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Essays On Food Banks: Operational Issues and the Role of Supply Chain Integration

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ESSAYS ON FOOD BANKS: OPERATIONAL ISSUES AND THE ROLE OF SUPPLY CHAIN INTEGRATION

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DEDICATION

To my parents, Havva and Ismet, for their unconditional love and support,

and to my sister, Esin, whose memory will live with us forever...

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ABSTRACT

Food banks are humanitarian aid organizations that collect, organize, and deliver food to the communities in need. In pursuit of achieving their social goal of alleviating hunger, food banks work with other non-profit member agencies such as soup kitchens, food pantries and shelters. Matching supply of funds and donated food with demand in this context is subject to unique challenges, which remain unaddressed in operations and supply chain literature. This dissertation presents three essays to gain deeper insights into critical operational and supply chain issues influencing the performance of food banks, and the impact of supply chain integration on food bank performance. To conduct an in-depth examination of supply chain integration in food banks, the first essay undertakes an extensive review and a meta-analytic investigation of the literature focusing on supply chain integration. The essay aids in discerning the association of integration practices with performance and in identifying potential moderating variables. The second essay utilizes secondary data merged with primary data to test a model covering key activities of food banks. Specifically, the model focuses on how food distributed is influenced by an integrated effort encompassing fundraising activities, public support, basic programs run, and supply chain integration. The results of the model illuminate the importance of supply chain integration for enhancing food bank performance. Utilizing the insights gained from the meta-analytic study and the second essay, the third essay employs survey data collected from food banks, and examines the antecedents of food bank supply chain integration and its performance implications.

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CHAPTER 1

INTRODUCTION

Food banks are not-for-profit organizations that collect, organize, and deliver food to non-profit member agencies – such as soup kitchens, food pantries and shelters - and also to individuals to help remedy the society's hunger problem. The network of food banks is quite complex considering private sector food industries, individual donors and governmental offices provide support in the form of money and food on the supply side; while member agencies including food pantries, soup kitchens, shelters and individuals deliver support on the demand side. Moreover, performance of food banks is measured on the basis of the amount of food distributed to the communities in need, which is quite different than the performance measures of a commercial organization.

Food banks act as centers for the redistribution of donated and surplus food that would otherwise be wasted. Over the past few decades, the food banking industry has become a remedy factor for the growing poverty, hunger and wasted food problems, by being the link that matches the supply with the demand of food. Therefore, these organizations are also important entities in decreasing waste, and they hold a place in the reverse logistics and sustainability realm of operations. This issue requires attention, since improving operations in this area has many stakeholders, such as companies that are

willing to donate food, the communities in need, and the policy makers that are searching for better ways to increase the welfare of people.

While food banking is relatively new in some parts of the world, it has grown and progressed more in the United States, Canada and Europe (Riches, 2002). The first food bank in the US was established in 1967 in Phoenix, Arizona, with the aim of matching the food industry's dilemma on how to handle surplus food, and the charity organizations whose goal was to provide resources to communities in need (Riches, 2002). The idea then grew over time to the other states, as well as countries such as Canada and UK. Over time, umbrella organizations (e.g. Feeding America, Global Foodbanking Network) have been established and food banks have become institutionalized. The food banks started to engage in partnerships with corporations that donate large amounts of food. Governments also support food bank organizations, not only in terms of grants, but also with policies such as the 1976 Tax Reform Act, which permitted corporate tax deductions of cost plus 50% of any appreciated value of the donated food (Daponte and Bade, 2006). This policy in particular, and similar policies to follow provided incentives to donors and supported the industry. The agencies that the food banks work with are in the downstream of food banking supply chains, and they do a considerable amount of distribution to hungry, in addition to the direct distribution that the food banks handle themselves.

The foodbanking context is interesting due to the complex structure it is embedded in. It has its own challenges and idiosyncrasies. While there are similarities with the for-profit supply chains, the way food banks operate and the resource constraints they have make it worthwhile to study their operations, understand the unique environment and provide solutions to the issues they encounter. The benefits are

obviously major and useful for the people that do not have access to enough food as well as the businesses that emphasize the triple bottom line (people, planet and profits), since the surplus resources are distributed accordingly to protect the people and the planet, over and above the profit goals of companies.

Seamless integration of the processes along the supply chain, from the suppliers to the customers, is considered to be a competitive edge for companies (Frohlich and Westbrook, 2001). The degree to which the organizations are integrated either upstream with the suppliers, or downstream with the customers varies across the companies. The level of integration was named "arc of integration" by Frohlich and Westbrook (2001) and has become an important issue to be considered in the operations management literature. In general, the broader the arc of integration an organization has, the more successful it will become. However, there are certain contingencies that call for integration more than others (Wong et al., 2011). The value of exchanging information and collaborating on activities has proven useful in various for-profit industries. However, supply chain integration has not been studied in non-profits extensively. In particular, the food banking industry, where the uncertainty of incoming food and demand complicate the processes, requires a timely and accurate flow of information in order to run seamlessly. This dissertation mainly aims to shed light on the dynamics of collaboration in this environment. Moreover, this study focuses on the antecedents of supply chain integration in this not-for-profit context.

First, an exploratory case study was conducted in order to understand the important processes that take place in food banks. The discussions with the Chief Operating Officer (COO) of a local food bank revealed the importance of management

style, human resources and strategic direction, as well as the food distribution structure for delivering aid to communities in need for a food bank. The COO emphasized human resources and upper management vision as the most critical factors in determining the way the food banks operate.

The interviews also indicated that the supply side of the operations consisted of food, friends and funds. The amount of food varies greatly from food bank to food bank, and is collected through local donations, donations through Feeding America relationships, and federal and state partnerships, and is purchased out of need by using the funds available. Friends are basically the volunteer workforce and the champions of the cause. Funds, which are essential for purchasing food as well as equipment, fuel, and utilities, are generated via fundraising activities. The amount of return on fundraising expenses varies to a great extent. Internally, the funds collected go into the programs run by the food banks, facilities, and vehicles. The supply of money determines the number and size of the programs that a food bank runs as well as the size and capacity of buildings, the amount and quality of vehicles and industrial handling equipment. On the demand side, there are clients that are served either directly or through agency partners.

This dissertation will present three essays to gain deeper insights into critical operational and supply chain issues that influence the performance of food banks. To conduct an in-depth examination of supply chain integration in food banks, the first essay undertakes an extensive review and a meta-analytic investigation of the literature focusing on supply chain integration. The essay aids in discerning the association of integration practices with performance and in identifying potential moderating variables. The second essay utilizes secondary data merged with survey data to test a model

covering key activities of food banks. Specifically, the model focuses on how food distributed per food insecure individual in the service area of the food bank is influenced by an integrated effort encompassing fundraising activities, public support, supply chain integration and basic programs. The results of the model illuminate the importance of supply chain integration for enhancing food bank performance. Utilizing the insights gained from the meta-analytic study and the second essay, the third essay employs primary data collected from food bank executives, and examines the link between key organizational variables as antecedents of integration, food bank supply chain integration practices, and performance.

A distinguishing characteristic of this dissertation lies in the use of multiple methodologies to examine the supply chain integration concept in food banks, in order to have a deeper understanding of the phenomenon from different angles. The dissertation contains five chapters. In Chapter 2, we present Essay 1, which is the meta-analytic investigation to gain insights about the supply chain integration literature and detail the main tenets and contingency factors in this area. Chapter 3 contains Essay 2, which is a general look at the food bank operations spanning from the generation of support to the delivery of the food. In Chapter 4, we discuss the survey essay, which aims to test a model regarding the antecedents of supply chain integration in food banks. Finally, we conclude and state the contributions of the dissertation in Chapter 5.

CHAPTER 2

A META-ANALYTIC INVESTIGATION OF THE RELATIONSHIP BETWEEN SUPPLY CHAIN INTEGRATION PRACTICES AND PERFORMANCE

2.1 INTRODUCTION

The topic of supply chain integration has received a lot of attention in operations and supply chain management literature for more than a decade. To advance theory development, it is important to critically examine the empirical findings in various studies published on a stream in the literature. In particular, this paper undertakes a meta-analytic investigation of the relationships between supply chain integration practices and various performance dimensions. The study contributes to literature in two important ways. First, it provides an in-depth review of the literature that examines the association between supply chain integration and performance. Second, meta-analytic methodology is used to formally analyze the correlations found in the empirical papers published in this area to disentangle the practice-performance relationships after accounting for various attenuation factors. The findings of the meta-analytic investigation provide further insights into the relationship between supply chain integration practices and performance. The essay discusses theoretical and managerial implications of the meta-analytic findings and offers several directions for extending supply chain integration

research, particularly for investigating this issue in the non-profit business context in this dissertation.

Supply chain integration is one of the prominent research streams in operations and supply chain management literature. Since mid-1990s, several research studies have examined the strategic aspect of supply chain management and empirically investigated the relationships between different supply chain integration practices and various performance measures (Ragatz et al., 1997; Frohlich and Westbrook, 2001; Stank et al., 2001; Dröge et al., 2004; Lee, 2004; Swink et al., 2005; Cousins and Menguc, 2006; Vereecke and Muylle, 2006; Devraj et al., 2007; Schoenherr and Swink, 2012). Supply chain integration practices manifest in terms of integration of internal operations within a firm, as well as external integration with customers and suppliers. In general, internal and external integration of operations have been emphasized to be a key competitive differentiator by several studies (Ragatz et al., 1997; Frohlich and Westbrook, 2001; Lee, 2004). The practices that are required to foster integration among supply chain partners mainly concentrate on information sharing and collaboration in the design of processes and products, joint decision-making, and coordination. These practices help align the interests of all firms within the value chain and aid in improving overall supply chain performance instead of maximizing only internal efficiencies of individual firms (Lee, 2004).

Notwithstanding the importance of supply chain integration practices, in previous studies the underlying constructs have been conceptualized and analyzed from different perspectives. Further, internal integration practices within a firm as well as external integration initiatives across firms along the supply chain have been shown to exert

different and varying levels of impact on various performance dimensions. For instance, Schoenherr and Swink (2012) find distinct associations of supply chain integration practices with operational and financial performance. Cousins and Menguc (2006) show that supply chain integration positively impacts the supplier's communication performance, however, it does not influence the supplier's operational performance. Devaraj et al. (2007) report that supplier integration has a positive impact on performance, but customer integration does not have a significant impact on performance.

In this paper, we focus on the relationship between key dimensions of integration (internal and external) and multiple aspects of performance (operational and financial) to synthesize the existing findings and contribute to theory development in the area of supply chain integration. Meta-analysis of correlations technique is employed to gain deeper insights into the observed relationships. The meta-analytic procedure helps answer the following questions:

1) Which supply chain integration practices are positively correlated with the firm's financial performance?

2) Which supply chain integration practices are positively correlated with various dimensions of the firm's operational performance?

3) Are the relationships between supply chain integration practices and various performance measures influenced by potential moderators?

The existence of numerous studies in this area, especially due to the increasing level of interest among scholars since early 2000, enables an in-depth examination of the relationships through formal statistical tests that are part of the meta-analysis technique

(Damanpour, 1991; Nair, 2006; Mackelprang and Nair, 2010). Meta-analytic investigation facilitates closer examination of research findings and presents further insights regarding those relationships that are generalizable after accounting for attenuation factors. These insights provide opportunities for future research investigations.

The rest of the essay is organized as follows. The next section provides a review of the supply chain integration literature. Section 3 explains the meta-analysis technique and describes the procedures employed in this study. The results of the analyses are presented in Section 4, which is followed by Section 5, which discusses the findings and presents research implications. In Section 6 we conclude and offer directions for future research.

2.2 LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Supply chain management literature includes several different but interrelated definitions of supply chain integration (Pagell, 2004). Fabbe-Costes and Jahre (2008) claim that the lack of a clear and single formal definition of supply chain integration makes it difficult to prescribe practical solutions regarding what to integrate and the costs and benefits of integration practices. Likewise, a collective understanding of supply chain integration will help in theory building and consensus in supply chain management literature. While there are discussions that emphasize the importance of bringing the supply chain integration literature together (Fabbe-Costes and Jahre, 2008), a systematic meta-analytic study to unravel the key insights gained thus far is missing.

Several research articles have undertaken an empirical investigation of supply chain integration in the extant literature (Frohlich and Westbrook, 2001; Koufteros et al., 2005; Swink et al., 2007; Schoenherr and Swink, 2012). The integration dimensions examined include internal integration within an organization, external integration with customers, and external integration with suppliers. Internal integration is defined as "the cross-functional intra-firm collaboration and information sharing activities that occur via interconnected and synchronized processes and systems" (Schoenherr and Swink, 2012; p.100). Accordingly, internal integration measures relate to collaboration between various functions of an organization, such as operations, logistics, marketing and sales, to accomplish supply chain objectives. Customer integration represents "… close collaboration and information sharing activities with key customers that provide the firm with strategic insights into market expectations and opportunities, ultimately enabling a more efficient and effective response to customer needs" (Schoenherr and Swink, 2012; p.100). It addresses the demand side collaboration / coordination endeavors of a firm. Supplier integration refers to "coordination and information sharing activities with key suppliers that provide the firm with insights into suppliers' processes, capabilities and constraints, ultimately enabling more effective planning and forecasting, product and process design, and transaction management" (Schoenherr and Swink, 2012; p.100). In essence, it helps a firm to tightly integrate the supply base with internal operations and external demand.

Chen et al. (2009) posits that integration is a broad term that spans different tangible and intangible elements of organizations' operations, both internally and externally, to develop efficiencies in their supply chains. Integration enables firms to

attain a competitive edge by streamlining business processes and by coordinating activities with business partners. Since there are materials, goods and information flows in a typical supply chain, integration requires the coordination of the downstream and upstream flow of materials and information within the supply chain (Frohlich and Westbrook, 2001). The degree of integration, either upstream with suppliers and/or downstream with customers, differs considerably among firms resulting in differential extended capabilities and performance. The importance of having a broad arc of integration that spans both upstream and downstream along the supply chain has been proposed in literature (Frochlich and Westbrook, 2001). In the absence of such broad-based integration, firms witness inefficiencies and glitches, such as the bullwhip effect (Lee et al., 1997; Metters, 1997), which adversely impacts performance.

On a general level, internal integration focuses on intra-organizational aspects, whereas external integration measures gauge the breadth and depth of relationships that firms maintain with their upstream and downstream business partners. While there are nuances in the conceptualizations of the supply chain integration and performance measures in the literature, the scales used to gauge these concepts typically include items focusing on the extent to which firms' operations are seamlessly coordinated internally and are synchronized with their partners. Supplier integration and customer integration are the main elements of external integration (e.g. Frohlich and Westbrook, 2001; Devaraj et al., 2007; Flynn et al., 2010). A review of literature indicates that terms such as supply chain coordination (Jayaram et al., 2011) and supply chain collaboration (Sanders and Premus, 2005; Vereecke and Muylle, 2006) have also been used to

represent the set of practices that are commonly considered in the operationalization of the supply chain integration construct.

The association between supply chain integration practices and performance has been an area of active research investigation. Firm level financial performance dimensions that have been considered in supply chain integration studies include such measures as growth of sales, return on investment, profit margin on sales, and overall business performance (Cao and Zhang, 2011; Frohlich and Westbrook, 2002; Flynn et al. 2010; Swink et al. 2007). Several studies in the area employ operational performance as a single scale (Flynn et al., 2010; Cousins and Menguc, 2006; Stank et al., 2001; Gimenez and Ventura, 2005), while others include various operational performance dimensions separately, such as cost, quality, flexibility, delivery, productivity, time to market and efficiency (Wong et al., 2011; Schoenherr and Swink, 2012; Vereecke and Muylle, 2006; Swink et al. 2007; Tracey, 2004; Saeed et al., 2005). Both financial performance and operational performance measures are hypothesized to be positively associated with supply chain integration practices. There is empirical evidence that supports these hypothesized relationships in the literature (Koufteros et al., 2010; Flynn et al., 2010; Wong et al., 2011). However, there are also papers that have mixed findings regarding the relationships between various dimensions of supply chain integration and performance (Devaraj et al., 2007; Vereecke and Muylle, 2006).

Along with the studies that focus on the direct effect of supply chain integration practices on performance, various studies have also investigated the moderation and mediation effects of certain variables on the relationships between supply chain integration practices and performance. For instance, Wong et al. (2011) have found that

environmental uncertainty has a significant moderation effect on the relationships between supply chain integration and operational performance. Interim outcomes such as collaborative advantage (Cao and Zhang, 2011), knowledge sharing, and process coupling with channel partners (Saraf et al., 2007) have also been emphasized in the literature, investigating the relationship between supply chain integration practices and performance. Some studies have also examined whether internal integration acts as a moderator for the relationships between external integration and performance rather than modeling a direct link between internal integration and various operational measures (Schoenherr and Swink, 2012). Furthermore, studies that model a correlational link between internal and external integration constructs also exist in the previous works in the area (Stank et al., 2001; Gimenez and Ventura, 2005).

The role played by various factors that act as key antecedents to supply chain integration have also been considered in the extant literature. For instance, information sharing and information systems related practices have been a part of broader investigation of supply chain integration (Saraf et al., 2007; Sanders and Premus, 2005). Product modularity has also been considered as an antecedent for integration (Dröge et al., 2004; Danese and Filippini, 2010; Howard and Squire, 2007; Jacobs et al. 2007) given that modular designs require sharing of information and specific assets between supply chain partners as a result of exchangeability of parts and standardization requirements in production (Howard and Squire, 2007). Similarly, relationship characteristics with the supply chain partners (such as trust, commitment, interdependency, length of relationship and guanxi relationship), and organizational characteristics (such as top management support, cultural similarity and goal

compatibility) have been also considered as precursors of supply chain integration (Lee et al., 2010; Vijayasarathy, 2010; Chen et al., 2010).

Overall, an examination of literature reveals various integration-performance configurations that are tested in the supply chain integration literature. In this meta-analytic study, we focus on the generally accepted relationships between supply chain integration practices (internal integration, supplier integration and customer integration) and performance dimensions (firm business performance and operational performance). We test the following hypotheses that investigate the presence of direct associations as well as moderating effects in the supply chain integration – performance relationship at an aggregate level.

