

# Incentives for the Adoption of Hazard Analysis and Critical Control Points (HACCP) in Fruit and Vegetable Processing Industry in Sri Lanka

S. M. KULARATNE and U. K. JAYASINGHE-MUDALIGE

*Department of Agribusiness Management, Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka, Makandura, Gonawila (NWP)*

## ABSTRACT

This article explores the incentives to fruit and vegetable processing firms for the adoption of HACCP in Sri Lanka through a survey conducted among 27 fruit and vegetable processing firms in Western, North Central, Central, Southern and Sabaragamuwa provinces from July to August 2006. The analysis was done using Statistical Package for Social Sciences (SPSS). Only 3.7 percent of producers had already implemented HACCP and 29.6 percent of respondents were in the process of implementing. There were 37 percent respondents who had established plans for HACCP while 26.6 percent had no idea to implement the system.

The study identifies seven key factors that motivate firms to implement HACCP, namely, market driven, required/ recommended practice, overseas market, regulations, expected regulations and impacts, reputation, and profit. Respondents were clustered according to the relative importance of those factors for their decision to adopt HACCP. Four clusters were identified. Market driven factors were the major motives to adopt HACCP and 59.2 percent of respondents were grouped into third cluster which is "market driven". Resistant to change by the employees was the major barrier to implement HACCP in the sector, for which fundamental change in the culture or attitudes of both employers and employees has become important. Sri Lanka Standard Institution plays the major role in providing food safety information to the processors. Mandating of HACCP is a must to motivate them to implement HACCP. But adoption of HACCP only to satisfy a regulatory requirement may drive the company towards the end.

**KEYWORDS:** Economic Incentives, Fruit and Vegetable Processing Sector, HACCP

## INTRODUCTION

Today in most of developed countries such as United States and European Union, there are heightened concerns about the safety of imported food items because food safety problems can cause not only the human illness but also economic losses to producers, processors and consumers and jeopardize the international competitiveness of the agricultural industry. Therefore in Sri Lanka there is an urgent need to improve the quality of processed products, to maintain the demand in the global market and to have competitive prices. In this context, introduction of modern quality assurance concepts, such as Hazard Analysis and Critical Control Points (HACCP), to food processing enterprises in Sri Lanka is very important.

Although HACCP and Sri Lanka Standard (SLS) certification is very important in fruit and vegetable processing industry adoption of these systems is very limited. SLS is compulsory for the industries which produce Ready-to-Serve (RTS) fruit drinks such as fruit cordials (Abeykoon, 2002). Generally, most of the people who are engaging in small and medium scale agro-food processing industries in the country do not have proper knowledge about quality assurance and food safety. There is lack of information regarding the usefulness of the system and the potential benefits after implementing the system. HACCP will provide the knowledge for formulating and introducing comprehensive quality assurance systems, including the HACCP concept, in order to develop the food industry further in Sri Lanka (Abeykoon, 2002).

## *Hazard Analysis and Critical Control Points*

HACCP is a production control system for the food industry. It is a process used to determine the potential danger points in food production and to define a strict management and monitoring system to ensure safe food products for consumers. HACCP is designed to prevent potential microbiological, chemical, and physical hazards, rather than catch them (Anon, 2005a). Its goal is to prevent hazards (a biological, chemical or physical agent in, or condition of food, with the potential to cause an adverse health effect) at the earliest possible point in the food chain (Anon, 2002). There is now widespread consensus that the most effective and economically efficient approach to food safety control is based on risk assessment and process control rather than end product testing which has been codified in the HACCP system. (see Henson and Holt, 2001)

Therefore it is very important to identify the motivations to adopt HACCP by Sri Lankan fruit and vegetable processors for further achievements in the global market.

## *HACCP Certification in Sri Lanka*

Sri Lanka Standard Institution is the major provider of HACCP certificate for Sri Lankan food processing industry and having obtained HACCP certificate from the SLSI implies that chemical, physical and biological hazards encountered during production or processing of the food item, as applicable to the scope of certification are controlled to make the food safe for human consumption. A certificate holder develops and maintains its food

safety assurance program based on the internationally accepted principles of Codex Alimentarius Commission, CAC/RCP - 1:1969, Rev.3 (1997) for Hazard Analysis and Critical Control Points (HACCP) (Anon, 2005b).

