

# INTERNATIONAL JOURNAL OF RESEARCH IN COMMERCE, IT & MANAGEMENT

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**AN ANALYSIS OF FACTORS AFFECTING POST-HARVESTING FOOD LOSS IN PERISHABLE CHAIN**

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**ABSTRACT**

*The growing concern for nutritional and food security are greater emphasis on consumer needs. In addition to tough competition from other countries, it has opened a host of challenges and opportunities. The necessary incentives to farmers and producers with huge potential for processing and value addition of agro produce for creation of additional income to the farm families and avenues for employment generation. With greater awareness among the consumers for safety as well as nutritional quality of foods, there is tremendous scope of modernizing existing post-harvest operations of various agro-produce. The paper addresses the strength, weakness and the opportunity available for the sector to thrive. From the literature review few factors are identified for the post-harvesting factors which affect the food loss. To analyse the various factors discriminant analysis is used. The response is collected from all the key player in the perishable supply chain using multi stage sampling technique.*

**KEYWORDS**

Post-harvesting, Food loss, Supply Chain Management, Perishable produce.

**1. INTRODUCTION**

uccessfully marketing fresh horticulture produce begins with the production of quality products and it requires careful attention to the details involved in post-harvest handling which protects quality, nutrition value, economic value and assures food safety. Further inadequate storage, transportation, handling and processing has led to an unacceptable level of wastages and value loss. Moreover wastage is around 25 per cent of its annual food produce due to lack of storage, transport and associated infrastructure inadequacies that deprive the country of Rs580 billion (Dh32.37 billion) worth of food annually — which is 42 per cent of the annual food subsidy planned under the Food Security Bill. India may be a global economic power, but it is by no means a rich country that can afford such a luxury. A reduction in food wastage can save India about two-fifths of the subsidy, that could be deployed in development activities. FAO estimates that if the food wasted or lost globally could be reduced by just one quarter, this would be sufficient to feed the 870 million people suffering from chronic hunger in the world," said Mr Konuma. In the production of fruits and vegetables, we stay second next to China with a production share of 11.6 percent and 9.7 percent in fruits and vegetables respectively (FAO). But the value addition like processing industry contributes only 3 percent total fruit and vegetable produced. To a great extent, food losses and waste are symbolic of the inefficiencies of food systems and this explains "why food losses and waste are becoming so central to discussions on both food security and sustainable development," Swaminathan said.

**2. OBJECTIVE OF THE STUDY**

- To analyse the strength, weakness, opportunity and thread in the post harvesting industry.
- To understand the key external factors influencing the food loss in the supply chain.
- To examine the key management factors influencing the food loss in the supply chain.

**3. METHODOLOGY**

To study the existing post-harvest management practice lot of literature survey where made. For the purpose of study Tamilnadu state has been selected. As the research area is large and the population is too big the respondents were selected based on the multi-stage sampling from the population. The state of Tamilnadu is divided into seven agro-climatic zones. Based on the top production area as per season and crop report of major crops, seven districts are selected from each climatic zone. The major crops considered for the study are banana, mango, brinjal, tomato, ladies finger, onion and potato which contribute about 91% of the total F&V sector. In the second stage of sampling, a block is selected based on the top production as per season and crop report of major crops from the selected districts. From the population, the required sample size is determined using the statistical tool. In the third stage of sampling, a village is selected and the samples are selected within that village. From the determined sample size and based on the production area as per season of major crops, sample size to be collected from each village is determined. The intermediaries and buyers are selected based on cluster approach from both Chennai and Dindugal district. Based on the SCM model, we have made an attempt to understand the role of SCM in developing post-harvest management.

**4. RESULT AND DISCUSSION****4.1 SWOT ANALYSIS OF PRESENT POST-HARVEST MANAGEMENT****STRENGTH**

1. The state have high value perishable crops which possess high nutrition value, due to soil and climatic conditions.
2. The hill stations spotted in the Western ghats and in the middle of the state grow the vegetables like carrot, cabbage, cauliflower, potato etc., and temperate and sub-tropical fruits like plums, peaches, straw berries and plantation crops.
3. Perishable produce is supported well with the horticulture development in the form of National Horticulture Mission, Tamilnadu Agricultural University etc. Moreover State has got the entire needed technical where-withal, supported by a separate Horticulture College and Research Institute and Horticulture Research Stations in the State.
4. The innovation of cost effective post-harvesting equipment has been under taken by the universities which satisfy the needs of farmers.
5. Many leading agro processing equipment and machinery manufacturers are also located.

**WEAKNESS**

1. Most of the fruit crops are highly season-bound and hence the year-round production is not possible.
2. Lack of scientific technical and administrative manpower.

3. Lack of scientifically trained manpower to handle the processing machinery. Mostly mechanics operate and control the operation, hence penetration of new innovations are difficult.
4. Lack of supporting infrastructural facilities.
5. Lack of appropriate supply of perishable produce and fluctuating quantities.

