre-defined measurement items for the survey questions, it is worth remembering that the basis of this research relies on the systemic review (Tranfield *et al.*, 2003). In other words, the research hypotheses and the conceptual model have been built upon the outcomes of rigid studies that were dedicated to the research themes of supply chain integration, the forecasting process and information sharing. The measurement items that play the representative role of each hypothesis earn the approval of prior research. In this way, the current research is compatible with the second objective of Pinsonneault and Kraemer

(1993). Finally, although the research underpins the literature-based outcomes with qualitative data, generalising its findings depends predominantly upon the reliability of quantitative data (Lee and Lings, 2008; Denzin and Lincoln, 2000). It is vital to reach a sufficient sample of the target population, and to measure the behaviour and characteristics of the sample so as to extrapolate findings to the whole population (Hyde, 2000). This motive accordingly justifies the final objective of Pinsonneault and Kraemer (1993) and reasonably impels the research to employ the survey questionnaire for the quantitative data collection process.

This research underpins the motivation of employing a survey questionnaire by exemplifying 26 articles that embraced the same method, which are presented in Table 4.6. To distil these articles from the literature, the research considered three criteria. Firstly, the data collection method of the article should rely on the survey questionnaire. Secondly, the article should contribute to at least one of the three research areas of supply chain, information sharing and forecasting. Finally, the article should contribute to the arguments of the current research in relation to the development of hypotheses or the CF practice. It is worth stressing, however, that the reason for presenting these articles is not to list whole survey based articles, but, instead, to clarify the suitability of the survey questionnaire in diverse research areas. Hence, it is not claimed that these 26 articles include an overall list of the survey based studies considered in this research.

Table 4.6. Survey questionnaire oriented studies

No	Article	Journal	Geography	Relevant research theme/s			Industry	
				Supply chain	Information sharing	Forecasting	Food	Other
1	Bourlakis *et al.* (2014)	Industrial Marketing Management	UK	x	x		x	
2	Danese *et al.* (2013)	Transport Research Part E	Italy	x	x			x
3	Danese and Kalchschmidt (2011)	International Journal of Production Economics	Italy		x	x		x
4	Fildes and Goodwin (2007)	Journal on the Practice of Operations Research, Interfaces	UK			x	x	x
5	Fischer (2013)	Supply Chain Management: An International Journal	Italy	x	x		x	
6	Flynn *et al.* (2010)	Journal of Operations Management	USA	x	x		x	x
7	Ha *et al.* (2011)	International Journal of Operations & Production Management	South Korea	x	x		x	x
8	He *et al.* (2013)	International Journal of Production Economics	UK	x	x			x
9	Hill and Scudder (2002)	Journal of Operations Management	USA	x	x		x	
10	Klassen and Flores (2001)	International Journal of Production Economics	Canada			x		x
11	Lorentz *et al.* (2013)	Supply Chain Management: An International Journal	Finland	x	x	x		x
12	McCarthy Byrne *et al.* (2011)	Industrial Marketing Management	USA			x		x
13	McCarthy *et al.* (2006)	Journal of Forecasting	USA			x		x
14	Mentzer and Kahn (1995)	Journal of Forecasting	USA			x		x
15	Nakano (2009)	International Journal of Physical Distribution & Logistics Management	Japan	x	x	x	x	x
16	Paiva (2010)	International Journal of Production Economics	Brazil	x			x	x
17	Ramanathan and Guneasekaran (2014)	International Journal of Production Economics	UK	x	x	x		x
18	Sanders and Manrodt (2003)	OMEGA The International Journal of Management Science	USA			x	x	x
19	Sanders and Manrodt (1994)	Journal on the Practice of Operations Research, Interfaces	USA			x		x
20	Van der Vaart *et al.* (2012)	International Journal of Operations & Production Management	The Netherlands	x	x			x
21	Vijayasarathy and Robey (1997)	Information & Management	USA		x		x	x
22	Vlachos and Bourlakis (2006)	Supply Chain Forum: An International Journal	Greece	x	x		x	
23	Yan and Dooley (2014)	Journal of Supply Chain Management	USA	x	x		x	x
24	Zhou *et al.* (2014)	International Journal of Production Economics	China		x			x
25	Zhou and Benton Jr. (2007)	Journal of Operations Management	USA		x			x
26	Zotteri and Kalchschmidt (2007)	International Journal of Production Economics	Italy		x	x		x

Source: *Developed by the author*

4.6.2. Design of the online survey questionnaire

To be able to gather accurate information by employing a survey questionnaire, it is imperative to design and test questions along with associated measurement items in a transparent and justifiable way (McClelland, 1994). There are two major factors that need to be taken into account to capture reliable information by survey questionnaire. First, the researcher needs to construct the survey from the most appropriate questions that capture the main value of the constructs. Second, the survey questionnaire should reach the most relevant audience, who have a clear wisdom about the subject of research interest (Wilson, 2010). Whilst this section aims to explain the first factor, the second factor is addressed in the following section, which is dedicated to the target population and sampling of the research.

By considering the procedures of Flynn *et al.* (1990), this research constructed the survey questionnaire from five-point Likert-type scales. For the measurement of scales, minimum four and maximum seven measurement items represented each construct, to ensure that there are a sufficient number of items capturing the value of each construct, as was suggested by Churchill Jr, (1979). The measurement items representing the constructs were also explored through the extensive review of the literature rather than employing existing items used by prior studies. Exploring literature-based multiple items for a single construct made it possible to measure internal consistency as well as discriminant and convergent validity during the data analysis process. Differently from previous studies, the current research employed four different ranges over the scales in measuring the perception of the audience, and all the scales were purely five-point Likert-type.

For instance, to measure manufacturers' CF, integration and forecasting related practices, related constructs consisted of the literature-based diverse measurement items that were stressed to be important in developing an efficient CF, improving supply chain integration and *Group Forecasting* between partners, along with considering the competence of forecasters. However, the development of measurement items for the construct of *Collaborative Forecasting Performance* was rather based on the major CF problems of manufacturers, improving the forecast accuracy and extending the duration of forecast collaborations. This construct, within the knowledge of the author, seems to be tested for the first time for the CF phenomenon, and therefore it is presumed as a newly developed construct in the model. Accordingly, the respondents were given a scale that has a range from 5: Strongly Agree; 4: Agree; 3: Neither Agree nor Disagree; 2: Disagree, to 1: Strongly Disagree. Measuring the level of agreement in a survey questionnaire is one of the most common ranges, if the researcher wants the confirmation of respondents over the associated constructs. Literature involves a plethora of research that follows this approach (please see, e.g. Hill and Scudder (2002), Lockamy III and McCormack (2004), Nakano (2009) and Vlachos and Bourlakis (2006)).

For the horizon of forecasts, the research intended to increase accuracy for the range of scale over a particular period of time. The reason for this there is a paucity of research clarifying the exact horizon of forecasts for the time-sensitive and / or short-life product-groups. To bring extra precision to the horizon of forecasts, the measurement items were developed based on the close periods that practitioners are likely to consider through the generation of forecasts for the associated product-groups, according to the forecasting literature. Therefore, the respondents were given a scale that ranges from 5: 1 month or less, 4: 1 to 3 months, 3: 3 to 6 months, 2: 6 to 12 months, to 1: 12 to 24 months. This helped respondents to choose the most appropriate horizon for associated product-groups in a precise way. Maintaining rigour and clarification during the design of the survey is the key determinant in enhancing the quality of quantitative data (DeVellis, 2003; Clark and Watson, 1995). When the subject is forecasting, maintaining the transparency of the scales becomes even more important in the academic field. This was the motivation for precise time intervals constituting the range of associated scales under the guideline of prior studies in the field (please see, e.g. Fildes and Goodwin (2007), McCarthy *et al.* (2006), Mentzer and Kahn (1995) and Klassen and Flores (2001)).

On the other hand, to measure constructs that targeted manufacturers' information sharing operations, the measurement items were developed by considering the different types of information of manufacturers and the benchmarks used to measure the quality of information sharing. This approach led to not only adding further value to manufacturer information, but also exploring new benchmarks in enhancing the quality of information shared with retailers. In terms of ranges, this research preferred to offer respondents a scale that ranges from 5: Always, 4: Most of the Time, 3: Sometimes, 2: Rarely to 1: Never. This type of range in survey scales is commonly chosen to measure the frequency level of associated items. Given the fact that this research has discussed the sharing of information in the CF of manufacturers, measuring the frequency level of related items was the foremost objective of the survey questionnaire. This purpose led the research to differentiate the range of scales based on the objective of constructs. The literature is also abundant in studies that intend to measure the frequency level of measurement items in the survey questionnaire (please see, e.g. Flynn *et al.* (1990), Zhou *et al.* (2014) and Zhou and Benton Jr, (2007)).

Finally, to be able to measure the satisfaction level of respondents from forecasts, the research developed the construct from the measurement items representing the forecast satisfaction of manufacturers for the perishable, seasonal, promotional and newly launched products. Given the paucity of studies considering the forecast satisfaction of the associated product-groups from the manufacturers' point of view, this construct, within the knowledge of the author, seems to be tested for the first time for the CF phenomenon in the FSC. Therefore, it is presumed as a newly developed construct in the model, like the construct of *Collaborative Forecasting Performance*. This construct also consisted of a scale that has the range of 5: Very satisfactory, 4: Satisfactory, 3: Neither Satisfactory nor Unsatisfactory, 2: Unsatisfactory, and 1: Very Unsatisfactory. It is worth recalling that although the CF of manufacturers in this research has been taken into account to enhance the duration and accuracy of CF, satisfaction from forecasts is a prime determinant in the forecasting literature. This enables the research to obtain accurate and reliable data that can be generalised for the overall population. Therefore, by embracing the prior forecasting literature, this research preferred the satisfaction range for the associated scale (please see, e.g. McCarthy *et al.* (2006), Mentzer and Kahn (1995) and Sanders and Manrodt (1994)).

Overall, it is common that researchers construct five-point Likert-type scales from different ranges in a single study. There is plenty of research that favours multiple ranges during the scale development to enhance the precision of constructs for respondents (please see, e.g. Chen and Paulraj (2004), Flynn *et al.* (2010), Hill and Scudder (2002), Nakano (2009) and Zhou and Benton Jr, (2007)). During the design of the survey questionnaire, this research took into account the suggestions of DeVellis (2003) and Clark and Watson (1995). The recommendations of these authors ensured that the questionnaire is free of ambiguity, jargon and double-barrelled items, and that questions are adequately short to ensure the clarity of the constructs. To be able to enhance the response rate of the survey, attention was also paid to the consistent font size, style and colours during the design of the survey questionnaire (Bryman and Bell, 2007).

Four academics and four practitioners from the food industry were then asked to review the questionnaire to warrant its structure, readability, ambiguity and completeness (Dillman, 1978). Validating the quality of a survey by academics and practitioners independently further strengthened the structure of the survey. Academics focused on measurement items to ensure that they clearly represent related constructs, which matters for the validity of the findings. Practitioners assured the perception of the constructs and associated measurement items in practice to ensure that respondents would discern correct practices that are the interest of research. The survey questionnaire is presented in APPENDIX-III.

4.6.3. Target population and sampling

If the major data collection method is survey questionnaire, it is essential to have a strategic sampling process to collect adequate information by reaching target respondents in a rational and justifiable way. In social research, sampling is the assortment of information from a group of the population of interest (Wilson, 2010; Churchill Jr. and Iacobucci, 2004). To be able to collect adequate information from a sufficient sample of the target population, Wilson (2010) offers a structured sampling process consisting of six stages. These stages are: to (i) define the target population, (ii) select the sampling frame, (iii) choose the sampling technique, (iv) determine the sample size, (v) collect the data and (vi) assess the response rate.

By drawing on these stages, this research initially focuses on the definition of the target population. Population is not only “a complete group of entities sharing some common set of characteristics” (Zikmund, 2003, p. 369), but also “the universe of units from which the sample is to be selected” (Bryman and Bell, 2007, p. 182). In this stage, it is worth remembering the focus of the current research is the CF of manufacturers in the FSC. While the region based comparison analyses and justifications were earlier addressed in *Section 1.5.2. FSC in Europe and North America*, it has been explained that the CF problem predominantly appears in Europe whilst manufacturers in North America seems to be more mature in employing CF in the FSC. The logic behind studying CF in relation to the perishable, seasonal, promotional and newly launched products was further scrutinised in *Section 1.5.4. Time-sensitive and / or short-life product-groups in the FSC*. Correspondingly, the target population of the current research consists of manufacturers that collaboratively forecast associated product-groups with retailers and are located in the UK & Ireland, North America and Europe.

4.6.3.1.Sampling frame

By definition, a sample is “a subset or some part of a larger population” (Zikmund, 2003, p. 369). It is also known as “the segment of the population that is selected for investigation” (Bryman and Bell, 2007, p. 182). In other words, sampling can be defined as the procedure of “using a small number of items or parts of a larger population to make conclusions about the whole population” (Zikmund, 2003, p. 369). Before the selection of the sample, it is important to clarify the sampling frame of research, which is a “listing of all units in the population from which the sample will be selected” (Churchill Jr. and Iacobucci, 2004. p. 182). Selecting a sampling frame is not only a difficult task, but also a time-consuming process. For this reason it has to be ensured that the frame adequately represents the target population (Wilson, 2010; Malhotra *et al.*, 1996)

In an attempt to select a rigid sampling frame for the food manufacturers, this research benefited from a wide range of sources. For instance, when the social networking service LinkedIn was utilised to reinforce the sampling frame, the research exploited the online databases of Bloomberg, Financial Analysis Made Easy

(FAME) and Osiris. The websites of a vast number of food and beverage federations were also taken into account during this process. The relevant contacts of the author, who have managerial positions in food manufacturing companies, were also considered as part of the sampling frame.

Previously, the motivation of the taking advantage of social networking sites during the data collection process was justified in Section 4.4.1. This justification also explains the logic behind regarding LinkedIn as part of the sampling frame of the current research (Smith, 2014; Vermeiren and Verdonck, 2011). To be able to provide sufficient data from LinkedIn, the research utilised the "Advanced People Search Tool" of LinkedIn[3], which makes it possible to classify members based on particular criteria. Regarding the online databases, Bloomberg[4] is an online database that provides descriptive and statistical information about 52,000 companies around the world. In a similar vein, FAME[5] is a financial database and offers rating information about companies. However, FAME is a rather UK and Ireland oriented database and involves information only about companies located in these areas. Identical to Bloomberg and FAME, Osiris[6] is an international database that offers both financial and descriptive information about companies around the world. These databases were comprehensively utilised from the library of Brunel University. Detailed descriptions of data collection from these databases are offered in section 4.6.4. Quantitative data collection stages.

Regarding the websites of food and beverage federations, by conducting an extensive search via google, a vast number of federations, which active in the UK and Ireland, Europe and North America, were explored. Then, the list of members of associated federations was merged into the sampling frame of the current research. The professional contacts of several managers, who have clear wisdom about the subjects

[3] **URL for Advanced People Search – LinkedIn**: www.linkedin.com/search?trk=advsrch
[4] **URL for Database of Bloomberg**:
http://www.brunel.ac.uk/services/library/databases/archive/bloomberg
[5] **URL for the UK and Ireland based Database of FAME**:
http://www.brunel.ac.uk/services/library/databases/archive/fame OR
https://fame2.bvdep.com/version-201442/Search.QuickSearch.serv?_CID=1&context=30K96PW86DKR8MQ
[6] **URL for the database of Osiris**: https://osiris.bvdinfo.com/version-2014512/Search.QuickSearch.serv?_CID=1&context=CNI65R6Y9LVIG9P OR
http://www.brunel.ac.uk/services/library/databases/archive/osiris

of interest, were also taken into account. In doing so, the sampling frame involved food manufacturers that were found from LinkedIn, Bloomberg, FAME, Osiris and the websites of associated federations and personal contacts of the author. Because a vast number of lists was revealed through the sampling search process, the research generated four selection criteria to be able to enhance the representativeness of the sampling frame (Wilson, 2010).

These criteria involve candidate respondents' (i) region, (ii) industry and (iii) the product-groups that their company provides to retailers as well as (iv) seniority level. The first criterion led to purifying candidate respondents based on regions, as the research interest was to find respondents from the UK & Ireland, Europe and North America. Although the candidate research process was conducted over the search tool of LinkedIn, this research benefited from the internet encyclopedia of Wikipedia[7] to categorise the regions and countries of candidates in a transparent and rational way. Because the intention here was to consider Europe in four segments and to shed further lights on the CF of manufacturers located in particular areas, candidate respondents were searched from six different regions: the UK & Ireland, North America, Eastern Europe, Northern Europe, Southern Europe and Eastern Europe.

Table 4.7 presents the target regions of the sampling frame and associated countries. It is worth accentuating that the UK & Ireland, per se, are involved in the region of Northern Europe. However, there is an abundance of research that depicts the capabilities of manufacturers in the UK FSC and raises question marks over this area (e.g. Adebanjo (2009), Adebanjo and Mann (2000), Francis *et al.* (2008), Taylor and Fearne (2006) and Taylor (2006)). Adding further insight into the practices of manufacturers located in these areas is the logic behind separating the UK & Ireland from Northern Europe and considering them as a separate region.

[7] **URL for the classification of regions in Europe**: http://en.wikipedia.org/wiki/Regions_of_Europe

Table 4.7. Target regions of the sampling frame

No	Regions	Countries comprised the associated region/s
1	United Kingdom & Ireland	The UK and Ireland
2	North America	The USA and Canada
3	Eastern Europe	Belarus, Bulgaria, Czech Republic, Hungary, Moldova, Poland, Romania, Russian Federation, Slovakia, Ukraine
4	Northern Europe	Denmark, Faroe Islands and Greenland, Estonia, Finland, Iceland, Latvia, Lithuania, Norway, Sweden
5	Southern Europe	Albania, Andorra, Bosnia and Herzegovina, Croatia, Cyprus, Greece, Italy, Malta, Montenegro, Portugal, San Marino, Serbia, Slovenia, Spain, Turkey
6	Western Europe	Austria, Belgium, France, Germany, Liechtenstein, Luxembourg, Monaco, Netherlands, Switzerland

Source: *Developed by the author*

The second criterion considered the related industries of candidate respondents in line with regions, which were selected based on the first criterion. The search tool on LinkedIn likewise assisted the research to explore associated industries. By using the keywords of “Food” and “Beverage”, the four most relevant industries were identified for the selection of the sampling frame. These industries are “Dairy Production”, “Food Production”, “Food & Beverages” and “Consumer Goods”. For personal contacts and manufacturers that were found from databases and the websites of federations, the research considered candidates that are in charge in the dairy, beverage and food industries, which predominantly provide different types of time-sensitive and / or short-life product to retailers.

Of the third criterion, the LinkedIn profile of members guided the research to reach associated manufacturing companies’ websites. The research also looked at the websites of candidates found from databases and the websites of federations to analyse the product-groups of manufacturers. During this process, the author comprehensively examined a vast number of manufacturers’ websites to ensure that their product range involves time-sensitive and / or short-life products. In doing so, a wide range of products, such as vegetables, fruits and poultry that are time-sensitive and / or have short-life were taken into account under this criterion. This process took long-time to ensure that clarity and accuracy over the sampling frame of this research were maintained. This criterion clearly validates the claims of Malhotra *et al.* (1996) and Wilson (2010) who stress that selecting a sampling frame is a challenging and time-consuming task when the intention is to ensure that the frame adequately represents the target population.

Finally, the research categorised candidates based on their position in the industries. The classification of candidates was constituted in six groups by bearing in mind the departmental responsibilities that matter in CF (Danese, 2007; Barratt, 2004; Helms *et al.,* 2000; Ireland and Bruce, 2000). The first group, therefore, involved forecasters, forecast analysts and forecast managers. The second group focused on marketing and sales managers while the third group was composed of supply chain and logistics managers. The fourth and fifth groups consisted of production and finance managers respectively. The final group involved candidates who have different managerial positions, and was named as others. Consequently, the sampling frame included the regions, industry and associated product-groups as well as the seniority level of candidate respondents.

Through the utilisation of LinkedIn, Bloomberg, FAME, Osiris and the website of federations as well as personal contacts, this research listed 5277 candidate respondents comprising the sampling frame. It is clear that there is always a limitation in the sampling frame of any research. This is because, each unit that was not included in the sampling frame is more likely to cause non-coverage error, which is also called non-sampling error. Therefore, it has to be borne in mind that some characteristics of the population were not covered in the sampling frame of this research (Bryman and Bell, 2007; Churchill Jr. and Iacobucci, 2004). In social science research, it is argued that this is a common difficulty that researchers confront. For instance, Churchill Jr. and Iacobucci (2004. p. 324) documented that "there is rarely a perfect correspondence between the sampling frame and the target population of interest". Therefore, this research aimed to further justify the rigour of the sampling frame and to mitigate the risks of arguments claiming that the frame does not reflect the target population perfectly.

As a remedy, Wilson (2010) offered to compare the sampling frame with the sampling frame of previous studies. Thereby, comparison analyses proceeded between the sampling frame of this research and previous studies. Whilst the sampling frame of this research included 5277 candidate respondents, the sampling frame of previous studies changed from 250 to 5000 (please see, e.g. Flynn *et al.* (2010) [4569], Hill and Scudder (2002) [931], McCarthy *et al.* (2006) [480], Mentzer and Kahn (1995) [478], Vlachos and Bourlakis (2006) [250] and Zhou and Benton Jr, (2007) [745]).

4.6.3.2.Sampling technique

There are two different types of sampling technique: probability (random) sampling and non-probability (non-random) sampling. Based on the probability sampling, "each population element has a known, nonzero chance of being included in the sample". In contrast, if the non-probability sampling is employed, "there is no way of estimating the probability that any population element will be included in the sample" (Churchill Jr. and Iacobucci, 2004, p. 324).

To put it another way, probability sampling ensures that every unit of the population of interest has the same chance of being part of the sample (Wilson, 2010), and therefore makes it possible to obtain a demonstrative outcome due to minimised sampling error (Bryman and Bell, 2007). Because whole population is considered as the candidate of the sample based on non-probability sampling technique, there is no likelihood of deducing a statistical outcome (Churchill Jr. and Iacobucci, 2004). This is the reason why non-probability sampling is largely preferred by qualitative research and / or case studies while probability sampling is preferred in quantitative research (Wilson, 2010). This inference provides further understanding why "probability or random sampling has the greatest freedom from bias but may represent the most costly sample in terms of time and energy for a given level of sampling error" (Brown, 1947, p. 337). Non-probability sampling involves the quota, snowball, convenience and purposive (or judgmental) sampling techniques. In addition, probability sampling consists of simple random, systematic, stratified random, cluster sampling, and multi-stage sampling techniques (Wilson, 2010; Bryman and Bell, 2007).

Based on this rationale, the survey questionnaire reached all the list of the sampling frame [5277] by employing the probability sampling of stratified random sampling (Bryman and Bell, 2007). Stratified sampling is "where the population is divided into strata (or subgroups) and a random sample is taken from each subgroup", and these subgroups can be candidate respondents' region, seniority level and gender (Wilson, 2010, p. 195). The criteria that conveyed the sampling frame in this research constitute subgroups that group the population, which are the candidate respondents' (i) region, (ii) industry and (iii) the product-groups that their company provides to retailers as well as (iv) seniority level. Stratified sampling is preferred when the target population is heterogeneous and has high level variation. In these cases, stratified sampling helps in collecting accurate data obtained over the sample of the target population and reduces the risk of having sampling error (Wilson, 2010). Overall, due to this probability sampling ensures every unit has nonzero chances of being included in the sample (Churchill Jr. and Iacobucci, 2004) the probability of each unit that was included in the sample was known in this research (Bryman and Bell, 2007).

4.6.3.3.Sample size

The literature is rich with the arguments that were dedicated to clarifying what should be the correct sample size to be able to employ different statistical analysis techniques (Hair *et al.*, 2010). In essence, the notion of research philosophy considered in academic research plays an important role in assessing the sufficiency of a sample size (Wilson, 2010). For research that relies on the paradigm of interpretivism, it is not necessary to have a large sample size owing to the lower concern with generalising results for the population of interest (Bryman and Bell, 2007). On the other hand, if research adopts the positivist paradigm and intends to generalise findings for a whole population, it is necessary to capture a large sample size to recognise this purpose theoretically (Saudners *et al.*, 2007).

There is a broad consensus among authors that sample size is associated with the statistical method preferred for data analysis (Wilson, 2010; Hair *et al.*, 2010; Saunders et al., 1997). To be able to provide a rational judgment for the reader, this research unified the suggestions of Saunders *et al.* (1997) and Wilson (2010).

Accordingly, the decision was made to assess the actual sample size and response rate by (i) considering the characteristics of the sample data, which is dependent upon the sampling technique, (ii) comparing the sample size and response rate with prior studies, and (iii) analysing the features of appropriate data analysis techniques to make sure of cohesiveness between the sample size and data analysis technique selected.

The next section clarifies the stages followed to complete the data collection process. These stages include the utilisation of LinkedIn, online databases of Bloomberg, FEMA and Osiris and the websites federations as well as the personal contacts of the author. The subsequent section is then dedicated to assessing the actual sample size and response rate of the current research by considering the suggestions of Saunders *et al.* (1997) and Wilson (2010).

4.6.4. Quantitative data collection stages

To capture quantitative data from the target population, the decision was taken to randomly reach the whole list of the sampling frame involving the 5277 candidate respondents. The data collection process of this research consisted of four stages, and each stage proceeded in parallel to provide coherence over the data collected. These stages are explained below.

4.6.4.1.Stage – 1: Social networking service LinkedIn

During this data collection stage, the author identified 475 candidates that were strongly relevant to be part of the survey questionnaire. To be able to contact these candidates, the author initially upgraded his LinkedIn membership from the free account to the premium account. Although this way was expensive, it accelerated the data collection process and allowed the research to contact relevant candidates first hand. Then, the candidates were contacted via the LinkedIn message service. The initial message involved a short paragraph that introduced the aim of the survey questionnaire and clarified the merit of filling in the survey. The link to the online survey questionnaire was also shared in the LinkedIn message, which made it possible to further inform candidates with a concise cover letter and to accelerate the data collection process. This was the first phase of reaching the candidate respondents from LinkedIn.

For reminder emails, the full list of email addresses of the candidate respondents was, one by one, transferred to the online survey software and insight platform of Qualtrics[8]. The current research took advantage of the mass e-mailing features of Qualtrics and shared the survey questionnaire with candidates straightforwardly. It is worth stressing that the research provided an informative cover letter for candidate respondents, which is vital for any survey questionnaire (Wilson, 2010). The cover letter clarified the nature of the research, objectives to achieve and the expected benefits that respondents would obtain. The ethical procedures of the research were also concisely noted in the cover letter to encourage the participation of respondents to the survey questionnaire. The statement of ethics approval of this research is presented in APPENDIX-IV, which was approved by the Research Ethics Committee of Brunel Business School. Furthermore, respondents were offered a summary of the research results via cover letter (Diamantopoulos and Winklhofer, 2001). At this stage, the research accurately reached all 475 respondents; however, only 70 usable survey questionnaires were received. Due to non-respondents and company procedures that prevented managers from being part of the survey, the research did not receive return from the rest of 405 respondents. This accordingly allowed the research to have a 14.74 percent response rate over the business oriented social networking service LinkedIn.

Before proceeding to the second stage, which relies on the online databases of Bloomberg, FAME and Osirirs, it is worth clarifying the benefits of using a web-based survey questionnaire and the online survey software of Qualtrics. By benefiting from the free membership feature of Qualtrics, a valuable opportunity arose to send reminder emails for LinkedIn-based candidates at once, and to save time for the delivery of surveys. Web-based surveys are beneficial to mitigate missing data, continuously track the progress of each survey, and to reach a vast number of candidates from different regions (Bryman, 2004). By benefiting from the extensive survey design feature of Qualtrics, this research obliged respondents to

[8] **The URL of online survey software Qualtrics:** http://www.qualtrics.com/

complete each question in the survey, as the system did not allow respondents to proceed to the following question. In doing so, this research did not have any missing data. The online survey software of Qualtrics has also a feature of limiting multiple responses, because of which the accuracy and reliability of quantitative data were maintained in this research. In addition, employing a web-based survey guaranteed confidentiality and anonymity to encourage respondents to be part of the research (Bryman, 2004). Web-based surveys ease the ways of recording data and transferring them to data analysis software, which allows to save more time for the data analysis process (Bryman and Bell, 2007; Bryman, 2004).