**Incentives for the Implementation of HACCP**

According to Caswell and Henson; Segerson, the incentives for food suppliers to undertake food safety controls operate at two levels. First, the controls can be market-driven or second, controls can be mandated by direct public regulation or production process or end-product safety or liability standards. According to Henson and Northen, in many circumstances, these two subsets of incentives are both interrelated and operate simultaneously (see Henson and Holt, 2001). But the adoption of HACCP by some fruit and vegetable processors in Sri Lanka can not be motivated even by regulations while few manufacturers are implementing HACCP regardless of regulations, perhaps because it is required by their major customers or for reputation in the industry.

The remainder of this paper explores these differences through a study undertaken in Sri Lankan fruit and vegetable processing industry.

**METHODS**

The questionnaire was designed by using existing literature on the implementation of HACCP and further changes were done after discussions with some fruit and vegetable processors. Sixty respondents were firstly targeted to be interviewed but had to be satisfied with 27 respondents as most firms were micro scale that have no idea on at least SLS and some others were reluctant to answer. The survey was conducted from mid July to mid August. Firstly, the survey was carried out in Western province and then expanded to Southern, Central, North Central and Sabaragamuwa provinces. Mail, fax and telephone surveys were also done with the difficulty of traveling and as requested by some respondents.

Respondents were presented with a list of factors as incentives to adopt HACCP and they were asked to indicate how important each of the given factors to adopt HACCP, using a five-point likert scale ranging from "very important" (5) to "very unimportant" (1). For better understanding of results and to classify into subsets, a factor analysis was done using principal component analysis technique. By considering the reproduced co-relation matrix, which specified only 37 % of residuals having absolute values greater than 0.05 and the percentage of variance that is explained by the number of factors, seven key factors were selected. To identify the similarities/ differences in the motivation to adopt HACCP, the respondents were clustered according to their loadings on each of the seven identified factors. K-means clustering method was selected as previously used by Henson and Holt. Three, four, five and six cluster solutions

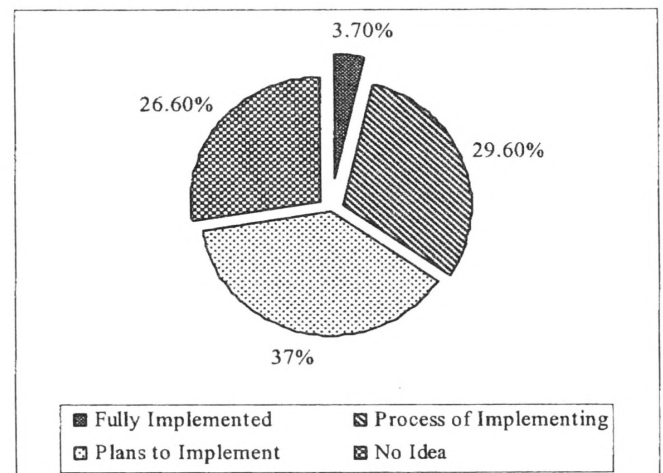
were requested and three cluster solution was rejected as it classified firms in to 16, 9 and 2 cases which is proportionately not good to accept. Five and six cluster solutions were also rejected as they classified firms in to groups in which some groups have only one case (Table 1). Finally four-cluster solution was accepted.

**Table 1 - Number of cases in each cluster:**

Cluster	Number of cases
Cluster 1	2
Cluster 2	4
Cluster 3	16
Cluster 4	5

**RESULTS AND DISCUSSION**

To get a preliminary indication of the motivations for adopting HACCP, an attempt was made to identify the HACCP status of the respondents. Only 3.7% of respondents had fully implemented HACCP in the sample taken but there are only very few number of firms those who have already obtained the certification, who were missed as they were reluctant to answer, while 26.6% of respondents had no idea to implement HACCP. And 29.6% of respondents were in the process of implementing HACCP while majority (37%) of the respondents indicated that they have established plans to implement HACCP (Figure 1).