H1. *Supply chain integration practices at an aggregate level encompassing supplier, customer and internal integration practices are positively correlated with aggregate performance.*

H2. *The correlation between aggregate supply chain integration practices and aggregate performance is influenced by moderating factors.*

In addition, we also examine the association of individual supply chain integration practices on aggregate performance as well as business and operational dimensions of performance. Specifically, we test the following hypotheses:

H3. *Customer integration practices are positively correlated with (a) aggregate performance, (b) business performance, and (c) operational performance.*

H4. *Supplier integration practices are positively correlated with (a) aggregate performance, (b) business performance, and (c) operational performance.*

H5. *Internal integration practices are positively correlated with (a) aggregate performance, (b) business performance, and (c) operational performance.*

H6. *The correlations of customer integration practices with (a) aggregate performance, (b) business performance, and (c) operational performance dimensions are influenced by moderating factors.*

H7. *The correlations of supplier integration practices with (a) aggregate performance, (b) business performance, and (c) operational performance dimensions are influenced by moderating factors.*

H8. *The correlations of supplier integration practices with (a) aggregate performance, (b) business performance, and (c) operational performance dimensions are influenced by moderating factors.*

Finally, the study examines the association of individual supply chain integration practices on cost, quality, delivery, and flexibility dimensions of operational performance. Organizations engage in supply chain integration practices to gain advantages in terms of efficient and effective processes. Supply chain integration enables cost reduction, improved quality, reliable delivery and flexibility in production (Vargas et al., 2000; Swink et al., 2007; Wong et al., 2011; Prajogo et al., 2012; Schoenherr and Swink, 2012). Accordingly,

H9. *Customer integration practices are positively correlated with (a) cost performance, (b) quality performance, (c) delivery performance and (c) flexibility performance.*

H10. *Supplier integration practices are positively correlated with (a) cost performance, (b) quality performance, (c) delivery performance and (c) flexibility performance.*

H11. *Internal integration practices are positively correlated with (a) cost performance, (b) quality performance, (c) delivery performance and (c) flexibility performance.*

H12. *The correlations of customer integration practices with (a) cost performance, (b) quality performance, (c) delivery performance and (c) flexibility performance dimensions are influenced by moderating factors.*

H13. *The correlations of supplier integration practices with (a) cost performance, (b) quality performance, (c) delivery performance and (c) flexibility performance dimensions are influenced by moderating factors.*

H14. *The correlations of internal integration practices with (a) cost performance, (b) quality performance, (c) delivery performance and (c) flexibility performance dimensions are influenced by moderating factors.*

Overall, the examination of these hypotheses will allow us to systematically accumulate the findings of studies that examine supply chain integration and performance relationships, weigh them based on the reliabilities of constructs and sample sizes, and to reach empirical generalizations. Specifically, the meta-analytic technique allows the examination of the overall association of supply chain integration practices and performance as well as the identification of the significance between sub-dimensions of supply chain integration practices and various performance measures. Moreover, the existence of moderating factors on the supply chain integration practices and performance, on both aggregate and individual level associations, can be tested using this methodology. The following section describes the meta-analytic technique used in this study to examine these relationships.

2.3 META ANALYSIS OF CORRELATIONS

Meta-analysis of correlations is a technique that is used to analyze the existing body of literature and develop theory (Hunter and Schmidt, 1990; 2004). This methodology considers the distribution of correlations of independent and dependent variable pairs within a specific domain. There is a certain amount of variation caused by sampling errors and transcriptional errors, as well as by the particular research methods used for research investigation. These types of variations, alternatively referred to as 'artifacts,' need to be accounted for so that the actual relationships between the variables of interest can be correctly identified. Meta-analytic methodology controls for the artifacts that could be a function of sample size, mean and spread of the variables, as well as the reliability of the scales (Hunter and Schmidt, 2004). By means of meta-analytic

procedures, we can analyze the data on replicated correlations from multiple studies that investigate the same fundamental relationships. The sampling error can then be reduced, as the relationships are based on a larger sample by bringing multiple studies together to analyze the relationships between the same independent-dependent variable pairs (Hunter and Schmidt, 2004). In a typical published empirical study, only significant results of correlational analyses are interpreted and discussed, and the non-significant correlations are considered to be statistically not different than zero. In contrast, since meta-analytic technique aims to discern the basic correlation between variables of interest, it considers inclusion of all correlations reported in the extant literature, irrespective of their significance levels (Hunter and Schmidt, 2004).

Construct operationalization and inter-construct correlations

There are various scales used in the supply chain integration literature. These measures mostly include multi-item, multi-dimensional manifests, and there are certain variations between their conceptualizations across studies. Despite these differences, as long as the main hypothesized relationships between independent and dependent variables are the same, meta-analysis methodology allows these distinct conceptualizations to be used for analyzing the broad concept (Hunter and Schmidt, 2004). This idea referred to as multiple operationalism (Webb et al., 1981) suggests that the same concept can be gauged by multiple measures that have some imperfections and irrelevancies to them. Nevertheless, at a higher level of abstraction, the core idea remains the same. If the latent construct can be measured with these multiple realizations and can still reveal associational patterns between variables, the uncertainties regarding the

relationships are greatly reduced. Therefore, it is actually desirable to aggregate various measurement efforts to develop theory by using meta-analysis.

In this study we focus on three main dimensions of supply chain integration that can be found in the literature. These three dimensions - supplier integration, customer integration, and internal integration - are generally operationalized as multi-item measures (Frohlich and Westbrook, 2001; Koufteros et al., 2005; Swink et al., 2007). The vertical (external) connections that aim at coordinating forward and backward flow of materials, services, information and money across the supply chain are called supplier and customer integration. The integration efforts with the external parties have strategic long-term orientation, which distinguishes them from arm's length relationships that include limited levels of coordination and information exchange with shorter time focus (Swink et al., 2007). Sharing of operational plans, mutually providing access to information systems, customization for partners' operations (such as packaging and containers) and joint planning of task forces are examples of external integration initiatives (Frohlich and Westbrook, 2001; Chen and Paulraj, 2004). On the other hand, the horizontal (internal) coordination emphasizes the inter-functional linkages that are strategically strengthened within the organization to fulfill customer requirements and to efficiently interact with suppliers (Flynn et al., 2010). In order to achieve seamless operational activities, internal integration emphasizes cross-functional teams, openness, teamwork, routine meetings of various departments, and use of enterprise resource planning (ERP) systems (Pagell, 2004; Braunscheidel and Suresh, 2009). In all types of integration, the main goal is to create operational processes that cannot be easily imitated by competitors (Frohlich and Westbrook, 2001).

Various measures of performance are used in empirical studies on supply chain integration. While some of the studies focus only on financial performance (Cao and Zhang, 2011; Narasimhan and Kim, 2002), others examine the impact of integration on operational performance by explicitly considering various facets such as cost, quality, delivery and flexibility separately (Vargas et al., 2000; Swink et al., 2007; Wong et al., 2011; Prajogo et al., 2012; Schoenherr and Swink, 2012), or as a composite single scale (Cousins and Menguc, 2006; Devaraj et al. 2007). Given the state of literature on supply chain integration, we focus on aggregate performance, business performance, and operational performance. We also examine the association of supply chain integration practices with individual operational measures of cost, quality, delivery and flexibility.

Sample

An academic literature database search was conducted to obtain the sample for this study. Search terms "supply chain integration" and "integration" were used to identify published articles to be included in the study. Specifically, the empirical papers on supply chain integration that appeared in the following journals were included in the current meta-analytic investigation: *Journal of Operations Management, Production and Operations Management, Decision Sciences Journal, Management Science, Manufacturing and Service Operations Management, International Journal of Production Research, International Journal of Operations and Production Management, International Journal of Production Economics, Journal of Business Logistics, Journal of Supply Chain Management, International Journal of Logistics Management, International Journal of Physical Distribution and Logistics Management, Management*

Information Sciences Quarterly, *Information Systems Research* and *Journal of Management Information Systems.*

In the initial search, 103 papers were identified. However, since some of these papers have a different conceptualization of integration as compared to external and internal integration, they were left out from further consideration. For instance, Koufteros et al. (2007) conceptualize integration as black-box and grey-box integration, where the level and form of supplier involvement in product development change is considered. Also, there are some other types of integration that appear in the literature such as purchasing integration (Narasimhan and Das, 2001) or logistics integration (Stock et al., 2000), that mainly investigate the coordination idea within specific functions of the organization. In addition, some papers that employed the same dataset for different research questions and models were not included in the final sample in order to avoid duplication. Hence, after a careful examination of the articles, the ones that use survey methodology and specifically include supply chain integration – performance relationships were identified for meta-analytical investigation. We obtained information from twenty articles by following the described process. Next, we sent e-mail requests to authors of fourteen survey-based research studies that have consistent conceptualization of the supply chain integration construct, but in which some of the required information needed for meta-analysis was not reported in the published article. Relevant information for four additional studies was collected following this step. When construct level correlations were not available in the papers, the correlations at the item level were averaged to substitute for the unavailable information. Overall, 24 articles were employed in the subsequent analyses. The sample size is consistent with the sample sizes of other

meta-analytic studies in operations management (Gerwin and Barrowman, 2002; Nair, 2006; Mackelprang and Nair, 2010). A detailed description of the studies used in this research is provided in Appendix A.

Meta-analytic method

The meta-analytic procedures used in this study follow the step prescribed in Hunter and Schmidt (1990; 2004), which has been adopted by other meta-analytic examinations in the operations management area (Gerwin and Barrowman, 2002; Nair, 2006; Mackelprang and Nair, 2010). The details of the two stages of meta-analytic procedures and the heuristics for interpretation of the results are presented in the following subsections.

As an initial step, the correlations between supply chain integration and performance were examined at an aggregate level to formally test for the positive effects that have received extensive support in the literature. Aggregate supply chain integration is a cumulative set of all supply chain integration dimensions, and aggregate performance captures composite performance outcomes. The data used in this first stage is presented in Table 2.1.

In the second stage, the correlations and moderating effects of individual supply chain integration practices and various performance dimensions were examined. Meta-analyses were conducted for the relevant subsets of studies to examine how much of the residual variance consists of sampling error as against capturing the actual variance. The details of the data associated with the second stage of the analysis are presented in Tables 2.2 - 2.7.

Table 2.1 Complete data sample

Study	Sample Size	SCI Reliability	Performance Reliability	SCI-Performance Sample Correlation
Wong et al. (2011)	151	0.803	0.823	0.376
Schoenherr and Swink (2012)	403	0.840	0.793	0.262
Vereecke and Muylle (2006)	374	0.570	0.685	0.146
Swink et al. (2005)	57	0.850	0.730	0.410
Swink et al. (2007)	224	0.827	0.763	0.198
Jayaram et al. (2011)	197	0.690	0.805	0.167
Dröge et al. (2004)	57	0.633	0.875	0.166
Danese and Filippini (2010)	186	0.763	0.777	0.192
Stank et al. (2001)	306	0.810	0.820	0.380
Tracey (2004)	180	0.780	0.880	0.173
Devaraj et al. (2007)	120	0.790	0.890	0.174
Flynn et al. (2010)	617	0.920	0.900	0.332
Frohlich and Westbrook (2002)	485	0.845	0.830	0.445
Cousins and Menguc (2006)	142	0.810	0.850	0.430
Lawson et al. (2009)	111	0.820	0.920	0.540
Lee et al. (2010)	271	0.913	0.879	0.224
Handfield et al. (2009)	151	0.760	0.840	0.465
Sanders and Premus (2005)	245	0.790	0.762	0.307
Saeed et al. (2005)	38	0.720	0.880	0.310
Saraf et al. (2007)	63	0.847	0.910	0.251
Villena et al. (2009)	133	0.700	0.720	0.220
Gimenez and Ventura (2005)	64	0.951	0.912	0.373
Chiang et al. (2012)	144	0.538	0.670	0.195
Cao and Zhang (2011)	211	0.910	0.920	0.670

Table 2.2 Relationship between supply chain integration and financial performance

Study	Corrected correlation (r')	Sample size (N)	Attenuation factor (A)	SCI-Performance correlation (r)	Study weight (W)
Supplier Integration					
Flynn et al. (2010)	0.234	617	0.940	0.22	545.181
Swink et al. (2007)	0.373	224	0.785	0.293	137.894
Dröge et al. (2004)	0.195	57	0.771	0.15	33.880
Saraf et al. (2007)	0.315	63	0.903	0.285	51.425
Customer Integration					
Flynn et al. (2010)	0.272	617	0.920	0.250	521.982
Swink et al. (2007)	-0.022	224	0.785	-0.017	137.894
Saraf et al. (2007)	0.255	63	0.852	0.217	45.692
Internal Integration					
Flynn et al. (2010)	0.376	617	0.930	0.35	533.582
Swink et al. (2007)	0.400	224	0.785	0.314	137.894
Swink et al. (2005)	0.677	57	0.782	0.53	34.884
Tracey (2004)	0.250	180	0.819	0.205	120.744

Table 2.3 Relationship between supply chain integration and operational performance

Study	Corrected correlation (r')	Sample size (N)	Attenuation factor (A)	SCI-Performance correlation (r)	Study weight (W)
Supplier Integration					
Cousins and Menguc (2006)	0.518	142	0.830	0.430	97.767
Devaraj et al. (2007)	0.469	120	0.844	0.396	85.440
Flynn et al. (2010)	0.345	617	0.899	0.310	498.783
Frohlich and Westbrook (2002)	0.518	485	0.869	0.450	366.321
Villena et al. (2009)	0.310	133	0.710	0.220	67.032
Lawson et al. (2009)	0.622	111	0.869	0.540	83.738
Lee et al. (2010)	0.250	271	0.896	0.224	217.485
Handfield et al. (2009)	0.638	151	0.799	0.510	96.398
Sanders and Premus (2005)	0.464	245	0.801	0.372	157.193
Gimenez and Ventura (2005)	0.451	64	0.938	0.423	56.325
Customer Integration					
Devaraj et al. (2007)	-0.059	120	0.833	-0.049	83.304
Flynn et al. (2010)	0.523	617	0.880	0.460	477.558
Frohlich and Westbrook (2002)	0.547	485	0.805	0.440	313.989
Internal Integration					
Flynn et al. (2010)	0.450	617	0.889	0.400	488.170
Saeed et al. (2005)	0.389	38	0.796	0.310	24.077
Handfield et al. (2009)	0.526	151	0.799	0.420	96.398
Sanders and Premus (2005)	0.321	245	0.750	0.241	137.777
Gimenez and Ventura (2005)	0.348	64	0.924	0.322	54.691
Chiang et al. (2011)	0.325	144	0.600	0.195	51.906

Table 2.4 Relationship between supply chain integration and cost performance

Study	Corrected correlation (r')	Sample size (N)	Attenuation factor (A)	SCI-Performance correlation (r)	Study weight (W)
Supplier Integration					
Wong et al. (2011)	0.479	151	0.815	0.390	100.204
Schoenherr and Swink (2012)	0.367	403	0.788	0.289	250.062
Vereecke and Muylle (2006)	0.111	374	0.558	0.062	116.351
Customer Integration					
Wong et al. (2011)	0.424	151	0.815	0.345	100.204
Schoenherr and Swink (2012)	0.453	403	0.769	0.348	238.294
Vereecke and Muylle (2006)	0.284	374	0.620	0.176	143.728
Internal Integration					
Wong et al. (2011)	0.408	151	0.835	0.341	105.277
Schoenherr and Swink (2012)	0.413	403	0.792	0.327	253.003
Swink et al. (2005)	0.498	57	0.804	0.400	36.822

Table 2.5 Relationship between supply chain integration and quality performance

Study	Corrected correlation (r')	Sample size (N)	Attenuation factor (A)	SCI-Performance correlation (r)	Study weight (W)
Supplier Integration					
Swink et al. (2007)	0.169	224	0.830	0.140	154.291
Wong et al. (2011)	0.604	151	0.770	0.465	89.468
Schoenherr and Swink (2012)	0.221	403	0.855	0.189	294.593
Jayaram et al. (2011)	0.222	197	0.824	0.183	133.874
Vereecke and Muylle (2006)	0.162	374	0.597	0.097	133.518
Customer Integration					
Swink et al. (2007)	0.129	224	0.799	0.103	143.002
Wong et al. (2011)	0.600	151	0.770	0.462	89.468
Schoenherr and Swink (2012)	0.167	403	0.835	0.139	280.730
Jayaram et al. (2011)	0.331	197	0.744	0.246	108.914
Vereecke and Muylle (2006)	0.462	374	0.664	0.307	164.934
Internal Integration					
Swink et al. (2007)	0.232	224	0.869	0.202	169.344
Wong et al. (2011)	0.567	151	0.789	0.447	93.998
Schoenherr and Swink (2012)	0.160	403	0.860	0.138	298.059

Table 2.6 Relationship between supply chain integration and delivery performance

Study	Corrected correlation (r')	Sample size (N)	Attenuation factor (A)	SCI-Performance correlation (r)	Study weight (W)
Supplier Integration					
Swink et al. (2007)	0.344	224	0.825	0.284	152.454
Wong et al. (2011)	0.496	151	0.843	0.418	107.361
Schoenherr and Swink (2012)	0.283	403	0.835	0.236	280.891
Dröge et al. (2004)	0.253	57	0.716	0.181	29.262
Vereecke and Muylle (2006)	0.170	374	0.618	0.105	143.055
Customer Integration					
Swink et al. (2007)	0.243	224	0.794	0.193	141.299
Wong et al. (2011)	0.419	151	0.843	0.353	107.361
Schoenherr and Swink (2012)	0.351	403	0.815	0.286	267.673
Vereecke and Muylle (2006)	0.084	374	0.687	0.058	176.715
Internal Integration					
Swink et al. (2007)	0.308	224	0.864	0.266	167.328
Wong et al. (2011)	0.514	151	0.864	0.444	112.797
Schoenherr and Swink (2012)	0.314	403	0.840	0.264	284.196
Danese and Filippini (2010)	0.249	186	0.770	0.192	110.270
Stank et al. (2001)	0.466	306	0.815	0.380	203.245
Tracey (2004)	0.168	180	0.838	0.141	126.360

Table 2.7 Relationship between supply chain integration and flexibility performance

Study	Corrected correlation (r')	Sample size (N)	Attenuation factor (A)	SCI-Performance correlation (r)	Study weight (W)
Supplier Integration					
Swink et al. (2007)	0.300	224	0.684	0.205	104.698
Wong et al. (2011)	0.351	151	0.795	0.279	95.432
Schoenherr and Swink (2012)	0.393	403	0.804	0.316	260.338
Jayaram et al. (2011)	0.187	197	0.745	0.139	109.396
Vereecke and Muylle (2006)	0.311	374	0.589	0.183	129.703
Customer Integration					
Swink et al. (2007)	0.219	224	0.658	0.144	97.037
Wong et al. (2011)	0.418	151	0.795	0.332	95.432
Schoenherr and Swink (2012)	0.379	403	0.785	0.297	248.087
Jayaram et al. (2011)	0.149	197	0.672	0.100	89.000
Vereecke and Muylle (2006)	0.280	374	0.655	0.183	160.222
Internal Integration					
Swink et al. (2007)	0.355	224	0.716	0.254	114.912
Wong et al. (2011)	0.287	151	0.815	0.234	100.264
Schoenherr and Swink (2012)	0.383	403	0.808	0.310	263.401
Swink et al. (2005)	0.386	57	0.777	0.300	34.400

Heuristics for interpretation of results

Two heuristics developed by Hunter and Schmidt (1990) were used to guide the interpretation of results in this paper. The ratio of the average corrected correlations and estimated population standard deviation, which is known as RATIO1 (RATIO1= $\bar{r}' / S_\rho$), is analogous to a confidence interval with the exception that it uses standard deviation of correlations instead of using the standard error. For RATIO1, the estimates of population variance S^2_ρ are obtained by using the values of the variance of corrected sample correlation $S^2_{r'}$ and the corrected estimate of the sampling error variability S^2_e: $S^2_\rho = S^2_{r'} - S^2_e$. If RATIO1 is greater than or equal to 2, it can be concluded that the population's correlation is greater than zero (Hunter and Schmidt, 1990; 2004). The second heuristic, RATIO2, presents the amount of observed variance caused by the artifacts. It is calculated by dividing the weighted mean sampling error variance by the variance of the corrected correlations (RATIO2 = $S^2_e / S^2_{r'}$). If RATIO2 is greater than or equal to 0.75, it means that there is only one population correlation and moderators that impact the strength of the relationships do not exist. On the other hand, if this ratio is less than 0.75, then it indicates the existence of moderators on the relationship between the constructs of interest (Hunter and Schmidt, 1990; 2004).