4.6.4.2.Stage – 2: Online databases of Bloomberg, FEMA and Osiris

In the second stage, the author extensively benefited from the library of Brunel University having access to these databases, and discovered 3517 candidate respondents as part of the sampling frame. Initially, the email addresses of the candidates were, one by one, registered with Qualtrics and additional information was recorded such as the name, position and region of candidates. This detailed registration was time-consuming, but resulted in an ability to track the progress of respondents. When the registration process was completed and the author ensured that the full list of candidates were in the system of Qualtrics, the survey questionnaire was delivered to candidates at once by using the mass e-mailing feature of Qualtrics.

Nevertheless, the outcome of this stage was not promising like LinkedIn. Although 2012 survey questionnaires arrived with candidates, the research obtained only 5 usable survey questionnaires. The rest of the 1505 survey questionnaires did not reach the candidates because of the emails that were out of use. For reminder emails, the author re-sent the survey questionnaire to 2012 candidate respondents that had received the survey beforehand, yet the number of returned survey questionnaires did not change. Therefore, this stage caused 2007 non-respondents, who did not respond to the survey questionnaire due to the restricted company procedures. The data collection process over this stage was completed with a 0.25 percent response rate. It can be argued that these databases involve a wide range of information about companies and managers around the world, but the frequency of updating existing data is still a question mark. This is because, although there was a wide range of financial and descriptive information about companies, it was not transparent whether the contact information about the candidates was updated. Therefore, this stage did not provide a valuable contribution to the data collection process of this research.

4.6.4.3.Stage – 3: Websites of food and beverage federations

In the third data collection stage, the aim was to reach candidates identified from the websites of food and beverage federations operating in the UK and Ireland, Europe and North America. At this stage, the research revealed 1260 appropriate manufacturers that were eligible to be part of the research. As happened in the first and second data collection stages, the email addresses of candidates were registered with the system of Qualtrics, and then the survey questionnaire was delivered to all candidates at once.

Because the survey questionnaire was delivered over the online software of Qualtrics, the research ensured that 923 emails arrived whilst 337 did not reach the target respondents due to the emails being out of use. For reminder emails, this research unfortunately could not benefit from the online software of Qualtrics, unlike in stages one and two. This is because the online software has a particular quota that can be used free by members during the survey delivery process. This research had already exceeded that quota over the first and second stages. Hence, the reminder emails were delivered to 923 candidates directly by the email address of the author. Sending reminder emails became one of most challenging and time-consuming tasks at this stage. Overall, this stage made it possible to have 17 usable respondents and 906 non-respondents due to the limitations of companies refusing to join the survey. As a result, the third stage of the data collection process, which relied upon the websites of federations, was completed with a 1.84 percent response rate.

4.6.4.4.Stage – 4: Personal contacts of the author

In the final data collection stage, the author benefited from personal contacts and attempted to contact 25 candidates who were working in food manufacturing companies. Unlike previous data collection stages, a printed survey questionnaire became the method of reaching candidates. Initially, the author contacted candidate respondents by phone and informed them about the aim of this research and the progress of the survey questionnaire. During the phone call, 5 candidates were not found and 7 candidates did not agree to be part of the survey due to the company procedures that prevented them from sharing corporate information. Therefore, 13 candidates were considered to deliver the survey.

For the delivery of the survey questionnaire, the author preferred to make an appointment during the phone call with these 13 candidates and to deliver the survey questionnaire first hand instead of using a prepaid envelope. For the rest of the 5 candidates, who were not found by phone call, the survey questionnaire was posted to candidates with prepaid envelopes. Unfortunately, the research did not receive any return from those 5 candidates. The research fortunately received 13 usable surveys from candidates to whom the survey questionnaires were delivered by visits. Consequently, the final data collection stage managed to obtain 13 usable survey questionnaires, and was completed with a 65 percent response rate.

In summary, the data collection process of this research was designed based on four stages, which involved the business oriented social networking service LinkedIn, online databases of Bloomberg, FAME and Osiris, and the websites of food and beverage federations as well the personal contacts of the author. Overall, the research attempted to deliver the survey questionnaire to all 5277 candidates that constituted the sampling frame. While 3430 emails reached to these candidates, 105 usable surveys were obtained which led to a 3.06 percent response rate at the end of the data collection process. The summary of each data collection stage is presented in Table 4.8.

Table 4.8. Outcomes of quantitative data collection stages

Stage	Type of Contact	Number of: Survey delivered	Survey did not reach	Survey reached	Non-respondents & surveys restricted due to company procedures	Survey returned	Response rate (percent)
	LinkedIn						
1	LinkedIn message Online software of Qualtrics (Reminder)	475	0	475	405	70	14.74
	Databases of Bloomberg, FEMA and Osiris						
2	Online software of Qualtrics Online software of Qualtrics (Reminder)	3517	1505	2012	2007	5	0.25
	Websites of food and beverage federations						
3	Online software of Qualtrics Email (Reminder)	1260	337	923	906	17	1.84
	Personal contacts						
4	Printed survey questionnaire	25	5	20	7	13	65
	Total:	**5277**	**1847**	**3430**	**3325**	**105**	**3.06**

Source: *Developed by the author*

4.6.5. Assessment of sample size and response rate

The response rate represents the number of candidate respondents who successfully completed the survey questionnaire divided by the number of candidates identified in the sample of the research (Wilson, 2010). Whilst the target sample of the current research was 5277, the number of respondents that agreed to complete the survey questionnaire was 105. This means that this research has to make theoretical inferences based upon 105 usable responses representing a 3.06 percent response rate.

Despite the fact that the research conducted the data collection process over four different stages and applied the three different methods of online software of Qualtrics, email and printed survey questionnaire, the response rate only reached 3.06 percent. This is evidence that the data collection process is one of the most difficult tasks and requires an extensive effort to obtain sufficient usable responses from surveys (Wilson, 2010; Saunders *et al.*, 1997). This outcome is also in line with the study by Cycyota and Harrison (2006), who warned researchers that there is a substantially reduced response rate in survey based studies. However, having a low response rate and / or sample size do not necessarily mean that the theoretical contributions of the current research are not representative of the target population (Saunders, 1994).

Research findings can still provide valuable insights as there are similar studies based on low response rate and sample size (please see, e.g. Melewar *et al.* (2000) and Melewar and Saunders (1998)). In this regard, the current research provides a rationale for the small sample size and response rate by (i) considering the characteristics of sample data, (ii) comparing the sample size and response rate with prior studies and (iii) analysing the features of candidate data analysis techniques, which will lead to ensuring that there is a rigid correspondence between the sample size and data analysis technique selected (Wilson, 2010; Saunders *et al.,* 1997).

4.6.5.1.Characteristics of sample data

Despite the small sample size and response rate, it is important to ensure that the characteristics of the data are accurate enough to represent the target population (Saunders *et al.,* 1997). It is therefore worth underlining that reflecting the characteristics of the population in the characteristics of the sample data hinges heavily upon the sampling technique used to select a sampling frame (Wilson, 2010). This research employed the probability of stratified sampling technique to be able to select the sampling frame (Bryman and Bell, 2007). While the most considerable weakness of this technique is to be time-consuming in selecting the subgroups of the population in a rational and justifiable way, it is superior to all other probability sampling techniques owing to the feature of making it possible to acquire vital sub-populations as representative of the population (Malhotra and Birks, 2006).

In other words, as the sampling frame criteria of the current research captured target regions, industries, time-sensitive and / or short-life product-groups as well as the seniority levels of candidate respondents, it is reasonable to argue that the sample captured relevant characteristics of the population (Wilson, 2010). Due to the rigid survey design, this research also did not have any missing data because respondents were obliged to respond to each question in the survey. Consequently, it can be defended that the existing data is sufficiently accurate to discuss the findings based on the limited sample and response rate.

4.6.5.2.Comparison analysis for sample size and response rate

Comparing the sample size and response rate of this research with previous studies seems a reasonable way to clarify the power of existing data (Wilson, 2010; Saunders *et al.*, 1997). Despite the unfortunate usable samples and response rate, it is realistic to argue that this research exhibited a widespread effort to reach a considerable number of candidates. For instance, when Zhou and Benton Jr, (2007) surveyed manufacturers in North America to evaluate their supply chain and information sharing practices, the authors delivered only 745 surveys and obtained an 18 percent response rate with 125 usable samples. Due to advantage of persuading a large part of the sampling frame to fill in their survey, the response rate rose yet the sample size was not excessive in their study. This sample size also did not prevent the study from offering rigid contributions to the literature. In a similar vein, the study by Zhou *et al.* (2014) had an 18 percent response rate with 125 usable samples, and offered implications to practice in terms of the information quality and supply chain practices of partners, like Zhou and Benton Jr, (2007).

On the other hand, Flynn *et al.* (2010) contacted 4569 companies, and 1356 surveys were delivered to respondents. This study obtained a 13.5 percent response rate with 617 usable responses, and extended the body of literature on the supply chain integration practices of manufacturers. In response to these studies, this research overall delivered 5277 survey and 3430 surveys reached respondents. Even though the number of surveys sent to respondents was much higher than these studies, only 105 surveys were usable. However, in the LinkedIn-based data collection stage, the research obtained a 14.74 percent response rate with 70 usable responses while the final stage, which was based on a printed survey questionnaire, managed to obtain a 65 percent response rate with 13 usable surveys. These two stages alone enabled the research to obtain 83 usable responses and a 16.76 percent response rate. It is apparent that the response rate of the current research declined to 3.06 percent owing to the intention of reaching candidates from online databases and the websites of food and beverage federations. In other words, these comparisons clarify that even though the response rate is reasonably low, the research has adequate sample size to argue for its contributions to the literature.

Supporting this, McCarthy *et al.* (2006) contacted 480 forecasting executives and obtained only 86 usable responses, which is below the sample of this research. This small sample size did not prevent the study from extending the body of forecasting knowledge about diverse forecasting methods and presenting various criteria for practitioners in evaluating the effectiveness of forecasts. In a similar vein, Sanders and Manrodt (2003) emailed 2394 surveys, 50 of which did not arrive due to address errors, and obtained 240 usable responses. This enabled the study to explore major differences between organisations that employ judgmental and quantitative forecasting methods based on a 10.3 percent response rate. Overall, it can be argued that the sample size of the current research is, more or less, adequate to claim its findings as a contribution to the literature and practice, since the literature witnesses similar studies that have small samples. The reason behind having a low response rate is also explored, which is because of online databases and the websites of federations limiting number of respondents. The reliability of LinkedIn can be advocated too, since this social networking service made it possible to accurately reach all candidate respondents first hand.

4.6.5.3.Types of data analysis technique

It is clear that the existing sample size, predominantly, leads to choosing "the analytical techniques that can be used" to test hypothetical relationships (Reynolds *et al.*, 2003, p. 87). Whilst the sample size of the research is one of the determinants of selecting the most appropriate technique, it is also worth considering the structure of the constructs, model complexity and research objectives to ensure the reliability of the research findings found from the data analysis technique used (Peng and Lai, 2012). Literature offers different types of statistical analysis techniques, the most common ones being Structural Equation Modeling (SEM) and PLS (Hair *et al.*, 2010; Byrne, 2010).

SEM is "a statistical methodology that takes a confirmatory (i.e. hypothesis-testing) approach to the analysis of a structural theory bearing on some phenomenon"

(Byrne, 2010, p. 3). On the other hand, PLS is a statistical analysis technique that "focuses on explanation of variance (prediction of constructs) rather than covariance (explanation of relationships between items)" (Hair *et al.*, 2010, p. 775). In other words, while SEM puts emphasis on the confirmation of causalities between constructs, PLS is rather exploratory and clarifies overall variances in a conceptual model (Peng and Lai, 2012). There are an abundance of studies which employed the confirmation oriented SEM technique (e.g. He *et al.* (2013), Ramanathan and Muylderman (2010) and Ramanathan and Gunasekaran (2014)) while others relied upon the exploratory technique of PLS (e.g. Braunscheidel and Suresh (2009), Perols *et al.* (2013), Oh *et al.* (2012) and Sawhney (2013)).

Hence, before justifying the data analysis technique of the current research in the following chapter, it seems worthwhile to scrutinise these two techniques and to compare their strengths and weaknesses. One of the most favoured features of SEM is to rely on causalities among hypotheses, and then to evaluate the complete conceptual model at once. In doing so, it generates fit statistics for the researcher which are used to theoretically validate the conceptual model based on existing data (Byrne, 2010). Due to its parameter oriented feature, SEM is favoured in studies which are purely based upon well-known theories (Peng and Lai, 2012). By employing SEM, the researcher can test latent constructs that have multiple observed variables as well. It is beneficial for studies that are dependent upon experimental, non-experimental and cross-sectional as well as longitudinal data (Lei and Wu, 2007).

Nonetheless, it is limited when it comes to analysing conceptual models relying on a limited sample size (Peng and Lai, 2012). The most common rule of thumb for SEM is to have a minimum of 200 usable responses (Shah and Goldstein, 2006), and the essential sample size is more likely to increase based on the complexity of model. It is also restricted when it comes to analysing hypothetical relationships between constructs that have a limited number of measurement items. If, for instance, a construct is represented by one or two observed variables, SEM is not appropriate to analyse such causalities in conceptual models (Hair *et al.*, 2010). Because SEM needs a large sample size, conceptual models with high complexity require a large number of observations to validate hypotheses. This, in turn, reduces its utility for studies involving complex conceptual models (Peng and Lai, 2012; Hair *et al.*, 2010). Another shortcoming of SEM is relevant to the structure of constructs. If the conceptual model has formative constructs, SEM is not appropriate to estimate hypothetical relationships (Jarvis *et al.*, 2003). The logic behind this limitation is about the structure of formative items. In detail, while reflective constructs determine observed variables, formative constructs are, inversely, determined by formative items (Diamantopoulos and Winklhofer, 2001; Chin, 1998b). Therefore, employing SEM in such cases brings about zero covariance between constructs (MacCallum and Browne, 1993).

In response to these strengths and weakness of SEM, this research firstly has low sample size, 105, which is under the minimum threshold value of 200. This, in turn, represents the first obstacle of choosing SEM as a proper technique (Lei and Wu, 2007; Kline, 2005). Secondly, the conceptual model of the current research involves a construct evaluating the two foremost observed variables, which are to achieve long-term and accurate CF (please see the construct of *Collaborative Forecasting Performance* in Figure 3.1. The CF practice). SEM is merely capable of testing constructs that have a minimum of three or more observed variables, and this limitation represents the second obstacle with using SEM (Hair *et al.*, 2010). Thirdly, the literature does not suggest SEM if the conceptual model is highly complex as it requires a large number of observations (Peng and Lai, 2012). This research has both low sample size and aims to test thirteen different hypothetical relationships over ten constructs. It is therefore reasonable to claim that the conceptual model is too highly complex for the employment of SEM. If SEM is employed in such conditions, the model of this research is most likely to cause unacceptable results (Hox and Maas, 2001).

Finally, the hypothesised relationships in this research depend on a single formative construct, which aims to achieve long-term and accurate CF in the FSC. This formative construct, namely the CF practice, is formed by five variables (for detail please see, Chapter 5, Section 5.3. Development of a formative construct: The CF practice). Hence, its existence in the conceptual model engenders another significant limitation in using SEM (Vinzi *et al.,* 2010; Jarvis *et al.,* 2003; Chin, 1998a). While these shortcomings prevent the application of SEM for the current research, literature witnesses studies that applied PLS to validate conceptual models. For instance, when a study by Braunscheidel and Suresh (2009) aimed to increase the supply chain agility of manufacturers, the authors favoured PLS. Their response rate was 7.4 percent due to 218 usable responses. Despite the tolerable sample size, the authors preferred PLS to increase the trustworthiness of the complex conceptual model, involving twelve hypothetical relationships. Literature is also wealthy in similar studies favouring PLS as a proper technique (please see, e.g. Claassen *et al.* (2008), Oh *et al.* (2012) and Sawhney (2013)).

The sense behind applying PLS relies upon its feature, because it addresses "a wider range of problems given its ability to work efficiently with a much wider range of sample size and model complexity and its less strict assumptions about the underlying data" (Hair *et al.,* 2010, p. 777). It is essential to estimate the required sample size for only complex conceptual models. Literature, for instance, offers the "10 times" rule of thumb based on the number of formative items and / or endogenous variables in estimating the minimum sample size. This therefore hints at the necessity of a minimum of 70 usable responses for the conceptual model of this research (Peng and Lai, 2012; Chin, 1998a).

Whilst SEM is not appropriate to analyse constructs that have one or two observed variables, PLS, in contrast, is capable of evaluating hypothetical relationships between constructs having a limited number of observed items (Hair *et al.*, 2010). On the other hand, because SEM needs a large sample size to analyse complex conceptual models, the existence of thirteen different hypothetical relationships over ten constructs in the conceptual model of this research constitutes another drawback that limits the application of SEM. Finally, employing SEM for conceptual models having formative constructs engenders inadmissible results (Hox and Maas, 2001), but PLS is capable of testing conceptual models with formative constructs (Jarvis *et al.,* 2003; Diamantopoulos and Winklhofer, 2001).

Overall, this comparison clarifies that PLS is superior to SEM based on the existing sample size and the structure of the conceptual model in this research. Taking into account the preferences of prior studies in terms of techniques used to analyse their conceptual models also made it possible to underpin the suitability of PLS for this research. Because of this, PLS is considered as most suitable technique to analyse hypothetical relationships.

4.7. Summary

This chapter was dedicated to explaining the methodological foundation of the current research and justifying the data collection process in a rational and legitimate way. The initial intention here was to provide a clear understanding of the approach and epistemological paradigm of the current research. Therefore, the reasons behind adopting the deductive approach were discussed by considering the theoretical validations. Then, further clarification was brought to the philosophical stance.

By scrutinising the qualitative and quantitative research strategies, a clear understanding of their strengths and weaknesses was provided. This in turn provided a reasonable justification, as the aim and objectives of the current research were intended to be achieved by using the triangulation strategy. The research design was also scrutinised and portrayed, the intention being to construct a time-based plan that clarifies the research process in a logical and chronological way to answer the research questions. Rationale was also provided for the business oriented social networking service of LinkedIn used during the qualitative and quantitative collection processes.

In terms of the qualitative data collection process, it was aimed at elaborating the reasons for selecting the qualitative data collection methods of semi-structured interviews and online group discussions. The associated data analysis technique of QSR NVivo 9 was also discussed in an effort to provide further insight into its impact on the qualitative contributions. Following this, the outcomes of the qualitative data analysis process were conveyed to the reader in an unbiased manner. At the end of the qualitative data collection process, the research primarily developed valuable hypotheses that had the support of the literature and pragmatic views while finalising the form of the conceptual model made it possible to initiate the quantitative data collection process.

As far as the quantitative data collection process is considered, effort was made to clarify its significance in generalising research findings in the research field. Thereby, the quantitative data collection method of the survey questionnaire was justified based on theoretical procedures. Presenting 26 studies that employed this method beforehand was one justification for the reliability of the survey questionnaire as a quantitative data collection method of this research. Given the importance of survey questionnaire design in collecting accurate data, further attention was paid to understanding the survey design process, which proceeded under the guidelines of Churchill Jr, (1979) and Flynn *et al.* (1990).

In terms of the target population and sampling, the population of the research involved manufacturers from the UK and Ireland, North America and Europe, where they collaboratively forecasted time-sensitive and / or short-life product-groups with retailers. Thereby, it was ensured that the characteristics of the target population suit the research domain. In an attempt to select a rigorous sampling frame, this research benefited from a wide range of sources. The business oriented social networking service LinkedIn, for instance, was used to reinforce the sampling frame. The online databases of Bloomberg, FAME and Osiris provided a vast number of relevant candidates while the websites of relevant federations offered a considerable number of samples. By considering the personal contacts of the author, the sampling frame was similarly enlarged. This research then generated four selection criteria to be able to enhance the representativeness of the sampling frame. These criteria were based upon candidate respondents' (i) region, (ii) industry and (iii) the product-groups that their company provides to retailers as well as (iv) seniority level. At the end of the process, 5277 candidate respondents were listed in the sampling frame.

To collect quantitative data, the decision was made to reach the whole list of the sampling frame involving the 5277 candidate respondents acquired from LinkedIn, the online databases of Bloomberg, FEMA and Osiris, and the websites of food and beverage federations along with the personal contacts of the author. The data collection process was completed through four different stages with each stage proceeding in parallel to maintain the coherence of the data collection. The first data collection stage relied upon the LinkedIn-based candidates, which led to a 14.74 percent response rate. The second data collection stage focused on the online databases of Bloomberg, FEMA and Osiris. The research obtained only a 0.25 percent response rate for this stage.

The third data collection stage focused on the candidates found from the websites of food and beverage federations, in which the research captured a 1.84 percent response rate. The final data collection stage was dedicated to the personal contacts of the author, and this stage was completed with a 65 percent response rate. Overall, the research delivered survey questionnaires to all 5277 candidates that constituted the sampling frame. While 3430 surveys touched these candidates, 105 usable surveys were obtained which led to have a 3.06 percent response rate at the end of the data collection process.

The research obtained few usable samples and a small response rate. The decision was therefore made to assess the achievability of the usable samples and response rate based on three assumptions. These were to (i) consider the characteristics of the sample data, (ii) compare the sample size and response rate with prior studies, and (iii) analyse the features of candidate data analysis techniques to ensure that there is a rigid rationality between the sample size and data analysis technique selected. It is known that reflecting the characteristics of the population in the characteristics of sample data is heavily dependent upon the sampling technique used to select a sampling frame. Because the probability of stratified sampling technique led the research to select the sampling frame, the sampling frame criteria of the current research captured target regions, industries, time-sensitive and / or short-life product-groups as well as the seniority levels of candidate respondents.

Regarding the sample size and response rate of prior studies, the comparative analyses clarified that the research displayed a widespread effort to reach 5277 candidates while prior studies reached much fewer candidates. Although having a 3.06 percent response rate was considerably low, it was, more or less, in line with prior studies, as there are studies with a lower sample size that have extended the body of literature and provided implications to practice. Furthermore, analysing the features of the candidate data analysis techniques led the research to have clear wisdom that the proper data analysis technique is PLS, in which the rationale for this technique is further scrutinised in the following chapter.

CHAPTER 5: DATA ANALYSIS AND FINDINGS

5.1. Overview

Subsequent to Chapter 4, this chapter clarifies the data analysis procedures. The prior chapter addressed alternative data analysis techniques and intended to clarify the leading reasons for favouring the data analysis technique of PLS. Yet before explaining the data analysis procedures, this chapter gives a rationale for the employment of PLS based on theoretical and pragmatic assumptions. This justification aims to enhance the rigour of the data analysis process and to underpin the reasons behind the selection of PLS.

As the existence of a formative construct in the conceptual model, namely the CF practice, was stressed previously, the development of a new formative construct is likewise elucidated. The comprehensive survey design allowed the research to obtain descriptive information about the target population. Hence, the outcomes of descriptive statistics are presented to clarify the characteristics of the samples. Given the large number of non-respondents and small samples obtained during the data collection stages, non-respondent bias is also evaluated to ensure that the findings are unbiased. Accordingly, this chapter;

- Examines the measurement model for reflective constructs over the related procedures, comprising several reliability and validity analyses, to evaluate relations between constructs and their observed variables.
- Analyses the measurement model for the formative construct of the CF practice by considering related procedures to validate the relationships between the construct and its formative items.
- Explains multiple model fit techniques used to validate the conceptual model in PLS in an attempt to enhance the trustworthiness of the model and to generalise its practicability.

- Presents the hypothetical relationships in the model and describes their statistical correlations to extend existing knowledge for the forecasting and supply chain phenomena.
- Assesses the size of path coefficients between the constructs to shed light on the importance of constructs for managerial implications.

5.2. Rationale for using Partial least squares (PLS)

The PLS technique is an exploratory approach that weights observed variables of constructs to evaluate the degree to which one part of the conceptual model predicts another part of the model (Peng and Lai, 2012; Vinzi *et al.*, 2010). PLS has capabilities of plotting several dependent variables in the same model and evaluating all relationships synchronically. It explicitly distinguishes itself from several techniques by considering reflective and formative variables in the same model simultaneously (Grefen *et al.*, 2000). However, statistically, it follows a different route compared to the confirmatory technique of SEM (Chin, 1995). Like SEM, it does not estimate the maximum likelihood for optimum predictions; instead PLS evaluates variables of the model via bootstrapping (Byrne, 2010; Hair *et al.*, 2010). To ensure that PLS is the appropriate technique within the existing conditions of the current research, the four rigour assumptions of Peng and Lai (2012) were taken into account. These assumptions involve (i) exploratory research objectives, (ii) small sample size and the complexity of the conceptual model and (iii) the properties of existing data, and (iv) the existence of formative constructs in the model.

Firstly, due to the scarcity of empirical studies involving the CF of manufacturers in the FSC (Småros, 2007), this research is designed to explore the degree to which factors from different research themes are associated with the performance of CF in dyadic manufacturer-retailer collaborations. The research was particularly extended to manufacturers' CF when they collaboratively forecast perishable, seasonal, promotional and newly launched products with retailers. This outlook enabled the research to explore concrete and precise outcomes over the research themes of supply chain integration, forecasting process and information sharing. With the combination of systemic review, qualitative data and grey literature, several exogenous variables were hypothesised to clarify the predictive power of relevant endogenous variables. In this regard, these hypothetical relationships match the requirements of the PLS technique (Lohmöller, 1989).

The reason behind this justification is that whilst SEM is appropriate to confirm how existing data fits the theory as the representative of the population, this research further adds insight to the relationships of a broad range of theoretical constructs, necessitating the PLS technique (please see, e.g. Cheung *et al.* (2010)). Supporting this, Peng and Lai (2012, p. 469) recommend that "if the nomological network has not been well understood and researchers are trying to explore relationships among theoretical constructs and to assess the predictive validity of the exogenous variables, then PLS can be considered". Therefore, this evidence underpins the research to validate the first assumption of Peng and Lai (2012).

Secondly, the statistical power and reliability of findings in SEM rely heavily on a large sample size (Shah and Goldstein, 2006). For SEM, the literature recommends a minimum of 200 observations (Lei and Wu, 2007; Kline, 2005), and suggests having a sample size from 5 to 20 times of the number of observed items (Tanaka, 1987; Bentler and Chou, 1987). On the other hand, the "10 times" rule of thumb is offered for PLS to estimate the required sample size (Peng and Lai, 2012; Chin, 1998a). According to this rule, the numbers of formative items and / or endogenous variables are considered. This research has five formative items, representing the CF practice, and seven dependent variables along with overall forty-six observed variables. In the worst case of considering the number of dependent variables, existing assets oblige the research to have a minimum of 70 (e.g. 7 x 10) usable samples to be able to take advantage of PLS. This requisite clearly matches the existing sample size of 105. However, when it comes to employing SEM based on the structure of the conceptual model, the sample size had to be 230 to 930 (e.g. 46 x 5 to 46 x 20). Accordingly, these procedures clearly suggest that PLS is the most appropriate technique to analyse the conceptual model of the current research.

Regarding the complexity of the conceptual model including multiple endogenous variables, PLS seems more appropriate for data analysis, since such a complexity causes additional model identification and convergence issues for SEM, and this in turn requires larger sample size (Peng and Lai, 2012). In detail, this research intended to test thirteen different hypothetical relationships over ten constructs. Favouring SEM in the existing situation of research gives rise to have unacceptable results (Hox and Maas, 2001). On the other hand, the repetitive feature of PLS makes it possible to analyse mediations and several dependent variables in a single model by separately analysing measurement models over path coefficients and factor loadings. This feature favours the PLS technique with a sufficient sample size (Peng and Lai, 2012; Helm *et al.,* 2010). It is worth remembering the study by Braunscheidel and Suresh (2009), who preferred PLS to increase the reliability of a conceptual model involving twelve hypothetical relationships.

