Supply Chain Optimization as a Tool for Fresh Fruits and Vegetables Social Sustainability

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Abstract

In south India Karnataka state is the seventh largest in terms of populations the demand for fruits and vegetables are in reasonable quantity. But the price of the products and freshness of the products are not up to the expected standard by the customers and the products are perishable in nature. If we have the effective supply chain practices with less no of intermediaries the products will reach to customer soon and the cost will also reduce. To address this problem the sample of 385 fruits and vegetable sellers was selected and the data was collected using the questionnaire and data was analyzed and interpreted using statistical tools such as Chi – Square and factor analysis, and the results are presented in the report for the further study.

Key Words: Supply Chain Optimization, Social Sustainability, Intermediaries, Perishability

1. Introduction

In Karnataka, a state in southern India is the 7th largest state in terms of area and 8th largest in terms of population. It comprises of 30 districts. The State is known to have a population density of 319 per Sq. Km. The state's capital city is Bangalore. In Bangalore we have lot of demand for fresh fruits and vegetables and we have lot of organization or retails shops to distributors the fresh fruits and vegetables in the Bangalore market. Supply-chain optimization is the application of processes and tools to ensure the optimal operation of a manufacturing and distribution supply chain. This includes the optimal placement of inventory within the supply chain, minimizing

operating costs (including manufacturing costs, transportation costs, and distribution costs).

2. Review of Literature

To validate the study the following reviews were done and the reviews are presented in the report.

Wladimir et al. (2015) stated that the fresh fruit and vegetables supply chain is characterized by long supply lead times combined with significant supply and demand uncertainties, and relatively thin margins. Rais and Sheoran (2015) studied the drawbacks of the current supply chain are high level of wastage, quality degradation, poor infrastructural facilities and high cost. Government and private operators have to join hands to improve the physical infrastructure, information sharing and the service required for quality improvement of the supply chain. Robert et al. (2014) explored the outlines current approaches to postharvest handling, describes progress toward a more integrated approach to postharvest research, emphasizes the importance of a systems approach, and illustrates continuing challenges in postharvest handling amenable to systems solutions.

Oliveira et al. (2015) Identified in his study the effect of modified atmosphere packaging on the survival and growth of food borne pathogens on fresh-cut fruits and vegetables. Substantial technological advances have been made in this area, mainly in improving the quality and shelf-life of minimally processed products. Cecilia et al. (2013) Stated that the variable pre-cooling at the centre of pallets resulted in physically invisible uneven the shelf life using simple temperature measurements much waste can be avoided during first expiring first out. Dilupa et al.(2015) found that the pragmatic approach for supporting logistics and supply chain practitioners in fresh food industry in making important decisions on the arrangements and procedures related to the transportation of multiple fresh food products to a warehouse from multiple farms in a cost-effective way without compromising product quality.

Kalidas et al.(2016) Stated in the paper that there is a gargantuan waste during post-harvest storage and handling due to improper bagging without crating, lack of temperature controlled vehicles, no cold chain facilities for preserving the produce, coupled with significant processing of the agricultural produce resulting in enormous losses to the nation. Mowat and Collins (2015) Studied that the Assessing and modelling consumer response to product quality provides information that demonstrates to supply chain stakeholders how better product quality

management can improve the performance of the whole chain. Carbone (2018) Found that the role of farmers with in the different chains, as these are usually strongly rooted in the place of origin but the weakest knots in the chain in terms of bargaining power. Vertical and horizontal coordination, together with collective actions, are essential for an effective alignment of the production process that can enhance quality and create/distribute value.

Etemadniaa et al. (2015) Explored that the wholesale facility locations in food supply chain systems on a national scale to facilitate the efficient transfer of food from production regions to consumption locations. It designs an optimal national wholesale or hub location network to serve food consumption markets through efficient connections with production sites. Yang et al. (2017) studied the degradation process of perishable food and determine the optimal temperature of the cold chain as well as the optimal price to maximize the channel profit. Optimal price with a certain temperature and develop an efficient search algorithm to find the optimal temperature.