2.4 RESULTS

In light of the heuristics presented in the previous section, initially RATIO1 was calculated to test the relationship between aggregate supply chain integration and aggregate performance. The information in Table 2.1 was used to calculate the necessary statistics. The results indicate a significant positive correlation between the independent

and dependent constructs (RATIO1 = 3.076). Since this value is greater than the cutoff value of 2, it can be concluded that supply chain integration and aggregate performance are positively correlated. The nominal value for mean corrected correlation between supply chain integration and aggregate performance is 0.38 and the credibility interval is [0.128 , 0.632]. This result implies that, assuming that the effect size correlations have a normal distribution, 95% of the values in the population correlation distribution are within the credibility interval (Hunter and Schmidt, 1990; 2004). The results provide further evidence for a positive correlation between supply chain integration and performance, since 0 is not included in the credibility interval, thereby lending support for H1. RATIO2 was calculated to test the existence of moderating factors on the aggregate relationships of interest. The value of this ratio is 0.272, which indicates that moderators do influence the strength of the relationship between aggregate supply chain integration and performance. The result lends support for H2.

After obtaining the Stage I results, in Stage II the relationships among individual supply chain integration dimensions and performance were examined. In particular, we test hypotheses H3 to H8 and investigate the association of individual supply chain integration practices on aggregate, business, and operational performance dimensions. We also test H9 – H14 to investigate the correlations among each individual supply chain integration practice (supplier integration, customer integration, and internal integration) and specific operational performance dimensions (cost, quality, delivery and flexibility). The same procedure as in the tests for the aggregate level relationships was used and the heuristics described before were employed for interpretation. Stage I results are presented in Table 2.8. Also, Stage II results can be found in Table 2.9.

Table 2.8 Stage I meta-analysis results

Study	Sample size (N)	SCI-performance correlation (r)	Corrected correlation (r')	Error variance (e)	Study weight (W)
Wong et al. (2011)	151	0.376	0.462	0.0081	99.772
Schoenherr and Swink (2012)	403	0.262	0.321	0.0030	268.277
Vereecke and Muylle (2006)	374	0.146	0.234	0.0055	146.028
Swink et al. (2005)	50	0.410	0.520	0.0264	31.025
Swink et al. (2007)	224	0.198	0.250	0.0057	141.195
Jayaram et al. (2011)	197	0.167	0.223	0.0073	110.296
Dröge et al. (2004)	57	0.166	0.222	0.0258	31.571
Danese and Filippini (2010)	186	0.192	0.249	0.0073	110.270
Stank et al. (2001)	306	0.380	0.466	0.0040	203.245
Tracey (2004)	180	0.173	0.209	0.0065	123.552
Devaraj et al. (2007)	120	0.174	0.207	0.0096	84.372
Flynn et al. (2010)	617	0.332	0.364	0.0016	510.876
Frohlich and Westbrook (2002)	485	0.445	0.531	0.0024	340.155
Cousins and Menguc (2006)	142	0.430	0.518	0.0083	97.767
Lawson et al. (2009)	111	0.540	0.622	0.0097	83.738
Lee et al. (2010)	271	0.224	0.250	0.0037	217.485
Handfield et al. (2009)	151	0.465	0.582	0.0084	96.398
Sanders and Premus (2005)	245	0.307	0.395	0.0055	147.485
Saeed et al. (2005)	38	0.310	0.389	0.0342	24.077
Saraf et al. (2007)	63	0.251	0.286	0.0168	48.559
Villena et al. (2009)	133	0.220	0.310	0.0120	67.032
Gimenez and Ventura (2005)	64	0.373	0.400	0.0147	55.508
Chiang et al. (2012)	144	0.195	0.325	0.0155	51.906
Cao and Zhang (2011)	211	0.670	0.732	0.0046	176.649

RATIO1 = sample means/standard deviation of population correlations = 3.076; RATIO2 = error variance/variance of corrected sample correlation = 0.272

Customer integration

The value of RATIO1 for the association between customer integration and aggregate performance is 7.671. As the value is greater than 2, we find support for H3a and conclude that the population correlation between this integration dimension and aggregate performance is greater than zero. However, the value of RATIO1 for the correlation of customer integration with business performance (1.112) and operational performance (1.393) do not lend support for H3b and H3c. The values of RATIO2 for the association of customer integration with aggregate performance (0.445), business performance (0.037) and operational performance (0.007) are less than the cutoff value of 0.75. This indicates that moderators influence these relationships, thereby lending support for H6a, H6b, and H6c.

Next, the correlations between individual operational performance measures with customer integration were evaluated. The RATIO1 values for customer integration's relationship with cost performance (4.928) and flexibility performance (2.945) are greater than the cutoff value of 2, indicating positive population correlations between customer integration and these performance dimensions. On the other hand, there is lack of statistical evidence regarding the population correlations of customer integration with quality (1.503) and delivery (1.921) performance. Hence, we find support for H9a and H9d but fail to find support for H9b and H9c.

The values of RATIO2 for the customer integration's relationships with cost (0.205), quality (0.029), delivery (0.060), and flexibility (0.107) are below the cutoff value of 0.75. Hence, it can be concluded that there are moderators that influence the strength of the relationships, thereby lending support for H12.

Table 2.9 Overall results of the meta-analysis of correlations

SCI factors	# of studies	Overall sample size	SCI-performance correlation (r)	Corrected correlation (r')	Mean error variance ($\bar{e}$)	SD corrected correlations ($\sigma r'$)	RATIO1	RATIO2
Customer Integration							7.671	0.445
Cost performance	3	928	0.296	0.396	0.002	0.090	4.928	0.205
Quality performance	5	1349	0.219	0.294	0.001	0.198	1.503	0.029
Delivery performance	4	1152	0.219	0.271	0.001	0.146	1.921	0.060
Flexibility performance	5	1349	0.228	0.309	0.001	0.111	2.945	0.107
Operational performance	3	1222	0.404	0.476	0.001	0.343	1.393	0.007
Business performance	3	904	0.196	0.213	0.001	0.195	1.112	0.037
Supplier Integration							21.603	0.875
Cost performance	3	928	0.254	0.327	0.002	0.188	1.782	0.051
Quality performance	5	1349	0.194	0.244	0.001	0.186	1.336	0.033
Delivery performance	5	1209	0.245	0.304	0.001	0.122	2.607	0.084
Flexibility performance	5	1349	0.242	0.326	0.001	0.104	3.332	0.116
Operational performance	10	2339	0.368	0.428	0.000	0.127	3.428	0.029
Business performance	4	961	0.234	0.263	0.001	0.080	3.652	0.199
Internal Integration							5.714	0.283
Cost performance	3	611	0.338	0.419	0.002	0.050	17.257	0.767
Quality performance	3	778	0.209	0.250	0.002	0.217	1.175	0.036
Delivery performance	6	1450	0.285	0.341	0.001	0.131	2.674	0.049
Flexibility performance	4	835	0.282	0.358	0.002	0.046	16.938	0.789
Operational performance	6	1259	0.357	0.422	0.001	0.081	5.639	0.142
Business performance	4	1078	0.330	0.375	0.001	0.180	2.114	0.031

Supplier integration

The values of RATIO1 for the relationship of supplier integration with aggregate performance, business performance, and operational performance are 21.603, 3.652, and 3.428, respectively. Since the values of RATIO1 are greater than 2, the results lend support for H4a, H4b, and H4c. The value of RATIO2 for the correlation of supplier integration with aggregate performance is 0.875, which is greater than the cutoff value of 0.75. This result suggests that the association between supplier integration and aggregate performance holds irrespective of the presence of moderating variables. Hence, we fail to find support for H7a. The corresponding values for RATIO2 for the association of supplier integration with business performance and operational performance are 0.199 and 0.029, respectively. This lends support for H7b and H7c.

The results for the association of supplier integration with individual operational performance dimensions indicate that supplier integration is positively correlated with delivery (RATIO1 = 2.607) and flexibility (RATIO1 = 3.332), but not with cost (RATIO1 = 1.782) and quality performance (RATIO1 = 1.336). Hence, we fail to find support for H10a and H10b, but hypotheses H10c and H10d are supported. The values for RATIO2 indicate that there are moderators influencing the relationship strength between all operational performance dimensions and supplier integration ($RATIO2_{Cost}$ = 0.051; $RATIO2_{Quality}$ = 0.033; $RATIO2_{Delivery}$ = 0.084; $RATIO2_{Flexibility}$ = 0.116; $RATIO2_{Operational}$ = 0.029; $RATIO2_{Business}$ = 0.199). Hence, hypotheses H13a, H13b, H13c, and H13d are supported.

Internal integration

The results for the third and the final integration dimension indicated that internal integration has a positive correlation with aggregate performance (RATIO1 = 5.714), business performance (RATIO1 = 2.114) and operational performance (RATIO1 = 5.639), lending support for H5a, H5b, and H5c. RATIO2 values for aggregate performance (RATIO2 = 0.283), business performance (RATIO2 = 0.031), and operational performance (RATIO2 = 0.142) are all below 0.75. These results provide support for hypotheses H8a, H8b, and H8c. The individual analyses of the relationships of internal integration with various operational performance dimensions indicate that this integration dimension has a significant positive correlation with all the individual level operational performance dimensions except quality performance ($RATIO1_{Cost}$ = 17.257; $RATIO1_{Quality}$ = 1.175; $RATIO1_{Delivery}$ = 2.674; $RATIO1_{Flexibility}$ = 16.938). Hence we find support for H11a, H11c, and H11d but fail to find support for H11b.

The values obtained for RATIO2 suggest that the relationship of internal integration with cost (RATIO2 = 0.767) and flexibility performance (RATIO2 = 0.789) does not involve moderation effects. Hence, H14a and H14d are not supported. However, the association of internal integration with quality (RATIO2 = 0.036) and delivery (RATIO2 = 0.049) affirm the presence of moderators, thereby lending support for H14b and H14c. The summary of the hypotheses testing results are presented in Table 2.10.

Table 2.10 Summary of hypotheses testing results

	A. P.	A. P. (mod. effects)	B. P.	B. P. (mod. effects)	O. P.	O. P. (mod. effects)	Cost	Cost (mod. effects)	Qual.	Qual. (mod. effects)	Del.	Del. (mod. effects)	Flex.	Flex. (mod. effects)
Aggregate Supply Chain Integration	H1: S	H2: S												
Customer Integration	H3a: S	H6a: S	H3b: NS	H6b: S	H3c: NS	H6c: S	H9a: S	H12a: S	H9b: NS	H12b: S	H9c: NS	H12c: S	H9d: S	H12d: S
Supplier Integration	H4a: S	H7a: NS	H4b: S	H7b: S	H4c: S	H7c: S	H10a: NS	H13a: S	H10b: NS	H13b: S	H10c: S	H13c: S	H10d: S	H13d: S
Internal Integration	H5a: S	H8a: S	H5b: S	H8b: S	H5c: S	H8c: S	H11a: S	H14a: NS	H11b: NS	H14b: S	H11c: S	H14c: S	H11d: S	H14d: NS

S: Hypothesis supported
NS: Hypothesis not supported

A. P.: Aggregate Performance
B. P.: Business Performance
O. P.: Operational Performance
Cost: Cost Performance
Qual.: Quality Performance
Del.: Delivery Performance
Flex.: Flexibility Performance
Mod. Effects: Moderating Effects

2.5 DISCUSSION AND IMPLICATIONS

Overall, the results of this study provide evidence for a significant positive association between aggregate supply chain integration and aggregate performance. This result is consistent with the large set of studies that present similar findings (Flynn et al., 2010; Schoenherr and Swink, 2012). Moreover, the results lend support for significant positive correlations of aggregate performance with individual dimensions of supplier integration, customer integration, and internal integration practices. The results indicate that more than half of the relationships of the individual level integration dimensions and individual performance measures have significant positive correlations. The results also point to the importance of focusing on appropriate performance dimension(s) that is (are) consistent with the competitive priority of an organization. It is important to improve the identified performance dimension(s) by focusing on supply chain integration practice(s) with which they are significantly associated. The results provide strong support for the presence of moderating factors that influence various supply chain integration practice-performance dimension links. In the subsequent sub-sections, we discuss the implications of the study's findings in further detail.

Theoretical implications

Table 2.11 presents the summary of the specific integration – performance relationships to discern the level of impact of individual integration practices. The pattern observed in Table 2.11 indicates that as compared to supplier integration, customer integration does not have an impact on a large breadth of performance dimensions. In light of the combined findings from the current set of empirical studies, this implies that

supplier integration would be a priority if an organization intends to integrate externally, as it is more likely to provide the focal firm performance benefits in a broad range of performance dimensions.

Internal integration is related to most performance dimensions. We propose that it might be wise for the firms to integrate internally before they even make external integration attempts. There are studies that conceptualize internal integration as a precursor of external integration in the literature (Tracey, 2004; Braunscheidel and Suresh, 2009). Internal attitudes and procedures need to be aligned before the inclusion of partners in the integration efforts (Tracey, 2004). Internal integration enables the knowledge sharing between the functions, and ultimately facilitates the coordination of production capacity and flexibility in the system (Sawhney et al., 2006; Wong et al., 2011). Moreover, internal integration is instrumental in improving product and process designs with the use of cross functional teams, which help reduce costs for the organization and provide efficiencies (Wong et al., 2011). This integration dimension also has positive associations with logistics service performance (Germain and Iyer, 2006; Stank et al., 2001) and delivery performance (Swink et al., 2007). The lack of support for the association of internal integration with quality performance is intriguing, even though some studies in the extant literature have emphasized this particular relationship with positive and significant results (Swink et al., 2007; Wong et al., 2011). Perhaps, the time (Iyer et al., 2004; Prajogo et al., 2012) and agility (Braunscheidel and Suresh, 2009) orientation of supply chain integration practices might be resulting in more emphasis on performance measures such as cost, delivery and flexibility. Incidentally, literature has even found evidence of negative association of supplier integration with

quality (Swink et al., 2007). It is plausible that more complex relationships, such as an inverted U-shaped relationship, might be at work between certain integration practices and performance measures. It would be important to examine optimal configurations for supply chain integration to achieve superior performance (Das et al., 2006).

Table 2.11 Impact analysis of individual supply chain integration dimensions on performance outcomes

SCI dimension	Cost	Quality	Delivery	Flexibility	Operational	Business	Breadth of impact (% of possible significant outcomes)	Depth of impact (average significant corrected correlations)
Customer integration	X			X			33.33%	0.327
Supplier integration			X	X	X	X	66.67%	0.315
Internal integration	X*		X	X*	X	X	83.33%	0.361

X significant positive correlation
* not subject to moderating factors

In addition to the direct association of supply chain integration practices with performance, the existence of moderators on several relationships is supported by the findings of this study. These moderators can manifest as control variables or statistical interaction effects. Control variables that are analyzed in supply chain integration literature include firm size, production process characteristics, product seasonality, product perishability (Chiang et al., 2012), industry sector, firm age (Villena et al., 2009),

and product customization level (Saeed et al., 2005). Furthermore, various conceptualizations of moderating effects can be observed in supply chain integration literature. For instance, internal integration has been considered as a moderator for the relationships between external integration and performance (Schoenherr and Swink, 2012). An organization's information system capability is shown to be a moderator between inter-functional integration and market and supply-chain intelligence, which are the interim outcomes that ultimately impact performance in new product development context. Information system includes control mechanisms for data updates and access, which enables quality assurance for shared information and enhanced supply chain integration (Bendoly et al., 2012). The dynamism level in the environment that the firms operate in is critical with respect to the integration and performance relationship. For instance, product clock speed has been employed as a moderator between integration and performance (Jayaram et al., 2011). Likewise, uncertainty is considered to be an important moderator in the relationship between supply chain integration, and operational and business performance dimensions (Wong et al., 2011; Boon-itt and Wong, 2011). The findings of this study highlight the importance of more focused examination of moderators that impact the association of supply chain integration practices and performance.

Managerial implications

This study provides some insights for practitioners that are engaged in managing operations within their organizations as well as in the extended supply chain. Firms typically have limited resources, and managers need to allocate these resources prudently

to obtain maximum possible benefits. Supply chain integration practices require monetary investments to set up the necessary infrastructure. This study provides some guidance for managers to make decisions regarding integration investments with respect to the chosen competitive priorities. The investments allocated for integration could be targeted towards, and prioritized upon, the relevant dimensions of supply chain integration depending on the desired performance outcomes. Internal integration should generally precede external integration, as the processes within an organization need to be aligned before engaging in information sharing and collaboration activities with external supply chain partners. Managers should consider this sequence when they are making supply chain integration decisions. As shown in Table 2.11, internal integration has the maximum breadth of impact (83.33%) followed by supplier integration (66.67%) and customer integration (33.33%).

Moreover, managers should be aware of the contextual differences in the relationship between supply chain integration practices and performance. The findings of this study lend support to certain moderating effects that might be strengthening or weakening the relationships between supply chain integration practices and performance. The context should be carefully analyzed and studied before making potentially expensive and hard-to-reverse investments in integration. For instance, environmental uncertainty stands out as a critical issue to be considered when it comes to supply chain integration. Information processing becomes more crucial in highly uncertain environments relative to others, and managers should be cognizant of the requirements of the business environment they operate in when they are making supply chain integration decisions to align the degree of coordination internally as well as externally. In essence,

managers should supplement their bandwagon-driven or benchmarking-driven supply chain integration initiatives with prudent consideration of their own contextual environments.

2.6 CONCLUSIONS AND FUTURE RESEARCH DIRECTIONS

This study provides insights into the relationships between supply chain integration and several performance dimensions. Internal integration as well as external integration play critical roles for organizations. Internal integration makes sure that the functions of an organization act as parts of a coordinated whole, whereas, external integration emphasizes the importance of implementing practices jointly with suppliers as well as customers to build relationships that help achieve a seamless flow of goods, materials and information in the supply chain.

The meta-analytic approach used in this study helps in gaining deeper insights beyond the findings of individual studies, and provides a foundation for building theory in this important research stream in the operations and supply chain management area. While there is an overall understanding of the impact of supply chain integration on performance, a systematic and statistical approach for analyzing these relationships was lacking in the literature. This study was motivated by that need and we carried out the necessary steps to provide deeper insights. The findings of this study present actionable recommendations for managers as well as contributions to theory development in the area.

There are few limitations of this study that are important to keep in consideration. While an extensive analysis of the literature was conducted and a significant amount of

effort was put in to gather data to obtain valid and reliable findings, several inescapable and undetectable artifacts such as deviation from perfect construct validity in the dependent and independent variables, or reporting and transcriptional errors (Hunter and Schmidt, 2004, p. 35) were not considered in this study. However, sampling error and error of measurement in the dependent and independent variables were taken into account by using construct reliabilities and assigning weights to the studies depending on sample sizes. There are obviously many more studies that investigate supply chain integration and performance relationships. However, some studies needed to be left out due to lack of access to relevant information to conduct meta-analysis. Nevertheless, the sample size used to conduct a meta-analysis of correlations in this study is representative of the domain, and is in line with the data used in other meta-analytic investigations (Damanpour, 1991; Gerwin and Barrowman, 2002; Nair, 2006; Mackelprang and Nair, 2010).

