

A REVIEW OF COLLABORATIVE PERFORMANCE SYSTEM IMPLEMENTATION IN THE FRESH PRODUCE SUPPLY CHAIN TO IMPROVE PERFORMANCE

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Abstract

Purpose of the study: The purpose of this research is to extend the review to which CPS implementation as part of the performance management system (PMS) in the fresh produce supply chain (FPSC), can improve performance, especially to reduce inefficiencies, improve services, and provide joint results for all partners. This paper focuses on the possibility of CPS implementation in FPSC, as well as reviewing a holistic understanding of CPS in the FPSC.

Methodology: This systematic review was conducted by analyzing selected articles and categorization to identify potentially relevant articles referring to peer-reviewed journals, thesis Ph.D., and proceedings. Using four steps, the first step found 161 articles. The second step obtained 56 articles. The third step, 17 articles were selected as topics of importance. The fourth step was designated to categorize and analyze the 17 articles.

Main Findings: Research results show a comprehensive review of the description of the CPS classification model in FPSC by categorizing previous literatures on different collaborative structures and different levels of planning. This paper also shows the relevant solution methods used in each level of planning. A review of the current state of CPS in the FPSC model is conducted by highlighting areas that have not been addressed or gaps in the literature and by suggesting directions for further study.

The implication of this study: Intended for CPS in FPSC, by reviewing CPS implementation in FPSC, it can develop and become the basis for seeing the benefits of a collaborative performance system in the field of fresh produce, this field still rarely applied, and it could be further identified what kind of collaboration should be carried out from the existing collaboration structure.

Novelty/Originality of this study: This study is considered as our best knowledge to observe the CPS system in the FPSC, which is an attempt to introduce it by exploring and evaluating the values that could be shared among collaborative partners under classification model of a collaborative structure, general characteristic, level collaboration and solution of the method. It also provides information for interested parties in the collaboration of supply chain to improve the performance based on CPS.

Keywords: Collaborative Performance System, Supply Chain, Collaborative Structure, Scope Planning, Solution Technique, Fresh Produce.

INTRODUCTION

Supply chain organizations in business competition require a performance system that can perceive all performances simultaneously in a single collaborative performance with all partners. Performance systems with CPS in the supply chain are needed to answer problems in describing the involvement of supply chain partners, and their role in mapping evidence and identifying CPS development in the supply chain in their environment. The supply chain environment requires collaboration among supply chain partners to build strong relationships with each other. In complex situations, the search for performance is still an open issue (Fawcett et al., 2008). Performance measurement focuses on a single business process, such as statistical process control, workflow-based monitoring, or process performance measurement systems (Neely et al., 2000). Collaboration is the driving force behind effective supply chain management and as a core capability (Gichuru, et al., 2015). Collaborative performance measurement eliminates single corporate boundaries and emphasizes the effectiveness of the overall supply chain (Chan and Qi, 2003). Relevant research attempts in measuring supply chain performance focus both on identifying significant performance metrics for specific challenges (Papakiriakopoulos and Pramatar, 2010) and on examining the success of supply chain collaboration (Fawcett et al., 2008). Companies in the supply chain will achieve success if they start implementing CPS. The relationship will be close between them than before which their performance will interrelated and link their performance management with CPS (Lee, et al., 2003). It means that the chain partners will be able to access performance information as a part of the CPS (Holmberg, 2000). By allowing chain partners to access the performance data, it will be easier for companies to identify the weaknesses and bottlenecks in their business processes, and strategies for dealing with these problems will be accessible to determine (Ireland and Bruce, 2000). Chain partners will perceive how the whole series are performing. If the overall supply chain performance is unsatisfactory, they will be able to see the problems and which company is causing them, will also be motivated to improve their performance as an effort to improve supply chain performance to

engage all chain partners. In conducting CPS, (Singh and Power, 2009) argue that cooperation is defined when companies exchange basic information with many customers/suppliers and have several long-term relationships. Coordination occurs when information technology is used to flow important information among supply chain partners. Collaboration takes place when there is a high level of commitment, information sharing, and trust among supply chain partners. Each relationship has factors that motivate drivers and regulate the supply chain environment. This is to ensure that the CPS provides an overall picture of the chain. The joint performance planning process must begin by gathering all the latest performance data information from individual chain partners, then identifying the problems or weaknesses focusing on the improvement plan.

The development of CPS in FPSC as the research area is still infancy and the number of papers investigating is very little (Bititci et al., 2004). In developing countries such as Brazil (Fehr and Romão, 2006), Indonesia (Wei et al., 2004), Vietnam (Chau et al., 2004), and China (Qiao and Zhang, 2005) the interest in supply chain management has developed. Previous researches on CPS in FPSC have been gaining public attention due to their critical relevance to food availability, security, and safety. Fresh produce is also an important component of healthy food and a healthy lifestyle for many people. Unfortunately, the use of the PMS as a part of the management system in the supply chain is still uncommon, and research focusing on CPS in the FPSC system is still limited. Therefore, this paper focuses on the possibility of implementing CPS in the FPSC to improve performance. The organizations of the Paper are; 1) the definition of CPS based on the previous literature summary, 2) the explanation of the systematic review method, 3) the literature examination based on its classification, 4) the systematic discussion of the findings and results, 5) the conclusions and finally 6) limitation and study forward.

LITERATURE REVIEW

The definition of FPSC, according to the British Growers Association (BGA, 2020), is fresh produce includes plants that are sent to consumers immediately after being harvested. Included in this definition are fruits and vegetables, which are usually sold in 'fresh' conditions and have a short shelf life (Relf, 1992). The discussions about the concept of supply chains have begun to be popular in the food ingredients industry since the early 1990s (Lummus and Vokurka, 1999). According to Mutonyi and Gyau (2013), performance measurement has gained attention in the fresh produce chain. Demand for fruit, vegetables, milk, meat, and fish has increased due to an increase in per capita consumer income (Da Silva, et al., 2009). To respond to consumer demand, producers have increased their capacity by adopting modern production technologies and gaining access to domestic and global markets. The adoption of this technology and market access helps farmers to utilize the efficiency of their land, machinery, infrastructure, and human resources to reduce their production and marketing costs. The increasing demand for processed and ready to eat food supports the development of the processing industry, packaging and warehouse industries, electricity, and the logistics and transportation sectors. There are several specific characteristics of fresh produce which put pressure on the flow of results from one member to another. Food produce is consumed as food and often easily damaged in nature. For this reason, food security and quality problems are adhered to in their production and delivery (Norina, 2004). Most fresh produces are also available in the market as unprocessed commodities. Because the production of many fresh produces is seasonal, the price in the market changes (O'Keeffe, 1998). Fresh products also needed to be transported and stored under controlled environmental conditions. Additionally, special attention is necessary for packaging and handling to protect them from quality degradation, namely cool chains that require specific equipment and expenses (Batt, 2006).

FPSC is divided into two groups (Cadilhon, et al., 2006; Cadilhon, et al., 2003). In Asian countries, the first and dominating groups are traditional wet markets, retail outlets, and mobile retailers. The second and rapidly growing groups are supermarkets, department stores, and hypermarkets. In the first type of chain, the partners pay little attention to food safety and product quality, but food safety and product quality are highly prioritized before handing them over to consumers in the second type of chain. The supermarket chain not only focuses on issues related to food security and product quality, but also adopts strategies such as rapid response (QR), efficient consumer response (ECR), and collaborative planning and charging forecasting (CPFR) to improve efficiency in providing better value to consumers (Sparks and Wagner, 2003). Rapid response is a partnership strategy where suppliers and retailers work together to respond more quickly to consumers by sharing data scanning points of sale, allowing both to estimate refill needs. Efficient consumer response is related to filling goods at retail outlets based on consumer demand and selling point information. In CPFR, partners collaborate for business planning, sales estimates, and all operations needed to replenish raw materials and finished goods.

The supply chain structure of fresh produce is different from others. There are several producers in the FPSC. The best way to consolidate them in the chain is the formation of several types, so producer groups such as cooperation (Batt, 2006). Such cooperation can help in regulating production inputs and marketing products. Marketing inputs and outputs through cooperation help reduce the number of levels between input suppliers and consumers. In the supply chain, according to (Berti and Mulligan, 2016), by bringing together agricultural producers, farmer cooperatives can provide the scale, coordination, and improvement of the marketing system needed to help their members succeed as well as the food hubs, whose aggregation function enables producers to unite and to develop businesses to meet new opportunities to supply food to mid-operations large wholesalers.