3. Objectives

- To study on optimization approach for managing fresh fruits and vegetables quality through supply chain to increase the performance efficiency
- To examine the factors influencing the buyers to buy from the fresh fruit and
- Vegetable seller
- To analyse the relationship between Satisfaction in terms of benefits and Quality control measures among the fruits and vegetable sellers

3.1 Hypothesis

H_1 - There is no association between the organization and Reasons for choosing products from sellers' dimensions

H_2 - There is no significant relationship between the factors influencing the purchase and the reason for choosing products from sellers.

3.2 Methodology

The study is descriptive in nature. Primary data were collected by distributing questionnaire to vegetable and fruit seller in Karnataka. Around 420 copies of questionnaires were distributed and 395 copies were returned. With the exclusion of 10 copies that are invalid and finally 385 were

taken for the study. The study applied simple random techniques under probability method for selecting the sample. To accomplish the research objectives, various statistical tools employed for analysis.

4. Data Analysis and Interpretation

4.1 Chi – Square Analysis

There is association between the organization and Reasons for choosing products from sellers dimensions

Table 1: Result of Chi-Square Test

S.No	Dimensions	Chi-Square	df	Sig.
1.	Delivery	20.160	4	0.000
2.	Goodwill	121.909	4	0.000
3.	Save time	43.447	4	0.000
4.	Easy to access	50.345	4	0.000
5.	Verity	205.317	8	0.000
6.	Good quality	65.571	4	0.000
7.	Less price	50.477	4	0.000
8.	Better packing	398.448	8	0.000
9.	Better services	82.479	4	0.000
10.	Products Availability	63.263	4	0.000
11.	Discount	146.246	4	0.000
12.	Fresh & New Stocks	132.068	4	0.000

*significant at 0.05 % level

The table shows that Among the 12 dependent factors relating to organization and Reasons for choosing products from sellers dimensions, all the factors shows a significant relationship with organization of the respondents, since their significance value is less than 'P' value (0.05%). Hence the null hypothesis is rejected, which means there is a significant relationship between Organization and Reasons for choosing products from sellers dimensions.

4.2 Factor Analysis

The individual statements on Reasons for choosing products from sellers was examined using factor analysis based on 14 individual statements and the reliability of the samples collected was

tested for internal consistency of the grouping of the items

Table 2: KMO and Bartlett's Test - Reasons for choosing products

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.539
Bartlett's Test of Sphericity	Approx. Chi-Square	1738.086
	Df	66
	Sig.	.000

KMO measure of sampling adequacy is an index to examine the appropriateness of factor analysis. High values between 0.5 and 1.0 indicate factor analysis is appropriate. Values below imply that factor analysis may not be appropriate. From the above table it is seen that Kaiser – Meyer – Olkin measure of sampling adequacy index is 0.0.539 and hence the factor analysis is appropriate for the given data set. Bartlett's Test of Sphericity is used to examine the hypothesis that the variables are uncorrelated. It is based on chi- Square transformation of the determinant of correlation matrix. A large value of the test statistic will favor the rejection of the null hypothesis. In turn this would indicate that factor analysis is appropriate. Bartlett's test of Sphericity Chi-square statistics is 1738.086, that shows the 4 statements are correlated and hence as inferred in KMO, factor analysis is appropriate for the given data set.

Table3: Total Variance Explained

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.179	26.490	26.490	3.179	26.490	26.490	2.884	24.036	24.036
2	1.870	15.582	42.072	1.870	15.582	42.072	1.988	16.569	40.605
3	1.657	13.805	55.877	1.657	13.805	55.877	1.662	13.848	54.453
4	1.483	12.361	68.238	1.483	12.361	68.238	1.654	13.785	68.238
5	.981	8.174	76.411	-	-	-	-	-	-
6	.717	5.975	82.387	-	-	-	-	-	-
7	.671	5.592	87.978	-	-	-	-	-	-
8	.398	3.319	91.297	-	-	-	-	-	-
9	.379	3.157	94.455	-	-	-	-	-	-
10	.273	2.274	96.729	-	-	-	-	-	-
11	.247	2.055	98.784	-	-	-	-	-	-
12	.146	1.216	100.000	-	-	-	-	-	-

Extraction Method: Principal Component Analysis.

Eigen Value represents the total variance explained by each factor. Percentage of the total variance attributed to each factor. All the 12 statements which is used for the study is now

reduced and grouped into 4 components which has similarity. Out of 4 components generated, Component 1 contributed 24.036 %, component 2 contributed 40.605%, component 3 contributed 54.453 and component 4 contributed 68.238.