**Figure 1 - Stage of HACCP implementation by the respondents:**

This reflects the present situation of fruit and vegetable processing Industry in Sri Lanka in terms of HACCP implementation. Most of the respondents, who had no idea to implement HACCP, are not familiar with "What is HACCP" and some others said that they are satisfied with their current food safety controls. One who has already implemented HACCP operates under Board of Investment (BOI), which has certified for ISO 14001 too.

**Motivations for Implementation of HACCP**

According to the mean scores derived from descriptive statistics, "To improve the control of production process" and "To reduce customer complaints" most respondents were motivated to adopt HACCP in their firms.

"Government regulations" is the factor that most of the firms strongly disagreed as a motivation for them as government involvement in terms of quality concept in food processing industry is very poor in Sri Lanka. SLS is the only compulsory certification for processed fruit and vegetable products which consist with minimum requirements of quality.

**Table 2 - Mean importance scores for factors motivating adoption of HACCP by firms:**

No.	Factor	Mean Scores
01.	Reduce customer complaints	4.70
02.	Control of production process	4.70
03.	Reduce risk of product recalls	4.67
04.	Good practice	4.56
05.	Reputation	4.52
06.	Better plant performance	4.48
07.	Increase shelf life of products	4.41
08.	Anticipated Future customer requirements	4.15
09.	Increase sales	4.00
10.	Commercial pressure	4.00
11.	Access new overseas market	3.93
12.	Liability	3.89
13.	Competitive strategy	3.85
14.	Employee turn over	3.85
15.	Customer pressure	3.85
16.	Enter the export market	3.81
17.	Retain existing overseas market	3.81
18.	Access new markets	3.70
19.	Recommended by trade organizations	3.67
20.	Competitor has succeed by HACCP	3.67
21.	Attract new customers	3.63
22.	Reduction of total cost	3.56
23.	Gain a greater share in the market	3.56
24.	Higher price for products	3.37
25.	Retain existing customers	3.30
26.	Future government regulations	3.04
27.	Judicial system	2.78
28.	Reduction of insurance premium	2.11
29.	Government regulations	2.04

Seven key factors derived from Varimax Rotation (Table 3), which accounts for 76.8% of the variance across the 29 issues, presented to respondents, can be interpreted as follows.

**Factor 1:** The issues loaded most heavily on this factor included "Attract new customers", "Retain existing customers", "Access new markets", "Competitive strategy", "Liability", "Enter the export market", "Gain a greater share in the market", "Judicial system" and "To reduce customer complaints". Therefore this key factor is associated with "Market driven" motivations where customers always represent the market and also the competition

occurs at the market. Firm's liability always towards the customer, which can be taken as the market as well, and also, the "Judicial cases" always related with the market.

**Factor 2:** The issues loaded most heavily on factor 2 are associated with "Required/ Recommended practice" as a motive to adopt HACCP. This factor consists with "Customer pressure", "Commercial pressure", "Recommended by trade organizations", "Future customer requirements", "Competitor has succeed by HACCP" and "Employee turn over". The two factors (item 14 and 15) are taken into "Recommended Practice" because if the competitor has succeeded by HACCP and if the implementation of HACCP increases the employee turnover then it can be recommended to implement HACCP within the firm.

**Factor 3:** The issues loaded most heavily on this factor included "Retain existing overseas market" and "Access new overseas markets". So this factor is associated with "Overseas market" related motivations where some firms highly motivate to adopt HACCP to obtain a distinctive place in the overseas market.

**Factor 4:** The issues loaded most heavily on this factor included "Government regulations" and "Reduction of insurance premium" where if the producers adopt HACCP they will have to pay lower insurance premium. So this factor is considered as "Regulations".

**Factor 5:** This factor is associated with "Expected regulations and impacts" regarding the product. It consists with "Future government regulations" and "Reduce risk of product recalls" where it is considered that the former as an expected regulation and the later as an expected impact of implementing HACCP.