This discussion explains that increased competition among companies and changes in consumer demand inspire partners to develop FPSC. Chain formation changes the nature of competition to become a chain versus a chain competition rather than a company versus a company competition. In such a situation, the goal to fulfill and satisfy consumers and provide benefits to future partners mostly depends on managing these chains. According to (Aramyan et al., 2007), the similarity of objectives that satisfy consumers will appear if the procedure of optimizing individual partners in the chain improved by providing insight into the effect opposing goals on performance. Thus, a well-defined supply chain system must reflect the individual chain partners' contribution to the overall chain performance.

In this Paper, CPS in FPSC is defined as a fresh produce collaboration performance system based on interaction, coordination, and collaboration between farmers, traditional wet markets, retail outlets, retailers and supermarkets/department store/hypermarkets involved in the chain process supply. The purpose of the CPS in FPSC is not only to reduce inefficiencies and costs in the operational collaboration of an FPSC system but also to provide reciprocal benefits to all partners, including farmers, as suppliers.

METHODOLOGY

A systematic CPS review of the FPSC was conducted in four steps. The first step is to manage Web-based search and recommendations by professionals. There is a lot of researches in the supply chain to identify potentially relevant articles referring to journal papers, Ph.D. theses, and conference articles from the literature of the last 15 years (years of 2003 to 2017). The search uses a combination of different keywords such as "collaboration system performance" and "Supply Chain"; "Collaborative supply chain,"; "Collaborative formations" and "collaborative structure"; and "Planning levels" and "Planning scope". A keyword like "Solution technique" is used to find each related article in this field. Based on this combination of keywords, 161 articles from various journals and publications were found. The second step is to find relevant publications. The keywords "CPS" and "Collaboration supply chain" are used. With the keywords in the database, 56 articles are obtained. A deep content analysis of 56 articles is done in the third step. Based on the full article title, abstract analysis and papers, 17 of 56 are selected. There are, 17 articles selected as important topics in the CPS supply chain, CPS implementation in the supply chain, contributions from the various supply chain of CPS models, CPS planning levels in the supply chain, and the methodology of CPS in the supply chain. Articles containing irrelevant topics have been removed. The rest of the 39 articles are excluded because they are not included in the fresh produce of the supply chain collaboration. Step four is to categorize and analyze 17 articles. More recently, the number of articles has increased. Nevertheless, there are no relevant contributions to the CPS model in the overall fresh produce ~~action~~ chain in one supply chain performance together in a supply chain organization.

CPS Model Classification in FPSC

The CPS Model Classification in FPSC is based on a systematic literature analysis framework. The order in presenting the classification of the literature is taken from four as adopted from (Okdinawati et al., 2015), such as; collaboration structure, general characteristics, level of collaborative planning, and solution of the methodology between the partners involved and the scope of collaboration. This category is obtained from the first dimension, namely the category of collaborative structures, such as vertical, horizontal, and lateral collaboration. This basis follows the definition of the supply chain in CPS, which functioned as a receiver, sender, and in this case, the operator is assigned to build a collaborative system in several collaborative structures for interaction between them. To reflect the general characteristics of each collaboration and CPS model, the second dimension is used. Referring to the existing literature, the implementation of CPS for every collaboration model in the supply chain is needed to develop an understanding of supply chain issues so that the benefits of collaboration for all partners of collaboration can be felt. This can also causes problems. In contrast, decision making in implementing CPS at FPSC uses planning methods and processes in collaborative processes that aim to coordinate the plans of several partners to achieve CPS goals. The decision-making process in planning can be used at various levels of planning, adjusted to the importance of the problem and the time required. Based on this perspective, collaborative planning in the third dimension is taken according to the level of planning decisions, namely; strategic, tactical, and operational planning levels, next, in identifying and classifying the existing literature, based on the fourth dimension, namely using the relevant solution methods for each CPS model in the supply chain. Several methods have been used to optimize and solve a complex problem related to CPS. It is critical and challenging to find a solution to the problem. The illustration of the classification of Paper can be seen in Fig.1.

Collaborative Structure

The classification of a description of the collaboration structure in this paper is divided into three sections to look at the CPS in FPSC categories, such as vertical, horizontal, and lateral collaboration. This determination depends on who are the parties involved and the scope of the collaboration (Simatupang and Sridharan, 2002; Soosay et al., 2008; Zamboni, 2011). According to the definitions above, it can be spelled out, where vertical collaboration is defined as loyalty involving two or more organizations, to share the responsibilities, resources, and flow of data information to serve relatively the same end customers. Meanwhile, horizontal collaboration is defined because it involves two or more organizations in sharing their personal information or resources such as a shared supply chain mode between two organizations. However, these activities are not related to or competing in cooperation. In contrast, the definition of

lateral collaboration is the activity of combining and sharing capabilities, both aim to get more flexibility from the combination of horizontal and vertical collaboration.

General of Characteristics

The characteristics of CPS in the FPSC are formulated generally by dividing them into three parts that resulted from problems in the previous literature process, namely the fundamental problem, mechanism, and performance metrics. The problem includes the performance's targets of each member in the supply chain, including increasing efficient and reliable product delivery, increasing usage capacity, reducing costs, and increasing competitiveness, furthermore, in terms of the CPS mechanism in this supply chain, it is highly related to the benefits of all parties involved in this collaboration as a unified objective. It is based on the efforts to share resources and information for achieving the common objectives. Activities involving the partners in CPS in the supply chain not only to provide significant benefits for them but also to enhance their understanding on CPS in the supply chain and supply chain management itself. Performance metrics used by previous researchers include; inventory level, forecast accuracy, imperfect orders, responsiveness, product availability, new product development, marketing planning, skills and knowledge, specialization, investment capability.

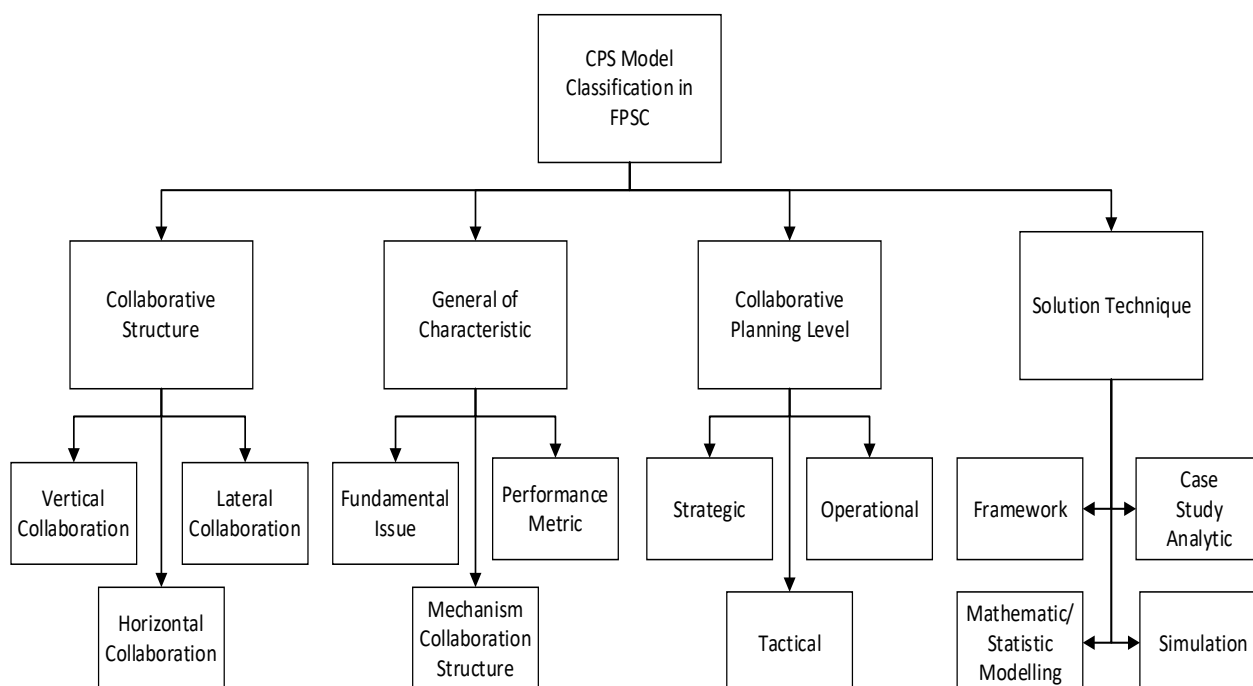


Figure 1: Clasification of Paper

Source: (Okdinawati et al., 2015)

