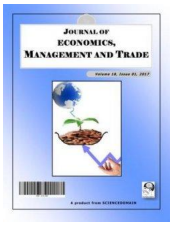

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A Study of Supply Chain and Estimation of Post-Harvest Losses in Banana in Middle Gujarat

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Authors' contributions

The work was carried out in collaboration between all authors. Author SM is the main author of this work. She along with author RS designed this study. Authors SM, AM and JS have done survey and analysis. Author Snehal Mishra wrote the draft of the manuscript. Author YAL managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The present study has examined the marketing efficiency and price spread of different existing channels and Post-harvest losses in Banana. The shortest route to customers i.e. Channel IV was the most efficient channel. Channel III was less efficient than other channels as the marketing costs involved in this channel was higher. Channel I and II were mostly used for marketing of produce to local and distant markets. Marketing efficiency is inversely proportional to price spread. Since the price spread is lowest in case of Channel IV, marketing efficiency is highest (1.37). The next efficient channel is Channel I (0.93). As the number of intermediaries increases the channel becomes less efficient. To increase the efficiency the producer should be able to contact customers directly. PHL is a matter of grave concern. It was found that PHL was higher at wholesaler level (7.23 percent) followed at producer's level (6.59 percent) and then at retailer's level (4.41 percent). Creation of cold storage structures, the establishment of ripening centres and processing units, providing refrigerated trucks for long distance transportation etc. are required to strengthen the supply chain of Banana.

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Keywords: Post-harvest loss; market efficiency; price spread; supply chain; channels.

1. INTRODUCTION

Banana is one of the oldest and a very popular fruit of India due to its nutritious properties and its round the year availability. It is rich in carbohydrates, calcium, potassium, magnesium, phosphorus and sodium. It can be used both as a fruit and as a vegetable (raw banana). Apart from the fruit, its pseudostem is also used as a vegetable. Leaves of this plant are used as a plate. This word banana has been derived from the Arabic word 'Banan', and its scientific names are *Musa acuminata* and *Musa paradisiacal.*

Banana is cultivated in an area of 860 thousand ha with a total production of 30477 thousand MT. It is an important tropical and sub-tropical crop [1,2]. The global production of Banana is around 102028.17 thousand tons. India's share in world production is 29.19 percent. Total fruit production in Gujarat is 9026.79 thousand MT from 415.34 thousand hectare area [1]. Main banana growing states are Tamil Nadu, Maharashtra, Gujarat, Andhra Pradesh and Karnataka.

Being perishable in nature, the post-harvest loss is a matter of grave concern in fruit crops specially banana. Long distance transportation, lack of cold storage facilities and ripening centres etc. result in increase in losses. The prices fluctuate frequently hampering the efforts of growers. In this backdrop, the study was conducted with the following objectives:-

1. To investigate the existing supply chain and existing market infrastructure of Banana
2. To examine the efficient marketing channel and price spread of Banana
3. To identify the post-harvest losses in existing marketing channels of Banana

1.1 Research Methodology

i. **Sampling unit:** Farmers, Commission agents and Traders
ii. **Sample size:** 120 farmers, 20 commission agents, 20 traders
iii. **Sampling method :** Non-probability sampling
iv. **Sampling technique:** Purposive Sampling
v. **Research approach:** Survey
vi. **Research instrument :** Schedules
vii. **Area of survey:** Middle Gujarat (Anand, Vadodara and Chota Udaipur)

1.2 Analytical Tools

* To work out the marketing efficiency* of Banana, Acharya method was used. The marketing cost was estimated by using following formula:

$C = C_f + C_{m1} + C_{m2} + C_{m3} + \ldots\ldots\ldots\ldots\ldots + C_{mi}$

where,

C = total cost of marketing of the commodity;
C_f = cost paid by the producer from the time the produce leaves the farm till sells and
C_{mi} = cost incurred by the i^{th} middleman in the process of buying and selling of the product