Our study offers several important directions for extending supply chain integration research. Given that a large set of supply chain integration practices – performance relationships were influenced by moderating variables, a focused investigation of potential set of moderators would provide richness to the literature base. Contingency and configuration approaches to integration have recently started receiving some attention by scholars in the area (Flynn et al., 2010). Contingency approach mainly focuses on the importance of the environment that an organization operates in, and the alignment of the structure and processes within the organization that the firms should attain in order to achieve high performance. This brings up the relevance of various contexts when we consider implementation of supply chain integration practices.

Furthermore, configuration approach takes a broader perspective on the fit idea by emphasizing the need to have a holistic alignment between various elements of an organization rather than fragmented focus of contingency approach (Flynn et al., 2010). In the supply chain integration area, there are some studies that have looked at the moderating effects (Germain and Iyer, 2006; Devaraj et al., 2007) and the taxonomic groups of different integration dimensions (Frohlich and Westbrook, 2001). Further research would be useful to identify various contextual factors influencing the impact of supply chain integration practices. Moreover, recognition of configuration typologies of supply chain integration in fast changing environment of contemporary global supply chains would present additional insights. Since supply chain integration practices include information exchange, joint decision-making, and emphasis on teamwork; the interactions mostly take place among the human actors of the organizations, and the integration practices are closely linked with knowledge based processes. Therefore, the level of collective skills and abilities in the form of human resources might influence the strength of the relationships between internal and external integration with organization's performance. This remains as an open avenue for future research in the supply chain management area. In particular, we consider human resources related associations with respect to supply chain integration in this dissertation.

Temporal and cumulative aspect of building capabilities using different types of supply chain integration brings an interesting twist to the interaction and accumulated effects of the dimensions of integration on performance. For instance, the precursor role of internal integration as well as the moderating role of it on the relationship between external integration and performance is discussed in the literature (Schoenherr and

Swink, 2012). These alternative conceptualizations need to be reconciled in future theory building efforts in supply chain integration area. Finally, the mixed findings of this meta-analytic study open avenues for further understanding and examination of the relationships between integration and different operational performance measures. Specifically, a broader conceptualization of quality performance that considers time-sensitive nature of this performance dimension should offer insights that extend the current findings. A more holistic conceptualization of performance measures would aid in tightly linking practices with performance more.

CHAPTER 3

AN EMPIRICAL EXAMINATION OF THE IMPACT OF ORGANIZATIONAL AND SUPPLY CHAIN PRACTICES OF FOOD BANKS ON FOOD DELIVERY PERFORMANCE

3.1 INTRODUCTION AND MOTIVATION

Poverty is considered to be a natural slow-onset disaster (van Wassenhove, 2006) and management of food distribution for hunger relief is an associated issue to be managed on a continuous basis within disaster relief and humanitarian logistics area. The natural slow-onset disaster category includes disasters that take a long time to produce emergency conditions, such as drought or socio-economic decline, which are normally accompanied by early warning signs. There are studies in the humanitarian logistics literature stream that examine issues related to disaster relief operations such as vehicle fleet management (van Wassenhove and Martinez, 2012) or stochastic optimization of natural disaster asset prepositioning (Salmeron and Apte, 2010). These studies mainly consider natural sudden-onset disasters (e.g hurricanes, floods, earthquakes) whereas operational issues regarding slow-onset disasters have not been researched extensively from the operations management point of view.

Food banks are not-for-profit organizations that collect, organize, and deliver food to non-profit member agencies – such as soup kitchens, food pantries and shelters - and

individuals to remedy the hunger problem in the society. Food bank networks are important, and are one of the most influential emergency food service delivery systems in the United States (Warsgwsky, 2010). Food banks were originally developed as temporary relief mechanisms to meet emergency food demand during economic downturns of 1970s and 1980s. Several tax incentives that were put into action starting around the 1970s, along with the consolidation of grocery industry and agricultural business growth, enhanced the food donations and development of food banking (Warsgwsky, 2010). Since the 1990s, food banks have grown to be permanent institutions in food delivery systems for underserved communities (Warsgwsky, 2010).

Feeding America, formerly known as America's Second Harvest, serves about 37 million people annually in 50 states via its large network of food banks and more than 40,000 member agencies (Feeding America, 2010) and became the largest food banking model in US. Feeding America relies on monetary and food donations from government agencies, food industries, institutions, and individuals. The funds are used for food bank operations and resources. The food donated to and procured by Feeding America is delivered to regional food banks to be stored in the warehouses until they are delivered to the member agencies and individuals. Food banks also get donations from corporations, individuals, and federal and state partnerships. Fundraising activities are important for food banks, and vary from one food bank to another due to the level of donated food supply. In turn, the level of food supply forces the food banks to generally purchase a large percentage of their food. On the demand and distribution side, member agencies pay a certain amount of money to their respective food banks to purchase food to be distributed to people in need. For many working and non-working Americans, the support

coming from food banks has become a major mode of sustenance (Feeding America, 2012).

The network of food banks is quite complex considering private sector food industries, individual donors as well as governmental offices that provide support in the form of money and food on the supply side; and member agencies including food pantries, soup kitchens and shelters, and individuals on the demand side. Food banks can also be considered as a waste management system for the overall food industry since much of the grown, processed and manufactured food is not consumed because of expiration, overproduction, damage, marketing and other decisions. Billions of pounds of food go to waste each year, while almost one billion people worldwide do not have enough food to eat. Food banks gather surplus food that would be otherwise wasted and deliver it to the people who need it the most (The Global FoodBanking Network, 2012). Management of operations in the humanitarian context is quite valuable as the resources managed by the humanitarian organizations are constrained, and they have to be well allocated. Therefore, understanding the factors that drive high performance will help improve the operations within this context.

Van Wassenhove (2006) emphasizes cross-learning possibilities despite the fundamental differences between private and humanitarian sectors. There are several practices to be learned from the private sector by humanitarian organizations – such as the tools of SCM in private businesses – which would help humanitarian supply chains, provided that they are carefully translated, and the complexities of humanitarian logistics are taken into account. Moreover, private sector also could gain some insights from the

humanitarian aid organizations since non-profits are in a position to be agile and adaptable, and to operate under more resource constrained environments.

In this essay, the basic operations of a food bank are analyzed by using secondary data combined with primary data. The supply side, internal operations and demand side are examined by means of recent operational and financial data of 71 food banks in the U.S. The data from primary and secondary sources were merged to capture important aspects of food bank operations as well as contextual conditions within which these food banks operate. The aim of this essay is to gain insights as to how the basic programs of the food banks are created in relation to the public support and revenue as a result of fundraising efforts as well as supply chain integration, and how these dynamics impact the amount of food distributed per food insecure individual in the service area of the food bank organization. In the next section, we present the model and the theoretical framework.

3.2 MODEL, HYPOTHESES AND THEORETICAL FRAMEWORK

The financial resources that are collected via fundraising efforts, along with the supply chain management practices and capabilities of the organization, result in basic programs, which ultimately determine the delivery performance of a food bank. The strategic side of the operations consists of the decisions regarding the money raising efforts and supply chain management style. The monetary resources, and the internal as well as external integration, produce the basic programs run by the food bank. These programs are the services that the food bank develops using the resources within the

organization, in addition to the customization and integration with the suppliers and the clients that the food bank works with.

The support from corporations and individuals in the form of in-kind donations constitute the largest portion of the income of food banks. Stakeholder theory posits that stakeholders are people or groups that have interests in a corporation's past, present or future activities (Clarkson, 1995). Aside from primary stakeholders, whose continued participation is required for the survival of an organization, such as employees, customers and suppliers; there are secondary stakeholders that influence or affect, and likewise are influenced or affected by the corporations' activities even though their relation to the corporation does not involve transactions that are essential for the survival of the organization (Clarkson, 1995). Ethical responsibilities and philanthropic acts are generally considered to fall into the activities that are exercised by the corporation to give back to the communities in which they do business. The types of behavior coming from corporations generally serve as indicators of social responsiveness. On the other hand, food banks are in need of support to run their operations by generating funds. They engage in certain activities to raise awareness of a social problem and increase their visibility in the form of fundraising activities. The more a food bank is proactive in attracting those funds by doing fundraising, the more share of support it will get from potential donations. It is expected that the extent of support collected will be positively associated with the efforts spent on fundraising activities. It is hypothesized that,

H1: *The extent of fundraising of a food bank is positively associated with the amount of total public support and revenue gained.*

The support collected is allocated to develop programs to provide basic services such as fresh produce, kids cafes, production kitchens, school pantries, senior meal delivery and such. If a food bank operates with more resources, it can increase the scope of operations and have more variety in the basic programs run, as the support will enable the organization to do so. The resource-based view emphasizes that organizations are bundles of heterogeneous resources and capabilities, which cannot be easily transferred to other organizations. If the resources maintained in the organizations are valuable, rare, inimitable and non-substitutable, they become a source of competitive advantage (Barney, 1991; McWilliams et al., 2006). Therefore, non-profit organizations, just like their for-profit counterparts, need to find sources of advantage that would attract support and elevate their performance. Today, non-profit organizations are operating in a highly competitive environment. There is an increasing demand for community services, escalating competition for contracts with the public and for-profit sector, a decline in volunteer support, and generally tighter government funding (Kong, 2007). This requires a need for increased resources and competent strategic management in non-profit environments (Stone et al., 1999). This starts with offering various services that are catered towards customer needs. Homburg et al. (2000) states that service organizations commonly introduce "product managers" into their organizational structures to make decisions about customer segmentation, product line development, service offerings, and standardization versus customization of the services. Moreover, this new organizational form that is customer-focused emphasizes a better assessment of the value chain including all downstream customers, and differentiation of the offerings on the basis of

this knowledge. Service ranges that the food banks have are analogous to this idea, and increased service lines are possible with the incoming support. Hence,

H2: *The amount of total public support and revenue is positively associated with the number of basic programs run in a food bank.*

The initial step to integrate the supply chain activities is the effective coordination of each partner organization's internal processes (Tracey, 2004). There is empirical evidence in the literature that the reduction of internal barriers precedes the removal of barriers to external integration (Frohlich and Westbrook, 2002). Initially, external supply chain members need to see the information sharing, trust and integration among the functions of the potential partner organizations to engage in collaboration with them. When we look at the supply chain integration literature, we can see several studies that conceptualize internal integration as an antecedent of external integration (Tracey, 2004; Braunscheidel and Suresh, 2009). Internal attitudes and procedures need to be aligned before the inclusion of partners in the integration process (Tracey, 2004). Internal cohesion of the processes will encourage the external parties to join the integrated processes. Food banks get the food from donors such as farms, manufacturers, distributors, retail stores, consumers, and other sources, and make it available to those in need through a community agency network. Matching the supply of food that would otherwise be wasted to the demand of people that are in need requires internal integration that precedes the integration activities that span the whole supply chain both upstream

and downstream. Internal integration of processes provides the basis for enabling the requisite supply and demand integration. Thus, we hypothesize that:

H3: *The level of internal integration in the food bank is positively associated with the level of supply integration in the food bank.*

H4: *The level of internal integration in the food bank is positively associated with the level of demand integration in the food bank.*

The importance of supply chain integration has been emphasized in the literature (Frohlich andWestbrook, 2001; Ragatz et al., 1997). The nature of collaboration with supply chain partners enables exchange of information and ideas between the parties engaged in integration. Therefore, the products and services can be better catered to the needs of the clients, and the supply integration can enhance the understanding about the abilities of the supply base. The supplier's existing knowledge of the partner organization's internal processes and goals make the service and product development, as well as appropriate planning of the supplier possible (Ragatz et al., 1997). Littler et al. (1995) argues that frequent inter-organizational communication, building trust, and ensuring that all parties act as expected are some of the key success factors for new product/service development. Furthermore, it is established in the literature that improvements in flexibility are positively associated with considering suppliers and customers as the sources of information and collaboration (Wong et al., 2011). Product variety is a dimension of flexibility performance (Schoenherr and Swink, 2012), which is the capability of producing numerous product/service lines and their variations (Berry

and Cooper, 1999). The type of flexibility that enables the firm to increase the mix of products/services is considered to be one of the most external facing ones among all flexibility types (Braunscheidel and Suresh, 2009), and is affected by a broad integration arc that faces outward to suppliers and customers (Frohlich and Westbrook, 2001).

Also, integrating the operations with downstream partners is critical to get information on demand patterns and customer requirements. The lack of demand side integration leads to important inefficiencies in the system such as poor customer service and waste. Especially in service operations, the characteristics of products/services such as customer participation, heterogeneity, and perishability adds to the complexity of activities, and increases the need to have demand integration in place to come up with the right scope of services for the clients (Frohlich and Westbrook, 2002). In this respect, coordination with the external partners of a food bank makes it possible to deal with the complexity in the system and to broaden the service range. Therefore, we hypothesize that:

H5: *The level of supply integration in the food bank is positively associated with the number of basic programs run in the food bank.*

H6: *The level of demand integration in the food bank is positively associated with the number of basic programs run in the food bank.*

The basic programs run in a food bank are customized services for different groups of clients. Some examples include programs targeted for seniors and kids. As indicated before, basic programs run are, in a sense, similar to variety of

products/services that a commercial firm offers to its customers. Broader product lines enable firms to meet customer demand more closely and increase the reach to customers, and higher "market shares" ensue (Kekre and Srinivasan, 1990). Product variety is often considered to lead to a competitive edge in for-profits through offering products or services tailored to specific market segments, and it helps in producing higher sales volumes (Berry and Cooper, 1999). Broadening the service offerings for a food bank would mean attracting attention of the people in need. For instance, introducing kids cafes programs would serve the elementary school children that would not be aware of the programs otherwise, and increase the target share of the population in need. Similarly, senior brown bag programs would help meet the needs of senior community members and increase the reach to this segment. Moreover, various programs would attract media and donor attention, thereby increase the incoming support. In this respect, the amount of food distributed will be dependent on the number of basic programs run, as the programs will be structured to meet different client needs and lead to higher amount of food distributed per food insecure individual in the service area. Accordingly, we hypothesize that:

H7: *The number of basic programs run in the food bank is positively associated with the amount of food distributed per food insecure individual in the service area of the food bank.*

Control Variables

The history of an organization basically reflects a unique bundle of critical resource as well as organizational skills and capabilities that have been accumulated over time. These resources influence an organization's strategies of growth and organizational structure (Nelson and Winter, 1982; Penrose, 1959). We expect that the longer the history of the organization, the greater the organization's embeddedness in its environment. (Yiu et al., 2005). Moreover, older organizations are more experienced in their areas of operations, and they emphasize efficiency (Lukas et al., 1996). Accordingly, we control for the *"age of the food bank"*. Organizational size can also affect the performance, since large organizations have more resources through which the performance could be strengthened (Tsai, 2001). The total assets are indicative of the *"size"* of the organization, which we incorporate in our model and control for (Waddock and Graves, 1997).

In a commercial setting, there is a tradeoff between increasing the number of channels and increasing the market coverage at the expense of reduction in intermediary incentive to invest and add value (Frazier, 1999). However, in a non-profit setting the incentives of all channel members are already aligned. Specifically, food banks and member agencies have the same goal of reaching more people in need and distributing as much food as possible. Multiple channels are also found to be supporting each other on several occasions via providing more identification with, and exposure to, the services to diffuse into the client base (Frazier, 1999). In distribution channels, relational exchange is considered to be ongoing transfers of value between independent channel members. The interactions and associations of personnel influence the channel governance (Frazier,

1999). There are benefits to relational exchange as a result of the transactions that occur repeatedly, such as learning and social rewards (Frazier, 1999). If a food bank has experience with multiple types of agencies, the delivery of basic programs to the clients will benefit from the knowledge accumulation gained from experience and the basic programs will result in higher performance. A food bank may or may not have a non-zero number of agencies for each category (Soup Kitchen, Shelter, Day Care etc.). We control for this difference that is described in terms of *"service agency breadth"*, which is the number of type of agencies in various categories. Putting all the relationships together, the illustration of the proposed model can be found in Figure 3.1.

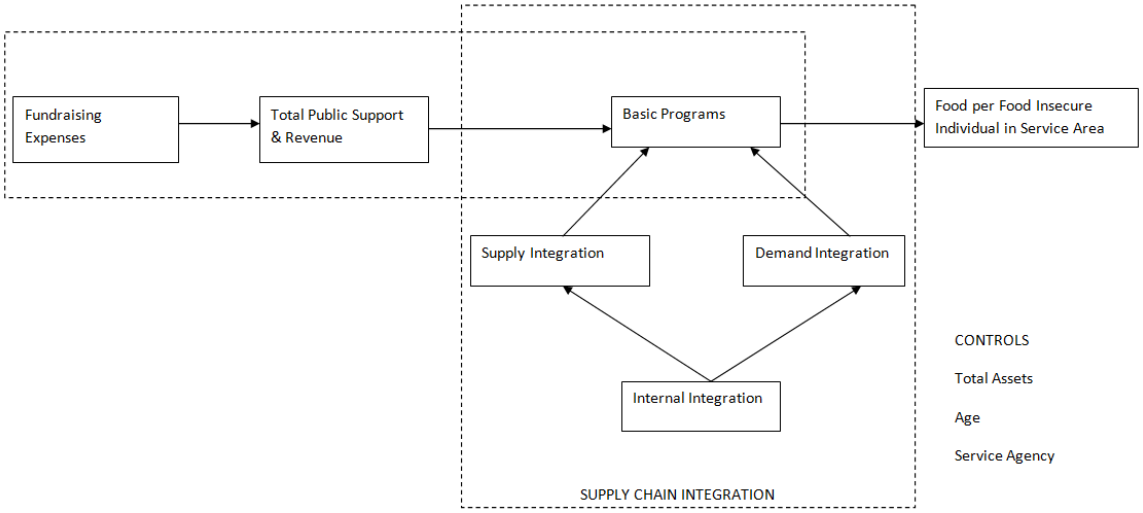

Figure 3.1 Conceptual Model

3.3 RESEARCH DESIGN

Data Collection

To undertake this research investigation, data on the population served and amount of food distributed annually were gathered from Feeding America's website

(http://feedingamerica.org/foodbank-results.aspx). There are 202 food banks throughout the United States, and operational information for all of them is available on this website. This data set is then merged with the financial information collected from IRS 990 forms of the food banks. Food banks report their financial standing for transparency of operations requirement and to show how they manage their funds to their stakeholders. The relevant financial information (IRS 990 forms) is available on the websites of many of the food banks. The form for year 2010 was used, which was the most recent financial information that was available on the food bank websites during the time of data collection. Since there were food banks that did not provide the IRS 990 form in the year 2010, the number of observations was reduced to 120 food banks. Then, this dataset was matched and merged with the survey data, which we will be talking about in the next chapter in more detail. There were 72 food banks that had both the secondary and primary information, and this final dataset was used to test the research model. There was one observation with a missing value for the variables in this model, and that data point was dropped from the analysis.

The amount of food distributed per food insecure individual in the service area of the food bank (in lbs) was operationalized and used as the performance variable. As mentioned before, the size of the food bank is controlled by using the total assets of the food bank. We also control for age of the organization, since older and larger organizations are more experienced in their areas of operations, and they emphasize efficiency (Lukas et al., 1996). Service agency breadth is also controlled for as mentioned before. A non-zero number for this variable indicates that a food bank has activity in a particular category. For instance, if a food bank has activity only in "emergency",

"senior" and "shelter" categories, it will have a score of 3, indicating the types of service agencies the food bank works with. We control for this impact on performance, (the amount of food distributed per food insecure individual in the service area of the food bank), since *Service Agency* measure stands for the distribution channels in this study. After accounting for the factors that would cause variability in the performance, the links that are significant for food bank operations were identified.