Collaborative Planning Level

Various problems often occur in collaborative activities, especially at the level of collaborative planning categories between collaborative partners. The purpose of this category in the CPS in the FPSC can more or less help to differentiate the proper planning of all partners, decision making, and coordination in achieving the expected goals. For each supply chain collaboration problem that represents the decision-making process depending on the unit of time (Gichuru et al., 2015; Hingley et al., 2006; Matopoulos et al., 2007), it is proposed with three levels of collaborative planning. The first level is the strategic level; prescribing facilities, locations, production technologies, and plant capacities. Referring to this strategic level serves as a front-end agreement, the foundation for the entire supply chain process, and as an important part of supply chain management. The classification, in this case, is a strategic partnership model, which is a formal agreement to develop collaborative relationships and network models. The aim is to make the relationship work well, be useful, reduce risk, and commitments that have been agreed upon with restrictions that can reduce the potential benefits themselves. The second level is the tactical level of managing material flow management policies, including production levels in all factories, construction policies, inventory levels, and lot sizes. The third level is the operational level; schedule operations to guarantee the prompt delivery of the final product to the customer.

Solution Technique

The current literature shows that several solution techniques have been proposed to solve problems and calculate optimization in the CPS area in FPSC's. The proposed solution technique can be classified into four categories. The first

solution technique is a framework, divided into a theoretical framework and conceptual framework. This solution technique demonstrates how the CPS concept works to increase understanding of the CPS concept itself concerning the FPSC. Analytics as a second solution method uses a related case study in one particular case that has a particular form and is used to describe changes in a system. While the mathematical model approach as an optimal solution as a third model solution, the function of this solution is to solve problems with incomplete or imperfect information and has limited computing capacity. While the simulation model is decided as a final solution method. The purpose of this solution is to show the effect of an action that happened.

RESULTS AND DISCUSSION

Findings

A literature review is a basis for determining the research findings. It is divided into three major groups. The first group of literature reviews examine the state of the art of the research, which is necessary for vertical collaboration development. The second group is a literature reviews that examine the state of the art of horizontal collaboration, and the third is the last group of literature reviews that examine lateral collaboration. In Table 1, CPS model classification in FPSC shows general characteristics as decision variables, the CPS model in three levels of collaborative planning, and the solution method that is used as a classification basis to distinguish one literature review group from another.

Vertical Collaboration

This section addresses collaboration among partners in the same supply chain known as vertical collaboration and discusses each level of collaborative planning separately. It also discusses general characteristics and various solution methodologies. The results of (Singh et al., 2014) study showed that justified objectives are very efficient for measuring the impact of vertical collaborative supply chains on the vegetable industry.

Strategic Level

In the strategic planning model, (Gichuru et al., 2015), determined that the level of corporate performance in collaboration with major suppliers led to high-profit margins, increased sales, expanded company growth, leading significant market share and increase customer loyalty. To identify decision-making criteria at various levels of management that influence procurement decisions and to analyze the impact of changes on the economic feasibility of farmers, direct storage as a logistic strategy to bring farmers and shop-manager buyers into direct communication to build a relationship in the collaborative supply chain was examined. The results of this study are in line with (Singh et al., 2014), who concluded that because agriculture is a local science, a long-term strategic approach to improve performance should consider the long-term interests and agricultural heterogeneity that vertical coordination in the vegetable industry supply chain is indispensable and will have a high impact on decision variables, namely; transparency of expert opinion systems, control of price fluctuations, waste reduction, technology support, reduction of product damage and risk reduction. Whereas contrast to (Gichuru et al., 2015), and (Singh et al., 2014), the research of (Hingley et al., 2006) showed that the development of a model of the supplier-retailer relationship in the UK FPSC shows that progress in the UK fresh produce industry has caused some controversy in recent years, mainly related to the provision of backhauling prices and gate factories where suppliers generally felt that this initiative did not benefit their relationship with retailers. Studies also found improved relations in the industry for several regions, although problems such as trust, cooperation, and collaboration must be addressed and will occur if there is further improvement. Retailers continue to have significant supply chain strengths compared to suppliers even though they begin to recognize how important farmers/suppliers are to gain market share for fresh produce.

According to the study of (Aramyan et al., 2006), the model of measuring the performance of tomato commodity in Germany, their model was evaluated the conceptual framework for measuring the performance of the agri-food supply chain. The model is also considered as the first step to develop an integrated performance measurement system, which contains financial and non-financial indicators combined with the specific characteristics of the agri-food supply chain. The evaluation, which is a complete chain from breeders to retailers. Produced a conceptual framework for proven to answer the first research question, that, these four categories are in an integrated performance measurement framework and evaluate the framework as complete to measure the performance of agri-food supply chains, namely; efficiency, flexibility, responsiveness, and food quality are key performance (Aramyan et al., 2006). Some suggested indicators such as transaction costs, a backorder, or emissions are considered not important for measuring chain performance. However, this indicator can be used to measure performance at the organizational level if chain partners consider it necessary. The results show that many performance measurement indicators are measured in several chain networks, while they are not measured in others. Given the different objectives in the chain, it provides answers to the second research question. The most relevant indicators for measuring the performance of the entire supply chain appear to be costs, profits, customer satisfaction, waiting times, and most of the product quality indicators.

Table 1: CPS Model Classification in FPSC

Author, Year	Main Objective of the Paper	Collaborative Structure *)			General Characteristic (**)			Collaboration Level (***)			Solution Methodology	Model Applicat ion/ Country
		VC	H C	L C	FI +)	C M ++)	PI +++)	SL	TL	OL		
(Cadilho n et al., 2003)	A developed conceptual framework for the analysis of vegetable supply chains in a southeast Asian context and the role wholesale markets play in these chains.	-	-	✓	SC, CI, IS, RC, IO, IN, UP	ID, SB, SR, MT	IL, FA, IO, RP, PA, MP	Partn ershi p Mode l	-	-	Framework	The vegetable marketing system for Supply Chains in South East Asia/ Vietnam
(Hingley et al., 2006)	To recommendat ions for how suppliers (retailers) can improve their relationships with retailers (suppliers)?	✓	-	-	CI, IS, RC, IO, IN, UP	ID, SB, MT	IL, FA, IO, RP, PA	Partn ershi p Mode l	-	-	Case Study Analytic	Supplier-Retailer Relationships in the UK FPSC
(Qiao and Zhang, 2005)	To analyze offer insights for improving the efficiency of the melon supply chain and the competitiveness the industry	✓	-	-	SC, CI, IS, RC, IC, IN, UP	ID, SB, SR, MT	IL, FA, IO, RP, PA	Partn ershi p Mode l	-	-	Case Study Analytic	Relationship of collectors and wholesalers/ China
(Aramya n et al., 2006)	Evaluate the usefulness of a novel conceptual model for supply chain performance measurement in an agri-food supply chain	✓	-	-	SC, CI, IS, RC, IC, IN, UP	ID, SB, SR, MT	I, FA, IO, RP, PA, MP, IV	Partn ershi p Mode l	-	.	Framework	Evaluated tomato supply chain; starting from the breeder till the retailer /Germany
(Matopulos et al., 2007)	Analyzed concept of supply chain collaboration and to provide an overall framework that can be used as a	✓	-	-	CI, IS, RC, IC, IN		IL, FA, IO, RP, PA	Partn ershi p Mode l	-	-	Case Study Analytic	Dual relationships at the grower-process or interfac