**Factor 6:** The issues heavily loaded on this factor are different from each other therefore this factor is considered as "Reputation" that motivate firms to adopt HACCP. They are "Reputation" and "Increase the shelf life of products" where increased shelf life of products finally resulted with increased reputation.

**Factor 7:** This factor is associated with "Profit" as a motivation to adopt HACCP by firms. It consists with "Get a higher price for products" and "Reduction of total cost". The firms motivate to adopt HACCP because of the extra profit going to be resulted by the implementation of HACCP, probably by the increased price of the final product or reduced cost of production because of the increased efficiency, reduction of product wastage, etc.

Several firms were motivated to implement HACCP due to several reasons such as customer/market requirements, regulations and profit.

**Table 3 -Factor loadings for motivations to implement HACCP derived from Varimax Rotation:**

No.	Item	F 1	F 2	F 3	F 4	F 5	F 6	F 7
01.	Attract new customer	.930	.130			.104		
02.	Retain existing customers	.867		.249		.140		
03.	Access new markets	.857	.186			.253		
04.	Competitive strategy	.761	.196		.331		.255	
05.	Liability	.710	.491					
06.	Enter the export market	.630	.315		.208		.279	
07.	Gain a greater share	.604	.166	.166		.367	.177	.149
08.	Judicial system	.587		.173	.535			
09.	Reduce customer complaints	.552				.310	.525	.105
10.	Customer pressure	.144	.910					
11.	Commercial pressure	.151	.863			.116		
12.	Recommended by trade organizations		.784	.204	.179			.188
13.	Future customer requirements	.341	.782			.204	.180	-.205
14.	Competitor succeed by HACCP	.274	.748	.331			.117	
15.	Employee turnover		.679			.280		.106
16.	Retain overseas markets			.950				
17.	Attract new overseas markets			.905				
18.	Government regulations	.404		.295	.691			.329
19.	Reduction of insurance premium	.332		.114	.550	.184		.157
20.	Future government requirements		.134	.216	.313	.761	.190	
21.	Reduce risk of product recalls	.358	.114			.737		
22.	Reputation	.132	.353				.725	
23.	Increase the shelf life of products	.393		.129		.416	.552	.227
24.	Get a higher price for products				.235			.808
25.	Reduction of total cost		.110					.714
<i>Proportion of variation explained %</i>		<i>21.30%</i>	<i>16.13%</i>	<i>9.35%</i>	<i>8.28%</i>	<i>7.86%</i>	<i>6.97%</i>	<i>6.89%</i>

Extraction Method: Principal Component Analysis.

**Differences in Motives between Firms**

To identify the systematic similarities/differences in the motivations to adopt HACCP, respondents were clustered according to their loadings on each of the seven identified factors.

**Cluster 1** Only 7.4% of firms can be classified as “Expected regulation and impact driven” implementers of HACCP (Table 4). When expected regulations and impacts are concerned, “Overseas market” was the major issue because EU has already mandated the HACCP and producers further expect new regulations from Japan and USA. “Market driven reasons” and “Reputation” are less important factors for them.

**Cluster 2** There were 14.8% of firms which can be classified as “Regulations” driven implementers of HACCP while “Market driven” motivation is the least important factor for them.

**Cluster 3** Majority (59.2%) of firms can be classified as “Market driven” implementers of HACCP. For these firms “Market driven” and “Reputation” were

the major factors motivating the adoption of HACCP. Company receives the reputation through the market for the issues such as continuous supply, and especially due to quality of the product. “Profit” was the least important factor for them as a motivation. Majority indicated that, expecting an extra profit after implementing HACCP is obvious as they can not increase the price of product because of HACCP, but they will have to bear a high cost.

