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Supply Chain Performance of Processed Fruit Products in Some Fruit Processing Units

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Abstract:
The present study was undertaken mainly to measure the supply chain performance of different processed fruit products in Allahabad district of Uttar Pradesh. Five fruit processing units which were the only functioning units were selected. Products for which supply chains studied were: (i) tomato ketchup (ii) mixed fruit jam (iii) mixed pickle (iv) lemon squash and (v) jelly. The supply chains in all companies studied had only three participants viz. supplier, manufacturing unit and retailer. Important findings were: (i) The business cycle had a time period ranging from 107 days to 124 days; (ii) On time delivery average was 90%; (iii) Customer satisfaction average was 88%; (iv) Range of efficiency for tomato ketchup, mixed fruit jam, mixed pickle, lemon squash and jelly were: 1.181 to 1.245, 1.163 to 1.185, 1.153 to 1.215, 1.189 to 1.230 and 1.145 to 1.160 respectively. None of the companies had backward, forward or vertical integration. There was no third party outsourcing for inventory management, distribution and logistics. Innovative infrastructural aspects like cross functional teams, partnerships, highly advanced information systems and cross-docking hardly existed. Ample scope for improving the performance of the supply chains in the fruit processing industries has been noticed.

1. Introduction

Chopra and Miendl (2004) has stated that the term "Supply Chain" conjures up images of products or supply moving from suppliers to manufacturers to distributors to retailers to customers along a chain. Supply Chain Management (SCM) has emerged as one of the crucial components of the newest of competitive strategic models as a result of the increase in competitive pressure in the business environment. Fearne (1996) states that SCM seeks to breach down the barriers existing between the various linkages of the supply chain to achieve higher savings for all channel members.

In the companies as well as producers involved in highly perishable products such as fruits and vegetables, SCM can stabilize returns and prices and can create economies of scale needed for successful horticultural marketing. In the national economy of countries, like India, which are large producers of fruits, the SCM of fruit processing plants is of great importance. Fruits serve the natural source of vitamins and minerals. Data about the various aspects of the existing supply chains in these industries can help in making appropriate recommendations for improvements where necessary. The present study was undertaken with the objective to measure the supply chain performance of the common processed fruit products in the food processing industries of Allahabad district. Uttar Pradesh, India.

2. Materials and Methods

All the five fruit processing units, which were functioning in Allahabad district were selected. The products which were chosen included (i) Tomato Ketchup, (ii) Mixed Fruit Jam, (iii) Mixed Pickle, (iv) Lemon Squash and (v) Jelly. The supply chain functionaries studied included suppliers, manufacturers and retailers (wholesalers did not exist for any of the products). Out of the 20 suppliers that existed, every second was selected, thus the survey included 10 (50%) of them. All five retailers which were situated in different localities of the district formed the study sample. In order to find out the customer satisfaction, the sample selected were the first 150 customers who visited these retailers' sites. Thus the customers came from different localities of the district.

A structured survey schedule was used in order to collect data by personal interviews from different levels of the supply chain. Measurement of customer satisfaction was done on a 5 point scale i.e. Greatly exceeded expectations-5, Exceeded expectations-4, Expectations just met-3, Did not meet expectations-2, Greatly disappointed-1. Various costs at the different levels of supply chain for each product were calculated. The supply chain performance and supply chain efficiency were computed by the method of Schroeder (2003). The components taken into consideration for the performance included (i) business cycle time in terms of a)

inventory in days and b) Accounts receivable in days, (ii) On time delivery %, (iii) customer satisfaction %, (iv) purchase cost as % of sales and (v) added cost as % of sales. The formula for efficiency was the following:
Sales at retailer level- purchase cost at supplier level
Added cost at each level of the supply chain

3. Results And Discussion

The supply chains of all the fruit processing units were simple having only four levels viz. suppliers, manufacturers, retailers and customers.

Product-wise supply chain performance of the five fruit processing units/companies (C1, C2, C3, C4 and C5) is depicted in Table 1.

For all the five products each of the five companies reported same business cycle time i,e. the total of inventory (days) and accounts receivable. The mean of business cycle was 111 days with a standard deviation of 6.51.

At the levels of supplier, manufacturer and retailer the percent delivery on time for each product was reported to be identical i.e. 85%, 90% and 95% respectively. Thus the on time delivery % on an average for all the products was 90%.

Response of the 150 customers on the 5 point scale of quality of the products revealed that all the customers met their expectations, as the scores allotted by all of them ranged from 3 to 5. At the levels of supplier, manufacturer and retailer the percent customer satisfaction fell between 80 to 90%.