	conceptual landmark for further empirical research												e /Nederl and
(Cai et al., 2010)	Developed a model to study distribution and transportation problem freshness product SC to deliver to the market, and characterize each party's optimal decisions in both decentralized and centralized systems.	✓	-	-	IS, RC, IC, IN, UP	ID, SB, SR.	FA, IO, RP,	Partnership Model	Distribution and Transportation Channel	-	Mathematic Modeling (computation report)	To address the decision concerns of both the producer and the distributor in FPSC/ China	
(Canavari et al., 2010)	Adopted and management of T+ system is part either of the operational or strategic information management, thus being included in the organizational performance or the competitive strategy of a firm	-	-	✓	CI, IS, RC, IC, IN	ID, SB, SR, MT	IL, FA, IO, PA, MP, IV, SK	Partnership Model	-	.	Case Study Analytic	Applications of such elements to buyers and sellers selection /Italia	
(Komo, 2010)	Generated insights into the potential existing structural marketing problem of the F& V retailing industry and at identifying opportunities for industry innovation at the product, process, and the level system.	✓	-	-	CI, IS, RC, IC, INc	ID, SB, SR, MT	IL, FA, IO, RP, PA, MP, IV	Partnership Model	-	-	Case Study Analytic	Relationship of Alpha-Sowa, Omega-Chesa, Zeta-Bete, Gamma-Laberi and Delta-Spibe/ UK	
(Khana, 2012)	Studied fresh vegetable supply chains are to identify factors that impact on the environment external to these	-	-	✓	CI, IS, RC, IC, IN	ID, SB, SR, MT	IL, FA, IO, RP, PA, MP	Partnership Model	-	-	Case Study Analytic	Vegetable supply chains were conducted using	

	chains, information flows along with them, and relationships between actors within them. It identifies the role that information structure plays in chain coordination, and so contributes to the emerging literature providing policy insights for the Nepalese government.											an embedded multiple case study approach/ Nepal
(Beshara et al., 2012)	An improved set of performance measures by developing a simulation model that helps in evaluating and analyzing the performance of these supply chains	-	✓	-	CI, IS, RC, UP	ID, SB, SR, MT	IL, FA, IO, RP, PA	-	-	Model distribution and production	Simulation	Two echelon -V/F between two different countries SC/ Egypt& Holland
Mutonyi and Gyau, (2013)	A proposed conceptual model for measuring Supply Chain upon five constructs: effectiveness, efficiency, adaptability, food quality, and customer satisfaction.	-	-	✓	CI, IS, RC, IC, IN	ID, SB, SR, MT	IL, FA, IO, RP, PA, MP	Partnership Model	-	-	Case Study Analytic	Measuring the performance of SME scale agri-food firms in developing countries/-
(Bahinipati, 2014)	Assesses sustainability of change in the management of procurement activities and ICT infrastructure supporting the e-market service mode, and builds a collaborative control framework that	✓	-	-	CI, IS, RC, IC, IN	ID, SB, SR, MT	IL, FA, IO, RP, PA, MP, SK	Partnership Model	-	-	Case Study Analytic	The Procurement Perspectives of Fruits and Vegetables Supply Chain Planning/ India

	could provide insight to the managers of the food-producing industries											
(Singh et al., 2014)	To know the effect of the vertical coordinated supply chain on the demand-supply gap and price gap for vegetables by experts. The second objective is to measure the impact of the vertical coordinated supply chain on the vegetable industry.	✓	-	-	CI, IS, RC, IC, IN, UP	ID, SB, SR, MT	IL, FA, IO, RP, PA, MP,	Partnership Model	-	-	Framework	Measure the impact of the vertical coordinated supply chain on the vegetable industry /India
(Gichuru et al., 2015)	Explored problems faced by Indian agriculture for food security in terms of inadequate infrastructure and highly inefficient supply chain	✓	-	-	SC, CI, IS, RC, IC,	ID, SB, SR, MT	FA, RP, PA, MP, SK, IV	Partnership Model	-	-	Case study Analysis	Collaborative Supply Chain Practices on Performance of Food and Beverages Companies/ Kenya
(Dunning, 2016)	Study was conducted to better understand the development of collaborative supply chains between farmers & grocery stores, and the broader potential that grocery store chains might play in localizing food systems Data consists of three years of the chain's local produce purchases via direct-store-	-	✓	-	CI, IS, RC	ID, SB, SR, MT	IL, FA, IO, RP, PA, MP	Partnership Model	-	-	Case study analytic	Collaboration and commitment in a regional supermarket supply chain/ USA

	delivery from farms to stores.												
(Castro and Jaimes, 2017)	Understudied how the structure affects logistical performance and food security is critical in the supply chains of perishable foods (PFSC). This research proposes a system dynamics model to analyze the effects of structures: lean, agile, flexible, and responsive, in the overall performance and of each agent of the PFSC.	-	-	✓	CI, IS, RC, IC, IN, UP	ID, SB, SR, MT	IL, FA, RP, PA, MP,	Partnership Model	-	Routing System	Mathematic Modeling	Dynamics Impact of the Structure of the Supply Chain of Perishable Fruits on Logistics Performance and Food Security /-	
(Castro, et al., 2017)	Proposed for the developed simulation model: the asymmetry in the packaging derived from the actors' individual management creates avoidable inefficiencies in inventories and transportation in the mango supply chain.	✓	-	-	CI, IS, RC, IN	ID, SB, SR,	IL, FA, IO, RP, PA	-	-	Warehouse and Transportation System	Simulation	Warehousing and transportation logistics of mango/ Colombia	

Remark:

- *) =VC = Vertical Collaboration, HC = Horizontal Collaboration, LC = Lateral Collaboration.
- **) =FI = Fundamental Issue, CM = Collaboration Mechanism, PI = Performance Indicator.
- ***) =SL = Strategic Level, TL = Tactical Level, OL = Operational Level.
- +) =SS = Safety and Security Issue, CI = Capacity Issue, IS = Improving Service Level, RC = Reducing cost, IC = Increasing Competitiveness, IN = inefficient, UP = Unreliable Product Delivery.
- ++) =ID = Information and Data Sharing, SB = sharing benefit, SR = sharing risk, MT = managing trust, IV = Investing Capabilities, SK = Skills, and Knowledge Specialization.
- +++) =IL = Inventory Level, FA = Forecast Accuracy, IO = Imperfect Orders, RP = Responsiveness, PA = Product Availability.

Some indicators are not measured by partners of the supply chain although considered important (e.g., shipping flexibility and marketing indicators). The main argument for not measuring this indicator lies in the difficulty of measuring these steps. Based on the results, (Aramyan et al., 2007), suggested a thick PMS framework for

agricultural/fruit and food supply chains. In addition, to their performance indicators, are advised to have a set of general performance indicators in four main categories, which will help them to compare performance in chain partners and ending chain performance. A similar multilevel performance system is recommended. The suggested indicators of the framework for efficiency are production/distribution and transaction costs, profits, return on investment, and inventory. Those indicators have currently been measured in breeding and wholesale companies. There are only three indicators (production costs, profits, and return on investment) measured by farmers. Inventory and transaction costs are not measured. Not all indicators are measured as data for the distribution center (if transaction costs calculated). Three indicators are measured by supermarkets. In the efficiency category, all chain partners except one found two important intermediate indicators namely transaction and inventory costs. A possible explanation is that this chain is structured, so that transaction costs (e.g. search costs and transportation costs) are kept to a minimum. Because farmers are not permitted to sell their products to wholesalers outside the chain, they are not looking for other channels such as auctions or direct marketing, to evaluate the conceptual framework for measuring the performance of agribusiness food supply chains for tomatoes ([Aramyan et al., 2007](#)).

The study conducted by ([Matopoulos et al., 2007](#)), contained the overall proposed case study research framework, by identifying the importance of element; trust, power, dependency, and risk/reward sharing in building and maintaining supply chain relationships, as well as the role of the above elements in choosing partners, width and depth of collaboration. However, the problem of selecting information, data and technology sharing techniques are also needed, especially its relationship with the elements of the second pillar. The propositions developed in this study, as well as the overall framework for the scope of collaboration in supply chain are offered for further testing and development. They must be seen as an effort to improve understanding of collaboration. The study has two main limitations. The first limitation is that his research was taken from a single relationship. Further qualitative testing of the conceptual model is needed with literal or theoretical replication objectives. The second limitation is the focus on dyadic relations; expanding the research focus for more complex supply chain relationships throughout the chain will be useful as well. Although none of the factors identified in this study were completely new, they had not been studied in the previous agribusiness context, and this was the main contribution of this study. Future research on supply chain collaboration is needed to develop a clearer understanding of the benefits, as well as the risks of supply chain collaboration and how the trust, power, and dependency elements mentioned above interact in the collaborative development process. In line with ([Komo, 2010](#)), the study was based on five case studies that formed the larger supplier relationships of SME customers that were considered. The purpose of this study identifies the areas of collaboration, how values are created together. This in-depth case study (business relationship) was taken from the UK organic food sector. Theoretical group, Industrial and Purchasing (IMP) group interaction approach, with its assumptions. Larger customers and SME suppliers are found to collaborate in various fields including innovation, corporate social responsibility, inter-linked technical systems, planning, joint evaluation, and interactive learning. Consider the value of co-creation practices as representing how values are created together, exchanging ideas about product development; facilitate and sponsor school children to visit farms; combined technical system; consultation in developing business plans; evaluation process and joint staff; and internship.