Marketing Efficiency [3]= $\frac{NP_F}{MC+MM}$

where,

NP_F = Net price received by farmer
MC = Total marketing cost
†**MM = Total marketing margin

2. RESULTS

Table 1. Number of cold storage structures present in middle Gujarat

Districts	Private	Public	Total
Ahmedabad	32	2	**34**
Kheda	70	3	**73**
Panchmahal	0	1	**1**
Vadodara	18	2	**20**
Total	**120**	**8**	**128**

Source- www.agriexchange.apeda.gov.in

** Marketing Efficiency-The extent of marketing efficiency depends on the market structure, market conduct and market performance. Marketing efficiency is determined by two factors - economic efficiency and technical efficiency. Economic efficiency deals with matters related to trading or pricing to enhance the degree of competition. Technical efficiency on the other tries to apply the least cost input combination. There are two criteria to measure marketing efficiency. One is price spread and the other is market integration.*

*† **Marketing Margin- The difference between the price paid by consumer and the price received by the producer for an equivalent amount of farm produce. Sometimes it is also termed as price spread. (Acharya, 2011).*

Marketing Channels

Table 2. Marketing channels of banana in middle Gujarat

Channel no.	Channels
Channel I	Producer-Wholesaler-Retailer-Consumer (Short distant market)
Channel II	Producer- Commission Agent- Wholesaler-Retailer-Consumer (Long distant market)
Channel III	Producer-Exporter-Consumer
Channel IV	Producer- Retailer- Consumer

Marketing Efficiency

Table 3. Marketing costs, margins and price spread for banana

Marketing cost (Rs/qtl)	Marketing channels of banana			
	Channel-I	**Channel-II**	**Channel-III**	**Channel-IV**
Net price received by the producer	998.07	1112.57	1411.50	719.07
i) Labour cost	24.93	24.93	30.00	24.93
ii) Commission	0.00	25.00	-	-
iii) Post Harvest Loss	77.00	87.50	108.50	56.00
Total (i to iv)	101.93	137.43	138.50	80.93
Commission agents price	1100.00	1250.00	-	-
Cost incurred by the commission agent				
Commission agents margin	0.00	62.50	-	-
Wholesaler cum processor price	1100.00	1312.50	-	-
Cost incurred by the wholesaler cum processor				
i) Transportation	33.33	45.00	-	-
ii) Loading & Cleaning	46.66	25.00	-	-
iii) Packing material	19.56	28.67	-	-
iv) Labour cost	0.00	10.00	-	-
V) Processing	66.66	66.66	-	-
vi) Post Harvest Loss	107.52	134.54	-	-
Total (i to vi)	273.73	309.87	-	-
Wholesaler cum processor margin	275.00	328.13	-	-
Retailers price	1648.73	1950.50	-	800.00
Cost incurred by the retailer				
i) Transportation	55.00	55.00	-	55.00
ii) Packing material	0.00	0.00	-	15.00
iii) Post Harvest Loss	65.92	80.00	-	32.00
Total (i to iii)	120.92	135.00	-	102.00
Retailers margin	412.18	487.62	-	400.00
Exporters Price	-	-	1550.00	-
Cost incurred by the exporter				
i) Cleaning /Grading/Packing	-	-	200.00	-
ii) Packing material	-	-	500.00	-
iii) Processing	-	-	200.00	-
iv) Transportation	-	-	800.00	-
v) Commission	-	-	100.00	-
vi) Labour Cost	-	-	400.00	-
vii) Post Harvest Loss	-	-	200.65	-
Total (i to vii)	-	-	2400.65	-
Exporters margin	-	-	775.00	-
Consumers price	**2181.83**	**2573.12**	**4725.65**	**1302.00**
Total marketing cost	**496.58**	**582.30**	**2539.15**	**182.93**