In terms of observed variables, minimum four and maximum seven items represented each construct to ensure that there are a sufficient number of items capturing the value of each construct as was suggested by Churchill Jr, (1979). Using a large number of observed variables for each construct reduced the sample size, since the time required for respondents to complete the survey increased. However, it reduced bias in terms of estimating the strength of reflective constructs and underpinned the choice of PLS (Peng and Lai, 2012). This is also another supportive determinant because having a large number of observed variables in the survey enables the research to increase the reliability of PLS results, which is an important matter of generalising results for the target population.

Thirdly, it is clear that the existing data for SEM should have multivariate normal distribution. If not, it causes errors and increases fit statistics in models (MacCallum *et al.,* 1992). Due to the regression based feature of PLS, without assuming the population and scale of measurement it evaluates nominal, ordinal and interval variables (Peng and Lai, 2012; Fornell and Bookstein, 1982). Given the five-point Likert-type scales employed for the survey questionnaire, the scales in this research already comprise only nominal and ordinal variables. Therefore, PLS is more appropriate for sustainable data analysis, confirming the third assumption of Peng and Lai (2012).

Finally, due to the lack of capability of SEM to test structural models that have formative constructs, PLS is more effective for data analysis (Peng and Lai, 2012). SEM indicates zero covariance between indicators (MacCallum and Browne, 1993), but ordinary least squares analyses in PLS make it possible to identify iterative models. This feature makes PLS superior to SEM in analysing models that have both reflective and formative constructs (Vinzi *et al.,* 2010; Chin, 1998b; 1998a). This is because the literature offers PLS if the structural model includes formative constructs (Diamantopoulos and Winklhofer, 2001). Given the fact that this research has a formative construct, it is essential to employ PLS to be able analyse hypothetical relationships in an accurate manner. These analyses therefore validate the final assumption of Peng and Lai (2012). The following section justifies the development of the formative construct: The CF practice.

5.3. Development of a formative construct: The CF practice

The CF practice was defined based upon five different formative items that capture its entire aspect and represent major preconditions for the long-term and accurate CF in the FSC. These formative items are trust, commitment and a joint business plan as well as consensus-based internal forecasts along with the sharing of order forecasts. The logic behind developing the CF practice and selecting these formative items from the literature were clarified in *Section 3.2.1. The CF practice*. Thus, this section aims to give theoretical validation to the formative structure of the CF practice.

Because these five items earned the support of both literature and qualitative data, they underpin the content validity of CF. They also became the representative of the CF practice in the survey. During the development of the survey and pilot-tests, four academics and four practitioners examined each item, which led to validating their theoretical and practical feasibility as was suggested by Andreev *et al.* (2009). There is a broad range of misspecification for formative constructs in operations management and information systems research (Roberts *et al.,* 2010; Petter *et al.,* 2007) that cause Type I or II errors. To be able to provide a theoretical definition for the CF practice, this research adopts the four criteria of Jarvis *et al.* (2003). These criteria are (i) direction of causality from items to construct, (ii) unnecessary interchangeability of items, (iii) unnecessary covariation among the indicators, and (iv) different nomological net of the indicators.

Firstly, the formative construct of the CF practice was defined by combinations of trust, commitment and joint business plan as well as consensus-based internal forecasts along with the sharing of order forecasts. Initially, the outcomes of the systematic review enabled the research to explore these items as vital determinants for CF. This first step explains that these items emerged from the literature (Diamantopoulos and Winklhofer, 2001). These items were also underpinned by the single semi-structured interview, three online group discussions and the review of grey literature. The CF practice in this research is defined as a "*trust and commitment based collaborative forecasting practice which links the business plans of partners who generate consensus-based internal forecasts and share order forecasts with each other*". This definition suggests that each item is essential to take advantage of the CF practice. In other words, without having any one of these items it is not possible to constitute the CF practice (Chin, 1998b).

While reflective constructs determine observed variables, formative constructs, in contrast, are determined by observed formative variables (Peng and Lai, 2012). To put it another way, "for formative measurement models, the direction of causality flows from the measures to the construct, and it flows from the construct to the measures for reflective measurement models" (Jarvis *et al.*, 2003, p. 203). Given the definition and structure of the CF practice, potential changes in any one of these items cause changes to the structure of CF but not vice versa. This approach clearly shows that the direction of causality in this construct is from the associated five items to the CF practice. Therefore, each item has an impact on the implementation of the CF practice (Diamantopoulos and Winklhofer, 2001). This outcome accordingly validates the first criterion of Jarvis *et al.* (2003).

Secondly, the CF practice is comprised of five different items, and each item adds its own unique characteristics to the domain of this construct. The unification of these diverse characteristics then constitutes the main aspect of the CF practice. Due to the distinguishing feature of these formative items that have consensus with each other, they are not interchangeable (Bollen and Lennox, 1991). Each formative item adds a different aspect to the formative construct and dropping an item varies the entire scope of the CF practice (Petter *et al.*, 2007; Jarvis *et al.*, 2003). This is because retaining all formative items of CF in the model is vital to assess its strength and to reduce the risk of distorting its scope (Diamantopoulos and Winklhofer, 2001; Chin, 1998b).

While the necessity of a joint business plan, for instance, enables manufacturers to follow a single path with retailers through the forecast collaboration, trust, on the other hand, focuses on building reliable and confidential relations with each other. The existence of commitment then makes it possible to ensure the relational continuity in CF. When the requisite of consensus-based internal forecasts obliges manufacturers to generate a single forecast, having the full support of related departments, the sharing of order forecasts implies the necessity of sharing order forecasts with retailers. In other words, each item provides completely different treatment to the CF practice and its structure, therefore, supports the second criterion of Jarvis *et al.* (2003).

Thirdly, a change in a relevant item of a reflective construct is expected to be associated with a change in all other items reflecting the same construct (Peng and Lai, 2012). In other words, any changes that occur to a reflective item is expected to cause changes to another reflective item that belongs to the same reflective construct (Petter *et al.*, 2007). Considering the formative items for the CF practice, the value of trust, commitment, and joint business plan as well as other formative items are not necessarily to be attributed to each other. This is because the value of formative items is independent, and they are not essential to be correlated with each other when they determine the same formative construct (Jarvis *et al.*, 2003). If the value of trust, for instance, changes, it does not necessarily mean that the value of generating consensus-based internal forecasts will be influenced in the model. This approach further clarifies that each formative item of the CF practice has a distinguished feature forming the construct, hence there is not an influential relationship between these formative items, unlike reflective items. In consequence, the CF practice is a formative construct in the model, and confirms the third criterion of Jarvis *et al.* (2003).

Finally, due to the different aspect of trust, commitment and other formative items, they are not interchangeable. Hence, they are not expected to have similar antecedents, unlike reflective items sharing a common theme of the relevant construct (Jarvis *et al.*, 2003). This implies that formative items can be related either negatively or positively in the construct, which feature makes the internal consistency redundant for the CF practice (Diamantopoulos and Winklhofer, 2001). Accordingly, each formative item is likely to show a different impact on the CF practice. For instance, whilst one formative item can positively influence the CF practice, another item can show a negative impact on it. This independency adds further insight to the diverse dimensions of formative items constituting the domain of the formative construct in this research. As a result, the different nomological indicators of CF practice validate its formative structure in the model based on the final criterion of Jarvis *et al.* (2003).

In summary, the four criteria of Jarvis *et al.* (2003) support the form of the CF practice. It is worth recalling that the aim of this research is to enhance the long-term and accurate CF when manufacturers collaboratively forecast perishable, seasonal, and promotional as well as newly launched products. This is because the CF practice is symbolised by two reflective items of long-term and accurate CF. These items were posited as the primary hypotheses of the research under the reflective construct of *Collaborative Forecasting Performance*. The underlying reasons for positing these items as hypotheses are not only to theoretically validate the structure of the CF practice (Bollen, 1989), but also to conceptually interpret the model over Multiple Indicators and Multiple Causes (MIMIC) or two-construct models that are applied to test the reliability of the model in PLS (Diamantopoulos *et al.*, 2008; Jarvis *et al.*, 2003; Diamantopoulos and Winklhofer, 2001). The following section presents the results of descriptive statistics and provides considerable insights to the characteristics of research samples.

5.4. Descriptive statistics

Descriptive information of the research samples involves the position of respondents, manufacturing companies' number of years in operation, region, number of employees and annual sales volume. Outcomes of descriptive statistics are presented in Table 5.1. In terms of respondents, the response sample included "Supply Chain / Logistics Managers" (25.7 percent) and "Forecaster / Forecast Analyst / Forecast Manager" (22.9 percent), followed by "Marketing / Sales Managers", "Production Managers" and "Finance Managers". Interestingly, a considerable number of respondents also responded to the survey from the "Others" category (25.7 percent). This category involved respondents who were of C-level executives, Operations and Managing Directors, and Head of Supply Chain and Forecasting along with General Managers. Based on different types of questions that were asked in the survey, it is reasonable to argue that reliable information was collected due to a sufficient level of seniority with regard to respondents (Phillips, 1981).

When 48.6 percent of manufacturers were more than 50 years in operation, manufacturers from Southern Europe (25.7 percent) and the UK & Ireland (24.8 percent) led the survey while the contribution of manufacturers from North America (21.9 percent) was considerably important. Following this, 31.4 percent of manufacturers had 100 to 999 employees while companies employing 10000 employees and over (19 percent) and 1000 to 4999 employees (18.1 percent) provided additional insight to the survey. Annual sales volume was £ 100 to £ 499.9 million by 21.9 percent of manufacturers, followed by 21 percent having annual sales volume of £20 to £99.9 million.

Table 5.1. Results of descriptive statistics

Position of respondents	**Frequency**	**Percentage**
Forecaster / Forecast Analyst / Forecast Manager	24	22.9
Marketing / Sales Manager	17	16.2
Supply chain / Logistics Manager	27	25.7
Production Manager	9	8.6
Finance Manager	1	1
Other	27	25.7
Total:	**105**	**100 percent**
Number of years in operation	**Frequency**	**Percentage**
Less than 5 years	6	5.7
5 to 10 years	7	6.7
11 to 20 years	16	15.2
21 to 50 years	25	23.8
More than 50 years	51	48.6
Total:	**105**	**100 percent**
Region of Manufacturers	**Frequency**	**Percentage**
United Kingdom & Ireland	26	24.8
North America (The USA and Canada)	23	21.9
Eastern Europe (Belarus, Bulgaria, Czech Republic, Hungary, Moldova, Poland, Romania, Russian Federation, Slovakia, Ukraine)	10	9.5
Northern Europe (Denmark, Faroe Islands and Greenland, Estonia, Finland, Iceland, Latvia, Lithuania, Norway, Sweden)	9	8.6
Southern Europe (Albania, Andorra, Bosnia and Herzegovina, Croatia, Cyprus, Greece, Italy, Malta, Montenegro, Portugal, San Marino, Serbia, Slovenia, Spain, Turkey)	27	25.7
Western Europe (Austria, Belgium, France, Germany, Liechtenstein, Luxembourg, Monaco, Netherlands, Switzerland)	10	9.5
Total:	**105**	**100 percent**
Number of employees	**Frequency**	**Percentage**
Under 20 employees	12	11.4
20 to 99 employees	15	14.3
100 to 999 employees	33	31.4
1000 to 4999 employees	19	18.1
5000 to 9999 employees	6	5.7
10000 employees and over	20	19
Total:	**105**	**100 percent**
Annual sales volume	**Frequency**	**Percentage**
Under (£20 - $30 - €23) million	19	18.1
(£20 - $30 - €23) to (£99.9 - $150.9 - €115.9) million	22	21
(£100 - $151 - €116) to (£499.9 - $755.9 - €578.9) million	23	21.9
(£500 - $756 - €579) to (£999.9 - $1511.9 - €1157.9) million	7	6.7
(£1 - $1.1512 - €1.158) to (£4.99 - $7.49 - €5.79) billion	16	15.2
(£5 - $7.5 - €5.8) billion and over	18	17.1
Total:	**105**	**100 percent**

It seems that the survey predominantly attracted the interest of mature companies operating in the market for a long-time, such as 50 years or more. Even companies within the developing position (e.g. 5 to 20 years) showed their desire to CF, and these manufacturers participate in the UK & Ireland, North America and Southern Europe. Comparing these implications with the annual sales volume of companies, the maturity of companies in the market did not seem to be in parallel with their annual sales, most of which were £ 100 and £ 499.9 million. Given the number of employees, mature companies appeared not to prefer employing large number employees as the survey largely witnessed manufacturers employing 100 to 999 employees, followed by larger manufactures employing 1000 to 4999 employees.

In terms of product-groups, 55.2 percent of manufacturers continually provided perishable products to retailers while 38.1 percent sometimes considered seasonal products in CF. While 41.9 percent of manufacturers occasionally considered promotional products, the collaboration of 23.8 percent relied predominantly upon promotional products in addition to 17.1 percent that frequently took into account this product-group in their CF with retailers. Similar to perishable products, newly launched products were sporadically subjected to collaborations by 37.1 percent of manufacturers while this product-group always became subject to CF by 25.7 percent, but 21 percent mostly collaborated with retailers by considering newly launched products. Frequency level of product-groups in terms of being subject to CF is presented in Table 5.2.

Table 5.2. Frequency level of product-groups considered in CF

Product-Groups	Frequency level of product-groups that manufacturers provide to retailers					
	Always	**Most of the time**	**Sometimes**	**Rarely**	**Never**	**Total**
Perishable products	58	9	9	9	20	105
	55.2	8.6	8.6	8.6	19	100 percent
Seasonal products	17	16	40	18	14	105
	16.2	15.2	38.1	17.1	13.3	100 percent
Promotional products	25	18	44	13	5	105
	23.8	17.1	41.9	12.4	4.8	100 percent
Newly launched products	27	22	39	15	2	105
	25.7	21	37.1	14.3	1.9	100 percent

The research compared the region of manufacturing companies to have a clear understanding of which product-groups and to what extent subject to their CF in different regions. The underlying reason for this comparison was to add further insight to the region based characteristics of companies and to increase the attention of researchers in dedicating further research to particular product-groups in specific regions. In this regard, the Chi-Square statistics clarified that, excluding perishable products, there is not a significant difference between regions, where manufacturers collaboratively forecast associated product-groups with retailers.

Results of Chi-Square statistics are presented in Table 5.3. Statistical tests show that there is no difference between manufacturers located in different regions when their CF focuses on to seasonal, promotional and newly launched products. Interestingly, the consideration of perishable products in CF is shown to be significantly different between regions. Table 5.4. presents more detailed information with regard to the frequency level of product-groups being subject to manufacturers' CF practices in different regions.

Table 5.3. Chi-Square tests of product-groups in different regions

Product-groups	Related values	Value	df	Asymp. Sig. (2-sided)
Perishable products	Pearson Chi-Square	32.692	20	**.036**
	Likelihood Ratio	31.380	20	.050
	Linear-by-Linear Association	.258	1	.611
	N of Valid Cases	105		
Seasonal products	Pearson Chi-Square	26.703	20	**.144**
	Likelihood Ratio	34.094	20	.025
	Linear-by-Linear Association	3.296	1	.069
	N of Valid Cases	105		
Promotional products	Pearson Chi-Square	26.882	20	**.139**
	Likelihood Ratio	29.728	20	.074
	Linear-by-Linear Association	3.216	1	.073
	N of Valid Cases	105		
Newly launched products	Pearson Chi-Square	21.421	20	**.373**
	Likelihood Ratio	23.337	20	.273
	Linear-by-Linear Association	4.493	1	.034
	N of Valid Cases	105		

A wide range of manufacturers from Western Europe (70 percent) and the UK & Ireland (69.2 percent) constantly considered perishable products in CF with retailers. In a similar vein, for manufacturers from North America (60.9 percent) and Southern Europe (59.3 percent), CF was based largely upon perishable products. It is interesting that 44.4 percent of manufacturers in Northern Europe did not consider perishable products when 40 percent of manufacturers from Eastern Europe rarely took into account perishable products in their CF. It is apparent that responses from Northern and Eastern Europe are not sufficient. Yet there is still an intriguing dilemma about why manufacturers in these regions do not allocate adequate time for CF in forecasting perishable products along with retailers.

Table 5.4. Frequency level of product-groups considered in different regions

		Regions												
		United Kingdom & Ireland		North America		Eastern Europe		Northern Europe		Southern Europe		Western Europe		Total
Product-groups	**Frequency**	**No**	**percent**	**No**	**percent**	**No**	**percent**	**No**	**percent**	**No**	**percent**	**No**	**percent**	
Perishable products	**Never**	3	11.5	4	17.4	3	30	4	44.4	4	14.8	2	20	20
	Rarely	1	3.8	1	4.3	4	40	1	11.1	2	7.4	0	0	9
	Sometimes	2	7.7	3	13.0	2	20	0	0.0	2	7.4	0	0	9
	Most of the Time	2	7.7	1	4.3	0	0	2	22.2	3	11.1	1	10	9
	Always	18	69.2	14	60.9	1	10	2	22.2	16	59.3	7	70	58
Total		**26**	**100**	**23**	**100**	**10**	**100**	**9**	**100**	**27**	**100**	**10**	**100**	**105**
Seasonal products	**Never**	3	11.5	2	8.7	1	10	2	22.2	6	22.2	0	0	14
	Rarely	3	11.5	0	0	4	40	0	0	8	29.6	3	30	18
	Sometimes	12	46.2	10	43.5	2	20	3	33.3	9	33.3	4	40	40
	Most of the Time	4	15.4	6	26.1	0	0	2	22.2	3	11.1	1	10	16
	Always	4	15.4	5	21.7	3	30	2	22.2	1	3.7	2	20	17
Total		**26**	**100**	**23**	**100**	**10**	**100**	**9**	**100**	**27**	**100**	**10**	**100**	**105**
Promotional products	**Never**	1	3.8	3	13.0	1	10	0	0	0	0	0	0	5
	Rarely	2	7.7	1	4.3	1	10	1	11.1	7	25.9	1	10	13
	Sometimes	11	42.3	7	30.4	3	30	5	55.6	12	44.4	6	60	44
	Most of the Time	2	7.7	5	21.7	1	10	2	22.2	7	25.9	1	10	18
	Always	10	38.5	7	30.4	4	40	1	11.1	1	3.7	2	20	25
Total		**26**	**100**	**23**	**100**	**10**	**100**	**9**	**100**	**27**	**100**	**10**	**100**	**105**
Newly launched products	**Never**	1	3.8	0	0	0	0	0	0	0	0	1	10	2
	Rarely	4	15.4	3	13	1	10	2	22.2	5	18.5	0	0	15
	Sometimes	6	23.1	6	26.1	5	50	2	22.2	15	55.6	5	50	39
	Most of the Time	5	19.2	6	26.1	1	10	3	33.3	5	18.5	2	20	22
	Always	10	38.5	8	34.8	3	30	2	22.2	2	7.4	2	20	27
Total		**26**	**100**	**23**	**100**	**10**	**100**	**9**	**100**	**27**	**100**	**10**	**100**	**105**

Regarding the seasonal products, 30 percent of manufacturers from Eastern Europe continuously focused on the seasonal products in their CF. Similarly Northern Europe (22.2 percent), North America (21.7 percent) and Western Europe (20 percent) based manufacturers largely improved their collaborative forecasts with retailers for seasonal products. On the other hand, only 15.4 percent of manufacturers from the UK & Ireland continually improved CF with retailers over the seasonal products, and the attention of 46.2 percent was at the moderate level in collaboratively forecasting these products. The 43.5 percent of manufacturers from North America likewise adopted a similar approach and did not pay high attention to seasonal products in CF. Compared to perishable products, manufacturers located in the UK & Ireland, North America, and Western Europe as well as Southern Europe did not favour seasonable products. They predominantly intended to improve collaborations with retailers by considering perishable products, instead of seasonal products.

Of the promotional products, Eastern Europe based manufacturers put more effort into collaborations compared with manufacturers from other regions, as 40 percent always built their CF over promotional products, like seasonal products. 38.5 and 30.4 percent of manufacturers from the UK & Ireland and North America respectively conducted CF with retailers over this product-group regularly. The interest of manufacturers from other regions was at the moderate level in terms of collaboratively forecasting promotional products. Even though there is not a significant difference between the regions of manufacturers, it seems that manufacturers from Eastern Europe (40 percent), the UK & Ireland (38.5 percent) and North America (30.4 percent) put more emphasis on collaborations in forecasting promotional products. It is worth stressing that the UK & Ireland based manufacturers did not pay sufficient attention to seasonal products, yet promotional and / or newly launched products attracted their interest in CF. Hence, it seems promising to dedicate further research to these manufacturers when seasonal, promotional and newly launched products are the subject of their CF in the UK & Ireland.

Like promotional products, 38.5 percent of manufacturers from the UK & Ireland took the leading position by constantly collaborating with retailers over the newly launched products. Manufacturers from North America (34.8 percent) and Eastern Europe (30 percent) also followed a similar vision for collaboratively forecasting newly launched products along with retailers. While 33.3 percent of companies from Northern Europe infrequently considered newly launched products in CF, the rest of manufacturers' interest in other regions was at the moderate level for the CF of this product-group. Manufacturers from Northern Europe and Northern America paid closer attention to newly launched products in CF compared to promotions, yet further interest was shown to promotional products in the CF of manufacturers located in Eastern Europe.

Overall, these results suggest that the CF of manufacturers from Eastern Europe focuses largely on promotional, seasonal and newly launched products. Perishable products seem to be the favour of CF in all regions excluding Eastern and Northern Europe. In addition to Eastern Europe, a wide range of manufacturers from the UK & Ireland and North America conduct CF based upon promotions. Interestingly, manufacturers in the UK & Ireland show a rising interest in promotional and newly launched products while these manufacturers do not pay a similar attention to seasonal products in CF.

5.5. Non-response bias

Taking into consideration the widespread effort made to reach a large number of respondents, only 105 usable responses were obtained. To evaluate late response bias, this research compared early and late responses by considering manufacturers' number of years in operation, region, and annual sales volume as well as number of employees along with respondents' position. Independent T-test statistics were employed to reveal potential bias between pre-test group (N: 80) and the final group (N: 25), which was obtained after the reminder of emails for the completion of the survey questionnaire (Armstrong and Overton, 1977). As is presented in Table 5.5, results show that there is not a significant difference between early and late responses in this research. Therefore, it can be advocated that the contributions of this research that are based on existing samples are bias free, and reflect the characteristics of the samples in an objective manner.

Table 5.5. Independent T-statistics for non-response bias

Nominal variables of the survey		Levene's Test for Equality of Variances		T-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95 percent Confidence Interval of the Difference	
									Lower	Upper
Number of years in operation	Equal variances assumed	.016	.898	.136	103	.892	.037	.275	-.509	.584
	Equal variances not assumed			.137	40.599	.892	.037	.274	-.515	.590
Region	Equal variances assumed	10.068	.002	-2.323	103	.022	-.930	.400	-1.724	-.136
	Equal variances not assumed			-2.754	55.646	.008	-.930	.338	-1.607	-.253
Annual sales volume	Equal variances assumed	.562	.455	.763	103	.447	.308	.403	-.492	1.107
	Equal variances not assumed			.757	39.705	.453	.308	.406	-.513	1.128
Number of employees	Equal variances assumed	.833	.364	1.217	103	.226	.440	.362	-.277	1.157
	Equal variances not assumed			1.234	41.078	.224	.440	.357	-.280	1.160
Respondent position	Equal variances assumed	2.115	.149	.419	103	.676	.180	.429	-.671	1.031
	Equal variances not assumed			.391	36.235	.698	.180	.460	-.754	1.114

5.6. Measurement model for reflective constructs

In PLS, good model fit is established over path coefficients, high value of R^2 and internal consistency, which is also known as construct reliability and should be above 0.7 for each reflective construct (Gefen *et al.*, 2000). Through the review of the methodological literature, this research distilled the reliability and validity analysis procedures to evaluate the measurement model for reflective constructs in PLS. To provide further clarification for these analysis procedures, their definitions, threshold parameters and the outcomes of analyses are presented in Table 5.6.

Table 5.6. Analysis procedures for reflective constructs in the measurement model

Procedures		Definition	Threshold parameter and value	Validated (Yes /No)	Relevant references
Construct reliability	Reliability coefficient	It evaluates the correlation between the scores of observed variables for the internal consistency of a construct	*****Cronbach's $\alpha \geq 0.7$ (for existing scales) *****Cronbach's $\alpha \geq 0.6$ (for new scales)	Yes	Fornell and Larcker (1981); Götz (2010); Hair *et al.* (2010); Nunnally (1978)
	Composite reliability	It evaluates whether or not observed variables commonly measure the relevant construct	Composite reliability ≥ 0.7	Yes	Braunscheidel and Suresh (2009); Bogazzi and Yi (1988); Chin (1998b); Hair *et al.* (2010); Gefen *et al.* (2000)
Construct validity	Content validity	It determines how well observed variables represent the main aspect of relevant construct	*Reflective items were developed through the systematic review, and then verified by the qualitative data and grey literature *****Each item was reviewed and confirmed by four academics and four practitioners	Yes	Andreev *et al.* (2009); Braunscheidel and Suresh (2009); Bollen and Lennox (1991b); Chin and Gopal (1995); Cohen *et al.* (1990); Götz *et al.* (2010); Peng and Lai (2012); Vinzi *et al.* (2010)
	Convergent validity	It shows how well the observed items converge or load together as the representative of relevant constructs	*****Average Variance Extracted (AVE) ≥ 0.5 *****The loading values of observed variables ≥ 0.7	Yes	Braunscheidel and Suresh (2009); Chin (1998b); Duarte and Raposo (2010); Fornell and Larcker (1981); Götz *et al.* (2010); Peng and Lai (2012); Peter (1981); Rodgers and Pavlou (2003); Vinzi *et al.* (2010)
	Discriminant validity	It helps to clarify dissimilarities among a set of items, representing different constructs	*****The square root of AVE > the correlations between latent variables	Yes	Chin (1998b); Braunscheidel and Suresh (2009); Götz *et al.* (2010); Hulland (1999); Fornell and Larcker (1981); Peng and Lai (2012)

Source: *Developed by the author*

For the construct reliability of measurement model, the measures of reliability coefficient and composite reliability were taken into account (Peng and Lai, 2012). Cronbach's α is the most commonly used reliability coefficient that determines the degree to which a group of observed variables evaluates the relevant constructs (Götz *et al.*, 2010). The α value should be minimum 0.7 for existing scales and 0.6 for new scales (Hair *et al.*, 2010; Nunnally, 1978). As is shown in Table 5.7, the α values of reflective constructs are bigger than 0.7 while the α value for newly developed *Collaborative Forecasting Performance* and *Forecast Satisfaction* constructs are greater than 0.6, supporting the reliability coefficient of the measurement model.

Unlike Cronbach's α, composite reliability does not consider equally weighted measures which make the α value the lower bound criterion for reliability (Braunscheidel and Suresh, 2009).The literature suggests the threshold value of 0.7 (Gefen *et al.,* 2000; Chin, 1998b), but values over 0.6 are also presumed acceptable by some authors (Bagozzi and Yi, 1988). In the conceptual model of this research, all constructs have 0.7 values for composite reliability, and the results therefore underpin the internal consistency of the model.

Table 5.7. Results of reliability analysis

Latent variables / constructs	Cronbach's α	Composite reliability	Average Variance Extracted (AVE)
The CF practice	-	-	-
Collaborative Forecasting Performance	0.6394	0.8471	0.7348
External Integration	0.7831	0.8595	0.6051
Forecast Horizon	0.8881	0.9069	0.6618
Forecast Satisfaction	0.8034	0.8722	0.6315
Forecasters' Competence	0.9445	0.9549	0.7523
Group Forecasting	0.9042	0.929	0.7241
Internal Integration	0.8085	0.8747	0.6363
Information Quality	0.9457	0.956	0.757
Information Types	0.8029	0.8707	0.6286
Threshold values	**Cronbach's α ≥ 0.7(for existing scales) and 0.6 (for new scales); Composite reliability ≥ 0.7; AVE ≥ 0.5**		

Construct validity was analysed by considering the content validity, convergent validity and discriminant validity (Braunscheidel and Suresh, 2009). Content validity determines how well observed variables represent the main aspect of the relevant constructs (Götz *et al.*,2010). The reflective items of the survey emerged from the systematic review, and then earned the support of the single semi-structured interview, three online group discussions and grey literature respectively. Four academics and four practitioners from the food industry then examined the scales of the questionnaire to ensure its structure, readability, ambiguity and completeness (Dillman, 1978). Academics focused on observed variables to ensure that they theoretically represent the related constructs. Practitioners, on the other hand, guaranteed the perception of constructs and associated variables in practice. Validating the rigour of the survey by academics and practitioners independently further strengthened the structure of the survey (Peng and Lai, 2012; Andreev *et al.*, 2009). Hence, this approach justifies the content validity of reflective constructs in the model.