The research results show many areas of collaboration including innovation, planning, developing knowledge and skills, marketing and promotion, and communication. Findings through identified collaborative areas show that in any business relationship, there are many interaction points including traditional exchange points with the implication that there are many points of customer-supplier interaction that are very important for shared value. The results, not just small suppliers who get from larger relationships also benefit; there are mutual benefits and hence value creation. The research model of ([Cai et al., 2010](#)) proposed a mathematical model for optimization in supply chain coordination for fresh produces. This study explains that producers and distributors must coordinate their decisions, especially in situations where the freshness and quantity of food products are susceptible to the efforts of maintaining freshness, and market demands are sensitive to the product freshness and distributor selling prices. The incentive scheme that is proposed ensures that both partners are better coordinated. The distribution of additional benefits for each partner depends on the actual bargaining power of each partner (as reflected by the parameters in the incentive scheme). The incentive scheme can function as a basis for a contract between the two partners of SC. Investigation of the supply chain of fresh produces by maintaining freshness is a new field of research, with several areas that have the potential to produce further research by ([Cai et al., 2010](#)); (1) Consideration of the situation where transactions between producers and distributors are carried out on a FOB basis. There are many different business models between upstream producers and downstream distributors. Insurance and shipping costs (CIF) are another common model, where producers bear logistics and distribution costs and risks. Decisions and schemes that are not coordinated and coordinated with CIF will be different. (2) Third-party logistics providers may be responsible for transportation, and their participation in the supply chain will impose new problems on the strategy and coordination of chain partners. The limitations of research of them, do not involve a mix of freshness maintenance costs, in addition, to the optimal characterization of decisions for distributors, to be explored further, such as how to obtain optimal wholesale prices for producers. The research conducted by ([Cai et al., 2010](#)), only considers the problem in which all product items have the same value and are also marked by the same selling price. In practice, there is a possibility that the product must be further categorized into a different class. They differ in terms of freshness. Therefore, they may encounter different market demands and must be given different prices. This is an interesting problem but much more difficult.

The research model (Singh et al., 2014) produces the theoretical framework, where the transparency of the expert opinion system, controlling price fluctuations, reducing waste, supporting technology, reducing poverty and reducing risk are six variables that have very high synaptic weight strength, concluding that vertical coordination in the vegetable industry supply chain is indispensable and will have a high impact on these variables to optimize the vegetable supply chain for the development of the vegetable sector (Komo, 2010; Singh et al., 2014). Seven other variables that control the improvement of quality standards; various vegetables, vegetable farmers, increased yield, non-seasonal availability guarantees, demand, and security also have a much higher value yet not very important if compared to the previous set but needs to be considered. The only variable quality control is to have a value that is poorly demonstrated and will not have much impact on the vegetable supply chain. This has justified the second goal very efficiently to measure the impact of supply chains that are coordinated vertically in the vegetable industry (Singh et al., 2014). The most important results of the research are for consumers in the sense of price, and beneficial for farmers involved in vegetable cultivation. Most can support all participants in the vegetable supply chain intermediary. This study can be a guide map for researchers working in the supply chain to produce agriculture and can be used as valid sources for assumptions. Besides, agricultural marketing supervisory authorities can use it for decision making and optimize vegetable supply chains. Bahinipati, (2014) used supply chain planning models in the fruit and vegetable supply chain, dealt with short life cycle products in competitive markets, integrated complicated farmers' networks, processing, and food supply to end consumers to improve operational effectiveness. This planning framework collects data from various sources, such as customers, supermarkets, farmer cooperatives, and contract farmers, to provide visibility of supply-demand status for inter-company collaboration. Supply chain analysis has considered aspects of business planning, inventory management, and demand, inventory, transportation, logistics optimization from the perspective of sharing information to meet the needs of end customers. Furthermore, this work assesses the sustainability of changes in the management of information computer and technology (ICT) procurement and infrastructure activities that support e-market service modes and builds a collaborative control framework that can provide insights to managers of food manufacturers. Because of the emergence of e-markets and competition for the rotten supply of fruits and vegetables, the problem for supermarkets lies in overcoming competition based on the time and demand of volatile customers and developing responsive and flexible supply chains. In the study, supermarkets dealing with fruits and vegetable supply, focus more on tactical and operational issues, not in aligning strategic business issues.

The supply chain planning perspective proposes guidelines, with the use of the proposed ICT framework, can form the basis for improving the capabilities of the supermarket retail industry's business by taking into account customer behavior later in the market. According to Bahinipati, (2014), the contract-supermarket farmer supply network uses the concept of preferred suppliers (contract farmers), which require reducing government costs related to handling and transportation practices through a small base of dedicated contract or cooperative farmers. It requires lessening the lead time for centralized coordinated and shipping orders while maintaining good relations with contract farmers and cooperatives. This process requires increased investment for quality and security guarantees through contract farmers. Case studies reveal that good implementation of standards and practices has reduced the chances of dissatisfied customers, who contribute to a good supermarket image. The proposed ICT framework will control information costs through a collaborative supplier-buyer network. Contract farmers can be encouraged to pursue quality control at the farm level through related specific investments. Supermarkets focus on the introduction of new varieties of fresh agricultural fruits and vegetables and new agricultural machinery and technology including the development of organic agricultural production which is oriented to specific consumer demand. That will allow the branding of fresh fruits and vegetables from supermarkets through close partnerships from contract farmers, cooperatives, and supermarkets. This partnership will have several direct implications for the term of the contract agreement and trust in the shipping relationship. Furthermore, gathering contract farmers and cooperatives will represent a business model to enable small and marginal farmers to have a direct relationship with supermarkets. The study of Bahinipati, (2014), focused more on a better understanding on the level of interdependence in supply chain collaboration, and the types of ICT needed to facilitate such relationships gradually. The study uses case studies to examine the driving forces for vertical collaboration, which has several limitations. Analytical, quantitative, and empirical studies are needed to evaluate the relationship between collaboration and supermarket supply chains. While, it is also only based on a single supermarket perspective, and thus a single supply chain. So, it is quite difficult to focus on several networks and to provide insight into vertical and horizontal collaboration patterns.

The argue of Bahinipati, (2014) is in line with (Cadilhon et al., 2003); when supply chain partners become more interdependent, there will be a need for this network to bear ranged vertically (supply chain) or horizontal method (a supermarket marketing group). This will increase information exchange and knowledge acquisition among all stakeholders. The use of case studies to examine the driving force and its necessity for vertical collaboration has several limitations (Bahinipati, 2014). Although the supply chain literature assumes that collaborative relationships resulted in improved operational and business performance, analytical, quantitative, and empirical studies can be conducted to evaluate the relationship between collaboration and performance in supermarket supply chains. Furthermore, the research is based on the perspective of a single supermarket, and thus a single supply chain. Future studies must focus on several supply chains and/or networks to provide insight into vertical and horizontal collaboration patterns. Study of (Castro et al., 2017), used dynamic research simulation model aims to evaluate the incidence of packaging asymmetry, which is resulted from the use of heterogeneous packaging materials by different Mango supply chain actors in

Colombia, in terms of measures of supply, transportation, and quality performance. A system dynamics model was proposed based on a literature review of transportation inventory and logistics, studies of asymmetry in supply chain packaging, and material packaging, and the results of characterization of logistics fruit chains in various departments of Colombia from 2012 to 2013. The proposed model is employed to test the following hypothesis: “Asymmetry in packaging comes from individual actor management, creates inefficiencies that can be avoided if the fruit packaging is done thinking on the chain”. The simulation model developed allows us to prove the proposed dynamic hypothesis. The model includes four echelons for the supply chain; production, processing, wholesale, and retail, as well as warehousing, transportation, and information ([Castro et al., 2017](#)).