Fundraising expenses were used as a precursor to the total support and revenue collected by the organization, as food banks need to spend some effort and money to attract donors, which will provide the necessary support and supplies in the form of food and money. Total support and revenue is allocated toward running basic programs, (operationalized as the number of basic programs run). This way the food bank builds the financial resources to put in the services, which are the main products of a food bank. The financial measures are reported in the IRS 990 forms, which are filed by non-profits, charities, and other tax-exempt organizations. The revenues and support, as well as how the expenses are allocated, are reported in these forms.

Over and above the financial resources collected, the basic programs of a food bank are formed as a result of the collaboration of the organization with the supply chain partners. The information regarding the resources and capabilities of the suppliers determine the way the programs are structured. Moreover, client needs are incorporated into the formation of basic programs to better meet the requirements of the beneficiaries. Inter-functional (internal) integration also plays a role indirectly through supply and demand integration, since a common understanding of the functional teams regarding the goals and capabilities is necessary to be able to come up with the programs that best

allocate the resources in the organization to the right services. We use perceptual measures regarding the level of internal and external (supply and demand) integration present in the food bank. The scale is a 7-point Likert scale, where 1 indicates "Strong Disagreement" and 7 indicates "Strong Agreement" with the manifest items. The details of the psychometric properties of the survey scales will be discussed in the next essay. In summary, the variables taken from the survey have appropriate validity and reliability.

Research Methodology

Seemingly unrelated regression (SUR) is an econometric analysis method that allows for simultaneously running a system of regression equations and accounts for correlated error terms across the variables (Autry and Golicic, 2010). Zellner (1962) introduced this method as an efficient estimation of generalized least-squares model, where the variables that are independent in one equation can be a dependent variable in another equation in the system (Autry and Golicic, 2010). As SUR has the power to account for contemporaneous cross-equation error correlations, it has advantages over other approaches such as path modeling. Therefore, if multiple equations are simultaneously tested and there is a chance that variables in the models can be related, SUR is the appropriate methodology (Devaraj et al., 2004; Autry and Golicic, 2010; Griffis et al., 2012). This method has become very popular recently in applied econometric research.

In operations management literature, we can see some examples that employ this technique. For instance, Autry et al. (2010) reports that SUR is an effective method for estimating models depicting mediating and/or moderating conditions using cross-

sectional data. This technique is also known for alleviating endogeneity concerns (Autry and Golicic, 2010), since possible correlation between error terms are accounted for and the focal variables are modeled to be both independent and dependent in the model (Greene, 1993; p.486). Moreover, Griffis et al. (2012) employs SUR in a recent empirical study, where the associations between the independent variable, controls, and multiple dependent variables are simultaneously tested, where several of the independent variables have the potential to be related to each other, leading to correlated error terms. We also deem that this is the appropriate method for the purposes of the model in this essay.

In general, non-normality of the error terms and heteroscedasticity occur together in the data (Kutner et al., 2005; p132). We checked for normality of the variables in the model by using the Shapiro-Wilk test, and did the necessary logarithmic and square root transformations on the variables that do not have normality to remedy the problem (Kutner et al., 2005; p132). SUR models assume that the error terms are homoscedastic. We tested for the assumption of errors with constant variance (homoscedasticity) via Breusch-Pagan test (Kutner et al., 2005; p118). The result of this test indicated that the error variances are not constant.

Since the reported errors in SUR output in STATA 12 imposes constant variance, and taking the natural logarithm of the variables did not reduce the heteroscedasticity in the data, Cameron and Trivedi (2009; p.160) propose that bootstrapping can be used in a SUR setting, where the error terms are heteroscedastic. This method allows us to get robust standard errors, and in the case that the error terms are homoscedastic, the results converge to the default standard errors (Cameron and Trivedi, 2009). We used this

methodology in order to estimate the data with heteroscedasticity using the default bootstrap option in STATA 12.

We also checked whether multicollinearity was a problem in the data. The multiple regression equations that take place in the system include Demand Integration, Supply Integration, and Total Public Support and Revenue as predictors of Basic Programs as the first equation. The second multiple regression equation has Food per Food Insecure Individual as the dependent variable; and Basic Programs, Total Assets, Age, and Service Agency as the independent variables. We looked at variance inflation factors (VIF) of these variables when entered into the regression equation simultaneously for multicollinearity diagnostics. A VIF value in excess of 10 is generally considered as an indication of multicollinearity being an issue influencing the least squares estimates (Kutner et al., 2005; p.409). In this particular model, the VIF values are below 1.5, which shows that there is no multicollinearity issue present in the model. The VIF values are reported in Table 3.1.

Table 3.1 VIF values of the variables

Variable	***VIF***	***1/VIF***
Equation 1		
Supply Integration	1.37	0.727844
Demand Integration	1.37	0.728394
Total Public Support and Revenue	1	0.996548
Mean VIF	1.25	
Variable	***VIF***	***1/VIF***
Equation 2		
Basic Programs	1.18	0.848224
Total Assets	1.1	0.905502
Service Agencies	1.07	0.937447
Age	1.01	0.993083
Mean VIF	1.09	

We also present the descriptive statistics of the variables employed in the model in Table 3.2.

Table 3.2 Descriptive statistics

Variable	N	Mean	Std. Dev.	Min	Max
Internal Integration	72	5.523	0.936	2	7
Demand Integration	72	5.714	1.002	1	7
Supply Integration	72	5.338	0.938	3	7
FOOD (performance)	72	68.447	35.705	2.718	181.575
Fundraising Expenses	71	740,669	628,061	72,363	2,783,378
Total Public Support & Revenue	72	30,700,000	20,900,000	1,982,299	88,000,000
Service Agency Category	72	8.917	1.441	1	10
Basic Programs	72	12.514	3.272	4	18
Age	72	29.556	5.886	5	42
Total Assets	72	12,100,000	9,460,891	1,080,599	46,400,000

The system of equations that are simultaneously estimated using SUR methodology is specified below:

$$\textit{Total Public Support and Revenue} = \beta_{10} + \beta_{11}\,(\textit{Fundraising Expenses}) + \varepsilon_1$$

$$\textit{Supply Integration} = \beta_{20} + \beta_{21}\,(\textit{Internal Integration}) + \varepsilon_2$$

$$\textit{Demand Integration} = \beta_{30} + \beta_{31}\,(\textit{Internal Integration}) + \varepsilon_3$$

$$\textit{Basic Programs} = \beta_{40} + \beta_{41}\,(\textit{Supply Integration}) + \beta_{42}\,(\textit{Demand Integration}) + \beta_{43}\,(\textit{Total Public Support and Revenue}) + \varepsilon_4$$

$$\textit{Food per Food Insecure Individual in the Service Area of the Food Bank} = \beta_{50} + \beta_{51}\,(\textit{Basic Programs}) + \beta_{52}\,(\textit{Total Assets}) + \beta_{53}\,(\textit{Age}) + \beta_{54}\,(\textit{Service Agency}) + \varepsilon_5$$

Also, for reference, the variable names and the descriptions can be found in Table 3.3.

Table 3.3 Variable Definitions

Variable Name	Definition
Internal Integration:	The cross-functional intra-organizational collaboration and information sharing activities that occur via interconnected and synchronized processes and systems.
Demand Integration:	Close collaboration and information sharing activities with clients that provide the firm with strategic insights into market expectations and opportunities, ultimately enabling a more efficient and effective response to client needs.
Supply Integration:	Coordination and information sharing activities with key suppliers that provide the organization with insights into suppliers' processes, capabilities and constraints, ultimately enabling more effective planning and forecasting, product and process design, and transaction management.
FOOD (performance):	Amount of food distributed per food insecure individual in the service area of the food bank (in pounds).
Fundraising Expenses:	The amount of money spent for publicizing and conducting fund-raising campaigns; maintaining donor mailing lists; conducting special fund-raising events; preparing and distributing fundraising manuals, instructions, and other materials; and conducting other activities involved with soliciting contributions from individuals, foundations, government agencies, and others.
Total Public Support and Revenue:	Public support generated by contributions and grants, contributed food received, and revenues in the form of fees and grants from government agencies, handling fees from member agencies, investment and other income
Service Agency:	Type of service agency categories distributing food (e.g. Emergency, Soup Kitchen, Shelter, Day Care, Senior etc.)
Basic Programs:	Programs that are being run by the food bank to achieve the goal of food distribution to the communities in need (e.g. Fresh Produce, Back Pack, Salvage, Senior Meal Delivery, Kids Cafes, After School Snacks etc.)
Age:	Time in years that the food bank has been in operation
Total Assets:	Sum of all current and non-current assets of the food bank

3.4 RESULTS AND IMPLICATIONS

The results of the analysis indicate that the general framework regarding the basic flow of operations forming the basic programs is supported. The amount of fundraising expenses is found to be associated with higher amount of total public support and revenue, lending support to H1. This finding is intuitive and expected. Nonetheless, we wanted to keep the whole picture in the framework and included this link in the model and found empirical evidence.

When we look at the precursors of basic programs run, it is evident from the significant finding that total public support and revenue provides the monetary resources necessary to build the basic programs in the food bank. Thus, we have support for H2. These resources are vital to run the operations of the organization. However, over and above the monetary resources that are collected, there are other factors that are essential to structure the programs in order to meet the food distribution goals of the food bank. We theoretically hypothesized that these factors are the elements of supply chain integration. The results of this part of the framework show that internal integration is strongly associated with supply and demand integration, whereas only demand integration has a significant association with basic programs when external integration measures and their relations to basic programs run are considered. This lends support to H3, H4, and H6, however, there is lack of support for H5 in this analysis.

Finally, the ultimate performance measure for the food bank organization is the amount of food distributed. The basic programs are the means to achieve this goal. The findings regarding the predictors of performance in this model show that the basic programs are positively and significantly associated with the amount of food distributed

per food insecure individual in the service area of the food bank. This lends support to H7. None of the control variables turned out significant in this setting. We combine and present all the findings regarding all the links tested in this model in Figure 3.2. Also, the detailed results can be found in Table 3.4.

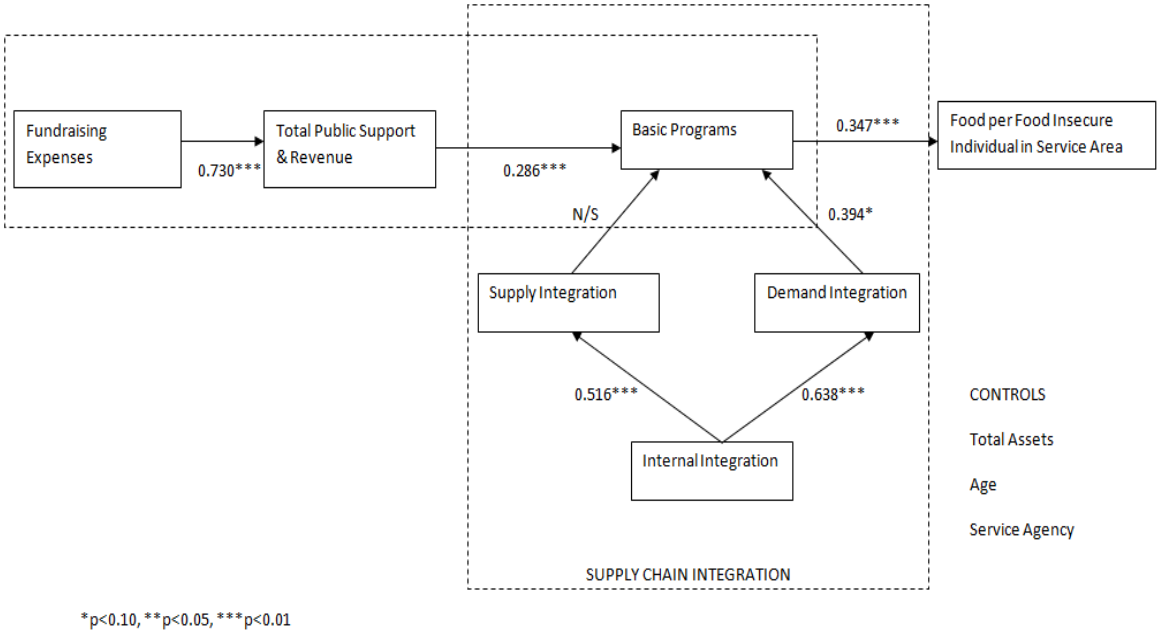

Figure 3.2 Seemingly Unrelated Regression Model - Results

The results indicate that food banks should strategically combine their fundraising efforts and supply chain integration in order to achieve their social goal of food distribution to the communities in need. However, they need to allocate more of their already constrained resources towards demand integration, rather than supply integration, since the results show that demand integration has a more significant impact on the basic programs run. This insight would be helpful for the food bank executives to see how they

should be balancing out their resources. Moreover, the findings prove the fact that internal integration precedes the external integration significantly in a non-profit context.

Table 3.4 Seemingly Unrelated Regression Results

	Observed Coefficient	Bootstrap Std. Err.	z	P>z	[95% Conf. Interval]	
Dependent Variable: Total Public Support and Revenue						
Fundraising Expenses	0.730	0.094	7.730	0.000	0.545	0.915
intercept	0.000	0.067	0.000	1.000	-0.131	0.131
Dependent Variable: Demand Integration						
Internal Integration	0.638	0.236	2.700	0.007	0.175	1.101
intercept	0.000	0.078	0.000	1.000	-0.153	0.153
Dependent Variable: Supply Integration						
Internal Integration	0.516	0.128	4.030	0.000	0.265	0.768
intercept	0.000	0.096	0.000	1.000	-0.189	0.189
Dependent Variable: Basic Programs						
Total Public Support and Revenue	0.286	0.094	3.040	0.002	0.102	0.470
Demand Integration	0.394	0.214	1.840	0.066	-0.027	0.814
Supply Integration	0.017	0.166	0.100	0.917	-0.308	0.343
intercept	0.000	0.116	0.000	1.000	-0.228	0.228
Dependent Variable: Food per Food Insecure Individual in the Service Area						
Total Assets	-0.078	0.126	-0.620	0.535	-0.325	0.169
Age	0.207	0.156	1.330	0.185	-0.099	0.513
Service Agency	-0.088	0.351	-0.250	0.801	-0.777	0.600
Basic Programs	0.347	0.116	3.000	0.003	0.121	0.574
intercept	0.000	0.128	0.000	1.000	-0.251	0.251

3.5 DISCUSSION AND LIMITATIONS

In general, in this essay we investigated the precursors of basic programs run in a food bank and the consequent performance implications by using a dataset that is comprised of information from secondary data and survey resources. This study gives us important insights into the general flow of operations and the importance of supply chain integration in a non-profit setting. So far, the majority of work in the empirical operations management field has dealt with for-profit enterprises. The literature on supply chain integration is no exception to this common theme. In this study, we have looked at the foodbanking sector as a non-profit setting, and found that supply chain integration has proven useful in food banking organizations. The mechanism through which internal and external integration affects the food bank performance is the basic programs structured in the organization.

Foodbanking organizations are dependent on total public support and revenue, which results from the fundraising efforts to gain the necessary resources to operate. Moreover, we observed that several tools of supply chain management that are found to be useful in other settings are commonly used in food banks with some adjustment to the non-profit environment in which they take place. There are several reasons for these adjustments, even though the idea of supply chain integration remains the same. For instance, there are different applications of the integration idea in food banking because of the nature of the non-profit service setting rather than a typical commercial exchange environment. The materials that are passed through the supply chain are food products that have a relatively short shelf life. Furthermore, these products are delivered on the basis of goodwill, which is quite distinct from a monetary transaction between a customer

and a service provider. These are some of the tenets of non-profits that make it necessary to adjust the supply chain integration idea that was originated in for-profit organizations. While the two sectors have their differences, the notion of collaboration, information exchange, and joint decision-making are pivotal, irrespective of the setting. This study provides insights in this manner.

We also shed light on the dynamics between the internal and external (demand and supply) integration in non-profit organizations. The literature that mainly focuses on for-profit organizations suggests that internal integration precedes external integration, and we have found that it actually is the case in food banks as well, as a result of our empirical investigation in this essay. Aside from the hard data, the observations in the food banks also provided an opportunity to see the inter-functional work that is taking place in these organizations. The interviews with the COO of a local food bank also support the awareness of the food banks regarding external integration, which was not immediately observable. The antecedents of supply chain integration in food banks remain as an open question to be explored in the next essay.

While there are important insights gained from this analysis, we need to acknowledge some limitations. For instance, the sample used to make the necessary analysis for this study is 71. First of all, the population of food banks in the nation is slightly higher than 200. Also, the overlapping and matched data between secondary and primary sources reduced the sample size. This prevented us from running analysis with structural equation modeling. We also wanted to keep the model simple rather than introducing complex moderating relationships into the framework at this stage, since the main aim here is to see to basic flow of operations in a food bank. Nonetheless, this is a

unique dataset that provides valuable information regarding food bank operations. The study answers several questions about how supply chain integration plays a role in forming basic programs, and opens the avenue for further inquiries about the antecedents of supply chain integration, which we investigate in the next chapter.

CHAPTER 4

ANTECEDENTS AND PERFORMANCE IMPLICATIONS OF SUPPLY CHAIN INTEGRATION IN FOOD BANKS: A SURVEY-BASED INVESTIGATION OF THE ROLE OF INTELLECTUAL CAPITAL

4.1 INTRODUCTION

Supply chain management practices and strategic supply management are very crucial for food banks as much as for commercial companies. Operating under constrained resources, food banks can and do greatly benefit from supply chain integration given the potential operational and financial benefits. Supply chain integration (SCI) has been one of the main areas of investigation in supply chain management research (Frohlich and Westbrook, 2001; Das et al., 2006). The SCI concept has generally been classified on two dimensions - internal integration and external integration. For a firm, external integration relates to the level of collaboration with its upstream suppliers and its downstream customers. Information exchange with supply chain partners on various stages of operations to make demand and supply management more efficient is the main tenet of external integration (Frohlich and Westbrook, 2001). On the other hand, internal integration involves information synchronization and integrative initiatives between the functions within an organization. Flynn et al. (2010) define SCI as the degree of an organization's strategic collaboration with its customers

and suppliers, and management of intra and inter organizational processes. The benefits of collaboration between supply chain partners as well as the integration between the functions within an organization have been shown to impact operational and financial performance in several research studies (Cao and Zhang, 2011; Germain and Iyer, 2006; Braunscheidel and Suresh, 2009; Devaraj et al., 2007; Swink et al., 2007).

An examination of the literature on SCI indicates that it has been primarily examined from the context of private sector enterprises spanning various industries from automotive (e.g. Wong et al., 2011; Droge et al, 2004) to consumer products (e.g. Rosenzweig et al., 2003), as well as multiple industries in a single study (e.g. Frohlich and Westbrook, 2001; Das et al., 2006). Notwithstanding the advances in research examining supply chain integration in the private sector, a sound understanding of the nature and potential of SCI for organizations engaged in serving social causes is a relatively under-researched domain. Organizations addressing issues such as hunger, health, and poverty are required to manage the steady flow of materials, services and information to achieve their social goals (Akingbola, 2006). Yet, they have unique budgetary and infrastructural constraints that require innovative business practices. This calls for transferring and extending the lessons learnt from the private sector, so that organizations focusing on performance measures that transcend beyond economic measures can attain their multi-dimensional goals effectively and efficiently (Akingbola, 2006).