Convergent validity shows how well the observed variables converge on the relevant constructs. It is measured by either considering Average Variance Extracted (AVE) or the loading values of observed variables, which should be greater than 0.7 (Peng and Lai, 2012; Götz *et al.*,2010). The AVE values need to be above 0.5 (Chin, 1998b; Fornell and Larcker, 1981). In other words, 50 percent or more variance should be explained by a set of observed variables representing the related construct for acceptable convergent validity. As is shown in Table 5.7, The AVE values of each reflective construct exceed the threshold value of 0.5. In addition, although Chin (1998b) accepts the lower bound of 0.5 and / or 0.6 for newly developed scales, like *Collaborative Forecasting Performance* and *Forecast Satisfaction*, the loading values of reflective items in this research are greater than 0.7 (please see Table 5.9). Accordingly, these results show that the scales of this research has robust reliability.

Finally, to clarify dissimilarities among a different set of items, representing different constructs, it is essential to measure discriminant validity (Hulland, 1999). If the square root of AVE is greater than the correlations between latent variables, discriminant validity is hold (Chin, 1998b; Fornell and Larcker, 1981). Table 5.8 shows that the square root of AVE for all reflective constructs is bigger than the correlation between the scores of constructs in terms of its related row and column values. This indicates that the variance shared between the construct and its relevant items is greater than other latent variables in the conceptual model, supporting the discriminant validity of the model.

Table 5.8. Results of discriminant validity

	The CF practice	**Collaborative Forecasting Performance**	**External Integration**	**Forecast Horizon**	**Forecast Satisfaction**	**Forecasters' Competence**	**Group Forecasting**	**Internal Integration**	**Information Quality**	**Information Types**
The CF practice	-									
Collaborative Forecasting Performance	0.714	**<u>0.857205</u>**								
External Integration	0.6826	0.5378	**<u>0.777882</u>**							
Forecast Horizon	-0.1263	-0.1443	-0.2297	**<u>0.813511</u>**						
Forecast Satisfaction	0.5141	0.2859	0.2657	-0.1903	**<u>0.79467</u>**					
Forecasters' Competence	0.5728	0.4048	0.3955	-0.203	0.2488	**<u>0.867352</u>**				
Group Forecasting	0.6365	0.5202	0.3923	-0.1399	0.2783	0.7015	**<u>0.850941</u>**			
Internal Integration	0.6676	0.4732	0.5822	-0.31	0.357	0.4335	0.4442	**<u>0.797684</u>**		
Information Quality	0.5813	0.3563	0.596	-0.1349	0.1313	0.3235	0.3521	0.4473	**<u>0.870057</u>**	
Information Types	0.5821	0.4298	0.3918	0.044	0.3381	0.2911	0.4759	0.2736	0.5463	**<u>0.792843</u>**

Square root of AVE: on diagonal in bold and underlined format

Table 5.9. Constructs and measurement items

Codes	Constructs and items	Item weights	Item loadings	Mean	Median	Std. Dev.
	The CF practice (Formative Construct)	5: Strongly Agree, 4: Agree, 3: Neither Agree nor Disagree, 2: Disagree 1: Strongly Disagree				
CF_3	Trust	**0.2383**	0.5324	3.88	4.00	0.958
CF_4	Commitment	**-0.0711**	0.4934	4.13	4.00	0.921
CF_5	Joint business plan	**0.4564**	0.8207	3.45	4.00	1.160
CF_6	Satisfaction from internally estimated forecasts	**0.5196**	0.7187	3.09	3.00	1.093
CF_7	Sharing of order forecasts	5: Always, 4: Most of the Time, 3: Sometimes, 2: Rarely, 1: Never				
		0.2738	0.585	3.24	3.00	1.148
	Collaborative Forecasting Performance	5: Strongly Agree, 4: Agree, 3: Neither Agree nor Disagree, 2: Disagree 1: Strongly Disagree				
CF_1	Long-term collaborative forecasting	0.5658	**0.848**	2.94	3.00	1.216
CF_2	Accurate collaborative forecasting	0.6004	**0.8663**	3.44	4.00	0.970
	Forecast Satisfaction	5: Very Satisfactory, 4: Satisfactory, 3: Neither Satisfactory nor Unsatisfactory, 2: Unsatisfactory, 1: Very Unsatisfactory				
FSat_1	Forecast satisfaction from perishable products	0.2859	**0.7191**	3.80	4.00	0.739
FSat_2	Forecast satisfaction from seasonal products	0.3236	**0.8216**	3.64	4.00	0.911
FSat_3	Forecast satisfaction from promotional products	0.334	**0.8621**	3.20	3.00	1.032
FSat_4	Forecast satisfaction from newly launched products	0.313	**0.7687**	2.85	3.00	1.026
	External Integration	5: Strongly Agree, 4: Agree, 3: Neither Agree nor Disagree, 2: Disagree 1: Strongly Disagree				
EI_1	Level of interdependence	0.3347	**0.8308**	3.79	4.00	0.895
EI_2	Level of flexibility	0.2685	**0.7739**	3.82	4.00	0.959
EI_3	Level of technological infrastructure for external information sharing	0.368	**0.7473**	3.34	3.00	1.082
EI_4	Level of same vision of top managements	0.316	**0.7568**	3.65	4.00	0.920
	Internal Integration	5: Strongly Agree, 4: Agree, 3: Neither Agree nor Disagree, 2: Disagree 1: Strongly Disagree				
II_1	Level of delivery effort	0.2945	**0.7336**	4.07	4.00	0.775
II_2	Level of inventory management	0.2945	**0.7952**	3.81	4.00	0.878
II_3	Level of technological infrastructure for timely internal information sharing	0.2974	**0.8342**	3.53	4.00	1.217
II_4	Level of recording information	0.3351	**0.8239**	3.80	4.00	0.955
	Forecast Horizon	5: 1 month or less, 4: 1 to 3 months, 3: 3 to 6 months, 2: 6 to 12 months, 1: 12 to 24 months				
FH_1	Forecast horizon of perishable products	0.2483	**0.7674**	3.32	4.00	1.297
FH_2	Forecast horizon of seasonal products	-0.061	**0.7561**	2.99	3.00	1.252
FH_3	Forecast horizon of promotional products	0.2622	**0.8093**	3.48	4.00	1.241
FH_4	Forecast horizon of newly launched products	0.2712	**0.8214**	3.01	3.00	1.252
	Forecasters' Competence	5: Strongly Agree, 4: Agree, 3: Neither Agree nor Disagree, 2: Disagree 1: Strongly Disagree				
FC_1	Level of market based experience for the products involved	0.1343	**0.7562**	3.52	4.00	0.910
FC_2	Level of advice	0.1702	**0.8718**	3.63	4.00	0.953
FC_3	Level of motivation	0.1788	**0.9034**	3.73	4.00	0.943
FC_4	Level of willingness	0.1807	**0.9061**	3.82	4.00	0.969

FC_5	Level of feedback	0.1401	**0.8204**	3.65	4.00	1.000
FC_6	Level of confidence in accepting suggestions	0.1631	**0.9172**	3.59	4.00	0.958
FC_7	Level of satisfaction on consensus forecasts	0.1812	**0.8847**	3.58	4.00	0.896
	Group Forecasting	5: Strongly Agree, 4: Agree, 3: Neither Agree nor Disagree, 2: Disagree 1: Strongly Disagree				
GF_1	Level of continuous meetings	0.1982	**0.7759**	3.72	4.00	1.042
GF_2	Level of decision making procedures	0.257	**0.864**	3.68	4.00	0.976
GF_3	Level of hierarchy	0.2262	**0.8551**	3.64	4.00	1.093
GF_4	Level of constructive discussions	0.2473	**0.8999**	3.62	4.00	1.078
GF_5	Level of effective usage of information for consensus	0.2435	**0.8549**	3.70	4.00	1.134
	Information Types	5: Always, 4: Most of the Time, 3: Sometimes, 2: Rarely, 1: Never				
ITypes_1	Share of inventory levels	0.377	**0.7243**	2.86	3.00	1.244
ITypes_2	Share of production plan	0.2786	**0.8383**	2.26	2.00	1.152
ITypes_3	Share of production scheduling	0.278	**0.8577**	2.22	2.00	1.143
ITypes_4	Share of recent information	0.3433	**0.7425**	2.97	3.00	1.267
	Information Quality	5: Always, 4: Most of the Time, 3: Sometimes, 2: Rarely, 1: Never				
IQL_1	Relevance	0.1486	**0.8623**	3.40	4.00	1.080
IQL_2	Adequacy	0.1657	**0.9226**	3.45	4.00	1.056
IQL_3	Accuracy	0.1566	**0.8848**	3.64	4.00	1.066
IQL_4	Timeliness	0.1452	**0.7417**	3.03	3.00	1.244
IQL_5	Frequency	0.1701	**0.8644**	3.26	3.00	1.110
IQL_6	Responsiveness	0.1732	**0.8958**	3.38	3.00	1.060
IQL_7	Consistency	0.1881	**0.9066**	3.30	3.00	1.055
Threshold values:	**Item weights for formative items ≥ 0.10, Item loadings for reflective items ≥ 0.70**					

Source: *Developed by the author*

5.7. Measurement model for the formative construct

For formative constructs, the direction of causality is from items to construct, which causes a different interpretation and measurement for the construct of the CF practice (Götz *et al.*, 2010). The literature suggests that due to low correlation between formative items, which means that there is no internal consistency, formative constructs cannot be assessed like reflective constructs (Hair *et al.*, 2010; Diamantopoulos and Winklhofer, 2001). Therefore, the guidelines of Peng and Lei (2012) and Götz *et al.* (2010) assisted the research to analyse the formative construct of the CF practice. By considering these guidelines and relevant literature, the current research listed all reliability and validity analysis procedures followed to evaluate the measurement model for the formative constructs (please see Table 5.10).

Table 5.10. Analysis procedures for formative construct in the measurement model

Procedures		Definition	Threshold parameter and value	Validated (Yes /No)	Relevant reference
Content validity		It determines how well observed variables represent the main aspect of relevant constructs	*****Formative items were developed through the systematic review, and then verified by the qualitative data and grey literature *****Each item was reviewed and confirmed by four academics and four practitioners *****Design of the CF practice is based on the procedures of Jarvis *et al.* (2003)	Yes	Anderson and Gerbing (1991); Andreev *et al.* (2009); Chin and Gopal (1995); Diamantopoulos and Winklhofer (2001); Götz *et al.* (2010); Jarvis *et al.* (2003); Rositter (2002)
Indicator reliability		It shows the contribution of latent variables to relevant construct	*****The weighs of formative items ≥ 0.1 *****T-statistics (sig) at 0.05 level *****CF_4 was kept in the model to maintain the main aspect of the CF practice due to low multicollinearity	Yes (excluding CF_4: The level of commitment)	Andreev *et al.* (2009); Chin (1998b); Duarte and Raposo (2010); Götz *et al.* (2010); Peng and Lai (2012); Rositter (2002)
Multicollinearity		It shows the latent variables' level of dependency to formative construct	*****The Variance Inflation Factor (VIF) ≥ 3.3 *****Having high multicollinearity complicates the definite impact of latent variable on a construct	Yes (No (collinearity)	Chin (1998b); Diamatopoulos and Siguaw (2006); Duarte and Raposo (2010); Götz *et al.* (2010); Joseph *et al.* (2014) Peng and Lai (2012)
External validity	Two-construct model	It helps to evaluate the significance of path coefficient between formative construct and its two reflective items	*****Two-construct model needs to show a significant path coefficient between the CF practice and its two reflective items of accurate and long-term CF	Yes	Diamantopoulos and Winklhofer (2001); Götz *et al.* (2010); Hauser and Goldberger (1971)

Source: *Developed by the author*

Content validity of the CF practice is about its development in the research. It is worth remembering that this research developed observed variables and constructs by reviewing the literature systematically, and then the constructs were purified based on qualitative data and the grey literature. These processes were previously addressed in Chapter 2. Literature Review, and justified in Chapter 4. Research Methodology and Data collection. The formative structure of the CF practice was also theoretically validated based on the four criteria of Jarvis *et al.* (2003). This verification was explained in Section 5.3. Development of a new formative construct: The CF practice. Given the necessity of expert judgements in developing new formative constructs as a contribution to theory, four academics and four practitioners evaluated the credibility of the CF practice in the academic field and practice (Rossiter, 2002; Diamantopoulos and Winklhofer, 2001). Therefore, both expert judgments and the procedures of Jarvis *et al.* (2003) support the content validity of the CF practice in the model.

Because the direction of causality is from items to formative constructs, formative items are not necessarily to be correlated with each other, unlike reflective items (Rossiter, 2002). Therefore, formative items' contribution should be evaluated based on their weights rather than loadings for indicator reliability (Götz *et al.*, 2010; Chin, 1998b). The literature recommends that the weights of formative items should be greater than 0.1 and the items' T-statistics need to be significant for consistency with the relevant theory (Andreev *et al.*, 2009). Table 5.11 shows that except from the commitment item (CF_4) the weights of all items are above the threshold value and significant at 0.05 level.

Table 5.11. Weights and T-statistics of formative items

Codes	Formative items	Outer weights	T-statistics
CF_3	Trust	0.2383	2.34**
CF_4	**Commitment**	**-0.0711**	**0.93**
CF_5	Joint business plan	0.4564	5.40***
CF_6	Consensus-based internal forecasts	0.5196	7.90***
CF_7	Sharing of order forecasts	0.2738	3.62***

Notes: *** p < 0.001, ** p < 0.05, *p < 0.1; (based on $t_{(499)}$, two-tailed test)

The logic behind following different procedures for formative constructs, compared with reflective constructs, relies on the structure of formative items (Peng and Lai, 2012). Formative items constitute the main domain of the CF practice, and they do not correlate with each other. In other words, each formative item theoretically conveys a different dimension to the construct, and a formative construct completes its domain through the unification of this diversity (Götz *et al.*, 2010). Eliminating one of the formative items gives rise to lose the significant part of the CF practice due to uncorrelated items (Jarvis *et al.*, 2003). Eliminating an insignificant and low weight formative item is appropriate if there is high multicollinearity (Peng and Lai, 2012). Multicollineary shows formative items' dependency on a formative construct (Götz *et al.*, 2010; Chin, 1998b). To be able to decide whether the commitment item

(CF_4) will be kept in the model, the research evaluated the multicollinearity of the formative construct.

The Variance Inflation Factor (VIF) is a common way of measuring the multicollinearity of formative items, and its threshold value is 10 (Peng and Lai, 2012; Götz *et al.*, 2010). Yet Diamatopoulos and Siguaw (2006) offered more rigorous criteria of 3.3 for VIF, which was adopted in this research. The VIF values were evaluated via Statistical Package for Social Sciences (SPSS). By considering the five formative items of the CF practice, linear regression in SPSS made it possible to keep each item as a dependent variable for once and to produce VIF values for each item whilst other items were presumed as independent variables (Joseph *et al.*, 2014). Table 5.12 shows that all VIF values are under the threshold value of 3.3, and there is no multicollinearity. This result accordingly indicates that the formative items of the CF practice are bias free, and although the commitment item is insignificant and has low weight value, it is essential to be kept in the model to sustain the main domain of the of CF practice (Chin, 1998b).

Table 5.12. Multicollinearity statistics

Dependent item	Independent item	Tolerance	VIF
CF_3	CF_4	0.655	1.527
	CF_5	0.574	1.741
	CF_6	0.857	1.167
	CF_7	0.784	1.276
CF_4	CF_5	0.632	1.582
	CF_6	0.872	1.146
	CF_7	0.783	1.277
	CF_3	0.734	1.362
CF_5	CF_6	0.986	1.014
	CF_7	0.823	1.216
	CF_3	0.382	2.616
	CF_4	0.375	2.663
CF_6	CF_7	0.776	1.288
	CF_3	0.381	2.621
	CF_4	0.346	2.886
	CF_5	0.659	1.517
CF_7	CF_3	0.385	2.598
	CF_4	0.343	2.913
	CF_5	0.607	1.647
	CF_6	0.857	1.167

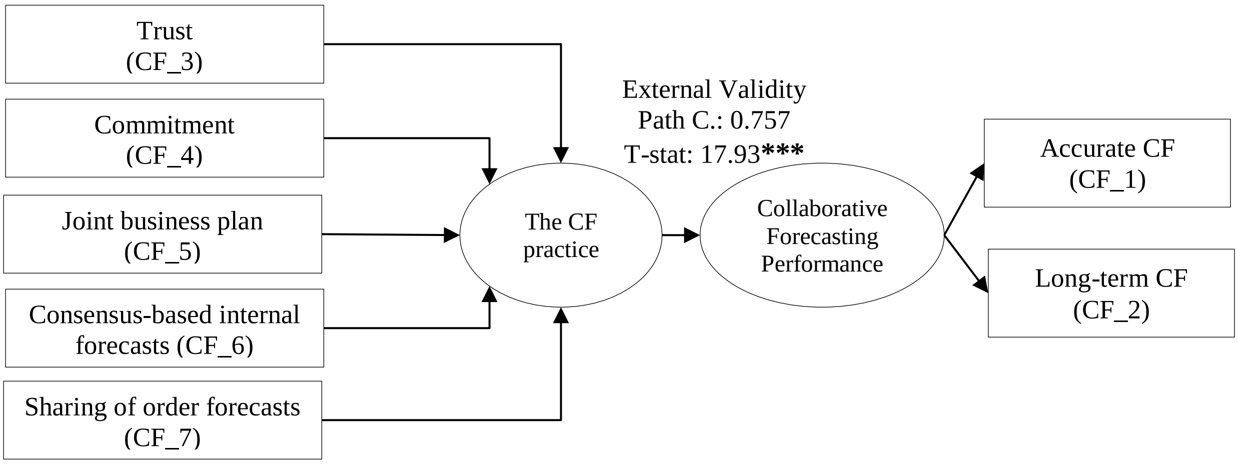
(**Reminder of abbreviations**: CF_3: Trust; CF_4: Commitment; CF_5: Joint business plan; CF_6: Consensus-based internal forecasts; CF_7: Sharing of order forecasts)

In terms of construct reliability, “contrary to the procedure in reflective measurement models, no evaluation is allowed of formative constructs that are based on the internal consistency measure” (Götz *et al.*, 2010, p. 699; Hulland, 1999, p. 201). The reason behind this is related to the impact of formative items on the formative construct: “Since the latent variable is viewed as an effect rather than a cause of the item responses, internal consistency is irrelevant” (Rossiter, 2002, p. 307). This is the reason why, construct reliability cannot be measured for the formative construct of the CF practice (Götz *et al.*, 2010). Instead, external validity is measured by way of MIMIC (Hauser and Goldberger, 1971) or two-construct models (Götz *et al.*, 2010; Diamantopoulos and Winklhofer, 2001).

Although the MIMIC model is applicable by using reflective items to externally verify the formative construct, Smart PLS is not capable of measuring the MIMIC model (Götz *et al.*, 2010). Therefore, its alternative two-construct model was adopted by considering the reflective construct of *Collaborative Forecasting Performance* as the representative of the CF practice (Diamantopoulos and Winklhofer, 2001). When it comes to analysing external validity via two-construct model, it is essential to have a significant path coefficient between CF and its representative of *Collaborative Forecasting Performance* construct (Götz *et al.*, 2010). Figure 5.1 shows that there is a significant relationship between the CF practice and its reflective items of accurate and long-term CF. This result accordingly supports the external validity of the CF practice in the model.

It is reasonable to stress that the two reflective items of the CF practice, namely the accurate and long-term CF, were posited as a primary hypothesis under the reflective construct of *Collaborative Forecasting Performance* representing the aim of the research. In this context, this research made it possible not only to theoretically validate the domain of the CF practice (Bollen, 1989), but also to justify the external validity of the CF practice by employing the two-construct model (Diamantopoulos *et al.*, 2008; Jarvis *et al.*, 2003; Diamantopoulos and Winklhofer, 2001). On the other hand, convergent and discriminant validity cannot be measured for formative items, as these items are not expected to be interrelated (Fornell and Larcker, 1981). In terms of nomological validity, it focuses on the relationships between the formative construct and reflective constructs (Götz *et al.,* 2010). Given the fact that the conceptual model was built upon this formative construct of the CF practice, all hypothetical relationships between reflective constructs and the CF practice will be scrutinised in the following section. In this respect, it is not essential to check nomological validity (Götz *et al.*, 2010; Diamantopoulos and Winklhofer, 2001).

Figure 5.1. Two-construct model for the external validity of the CF practice



Source: *Developed by the author*

5.8. Model fit for the conceptual model

PLS analysis does not allow evaluating fit statistics (Duarte and Raposo, 2010). Given the fact that formative items cannot be explained, fit statistics are not recommended for PLS (Henseler and Sarstedt, 2013; Hair *et al.*, 2012). As a remedy, Tenenhaus *et al.* (2005) recommended the Goodness-of-Fit (GoF) criterion to validate conceptual models in PLS. In addition to this criteria, the current research applied additional techniques for the assessment of the structural model. These techniques are determination coefficient (R^2), effect size for predictive variables (f^2), predictive relevance of Stone-Geisser test (Q^2) and effect size of endogenous variables (q^2) (Joseph *et al.*, 2014; Peng and Lai, 2012; Chin, 1998b; Cohen, 1988). The definition of these procedures, threshold values and the outcomes of analyses are presented in Table 5.13.

Regarding the criterion of GoF, it is the "geometric mean of the average communality and the average R^2" (Duarte and Raposo, 2010, p.469). As shown in Table 5.14, the GoF value of the conceptual model in this research is 0.53, and it is over the threshold value of 0.36, confirming that the conceptual model performs well based on the GoF criteria (Perols *et al.*, 2013). As far as the determination coefficient (R^2) is considered, R^2, representing the level of the constructs' explained variance, is expected to be greater than 0.1 to be able to develop a reliable theoretical model (Falk and Miller, 1992). The R^2 values of 0.67, 0.33 and 0.19 indicate the substantial, moderate and weak variance explained for endogenous constructs (Peng and Lai, 2012; Chin, 1998b).

Having larger R^2 values in the conceptual model implies the larger percentage of variance explained for constructs (Götz *et al.*, 2010). Table 5.14 shows that the R^2 values of all endogenous constructs are over the threshold value. In detail, while the percentage of variance for the CF practice is substantially explained, except for *Forecast Satisfaction* and *Information Types*, all constructs' percentage of variance is explained at the moderate level. Therefore, the conceptual model of this research has a satisfactory combined predictiveness.

Table 5.13. Analysis procedures for the structural model

Procedures	Definition	Threshold parameter and value	Validated (Yes /No)	Relevant reference
Goodness-of-Fit (GoF)	GoF evaluates the quality of the measurement model over the average communality (AVE) and of the structural model over the average of R^2	*****Although it is applied to validate the conceptual model in PLS, it is not recommended by contrary views (Henseler and Sarstedt, 2013) *****GoF ≥ 0.36 (Threshold value)	0.53 (Larger GoF represents better model fit)	Duarte and Raposo (2010); Götz *et al.* (2010); Henseler and Sartedt (2013); Perols *et al.* (2013); Tenenhaus *et al.* (2005; 2004)
Determination coefficient (R^2)	It shows the level of explained variance for endogenous constructs	*****$R^2 \geq 0.1$ (Threshold value) *****$R^2 \geq 0.67$ (substantial); ≥ 0.33 (moderate); ≥ 0.19 (weak) *Larger R^2 implies larger percentage of variance explained for endogenous constructs	Yes (satisfactory combined predictiveness)	Backhaus *et al.* (2003); Chin (1998b); Falk and Miller (1992) Götz *et al.* (2010); O'Leary-Kelly and Vokurka (1998); Peng and Lai (2012)
Effect size for predictive / independent variables (f^2)	It shows the particular impact of an exogenous variable based on increased R^2 values that remain unexplained on an endogenous construct	***** $f^2 \geq 0.02$ (Threshold value) *****$f^2 \geq 0.35$ (large); ≥ 0.15 (medium); ≥ 0.02 (small) *****(f^2) effect size of an independent variable is measured based on the change of R^2 value when that independent variable is eliminated from the conceptual model *****$(f^2) = (R^2 \text{ included} - R^2 \text{ excluded}) / (1-R^2 \text{ included})$	Yes (all endogenous constructs' f^2 values are over the threshold value)	Cohen (1988); Götz *et al.* (2010); O'Leary-Kelly and Vokurka (1998); Peng and Lai (2012)
Predictive relevance of Stone-Geisser test (Q^2)	It helps to understand how well the conceptual model and PLS parameters reconstituted the observed latent variables	*****$Q^2 \geq 0$ (Threshold value) *****It is only measured for reflective endogenous constructs *****$Q^2 \geq 0.35$ (large); ≥ 0.15 (medium); ≥ 0.02 (small) *****Q^2 is measured via blindfolding procedure in which a part of data matrix is omitted for once, and then the model is re-evaluated to predict the omitted part of the model	Yes (Good predictive relevance for endogenous constructs)	Chin (1998b); Duarte and Raposo (2010); Giesser (1975); Joseph *et al.* (2014);Stone (1974); Tenenhaus *et al.* (2005)
Effect size (q^2) of endogenous variables	It measures the effect size of exogenous constructs on a specific reflective endogenous construct based on the predictive value of Q^2	***** $q^2 \geq 0.02$ (Threshold value) *****$q^2 \geq 0.35$ (large); ≥ 0.15 (medium); ≥ 0.02 (small) *****q^2 effect size of an independent variable is measured based on the change of Q^2 value when that independent variable is eliminated from the conceptual model *****$q^2 = (Q^2 \text{ included} - Q^2 \text{ excluded}) / (1- Q^2 \text{ included})$	Yes (Good predictive relevance for endogenous constructs)	Cohen (1988); Joseph *et al.* (2014)

Source: *Developed by the author*

Table 5.14. Variance explained, communality and redundancy

Latent variables / constructs	Variance explained (R^2)		Communality	Redundancy
	Values	Size		
The CF practice	0.7411	Substantial	0.4119	0.1468
Collaborative Forecasting Performance	0.5098	Moderate	0.7348	0.3743
External Integration	0.339	Moderate	0.6051	0.1932
Forecast Horizon	-	-	0.6618	-
Forecast Satisfaction	0.2643	Weak	0.6315	0.1668
Forecasters' Competence	-	-	0.7523	-
Group Forecasting	0.492	Moderate	0.7241	0.3543
Internal Integration	-	-	0.6363	-
Information Quality	0.3552	Moderate	0.757	0.2682
Information Types	0.2984	Weak	0.6286	0.1644
(GoF): 0.5295	**R^2 = 0.67 ≥ Substantial, 0.33 ≥ Moderate, 0.19 ≥ Weak**			

Note: Variance explained (R^2) is measured for only endogenous constructs. The constructs of *Forecast Horizon, Forecasters' Competence* and *Internal Integration* are exogenous in the model, therefore their explained variance cannot be measured

On the other hand, the effect size of independent variables (f^2) shows the particular impact of exogenous variables based on increased R^2 values that remain unexplained on an endogenous construct (Peng and Lai, 2012). Effect size of an independent variable (f^2) is measured based on the change of R^2 value when it is eliminated from the conceptual model (Cohen, 1988). The f^2 values of 0.35, 0.15 and 0.02 are the threshold of large, medium and small effect size for each exogenous construct in the conceptual model (Cohen, 1988). Table 5.15 shows that although all predictor variables for the CF practice have small effect size, the rest of the endogenous constructs have a large effect size and f^2 of all endogenous constructs are greater than the lower bound 0.02 in the model. This result indicates that all independent variables of the conceptual model have the minimum required effect size for associated dependent variables, supporting the following procedure: the effect size of independent variables (f^2).