**Cluster 4** Only 18.5% of respondents can be classified as “Profit oriented” implementers of HACCP and “Market driven” factors were least important for them. These cluster solutions were resulted according to the motivations for the respondents to adopt HACCP. Within Sri Lankan conditions, ranking of motivations were highly dependent on, knowledge of respondents, richness of them with updated information and the markets they operate; cluster solutions are also depend on them. Therefore it was difficult to get an idea about how the motivations differ according to characteristics of firm such as number of employees, products, etc.,

**Table 4 - Cluster means for factor scores derived from k-means clustering:**

No.	Factors	Cluster 1	Cluster 2	Cluster 3	Cluster 4
01.	Market driven	-2.0348	-1.8762	.6585	-1.8522
02.	Required/ Recommended Practice	1.2512	1.0508	.1216	-1.8483
03.	Overseas market	.7901	-.0117	.0403	-.0619
04.	Regulations	-1.0365	2.3976	-.6020	-.3653
05.	Expected regulations and impacts	1.3458	-1.2242	.9885	-1.3196
06.	Profit	-.0486	-1.3903	-1.8689	.6704
07.	Reputation	-2.2210	.0138	.9914	.2285
<i>Number of cases</i>		<i>2</i>	<i>4</i>	<i>16</i>	<i>5</i>
<i>Proportion of respondents</i>		<i>7.4%</i>	<i>14.8%</i>	<i>59.2%</i>	<i>18.5%</i>

**Barriers to Implement HACCP in Fruit and Vegetable Processing Sector in Sri Lanka.**

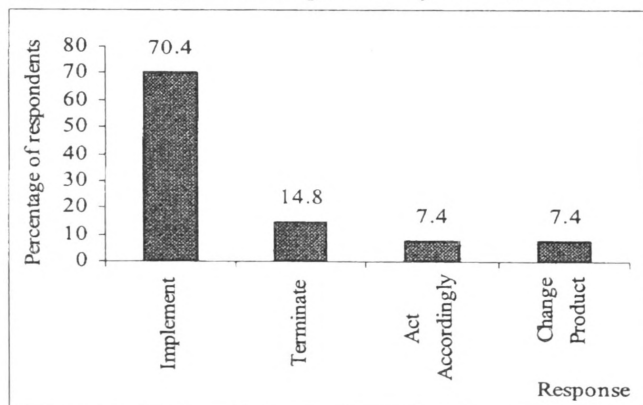
The results revealed that “Resistant to change by the employees” is the major barrier to adopt HACCP, followed by “Current food safety controls considered sufficient”. Respondents indicate that, having SLS certification is more than enough for them to tolerate in the local market. Some other respondents said that they are very proud to have ISO certification with SLS. “Scale of operation is too small” is the least barrier for the respondents to implement HACCP. Most respondents indicate that smaller the scale, easier the implementation of HACCP (Table 5).

**Table 5 - Mean scores derived for the barriers to implement HACCP by the firms:**

No.	Factor	Mean Score
01.	Resistant to change by the employees	4.15
02.	Current food safety controls considered sufficient	3.63
03.	Monetary problems	3.56
04.	Not sure whether implementation of HACCP would meet our customers’ requirements	3.22
05.	To see the experiences by others of implementing HACCP	3.19
06.	Lack of knowledge	3.19
07.	Lack of information	3.11
08.	Uncertain about the potential benefits of implementing HACCP	3.11
09.	Unavailability of skilled supervisors with in the plant	2.74
10.	Objectives other than food safety	2.48
11.	Scale of operation is too small	2.30

**Response by the Firms for HACCP Mandating in the Market**

Majority of respondents (70.4%) said that they will implement HACCP in their plants if it is mandated in the market they operate in (Figure 2). As HACCP is already mandated in the European Union some respondents have given the contract to SLSI to implement the HACCP system in their plants. But 14.8% of respondents said that they will terminate the business because of inability to bear the cost of implementing HACCP, and also reluctant to be supervised the production process by the outsiders.



**Figure 2 - Response to HACCP mandate, by the firms:**

**Sources of Food Safety Information for the firms**

For most respondents Sri Lanka Standard Institution is the major information source on food safety. They also collect information from their customers (especially from foreign customers who request higher quality) to a reasonable extent.