**OPPORTUNITIES**

1. As the urbanization, industrialization and the family income have shown an increasing trend in the recent years, the effective demand for protective foods is growing. Hence there exist ample of demand for the quality fresh perishable production in the State.
2. Existing agro processing equipment is not capable of producing the desired quality product for upper class segment and export and hence technologies need to upgrade the existing processing infrastructure.
3. With increased income of Indian middle class and exposure to international processed products is increasing day by day. Hence there is ample opportunity for domestic processed product hence many upcoming entrepreneurs are willing to take up agro processing business.
4. Government is providing 100 percent rebate on profit for the first five years and 25 percent for next five years. 100 percent FDI is allowed in processing industry.
5. The crops of Indian origin due to their unique aroma and flavour are being sourced by developed countries at premium price. Hence their value addition and processing for export is getting attention of private players.

**THREADS**

1. High-cost of high-tech cultivation of horticulture crops and low financial capability of majority of farmers. Increase in number of small and marginal farmers.
2. Lack of awareness among the conventional processors about quality and safety codes and standards.
3. Long and fragmented supply chain, tiny and fragmented holdings and low technology.
4. Costly and inefficient transportation of raw and finished products.
5. Comparatively high cost of packaging and storage cost of finished produce

**4.2 EXTERNAL SUPPLY CHAIN MANAGEMENT FACTORS INFLUENCING FOOD LOSS**

Infrastructure, government policies, weather pattern which is not under the control of the supply chain players are analysed in the section. The impact of these factors play a key role in the impact of the food loss in the channel.

**TABLE 1: FRIEDMAN TEST FOR SIGNIFICANT DIFFERENCE BETWEEN MEAN RANKS TOWARDS REASON OF EXTERNAL FACTORS INFLUENCING FOOD LOSSES**

	Mean Rank	Rank	Chi square value	P value
1.Regulations and Policies	1.95	III	634.8	0.001**
2.Infrastructure	3.29	I		
3.Disease and insect infection	1.88	IV		
4.Weather patterns	2.87	II		

Infrastructure facilities like transportation, storage of perishable produce creates lot of problem. The damage of produce during transit account 30% admits report. From the table it is clear that with mean rank 3.29 the infrastructure tops the ranking. It is followed by sudden change in climate like cyclone, draught etc. makes the output to fluctuate during different seasons. Government regulation and disease infection ranks third and fourth.

**DISCRIMINANT ANALYSIS OF EXTERNAL FACTORS AFFECTING FOOD LOSS**

Discriminant analysis is used to distinguish between farmers, intermediaries and buyers based on the food loss due to external factors in the channel and the most important results are presented in this section.

Food loss due to external factors are measured using 4 statements. Based on this opinion of the key players, discriminate analysis is carried out to distinguish between farmers, buyers and intermediaries. The tests of equality of group means measure each independent variable's potential before the model is created. Wilks' lambda, the F statistic and its significance level are presented in the following table.

**TABLE 2: F TESTS OF EQUALITY OF GROUP MEANS OF EXTERNAL FACTORS**

	Farmers	Intermediaries	Buyers	Wilk's Lambda	F value	P value
Regulations & policies	2.6 (.81)	4.18 (.76)	3.14 (.77)	0.529	258.97	<0.001**
Infrastructure	4.38 (.80)	4.60 (.60)	4.46 (.61)	0.981	5.65	0.004**
Disease and pest infection	3.28 (.85)	2.64 (.95)	3.06 (.96)	0.894	34.29	<0.001**
Weather Pattern	4.35 (.83)	3.44 (.69)	4.12 (.69)	0.805	70.59	<0.001**

The above test displays the results of a one-way ANOVA for the independent variable using the grouping variable as the factor. According to the results in the table, out of 4 variables, 4 variables in discriminant model is significant, since P value is less than 0.01. Wilks' lambda is another measure of a variable's potential. Smaller values indicate the variable is better at discriminating between groups. The table suggests that regulations is best, followed by Weather pattern. The number of functions is equal to the number of discriminating variables. Here there are three grouping variables, therefore two functions are evaluated. From the significance table it is clear that two functions are significant as p value is less than 0.01.

**TABLE 3: CANONICAL DISCRIMINANT FUNCTION UNSTANDARDIZED COEFFICIENTS OF EXTERNAL FACTORS**

	Function	
	1	2
Regulations & policies (X <sub>1</sub> )	.882	.772
Infrastructure (X <sub>2</sub> )	.946	-1.106
Disease and pest infection (X <sub>3</sub> )	-.280	-.224
Weather pattern (X <sub>4</sub> )	-1.105	1.432
(Constant)	-1.573	-2.706

Based on the Canonical Discriminant Function coefficient, the linear discriminant equation can be written as

$$D1 = -1.57 + 0.88X_1 + 0.946X_2 - 0.28X_3 - 1.105X_4$$

$$D2 = -2.706 + 0.772X_1 - 1.106X_2 - 0.22X_3 + 1.43X_4$$

The classification table shows the practical results of using the discriminant model. Of the cases used to create the model, 370 of the 384 farmers (96.4%) are classified correctly. 105 of the 150 intermediaries (70 %) are classified correctly. 10 of the 50 buyers (18 %) are classified correctly Overall, 67.8% of the cases are classified correctly based on food loss during different stages in the channel.