In terms of percent of sales, the purchase cost of the five products at the supplier level ranged from 52.2 to 68%, at manufacturer level 20 to 33.3% and at retailer level 88.5 to 95.6%. For individual product and company the exact percent may be noted in table 1.

The added cost at supplier level formed 14.3 to 27.8% of the sales whereas at manufacturer level the same formed 61.1% to 72.3% and at retailer level 2.5% to 4.5%. Company-wise and product-wise there was wide variation (Table 1).

At the manufacturer level the added cost is relatively high which can be attributed to the higher labor cost, distribution cost, inventory carrying cost and other overhead costs that are higher at the manufacturing units, in comparison to supplier and retailer level. The reverse can be observed about the retailer level which shows higher purchase cost and lower added cost.

The supply chain of tomato ketchup pertaining to company No.1 was found having highest efficiency, with the efficiency (total) value of 1.245. Others were in the range of 1.145 to 1.215. At the three different levels of the supply chain too, viz. supplier, manufacturer and retailer, there was variation in the efficiency values. The results are depicted in the form of figures (Fig. 1 to 5).

Statistical analysis revealed that supply chain costs significantly influenced the supply chains of three products, viz. tomato ketchup, mixed fruit jam and mixed pickle. The calculated F values were 121.84, 10.11 and 5.86 respectively.

The authors are of the view that the supply chain performance / efficiency can be improved if the findings of recent managerial and scientific researches are applied by the participants of the supply chain. Coordination among the participants of the supply chains studied was found to be very limited. Also in terms of infrastructure, equipments and communication systems etc. very little of the modern advances were found adopted. Fearne (1996) has stated that supply chain partnerships are based on interdependence, trust and open communication and mutual benefits. Managing a supply chain requires an integral approach in which chain partners jointly plan and control the flow of foods, information, technology and capital from farm to fork; meaning from the core suppliers of raw materials to the final consumers and vice versa.

Hamdar (1999) has reported that Conserves Chtaura (CMC) of Lebanon is tackling the challenges of increased competition in the Lebanese food industry by re-structuring its supply chain to improve links with farmers and raise quality standards as the Lebanon enters a new era of food processing. He has stated that the continuous globalization of food markets will necessitate the elimination of all subsidies and import control policies currently operated by the Lebanese government. Food processing will be transformed by a much higher degree of complementarily with the farming industry, through vertical alliances and with retail industry through improved SCM. By using examples from the US fruit industries, Ricks et al (2000) have discussed how SCM can lead to performance, enhancing industry efforts that can improve the overall competitiveness and economic viability of these industries. Emphasis has been given to promotion and advertising, export expansion and market research on customer needs and preferences. Hewett et al (2004) expressed the critical importance of all the parties involved in the production, packaging, storage, transport, distribution and marketing of fruits and vegetables in doing everything correctly in the chain from farm to plate. SCM has become a key business process for adopting key principles of developing strategic alliances, optimizing organizational structure, developing the human resource to enhance the corporate vision and commitment to excellence and continually improving tools available in information technology. Concerned organizations need to try applying these principles to the fruit and vegetable industry that tends to be characterized by large numbers of small growers in dispersed locations with disparate products of variable quality. Hamprecht et al (2005) recommended that the economic, social and environmental performance of the SCM must be controlled in order to control the sustainability of agricultural inputs to the food industry. This is important because of the depletion of arable land and a growing world population.

4. Literature Cited

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5. Acknowledgements

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Encl : one Table and five graphs