Table 4: - Rotated Component Matrix (a)

	Component			
	1	2		
Delivery	**0.019**	**-0.117**	**0.826**	-0.154
Goodwill	0.760	-0.112	0.253	0.138
Save time	0.074	0.090	0.776	0.136
Easy to access	**0.201**	**0.802**	0.114	0.065
Verity	0.077	-0.393	0.317	0.076
Good quality	0.770	0.225	0.176	0.011
Less price	-0.322	0.332	0.259	0.771
Better packing	**0.799**	-0.052	-0.265	0.109
Better services	**0.299**	**-0.067**	**-0.155**	**0.838**
Products Availability	0.364	0.768	-0.065	0.242
Discount	0.359	-0.556	0.045	0.463
Fresh & New Stocks	0.754	0.301	0.029	-0.034

Extraction Method: Principal Component Analysis

Rotation Method: **Varimax with Kaiser Normalization**.

a. Rotation converged in 3 iterations.

Interpretation of factors is facilitated by identifying the statements that have large loadings in the same factor. The factor can be interpreted in terms of the statement that loads high on it. The table shows the factors of a study on factors influencing the Reasons for choosing products from sellers variable comprises of 14 individual statements. Out of 12 statements, 4 individual statements contribute more towards the study (68.238%).

The statements are

- ➢ Delivery
- ➢ Easy to access
- ➢ Better packing
- ➢ Better services
- ➢ Good quality

5. Conclusion

Supply Chain Management is being practiced in many organizations as a tool to leverage their overall performance. It is also helpful to increase the profit by minimizing the cost and to satisfy the end-customer.

The objective are been meat which shows that to propose an efficient supply chain model for Sellers to increase the performance efficiency, To study the demographic profile of the respondents & its impact on Supply chain Practices in Sellers, To examine the factors influencing the buyers to buy specifically from Sellers, To know the relationship between Satisfaction in terms of benefits & Quality control measures by the Sellers.

The undertaken study was successful in completing all the aims that were taken into consideration by providing the review result and making effective recommendation that would provide more light to the topic and benefit the entire study in the future.

Optimizing the Supply Chain with extended visibility is one of the most important in the world of fresh fruits and vegetables, and is considered as the highest level of integration in Food products, logistics, relocation and consolidation of the world Fruits and vegetables industry. Clearly, an optimized supply chain in the Fruits and vegetables industry is tightly connected with the role defined by the decision making, scheduling, planning, Fruits and vegetables markets etc in the Fruits and vegetables supply chain.

In this paper, the challenges to the supply chain in the Fruits and vegetables industry are analyzed; The application of supply chain to improve Fruits and vegetables industry and expand visibility across the supply chain for each participant in the Fruits and vegetables industry is discussed. As a result, we propose the future development of the supply chain in Fruits and vegetables industry, and develop an optimized supply chain and a win-win path for the participants across the chain. an optimized supply chain will provide a win-win situation for each participant across the Fruits and vegetables industry in supply chain, and Fruits and vegetables industry will obtain wide benefits and profits from their optimized, value-added supply chain.

Recommendations

The Sellers can implement the **D – Quality Survey** for the forming land and also for the fresh fruits and vegetables, by doing this survey the Sellers can reduce the time period to deliver the fresh fruits and vegetables to the end of the customer.

➢ It is recommended to cover the 64% of other retail outlet and private company. Whereas Sellers has about 36% as Sellers Retail and private company.

➢ It is good to have that 53% of people are Fruits from Sellers outlet.

➢ Whereas Sellers can also increase their percentages sell both fruits and vegetables in the Market.

➢ It is recommended to cover the 62% of population to buy the fruits and vegetables from the Sellers daily.

➢ Whereas sellers has about 38% population are buying fruits and vegetables daily.

➢ Yes, it's good to have that 37% of population is buying 5 to 10 tons of fruits and vegetables from sellers. But they can take a step to increase the buying percentage.

➢ It's very good that 72% of the population is "Yes" that the Sellers offers greater benefits then others sources of supply of fruits and vegetables to the customer. Even they can make it 100%.

➢ Its good have 100% for the process of treating the excess of fruits and vegetables. Whereas in private company and sellers retail outlet has 92%.

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