Table 5.15. Effect size of independent variables (f^2)

Effect size (f^2) over variance explained (R^2)				
Predictor constructs	**R^2 included**	**R^2 excluded**	**f^2**	**Size**
Internal Integration → The CF practice	0.7411	0.7066	0.13	Small
External Integration → The CF practice	0.7411	0.7053	0.14	Small
Information Quality → The CF practice	0.7411	0.7343	0.03	Small
Forecast Horizon → The CF practice	0.7411	0.7347	0.02	Small
Information Types → The CF practice	0.7411	0.7195	0.08	Small
Forecasters' Competence → The CF practice	0.7411	0.7368	0.02	Small
Group Forecasting → The CF practice	0.7411	0.7269	0.05	Small
Internal Integration→ External Integration	0.339	0	0.51	Large
External Integration → Information Quality	0.3552	0	0.55	Large
The CF practice → Collaborative Forecasting Performance	0.5098	0	1.04	Large
The CF practice → Forecast Satisfaction	0.2643	0	0.36	Large
Information Quality → Information Types	0.2984	0	0.43	Large
Forecasters' Competence → Group Forecasting	0.492	0	0.97	Large

f^2 = (R^2 included - R^2 excluded) / (1-R^2 included)
Effect size f^2: 0.35 ≥ Large; 0.15 ≥ Medium; 0.02 ≥ Small

As regards the predictive relevance of the Stone-Geisser test (Q^2), it is an assessment criterion for model fit that is only measured for reflective endogenous constructs (Geisser, 1975; Stone, 1974). Q^2 helps to understand how well the conceptual model and PLS parameters reconstituted the observed variables (Chin, 1998b). Having zero or greater value Q^2 ($Q^2 \geq 0$) indicates a good predictive relevance in the conceptual model, and the values above 0.35, 0.15 and 0.02 exhibit large, medium and small predictive relevance of the relevant endogenous variables respectively (Joseph *et al.*, 2014). Q^2 is measured via a blindfolding procedure in which a part of the data matrix is omitted for once and the model is revaluated to predict the omitted part of the conceptual model (Duarte and Raposo, 2010).

It is important to stress that the Q^2 values can be estimated by either cross-validated redundancy or cross-validated communality approaches during the blindfolding procedure (Joseph *et al.*, 2014). Cross-validated communality "measures the capacity of the path model to predict the manifest variables or data points from their own latent variable score, and serves as an indicator of the quality measurement model"

(Duarte and Raposo, 2010, p. 472). The cross-validated redundancy "measures the capacity of the model to predict the endogenous manifest variables using the latent variables that predict the block in question, and serve as a sign of the quality of the structural model" (Duarte and Raposo, 2010, p. 472; Tenenhaus *et al.*, 2005).

According to Chin (1998b), values for omission distance in blindfolding can be from 5 to 10. Given the complexity of the conceptual model, greater numbers were also preferred in similar studies (e.g. G: 30, see Duarte and Raposo (2010)). In this research, the blindfolding procedure was estimated for omission distances at 10 and 30 to reveal whether there are potential differences in terms of the predictive relevance of Q^2. In essence, this approach enables the research not only to enhance the quality of Q^2, but also to allow the reader to judge the complexity of the model in terms of deciding whether it is advisable to prefer larger omission distance for the blindfolding procedure.

As shown in Table 5.16, all Q^2 values are greater than zero, and these results indicate that there is a good predictive relevance for both endogenous constructs (via cross-validated redundancy) and manifest / observed variables (via cross-validated communality). It is worth stressing that the *Collaborative Forecasting Performance* construct has large cross-validated redundancy. This outcome accordingly implies the strong predictive relevance of the CF practice to accomplish accurate and long-term CF, which are represented by the *Collaborative Forecasting Performance* construct in the model. Overall, the results of the blindfolding procedure indicate that the model of this research fits well. Each endogenous variable therefore has reliable predictive relevance in constituting the conceptual model, validating the following procedure: the predictive relevance of the Stone-Geisser test (Q^2).

Table 5.16. Results of blindfolding procedure

Endogenous constructs	Cross-validated communality — Omission distance (G)				Cross-validated redundancy — Omission distance (G)			
	Q^2 (G: 10)	Size (G: 10)	Q^2 (G: 30)	Size (G: 30)	Q^2 (G: 10)	Size (G: 10)	Q^2 (G: 30)	Size (G: 30)
Collaborative Forecasting Performance	0.2169	Medium	0.2208	Medium	0.3548	Large	0.3558	Large
External Integration	0.5607	Large	0.5460	Large	0.1909	Medium	0.1924	Medium
Forecast Satisfaction	0.4597	Large	0.4519	Large	0.1562	Medium	0.1590	Medium
Information Types	0.5644	Large	0.5540	Large	0.1596	Medium	0.1605	Medium
Group Forecasting	0.6056	Large	0.5929	Large	0.3485	Medium	0.3488	Medium
Information Quality	0.5390	Large	0.5279	Large	0.2613	Medium	0.2624	Medium

Predictive relevance Q^2 = 0.35 ≥ Large; 0.15 ≥ Medium; 0.02 ≥ Small

Finally, by using the predictive values of Q^2, the effect size of endogenous variables (q^2) was estimated whilst R^2 values were used to evaluate the similar effect size (f^2) (Cohen, 1988). Similar to the effect size of independent variables (f^2), the values of 0.35, 0.15 and 0.02 represent large, medium and small effect size (q^2) respectively (Joseph *et al.*, 2014). The effect size (q^2) of each exogenous construct to endogenous construct is evaluated based on two different values. The first value of "Q^2 included" is obtained when the conceptual model is complete and includes all exogenous constructs. Another value of "Q^2 excluded" is found when the relevant exogenous construct is dropped from the model. By using these two different Q^2 values, the effect size (q^2) for each exogenous construct to endogenous construct is estimated. Because the effect size of (q^2) represents the impact of endogenous variables in the complete model, it is essential to consider the value of Q^2 that was found based on the analysis of cross-validated redundancy, instead of cross-validated communality (Joseph *et al.*, 2014). The results of effect size (q^2), estimated based on the values of predictive relevance (Q^2), are presented in Table 5.17.

Overall, the results *of* q^2 show sufficient effect size for each exogenous construct on the relative endogenous constructs with regard to the changes of predictive relevance (Q^2). In addition to the moderate level of effect size for all endogenous constructs, excluding *Forecasters' Competence*, the CF practice has a large effect size in producing the predictive relevance (Q^2) for the *Collaborative Forecasting Performance* construct. The predictive relevance of the CF practice for the *Forecast Satisfaction* construct is also at the moderate level. Accordingly, these results confirm that the effect size (q^2) for each endogenous construct is over the lower bound of 0.02, and the conceptual model has sufficient effect size for endogenous constructs over the predictive relevance (Q^2), validating the final procedure: effect size of endogenous variables (q^2).

Table 5.17. Effect size of endogenous variables (q^2)

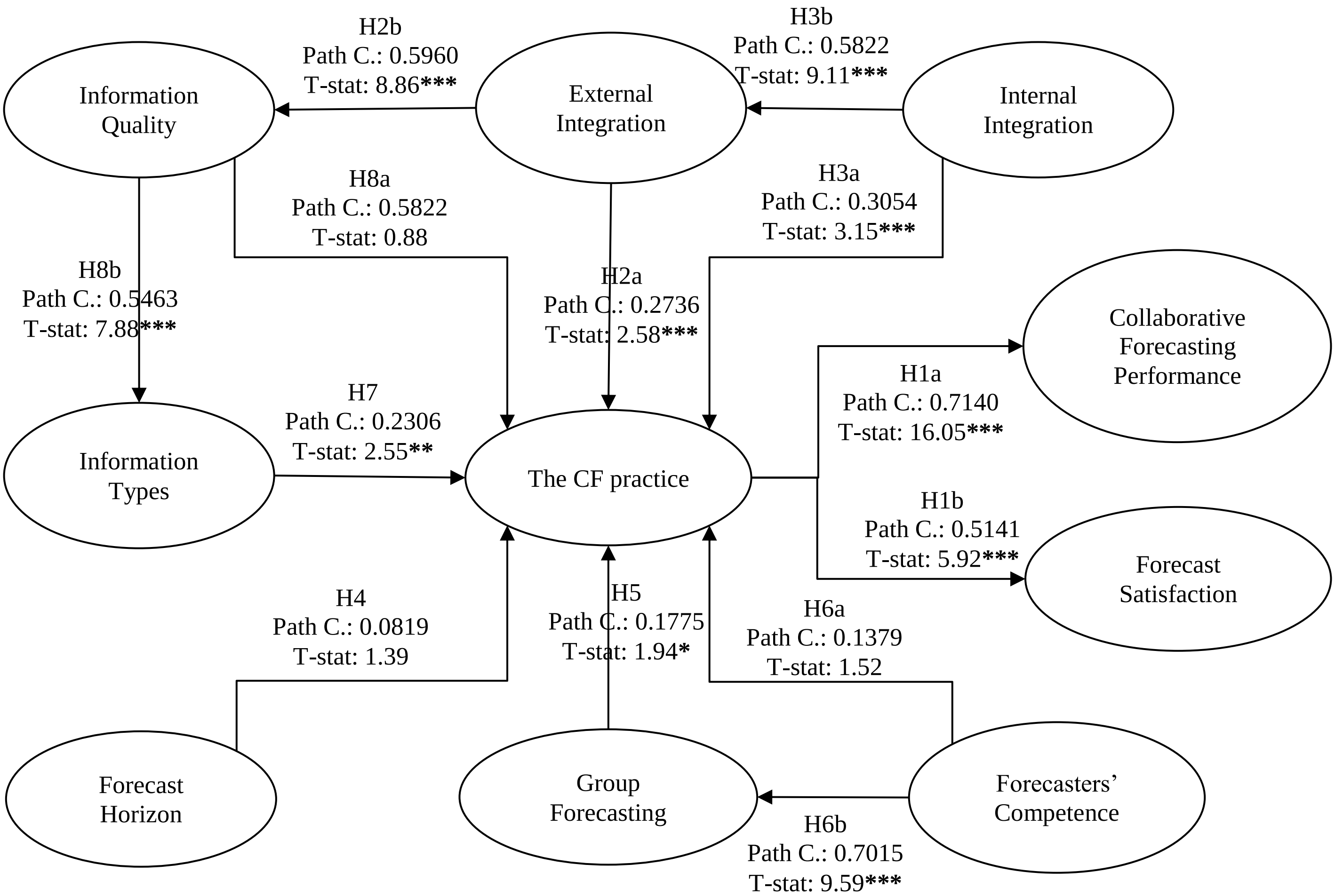
Effect size (q^2) over predictive relevance (Q^2)					
Omission distance	**Predictor constructs**	**Q^2 included**	**Q^2 excluded**	**q^2**	**Effect size**
G:10	**The CF practice → Collaborative Forecasting Performance**	0.3548	0	0.5499	Large
G:30		0.3558	0	0.5523	Large
G:10	**The CF practice → Forecast Satisfaction**	0.1562	0	0.1851	Medium
G:30		0.1590	0	0.1891	Medium
G:10	**Internal Integration → External Integration**	0.1909	0	0.2359	Medium
G:30		0.1924	0	0.2382	Medium
G:10	**External Integration → Information Quality**	0.2613	0	0.3537	Medium
G:30		0.2624	0	0.3557	Medium
G:10	**Information Quality → Information Types**	0.1596	0	0.1899	Medium
G:30		0.1605	0	0.1912	Medium
G:10	**Forecasters' Competence → Group Forecasting**	0.3485	0	0.5349	Large
G:30		0.3488	0	0.5356	Large
q^2 = (Q^2 included - Q^2 excluded) / (1- Q^2 included) **Effect size q^2 = 0.35 ≥ Large; 0.15 ≥ Medium; 0.02 ≥ Small**					

5.9. Findings for the structural model

Data analysis of PLS for the structural model explains the hypothetical relationships between latent variables. In the conceptual model, the latent variables predicting other constructs were called exogenous / independent variables while latent variables that were predicted by other constructs were entitled endogenous / dependent variables (Götz *et al.*, 2010). Due to the prediction feature of PLS the strength of each structural path and the values of R^2 (combined predictiveness) for endogenous constructs show the goodness of the conceptual model (Chin, 1998b).

Bootstrap analysis in the Smart PLS software evaluated the statistical significance of hypothesised relationships by resampling 5000 times based on 105 usable responses to the survey questionnaire (Chung and Lee, 2001). Although Chin (1998b) recommended that resampling 500 times is adequate during the bootstrap analysis process, recent literature suggested considering as many samples as possible due to the fact that increased resampling leads to reducing the effect of random sampling error, which is likely to occur during the analysis process (Peng and Lai, 2012). The results of bootstrapping analysis for the structural model are portrayed in Figure 5.2.

Figure 5.2. Results of the structural model



{*p < 0.001, ** p < 0.05, *p < 0.1; (based on $t_{(499)}$, two-tailed test)}**

Source: *Developed by the author*

In addition to the statistical significance of relationships between constructs, this research explicated the size of path coefficients. As having a larger path coefficient indicates the greater impact of related constructs on the CF practice, this symptom makes it possible to expound findings beyond the statistical significance and to have a clear understanding of the contributions of this research. This approach also ensures the reliability of the constructs in terms of underpinning the CF practice, and enriches the value of managerial implications for practitioners (Joseph *et al.*, 2014). In the first instance, the standardised path coefficient from CF to *Collaborative Forecasting Performance* was robust and statistically significant (Path C: 0.7140; $p < 0.001$), supporting H1a. This result empirically stressed that the CF practice is a strong and direct predictor of *Collaborative Forecasting Performance* in the FSC.

Because of the fact that the size of path coefficient from CF to *Collaborative Forecasting Performance* was substantially large, this outcome demands the attention of practitioners by underpinning the reliability of the newly developed CF practice in generating accurate forecasts for related product-groups and conducting long-term collaborations with retailers. Following this, the standardised path coefficient from CF to *Forecast Satisfaction* was significant too (Path C: 0.5141; $p < 0.001$), supporting H1b. The implication here is that in spite of the fact that the satisfaction factor is a subjective facet and likely to differ based upon the objectives of companies and / or forecasters, the implementation of the CF practice has a strong and direct impact on the satisfaction of manufacturers when they forecast the time-sensitive and / or short-life product-groups.

On the basis of above stressed hypotheses (H1a & H1b), it is timely to recall that the aim of current research was "*to identify factors that have a significant influence on achieving the Collaborative Forecasting Performance of manufacturers, when they collaboratively forecast perishable, seasonal, promotional and newly launched products with retailers in the FSC*". The criteria of the *Collaborative Forecasting Performance* for manufacturers were (i) to improve the forecast accuracy of associated product-groups and (ii) to conduct long-term collaborations with retailers (one year or more). Demonstrating the significant impact of the CF practice on the *Collaborative Forecasting Performance* justified the reliability of the CF practice in achieving long-term and accurate CF for manufacturers, and allowed the research to develop a theoretical concept in achieving its aim. The research then made it possible to generalise its contributions for practice by way of demonstrating the impact of the CF practice on the *Forecast Satisfaction* of manufacturers.

In terms of the integration of manufacturers in the FSC, the standardised path coefficient from *External Integration* to the CF practice was significant (Path C: 0.2736; $p < 0.001$). This result confirms that manufacturers need to integrate with retailers to be able to take advantage of CF. Therefore, this result supports H2a. In a similar vein, the path coefficient from *External Integration* to *Information Quality* was significant (Path C: 0.5960; $p < 0.001$), supporting H2b. This outcome indicates that manufacturers' integration with retailers enables them to share good quality information in CF. Nonetheless, due to the bigger size of path coefficient from *External Integration* to *Information Quality*, the impact of *External Integration* on sharing quality information recommends additional implications for practitioners compared to its impact on the CF practice. In other words, whilst manufacturers' integration with retailers delivers a vital impact on their CF, this integration conveys a more promising outcome by increasing the quality of information exchanged in CF. This finding also corroborates the findings of Hartono *et al.* (2010), who explored the direct impact of top management and IT systems on the sharing of quality information.

Like *External Integration*, *Internal Integration* of manufacturers was statistically significant and a strong predictor of the CF practice (Path C: 0.3054; $p < 0.001$). This finding confirms H3a, and therefore the importance of interdepartmental relationships in CF. *Internal Integration* was likewise statistically significant and the direct predictor of *External Integration* (Path C: 0.5822; $p < 0.001$), supporting H3b. This result indicates that manufacturers' interdepartmental integration is vital for effective integration with retailers at the external level. This finding also validates the arguments of Stevens (1989), who stressed on the importance of *Internal Integration* in terms of effectively managing product flows into and out of the companies. In addition, uncovering the significant impact of manufacturers' *Internal Integration* on the *External Integration* with retailers extended the limited findings of Braunscheidel and Suresh (2009) to the downstream level, as their study merely addressed *Internal Integration* in manufacturer-supplier collaborations. On the other hand, the size of path coefficient from *Internal Integration* to *External Integration* was superior to the coefficient size that represents the predictor role of *Internal Integration* on the CF practice. Hence, manufacturers' interdepartmental integration seems to be a pivotal factor for successful integration with retailers, and this *Internal-External Integration* eases the implementation of CF in achieving long-term and accurate CF in the FSC.

These demonstrations on the supply chain integration of manufacturers led the research to accomplish its first objective, which was "*to analyse the supply chain integration of manufacturers both externally and internally, in which external integration spans their relation with retailers and internal integration surrounds their interdepartmental relations*". Accordingly, it was expected to answer the first research question, which asked; *"What factors in terms of manufacturers' supply chain integration influence their collaborative forecasts with retailers in achieving long-term and accurate CF?*" By relying on the aforementioned hypotheses (H2a & H3a), the answer to this question is that manufacturers' *Internal Integration* and *External Integration* influence their collaborative forecasts with retailers in achieving long-term and accurate CF. By demonstrating additional causalities, the existing knowledge is further extended. In particular, *External Integration* with retailers significantly influences the protection of *Information Quality* in CF (H2b), while *Internal Integration* of manufacturers has a significant impact on their *External Integration* with retailers (H3b).

As regards the forecasting process of manufacturers, the standardised path coefficient from *Forecast Horizon* to the CF practice was not significant, not supporting H4. This research deduces from this outcome that considering different horizons between partners for the forecasts of perishable, seasonal, promotional, and newly launched products does not influence CF from the viewpoint of manufacturers. However, it seems encouraging to extrapolate this outcome, as the results of qualitative data analysis offered opposing outcomes from the single semi-structured interview and three online group discussions. On the other hand, *Group*

Forecasting was found to have a significant and direct impact on the CF practice (Path C: 0.1775; $p < 0.1$), supporting H5. Nonetheless, *Group Forecasting* seems not as important as manufacturers' *Internal Integration* and *External Integration* with retailers for promising CF. This can be deduced by comparing the size of the path coefficients of these factors. Given the paucity of studies addressing group dynamics in collaborations, this finding closed the extant gap in the forecasting literature (Önkal *et al.*, 2012). It is also valuable to interpret this outcome by stressing the importance of conducting structural forecasting meetings in practice.

As far as forecasters are considered in CF, it was found that the standardised path coefficient from *Forecasters' Competence* to the CF practice was not significant, not supporting H6a. However, the impact of *Forecasters' Competence* was statistically significant and this factor showed direct impact on *Group Forecasting* (Path C: 0.7015; $p < 0.001$), supporting H6b. Given the significance of *Group Forecasting* on the CF practice, finding the direct impact and large size path coefficient of *Forecasters' Competence* on *Group Forecasting* implies additional outcome for this research. In other words, it can be argued that *Forecasters' Competence* is indirectly important for the CF practice.

Quantitative data analysis, conducted for the forecasting process of manufacturers, made it possible to fulfil the second objective of this research, as the intention was "*to examine the forecasting process of manufacturers, when they generate the forecasts of related product-groups within their departments, and when they aggregate these forecasts with retailers' forecasts in group meetings*". This objective expected answers from the research to the second research question; "*What factors in terms of manufacturers' forecasting process influence their collaborative forecasts with retailers in achieving long-term and accurate CF?*" In response, it was demonstrated that manufacturers' *Group Forecasting* influences their collaborative forecasts with retailers in achieving long-term and accurate CF (H5). Because of the significant impact of *Forecasters' Competence* on the *Group Forecasting*, *Forecasters' Competence* indirectly influences collaborative forecasts with retailers in achieving long-term and accurate CF (partially H6a). Accordingly, the second research question was answered to extend the body of forecasting literature.

In terms of the information sharing practices of manufacturers, the standardised path coefficient from *Information Types* to the CF practice was significant (Path C: 0.2306; $p < 0.05$), supporting H7. This significance seemed superior to the significance of *Group Forecasting*, but comparable with *Internal Integration* and *External Integration*. Based on the size of path coefficients, it can be inferred that sharing different *Information Types* with retailers is statistically significant for CF, and it seems a prevailing practice compared with partners' *Group Forecasting*. Yet it is comparable with manufacturers' *Internal Integration* as well as *External Integration* with retailers in terms of the extent to which it affects CF. In other words, whilst integration practices of manufacturers earn more credit for CF, the impact of sharing different types of information with retailers cannot be subordinated. In addition, whilst the literature witnessed studies that added more value to retailer information in CF (Ramanathan, 2013; Sari, 2008; Aviv, 2001), this research brought a new dimension to the information sharing literature and offered the value of manufacturer information for promising CF in the FSC.

Finally, the standardised path coefficient from *Information Quality* to the CF practice was not found to be significant, not supporting H8a. Nonetheless, *Information Quality* was found to be significant and showed a direct impact on the share of different *Information Types* with retailers (Path C: 0.5463; $p < 0.001$), supporting H8b. In this context, there was a direct impact of *Information Types* on the CF practice as well as the strong impact of sustaining *Information Quality* on the share of different *Information Types*. Accordingly, it is reasonable to argue that *Information Quality* has an indirect influence on the CF practice, and this argument needs to be interrogated for additional insights to the literature and practice.

By examining information sharing practices of manufacturers, this research achieved its final objective, which was "*to investigate manufacturers' information sharing, when they exchange various information sources with retailers, and when the quality of information shared plays a vital role in the forecast accuracy of associated product-groups*". This final objective addressed the final research question; "*What factors in terms of manufacturers' information sharing influence their collaborative forecasts with retailers in achieving long-term and accurate CF?"*. It was demonstrated convincingly that manufacturers' share of different *Information Types* influences their collaborative forecasts with retailers in achieving long-term and accurate CF (H7). As sustaining *Information Quality* was found to be significant for the sharing of diverse *Information Types*, it was argued that manufacturers' effort made to sustain *Information Quality* indirectly influences their collaborative forecasts with retailers in achieving long-term and accurate CF (partially H8a). Results of hypothesis testing are presented in Table 5.18.

Table 5.18. Results of hypothesis testing

Codes	From		To	Significant at 0.001 level	Significant at 0.05 level	Significant at 0.1 level	Not significant
H1a	**The CF practice**	→	**Collaborative Forecasting Performance**	***			
H1b	**The CF practice**	→	**Forecast Satisfaction**	***			
H2a	**External Integration**	→	**The CF practice**	***			
H2b	**External Integration**	→	**Information Quality**	***			
H3a	**Internal Integration**	→	**The CF practice**	***			
H3b	**Internal Integration**	→	**External Integration**	***			
H4	**Forecast Horizon**	→	**The CF practice**				---
H5	**Group Forecasting**	→	**The CF practice**			*	
H6a	**Forecasters' Competence**	→	**The CF practice**				---
H6b	**Forecasters' Competence**	→	**Group Forecasting**	***			
H7	**Information Types**	→	**The CF practice**		**		
H8a	**Information Quality**	→	**The CF practice**				---
H8b	**Information Quality**	→	**Information Types**	***			

Significant at 0.001 level: *; at 0.05 level: **; at 0.1 level:*; Not significant: ---**

In summary, the hypothesis testing results showed the significant impact of the CF practice on the performance of CF. Therefore, the CF practice offered by this research appeared to be the strong predictor of enhancing long-term and accurate CF in the FSC. Despite the fact that satisfaction is a subjective facet, findings validated the reliability of the CF practice and showed its significant and direct impact on the *Forecasts Satisfaction* of manufacturers in CF. These outcomes made it possible not only to accomplish the research aim, but also to generalise findings for the target population. In terms of the supply chain integration of manufactures, *Internal-External Integrations* were found to be significant for the implementation of the CF practice while manufacturers' *Internal Integration* became the strong predictor of integrations conducted at the external level. Consequently, this research accomplished its first objective and answered the first research question.

When forecasting practices were taken into account, the findings uncovered the insignificant impact of *Forecast Horizon* on the CF practice. Conversely, *Group Forecasting* of partners was found to be significant by showing a direct impact on the CF practice. Although *Forecasters' Competence* exhibited a significant and direct impact on the *Group Forecasting*, it was found to be insignificant in practising the CF practice. However, the significant impact of *Group Forecasting* on the CF practice led to arguing the indirect impact of *Forecasters' Competence* on the CF practice. These findings then allowed the research to achieve the second objective by responding to the second research question. As regards the information sharing of manufacturers, the share of different *Information Types* demonstrated its significant and direct impact on the achievement of CF practice. Maintaining *Information Q*uality was also found to be a significant and strong predictor of sharing diverse *Information Types* in CF. The significance of *Information Quality* on the CF practice was not found, yet its direct impact on the share of different *Information Types* led to claiming its indirect impact on the CF practice. Accordingly, the final research objective was achieved, and these contributions made it possible to answer the final research question.

5.10. Summary

This chapter commenced with the aim of theoretically validating the appropriateness of the data analysis technique PLS. The four rigour assumptions of Peng and Lai (2012) confirmed that PLS is the most appropriate technique based on the existing conditions of this research. These assumptions were (i) exploratory research objectives, (ii) small sample size and the complexity of the conceptual model, and (iii) properties of existing data along with (iv) the existence of formative constructs in the model.

Given the existence of the formative construct in this research, namely the CF practice, it was essential to give a rationale for its formative structure and to provide a theoretical definition. Based on the four criteria of Jarvis *et al.* (2003), it was confirmed that the CF practice is a formative construct and consists of five different items. The criteria that validated its formative structure were (i) direction of causality from items to construct, (ii) unnecessary interchangeability of items, (iii) unnecessary covariation among the indicators, and (iv) different nomological net of the indicators. To explain the characteristics of research samples, descriptive statistics involved the position of respondents, manufacturing companies' number of years in operation, region, and number of employees as well as annual sales volume. Given the importance of providing unbiased contributions to the literature and practice, independent T-test statistics also confirmed that the research samples are bias free. Therefore, data analyses and research findings were shared with the reader in an objective and transparent manner.

For the measurement model of reflective constructs, Cronbach's α led to determining the degree to which a group of observed variables evaluates the relevant constructs. Following this, all constructs in the model had 0.7 values for composite reliability, and this led the research to support the internal consistency of the model. Then, construct validity was affirmed over the content validity, convergent validity and discriminant validity. The verification of convergent validity hinged on the value of AVE and the loading values of observed variables, which were already greater than 0.7. Presenting the greater value of the square root of AVE compared to the correlations between latent variables led the research to validate the discriminant validity of the reflective constructs in the model.

In terms of the measurement model for the formative construct, the content validity was confirmed by creating the CF practice based on the systematic review of literature. The domain of this construct was confirmed by qualitative data and the grey literature, and eight expert judgments affirmed its formative structure. Theoretically, the four criteria of Jarvis *et al.* (2003) also ensured that the CF practice of this research has the content validity. Due to the impact of formative items on the construct, implying unrelated internal consistency, the research considered the weights of formative items to approve the indicator validity. All formative items, excluding the commitment factor, were over the threshold value of 0.1 and significant at 0.05 level. To decide whether the commitment factor would be kept in the model, the multicollinearity statistics were employed by considering the values of VIF for the formative items.

Having VIF values less than the threshold value of 3.3 permitted the research to keep the commitment factor in the model. The external validity was then considered by evaluating the significant path coefficient between the CF practice and its reflective items of accurate and long-term CF, which were represented by the reflective construct of *Collaborative Forecasting Performance*. Having a significant path coefficient between CF practice and *Collaborative Forecasting Performance* validated the external validity of the formative construct in the model.