S.No.		Measures				Suppliers			Manufacturing Units				Retailers			
		C_1	C_2	C_3	C_4	C_5	C_1	C_2	C_3	C_4	C_5	C_1	C_2	C_3	C_4	C_5
1	Inv	2.0	3.0	3.0	3.0	2.0	12.0	10.0	10.0	10.0	10.0	30.0	20.0	20.0	20.0	20.0
2	A/c rec	20.0	20.0	20.0	20.0	20.0	30.0	25.0	25.0	25.0	25.0	30.0	30.0	30.0	30.0	30.0
3	O.t .d. (%)	85.0	85.0	85.0	85.0	85.0	90.0	90.0	90.0	90.0	90.0	95.0	95.0	95.0	95.0	95.0
4	C.S. (%)	90.0	80.0	80.0	80.0	80.0	85.0	80.0	80.0	80.0	80.0	90.0	90.0	90.0	90.0	90.0
5	P.C. (%)															
	Tom ket	52.2	62.5	68.0	-	-	31.9	32.0	31.2	-	-	92.4	93.7	91.0	-	-
	Mix fr jam	62.6	65.0	-	66.6	-	25.4	30.3	-	32.4	-	92.7	92.4	-	92.6	-
	Mix pick	53.8	66.6	-	66.7	-	20.0	33.3	-	30.4	-	95.6	94.8	-	90.8	-
	Lemon sq	57.8	-	-	-	66.7	25.3	-	-	-	30.4	93.7	-	-	-	88.5
	jelly	55.5	61.1	-	-	-	26.1	25.7	-	-	-	92.0	94.6	-	-	-
6	A.C. (%)															
	Tom ket	26.1	20.8	20.0	-	-	61.1	64.0	63.7	-	-	3.8	2.5	4.5	-	-
	Mix fr jam	18.7	20.0	-	16.7	-	69.8	65.1	-	63.5	-	2.9	2.8	-	3.7	-
	Mix pick	23.1	16.7	-	14.3	-	72.3	63.9	-	65.2	-	2.9	2.6	-	3.9	-
	Lemon sq	21.1	-	-	-	19.0	-	69.3	-	-	65.2	2.5	-	-	-	3.8
	jelly	27.8	22.2	-	-	-	69.6	70.0	-	-	-	4.0	2.7	-	-	-
7	P.C. + A.C. (%)															
	Tom ket	78.3	83.3	88.0	-	-	93.0	96.0	95.0	-	-	96.2	96.2	95.5	-	-
	Mix fr jam	81.2	85.0	-	83.3	-	95.2	95.4	-	95.9	-	95.5	97.1	-	96.2	-
	Mix pick	76.9	83.3	-	80.9	-	92.3	97.2	-	95.6	-	98.5	97.4	-	94.7	-
	Lemon sq	78.9	-	-	-	85.7	94.7	-	-	-	95.6	96.2	-	-	-	92.3
	jelly	83.3	83.3	-	-	-	95.6	95.7	-	-	-	96.0	97.3	-	-	-

Table 1: Supply Chain Performance of Processed Fruit Products in Allahabad (N=5)

Inv= Inventory in days, A/c rec= Accounts receivable in days, O.t.d. (%)= On time delivery %, c.s. (%)= cu satisfaction%, P.C. (%)= Purchase Cost (% of sales) , A.C. (%) = Added Cost (% of sales), Tom ket=Tomato ketch fr jam=Mixed fruit jam, Mix pick= Mixed pickle, Lemon sq= Lemon squash