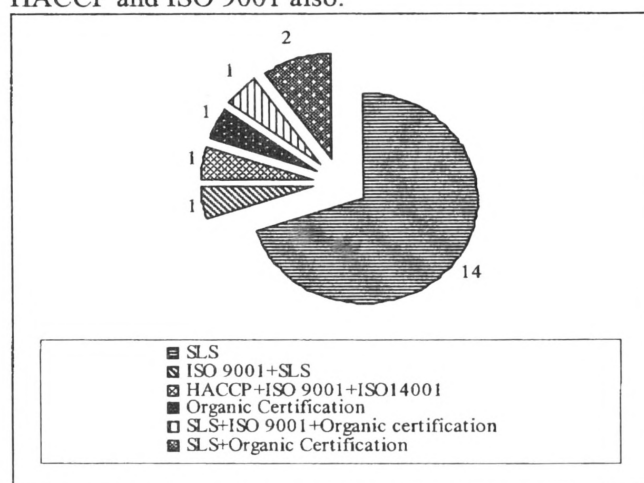
Unfortunately, journals and National Agribusiness Council are not good information sources for the producers (Table 6).

**Table 6 – Major sources of food safety information for the processors:**

No.	Source	Mean Score
01.	Sri Lanka Standards Institution	4.37
02.	Customers	4.11
03.	Industrial Technological Institute	4.04
04.	Trade shows	3.74
05.	Competitors	3.26
06.	Input suppliers	3.22
07.	Journals	3.19
08.	National Agribusiness Council	2.63

**Other Food Safety Controls Currently Practice by the Respondents**

Out of the 27 respondents most (14) practiced only the SLS perhaps because it is compulsory especially in RTS industry while another four respondents had SLS with other certifications like ISO and Organic Certificate (Figure 3). Out of the sample only one respondent had ISO 14001 who had HACCP and ISO 9001 also.



**Figures 3 - Other Food Safety Controls currently practice by the firms:**

**CONCLUSION AND POLICY IMPLICATIONS**

This article has explored the factors that motivating the adoption of HACCP by fruit and vegetable processors in Sri Lanka through a survey conducted among 27 respondents. The incentives that suggested by previous studies were classified into seven key factors: Market driven, Required/Recommended practice, Overseas market, Regulations, Expected regulations and impacts, Reputation, and Profit. The results show that “Market driven incentives” are the major factors that motivate the firms to adopt HACCP, followed by Regulation / Efficiency which accounted for 16.1% of total

variance. Firms were subdivided into four categories, based on the importance scores they have given to the seven major factors namely; "Regulation and Expected impact driven", "Direct external requirement driven", "Market driven" and "Profit oriented". The study further reflects that the "Resistant to change by the employees" is the major barrier to implement HACCP in fruit and vegetable processing industry in Sri Lanka followed by "Current food safety controls considered sufficient" where processors think that the food safety controls they currently practice are more than enough for them to compete in the markets where they operate. Some firms who operate regionally do not consider at least about SLS.

It is recommended that mandating the HACCP in the markets in which these firms are operated be the major driving factor for them to implement HACCP as 70.4% of respondents indicated that they would implement HACCP if it is mandated (Figure 2). Further, conducting educational and training programs about the importance of HACCP especially for rural/ small and micro scale processors as well as to the employees is very important, as most of the processors have no idea on "What is HACCP" and also to change the negative attitudes (resistant to change) of employees towards implementation of HACCP. Also, introducing financial facilitating schemes such as loan facilities with low interest rates to implement HACCP/ (Quality assurance systems), will be a major factor that could be able to attract processors on it. As most respondents indicate that they are not going to implement HACCP because local customers are not much concerned about food safety controls, it is very important to organize awareness programs for the consumers also, regarding the importance of food safety controls. Announcing a reward system for quality/ safety will make a competition among processors and as a result they will tend to implement food safety controls such as HACCP.

The research revealed that for an effective implementation of HACCP may require a fundamental change in the culture or attitudes of both employers and employees. If the adoption is only to satisfy a regulatory requirement it will lead for a failure of the producer because satisfaction of

regulations will not be the level of satisfaction of buyers.

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