The analysis of the conceptual model was completed based on five different analysis procedures, which were Goodness-of-Fit (GoF), explained variance (R^2) and effect size for predictive variables (f^2) as well as blindfolding and predictive relevance (Q^2) along with the effect size of endogenous variables *(*q^2*).* The analysis procedure of GoF confirmed that the conceptual model of this research performs well. The second procedure of R^2 then led the research to clarify the explained variance for endogenous constructs.

The third analysis procedure was the effect size of independent variables (f^2). This procedure led the research to explore the effect of exogenous variables on the associated endogenous variables by considering the values of R^2. As regards the fourth analysis procedure, the predictive relevance of the Stone-Geisser test (Q^2) was measured for the reflective endogenous constructs. This procedure made it possible to understand how well the conceptual model and PLS parameters reconstituted the observed variables. The research employed the blindfolding procedure and confirmed that the conceptual model has a sufficient predictive relevance. The final analysis procedure was the effect size of endogenous variables (q^2). This procedure confirmed that exogenous variables in the model have a sufficient influence on the associated endogenous variables.

The findings of the structural model were then obtained through the bootstrap analysis, where Smart PLS evaluated the statistical significance of hypothesised relationships by resampling 5000 times based on 105 research samples. Primarily, the hypothesis testing showed the significant impact of the CF practice on the performance of CF (supporting H1a), and this outcome led to demonstrating the direct impact of the CF practice in achieving long-term and accurate CF in the FSC. The CF practice was found to be a significant and direct predictor for the *Forecast Satisfaction* of manufacturers based on the associated product-groups (supporting H1b).

External Integration with retailers was found to be a significant predictor of the CF practice (supporting H2a). *External Integration* showed a significant and direct impact on the *Information Quality* (supporting H2b). Following this, *Internal Integration* of manufacturers demonstrated a significant impact on the CF practice (supporting H3a). While this outcome increased the importance of interdepartmental relations, *External Integration* was significantly predicted by manufacturers' *Internal Integration* (supporting H3b).

As far as the forecasting process of manufacturers was considered, data analyses demonstrated the insignificant impact of *Forecast Horizon* on the CF practice (not supporting H4). Following this, *Group Forecasting* of partners was found to be significant, and it demonstrated a direct impact on the CF practice (supporting H5). This finding allowed the research to highlight the key role of forecasting meetings in CF. Next, the insignificant impact of *Forecasters' Competence* was found on the CF practice (not supporting H6a). Inversely, *Forecasters' Competence* demonstrated a significant and direct impact on the *Group Forecasting* (supporting H6b). In spite of the insignificant impact of *Forecasters' Competence* on the CF practice, it demonstrated a rigorous influence on the *Group Forecasting*, which was the strong predictor of the CF practice. Accordingly, this research earned an opportunity to argue that *Forecasters' Competence* indirectly influences the CF practice.

As regards the information sharing of manufacturers, data analysis demonstrated the significant and direct impact of sharing different *Information Types* on the CF practice (supporting H7). This demonstration gave full credit to manufacturers' information and led to defending their value in CF whilst prior literature put emphasis on the retailer information. On the other hand, sustaining *Information Quality* was found to be insignificant on the CF practice (not supporting H8a), while it demonstrated a significant and direct impact on the share of diverse *Information Types* with retailers (supporting H8b). This outcome led the research to assert the indirect impact of *Information Quality* on the CF practice due to its significant role in sharing diverse *Information Types* with retailers, which is the strong predictor of the CF practice.

CHAPTER 6: DISCUSSION AND CONCLUSIONS

6.1. Overview

This chapter examines the overall research findings that extend the body of the literature and provide applicable implications to practice. In this context, the scope of the research is initially described clarifying how this research achieved its aim and objectives, and answered each research question in a logical and justifiable manner. Then, the scope of each chapter is summarised in an attempt to highlight key contributions offered to theory, methodology and practice. After tabulating the key contributions of each chapter, a particular emphasis is placed on theoretical and managerial implications. Accordingly, further clarification is provided on how research findings contribute to theory and what are the distinguishing features from prior studies. Finally, future research opportunities are clarified, and limitations are stressed as a contribution to extending the future research fields for the diverse research themes.

6.2. Scope of research and key contributions

The current research has been dedicated to the CF practices of manufacturers and retailers collaborating in the FSC. With a particular emphasis on manufacturers' standpoint in CF, four different product-groups, namely perishable, seasonal and promotional as well as newly launched products, have become the concentration of CF under investigation. With the purpose of increasing the forecast accuracy of associated product-groups and extending the duration of collaboration (one year or more) between partners, this research developed three research questions. Each research question relied extensively upon the research themes of supply chain integration, forecasting process and information sharing respectively, since the intention was to explore candidate factors in achieving long-term and accurate CF in the FSC.

Through the systematic review, qualitative data analysis and critical review of grey literature, thirteen hypotheses were developed depending upon ten constructs in the conceptual model. Based upon survey data captured from manufacturers, located in the UK & Ireland, North America and Europe, ten hypotheses were theoretically validated by the exploratory data analysis technique PLS in response to the research questions. With the intention of conveying this research to the reader, this thesis was organised into six chapters.

6.2.1. Scope of chapter one – Introduction

In chapter one, the background of CPFR was initially addressed to provide contextual knowledge and to present the arguments of prior literature dedicated to this phenomenon. Then, attention was paid to describing the problems that appear in CF, which is one of the three sub-stages of CPFR. Accordingly, the research gap was explored in the dyadic manufacturer-retailer forecasts collaborations, and this gap constituted pragmatic challenges preventing partners from conducting accurate and long-term CF for perishable, seasonal, promotional and newly launched products in the FSC.

Whilst there is a scarcity of research addressing the pragmatic problems in CF, the aim and objectives of this research focused on the extant gap to extend the body of the literature and to offer managerial implications. Accordingly, with a particular emphasis on the food industry, the vulnerability of the market, the role of FSC in Europe and North America, and environmental uncertainties were elaborated. To give a rationale for the significance of associated product-groups, each product-group was also examined based upon the findings and shortcomings of prior literature. Following this, the research approach and philosophy were summarised to provide a clear understanding of the methodological stance of the research. In an attempt to inform the data collection process, which was used to respond to the research questions, the summary of research strategy was conveyed to the reader.

6.2.2. Scope of chapter two – Literature review

In chapter two, systematic review and the critical review of grey literature constituted the primary focus of the research. The systematic review methodology, conducted under the guideline of Tranfield *et al.* (2003), was initially explained (Section 2.2). This description provided a rationale for the review methodology, where the aim was to review peer-reviewed articles published from 1971 to 2013 and to share contributions, limitations and future research opportunities over the research themes of supply chain integration, forecasting process and information sharing. A new systematic review protocol was then introduced as a systematic path of reviewing the literature. This protocol is one of the core contributions to methodology (Figure 2.1). Research approach adopted through the analysis of systematic review and data extraction was then documented transparently.

Accordingly, the results of the systematic review process were outlined. 29 different journals that led to distilling 92 peer-reviewed articles were classified into four groups, namely OM, F&DM, SCM&L and F&DM. Classifying journals into four groups led to distinguishing their primary coverage topic areas, which, in turn, facilitated the categorisation of secondary data upon the particular research themes of this research. Presenting journals' publication trends (Figure 2.2), classification in four groups (Table 2.4), and geographical distribution of articles (based on the affiliation of the first author) (Figure 2.3) became the following contributions to increase the awareness in the field. Next, by considering the four journal groups, methodological contributions of journals were discussed and presented (Figure 2.4), followed by scrutinising the methodological contributions of 92 articles which were categorised based on the three major research themes of this research (Figure 2.5). After that, 28 articles were presented as a contribution to methodology (Table 2.5).

Then, with a particular emphasis on the systematic review and grey literature, the phenomenon of CPFR was subject to the critical review process on the basis of prior studies. Following this, the collaboration practices of S&OP, VMI and QR as well as ECR were reviewed in an attempt to enhance the understanding of their theoretical context and implementation in practice. With the combination of diverse findings from prior literature, the research extracted the objectives, benefits of these four collaboration practices and highlighted the required responsibilities of partners in practice. This outcome represented one of the pragmatic contributions of this research (Table 2.6). Then, the research theme of supply chain integration was reviewed by exploring barriers that prevent integrations in the FSC.

Next, the review process relied purely upon the forecasting process by exploring the extant gap over the forecasting strategies and forecasting methods along with their selection criteria. While the review process addressed the forecasting meetings, four different methods were reviewed. Then, the strengths and weaknesses of these meeting methods, namely Face-to-Face Meeting, Nominal-Group and Delphi-Technique as well as Prediction-Markets, were scrutinised and tabulated as a contribution to practice (Table 2.7). Finally, the role of forecasters was reviewed to have clear wisdom about the extant situation of forecasters in CF.

The final research theme of information sharing was then reviewed. Despite the fact that the focus was manufacturers and this necessitates the analysis of manufacturer information, diverse information sources belonging to retailers were additionally analysed in chapter two. The quality level of information was likewise considered by reviewing diverse benchmarks offered by prior literature while the role of IT systems in CF was not overlooked through the review process.

6.2.3. Scope of chapter three – Development of hypotheses and conceptual model

In chapter three, the primary focus became to justify the theoretical way followed to develop the hypotheses and conceptual model. Therefore, the research concentrated on the theoretical concepts of Whetten (1989) which involved "what, how, why and the combinations of who, where and when". In doing so, the reason behind developing a new CF practice was elaborated, and the research argued its impact on achieving long-term and accurate CF as well as enhancing the forecast satisfaction of manufacturers. This rationalisation encapsulated the first two hypotheses of the research (H1a & H1b). Then, five items constituting the theoretical domain of the CF practice were scrutinised to add a clear understanding of CF in the FSC. These items were trust, commitment and a joint business plan as well as consensus-based internal forecasts along with the sharing of order forecasts. Relevant references supporting the contributions of each item to the domain of the CF practice were also presented (Table 3.1) whilst the CF practice was introduced to the reader as a new candidate contributing to theory (Figure 3.1).

Emphasis was then placed on the integration of manufacturers in an attempt to discuss the potential candidate factors in reply to the first research question. The research offered two hypotheses, *External Integration* and *Internal Integration*, and discussed their impact on the CF practice as potential contributors to achieving long-term and accurate CF in the FSC (H2a & H3a). Elaborating causalities among these hypotheses also became an additional argument in extending the body of the literature over supply chain integration (H3b). Later, the forecasting process of manufacturers was discussed, and the research offered the three hypotheses of *Forecast Horizon*, *Group Forecasting,* and *Forecasters' Competence* as potential answers to the second research question (H4, H5 & H6a). These hypotheses' impact on the CF practice were discussed in a legitimate way, and they turned into potential contributors to theory. By extending the hypothetical arguments, the impact of *Forecasters' Competence* on the *Group Forecasting* was hypothesised as a supplementary candidate extending the body of forecasting knowledge (H6b).

Finally, by initiating the arguments on the information sharing of manufacturers, two hypotheses were offered in response to the final research question, which were *Information Types* and *Information Quality* (H7 & H8a). Along with the reasonable debate over these hypotheses' impact on the CF practice, the research expanded theoretical arguments on the *Information Quality*. Then, hypothetical causalities were defended between *Information Quality* and *External Integration* (H2b) and between *Information Quality* and *Information Types* (H8b) in a legitimate manner. Therefore, apart from offering rigorous answers to the final research question, theoretical contributions were intended to be expanded by interlinking the two different research themes of supply chain integration and information sharing. All hypothetical relationships were then unified, and the conceptual model of the research was presented as a candidate model in extending the body of knowledge over three different research themes (Figure 3.2). In the end, relevant references underpinning the hypothetical relationships were listed to guide the reader in judging the theoretical arguments of the research (Table 3.2).

6.2.4. Scope of chapter four – Research methodology and data collection

In chapter four, the research methodology was justified in a transparent manner, and the logics behind embracing the deductive approach and the epistemological paradigm of positivism were conveyed to the reader. The epistemological paradigms of positivism and interpretivism were also compared, and this comparison was tabulated as an additional guideline for researchers (Table 4.2). Then, the world-view elements of ontology, axiology, and methodology were reviewed. When the world-view methodology was studied, the research presented its methodological aspect by explaining its posture in a rationale way (Table 4.3). Then, research strategies and the triangulation approach were discussed.

Next, attention was paid to explaining the research design. Accordingly, the strategic research process was developed (Figure 4.3). Given the fact that this process consisted of two phases, namely (i) hypothesis development phase and (ii) hypothesis testing phase, each step followed in these phases was explained. After that, the research's data collection process – mixed design was clarified, and the structural and chronological data collection process was portrayed to illuminate the process (Figure 4.4). The research then emphasised the role of social networking sites to give a rationale for the impact of the social networking service LinkedIn on the data collection process. Justifying its employability in the academic field became an additional contribution to methodology (Section 4.1.1)

Then, this chapter provided a clear understanding of the qualitative data collection process of the research. Presenting the outcomes of the single semi-structured interview became the following step, as these outcomes led the research to modify the systematic review based propositions and conceptual model to increase the pragmatic contributions in the field (Section 4.5.1.4). In this respect, the descriptive information about these online group discussions was documented (Table 4.5), along with the explanation of the qualitative data analysis process and the utilisation of QSR NVivo 9. After that, the outcomes of each online group discussions were discussed by underpinning results via literature-based findings (Section 4.5.2.4).

Following this, the research focused on the quantitative data collection process. Descriptions commenced by justifying the reasons for employing the data collection method of online survey questionnaire. This justification was underpinned by distilling 26 articles from the literature (Table 4.6). Next, the design of the online survey questionnaire was described, and it was clarified that this process was conducted under the guidelines of Churchill Jr, (1979) and Flynn *et al.* (1990). Clarifying the process followed to explore the target population and sampling became the next step in chapter four. By considering the structured sampling process of Wilson (2010), the research described the steps of (i) defining the target population, (ii) selecting the sampling frame and (iii) choosing the sampling technique, then (iv) determining the sample size and (v) collecting the data as well as (vi) assessing the response rate.

The quantitative data collection stages were also conveyed to the reader. Initially, the first data collection stage focusing of the social networking service LinkedIn was described. It was followed by the second stage clarifying the utilisation of the online databases of Bloomberg, FEMA, and Osiris. The third and fourth data collection stages were then clarified, with being based on the websites of associated federations and the personal contacts of the author respectively. At the end of the data collection stages, the outcomes were tabulated (Table 4.8), where the research presented the existence of 105 usable responses engendering a 3.06 percent response rate. Then, particular emphasis was placed on assessing the reliability of the sample size and response rate. Initially, the research recalled the interesting findings of Cycyota and Harrison (2006), who warned researchers that there is a noticeably decreasing response rate in survey based studies. The research then unified the suggestions of Saunders *et al.* (1997) and Wilson (2010) to develop three assessment criteria for the sample size and response rate. These criteria were to (i) consider the characteristics of the sample data, which relies on the sampling technique, (ii) compare the sample size and response rate with prior studies, and (iii) analyse the candidate data analysis techniques' features to ensure the coherence between the sample size and the data analysis technique selected.

6.2.5. Scope of chapter five – Data analysis and findings

In chapter five, by extending the discussions on the data analysis technique of PLS, theoretical validation was provided based on the four rigour assumptions of Peng and Lai (2012). The formative structure of the CF practice was also validated based on the four criteria of Jarvis *et al.* (2003) (Section 5.3). Then, the research notified the results of descriptive statistics to the reader. The outcomes encapsulated the position of the respondents, manufacturing companies' number of years in operation, region, and number of employees as well as annual sales volume. Descriptive statistics were then focused on the product-groups to increase the awareness of researchers in the field for future research (Section 5.4).

By employing T-test statistics, it was then confirmed that the research samples are bias free. Then, the research conducted reliability and validity analysis procedures for the measurement model of reflective constructs, the measurement model for the formative construct and the structural model of the research. At the end of analysis procedures, the research statistically confirmed the quality of the conceptual model. In other words, while observed variables appropriately characterised related constructs, each exogenous construct properly predicted associated endogenous constructs, with both endogenous and exogenous constructs accurately creating the complete form of the conceptual model.

Finally, the research applied the bootstrap analysis in the Smart PLS and evaluated the hypothetical relationships in the conceptual model. The hypothesis testing demonstrated the significant impact of the CF practice on the *Collaborative Forecasting Performance*. This finding added important insights into the value of the CF practice by confirming its impact on the achievement of long-term and accurate CF in the FSC. Then, the data analysis explored the CF practice as a significant and direct predictor of *Forecast Satisfaction*, representing manufacturers' satisfaction from forecasts generated for perishable, seasonal and promotional as well as newly launched products. These two demonstrations led to confirming the arguments of the current research on the CF practice, developed to accomplish the research aim.

In reply to the first research question, manufacturers' *External Integration* with retailers was found to be a significant predictor of the CF practice. Based on this finding, manufacturers' integration with retailers is a substantial necessity to achieve long-term and accurate CF. Data analysis then exhibited the significant and direct impact of *External Integration* on the *Information Quality*. In other words, when manufacturers successfully integrate with retailers they will be able to sustain the quality of information exchanged in CF. *Internal Integration* of manufacturers also demonstrated a significant impact on the CF practice. This outcome confirmed the significant role of interdepartmental relations of manufacturers in achieving long-term and accurate CF. Then, the significant and direct impact of *Internal Integration* was confirmed on the *External Integration*.

In terms of the second research question, data analysis revealed the insignificant impact of *Forecast Horizon* on the CF practice. This finding made it possible to infer that different choices of partners about the *Forecast Horizons* of perishable, seasonal, promotional, and newly launched products do not influence the performance of CF. *Group Forecasting* of partners was then found to be significant, and it demonstrated a direct impact on the CF practice. To put it another way, partners' *Group Forecasting* is important in CF. Nevertheless, it is not as imperative as either manufacturers' *Internal Integration* or *External Integration* with retailers. This inference emerged from the path coefficient size of hypotheses. Then, the insignificant impact of *Forecasters' Competence* was demonstrated on the CF practice. However, *Forecasters' Competence* showed a significant and direct impact on the *Group Forecasting*. This finding arguably implied that *Forecasters' Competence* indirectly influences the CF practice due to its predictor role on the *Group Forecasting*.

As regards the final research question, data analysis demonstrated the significant and direct impact of *Information Types* on the CF practice. This finding allowed the research to advocate that sharing diverse *Information Types* with retailers is a promising practice for long-term and accurate CF, and it is more valuable than the implementation of *Group Forecasting* in CF. Based on the size of path coefficients, the importance of *Information Types* in CF is also comparable with manufacturers'

Internal Integration and *External Integration.* Maintaining the *Information Quality* was, however, found to be insignificant on the CF practice while it demonstrated a significant and direct impact on the share of diverse *Information Types* with retailers. By taking into account the significant role of *Information Quality* in sharing diverse *Information Types* with retailers, it can be argued that *Information Quality* has an indirect impact on the CF practice. Overall, the combinations of all findings, responding to the research questions, led to recommending a concrete conceptual model to the literature and practice (Figure 5.2). The summary of contributions emerged from each chapter is presented in Table 6.1. The following section extrapolates the research findings in detail and adds valuable contributions to both theory and practice.

Table 6.1. Contributions to theory, methodology and practice

	Achievements in chapter/s	Contributions to			
		Theory	**Methodology**	**Practice**	**Guide the reader / researchers**
1	*****Research aim and objectives (Section 1.3) *Research questions (Section 1.4)	x			
2	*****Systematic review protocol (Section 2.2.1) & (Figure 2.1)		x		x
	*****Publication trend of systematically reviewed articles (Figure 2.2)				x
	*****Geographical distribution of journals (Figure 2.3)				x
	*****Methodological contributions of journals (Figure 2.4)		x		
	*****Methodological contributions of articles (Figure 2.5)		x		
	*****Classification of journals (Table 2.4)				x
	*****List of articles purified based on their contributions to the food industry, associated product-groups and research themes (Table 2.5)		x		x
	*****Objectives and benefits of collaboration practices along with the responsibilities of partners in S&OP, VMI, QR and ECR (Table 2.6)			x	
	*****Strengths and weaknesses of techniques used in the forecasting meetings (Table 2.7)			x	
3	*****Relevant references of formative variables constituting the CF practice (Table 3.1)				x
	*****The CF practice aiming to achieve long-term and accurate CF and the forecast satisfaction of manufacturers (Figure 3.1)	x			
	*****Conceptual model (Figure 3.2)	x			
	*****Relevant references of hypotheses (Table 3.2)				x
4	*****Comparison of epistemological research philosophies / paradigms (Table 4.2)		x		x
	*****Methodological aspect of current research (Table 4.3)		x		x
	*****Strategic research process – Flowchart (Figure 4.3)		x		x
	*****Structural and chronological data collection process (Figure 4.4)		x		x
	*****Rationale for using social networking sites for academic research (Section 4.4.1)		x		x
	*****Outcomes of the semi-structured interview (Section 4.5.1.4)	x		x	
	*****LinkedIn-based online group discussions (Table 4.5)		x		x
	*****Outcomes of the online group discussions (Section 4.5.2.4)	x		x	
	*****Survey questionnaire oriented relevant studies (Table 4.6)		x		x
	*****Outcomes of quantitative data collection stages (Table 4.8)				x
5	*****Development of a formative construct: the CF practice – Theoretical definition (Section 5.3)	x			
	*****Descriptive statistics (Section 5.4)				x
	*****The CF practice → Collaborative Forecasting Performance (H1a)	x		x	
	*****The CF practice → Forecast Satisfaction (H1b)	x		x	
	*****External Integration → The CF practice (H2a)	x			
	*****External Integration → Information Quality (H2b)	x			
	*****Internal Integration → The CF practice (H3a)	x			
	*****Internal Integration → External Integration (H3b)	x			
	*****Forecast Horizon → The CF practice (H4)				x
	*****Group Forecasting → The CF practice (H5)	x			
	*****Forecasters' Competence → The CF practice (H6a)				x
	*****Forecasters' Competence → Group Forecasting (H6b)	x			
	*****Information Types → The CF practice (H7)	x			
	*****Information Quality → The CF practice (H8a)				x
	*****Information Quality → Information Types (H8b)	x			
	*****Results of Structural Model (Figure 5.2)	x		x	

Source: *Developed by the author*

6.3. Theoretical and managerial implications

6.3.1. The CF practice in the FSC

Through the systematic review, qualitative data analysis and critical review of grey literature as well as quantitative data analysis, this research offers a new theoretical approach for the CF of manufacturers. The CF practice aims to (i) increase the forecast accuracy of perishable, seasonal and promotional as well as newly launched products and (ii) guide manufacturers in conducting long-term collaborations with retailers. Its implementation also seems to satisfy manufacturers from the forecasts generated for associated product-groups. Practitioners can avail themselves of this CF practice when they aim to conduct long-term and accurate CF with retailers. Its application, however, entails fundamental preconditions, which are trust, commitment, and joint business plans as well as consensus-based internal forecasts along with the sharing of order forecasts with retailers.

Regarding these preconditions, manufacturers' consensus-based internal forecasts is the most significant factor for the implementation of the CF practice, which is followed by joining business plans and sharing of order forecasts with retailers. Building trust in CF is also a significant factor, but not like the former three preconditions. Exhibiting commitment between partners is not a significant entailment, yet the data analysis of this research made it possible to ensure that this factor needs to be taken into account during the implementation of the CF practice. In this regard, as long as manufacturers fulfil these preconditions, they can not only conduct long-term and accurate CF with retailers, but also be satisfied from forecasts generated for perishable, seasonal and promotional as well as newly launched products.

In terms of the consensus-based internal forecasts, this practice clearly adds more insight to manufacturers' multiple forecasts generated by diverse departments over different sources and objectives. As multiple forecasts exacerbate internal-external conflicts in collaborations with retailers (Taylor and Fearne, 2006; Fliedner, 2006; 2003; Helms *et al.*, 2000), generating consensus-based internal forecasts seems a promising remedy for manufacturers. This indicates that manufacturers need to generate a single forecast that fully satisfies relevant departments beforehand. This calls for the cross-functional relationships of departments. For instance, McCarthy *et al.* (2006) stressed how 53 percent of USA firms worked cross-functionally to incorporate departmental forecasts while 54 percent employed CF. As departments' cross-functional integration underpins accurate forecasts (Oliva and Watson, 2011; Nakano, 2009; Davis and Mentzer, 2007), agreeing on a single forecast improves CF with retailers (Fliedner, 2006; 2003).

To accomplish better consensus-based internal forecasts, S&OP seems a reliable option for manufacturers. This is because, S&OP is a decision making process to harmonise strategic, operational and financial plans to have a consensus on a single plan, and such a plan holds risks, opportunities and actions relative to demand forecasts and the supply chain (VICS, 2010). It is a long-term strategic plan that allows manufacturers to synchronise their internal-external relation in CF with retailers (Mello, 2013). Hence, merging S&OP to the CF practice offered by this research will assist manufacturers, not only facilitating consensus between departments, but also improving their integration with retailers. It is worth underpinning this recommendation with the collaboration of The Lowe's Home Improvement and Whirlpool. These partners successfully linked the practices of CPFR and S&OP, and increased sales by 12 percent through timely deliveries, which led to reducing inventory costs by 5 percent (Smith *et al.*, 2010).

Considering the necessity of joining business plans, it is one of the significant factors for the CF practice. The finding is in line with past literature, where joint business plans were stressed as a vital and collaborative task of engaging strategies and building steps to solving conflicts between partners (VICS, 2004; Siefert, 2003; Barratt and Oliveira, 2001). Because the CF practice aims to improve long-term and accurate CF, joining business plans with retailers should be an essential practice. Supporting this view, Nyaga *et al.* (2010), for instance, highlighted the necessity of joining plans in long-term collaborations. There are contrary views too, and Ramanathan and Gunesakaran (2014), for instance, showed that collaborative planning is not a significant factor for future collaborations. However, these authors' analyses were in the textile industry, and perceptions on future collaborations regarded business expansion, collaboration on a new project and transparent information sharing. Whilst their study was limited to promotions, this research stresses long-term collaborations based upon the forecasts of particular product-groups, including perishable, seasonal, promotional and newly launched products, in the FSC. Therefore, researchers can benefit from these differing findings to interrogate the importance of joint business plans in partners' collaboration.

Another precondition for the CF practice is to share order forecasts with retailers. This finding supports the observations of Småros (2007) in Europe, where partners confronted challenges in transforming forecasts from the supply chain level to the store level due to different forecasting approaches. The underlying reason is that when partners share separately generated order forecasts, it enables them not only to reflect recent changes in demand but also to clarify whether the order is for the short or long-term (Ireland and Crum, 2005; Siefert, 2003). Furthermore, increasing forecast accuracy relies largely upon the clear understanding about for what purpose these forecasts are used (Zotteri and Kalchschmidt, 2007). For practitioners, this indicates that sharing order forecasts with retailers enables retailers to have a clear understanding about the reason for order forecasts (e.g. production planning and supply chain) and to modify demand based on manufacturers' forecasts. This practice therefore makes it possible to conduct a transparent forecasting process in meetings, easing consensus with retailers in CF.

Regarding the role of trust and commitment for the CF practice, the results of the current research are contrary to earlier literature. In response to the significance of trust (at 0.05 level), it was found that commitment is not a crucial item in forming the CF practice. Past literature stressed that trust and commitment are two major essentials of long-term collaborations (Vlachos and Bourlakis, 2006; Mentzer *et al.*, 2000). It is interesting that the qualitative data analysis of this research also claimed the importance of both trust and commitment, contrary to the quantitative data analysis. In detail, the outcomes of the semi-structured interview claimed the necessity of trust and commitment in the long-term.

In terms of the trust factor, the current research supports the assertions of Taylor and Fearne (2006), who stressed the importance of trust between partners for effective demand management. The findings of online group discussions are also in line with the quantitative data analysis and prior literature. These outcomes add further understanding to the importance of trust, as the quality of relationships between partners hinges upon their effort put into building trust, which in turn conveys permanence to their collaboration (Fischer, 2013).