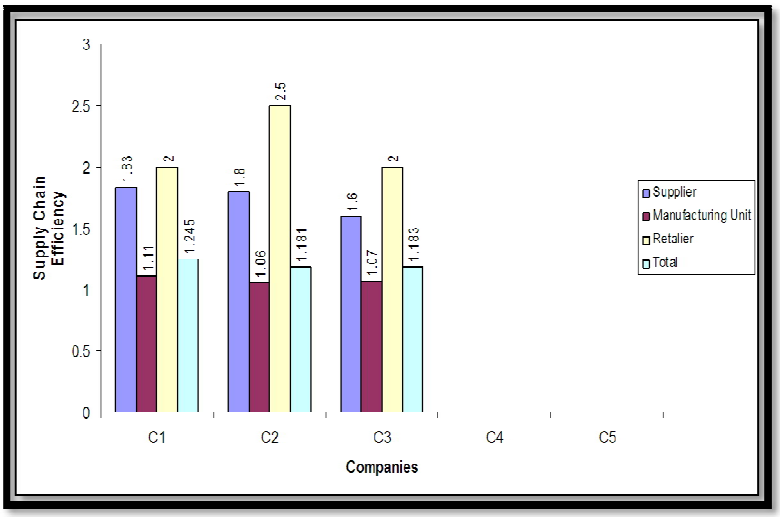

Figure 1: Supply Chain Efficiency of Tomato Ketchup

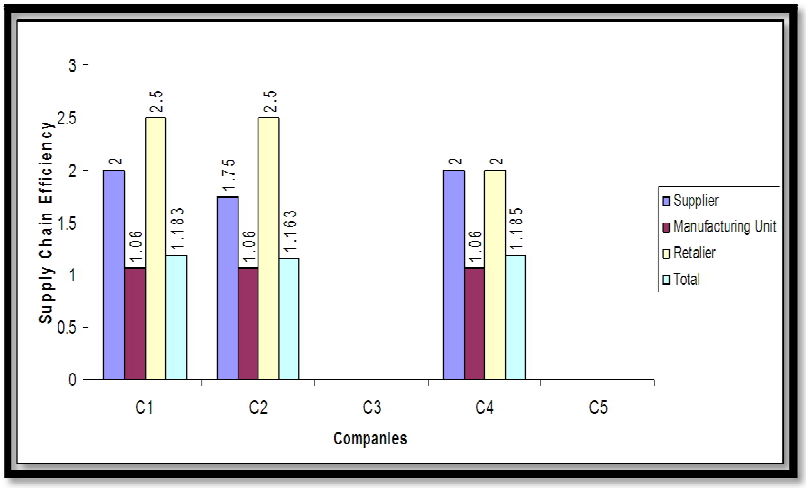

Figure 2: Supply Chain Efficiency of Mixed Fruit Jam

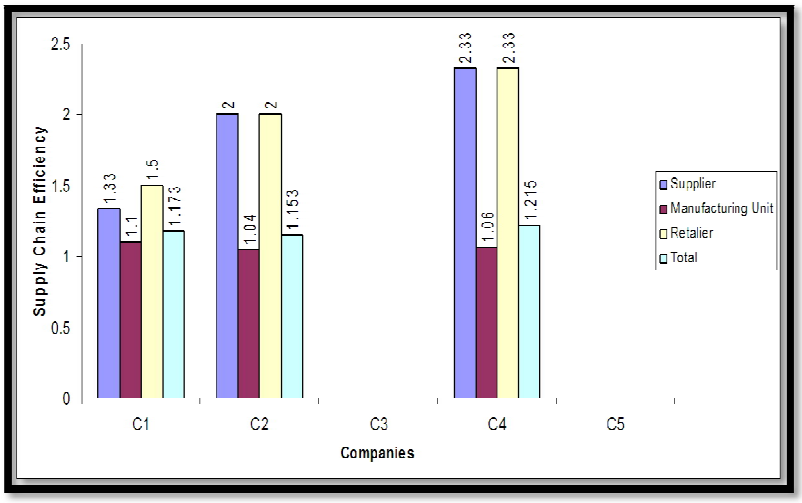

Figure 3: Supply Chain Efficiency of Mixed Pickle

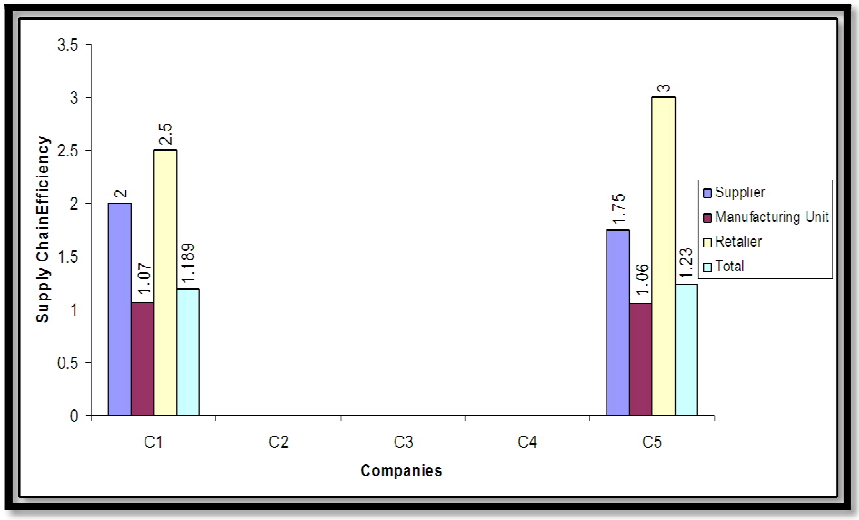

Figure 4: Supply Chain Efficiency of Lemon Squash

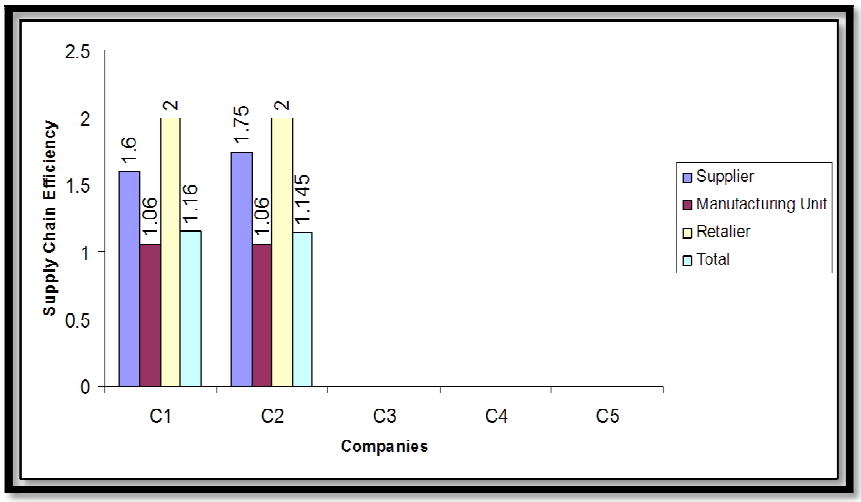

Figure 5: Supply Chain Efficiency of Jelly