An exploratory interview with the Chief Operating Officer (COO) of a local food bank highlighted the importance of SCI and indicated that the level of integration varies greatly from one food bank to another. This essay aims to investigate the key antecedents

and implications of supply chain integration (SCI) for food banks. The discussion with the COO revealed the importance of organizational and human assets for ensuring efficient and effective operations of food banks. The importance of human assets was also emphasized in the keynote speech by the CEO of Global Foodbanking Network, Jeff Klein, at the Humanitarian Logistics College Mini Conference, (23rd Annual POMS Annual Meeting, 2012). Drawing upon the opinions and observations of practicing professionals in the food banking sector, it is apparent that a highly skilled workforce is as crucial, if not more so, for the operations of these non-profit sector organizations as it is for a commercial organization, since food banks are already resource constrained.

This essay aims to disentangle the key organizational factors that lead into supply chain integration in the context of food banks. There are certain idiosyncrasies that come into play in this particular context. This study examines the role of intellectual capital (Subramaniam and Youndt, 2005) as a key organizational factor that leads to the development of supply chain integration. Information exchange and interactions between parties that engage in supply chain activities to end up with a common understanding of the overall supply chain are emphasized in internal and external integration. As a human resources related capability, intellectual capital's driving force for achieving supply chain integration is the main question in this essay.

Additionally, the strength of impact of supply chain integration on delivery performance may be influenced by environmental uncertainty, as the level of incoming support as well as the demand for food is not very steady and it creates a mismatch in the delivery of the service to the clients. In this respect, the precursor role of intellectual capital on supply chain integration, as well as the performance implications that ensue,

incorporating the contextual setting, are studied in food banks. The model was analyzed using responses to a questionnaire that was collected from food bank executives. Overall, the study targets a comprehensive understanding of the operational issues that span the building of supply chain integration capabilities and resulting performance in the foodbanking sector. In the next section, the model, hypotheses, framework and research design are elaborated.

4.2 MODEL, HYPOTHESES AND THEORETICAL FRAMEWORK

Drucker (1989) argues that motivation and productivity of knowledge workers in non-profit organizations are extremely crucial. Moreover, these organizations are not fixated on financial returns, rather, the performance of their mission is much more important to have a disciplined organization in place. Therefore, a sound understanding and dedication to the social goals are pivotal for the success of non-profit organizations. Thus, what makes information exchange and communication possible are the people of the organization and their approach towards the mission of the non-profit organization. In this study, we theorize that the intellectual capital leads to supply chain integration to achieve the social performance of alleviating hunger in food banks.

Organizations have different ways of accumulating and using knowledge. Intellectual capital is all the knowledge firms utilize to gain a competitive advantage (Subramaniam and Youndt, 2005). Subramaniam and Youndt (2005) conceptualize intellectual capital on three dimensions. “Human capital is the knowledge, skills, and abilities residing with and utilized by individuals, whereas organizational capital is the

institutionalized knowledge and codified experience residing within and utilized through databases, patents, manuals, structures, systems and processes" (Subramaniam and Youndt, 2005; p.451). The third aspect of intellectual capital is the social capital, which is the knowledge that emerges through interactions between individuals and their interrelationships.

The building blocks of human capital are creative, bright, skilled employees, with expertise in their roles and functions, who constitute the major source for new ideas and knowledge in an organization (Subramaniam and Youndt, 2005). As such, human capital requires the hiring, training, and retaining of employees. However, since human capital is embedded in individual expertise, it may not necessarily stay within the organization due to the mobility of employees. As a result, human capital can come into and go from the organization. On the other hand, the main tenets of organizational capital include reliance on manuals, databases, patents, and licenses to codify and preserve knowledge, along with the establishment of structures, processes, and routines that encourage repeated use of this knowledge (Hansen et al., 1999). As such, organizational capital, which takes form in institutionalized knowledge, stays within the organization and does not change very easily. This is because organizational capital is related to the codification and preservation of knowledge through structured and repetitive activities. The codification is manifested in the form of manuals, databases, and patents that organizations use to accumulate and retain knowledge. At the same time, organizational capital is also concerned with formal procedures and rules for retrieving, sharing, and utilizing knowledge. In essence, organizational capital aims to institutionalize knowledge within an organization by means of preserving knowledge and by incorporating mechanisms to

use it recurrently. Social capital emerges from norms of collaboration, interaction, and sharing of ideas. This form of intellectual capital does not follow predetermined rules for knowledge transmission; instead, it requires structures that facilitate the interactions in networks. Although the dimensions of intellectual capital may sound different, they transform into and transferred via each other, and ultimately unfold the organizational knowledge (Subramaniam and Youndt, 2005).

Knowledge management is not a foreign concept in the context of supply chain management. Research in the knowledge management area emphasizes that organizations that possess higher levels of intellectual capital are more successful at responding to demand unpredictability (Chakravarthy et al., 2003). Knowledge sharing is one of the main characteristics of supply chain integration since information exchange and interactions between parties that engage in supply chain activities to end up with a common understanding of the overall supply chain are emphasized in internal and external integration. Knowledge based view argues that knowledge is the most important strategic resource of an organization (Chakravarthy et al. 2003; Eisenhardt and Santos 2002). The factor that gives knowledge this critical position is that it is not imitable, which is one of the tenets that RBV argues (Dierickx and Cool, 1989). RBV basically states that organizations seek valuable, rare, inimitable and non-substitutable resources to achieve competitive success. Human and knowledge based resources are strategic in the sense that they bring in the skills, practices, knowledge and capabilities that add positive value to the organization, and are either unique or rare among the organizations in the industry (Wright and McMahan, 1992). In the supply chain literature there are several studies that use KBV and RBV as the theoretical lens since the relationships and

information exchange with suppliers and customers as well as cross-functional streamlining of operations, trust and involvement in partners' activities are key characteristics of successful supply management (Cao and Zhang, 2011; Cousins and Menguc, 2006). As indicated before, supply chain integration mainly focuses on information exchange, building relationships and close connections that go beyond day-to-day transactions. This directly influences the development of valuable and unique resources that cannot be replicated.

As previously mentioned, human capital represents tacit and explicit knowledge that resides in the workforce as well as their learning capabilities, and social capital is the knowledge that emerges through interactions between individuals and their interrelationships. Social capital is an asset reflecting the characteristics of social interactions achieved through individual level collective understandings regarding the tasks and goals. The employees' abilities to solve problems and their skills are the reasons that lead to the selection of recruitment of that particular individual (Leana and Van Buren, 1999). The accumulation of the right human actors with their abilities and resources foster the necessary social capital in the organization, as social aspect of intellectual capital represents embedded knowledge available though the interrelationships and interactions of the individuals (Subramaniam and Youndt, 2005). Moreover, emergence in the form of collective knowledge of human actors of the organization emphasizes that the accumulation of the human capital in the organization is a function that does not need to be linear (Wright and McMahan, 2011). Hence, this statement implies that while human capital forms the basis as the parts of a whole, the resulting setting that the interactions occur and knowledge is shared is emergent, which

social capital stands for. It is stated that the non-profit employees select to work for the non-profit organizations to be knowledge workers in this environment, where they can contribute to society to achieve certain meaningful results (Drucker, 1989). Also, the aspirations, personalities and motivations of the individual human actors that target a common social goal present a context, where the knowledge, experiences, and know-how are exchanged willingly, and collaboration and teamwork happens naturally. We posit that the prerequisite to building the social aspect of intellectual capital is expected to be the skilled, creative and bright workforce, which is the human capital. Training, education, and sophistication of individuals of the organization accumulate to form the level and quality of interactions and interrelationships between the employees in food banks. Therefore, we hypothesize

H1: *Human capital is positively associated with the level of social capital in food banks.*

Moreover, organizational capital represents structured recurrent processes that are codified and preserved in an organization, and it leads to cross-functional information exchange as well as a common understanding of the operations and metrics about the supply chain management of the organization. Moreover, an organization's existing knowledge base is used in structured and recurrent activities as a reliable and robust response. It influences the problem solving patterns that take place in the organization (Subramaniam and Youndt, 2005). In general, recurrent processes and routines leveraged on the organization's preserved knowledge are expected to enhance the level of interactions, relationships, and collaborations among the individuals that deploy the

organizational knowledge. Especially, the projects that require collective work of the individuals provide context, where the organization's codified knowledge (e.g. in databases, patents, and licenses) is put to use, updated and reinforced (Subramaniam and Youndt, 2005). Organizational capital, the way it is conceptualized by Subramaniam and Youndt (2005), comprises of structures, standardized processes, routines, formalization of rules and procedures; is mostly mechanistic (Kang and Snell, 2008). These structures create a resource for the employees to refer to as an institutionalized, reliable, and legitimate codebook, and help in organizational learning processes. The organizational capital that is available minimizes the time it takes to understand and interpret issues to be solved in the organization (Kang and Snell, 2008). In addition, these sources define the protocols and implementation of processes, assuming the starting point role, and lead the interactions that take place within and across the organization. Food banks provide manuals, general rules and guidelines to their workforce as well as to their supply chain partners to describe the process and transfer the knowledge. Thus,

H2: *Organizational capital is positively associated with the level of social capital in food banks.*

Social capital has a cooperative role that expands the collection of knowledge that is embodied in various sources, including the human actors, structures and systems, and channels the emergent interactions towards collaboration and teamwork that make up the internal integration. Both human and organizational capital are utilized and transferred via interactions that occur in networks (Subramaniam and Youndt, 2005). Mainly, the

links that enable sharing of information and know-how among the members of an organization (social capital) facilitate the precursor role of human capital by encouraging collaboration, which leads to integration of intra-organizational processes. Social capital encourages exchange of ideas and interactions of the human capital. Networking aspect of social capital sets out the connections required for sharing of ideas. Likewise, social capital works through the enhancement of group work and information exchange among team members of an organization, and facilitates the organizational capital's knowledge reinforcement role. The amount of information exchange in groups of people and their interactions helps aid in achieving higher levels of internal integration in an organization. In other words, internal integration emphasizes a deliberate effort towards teamwork and information exchange between the functions of an organization (Schoenherr and Swink, 2012), and the team members will turn to the expertise sharing, internal resources and the existing norms of collaboration in place to find process solutions. Since food banks are non-profits that have an advantage regarding the commitment and relationships of the employees due to the common social good to be achieved, the environment that has emerged via the interactions of the members gives rise to the inter-functional teamwork, consensus on common metrics and understanding of the ultimate social goal. Therefore,

H3: *Social capital is positively associated with the level of internal integration in food banks.*

The prerequisite for successful supply chain integration is the effective coordination of each partner organization's internal processes initially (Tracey, 2004).

First of all, supply chain members need to see the information sharing, trust and integration among the functions of potential partner organizations to engage in collaboration with them. There are studies that conceptualize internal integration as a precursor of external integration in the literature (Tracey, 2004; Braunscheidel and Suresh, 2009). Internal attitudes and procedures need to be aligned before the inclusion of partners in the integration efforts (Tracey, 2004). Internal cohesion of the processes will encourage the external parties to join the integrated processes. Food banks get the food from donors such as farms, manufacturers, distributors, retail stores, consumers, and other sources, and make it available to those in need through a community agency network. Matching the supply of food that would otherwise be wasted to the demand of people that are in need requires internal integration, which precedes the integration activities that span the whole supply chain both upstream and downstream. Internal integration of processes provides the basis for enabling the requisite supply and demand integration. Moreover, the interview with the COO of a local food bank supports this theoretical argument. The following is an excerpt from the discussion about food bank operations:

"*Interviewer: We discussed internal integration as well as supplier and demand integration during our meeting before. Do you think one integration type precedes another? Does one lead into another one? As you may remember, internal integration is more about cross-functional information exchange within the food banks, and supplier and demand integration are coordination of activities of the food bank with external parties, involvement and synchronization of processes with those of suppliers and clients.*

COO: I think our internal integration precedes external. Message about our brand must be consistent and have internal buy in to be successful."

Accordingly, we hypothesize that:

H4: *Food banks that have a high level of internal integration will have high levels of supply integration.*

H5: *Food banks that have a high level of internal integration will have high levels of demand integration.*

Delivery is one operational dimension that is critical in the context of food banking, as the essence of work is all about delivery of the aid to communities in need. Delivery has been employed as the single performance outcome of supply chain integration efforts in previous studies (Ahmad and Schroeder, 2001; Da Silveira and Arkader, 2007), aside from the studies that examine all operational performance dimensions simultaneously (Flynn et al., 2010; Wong et al., 2011). Exchanging the information with the supply side to synchronize the activities with upstream partners, and being aware of the demand side of the supply chain to better address the client requirements, give food banks a competitive advantage in improving the delivery performance. Therefore,

H6: *The higher the supply integration in food banks, the better they will deliver service.*

H7: *The higher the demand integration in food banks, the better they will deliver service.*

The dominant forces for non-profit enterprises include mission, values, funders, government, political system, clients, social needs, stakeholders, advocacy groups, governance, and regulations (Akingbola, 2013). These collectively create a social complexity to be handled by the non-profit organizations. In this complex structure, environmental uncertainty, including the difficulty of predicting demand and supply, is an influential factor that determines the effectiveness of supply chain integration on delivery performance (Boon-itt and Wong, 2011). The interviews with the COO also indicated that one of the most prominent issues in a food bank is the sorting process. This is a bottleneck for the organization because of the uncertainty about incoming food, and the lack of standardization and accurate information regarding the support. Uncertainty distorts the accurate information that is achieved though the integration of the processes along with the supply chain and causes issues regarding matching of supply with demand by introducing variability to the system. Environmental uncertainty basically hinders the potential operational supply chain integration benefits that would be realized in case of its absence. Thus,

H8a: *The effectiveness of supply integration on delivery performance will be diminished by the extent of environmental uncertainty.*

H8b: *The effectiveness of demand integration on delivery performance will be diminished by the extent of environmental uncertainty.*

Putting all the hypotheses together, the conceptual framework is presented in Figure 4.1. In the next section, we describe the data and the methodology.

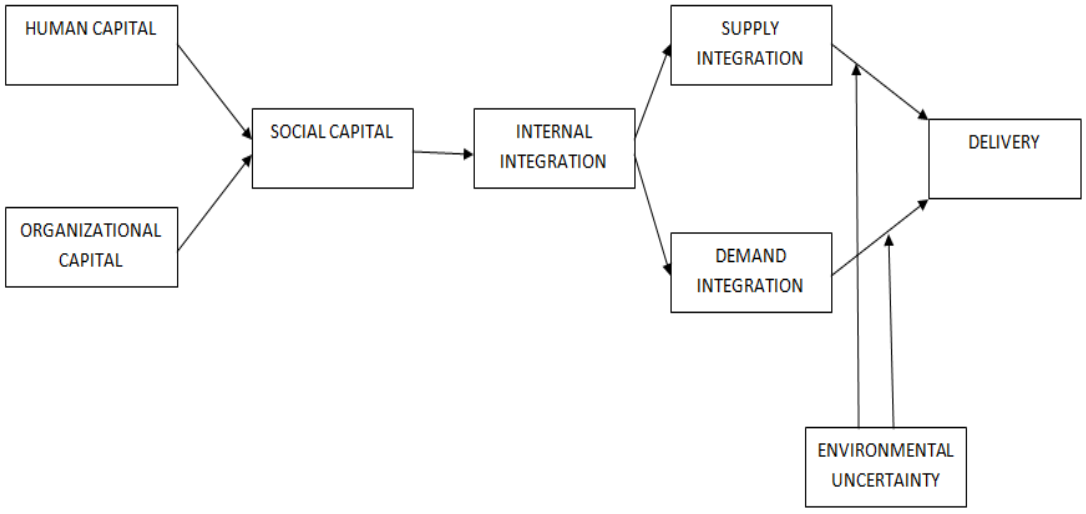

Figure 4.1 Conceptual Model

4. 3 DATA AND METHODOLOGY

Data Collection

In order to test the proposed model, we use an online survey instrument that was sent to US based food banks that are members of Feeding America network to collect information about the SCI practices and several key organizational variables of these organizations. There are 202 food banks that are connected to this network spanning the 50 states of the US as of the timeline of this study. First of all, we referred to the meta analysis study (Essay 1) to determine the important concepts in the supply chain integration literature. The scales for the supply chain integration constructs are adapted from the previous studies in supply chain management (Schoenherr and Swink , 2012; Koufteros et al., 2005; Swink et al., 2007), and intellectual capital scales are adapted

from the management literature (Subramaniam and Youndt, 2005). Environmental uncertainty contains items that relate to both supply and demand uncertainty (Paulraj and Chen, 2007). There is not a universally accepted organizational performance measure for non-profit sector in the literature (Akingbola, 2006). The performance measurement of non-profit organizations cannot be simply boiled down to profitability, since the aims of non-profit organizations vary. Their effectiveness can be gauged as the extent to which they achieve their mission (Akingbola, 2006). In this study, delivery performance (Schoenherr and Swink, 2012) is used as the social performance measure in the model, since the raison d'être of food banks is the delivery of food to the communities in need. The validity of this performance measure has been verified by the interviews with the COO of a local food bank. The measurement items for the survey can be found in Appendix B.

The survey was sent to the COO that was interviewed for face validity. He was asked to go through the survey, indicate if there was any ambiguity, and record the time it takes to estimate the time to complete the questionnaire. Some changes were made according to his inputs to ensure readability and clarity. Then, the first wave of the survey was distributed through Qualtrics - a web based survey application - in September 2012. The procedure carried out to communicate was an initial e-mail to the food bank executives to introduce the study, followed by the link to access the survey if the executive agreed to cooperate. If there was no response in about a week, several reminder e-mails were sent to improve the response rate. The cover letters that were sent to recruit respondents is presented in Appendix C.

Some food bank executives declined the invitation to participate in this study indicating reasons such as "Very busy", "Not interested" or "Length of the survey". The potential respondents were asked to complete the survey by October 31, 2012, to be eligible to enter a drawing to win a gift donation. Moreover, the food bank executives were also told that they would be provided with an executive report once the project was completed. These incentives were provided to increase the response rate, which is known to be problematic in organizational survey research (Baruch and Holtom, 2008). There were 36 food bank executives who completed the survey in the first wave. The Darla Moore School of Business research grant was used to make a donation of $180 to the Virginia Peninsula Foodbank as a result of the first wave. Since the sample size in the first phase was not as high as it was desired, a second wave of communication was held in December 2012. The researcher of the project travelled to the New York City area, using the support of Darla Moore School of Business research grant, to visit four food banks, and also to observe the environment and to increase the sample size by meeting the food bank executives in person. We should mention in passing that it has been observed that face-to-face interaction was useful, since the respondents could ask their questions and learn about the project instantly. Unfortunately, the visits do not guarantee a response, as the food banks are resource constrained organizations, and some of them turn down research requests such as this one. For the second wave, the data collection ended at the end of May, 2013, resulting in 74 responses collected. Both waves combined, the sample size became 110 with a response rate of 54.5%. This response rate is appropriate for survey research in operations management surpassing the 20% response

rate level recommended in the literature (Malhotra and Grover, 1998), and is also much higher than the average observed response rates in the field.