## 4.3 MANAGEMENT FACTORS INFLUENCING FOOD LOSSES

Throughout the chain a proper organised setup is missing. Each players work independently for their benefit not consulting with the immediate key players. This situation results in chaos leaving no scope for managing the business. The divided work with mis-coordination makes a huge loss on perishable produce

TABLE 4: FRIEDMAN TEST FOR SIGNIFICANT DIFFERENCE BETWEEN MEAN RANKS TOWARDS REASON OF MANAGEMENT FACTORS ON FOOD LOSS

	Mean Rank	Rank	Chi square value	P value
Poor demand forecasting	1.84	IV	543.7	0.001**
Poor inventory management	2.19	III		
Poor logistics management	3.31	I		
Lack of handling procedure	2.66	II		

Table 6.5 shows the key players admit that the loss is incurred during transportation of goods which admits a mean rank of 3.31. Followed by the handling the process with mean rank of 2.66. During loading and unloading at various markets the product cause lot of damage. Poor inventory management ranks third with 2.19 as mean rank. There is no common procedure in fixing the priority for selecting the material in the inventory resulting in stagnation of produce in bumper season. Demand management is poor with less transparency in the chain.

## 4.3.1 DISCRIMINANT ANALYSIS FOR MANAGEMENT FACTORS AFFECTING FOOD LOSS

Discriminant analysis is used to distinguish between farmers, intermediaries and buyers based on the management factors affecting food loss in the channel and the most important results are presented in this section. Food loss due to management factors are measured using 4 statements. Based on this opinion of the key players, discriminate analysis is carried out to distinguish between farmers, buyers and intermediaries. The tests of equality of group means measure each independent variable's potential before the model is created. Wilks' lambda, the F statistic and its significance level are presented in the following table.

TABLE 5: F TESTS OF EQUALITY OF GROUP MEANS OF MANAGEMENT FACTORS

	Farmers	Intermediaries	Buyers	Wilks' lambda	F value	P value
Poor demand forecasting	2.82 (1.02)	2.82 (.68)	3.82 (.98)	0.918	25.82	<0.001**
Poor inventory management	2.85 (.91)	4.24 (.71)	3.44 (1.04)	0.666	145.63	<0.001**
Poor logistics facility	4.38 (.80)	4.30 (.75)	4.30 (.76)	0.998	.726	0.484
Lack of handling facility	3.99 (.86)	3.02 (.88)	4.00 (.96)	0.809	68.45	<0.001**

The above test displays the results of a one-way ANOVA for the independent variable using the grouping variable as the factor. According to the results in the table, out of 4 variables, 3 variables in discriminant model is significant, since P value is less than 0.01. . Wilks' lambda is another measure of a variable's potential. Smaller values indicate the variable is better at discriminating between groups. The table suggests that Storage facility is best, followed by material handling, processing etc.

TABLE 6: CANONICAL DISCRIMINANT FUNCTION UNSTANDARDIZED COEFFICIENTS OF MANAGEMENT FACTORS

	Function	
	1	2
Poor demand forecasting (X <sub>1</sub> )	.735	1.007
Poor inventory management (X <sub>2</sub> )	-1.274	.094
Poor logistics facility (X <sub>3</sub> )	-.098	-.174
Lack of handling facility (X <sub>4</sub> )	.558	.023
(Constant)	.348	-2.559

Based on the Canonical Discriminant Function coefficient, the linear discriminant equation can be written as

$$D1 = 0.35 + 0.73X_1 - 1.27X_2 - 0.09X_3 + 0.55X_4$$

$$D2 = -2.55 + 1.01X_1 + 0.094X_2 - 0.17X_3 + 0.023X_4$$

The classification table shows the practical results of using the discriminant model. Of the cases used to create the model, 366 of the 384 farmers (94.8%) are classified correctly. 114 of the 150 intermediaries (76 %) are classified correctly are classified correctly Overall, 82.4% of the cases are classified correctly based on food loss during different stages in the channel.

## 5. CONCLUSION AND RECOMMENDATIONS

Based on the above analysis, the lack of infrastructure and flexible weather pattern play important roles in food loss, which is external to the chain. From the discriminating analysis we could conclude that government regulation and weather pattern is discriminating among groups. Mean suggest that lack of government regulation is the problem to the intermediaries as they are the coordinating agent between the buyers and producers. Changing weather pattern is a problem for the farmers when compared with other key players. The study about the management factors show that poor logistics management and handling procedure are the key factors related to management which affect the food loss. From the discriminating analysis we could conclude that inventory management is discriminating with other groups. The mean suggests that the intermediaries' woe to more problems related to the food loss. Taking into consideration of few solid strength and opportunities available in the sector and the problem identified for food loss some of suggestions are formulated. Farmers could adopt cluster approach to use post harvesting techniques. As 90 percent of farmers belong to small and marginal farmers, updating to modern techniques is a difficult task as it involves huge cost. The farmers of a closely associated area can organize a group and can share post harvesting equipment among them.

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