Tactical Level

According to ([Matopoulos et al., 2007](#)), companies coordinate the procurement and distribution processes, especially at the tactical level (for example, set the details and procurement requirements, delivery times), but when it comes to more complex supply chain activities, such as product design/new product development and demand management or even when they have to plan at the operational level, they cannot collaborate. Regarding the significant elements that affect the formation and maintenance of supply chain relationships, trust seems to influence the collaboration intensity which limits the depth and width of the collaboration. Evidence of exploration is different from ([Zhang et al., 2006](#)), proving that it is an element of dependence that influences risk and information sharing rather than the element of power, and thus, the process of building trust and the intensity of collaboration. Regarding the risk of small company dependence by large companies, case studies show in the long run that imbalance and power imbalances can be changed to support small companies.

Operational Level

Included at the operational level related to daily processes, decision making, and planning that make the supply chain process run smoothly, achieve maximum benefits, and improve performance. However, the potential benefits of ([Castro et al., 2017](#)), show that, the system dynamics model for analyzing structural effects: lean, agile, flexible, and responsive, in overall performance and every supply chain agent/partner. This model is applied to the supply chain of mango, orange, and tangerine and includes supply chain characteristics such as perishability. The results show that short-term planning strategies, by improving the behavior of the logistic of the entire chain, are related to logistics time and costs. But not all of each strategy only increases the number of logistical performance measures, while some agents/partners benefit others can be harmed, which means that each chain agent will apply the best structure following their interests, to the detriment of consumers. Lower inventory levels and greatest efficiency are achieved by responsive and lean structures while greater food inflow is achieved with flexible structures. Concerning food security, lean and responsive structures contribute to access because of their efficient costs, while being agile and flexible provide availability since they increase shipping speed and reduce losses. However, for the three supply chains that evaluated responsive structures have the lowest losses across the supply chain while flexible has the lowest transportation losses. The results come from the need to conduct studies with mixed structures, complemented by trade-off analysis and multi-objective models.

While, according to ([Zhang et al., 2006](#)), the cost of melon transportation in China with the melon supply chain mapping is quite high because of the considerable distance to the retail location, there are delays in transportation scheduling problems. Because these problems do not appear on a large scale, farmers often do not treat them until it is too late to save the plant. Input suppliers are far from end consumers. They only sell products to farmers and are rarely involved in farmers' planning decisions. One of the main reasons is that these companies often lack the specialized personnel to provide further information to farmers. Another reason appears as insufficient trust between input suppliers and farmers to perform planning together. Meanwhile, melon supply chain relationships are complex because partners are free to replace suppliers and move to different customers based on short-term calculations. Sometimes forward contracts are made between farmers and collectors. However, farmers often do not respect contracts when other collectors offer higher prices. A similar situation occurs between collectors and wholesalers. Collectors will almost certainly turn away from existing wholesalers whose offers are lower than other large traders for certain transactions. Emphasize that there is little exchange of information and technology among chain partners who generally act opportunistically under a rather fragmented and decentralized industrial structure ([Zhang et al., 2006](#)). Farmers have benefit from arrangements with wholesalers because they do not have transportation costs and save time to market their products. On the other hand, wholesalers are guaranteed with a constant supply of products. Unlike other chain partners, breeders emphasize the importance of inventory costs. Inventory costs are important for breeders considering that large amounts of expensive seeds are stored in storage for long periods, which increases warehousing costs. Wholesalers and distribution centers sell all of their stock in one day and therefore inventory costs do not affect them. There is a high level of agreement between chain partners on production costs and earnings indicators in the efficiency category, which shows that costs remain as the main concern for measuring supply chain performance.

[Bahinipati, \(2014\)](#) was proposed supply chain planning perspectives, with the use of the proposed ICT framework, to form the basis for enhancing the supermarket retail industry's business capabilities by considering customer behavior in the market. The contract-supermarket farmer supply network uses the concept of preferred suppliers (contract farmers), which requires reducing government costs related to handling and transportation practices through a small base of

dedicated contractor cooperative farmers. It requires a reduction in lead time for centralized coordinated and shipping orders while maintaining good relationships with contract farmers.

Horizontal Collaboration

Horizontal collaboration occurs, when two different types of supply chains produce similar products or different components of one product, a cooperative association to share resources forms such as warehouse space and manufacturing capacity, horizontal collaboration may overcome financial barriers to trade ([Manning and Baines, 2004](#)).

Strategic Level

The argument of ([Gichuru et al., 2015](#)), based on consideration of resource and environmental allocation, at this strategic level provides overall direction regarding goal setting, policy development, and plan development. Descriptive case study analysis conducted in Del Monte Kenya Ltd. Aims to determine the effect of sharing information on the company's performance and investigate the resource sharing and collaborative supply chain practices effect. The targets were 243 staff partners. The stratified random sampling technique was used to select 73 respondents from the sampling list (the researchers used a questionnaire to collect information from respondents. The collected data were analyzed using quantitative and qualitative techniques. The study found that sharing information and sharing resources had a positive influence on company performance. Companies must share resources with key suppliers to improve capabilities. The study recommends that food manufacturing companies must collaborate with suppliers and other stakeholders in information sharing and resources to achieve high performance.

In the same direction, ([Dunning, 2016](#)), proposed a conceptual framework that connects existing resources in collaboration with trust, which underlies shared commitment and interdependence between partners of the supply chain, and which depend on effective communication and previous positive market exchanges. In their research, it was found that, although the organizational structure inhibits single store autonomy in purchasing and pricing, coupled with supply variability from agriculture, limiting trust formation and the formation of mutual commitment and dependence. These constraints do not completely exclude direct-store-delivery as a strategy for localizing the food system and diversifying the grower market. That practitioners can support collaborative supply chain development through capacity building and grazing of initial market exchanges between farmers and shops and supporting individual farmers/farmer groups to become "preferred vendors" for regional shopping chains. They concluded that the method of long-term contracts would increase trust and be more efficient than short-term contracts ([Dunning, 2016](#)). The limitation of the research by ([Zhang et al., 2006](#)), does not explore how the process of information sharing in the process of long-term contracts are carried out and how the joint planning mechanism between farmers and retailers regarding distribution and transportation is far from the supply center to retail. As proposed by [Bahinipati, \(2014\)](#), a contract-supermarket farmer supply network uses the concept of preferred suppliers (contract farmers), which requires a reduction in governance costs related to handling and transportation practices through a small base of dedicated contract or cooperative farmers. This requires reducing the lead time for centralized coordinated and shipping orders while maintaining good relations with contract farmers and cooperatives. This process requires increased investment for quality and security guarantees through contract farmers. Case studies reveal that good implementation of standards and practices has reduced the chances of dissatisfied customers, who contribute to a good supermarket image. The proposed ICT framework will control information costs through a collaborative supplier-buyer network. Contract farmers can be encouraged to pursue quality control at the farm level through related specific investments. Supermarkets focus on the introduction of new varieties of fresh agricultural fruits and vegetables, new agricultural machinery, and technology, including the development of organic agricultural production, which is oriented to specific consumer demand. This will allow the branding of fresh fruits and vegetables from supermarkets through close partnerships from contract farmers, cooperatives, and supermarkets. This partnership will have several direct implications for the term of the contract agreement and trust in the shipping relationship. The model developed by [Bahinipati, \(2014\)](#) has limitations because it only uses qualitative analysis and samples are used only for one supermarket, and to evaluate the relationship between collaboration and performance in the supermarket supply chain, quantitative data, and empirical studies are needed to support the existing analysis.

The model developed by ([Beshara et al., 2012](#)) can be applied in the food-agriculture supply chain and further complexity can be carried out on it by assuming the lead variables. By adding different products with different lifespan, considering orders at the manufacturer from suppliers, adding more than one distributors, considering the retailer's inventory model to make it three-echelon supply chain models, is the possibility of future extensions of the model. It is further recommended to optimize economic order quantities to reduce costs, improve performance, and reduce waste. However, due to limited horizontal collaboration within the CPS in FPSC, it is needed to adopt the proposed model for applications that have been carried out at a practical level. Because the research only employs a few samples, by using three operator companies as samples ([Beshara et al., 2012](#)).

Operational Level

The operational level includes an operational level schedule to ensure the delivery of the final product to customers in a timely manner. Decisions at this level include data on transportation, storage, demand forecasting, and material requirements, which are considered an important element of shared information due to the strong impact on production and delivery schedules. In addition, the production schedule and requirements of the materials produced are routinely

distributed by their main collaborative partners so that the order process can be in accordance with the need of the starting point to the final destination. Only one researcher, (Beshara et al., 2012) developed a simulation model for the operational level. The study shows that collaboration between supplier and retail customers can reduce storage, transportation, and purchase costs showing that the operational level of collaborative supply chain performance helps in improving overall system performance.