On the other hand, quantitative data analysis indicates that commitment is not a vital requisite for the CF practice. This raises question marks, as past literature confirmed its necessity for satisfactory relationships (e.g. coordination, participation in decision marketing, information sharing and management activities) (Nyaga *et al.*, 2010). Past literature also gave full credit to the commitment to develop promising collaborations (Dwyer *et al.*, 1987). It is worth remembering that the qualitative data analysis of this research also claimed its prominence in collaborations. In a similar vein, Simatupang and Sridharan (2002) argued that commitment between partners is the precondition of successful collaborations. Interestingly, while Nyaga *et al.* (2010) confirmed the importance of commitment for profitability, sales growth, and market share in collaborations, this factor, contrarily, was not found to be a significant factor for a collaborative performance, including forecast accuracy, order cycle times and order processing accuracy as well as on time deliveries.

Similar to Nyaga *et al.* (2010), the CF practice in this research aims to improve forecast accuracy, and commitment was not found to be a significant factor. However, the findings of these authors confirmed the commitment for financial and operational practices. There are also a plethora of studies supporting the necessity of both trust and commitment to cope with volatile demand in the FSC (Van der Vaart *et al.*, 2012; Ha *et al.*, 2011; Johnston *et al.*, 2004). These comparisons and contrary views therefore need to be appraised with future research to clarify the role of commitment on the forecast accuracy in addition to the trust factor in the FSC.

For managerial practice, it can be argued that building trust is an important element for the implementation of the CF practice, yet creating such a trust-based environment in collaborations is most likely to demand the other elements of the CF practice. In other words, generating consensus-based internal forecasts is likely to lead to sharing reliable order forecasts with retailers. Developing joint business plans is an action of not only integrating strategic objectives and operational practices, but also showing willingness and confidence in pursuing collaborations. Thereby, partners are very likely to build trust with each other in CF. In this context; it is promising to deduce that developing the CF practice adds a new dimension to the forecasting and supply chain practices of manufacturers. This approach can guide practitioners to generate accurate forecasts for perishable, seasonal and promotional as well as newly launched products. Conducting long-term collaborations is also achievable, yet the aforementioned preconditions need to be fulfilled in collaborations. To fulfil these necessities and to get full benefit from the CF practice, there are more responsibilities that should be taken, which were explored by achieving the research objectives. They are discussed in the following sections.

6.3.2. Integration of supply chain

Accomplishing the first research objective led to the finding that integration practices of manufacturers are the most contributing factors to long-term and accurate CF. Unlike past studies, this research started to investigate the operations of manufacturers from the internal level. These internal practices comprise the skills of preparing and conducting effective delivery plans, inventory management for end products, and the availability of IT systems for timely information sharing between departments as well as the level of recording departmental information. The findings of the research confirm that the *Internal Integration* of manufacturers is the strongest antecedent of the CF practice.

This finding corroborates the observations by Småros (2007), who illustrated the manufacturers' loss of information when they collaboratively forecasted newly launched products with retailers in the European grocery sector. The findings of Ramanathan and Gunasekaran (2014) are also underpinned by this empirical outcome, since they demonstrated the significance of timely delivery and investment in IT systems for long-term and successful collaborations. Differently from prior studies, this research not only underpins the existing literature, but also broadens it by ascertaining how manufacturers' inventory management and regular data recording affect their CF with retailers. These results are beneficial for practitioners and need to be taken into account through the forecast collaboration with retailers.

In addition, the findings show that *Internal Integration* is the vital predictor of *External Integration. External Integration* comprises interdependence, flexibility and availability of IT systems for information exchange along with top managements' adoption of the same vision. The findings present manufacturers' *External Integration* with retailers as the second strongest and direct antecedent of the CF practice. This makes manufacturers' *Internal Integration* even more important to extend the integration external level and to conduct promising CF with retailers in the FSC. With this finding, the arguments of Stevens (1989) are supported, because the author considered *Internal Integration* as the preceding step of integration with suppliers and customers at the external level. Unlike Stevens (1989), this research focuses on strategic and long-term integration with retailers while the study by Stevens (1989) also considered suppliers based on the tactical and medium term integration. Furthermore, this research extends the findings of Braunscheidel and Suresh (2009) to the downstream level. These authors demonstrated the importance of *Internal Integration* for *External Integration* with suppliers, yet the same vision was followed in terms of building long-term relationships between partners.

In practice, this finding indicates that manufacturing companies need to not only invest in IT systems and record departmental information, but also increase their skills for timely deliveries and inventory management. This will allow manufacturers to improve cross-functional communication and to prepare a rigid infrastructure for successful integrations with retailers at the external level. As the IT systems are critical for interdepartmental communications in the FSC (Taylor and Fearne, 2006; Taylor, 2006), these findings offer valuable implications to sustain profitable CF. Manufacturers can make use of these findings to create a good interdepartmental platform, which will in turn help them to improve production and supply chain plans in addition to better collaborations with retailers.

Exploring the significant impact of *External Integration* on the CF practice led to offering opposing findings to a number of prior studies. In detail, Småros (2007) argued that IT systems are not a primary barrier for long-term CF. Similar to Småros (2007), Barratt (2004) claimed that technology is not essential in collaborations. This finding extends the literature in the contrary way, and shares the same vision with studies which stressed the role of costly IT systems restricting the application of CF for a broad range of product-groups (Sari, 2008; Fliedner, 2003; McCarthy and Golicic, 2002). In terms of product-groups, the current research extends the findings of Aviv (2007; 2001). The author previously stressed the benefits of IT systems when long-life cycle product-groups were taken into account in CF. This research rather considered time-sensitive and / short-life product-groups in CF, and demonstrated the importance of IT systems. Therefore, it is reasonable to stress that IT systems are important to collaboratively forecast a wide range of product-groups. These findings and comparative analyses offer important implications for manufacturers to invest in IT systems regardless of the shelf life products being subject to collaborations.

It is worth stressing that having different IT systems with some retailers was found to be an important obstacle by Taylor and Fearne (2006). These authors exemplified how partners' different IT systems reduced the speed of information exchange and engendered forecast errors along with the administrative costs in the UK FSC. The outcomes of the semi-structured interview are also in line with prior literature. There are also a number of studies, which argue the proliferation of IT systems resulting in difficulties (Evangelista *et al.,* 2013; Taylor, 2006). For instance, by examining the role of IT systems in the third party logistics providers, a study by Evangelista *et al.* (2013) addressed how widespread IT systems caused difficulties for small and medium sized companies in selecting appropriate systems. The examination of IT systems in this research is limited to the integration level of manufacturers; as such it seems promising to question how different IT systems affect forecast accuracy and information exchange in the FSC. Such an examination will provide encouraging insights to practitioners who not only participate in the FSC, but also in the logistics sector.

On the other hand, clarifying the importance of interdependence and top management vision through the integration with retailers led to following a similar path with past studies. This is because prior literature similarly found that these practices are the major drivers of long-term collaborations (Zacharia *et al.,* 2011; Hong *et al.,* 2005; Mentzer *et al.,* 2000). Chen and Paulraj (2004) also defended the necessity of interdependence for better networks between partners, rather than driving forward the power in supply chains. Barratt (2004) stressed the support of top management, yet the author placed emphasis on its role for inter-organisational operations.

This research rather supports the vision of top management for manufacturers in terms of adopting the same strategic objectives with retailers. Following this, this research found that being flexible in case of unexpected contradictions strengthens integrations with retailers. This outcome adds a new dimension to the CF of manufacturers in the FSC. In the literature, while some studies considered the flexibility factor as a corporate behaviour by linking it to suppliers' trust-based relationships with buyers (Johnston *et al.*, 2004), others considered it as a skill of modifying production, inventory and short-term fluctuating demand from the manufacturer's standpoint (Ha *et al.*, 2011). Therefore, this finding extends the assessment of the flexibility factor from corporate behaviour and the internal abilities of manufacturers to the *External Integration* level in CF.

For managerial practice, manufacturers need to show loyalty to retailers and to be flexible in case of having some disagreements in terms of forecast collaborations. This will not only help them to get further benefit from CF, but also to improve their abilities of rapidly reacting to market dynamics (Ha *et al.,* 2011). Being responsive against instant demand changes is vital when time-sensitive and / or short-life product-groups are subject to CF. This necessitates investments in IT systems for timely information exchange with retailers. Such an investment will broaden the application of CF for a wide range of product-groups (Sari, 2008). Yet the top management plays a vital role through this integration process, calling for the adoption of the same vision in CF. The reason is that collaborating over a single vision with retailers intrinsically reflects manufacturers' ability to be open to new forms of partnerships and to make the required investments (Mentzer *et al.,* 2000). The successful collaboration of H.J. Heinz Ltd and Oshawa foods is an important example, as these companies collaborated upon the same vision of their top management teams (Crum and Palmatier, 2003). Tesco and Sainsbury's, for instance, expect to be proactive and open to multi-functional linkages from manufacturers, calling for the approval of top management (Fearne and Hughes, 2000).

Another finding is the significant impact *of External Integration* on the *Information Quality*. This result initially closes the gap in the literature due to the scarcity of empirical studies addressing the impact of top management and IT systems on sustaining *Information Quality*. Further, it strengthens the contributions of the study by Hartono *et al.* (2010), which is the first study to find a significant impact of top management and availability of IT systems on the sharing of quality information. On the other hand, the research provides contrary evidence to the study by Li and Lin (2006), where top management and the availability of IT systems did not influence *Information Quality*. As a managerial implication, manufacturers should consider how their interdependence to retailers and the behaviour of being flexible in case of having disagreements affect *Information Quality* during information sharing, rather than taking into account the dominance related conflicts.

In essence, these findings evoke the study by Chen and Paulraj (2004). These authors stressed the non-power based relationships by implying the importance of interdependence between partners. Given the fact that dominance is already a vital barrier for CF (Aviv, 2007; Småros, 2007), further attention should be paid to conducting collaborations shoulder to shoulder rather than exhibiting dominance related attitudes. Considering the study by He *et al.* (2013) which revealed that limiting dominance between partners reinforces information exchange and supply chain performance, it can be a good opportunity to address the power of partners in CF based on their degree of collaboration. It is important to highlight the complex and dynamic structure of FSC (Bourlakis and Weightman, 2004). Therefore, shedding further light on the role of top management and IT systems in terms of maintaining *Information Quality* in CF seems a vital implication for manufacturers. Managers can benefit from this research to have a clear insight about the ways of conducting transparent information sharing with retailers during the alignment of supply chains, which will in turn enable them to generate reliable forecasts in CF.

Overall, this research not only extends the body of literature on supply chain integration, but also connects the supply chain knowledge to the information sharing literature. Practitioners can benefit from this research by having a clear understanding of the attitude that they adopt in collaborations and of investment requirements to integrate internally and externally for promising CF in the FSC.

6.3.3. Group based forecasting

The third objective of the research made it possible to explore the significant role of *Group Forecasting* in achieving long-term and accurate CF, in which partners meet as a group to negotiate exceptions over product-related forecasts to have a consensus on a single order forecast. *Group Forecasting* is a direct and strong predictor of the CF practice, yet this impact is inferior to manufacturers' *Internal-External Integration* as well as the sharing of diverse *Information Types*. In this research, *Group Forecasting* consists of partners' regular meetings, pre-established decision making procedures and level of hierarchy along with constructive discussions and effective usage of information for consensus forecasts. Primarily, this finding closes the gap in the literature due to the absence of studies devoted to *Group Forecasting* (Önkal *et al.*, 2012), which is a good platform for forecasters to judge forecasts over market dynamics (Önkal *et al.*, 2011).

Uncovering the significance of *Group Forecasting* in CF reinforces the previously developed CPFR process, where meetings are vital in solving partners' forecast exceptions (Ireland and Crum, 2005) and are requisite for making decisions based on pre-established rules to be able to facilitate consensus amid partners (Siefert, 2003). The difference in the research is to extend partners' forecasting meetings to a number of *Group Forecasting* techniques. In this regard, partners earn alternative options to utilise meetings based on existing situations through collaborations. As far as the elements of *Group Forecasting* are considered, the level of hierarchy seems an important matter in meetings, as was previously argued by Graefe and Armstrong (2011) as one of the blind sides of face-to-face-meetings. Given that these authors' experimental analyses considered non-hierarchical meetings, this finding empirically validates the arguments of authors in the realistic food market. Nominal-Group does not allow such a drawback due to its structured format (Van de Ven and Delbecq, 1974; 1971), which in turn implies this technique's strengths in ruling out hierarchical conflicts in CF.

Previously, Helms *et al.* (2000) stressed the risk of dominance in CF when partners' forecasting teams meet to generate consensus forecasts, and such characters tend to achieve superiority by influencing forecast results. Therefore, formalising the concept of *Group Forecasting* as a non-hierarchical and structural platform leads to making decisions based on pre-established procedures. Practitioners can take notice of hierarchal impacts in meetings and modify their *Group Forecasting* by getting benefit from this research. Accordingly, forecasters can generate / adjust forecasts or merge external sources to forecasts based on pre-established procedures, enabling them to objectively aggregate forecasts, which will in turn enhance participation in *Group Forecasting* (Graefe and Armstrong, 2011).

Due to the importance of constructive discussions in *Group Forecasting*, the multimedia based Delphi-Technique seems to be an alternative for partners, who do not have sufficient time to conduct regular face-to-face-meetings. Such time constraints are likely to occur when perishable, seasonal and promotional as well as newly launched products are subject to collaborations. The characteristics of Delphi-Technique are similar to Nominal-Group, enabling transparency on consensus forecasts in meetings (Kerr and Tindale, 2011; Davis and Mentzer, 2007; Aviv, 2001; Helms *et al.*, 2000). In spite of the fact that contract based collaborations are beyond the scope of this research, if partners tend to collaborate over contracts, it can be an option for them to apply Prediction-Markets. This technique will allow them to share different types of information (Wolfers and Zitzewitz, 2004) and to reinforce forecasts with additional information. Practitioners can get further benefit from this research by considering Table 2.7 developed to present the strengths and weaknesses of the aforementioned techniques used for forecasting meetings.

Relying on the role of forecasters, *Forecasters' Competence* was not found to be significant for the CF practice, but it showed a direct and strong influence on the *Group Forecasting*. *Forecasters' Competence* includes market based experience for the products involved, level of advice, motivation, willingness and feedback as well as confidence in accepting advice from each other along with satisfaction from consensus forecasts. Previously, Van Swol (2011) discussed the role of experience, and stressed the worsened consensus in meetings because of the overlapping experience of forecasters on particular product-groups. This research shares similar views to Van Swol (2011), and extends the literature by clarifying the requisite of experience when perishable, seasonal and promotional as well as newly launched products are forecasted in meetings. Stressing the importance of market based experience for the products involved in this research equally reinforces the findings of previous studies (Sanders and Ritzman, 2004; Edmundson *et al.,* 1988), which highlighted the product based knowledge as the most significant factor to improve forecast accuracy during the judgment of forecasts. This outcome implies that practitioners should give priority to the product-based knowledge through the development of consensus forecasts in *Group Forecasting*, and not underestimate market dynamics that are likely to escalate demand variability.

Drawing further attention to the role of advice given between forecasters in *Group Forecasting* seems an important contribution for the forecasting literature (Önkal *et al.*, 2012). The value of advice here is dependent largely upon the advisor and the information, which prompted him/her to give advice (Lawrence *et al.*, 2006). This obliquely hints at the importance of trust and commitment between forecasters. The underlying reason is that previous studies already indicated that accepting advice is pertinent to forecasters' trust in and commitment to each other (Van Swol, 2011; Rowe and Wright, 2011) whilst their overconfidence gives rise to bias in *Group Forecasting* and harms collaborations (Kerr and Tindale, 2011; Sanders and Ritzman, 2004). Further, previous literature stressed the important role of motivation in effectively adjusting forecasts (Fliedner, 2006; 2003; Webby and O'Connor, 1996). Supporting this, case studies by Frewer *et al.* (2011) exemplified the importance of motivation for the utilisation of the Delphi-Technique in the European agri-food sector. Consequently, this research shares the same opinion with past studies, and stresses the importance of *Forecasters' Competence* in *Group Forecasting*.

It is, however, important for forecasters to understand the underlying reason for feedback given to each other, which relies on the level of understanding, timing, and presentation (Lawrence *et al.*, 2006). This accordingly eases the satisfaction from consensus forecasts (McCarthy Byrne *et al.*, 2011). The findings of the current research advocate the same views as Ireland and Crum (2005) who indicated that successful collaboration relies on cross-functional teams' common understanding of cooperative expectations and forecasts generated during *Group Forecasting*. Confidence is another competence that forecasters need to exhibit to each other. If *Group Forecasting* is managed through the Delphi-Technique or face-to-face-meetings, this competence implies forecasters to trust each other through suggestions given in *Group Forecasting*. The reason behind this is that these techniques allow forecasters to provide insight when their colleagues bring new information to meetings (Kerr and Tindale, 2011). Such a harmony among forecasters is very likely to facilitate consensus forecasts, and positively influence the collaboration between manufacturers and retailers.

When it comes to generating forecasts in *Group Forecasting*, forecasters however should avoid having strong confidence in dictating personal views to other forecasters. In that, such a dictatorial attitude not only harms the rationale for *Group Forecasting* (Bolger and Wright, 2011), but also engenders dominance, which worsens the coherence in meetings and, of course, consensus forecasts. In essence, this implication adds more understanding on the experimental findings of Graefe and Armstrong (2011), who illustrated the increased satisfaction of forecasters in Nominal-Group, which does not allow forecasters to show such dominance due to its structured form. Overall, despite the insignificant role of *Forecasters' Competence* in the CF practice, exploring its direct and strong impact on the *Group Forecasting* indicates that forecasters are valuable for CF. Despite this, the forecasting literature needs to be extended further with regard to the role of forecasters. For instance, it is encouraging to question how forecasters' qualifications and / or collaboration in meetings affect the forecast collaborations of manufacturers with retailers.

On the other hand, the antecedent of *Forecast Horizon* was found to be insignificant for the CF practice. This finding is contrary to the observations that uncovered partners' overlapping views with regard to the term of forecasts over short-life and newly launched products in CF (Småros, 2007; 2003). Given the unilateral outcomes of this research representing manufacturers, this ambiguity exacerbates doubts about retailers' view on the *Forecast Horizon* for future research. On the other hand, revealing the *Forecast Horizon* of associated products as an insignificant factor supports the presumptions of Aviv (2002; 2001), where the author addressed the CF practices of partners based on long-life products. In essence, this finding on the *Forecast Horizon* is likely to be attributed to manufacturers' consensus-based internal forecasts, which is one of the key items that form the CF practice in this research.

The logic behind this judgment is to recognise that *Forecast Horizon* related conflicts between partners largely occur due to manufacturers' long lead-times and production plans (Småros, 2007). In this research, consensus-based internal forecasts are found to be a remedy for manufacturers' multiple forecasts generated by departments based on diverse objectives and sources, which in turn escalates conflicts in CF (Fliedner, 2006; Helms *et al.*, 2000). Consequently, this result hints that while manufacturers are satisfied of their own forecasts, manage their delivery plans effectively and share production plans with retailers, there could be no reason for not agreeing on the *Forecast Horizon* of related product-groups with retailers. Nevertheless, academics need to pay further attention to this result and to clarify underlying reasons that direct partners to consider different *Forecast Horizon* in CF.

In this respect, this research serves to extend the forecasting literature on the *Group Forecasting* by way of CF, and recommends future research on the *Forecast Horizon* of related product-groups. For example, it could be interesting to learn the perception of retailers on the *Forecast Horizon* of associated products and then to compare related results to the findings of this research. The central implication for practitioners here represents their constructive forecasting meetings, which is a matter for consensus forecasts. When time-sensitive and / or short-life products are subject to CF, *Forecasters' Competence* plays a prominent role in meetings as a remedy for generating accurate forecasts in a timely manner. This is very likely to bring a competitive advantage to partners in the vulnerable food market. The results of this research can guide practitioners to conduct encouraging meetings and to get full benefit from forecasters for consensus forecasts in CF.

6.3.4. Information exchange

The final objective of this research made it possible to contribute to the information sharing literature by disclosing the significance of sharing diverse *Information Types* with retailers as one of the solutions for long-term and accurate CF in the FSC. In response to past literature giving value to the retailer information (Ramanathan, 2013; Danese, 2007; Småros, 2007; Fliedner, 2006), this research draws the attention of practitioners to manufacturers' sources. Unlike past studies, this research extends the literature and closes the gap between theory and practice by clarifying the importance of various *Information Types.* These sources include manufacturers' inventory levels, production planning and scheduling as well as recent information that captures environmental factors, weather conditions and product / company related data along with past experience, which needs to be merged into forecasts afterwards.

The current research also correlates the information sharing and supply chain integration literature, giving value to the sharing of production planning and scheduling, and extends their findings to the strategic level. In particular, Flynn *et al.* (2010) highlighted the necessity of sharing production planning and scheduling for the customer-supplier integrations, where such integration underpins operational performance, such as rapid response to demand changes, on time deliveries and new product introductions to market. On the other hand, Zhou and Benton Jr, (2007) addressed the sharing of production planning through information sharing for effective supply chain practices, including supply chain planning, JIT production and delivery practices. This research rather focuses on production planning and scheduling as rewarding data that should be shared for accurate forecasts and long-term collaborations by way of CF. In other words, this finding raises the importance of production planning and scheduling from the operational level to the strategic level, calling for long-term partnerships.

Interestingly, this outcome is contrary to the findings of Ramanathan and Gunasekaran (2014). These authors highlighted the sharing of production planning as a part of collaborative planning, which supports the success of collaboration and does not influence the long-term collaborations. However, demonstrating the significant impact of sharing various *Information Types* on the CF practice shows a solid implication that the sharing of production planning is one of the building blocks of long-term collaborations by way of information sharing. In a similar vein, past literature confirmed that sharing production planning and scheduling related data for the products of interest augments the understanding of the demand of retailers. This practice, in turn, assists manufacturers to satisfy retailers by way of procuring their short-term demand and to reduce excessive capacity requirements (Fliedner, 2006).

In addition to the sharing of production scheduling for the products of interest in CF, sharing inventory related data received the support of prior literature. This sort of information sharing facilitates collaborative planning and reduces inventory costs among partners (Arshinder *et al.*, 2008; Chen and Paulraj, 2004; Karoway, 1997). In this research, sharing inventory data of the products that are subject to CF supports long-term collaborations and the generation of accurate forecasts. Hereby, it is promising for practitioners to infer that sharing product-oriented inventory information not only reduces costs in collaborations, but also leads to maintaining the product availability that brings competitive advantage in the market.

Supporting this inference, Wal-Mart and its suppliers, for instance, gained valuable benefits by exchanging their inventory related data in collaborations. Specifically, while this information exchange enabled the retailer to give timely orders and to reduce inventory costs, suppliers earned the retailer’s loyalty due to their increased response against rapid demand changes, which brought a competitive advantage to Wal-Mart (Simatupang and Sridharan, 2002). In the computer sector, Dell similarly exchanged inventory data with both suppliers and customers, and this practice helped the company to increase the capability of supply chain planning (Zhou and Benton Jr, 2007). Prior literature and these practical anecdotes promote the reliability of the findings offered by this research, and make it possible to provide implications for practice.

Uncovering the impact of recent information to be shared in CF is also in line with the previous literature highlighting its positive effect on the forecast accuracy and consensus between partners (Lawrence *et al.*, 2006; Sanders and Ritzman, 2004; Sanders and Manrodt, 2003). It is clear that whilst forecasters generate forecasts for newly launched and promotional products in dynamic markets, they need additional information to cope with fluctuating demand (Helms *et al.,* 2000). Hence, data exchange should not be limited to only past and present sources, but also it is significant for partners to inform each other about recent changes as well as future events planned beforehand (Sanders and Manrodt, 2003). In this context, recent information can be related to the environment, competition, weather conditions and product / company related recent changes. It can also be related to the experience of companies with regard to related product-groups or specific market circumstances (Sanders and Ritzman, 2004). Notwithstanding the judgment capability of forecasters, sharing such sources enables them to strengthen their forecasts and to improve forecast accuracy. For managerial practice, manufacturers need to take advantage of these findings and to share the aforementioned *Information Types* with retailers to be able to improve the performance of CF.

Unexpectedly, *Information Quality* was not found to be a significant antecedent of the CF practice. In this research, the quality level of information is based on its relevance, adequacy and accuracy along with timeliness. It also involves the frequent and consistent information sharing in addition to manufacturers' responsiveness in reply to information received from retailers. It is interesting that past studies revealed the important role of *Information Quality* on supply chain performance and associated practices (e.g. supply chain planning, delivery and production), which, in turn, enhanced transparency and reduced forecast errors (Hartono *et al.*, 2010; Zhou and Benton Jr, 2007). For instance, related studies that addressed the sharing of good quality information between partners demonstrated that accurate information flow is the most significant factor while the indicators of timeliness and adequacy appear to be the following factors improving supply chain performance (Chang *et al.*, 2013).

In this research, *Information Quality* was yet to be the strong predictor of the CF practice, which aims at improving the duration of collaboration and forecast accuracy of the associated product-groups. Knowing that through the sharing of quality information, partners are likely to develop reciprocal trust for long-term collaborations (Chang *et al.*, 2013), the findings of this research cause contradictory outcomes, compared with the literature.

In this context, it is reasonable to deduce that manufacturers' perception on the *Information Quality* seems an uncertain field, when it comes to conducting CF with retailers in the FSC. For instance, case studies in the food industry stressed the benefits of maintaining *Information Quality* in terms of effectively managing demand and reducing costs (Taylor, 2006; Taylor and Fearne, 2006). Zhou and Benton Jr, (2007) then clarified that increasing the quality level of information sharing helps manufacturers to improve delivery performance in collaborations. The study by Zhou *et al.* (2014) has recently recommended practitioners to aligning their supply chain based on the level of *Information Quality* considered during information sharing. Accordingly, these findings on the *Information Quality* need to be examined by academics, and addressing the contradictory finding of this research is a good opportunity to extend to body of the information sharing literature.

Revealing the direct and strong impact of *Information Quality* on the sharing of various *Information Types* is an important contribution of the current research to the information sharing literature. Pragmatically, this outcome implies that managers should bear in mind what criteria / benchmarks are vital during the sharing of various *Information Types* with retailers. In detail, it can be deduced that while manufacturers are prepared to share production planning and scheduling, stock levels and even recent changes with retailers, they need to take note of sharing only relevant and adequate sources, which accurately represent its main domain. It is important to conduct timely information sharing and to frequently update data when they need to be more responsive to data received by retailers.

Since the CF practice in this research focuses on conducting long-term collaborations and improving forecast accuracy, it is essential for manufacturers to consistently share of good quality information with retailers to be able to take advantage of the CF practice. Extra insight here therefore is to indicate the indirect impact of *Information Quality* on the forecast accuracy and long-term collaborations due to its strong and direct impact on the sharing of different *Information Types*, which is the strong predictor of CF practice in the model. However, this insight needs future research to be able to generalise the role of *Information Quality* on the forecast accuracy and the duration of collaborations.

This research not only provides implications to practice, but also encourages future research on the *Information Quality* to enrich the existing knowledge in the literature. Practitioners would benefit from the findings of this research when they intend to design and / or improve the information sharing process with retailers in the FSC. Academics can also get benefit from the contradictory findings of this research to investigate how *Information Quality* affects the CF of partners with regard to particular product-groups. It is also promising to examine various information sources of manufacturers to explore their impact on the forecast accuracy and transparency in the FSC.

6.4. Future research and limitations

Even though the current research extends the literature through the three different research themes and recommends promising implications to practice, it could not shed light on a number of intriguing factors, requiring future research. Particularly, the horizon of forecasts is the main concern that needs to be studied from manufacturers' and retailers' points of view in the FSC. Although results show its insignificant impact on the CF practice, case studies illustrated partners' conflict in the European grocery sector. Academics need to put further emphasis on the horizon of forecasts while specific product-groups are forecasted in collaborations. Taking into account the shelf life of products can be an additional contribution to literature and practice when the horizon of forecasts is subject to future research.