Marketing cost (Rs/qtl)	Marketing channels of banana			
	Channel-I	Channel-II	Channel-III	Channel-IV
Total marketing margin	**687.18**	**878.25**	**775.00**	**400.00**
Price Spread	**1183.76**	**1460.55**	**3314.15**	**582.93**
Producer's Share in Consumer's Rupee	**0.46**	**0.43**	**0.30**	**0.55**
Marketing efficiency (Acharya's Method)	**0.93**	**0.86**	**0.47**	**1.37**

Source- Author's Calculation

Post-Harvest Loss of Banana

Table 4. Post harvest loss in marketing of banana

Stages of handling	PHL (%)	Major causes/Reasons of PHL
Field/Producer level	6.59	Harvesting injury, Immature and small fruits, Black spot due to latex, Cracks
Wholesaler level	7.23	Press damage, Separated bananas, Mechanical injury, Rotten fruits
Retail level	4.41	Overripe fruits, Crushed fruits

Source- Primary survey

3. DISCUSSION

In Gujarat there are 753 cold storages with a capacity of 2875713 MT. In Middle Gujarat the list of cold storages are presented in Table 1.

3.1 Marketing Channels

Banana is marketed through four different channels consisting of commission agents, wholesaler, retailer, exporter as intermediaries. The four channels being identified for marketing of banana in the study area is illustrated in table 2. The most commonly used channels were Channel I and II [4]. 90 percent of the produce was disposed of through these channels. It needs to be mentioned that the commission agents play a very crucial role in the marketing of banana. They are spread throughout the area for both the local and distant markets. Large volume of produce which is marketed to consumer is via commission agents. The number of exporters and processors in banana marketing channels were less in number in the selected study area [5]. The direct route (Channel IV) from producer to consumer via retailer exists mainly for B grade banana as these are highly perishable in nature. For A grade of banana Channel II is more prevalent as good quality of banana are transported to long distant markets like Delhi, Punjab, Rajasthan, MP etc. Channel I, from producer to consumer via wholesaler and retailer, is prevalent in short distance market (like within the state).

3.2 Marketing Efficiency

The estimation of marketing costs, marketing margin, post-harvest losses and marketing efficiency are presented in table no. 3. It is observed that the most efficient is channel IV although small volume of produce is transferred through this smallest channel. The marketing cost is Rs.182.93 per quintal which is lowest as compared to other channels. The producer's share in consumer rupee is highest (55 percent) in this channel as the number of intermediaries involved is less. More the number of intermediaries less will be the share of the producer in consumer's rupee and thus the efficiency of the channel will also be less. This channel is not that much prevalent because the price received by the farmer is less.

Under Channel I the marketing costs incurred by different intermediaries viz. sample farmers, wholesaler and retailer were: Rs.101.93/q, Rs.273.73/q and Rs.120.92/q respectively. The marketing margins charged by wholesaler and retailer are Rs.275/q and Rs.412/q respectively. Channel II is mostly used for long distance marketing and it includes commission agent also. The marketing costs incurred by different intermediaries were producer (Rs/q 137.43), wholesaler (Rs/q 309.87) and retailer (Rs.135.00). The marketing margins charged by commission agent was (Rs/q 62.50), wholesaler (Rs/q 328.13) and retailer (Rs/q 487.62). The share of wholesaler in consumer's rupee was 51 percent, retailer's share was 75.80 percent. In channel I wholesaler' share in consumer rupee was 50.42 percent whereas retailer's share was 75.57 percent. In Channel III (Producer-Exporter-Consumer) the marketing costs incurred by producer was Rs/q 138.50 and exporter was Rs/q 2400 with marketing margin of Rs/q 775.00.

The marketing cost is highest as exporter charges a higher margin. The maximum expenditure is on transportation which accounts for 16.93 percent of share in consumer's rupee. The share of exporter in consumer's rupee is 32.80 percent. The lower percentage share is due to higher marketing costs.