In order to check for non-response bias, we conducted several t-tests (Lambert and Harrington, 1990), assuming that the responses of the late respondents were representative of the non-respondents (Armstrong and Overton, 1977). The early wave and the late wave respondents were compared using "Age" and "Warehouse Size" as well as a randomly selected construct measurement item to test whether non-response bias was a problem in the sample (Chen et al., 2004). The t-test results indicated no statistically significant differences between the first wave and second wave responses at 0.05 level (Difference in "Age": 95% CI -- [-2.60, 2.47], difference in "Warehouse Size": 95% CI -- [-26,061.98, 22,154.95], and difference in measurement item for "Organizational Capital": 95% CI -- [-0.51, 0.67]). Thus, the results support that non-response bias is not present in the data.

Common method bias is tested using Harman's single factor test (Podsakoff et al., 2003). If there is a substantial common method variance caused by using a single method of data collection (survey), a single factor is expected to emerge when all the measurement items of variables are entered into an exploratory factor analysis (Podsakoff and Organ, 1986). All the items could not be included in the factor analysis because of the sample size and the number of variables in this study. Instead, two factor analyses were done to satisfy the subjects to variables ratio of 5 (Arrindell and van der Ende, 1985), one with intellectual capital items and the second one with supply chain integration items. The first factor analysis conducted on 14 items with no rotation resulted in two factors with eigenvalues greater than 1 and a third factor that has an

eigenvalue of 0.82. Scree plot indicated a three-factor solution to the analysis. The second factor analysis with 17 items and no rotation yielded three factors that have an eigenvalue that is greater than 1. This solution was supported by Scree plot as well. These results provide evidence that common method variance is not a problem in the dataset.

We conducted a missing value analysis to see if missing values follow a pattern. Missing values in a dataset can be MCAR (missing completely at random), MAR (missing at random, called ignorable nonresponse) and MNAR (missing not at random or nonignorable) (Tabachnick and Fidell, 2007; p.62). The missing values are desired not to follow a certain pattern. Therefore, we tested if the missing observations were predictable. Although this procedure is not required for the variables with less than 5% of data missing and none of the variables we used for this analysis has more than a 5% missing value percentage, the Little's MCAR test conducted on SPSS indicates a statistically non-significant result ($p = 0.463$), which lends support for MCAR.

Measurement, Validity and Reliability

As indicated before, the sample size was not large enough to estimate a factor analysis on the entire model all at once. Therefore, we ran two confirmatory factor analyses (CFA). The first one included the items representing intellectual capital, and the second one was done on supply chain integration variables. In the literature, an index of 0.90 is generally accepted as a good fit (Bollen, 1989). Also, RMSEA (root mean square of approximation) of 0.1 or less indicate an acceptable fit (Sharma et al., 2005). The CFA model for intellectual capital yielded fit indices of CFI = 0.91, TLI = 0.89. The χ^2/df ratio is 2.07 (153.062/74), and RMSEA = 0.096. Although TLI is slightly below the

recommended cutoff value, we move on with the structural analysis since the fit index issue may be due to the sample size (Sharma et al., 2005). The CFA for supply chain integration constructs yielded CFI = 0.89, TLI = 0.87, χ^2/df ratio of less than 2 (216.813/116), and RMSEA = 0.09. Some of the fit indices are slightly below the cutoff values for this model as well. In general, it is known that fit indices increase with sample size (Hu and Bentler, 1998). The standardized factor loadings are presented in Table 4.1 and Table 4.2.

Table 4.1 Standardized CFA path loadings for Intellectual Capital Constructs

Item	**Human Capital**	**Organizational Capital**	**Social Capital**
HUM1	0.777		
HUM2	0.678		
HUM3	0.868		
HUM4	0.665		
HUM5	0.818		
ORG1		0.794	
ORG2		0.646	
ORG3		0.831	
ORG4		0.841	
SOC1			0.880
SOC2			0.792
SOC3			0.768
SOC4			0.737
SOC5			0.760

Table 4.2 Standardized CFA path loadings for Supply Chain Integration Constructs

Item	Internal Integration	Demand Integration	Supply Integration
INT1	0.660		
INT2	0.714		
INT3	0.754		
INT4	0.772		
INT5	0.799		
INT6	0.651		
DEM1		0.662	
DEM2		0.723	
DEM3		0.810	
DEM4		0.792	
DEM5		0.701	
SUP1			0.577
SUP2			0.780
SUP3			0.796
SUP4			0.779
SUP5			0.545
SUP6			0.612

Construct validity is the assessment of the degree to which a particular measure actually measures the latent construct of interest. The most efficient measures are manifestations of constructs that take place in articulated theory and are supported by empirical data (Netemeyer et al., 2003; p.8). The measures used in this study resulted from an extensive literature search, and supply chain integration constructs are determined on the basis of the thorough meta-analysis conducted for this research. Moreover, since the measures were adopted from the previous studies, they have been

evaluated by academics over the years as the literature has developed and the scales have been refined (Netemeyer et al., 2003; p.8). As mentioned before, the particular measures in this study were assessed in by a practitioner terms of face validity in the context of foodbanking. We believe that all these steps collectively strengthen the validity of the scales used in this project.

We also assessed the discriminant validity of the constructs. Discriminant validity checks are done to evaluate the degree to which the constructs of interest are distinct from each other. In order to examine the discriminant validity, we compare the two CFA models, one of which the correlation between the latent variables are set equal to 1, and another where the correlations are free. When the two models are compared, a significantly lower χ^2 value for the unconstrained model with respect to the constrained model indicates discriminant validity (O'Leary-Kelly and Vokurka, 1998). For the intellectual capital block, the χ^2 value is 407.55 with 77 degrees of freedom for the constrained model. The χ^2 difference test indicated that the unconstrained model explains the data better, thus, we established discriminant validity for intellectual capital. Likewise, for the integration block, the χ^2 value is 460.23 with 119 degrees of freedom for the constrained model. The χ^2 difference is significant indicating better fit for the unconstrained model. Therefore, we establish discriminant validity for both sets of latent constructs.

Convergent validity is assessed by examining the factor loadings on the latent constructs (Hair et al., 1998). All of the item loadings on their respective latent constructs that are in excess of 0.5 indicate that convergent validity is achieved. Moreover, each

indicator's estimated path coefficient on the respective underlying factor is greater than twice its standard error, indicating significance (Anderson and Gerbing, 1988).

Reliability has also been assessed to establish construct validity. This measure of validity is concerned with the consistency of a scale in measuring a given construct, and the degree to which the items hold together (Netemeyer et al., 2003; p.10). There are various measures to gauge reliability. We use Cronbach's coefficient alpha in this research. Cronbach's alpha is a coefficient of internal consistency and is a function of inter-item correlations of the items that measure a construct. The cutoff value for Cronbach's alpha is reported to be 0.70 (Nunnally, 1978). Some researchers accept 0.60 and greater values as satisfactory levels of alpha reliability (Hair et al., 1998; p. 118). The reliabilities of the scales used in this study are presented in Table 4.3. The scale reliabilities of all constructs except the environmental uncertainty scale are above the cutoff value.

Table 4.3 Reliability results for the constructs

Construct	**Number of Measurement Items**	**Cronbach's alpha**	**Average Variance Extracted**
Human Capital	5	0.870	0.586
Organizational Capital	4	0.852	0.611
Social Capital	5	0.890	0.622
Internal Integration	6	0.860	0.529
Demand Integration	5	0.847	0.547
Supply Integration	6	0.838	0.476
Delivery	3	0.801	0.561
Environmental Uncertainty	4	0.375	0.333

Since the sample size is not sufficient to run the whole structural model, the data is analyzed using SUR. In general, SUR technique enables the simultaneous analysis of the complete model including the moderating relationships. We present the results in the next section.

4.4 RESULTS AND IMPLICATIONS

As explained in the previous essay, SUR allows for simultaneously running a system of regression equations and accounts for correlated error terms across the variables (Autry and Golicic, 2010). Also, a dependent variable in one equation can be an independent variable in another equation, and the relationships between the equations stemming from the use of same variables in different parts of the system are controlled for. We have averaged the scale items and treated the constructs as observed variables to run the model as a SUR. The results are presented in Figure 4.2. Also, the detailed results can be found in Table 4.4.

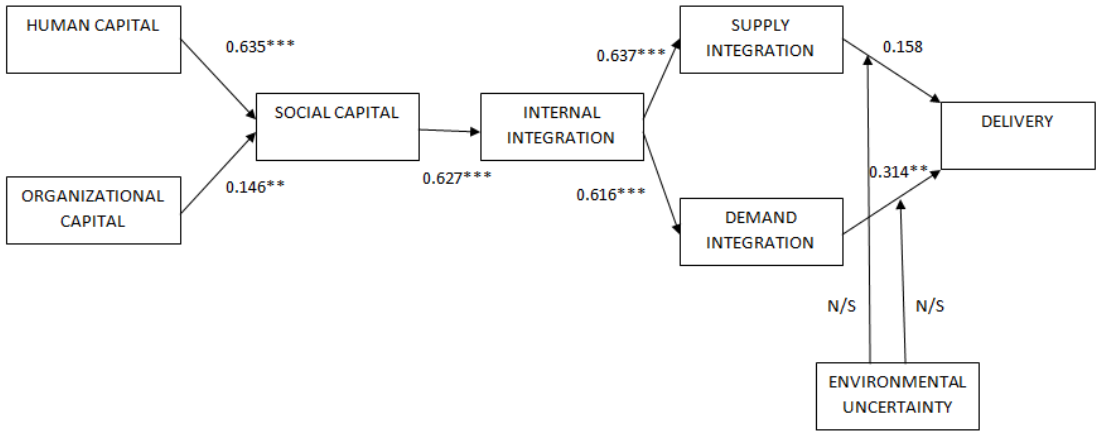

Figure 4.2 Seemingly Unrelated Regression Model - Results

Table 4.4 Seemingly Unrelated Regression Results

	Observed Coefficient	Bootstrap Std. Err.	z	P>|z|	[95% Conf. Interval]	
Dependent Variable: Social Capital						
Human Capital	0.635	0.097	6.530	0.000	0.445	0.826
Organizational Cap.	0.146	0.074	1.960	0.050	0.000	0.292
intercept	1.237	0.520	2.380	0.017	0.218	2.256
Dependent Variable: Internal Integration						
Social Capital	0.627	0.113	5.560	0.000	0.406	0.848
intercept	2.078	0.642	3.240	0.001	0.820	3.337
Dependent Variable: Demand Integration						
Internal Integration	0.616	0.132	4.670	0.000	0.357	0.874
intercept	2.282	0.760	3.000	0.003	0.791	3.772
Dependent Variable: Supply Integration						
Internal Integration	0.637	0.099	6.420	0.000	0.443	0.832
intercept	1.789	0.572	3.130	0.002	0.669	2.909
Dependent Variable: Delivery						
Supply Integration	0.158	0.100	1.590	0.112	-0.037	0.354
Demand Integration	0.314	0.131	2.400	0.016	0.058	0.570
Environmental Uncert.	-0.003	0.110	-0.030	0.980	-0.219	0.213
Sup. Int. X Env. Uncer.	0.058	0.105	0.560	0.579	-0.147	0.264
Dem. Int. X Env. Uncer.	-0.115	0.116	-0.980	0.325	-0.343	0.114
intercept	3.235	0.897	3.610	0.000	1.478	4.993

Based on the results of SUR, *Human Capital* turns out to be a significant predictor of *Social Capital* in food banks, lending support for H1. Also, when we examine the *Organizational Capital* - *Social Capital* link, we find support for H2 (at $p<0.05$). Nonetheless, it is obvious that *Human Capital* is more crucial in building *Social Capital* than *Organizational Capital* is in the food banking environment.

Social Capital is a significant precedent of *Internal Integration* as hypothesized. The results support H3, emphasizing the importance of having the social interactions and the network between the employees of the organization to build the teamwork, functional team decision consensus and common understanding of the processes and performance outcomes. Also, external integration (both *Demand Integration* and *Supply Integration*) is influenced by internal integration as evidenced by the data as well as the literature. Therefore, we find support for H4 and H5.

Finally, *Delivery* performance is significantly influenced by *Demand Integration* compared to *Supply Integration*. *Supply Integration* is not a significant predictor, while *Demand Integration* has a significant impact at 0.05 (not supporting H6 and supporting H7). The moderation effect of *Environmental Uncertainty* is not supported by the data on food banks in this study (lack of support for H8a and H8b). It is an interesting result given the amount of uncertainty the food banks have to deal with. However, the adaptation of the organizations to the high levels of demand and supply uncertainty may be explanatory for this result. Since these organizations emerge, develop and mature over time in highly uncertain environments, their operating mechanisms could be at a stage that has already adapted to the uncertainty inherent in the system. In this respect, perhaps,

we might consider food banks as complex adaptive systems, where the entities and the environments co-evolve in the philanthropy scene (Choi et al., 2001).

Overall, the results of this essay provide support for the interplay between the *Intellectual Capital* aspects we hypothesized in a non-profit environment. Moreover, we have found support for the antecedent role of *Intellectual Capital* to *Supply Chain Integration* in this study. Also, the precedence of *Internal Integration* to *External Integration*, which take places in the supply chain integration literature that mainly examines for-profit organizations, is supported for non-profits as well. Interestingly, *Delivery* performance of the food banks is not influenced by *Supply Integration*, which emphasizes strong relationships and information exchange with the suppliers. On the other hand, *Demand Integration* is significantly influential on *Delivery* performance. This finding indicates that client relationships and inputs in the food distribution process are important for increasing the amount of food distributed in the service area.

This study presents valuable insights for the management of food banks. First of all, knowing that *Intellectual Capital* precedes and determines the level of *Supply Chain Integration*, foodbanking organizations should be proactive in how to manage the *Human, Organizational and Social Capital*. *Internal Integration* is positively and significantly associated with *Social Capital*, which should be enhanced by the food banks to have a high level of *Supply Chain Integration* as the structure of the organization. The results indicate that what is invested in *Demand Integration* should be higher than the investments for *Supply Integration* in order to improve *Delivery* performance. The lack of the significant relationship between *Supply Integration* and *Delivery* is worth investigating as a future research opportunity. Also, within the *Intellectual Capital*

dynamics in this non-profit environment, the lower degree of *Organizational Capital*'s influence on *Social Capital* with respect to *Human Capital* could be examined further.

4.5 DISCUSSION AND LIMITATIONS

In this study, we have examined how supply chain integration develops and affects delivery performance. Building upon the first two essays in the dissertation, intellectual capital has been conceptualized as the antecedent of integration in food banks. We have shown the interplay between the intellectual capital aspects, along with the sequence of internal and external integration that take place in food banks, with the help of survey responses collected from food bank executives. The results of the study lend support for most of the hypothesized relationships.

This study sheds light on the mechanism through which the social capital is built in a non-profit setting. Human capital and organizational capital precede the social capital, which in turn helps in building internal integration in food banks. Supply chain integration literature, along with the interviews with the COO of a local food bank, has been used to conceptualize the internal and external integration relationships. As expected, internal integration is found to be the precursor of demand integration and supply integration.

Since the reason of existence of food banking organizations is the delivery of food to the communities in need, we have looked at the impact of supply chain integration on delivery as the social performance measure of food banks. We have found support for the significant impact of demand integration on delivery, whereas the findings indicate that there is lack of support for the supply integration and delivery relationship. This is

quite an interesting result and requires further investigation as a future research opportunity. The unique nature of food banks as opposed to for-profit enterprises sets out a context that is worthwhile to investigate, and the idiosyncrasies that come with this setting may be altering some of the expectations regarding how the mechanisms generally work in for-profit enterprises.

There are some implications of the current study for food bank management. First of all, the value of intellectual capital has been verified in food banking as a result of this study. Moreover, the interplay between the intellectual capital dimensions has been investigated in a non-profit environment. The findings have indicated the importance of skilled, bright and creative individuals as well as the systems, structures and institutional knowledge in building the emergent social structure that consists of the interactions of the food bank employees who are committed to the achievement of the social goal that is delivery. Attracting and retaining the skilled workforce, and creating a robust structure that facilitates knowledge sharing, are pivotal in establishing collaboration and teamwork in food banks. Secondly, the results also indicate that internal integration precedes the external integration, which is in line with the expectations depending on the literature and the interviews with the COO. We have found evidence supporting the precedence of the message as to the consistency of the food bank's brand and reputation with respect to the functional integration and collaborative operations, before establishing supply and demand integration to be successful.

This study is, unfortunately, not free from limitations. First of all, like any other survey study, we rely on perceptual measures to gauge the constructs of interest to answer our research questions. We have tried to overcome this limitation by combining

perceptual measures with objective measures in the previous essay to see the impact of supply chain integration on delivery performance. Also, given the total number of food banks under Feeding America umbrella is already limited (202), even though the response rate is successful (~55%), we use a sample size of 110 to conduct the statistical analysis in this study. This constrained us from running a full-fledged structural equation model for the entire conceptual framework. However, SUR enabled us to run the entire model including the moderating relationships, by treating the constructs as observed variables via averaging the scales for each construct. Nonetheless, we have incorporated the CFA in order to see the structure of the data, and have an item-level analysis in the study.

In general, this study sheds light on an important topic, yet in a relatively new context for business research. Non-profit organizations have been using some of the tools developed in for-profit contexts, however, they also present to be the incubators for new ideas and approaches to process management and improvement, as non-profits are in a place to be agile and efficient in their operations due to lack of abundant resources. We have found evidence to the use of supply chain management tools as we know them in non-profit settings. Moreover, we also could not observe some of the expected relationships such as the supply integration - delivery link, or the moderation effect of environmental uncertainty, in this study. We have presented some possible explanations for these findings. However, further investigation of the same issues from different angles (e.g. case studies, modeling approaches) would give a better understanding of the mechanics of the operations in food banks.

CHAPTER 5

CONTRIBUTIONS, CONCLUSIONS AND LIMITATIONS

In this dissertation, we have investigated the supply chain integration concept and its antecedents in food bank organizations. We have studied the main dimensions of supply chain through an in-depth literature review and systematic examination of the articles published in this area in the first essay. The meta-analytic investigation has provided the background to identify the concepts and main constructs that take place in this major subject area in operations management. Moreover, some potential moderators of supply chain integration and performance relationships were determined using meta-analysis.

In the second essay, we have looked at the basic operations of a food bank with the help of data from secondary and primary sources to understand how fundraising, basic programs and supply chain integration play various roles to deliver food to the communities in need. The findings of the second essay indicated the key role played by supply chain integration (especially internal integration and demand integration) on the delivery performance measured as the amount of food distributed per food insecure individual in the service area of the food bank.

Building upon the first and second essays, we have examined the antecedents of supply chain integration in food banks in the third essay. We have used survey responses

collected from the US food banks with a good coverage and response rate (~55%) to conduct the analysis for this study. Also, the interviews done with the COO of a local food bank were helpful in conceptualizing the precedent role of intellectual capital for building supply chain integration in this non-profit setting. The general framework of "Intellectual Capital" - "Supply Chain Integration" - "Performance" relationships were tested using the appropriate statistical techniques. The natural performance measure for a food bank organization has been determined to be the delivery of food throughout the dissertation. The second essay includes an objective performance measure, while the third essay uses a perceptual measure of delivery performance. The use of multiple techniques to collect and analyze data adds to the robustness of this dissertation.

Theoretical Contributions

This dissertation presents empirical evidence of supply chain integration practices and their impact on delivery performance in a non-profit environment. Although supply chain integration has been studied extensively in for-profit enterprises, there has been lack of empirical studies conducted regarding non-profit operations, especially concerning the supply chain management of these organizations. As previously mentioned, the use of multiple methodologies in order to examine various operations management related questions on this topic was a deliberate effort to strengthen the contribution of this work as a whole.