On the other hand, the quality level of information sharing was examined from manufacturers' point of view based upon several benchmarking factors. However, results implied its indirect relation with the CF practice by uncovering its direct and strong impact on the sharing of various sources, which is the strong predictor of CF practice. Hence, taking into account the past literature that stresses the impact of information quality on supply chains, and then comparing prior outcomes with the overlapping findings of this research is most likely to allow researchers to add more understanding on the quality level of information disseminated in the FSC. Following this, the examination of FSC is still lacking in the standpoint of retailers when the quality of information is subject to collaborations.

The competence of forecasters was not found to be a significant antecedent of the CF practice, yet its direct and significant role in meetings implies the indirect influence on CF. The role of forecasters in CF did not earn the attention of academics adequately, and therefore to examine different characteristics seems to offer valuable insights to the forecasting literature. For instance, examining the role of training required for conducting group meetings and / or skills for aggregating the forecasts of particular products seems to be an interesting topic for future research. In addition to these future research fields, there are a considerable number of limitations that need to be converted to opportunity by academics.

Firstly, this research is limited to only food manufacturers located in the UK & Ireland, Europe and North America. Even though data were gathered from a broad range of regions, replication of this research in a particular region is likely to give more detailed results to be compared with existing findings. By considering the descriptive results of this research, academics, for instance, can question why manufacturers from Northern and Eastern Europe do not have adequate interest in collaboratively forecasting perishable products with retailers. It is also worthwhile to question why manufactures in Southern Europe do not put adequate emphasis on seasonal products in CF with retailers.

The research showed the high interest of the UK & Ireland based manufacturers in collaboratively forecasting promotional products, yet there is an important doubt why these manufacturers do not pay similar attention to seasonal products in their collaboration with retailers. Future research needs to place further emphasis on manufacturers located in the UK & Ireland, and to examine the scope of collaborations, which vary based on product-groups considered in CF. On the other hand, manufacturers from Southern Europe look deficient in terms of collaborating with retailers over promotional and newly launched products when they expressed their interest in the collaborative forecasts of perishables. Therefore, the research provides valuable insights for academics and encourages them to dedicate further research to particular product-groups in particular regions. This approach not only extends the body of literature, but also offers interesting implications to practitioners located in those regions.

Secondly, retailers are not subject to this research, and therefore it is essential to examine their role in CF. Given their closeness to customers, their contribution to CF becomes even more important. Testing the conceptual model of this research in dyadic manufacturer-retailer collaborations by way of case studies seems a promising future research topic to explore unique insights in practice. For instance, academics can test how the conceptual model of this research works in a case study that is based on a single retailer and its multiple manufacturers providing different product-groups. Such a future research design is most likely to uncover major drivers and inhibitors in generating accurate forecasts and conducting long-term collaborations in the FSC. The logic behind encouraging academics to give high importance to the role of retailers in CF is also to explore their expectations from collaborations with manufacturers. Because retailers seem to be in a leading position in collaborations, their needs of pursuing collaborations are likely to be an important matter for the supply chain literature. In essence, this research is a good example to be compared with studies addressing CF from the retailers' point of view. Since, such a comparative future research is most likely to extend the body of literature by exploring common and contradictory needs of partners for the development of accurate and long-term CF in the FSC.

When it comes to considering the role of regions and peripheral factors in CF, future research needs to question how partners' distribution and replenishment operations influence the performance of CF, because these practices are likely to be influenced by external factors, such as the location of stores / production plants and / or weather conditions. In particular, retailers' region and the complexity of distribution channels in regions connected with the location of stores play a vital role in CF, and these practices deserve the attention of academics. Bearing in mind the logistics capabilities of manufacturers is an important matter when future research considers the geographical dissemination of retailers in particular regions. Generating such pragmatic studies in the future can provide valuable implications for practitioners and add a new dimension to forecasting and SCM phenomena.

Thirdly, through the development of measurement items for reflective constructs, this research excluded several items that were explored during the review of the literature. Hence, the current research does not claim that related items capture the complete domain of reflective constructs in the conceptual model. This is why considering different items over the related constructs is beneficial to extend the literature and to provide further implications to practice. For instance, while manufacturers' interdepartmental relations are considered, future studies need to place further emphasis on their ability to manage production capacity, production systems used and production lead-times of particular product-groups. Externally, manufacturers' responsiveness to orders given by retailers is another concern of the collaborations (see Fliedner (2006) for details). In other words, extending this research to manufacturers' operational practices seems to be an interesting contribution to the operations management literature. In particular, production and delivery capabilities of manufacturers deserve to be examined in order to explore their impact on strategic collaborations that rely on long-term collaborations.

Regarding the information sharing practices in CF, although manufacturers' data were the subject of this research, there are more sources that are likely to influence forecasting and transparency in the FSC, such as information in terms of price changes, delivery and lead-times. From retailers' point of view, it is also worthwhile to question what types of information are beneficial for manufacturers, such as shelf data, promotional plans and substitution related data, as retailer information needs to be used through the forecasting of newly launched products. In terms of forecasting practices, although forecasters became subject to this research, their characteristics that cause bias and the level of training are important mysteries necessitating further examination for the forecasting literature (see Lawrence *et al.* (2006), Fildes *et al.*

(2009) and McCarthy *et al.* (2006) for details). In addition, it seems very interesting to ask how the training of forecasters influences their bias and accordingly accuracy in CF.

Fourthly, although the conceptual model of this research was dedicated to the FSC and particular product-groups, there are several industries that host similar product-groups. FSC is likewise not restricted to only perishable, seasonal, promotional and newly launched products. For instance, the clothing industry has fashion-based new products, necessitating timely and reliable forecasts to cope with seasonal changes, consumer behaviours and ongoing trends in the market. Future research can test the conceptual model of this research in this industry to explore how it improves the accuracy of seasonal, promotional and newly launched products and to reveal whether there are additional industry oriented factors that affect partners' collaboration. Tourism is another season related industry. Especially summer seasons are critical to future demand based on number of visitors from previous seasons. Therefore, this research can be extended to the tourism industry by focusing on the collaborations of hotels, air carriers and / or tourism agencies.

Further, the pharmaceutical industry involves various products that have intermittent demand, which require further understanding in terms of market and product characteristics to merge recent information into forecasts. The product-groups of this research could also provide practical insight for this industry in relation to employing CF. Cosmetic and household industries are likely to be a good platform in terms of examining the conceptual model of this research for particular product-groups. These industries are a good platform for future research to extend this research and to explore industry oriented insights for the forecasting and SCM literature. As regards the FSC, the conceptual model of this research can be extended to broader product-groups, such as products that have long shelf life and / or frozen foods. Such future studies not only close the gap in the literature, but also provide industry and product based implications for practitioners.

Fifthly, suppliers that provide raw material to manufacturers were not part of the participant sample in this research. This limitation is another opportunity for academics to extend the body of the SCM literature by examining the CF practices of manufacturers. Given the fact that the literature is rich in studies addressing CF between retailers and manufacturers, extending this research to the upstream level is most likely to bring a new dimension to the CF practice in the three-echelon FSC. Because, developing a future research linking suppliers to the forecast collaborations of retailers and manufacturers not only reveals the impact of suppliers on manufacturer-retailer partnerships, but also broadens the knowledge about the role of suppliers in conducting long-term and accurate CF in the FSC.

In other words, such a future research is likely to extend the findings of this research to three-echelon supply chains and to broaden existing knowledge on the themes of supply chain integration, forecasting process and information sharing. Since partners' integration through forecasting and information sharing can change based on the echelon of chains, additional and / or contrary findings are expected to be explored when it comes to comparing results with this research. From manufacturers' point of view, it can be interesting to compare major necessities that require to successfully collaborate with retailers and suppliers. Such future research is very likely to enable manufacturers to adopt different perspective in terms of collaborating with downstream and / or upstream levels in the FSC.

Sixthly, this research focused on the CF practice to improve long-term collaborations and forecast accuracy between manufacturers and retailers in the FSC, but it gave rise to have a number of insignificant factors in accomplishing its aim. Whilst the literature offers long-term collaborations over strategic partnerships, operational partnerships seem to be an option for short- and mid-term collaborations. In this research, although manufacturers' *Internal Integration* was found to be the most important factor for long-term collaborations in CF, *Information Quality, Forecasters' Competence* and *Forecast Horizon* were found to be insignificant elements for the development of CF practice, where the commitment factor was found to be the insignificant entailment whilst the trust factor was.

The reason behind having these insignificant factors for the CF practice could be attributed to the aim of this research, which was to improve the forecast accuracy of associated product-groups in addition to extending the duration of collaborations between partners. Therefore, conducting a future research addressing the factors of *Information Quality, Forecasters' Competence, Forecast Horizon,* trust, and commitment in strategic partnerships, built upon the strong *Internal Integration* of partners, seems to be an intriguing topic with the purpose of revealing their impact on partnerships, where forecast accuracy is not the main subject of interest.

Finally, the focus of this research in the forecasting literature is limited to forecasting meetings, the role of forecasters, and the horizon of forecasts. During the review of the literature, several research areas were explored that are likely to be related to CF. For instance, forecasting strategies of partners, involving judgmental adjustments and forecast combinations, are some of the vital areas that academics need to pay attention to. In forecasting meetings, forecasters try to cope with a wide range of information. While promotional and newly launched products are subject to these meetings, forecasters need to reinforce statistical results with contextual information (e.g. advertising, past experience and rumours). In such circumstances, judgmental adjustments play an important role in terms of improving accuracy. Therefore, future research needs to focus on judgmental adjustments when particular product-groups are collaboratively forecasted in meetings. Furthermore, manufacturers confront difficulties when their departments generate multiple forecasts, and this causes internal-external conflicts in CF. In this respect, it is an attractive research topic to examine forecast combinations when manufacturers intend to generate forecasts within their departments.

Manufacturers and retailers are likely to use different forecasting methods (e.g. exponential smoothing, regression and artificial neural network) and accuracy measurement techniques (e.g. mean absolute percentage error and mean average error) in their forecasting process. Their preferences are likely to change based on product-groups, market dynamics and organisational objectives. Although past studies compared different forecasting methods in the FSC, they considered various accuracy measurement techniques to validate the reliability of the methods. Nevertheless, there is a paucity of pragmatic studies clarifying how practitioners apply related methods in practice and what benchmarks they consider through the selection of methods and the evaluation of their performance.

LIST OF ABBREVIATIONS

AVE	Average Variance Extracted
CF	Collaborative Forecasting
CPFR	Collaborative Planning, Forecasting and Replenishment
ECR	Efficient Consumer Response
EDI	Electronic Data Interchange
ERP	Enterprise Resource Planning
FAME	Financial Analysis Made Easy
F&DM	Forecasting and Decision-Making
FSC	Food Supply Chain
GoF	Goodness-of-Fit
ISF	International Symposium on Forecasting
IS&M	Information-Systems and Management
IT	Information Technology
JIT	Just-In-Time
MIMIC	Multiple Indicators and Multiple Causes
MRP	Manufacturing Resource Planning
OASIS	Operations and Supply Chain Systems Group
OM	Operations Management
PLS	Partial Least Squares
POMS	Production and Operations Management Society
POS	Point-of-sales
QR	Quick Response
SCM	Supply Chain Management
SCM&L	Supply Chain Management and Logistics
SEM	Structural Equation Modeling
SKUs	Stock-Keeping-Units
S&OP	Sales and Operations Planning
SPSS	Statistical Package for Social Sciences
VICS	Voluntary Interindustry Commerce Standards
VIF	Variance Inflation Factor
VMI	Vendor Managed Inventory

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APPENDIX-I: A single semi-structured interview

- **Company**: UK based food manufacturer
- **Product-groups considered in CF**: time-sensitive and / or short-life product-groups (e.g. vegetable, poultry, meat and frozen food)
- **Interviewee**: Supply chain manager
- **Date**: 06th December 2011
- **Duration of interview**: from 10.00am to 11.30am (1 hour 30 min)
- Types of record: Note-taking
- **Overview**: Explanation of research aim and objectives and description about the preliminary conceptual model of the research
- Interview questions:

SECTION - 1) Collaborative forecasting performance

Q.1. Do you confront duration and / or accuracy related collaborative forecasting problems in collaborations with retailers? Can you talk about how these difficulties influence your (the company) relationship with retailers?

Q.2. Are there additional collaborative forecasting problems giving rise to conflicts in collaborations? If yes, in what situations do you confront these problems? And how do you deal with them?

SECTION - 2) Factors having an impact on the collaborative forecasting performance (Preliminary propositions and the conceptual model were introduced to the manager)

Q.4. Can you share your views and experience with regard to associated propositions and their impact on the duration and accuracy of collaborative forecasting? What is their realness in practice?

Q.5. Do you think that there are additional situations and / or factors that prevent you from conducting long-term and accurate collaborative forecasting practices with retailers?

Q.6. How these situations and / or factors influence the forecast accuracy and collaborations with retailers?

SECTION - 3) The role of various product-groups in collaborative forecasting

Q.7. What is the extant performance of collaborative forecasting based on particular product-groups that are considered in collaborations? (e.g. seasonal, perishable, promotional and newly launched products, including short-life products such as poultry, meat and vegetables) Does the performance of collaborative forecasting satisfy you (in general)?

SECTION - 4) Information sharing, forecasting, decision making and risk management procedures in collaborative forecasting

Q.8. What sort of operational/strategic practices do you implement to improve information sharing, forecasting, decision making and risk management procedures with retailer partners?

Q.9. How these practices influence the performance of collaborative forecasting? Can you obtain tangible - positive – results by way of these practices?

Q.10. What is your overall view about existing collaborative forecasting problems and the preliminary propositions offered as a remedy to these problems? Do you have any additional suggestions in terms of examining specific situations / subjects that are vital in practice to be investigated through the review of literature?

APPENDIX-II: Online group discussion -1

- **Group**: Forecasting Net
- **Title**: The Collaborative Forecasting (CF) problems of manufacturers and retailers in the Food Supply Chain
- **Start-End Dates**: 21st March 2012 – 8th May 2012
- Topic of discussion:

Hi everyone,
I am a PhD candidate at Brunel Business School, and conducting my research in the Food Supply Chain by considering the practice of Collaborative Forecasting (CF), implemented between manufacturers and retailers. The aim of the study is to explore significant factors having an impact on the performance of CF with the development of long-term and accurate CF between partners.

During the review of literature, I identified a number of important factors influencing the accuracy and duration of the forecast collaborations. For instance;
-Trust
-Retailers' forecast capabilities and shelf tracking performance
-Production capacity of manufacturers
-Promotion types & risks
-Forecasting methods used by partners (e.g. judgmental forecasting and time-series)
-Incompatible forecasting frequency of partners

I will be more than happy if you can share your views and experience by responding to these questions:
1-) What is the role of these factors in practice?
2-) What sort of measures are taken in practice to cope with CF problems occurred between manufacturers and retailers?

Thank you for your comments...

APPENDIX-II: Online group discussion -2

- **Group**: Business Forecasting & Planning Innovation
- **Title**: Collaborative Forecasting (CF) Problems in the Food Supply Chain
- **Start-End Dates**: 26th March 2012 – 12th April 2012
- Topic of discussion:

Hi everyone,

I am a PhD candidate at Brunel Business School, and conducting my research in the Food Supply Chain by considering the practice of Collaborative Forecasting (CF), implemented between manufacturers and retailers. The aim of the study is to explore significant factors having an impact on the performance of CF with the development of both long-term and accurate CF between partners.

During the review of literature, I identified a number of important factors influencing the accuracy and duration of the forecast collaborations. For instance;

-Trust

-Retailers' forecast capabilities and shelf tracking performance

-Production capacity of manufacturers

-Promotion types & risks

-Forecasting methods used by partners (e.g. judgmental forecasting and time-series)

-Incompatible forecasting frequency of partners

I will be more than happy if you can share your views and experience by responding to these questions:

1-) What is the role of these factors in practice?

2-) What sort of measures are taken in practice to cope with CF problems occurred between manufacturers and retailers?

Thank you for your comments...

APPENDIX-II: Online group discussion -3

- **Group**: Forecasting Net
- **Title**: Which factor is most critical in estimating the forecast of promotions?
- **Start-End Dates:**: 20th December 2012 – 28th December 2012
- Topic of discussion:

Which factor is most critical in estimating the forecast of promotions?

a) Forecasting Method
b) Forecaster's knowledge about the market
c) Forecaster's knowledge about product/s
d) Old promotional data about product/s

APPENDIX-III: Items of survey and relevant references

CODES	DEFINITION OF ITEMS IN SCALE	RELEVANT REFERENCES
	The Collaborative Forecasting practice	
CF_3	Our company shows willingness to pursue forecast collaborations with collaborative firms that show confidence in the relationships	Barratt (2004); Barrat and Oliveira (2001); Crum and Palmatier (2003); Danese (2007; 2006); Fliedner (2003); Gulati (2011); Ha *et al.* (2011); Ireland and Crum (2005); Johnston *et al.* (2004); Mentzer *et al.* (2000); Moorman *et al.* (1992); Nyaga *et al.* (2010); Özer *et al.* (2011); Småros (2007); Spence and Bourlakis (2009); Taylor and Fearne (2006); Van der Vaart *et al.* (2012)
CF_4	Our company shows a desire to maintain valued relationships with collaborative firms	Barratt (2004); Gulati (2011); Ireland and Crum (2005); Moorman *et al.* (1993); Nyaga *et al.* (2010); Simatupang and Sridharan (2002); Småros (2007); Taylor and Fearne (2006)
CF_5	Our company develops joint business plan with collaborative firms during collaborations	Aviv (2001); Barrat and Oliveira (2001); Danese (2007); ECR Europe (2002); Fliedner (2006); Ireland and Crum (2005); Larsen *et al.* (2003); Nyaga *et al.* (2010); Siefert (2003); Simatupang and Sridharan (2002); VICS (2004)
CF_6	Our company is happy with the accuracy level of forecasts, as internally estimated in its' department(s)	Davis and Mentzer (2007); Fliedner (2006); Helms *et al.* (2000); Lawrence *et al.* (2006); McCarthy *et al.* (2006); McCarthy and Golicic (2002); Nakano (2009); Oliva and Watson (2011); Sanders and Ritzman (2004); Småros (2007); Taylor and Fearne (2006)
CF_7	Our company shares order forecasts of relevant products with collaborative firms	Barrat and Oliveira (2001); Fliedner (2006; 2003); Helms *et al.* (2000); Ireland and Crum (2005); Siefert (2003); Småros (2007)
	Collaborative Forecasting Performance	
CF_1	Our company regularly conducts long-term forecast collaborations with collaborative firms (Long-term ≥ 1 year)	Danese (2007); Droge *et al.* (2004); Flynn *et al.* (2010); Ramanathan and Gunasekaran (2012); Paulraj *et al.* (2008); Noekkentved (2000); Nyaga *et al.* (2010); Vlachos and Bourlakis (2006)
CF_2	Our company increases the forecast accuracy, when forecasts are estimated during collaborations	Fliedner (2006; 2003); Småros (2007)
	Forecast Satisfaction	
FSat_1	Forecasts of perishable products are generally:	This construct was added by the author to be able to generalise the results of the conceptual model by considering the suggestions of McCarthy *et al.* (2006); Mentzer and Kahn (1995); Yokum and Armstrong (1995)
FSat_2	Forecasts of seasonal products are generally:	
FSat_3	Forecasts of promotional products are generally:	
FSat_4	Forecasts of newly launched products are generally:	
	External Integration	
EI_1	Our company shows loyalty to collaborative firms during collaborations	Chen and Paulraj (2004); Hong *et al.* (2005); Mentzer *et al.* (2000); Zacharia *et al.* (2011)
EI_2	Our company is flexible when dealing with unexpected contradictions during collaborations	Ha *et al.* (2011); Ireland and Crum (2005); Johnston *et al.* (2004); Van der Vaart *et al.* (2012)
EI_3	Our company has a technological infrastructure to conduct timely information sharing with collaborative firms	Barratt (2004); Danese (2007; 2006); Droge *et al.* (2004); Fliedner (2003); Hartono *et al.* (2010); Kerr and Tindale (2011); McCarthy and Golicic (2002); Mendelson and Pillai (1998); Mentzer *et*

		al. (2000); Ramanathan (2013); Ramanathan *et al.* (2011); Sari (2008); Småros (2007); Taylor and Fearne (2006); Taylor (2006); Zhou and Benton Jr. (2007)
EI_4	The top management of our company adopts the same vision with collaborative firms	Chen and Paulraj (2004); Crum and Palmatier (2003); Hartono *et al.* (2010); Ireland and Crum (2005); Li and Lin (2006); Mentzer *et al.* (2000); Moon *et al.* (2003)
	Internal Integration	
II_1	Our logistics department prepares and conducts effective delivery plans	Chen *et al.* (2009); ECR Europe (2001); Lockamy III and McCormack (2004); Ramanathan and Gunasekaran (2014; 2012)
II_2	Our company successfully manages inventory levels	Nakano (2009); Power (2005); Stevens (1989); Taylor (2006); Taylor and Fearne (2006)
II_3	Our company has a technological infrastructure for timely information sharing between departments	Arshinder *et al.* (2008); Barratt (2004); ECR Europe (2001); Fliedner (2006); Hill and Scudder (2002); Paula *et al.* (2003); Paulraj *et al.* (2008); Power (2005); Ramanathan *et al.* (2011); Sanders (2008); Småros (2007); Taylor and Fearne (2006); Zhou and Benton Jr. (2007)
II_4	Our company regularly records information provided by its departments	Taylor and Fearne (2006); Taylor (2006)
	Forecast Horizon	
FH_1	The forecast horizon of perishable products is generally:	Ali *et al.* (2009); Aviv (2002; 2001); Fildes and Goodwin (2007); Klassen and Flores (2001); Lawrence *et al.* (2006); McCarthy *et al.* (2006); Mentzer and Kahn (1995); Småros (2007; 2003); Zotteri and Kalchschmidt (2007)
FH_2	The forecast horizon of seasonal products is generally:	
FH_3	The forecast horizon of promotional products is generally:	
FH_4	The forecast horizon of newly launched products is generally:	
	Group Forecasting	
GF_1	Our company consistently attends previously scheduled meetings	Graefe and Armstrong (2011); Ireland and Crum (2005); Siefert (2003)
GF_2	Forecast decisions are taken by following pre-established procedures	Ireland and Crum (2005); Siefert (2003)
GF_3	Managerial positions of forecasters play an important role in forecast decisions	Graefe and Armstrong (2011); Helms *et al.* (2000); Rowe and Wright (2011)
GF_4	Forecasters implement constructive discussions during meetings	Aviv (2001); Davis and Mentzer (2007); Graefe and Armstrong (2011); Helms *et al.* (2000); Van de Ven and Delbecq (1974; 1971); Kerr and Tindale (2011)
GF_5	Information gathered during meetings is used effectively to estimate consensus forecasts	Byrne *et al.* (2011); Davis and Mentzer (2007); Frewer *et al.* (2011); Graefe and Armstrong (2011); Helms *et al.* (2000); Kerr and Tindale (2011); Van de Ven and Delbecq (1974; 1971)
	Forecasters' Competence	
FC_1	Forecasters have market based experience for the products involved	Lawrence *et al.* (2006); Rowe and Wright (1999); Sanders and Ritzman (2004); Van Swol (2011)
FC_2	Forecasters are willing to accept advice from each other during meetings	Frewer *et al.* (2011); Lawrence *et al.* (2006); Önkal *et al.* (2012); Van Swol (2011); Yaniv (2004)
FC_3	Forecasters are motivated to arrive consensus forecasts in meetings	Byrne *et al.* (2011); Davis and Mentzer (2007); Flynn *et al.* (2010); Frewer *et al.* (2011); Kerr and Tindale (2011); Småros (2007); Webby and O'Connor (1996)
FC_4	Forecasters show willingness and intention	Mayer *et al.* (1995); Rowe and Wright (2011);

	to become involved with the forecasting process	Van Swol (2011)
FC_5	Forecasters give feedback to each other during meetings	Byrne *et al.* (2011); Goodwin and Fildes (1999); Lawrence *et al.* (2006); Rowe and Wright (1999); Sanders (1997)
FC_6	Forecasters have confidence in each other when accepting suggestions given during meetings	Davis and Mentzer (2007); Graefe and Armstrong (2011); Kerr and Tindale (2011); Rowe and Wright (2011); Sanders and Ritzman (2004); Van Swol (2011)
FC_7	Forecasters are satisfied with final consensus forecasts at the end of the meetings	Byrne *et al.* (2011); Graefe and Armstrong (2011); Van de Ven and Delbecq (1974)
	Information Types	
ITypes_1	Our company shares the inventory level of products with relevant collaborative firms	Arshinder *et al.* (2008); Danese (2007); ECR Europe (2001); Larsen *et al*, (2003)
ITypes_2	Our company shares the production plan of relevant products with collaborative firms	Fliedner (2006); Flynn *et al.* (2010); Larsen *et al.* (2003); Lee *et al.* (2000); Ramanathan and Gunasekaran (2014; 2012); Zhou and Benton Jr. (2007); Zotteri and Kalchschmidt (2007)
ITypes_3	Our company shares the production scheduling of relevant products with collaborative firms	Arshinder *et al.* (2008); Chen and Paulraj (2004); Fliedner (2006); Flynn *et al.* (2010); Karoway (1997); Larsen *et al.* (2003); Zhou and Benton Jr. (2007)
ITypes_4	Our company informs collaborative firms of recent changes (Recent changes include the latest information of environment, weather, product/company related data and past experience into the forecast)	Helms *et al.* (2000); Lawrence *et al.* (2006); Sanders and Ritzman (2004); Sanders and Manrodt (2003)
	Information Quality	
IQL_1	Our company shares relevant information with collaborative firms during collaborations	Danese (2007); Hartono *et al.* (2010); Taylor and Fearne (2006); Taylor (2006); Zhou and Benton Jr, (2007)
IQL_2	Our company shares adequate information with collaborative firms during collaborations	Chang *et al.* (2013); Du *et al.* (2012); Webby and O'Connor (1996)
IQL_3	Our company shares accurate information with collaborative firms during collaborations	Du *et al.* (2012); Hartono *et al.* (2010); Helms *et al.* (2000); Li and Lin (2006); Webby and O'Connor (1996); Zhou and Benton Jr, (2007)
IQL_4	Our company provides real-time information to collaborative firms during collaborations	Du *et al.* (2012); Hartono *et al.* (2010); Mendelson and Pillai (1998); Vijayasarathy and Robey (1997); Zhou and Benton Jr, (2007)
IQL_5	Our company frequently updates information for collaborative firms during collaborations	Aviv (2007; 2002; 2001); Danese (2007); Fisher (2000); Forslund and Jonsson (2007); Flynn *et al.* (2010); Hartono *et al.* (2010); Larsen *et al.* (2003); Neumann and Segev (1979); Sanders (2008); Zhou and Benton Jr, (2007)
IQL_6	Our company shares up-to-date information in response to information received from collaborative firms	Arshinder *et al.* (2008); Danese (2007); Hartono *et al.* (2010); Ramanathan *et al.* (2011)
IQL_7	Our company engages in consistent information sharing with collaborative firms during collaborations	Fisher (2000); Småros (2002); Taylor and Fearne (2006); Taylor (2006)

APPENDIX-IV: Statements of ethics approval

Head of Brunel Business School
Professor Zahir Irani

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Brunel Business School
Research Ethics Committee

21st November 2011

STATEMENT OF ETHICS APPROVAL

Proposer: Can Eksoz

Title: Improving Collaborative Forecasting Performance in the Food Supply Chain

The school's research ethics committee has considered the proposal recently submitted by you. Acting under delegated authority, the committee is satisfied that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that you will adhere to the terms agreed with participants and to inform the committee of any change of plans in relations to the information provided in the application form.

Please ensure that you maintain you points of contact as there needs to be 10 contact points per year; annual enrolment and the annual review of progress count as two. Therefore there will have to be a minimum of 8 formally recorded supervision meetings with a maximum of 6 weeks between formal supervisory meetings.

In exceptional cases (such as collecting Data away from the University).These 'meetings' may be carried out by e-mail correspondence but in such cases there should be an exchange of e-mails; the student should provide written evidence of the progress they are making and the supervisor should provide a critical assessment of the work submitted. The e-mails will have to be printed and saved with the report form.

Yours sincerely,

Dr. Ahmad Ghoneim
Chair, Research Ethics Committee
Brunel Business School