ISSN: 2513-2512
R4TLI Conference Proceedings 2016
Paper Reference: *R4TLI-D11*

Evaluation of Fresh Vegetable Supply Chain Structure and its Performance

J. R. A. Piyumali
University of Moratuwa, Sri Lanka

Pradeepa Jayaratne
University of Moratuwa, Sri Lanka

1. Introduction

The term "Supply Chain Management" (SCM) first appeared in the literature in the early 1980s. Since then SCM concepts have captured significant attention from academics and practitioners in the field [1]. In the current competitive business environment, SCM has become an important for all industries due to the increased focus on overall revenue growth and performance [2]. Supply chains are complex in nature as many partners such as producers, processors, marketers and distributors are generally involved. Increasing the number of partners along the supply chain would increase its length as well as its complexity, which ultimately reduce the efficiency. Traditionally SCM principles were mainly implemented in manufacturing sector due to the complexity of both in-bound and out-bound logistical operations. Meanwhile, Salin showed that the application of SCM practices in agricultural sector was also vital mainly due to increased awareness of issues of food quality, food safety and ethical concepts [3]. Due this fact, many food supply chains have also gone through significant structural changes over the last three decades.

A Traditional Fresh Vegetable Supply Chain (FVSC) involves in moving vegetables from farmers to consumers through many middlemen, which result in inefficiencies and quality issues along the supply chain. As a result, large-scale retailers such as supermarkets have taken initiations to purchase directly from the farmers to minimise the inefficiencies and costs as well as to maintain the quality of vegetables.

Therefore, this research focuses on how supply chain structure affects their performance. Further, the relationship between supply chain length (number of intermediaries) and its performance level is analysed.

2. Research Objective

Vegetable industry in Sri Lanka also has gone through similar structural changes over the last few decades, as many emerging retailers such as supermarkets have

implemented the direct purchasing models. Even though the direct purchasing model has been implemented widely, still there is a lack of research to determine whether this model actually helps to improve the logistics performance, especially in developing countries such as Sri Lanka. Therefore, this study aims at filling this research gap. The main objective of this research is to identify the effect of supply chain structure on the performance of both traditional and modern direct FVSCs. Accordingly, the hypotheses were developed to find the relationship between supply chain length with variables such as lead time, quality, wastage and cost for both supply chains.

3. Research Methodology

Data were collected from the main stakeholders involved in both supply chains: traditional and supermarket supply chains. For traditional supply chains, the farmers, vegetable collectors and distributors and wholesale distributors were selected randomly. The sample size was 100, representing each category equally. With respect the supermarket supply chain, in addition to the above mentioned stakeholders, the professionals who are working at supermarkets, wholesalers and collecting agents were also interviewed. From the supermarket chain, 10 were professionals and 10 were farmers (Angunakolapelassa and Embilipitiya areas) who supply vegetables for supermarkets. Five wholesalers and five collecting agents were also interviewed.

A questionnaire was developed using the existing literature review. Data were gathered using two channels: data from supermarkets were gathered from purchasing professionals in the company using an online data collection approach, while face-to-face data collection approach was used to collect the data from the farmers and the other stakeholders in the FVSC. This included wholesale distributors at Colombo Wholesale Market, Manning market, Embilipitiya Economic Centre, transport service providers as well as farmers around Embilipitiya and Angunukolapelassa areas.

4. Data Analysis

Analysis was carried out to identify the relationship between supply chain length and performance indicators which are mostly affected according to previous published research, such as total supply chain cost, lead time, transport, wastage and quality level of both traditional chain and super market chain structure. Supply chain length is measured according to the number of intermediaries involved along the chain. When there are 0-1 intermediaries, the chain is considered “short”, 2-3 as “medium” and more than 4 intermediaries would classify the chain as “long”. The relationship was analysed using Chi-Square test while the Spearman correlation test

was used to measure the correlation between supply chain length and each performance factor.

Table 1- Output from Chi-Square Analysis

Alternate Hypothesis	Pearson chi- sq value	Likelihood Ratio	D.F	Asymp Sig value (P value)	Critical value for chi- sq	Spearman correlation	Decision on Alternate Hypothesis
Traditional SC (SC Length Increase)							
1 – Cost Increase	9.334	9.229	1	0.020	3.841	0.306	Accepted
2 – Lead Time Increase	11.771	11.692	2	0.003	5.991	0.230	Accepted
3 – Wastage on transit Increase	4.340	4.331	1	0.037	3.841	0.208	Accepted
4 – Wastage at Warehouse Increase	4.027	4.236	2	0.134	5.991	-0.195	Rejected
5– Quality Reduce	8.070	8.368	2	0.018	5.991	0.276	Accepted
Super Market SC (SC Length Reduce)							
6 – Cost Reduce	11.808	13.301	1	0.010	3.841	0.627	Accepted
7- Lead Time Reduce	19.260	22.343	2	0.000	5.991	0.798	Accepted
8– Wastage Reduce	10.208	10.664	1	0.001	3.841	0.522	Accepted
9 – Quality Increase	5.926	6.035	1	0.015	3.841	0.444	Accepted

This study shows that when the partners along the supply chain is increasing the supply chain length is also increasing, resulting an increase of the total supply chain cost, lead time and wastages, while the quality reduced. Interestingly, this study shows that wastages at warehouses for traditional supply chains are rejected. This study shows due to the less number of intermediaries involved, direct purchasing supply chain structures are comparatively more efficient and effective than traditional FVSC in terms of post-harvest losses, quality of vegetable, price of vegetables and degree of transparency. It was observed that the direct model provides a win-win solution for both stakeholders: farmers and super markets.

5. Discussion and Conclusion

According to the results of this research, the traditional supply chain shows inferior performance compared to the supermarket chain, apparently due to its longer supply chain structure. Increasing the supply chain negatively affects not only the individual performance but also the overall performance of the entire supply chain. Furthermore, the analysis shows that longer the supply chain, more would be

wastage and costs. This highlights the need for more collaborative supply chain partnerships between primary producers (farmers) and retailers. Research further shows that reducing the supply chain length not only reduces wastage during transport and storage but also stimulates better collaboration among supply chain partners as they can understand each other's requirements and operations efficiently and effectively. Reducing supply chain length also helps reduce the lead time from farmer to retailer. This study indicates that it is essential to develop logistics infrastructure and network operations to reduce this lead time while creating an environment where quality is not compromised over price.

References

[1] Martha C. Cooper, Douglas M. Lambert, Janus D. Pagh, (1997) "Supply Chain Management: More Than a New Name for Logistics

[2] Chandra, K., & Kumar, S. (2000). Supply chain management in theory and practice

[3] Salin (1998), Food quality and environmental issues impact Agri-food supply chain

Keywords: *Logistics performance, supply chain length, food supply chain, supply chain structure*