The meta-analysis study is a response to the call regarding the importance of bringing the supply chain integration literature together, and this study has been conducted to arrive at a collective understanding of supply chain integration -

performance relationships to help in theory building and consensus in supply chain management literature. The operations management literature is rich in supply chain integration studies that examine this concept from various angles. The meta-analysis of the articles in this area enables us to systematically collect the findings of studies that take place in the literature, weigh them based on the reliabilities of constructs and sample sizes, and eventually reach certain generalizations. In particular, the meta-analytic methodology in this dissertation has examined the overall association of supply chain integration practices and performance, as well as identified the significance between sub-dimensions of supply chain integration practices and various performance measures. Furthermore, the existence of moderating factors on the supply chain integration practices and performance, on both aggregate and individual level associations, have been tested using this methodology in this subject. Specifically, the importance of internal integration has been emphasized in the meta-analysis and helped in understanding the dynamics between internal and external integration. Environmental uncertainty has also emerged to be an important moderator, which was used in the third essay particularly in this dissertation.

The second essay was useful in investigating the basic flow of operations in food banks. We have found empirical evidence for the use and benefit of a supply chain management concept that originated in for-profit enterprises. Supply chain integration and the precedence of relationships between internal and external integration in relation to how basic programs are conceived in a non-profit setting have been tested. As a result, the general framework has been supported, and set the stage for the third essay that examined the antecedents of supply chain integration and the moderation effect of

environmental uncertainty, which has been found to be an important moderator in the first essay.

Finally, to our knowledge, the antecedent role of intellectual capital has not been studied in literature before. Triangulating between the comments and highlights by the operations executive of a local food bank and the literature, we have conceptualized the framework in the third essay. The model has been tested using survey data, and the findings indicate that the interplay between the dimensions of intellectual capital as well as the precursor role of it for supply chain integration has been supported. The lack of support for the moderation effect of environmental uncertainty raises other research opportunities such as the impact of this construct in an inherently uncertain context, which is the foodbanking environment.

Contributions to Practice

In this dissertation, we have shown that supply chain integration practices have been known and used in food banks. Supply chain management tools that originate in other industries apparently take place in non-profit sector as well. Especially, internal integration has been an essential part of the operations in food banks in the sense that it drives the external integration and ultimately performance. This finding is helpful for food banking practice, since strategy setting, planning and formalization of operations should take this effect into account and emphasize the importance of this dimension of supply chain integration. As entities that are resource constrained, food bank organizations should allocate their resources toward building internal integration before external integration.

Second, demand integration should be the priority while making decisions about external integration, since empirical evidence supports the positive and significant impact of client side integration on performance. There is lack of support for the influence of supply integration on delivery performance, both for objective and perceptual measures. Perhaps, supply integration is not where it needs to be yet in non-profits, or the suppliers do not have enough incentives to share operational information and for further involvement with the organizations that they work with, compared to the agencies and clients that are in the downstream of the supply chain. This result creates some awareness about the potential benefits and the current situation.

Moreover, human capital (i.e. skilled, educated, creative and bright workforce) relative to organizational capital (i.e. manuals, databases, structures, systems and processes) has been found to be essential in forming the social capital (i.e. networks and interactions), which is the backbone of internal integration in the organization. Social capital is the driving force for inter-functional teamwork, and common understanding of goals and metrics. Therefore, food bank managers should be cognizant of this dynamic happening throughout the organization, and value the intellectual capital properly. The findings show that the leverage of organizational capital is not very strong in this setting. However, this may be due to the lack of resources to invest in formalized structures compared to skilled workforce, but it could be strengthened considering the potential it may bring into the intellectual structure of the food bank.

Limitations and Future Research

This dissertation provides empirical evidence for the supply chain integration - performance relationships in food banks. Moreover, the driving forces of integration have also been examined and their existence has been empirically supported. We have made every effort to get data from as many food banks as possible by using incentives and multiple follow-ups with the respondents. While the response rate was quite successful for a survey study, the sample size turned out to be 110. This sample allowed us to make certain statistical analysis to answer the research questions we had, however, a structural equation model to test the entire model required a much larger sample size. Therefore, another non-profit setting that has a larger population of organizations that could yield a higher sample size can be investigated as a future research opportunity to test a similar model, this time as an SEM.

Moreover, the findings we presented show that there is much more to investigate in food bank organizations, since we could not find support for some of the expected relationships in the overall framework. For instance, the lack of significant impact of supplier integration on delivery performance leads to new questions as to why this is the case, or how supply side integration could be achieved given that there may be several efficiencies gained through information exchange, streamlining of operations with those of the suppliers, and new forms of involvement that go beyond daily transactions. Finally, environmental uncertainty did not turn out to be a significant moderator for supply chain integration - performance relationship in this study. Further research could look into the alternative role that uncertainty may be playing, or the contextual idiosyncrasies due to

the non-profit setting studied here, which cancels out the significance of environmental uncertainty more in depth.

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APPENDIX A

Table A.1 Summary of the articles used for meta-analysis

Paper	Sample	Method	Operationalization SCI practices	Operationalization of performance	Key Findings
Wong et al. (2011)	151 plants from Thailand automotive industry	Structural Equation Modeling	1. Internal Integration 2. Supplier Integration 3. Customer Integration	1. Delivery 2. Production Cost 3. Product Quality 4. Production Flexibility	Environmental uncertainty has significant moderation effect on the relationships between various integration-performance pairs.
Schoenherr and Swink (2012)	403 supply chain professionals	1. Discriminant Analysis 2. ANCOVA	1. Internal Integration 2. Supplier Integration 3. Customer Integration	1. Quality 2. Delivery 3. Flexibility 4. Cost	Frohlich and Westbrook's framework is revisited. The moderating role of internal integration on the relationship between arcs of integration and performance is investigated. Results indicate that internal integration strengthens some of the relationships between external integration measures and performance.

Vereecke and Muylle (2006)	374 firms from European countries	1. Factor Analysis 2. ANOVA 3. Correlations	1. Collaboration with Supplier 2. Collaboration with Customer	1. Cost 2. Flexibility 3. Quality 4. Delivery 5. Procurement 6. Time to Market	Empirical support was found for the hypothesized higher levels of collaboration among companies showing higher performance improvement. There was partial support for the hypothesized relationships.
Swink et al. (2005)	57 North American manufacturing plants	Structural Equation Modeling	Strategic Integration	1. Process Flexibility 2. New Product Flexibility 3. Cost Efficiency 4. Market-based Performance	Strategy integration impacts manufacturing cost efficiency and new product flexibility capabilities. Strategy integration moderates the relationship between product-process development, supplier relationship management, workforce development, JIT flow, and process quality management practices and certain manufacturing capabilities. Manufacturing capabilities mediate strategy integration and market based performance relationship.
Swink et al. (2007)	224 responses from manufacturing plant managers	Path Analysis	1. Corporate Strategy Integration 2. Product-process Integration 3. Strategic Customer Integration 4. Strategic Supplier Integration	1. Cost 2. Quality 3. Delivery 4. Process Flexibility 5. New Product Flexibility 6. Market Performance 7. Customer Satisfaction	Each type of integration has varying levels of impact on manufacturing competitive capabilities.

Jayaram et al. (2011)	197 responses from Chinese manufacturing firms	Regression	1. Supplier Coordination 2. Customer Coordination	1. Quality Performance 2. Flexibility Performance	Results support four direct and positive relationships. Some of the interaction effects were significant.
Dröge et al. (2004)	57 US automotive manufacturers	1. Canonical Correlation 2. Regression	1. Supplier Integration 2. Customer Integration	1. Delivery Performance 2. Support Performance	Product/process strategy (product modularity and process modularity) precede external integration (supplier and customer), which ultimately impacts service performance (support and delivery). Customer integration mediates the linkages from modularity variables to delivery, and process modularity to support performance. Supplier integration only mediates process modularity and delivery performance.
Danese and Filippini (2010)	186 manufacturing firms from multiple countries	Regression	Inter-functional Integration	NPD Time Performance	Supplier involvement and inter-functional integration are moderators of the relationship between product modularity and NPD time performance. Modularity has a direct impact on NPD time perf. Inter-functional integration moderates the relationship whereas modularity moderation hypothesis is not supported.

Stank et al. (2001)	306 firms from US	Structural Equation Modeling	1. Internal Integration 2. External Integration	Logistical Service Performance	Internal collaboration positively impacts firm performance but external collaboration doesn't have a direct effect. Internal and external collaboration are significantly correlated.
Tracey (2004)	180 manufacturing firms	Path Analysis	1. Integrated Product Development – Internal 2. Integrated Product Development – Supplier Involvement 3. Integrated Product Development - Customer Involvement	1. Manufacturing Efficiency 2. Manufacturing Agility 3. Delivery Service 4. Organizational Performance	Integration on each aspect leads to higher manufacturing efficiency and manufacturing agility, hence, delivery service and ultimately organizational performance.
Devaraj et al. (2007)	120 responses	Structural Equation Modeling	Production Information Integration 1. Supplier Integration 2. Customer Integration	1. Cost 2. Quality 3. Flexibility 4. Delivery	Supplier integration impacts performance. Customer integration effect is non-significant.
Flynn et al. (2010)	617 responses from Chinese firms	1. Regression 2. Cluster Analysis	1. Supplier Integration 2. Customer Integration 3. Internal Integration	1. Operational Performance 2. Business Performance	Supply chain integration influences both operational and business performance.
Frohlich and Westbrook (2002)	485 responses from UK based firms	1. Discriminant Analysis 2. ANOVA	1. Demand Integration 2. Supply Integration	Performance 1. Faster Delivery Time 2. Reduced Transaction Costs 3. Greater Profitability 4. Enhanced Inventory Turnover	Demand chain management impacts performance in manufacturing environment compared to in service environment.
Cousins and Menguc (2006)	142 responses from UK based firms	Regression	Supply Chain Integration	1. Supplier's Operational Performance 2. Supplier's Communication Performance	Supply chain integration impacts supplier's communication performance but not its operational performance.

Lawson et al. (2009)	111 purchasing executives of UK based firms.	Structural Equation Modeling	Supplier Integration	Buyer Performance Improvement	Strategic purchasing leads into socialization mechanisms, supplier integration and supplier responsiveness, which ultimately leads to buyer performance improvement. All hypotheses except strategic planning to supplier responsiveness and socialization mechanisms to buyer performance improvement relationships hold for the data.
Lee et al. (2010)	271 manufacturing firms from South Korea	Structural Equation Modeling	Collaboration	Performance 1. Efficiency 2. Effectiveness	Antecedents – Relationship characteristics (trust, commitment, interdependency, length of relationship), Organizational characteristics (top management support, cultural similarity, goal compatibility) and Info/Tech characteristics (information quality, rate of technological change). These lead into information sharing, which leads to collaboration and ultimately performance. Most of the hypothesized relationships hold. However, there's no significant relationship between length of relationship and information sharing & collaboration.

Handfield et al. (2009)	151 UK based firms	Structural Equation Modeling	1. Cross-enterprise Integration 2. Supplier Integration	1. Sourcing Enterprise Performance 2. Buyer Financial Performance	Supply market intelligence and supply management influence are antecedents of the integration types. The theoretical model is supported. SM Intel. and SM Influ. impact cross-enterprise integration and supplier integration, which in turn impact sourcing enterprise performance, which ultimately impacts buyer financial performance.
Sanders and Premus (2005)	245 US manufacturing firms	Structural Equation Modeling	1. Internal Collaboration 2. External Collaboration	1. Cost 2. Quality 3. New Product Introduction Time 4. Delivery Speed	Firm IT capability impacts internal collaboration, and external collaboration. It also has a direct effect on firm performance. External collaboration impacts internal collaboration and internal collaboration impacts firm performance.
Saeed et al. (2005)	38 responses	1. Cluster Analysis 2. Regression	1. External Integration 2. Internal Integration	1. Process Efficiency 2. Sourcing Leverage	External integration, along with inter-organizational systems breadth and inter-organizational systems initiation, impacts the performance variables.

Saraf et al. (2007)	63 responses	Partial Least Squares	1. IS integration with customers 2. IS integration with channel partners	Business Unit Performance	Knowledge sharing with customers, knowledge sharing with partners, process coupling with customers, process coupling with channel partners mediate the relationships between IS integration and performance. IS integration with channel partners and customers contributes to both knowledge sharing and process coupling with both types of enterprise partners. Process coupling with customers and knowledge sharing with channel partners have sig relationship with performance.
Villena et al. (2009)	133 Spanish firms	Regression	Supply Chain Integration	Operational Performance 1. Productivity 2. Quality 3. Leadtime 4. Service Levels	Compensation risk and employment risk precede supply chain integration – this relationship is moderated by environmental risk. Supply chain integration impacts operational performance.
Gimenez and Ventura (2005)	64 Spanish FMCG firms	Structural Equation Modeling	1. Internal Integration - Logistics / Production 2. Internal Integration - Logistics / Marketing 3. External Integration	Logistics Performance	Integration types influence each other. Structural model includes direct links to performance and correlations between the integration types.

Chiang et al. (2012)	144 manufacturing firms	Structural Equation Modeling	Internal Integration	Firm's supply chain agility 1. Customer responsiveness 2. Demand response 3. Joint planning	Internal integration takes place in strategic sourcing construct along with strategic purchasing, information sharing and supplier development. Both strategic sourcing and strategic flexibility are related to the firm's supply chain agility.
Cao and Zhang (2011)	211 responses	Structural Equation Modeling	Supply Chain Collaboration 1. Information Sharing 2. Goal Congruence 3. Decision Synchronization 4. Incentive Alignment 5. Resource Sharing 6. Collaborative Communication 7. Joint Knowledge Creation	Firm Performance 1. Growth of Sales 2. Return on Investment 3. Growth in ROI 4. Profit Margin on Sales	Collaborative advantage is a mediator. Firm size is a moderator. Hypothesized relationships hold at varying levels in different sized companies.

APPENDIX B

Table B.1 Measurement Items

Construct	Measurement Items	Reference
Internal Integration	1. Functional teams are aware of each other's responsibilities. 2. Functional teams have a common prioritization of clients in case of supply shortages and how allocations will be made. 3. Supply decisions are based on plans agreed upon by all functional teams. 4. All functional teams use common metrics of performance while coming up with supply chain operations plans. 5. Operational and tactical information is regularly exchanged between functional teams. 6. Performance metrics promote rational trade-offs among customer service and operational costs.	Schoenherr and Swink (2012), Koufteros et al. (2005), Swink et al. (2007)
Demand Integration	1. We pursue client relationships and involvement that go beyond service transactions. 2. Our plans address individual client requirements. 3. We have clearly defined roles and responsibilities for managing client relationships. 4. We are constantly exploring new ways of utilizing client input in our operations. 5. We synchronize our internal activities so that we can serve to clients in need in a timely fashion.	Schoenherr and Swink (2012), Koufteros et al. (2005), Swink et al. (2007)

Supplier Integration	1. We pursue supplier relationships and involvement that go beyond daily operational transactions. 2. Our plans address individual suppliers' capabilities. 3. We synchronize our activities with those of key suppliers. 4. We exchange operational information with suppliers on a regular basis. 5. We occasionally exchange operational information with suppliers. 6. We are constantly exploring new working relationships with suppliers.	Schoenherr and Swink (2012), Koufteros et al. (2005), Swink et al. (2007)
Human Capital	1. Our employees are highly skilled. 2. Our employees are widely considered among the best trained and educated in their particular fields. 3. Our employees are creative and bright. 4. Our employees are experts in their particular jobs and functions. 5. Our employees develop new ideas and knowledge.	(Subramaniam and Youndt, 2005)
Social Capital	1. Our employees are skilled at collaborating with each other to diagnose and solve problems. 2. Our employees share information and learn from one another. 3. Our employees interact and exchange ideas with people from different areas of the food bank. 4. Our employees partner with clients, suppliers, agencies etc., to develop solutions. 5. Our employees apply knowledge from one area of the food bank to problems and opportunities that arise in another.	(Subramaniam and Youndt, 2005)

Organizational Capital	1. Much of our food bank's knowledge is contained in manuals, databases, etc. 2. Our food bank's culture (stories, rituals) contains valuable ideas, ways of doing business, etc. 3. Our food bank embeds much of its knowledge and information in structures, systems, and processes. 4. Our food bank strictly keeps detailed documentation of the operations to preserve the knowledge.	(Subramaniam and Youndt, 2005)
Environmental Uncertainty	1. The suppliers consistently meet our requirements. 2. We have a high disposal rate of products that we receive from our suppliers. 3. The volume and/or composition of demand is difficult to predict. 4. We keep weeks of inventory of the critical/basic products to meet the changing demand.	(Paulraj and Chen, 2007)
Delivery	1. Our food bank is successful at achieving a high fill rate for the communities in need. (Fill rate is the proportion of orders immediately met by available inventory) 2. Our food bank is successful at achieving timely delivery of aid for the communities in need. 3. Our food bank is successful at reducing the lead time of delivery of aid for the communities in need.	(Schoenherr and Swink, 2012)

APPENDIX C

Survey Cover Letter

WAVE 1

You are invited to participate in a research study concerning supply chain practices in food banks. The relationships of intellectual resources with supply chain operations in non-profit organizations, and their resulting impact on performance are investigated in this project.

This survey, which contains questions on your perceptions and experiences regarding your organization's operational practices, should take about 20 minutes to complete. By receiving this email, you are eligible to enter your email address into a drawing for a chance to receive a donation for your food bank. The amount to be donated will be dependent on the total number of participating food banks. For each response, $5 will be added to the donation pool. If all of the US based food banks currently listed in Feeding America's website participate in the survey, the total maximum amount will be $1,010. If the number of participating food banks is less than 202, the donation amount will be determined by multiplying the number of participants by $5. The greater the number of the participating food banks, the bigger the donation will be.

Below, you will be asked to enter your email address so that I may enter your food bank into the drawing for the donation. One email address, which is affiliated with one food bank will be drawn, receiving the food bank donation that may be up to $1,010. Only one food bank will receive the donation. The result of this drawing will be announced to all the participants who include an email address. Email addresses will be destroyed once the drawing is complete. No identifying information will be stored with your survey responses. You should also indicate if you would like to receive an executive summary of the results after the study is completed.

To be eligible for the drawing, you must access the survey by 10/31/2012.

*No individual participants will be identified in the results of this study; only group statistics will be published.
*Participation presents no risk to you whatsoever.
*Your personal scores will not be published separately.
*The author will never disclose any personal information regarding you or any other participants.

Your participation is completely voluntary, and only I will have access to your responses. For more information concerning this research, you can contact me:

Cigdem Ataseven

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Thank you for your interest in this research study!

WAVE 2

You are invited to participate in a research study concerning supply chain practices in food banks. The relationships of intellectual resources with supply chain operations in non-profit organizations, and their resulting impact on performance are investigated in the project.

This survey, which contains questions on your perceptions and experiences regarding your organization's operational practices, should take about 20 minutes to complete.

You should indicate if you would like to receive an executive summary of the results after the study is completed.

*No individual participants will be identified in the results of this study; only group statistics will be published.
*Participation presents no risk to you whatsoever.
*Your personal scores will not be published separately.
*The author will never disclose any personal information regarding you or any other participants.

Your participation is completely voluntary, and only I will have access to your responses. For more information concerning this research, you can contact me:

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Thank you for your interest in this research study!