Lateral Collaboration

Collaborative activities involving the incorporation of vertical collaboration or horizontal collaboration that are carried out in many companies. Unfortunately, combining this collaboration at the ground level is difficult to be implemented. The purpose of this collaboration between vertical and horizontal collaboration is to get the benefits of the combined collaboration of both. According to (Lazzarini, et al., 2001) and in line with (Cadilhon et al., 2003; Khanal, 2012), a network approach considers not only vertical collaboration relationships but also horizontal collaboration relationships built between the two to compete and collaborate with their suppliers and customers.

Strategic Level

The research of (Cadilhon et al., 2003) focused on proposing a particular type of product chain model chosen, so that vertical and horizontal coordination are practiced within the framework of the marketing strategy that can be integrated among stakeholders in the existing supply chain. Marketing system includes all the activities. However, empirical observational evidence from the food marketing system in Ho Chi Min City is more focused on the vegetable marketing sub-system with the product specifications. Stakeholders in the cities were not discussed, and at the level of special stakeholders in one or two products were observed, but several stakeholders at each level of the vegetable supply chain were discussed in general. In this collaboration relationship, in addition to product marketing and procurement links, it also discusses the scope of information sharing about market conditions, joint planning, problem-solving, and investment transaction specifications to better meet the specific needs of business partners. These efforts are addressed to improve the internal relationships that all of these elements have discovered, which have an indirect effect on improving the performance of the supply chain in its collaboration. The limitations of the model of this performance system research have not been addressed are performance measures and lack of information adequacy and performance involvement. The need for specific indicators must be the subject of further research after the evaluation focus domain has been chosen by retail level stakeholders since many businesses remain unofficial.

The model of analysis proposed by (Canavari et al., 2010) proves traceability as part of information management in the fruit supply chain from Emilia-Romagna in Italy. The rule review that is used for tracing can be distinguished between proper traceability and traceability plus (T +), which is attached to many valuable attributes. The element of competitive strategy, which is considered in the analysis, tries to show that not only strategic choices but also operations determine the way a single company, or manages traceability and information problems. The application of these elements to buyers and the selection of competing sellers and retailers from the fruit supply chain verifies the hypothesis.

The model proposed by (Khanal, 2012) in the form of the theoretical framework in Nepal's fresh vegetable supply chain is objected to identify factors that impact the external environment on these chains, the flow of information throughout them, and the relationships among partners in them. This identifies the role that information structures played in chain coordination, and contributes to the emerging literature about this, while also providing policy insights for the Nepal government. A theoretical framework was developed by incorporating the principles of coordination theory, transaction cost economics, and network theory to postulate the relationship between information structures and coordination in the supply chain. Empirical research on four Nepal vegetable supply chains was carried out using a dual case study approach. It was found that the environment outside the chain has little effect on information structure and chain coordination. On the contrary, internal factors to the chain are proven more important. The results showed that four chains could be collapsed into two models. The first model shows a relatively complete information structure and strong vertical and horizontal coordination. The second model has a relatively asymmetrical information structure, along with weak horizontal and vertical coordination. Therefore, the completeness of the information structure is positively related to the level of coordination, both horizontally and vertically. It was observed that strong horizontal coordination accompanied by a complete information structure at the farm level aligned producers in the production and supply of vegetables according to market requirements, assembled vegetables to attract buyers, and disseminated knowledge and experience to improve the efficiency of all partners. Similarly, strong vertical coordination in relation to a complete information structure from input suppliers to retailers aligns activities and incentives, directs partners towards achieving chain goals, and increases efficiency in product delivery.

While, the proposed method by Mutonyi and Gyau (2013) that is different from the previous research has been proposed in the marketing literature and supply chain management to measure supply chain performance such as Activity-Based Costing (ABC), Balanced Scorecard, Economic Value Added (EVA), Analysis Multi-Criteria (MCA), Life Cycle Analysis (LCA), data envelope analysis (DEA) and Supply Chain Council (SCOR model). Despite these measurement metrics, there is a lack of consensus on what determines the performance of the supply chain which makes it difficult to select one measurement system in the agri-food chain. These steps may not often be applied to small and medium-sized

agribusiness companies, especially producer organizations in developing countries. Because they are not well structured, there is less information gathering that is often needed to provide input for complex models.

[Mutonyi and Gyau \(2013\)](#) proposed a conceptual model for measuring marketing performance based on five constructs: effectiveness, efficiency, adaptability, food quality, and customer satisfaction. While the model proposed by [\(Castro and Jaimes, 2017\)](#) uses a system dynamics model and design of experiments. It is studied how the different structures and their combination, affect the behaviour of inventory, transportation, responsiveness, efficiency, availability, and quality-safety of the fresh fruits supply chain and each echelon. It includes six echelons: farmers, wholesalers, agroindustry, logistics operators, and third-party retailers. The dynamic contemplates deterioration rate to model perishability and other losses, dynamically reflect on the damage rate to the perishability model and other losses. Understanding how structures affect logistical performance and food security is very important in a perishable food supply chain (PFSC). This study proposes a system dynamics system model to analyze the effects of structure: slim, agile, flexible, and responsive, in overall performance and every PFSC agent. These studies of the supply chain have been carried out for each structure in an independent manner and rare investigations in perishable food supply chains. The structure modeled in this study does not show better performance in all chain metrics, nor in all partners for each structure. The results show the need to investigate mixed structures with the characteristics of the PFSC itself; models can be applied in other supply chains from perishable foods. Study implication is management by incorporating structures in the PFSC, improving logistics performance, and contributing to food security. PFSC agents can apply the structure found in this study, to improve their logistical performance and food security.

Operational Level

The research conducted by [\(Cadilhon et al., 2003\)](#) developed a network framework to measure operational performance levels. Factors incorporated into the context of a broader system environment are the most appropriate representation of the vegetable marketing system in Ho Chi Minh City integrating the environment that interacts around the marketing system which is represented by economic and institutional, factors as well as technical, legal and policy factors. Both literature reviews and field observations have been connected to increase the importance of environmental impacts on food marketing systems. Domestic legal and policy factors such as government and city government and their decisions play an important role in shaping the marketing system. So that the common goal in public decisions ultimately creates goods publicly or by influencing the way the system operates. But, unevaluated marketing performance indicators, risks arising from sharing information and information technology, and interactions between the partners involved, especially farmers, and how trust is developed and maintained by each partner. While, the research developed by [\(Castro and Jaimes, 2017\)](#) used dynamics system model to illustrate the advantages of collaboration among supply chain partners that use seven simulation sectors represented the flow information and materials related to logistics, packaging, warehouses, and transportation in the mango supply chain.

The type of packaging used by supply chain partners affects inventory levels, transportation flow times, and product quality. Inter-fundamental coordination to increase performance measures in packaging, inventory, and transportation from the fruit supply chain. The result is that this type of packaging, according to the chain requirements, results in fewer efficiencies. Repackaging operations increase average seasonal supplies, and average transport flow times, and reduce product quality. In this sense, the combination of this simulation and the type of packaging used underline space aging symmetry, and better performance in terms of seasonal inventory size, transportation time, and quality. Packaging asymmetry and changes (repackaging) among actors have a negative impact on storage, transportation, and product quality. It shows that the hypothesis is accepted in the decrease of asymmetry in packaging that allows for an increase in logistics performance of supplies, transportation, and quality, which is achieved through decisions made by partners when packing for SC, and not for themselves. Links depend on available resources. The limitations of the study are that [\(Castro and Jaimes, 2017\)](#) did not evaluate performance indicators to see that all responsive structures have the lowest losses and are flexible with the lowest transportation losses. The study has limitations, namely not evaluating CPS in supply chain performance indicators, risks arising from the results of sharing information and information technology, and interactions among collaborating partners, especially how trust is developed, is maintained by each of the partners involved.