Marketing efficiency is inversely proportional to price spread. Since the price spread (Rs.582.93) is lowest in case of Channel IV, marketing efficiency is highest (1.37). The next efficient channel is Channel I (0.93). This channel deals with marketing of produce in nearby areas. It does not include commission agent. Since the area is nearby so farmers directly sell their produce to the wholesaler. The producer's share in consumer's rupee was 50.41 percent. In Channel II, due to the existence of commission agent, its marketing efficiency is 0.86 as the price spread (Rs.1460.55**)** was more than Channel I. In Channel III marketing efficiency is lowest (0.47) due to high marketing costs and margins. The producer's share in consumer's rupee was found to be 32.79 percent. Since the produce is marketed to distant places, exporters paid due care towards the packing of the produce and spent more money (14.81 percent of consumer's rupee) than other channels to prevent damage and higher acceptance by foreign consumers. Although the channel with the shortest link was most efficient the volume of produce that is disposed of is less due to high perishable nature of B and C grade banana and its limitation to handle large amount of produce efficiently. Place and form of the commodity are not the same in different channels. There is scope of making other channels more efficient by contracting the length of supply chain. In Channel II commission agents' share in consumers' rupee was 2.43 percent. This highlights the need of reducing the supply chain to increase its efficiency by providing suitable infrastructure like pack houses, ripening centres, cold storage facilities etc. and facilitating a direct link between farmers and ultimate consumers [6]. The backward and forward linkages should be strengthened in such a way that the overall cost of marketing the produce gets reduce. The retailers' margin in consumer rupee is nearly 19 percent which is approximately one-fifth of the consumer's price. This margin can be reduced by promoting more organised supply chain and by providing a platform where farmers can directly contact their customers like e NAM.

3.3 Post-Harvest Loss of Banana

The table 4 depicts the post-harvest loss in supply chain of banana at different levels. It was found that PHL was higher at wholesaler level (7.23 percent) [7,8]. At producer's level PHL was 6.59 percent and at retailer's level it was 4.41 percent. This highlights the strengthening of infrastructure facilities like cold storage structures, ripening centers, pack houses etc [9,10]. at all levels. Precise and timely availability of market information is also very necessary to improve the marketing efficiency of different channels by fetching good prices in market and timely movement of produce from one place to the other. Being a high perishable fruit banana needs proper infrastructural facilities and backward and forward linkages to avoid PHL. Good transportation facility like refrigerated trucks for transfer of produce to distant places and its quality distribution is another major area of great concern specially to boost up the export of fruit since the major share of marketing cost is spent on transportation. The development of cold chain network throughout the supply chain will help in reduction of PHL [11]. Due to lack of these facilities at every end the volume and quality of produce is greatly affected.

4. CONCLUSIONS

Marketing of fruits especially Banana has always been a questionable issue due to its perishable nature. In this study marketing efficiency of different supply chains of banana was carried out. It is clear from the above discussion that the efficiency of marketing channels can be increased by decreasing the spread of price among intermediaries. More the number of intermediaries more will be the price spread, and less will be the efficiency of the channel. The shortest route to customers via Channel IV was the most efficient one. Channel III was less efficient than other channels as the marketing costs involved in this channel was highest. Channel I and II was mostly used for marketing of produce to local and distant markets. Although the presence of commission agent in Channel II has decreased the marketing efficiency, they play an important role while distributing produce to long distance places like Delhi, Rajasthan, Punjab etc. So their role in the supply chain cannot be ruled out. This highlights the need of efficient market information provision which will enable farmers to take their decisions in line to the demand and can facilitate them in directly contacting customers. Poor marketing efficiency

and poor infrastructure leads to a decrease in producer's share in consumer's rupee. Post-harvest deterioration is another matter of grave concern. At every level there is a loss of 4-7 percent which can be avoided by providing infrastructural facilities in the nearby areas of banana cultivation and promoting more value addition in the crop. Creation of cold storage structures, the establishment of ripening centres and processing units, providing refrigerated trucks for long distance transportation etc. are need of the hour to strengthen the linkages of the supply chain.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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