Based on the 17 articles reviewed, it shows the benefits of CPS in FPSC on vertical, horizontal, and lateral collaboration structures. Various performance indicators are evaluated to demonstrate the benefits of implementing CPS in FPSC. Although all articles show the benefits of the CPS in FPSC, there are still some limitations from the previous studies. The best-formed collaboration used in the CPS in the FPSC field is vertical collaboration. However, there are some limitations in the current literature, [\(Aramyan et al., 2006; Bahinipati, 2014; Cai et al., 2010; Hingley et al., 2006; Komo, 2010; Matopoulos et al., 2007; Castro et al., 2017; Singh et al., 2014\)](#) developing a strategic partnership model even though the measurement of the benefits and impacts of CPS in the FPSC on farmers and supply chain partners is not integrated into it, but previous researchers only identified the benefits and impacts of CPS in the FPSC to demonstrate the impact of CPS in the FPSC with several performance indicators without analyzing the interaction and elements of partnership relationships, such as commitment, collaborative trust management, conflict resolution, and risk-sharing. Meanwhile, research by [\(Gichuru et al., 2015\)](#), attempted to explore the deficiencies of previous literature by looking at the benefits of CPS by examining the interactions among the partners involved in their collaboration.

At this tactical level, only one research discusses the tactical level, which means that only one article is found, it was written by (Matopoulos et al., 2007) about the companies coordinate the procurement or supply and distribution process especially at the tactical level (for example, set the details and procurement requirements, delivery time), but when it comes to more complex supply chain activities, such as product design/development new products and demand management or even when they have to plan at the operational level, they cannot collaborate. However, at the practical level, no one evaluates suppliers (including farmers) and downstream retailers (distributor customers) to get a more tangible CPS effect in the FPSC on the supply chain. To demonstrate the impact of CPS in the FPSC with several performance indicators without analyzing the interaction and elements of partner relationships, such as commitment, collaborative trust management, conflict resolution, and risk-sharing. Meanwhile, research by (Gichuru et al., 2015), attempted to explore the deficiencies of previous literature by looking at the benefits of CPS by examining the interactions between the partners involved in their collaboration.

It was not found previous literature that discusses about the estimated delivery model. Although several studies discuss about logistical strategies to bring farmers, namely by trying to develop a direct storage inspection model, and shop-manager buyers into direct communication to establish collaborative supply chain relationships, to demonstrate the benefits of CPS in the FPSC (Gichuru et al., 2015; Castro and Jaimes, 2017; Zhang et al., 2006). However, demonstrating the benefits of CPS in the FPSC is not simply by presenting how CPS in the FPSC works at the operational level. Bahinipati, (2014) argues otherwise, that the lack of prior research by showing operational interactions among supply chain partners under disruption of demand. The study only explores one risk in the supply chain and the use of ICTs as a for calculation in its order system. Various risks such as technological and operational risks arising from distribution and transportation, especially those related to the order processing model were not explored.

Horizontal collaboration has gained attention as a new business model that can make the fresh produce sector in the supply chain and logistics more efficient, effective, and sustainable. However, there are still limitations regarding horizontal collaboration in reality at the practical level and because of the complex nature of collaboration. Previous research focused on horizontal collaboration at the strategic level only developed the strategic partnership model. As the research of (Dunning, 2016; Gichuru et al., 2015), did not evaluate performance indicators except cost savings on existing horizontal collaborations. (Beshara et al., 2012), provides an evaluation of performance indicators on horizontal collaboration. However, they did not evaluate the information sharing process, the interaction between collaborative partners, and trust management related to sharing information among collaborative partners to share the same costs. The proposes of research by considering orders at producers from suppliers, adding more than one distributor, considering the retailer's inventory model to make it three echelon supply chain models, is the possibility of future extensions of the model. It is further recommended to optimize economic order quantities to reduce costs, improve performance, and reduce waste.

Based on the discussion mentioned in the previous literature, there are seven research gaps found. The first research gap is that many previous studies did not specifically include the role of farmers as a whole system of performance along with the FPSC. Therefore, a well-defined PMS should give an insight into the contribution of individual chain partners to the performance of the entire chain (Aramyan et al., 2007; Papakiriakopoulos and Pramatar, 2010). The second gap from previous research are many performance measurement indicators are measured in a number of chain links while they are not measured in others, where the supply of chain partners, in addition to their own performance indicator devices, can also have a set of general performance indicators, which will help all chain partners compare performance in chain partners and end the supply chain performance. The multilevel CPS approach can be used (Aramyan et al., 2007; Im and Park, 2009). The third research gap from previous research only focused on optimizing CPS in the FPSC, causing gaps in the exploration of behavior and interactions among partners involved in the CPS in the FPSC. Therefore, this gap prevents a more realistic understanding of the CPS in the FPSC. Behavior and interaction among collaborative partners can greatly influence the effectiveness of the operating system's working methods and overall performance improvement (Gino and Pisano, 2008; Poltrock and Handel, 2009). The fourth research gap is the limitations regarding integrated information structures, as a basis for sharing information into CPS within the FPSC. Integration is needed to form the basis for developing decisions at every level of planning, while at each stage of the collaboration process aims to improve the visibility and accuracy of decision making. The fifth research gap is that all previous studies did not explore the integration of decision making into the model, to get better results in implementing CPS at the FPSC. Decision making distributed among collaborative partners leads to increased agility by synchronizing decisions on each collaborative partner that has the same perspective and goals (Wadhwa and Rao, 2003).

The sixth research gap is that all previous literatures did not explore and evaluate the alignment of incentives to share risks and benefits equally to all involved in the collaboration. For example, leveling incentives can be used as an instrument to motivate and encourage all collaborative partners involved in CPS at the FPSC to join collaboration by sharing costs, risks, and incentives. The final research gap is that all previous literatures explore several performance indicators to capture the benefits of CPS for FPSC on all collaborative partners. However, the previous literature did not explore and evaluate how shared values among collaborative partners, based on customer values and customer expectations, benefit from CPS at the FPSC in addition to performance metrics.

CONCLUSION

This study aims to explore the implementation of CPS in the FPSC industry as a business strategy to eliminate inefficiencies in the FPSC component. Although the interest of CPS in FPSC is increasing, several problems are unaddressed. According to 17 articles were selected, they have been reviewed and classified based on four categories. The first category is based on different collaborative level structures, namely vertical, horizontal, and lateral collaboration. The second category is the general characteristics of the underlying problem and the mechanism of collaboration, and the third category is the length of the level of collaborative planning, such as strategic, tactical, and operational levels. The last category is based on the solution technique used to solve problems derived to improve from the approach of the CPS model in the FPSC.

LIMITATION AND STUDY FORWARD

The limitations of this study only discuss the CPS related to the FPSC, it is expected that in the future the implementation of CPS in the FPSC can develop and become the basis for seeing the benefits of a collaborative performance system in the field of fresh produce that is still small applied, in improving the performance of companies and general supply chain organizations in overall performance. Based on the research gap, Limitations can be taken that many previous studies did not specifically include the role of farmers as a whole system of performance along with the FPSC. Therefore, a study forward to well-defined PMS should give an insight into the contribution of individual chain partners to the performance of the entire chain. Limitations of previous research are that many performance measurement indicators are measured in several chain links while they are not measured in others, where the supply of chain partners. Further study must also focus on their own performance indicator devices, can also have a set of general performance indicators, which will help all chain partners to compare performance in chain partners and end supply chain performance. Limitations only focused on optimizing CPS in the FPSC, causing gaps in the exploration of behavior and interactions among partners involved in the CPS in the FPSC. Therefore, this limitation prevents a more realistic understanding of the CPS in the FPSC. Behavior and interaction between collaborative partners can greatly influence the effectiveness of the operating system's working methods and overall performance improvement. The future study should also include behaviors that capture interactions among collaborative partners. Limitations in previous research regarding integrated information structures, as a basis for sharing information into CPS within the FPSC. Integration is needed to form the basis for developing decisions at every level of planning, while future study could be focused on integrating information structures into the process of collaboration and hierarchical decision making, can also be focused on the use of aligning incentives to persuade collaborative partners to behave in the best way for all by distributing equitable risks, costs, and rewards among the parties involved. Limitations in all previous studies did not explore the integration of decision making into the model, to get better results in implementing CPS at the FPSC. Decision making distributed among collaborative partners leads to increased agility by synchronizing decisions on each collaborative partner that has the same perspective and goals. The study forward should be developed at each stage of the collaboration process aims to improve the visibility and accuracy of decision making. Limitation of previous literature did not explore and evaluate how shared values among collaborative partners, based on customer values and customer expectations, benefit from CPS at the FPSC in addition to performance metrics. Future forward should focus more on the use of aligning incentives to collaborative partners so that they behave in the best way, such as in the framework of distributing equitable risks, costs, and rewards among the partners involved in the collaboration supply chain. Also, to see how useful the value of creating a joint CPS at the FPSC can be evaluated by all collaborating partners.

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