

# Benefits, Costs and Constraints Analysis of HACCP Adoption by Tea Processing Industry of Sri Lanka

G.S.D.P.C. ARIYARATNE<sup>1</sup>, K.G.M.C.P.B. GAJANAYAKE<sup>1</sup>,  
U.K. JAYASINGHE-MUDALIGE<sup>2</sup> and L. SENAWEERA<sup>3</sup>

<sup>1</sup>Department of Plantation Management, <sup>2</sup>Department of Agribusiness Management, Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka, Makandura, Gonawila (NWP), Sri Lanka.

<sup>3</sup>Sri Lanka Standards Institute, 17, Victoria Place, Elvitigala Mawatha, Colombo 08, Sri Lanka.

## ABSTRACT

With the globalization of the food industry, tea importing countries have formulated very stringent food safety laws and the compliance to food safety laws has now become a compulsion to make the future of tea industry economically viable. In this scenario, the adoption of Hazard Analysis Critical Control Points (HACCP) safety management meta system in tea factories has become an essential pre-requisite for the Sri Lankan tea industry, which maximizes product quality and safety, gains acceptance and competitiveness in the international market.

A questionnaire based survey was carried out among up country and low country HACCP certified tea factories to find out the benefits, costs and constraints of HACCP adoption by the Sri Lankan tea processing industry by direct interviews with responsible personnel in those factories. Five point Likert Scale was used to rank the benefits and constraints of HACCP adoption. The study identified major benefits and constraints by running a Principle Component Analysis. Identified benefits are profit oriented, production oriented and internal efficiency, and constraints are management attitudes, internal environment and monetary constraints. The tea factories were clustered according to differences and similarities of the benefits and constraints of adoption of HACCP. Internal efficiency was the major benefit than obtaining any real competitive advantage over other suppliers for majority (*i.e.* 35%) of respondents. All the factories faced the difficulty in training of supervisory and production staff. Most of the factories (*i.e.* 36%) experience "monetary constraints" than other constraints presented to the respondent, except training of supervisory and production staff. The costs were taken by using percentages. The results conclude that the most widespread costs are associated with external training, documentation, external consultants and supervisory staff time.

**KEY WORDS:** Adoption, Benefits and costs, Food safety, HACCP, Tea processing sector

## INTRODUCTION

Tea is the most popular and cheapest natural beverage consumed throughout the world next to water. Sri Lanka started its tea production in year 1883 and at present it grabs remarkable position in the global beverage market. Tea being the major plantation and export crop in Sri Lanka, it plays a vital role in the economy in terms of foreign exchange earnings contributing 1.3 percent to the total GDP, government revenue earnings, employment generation and land use (Anon, 2004).

Within recent trends in the global trade of food and beverages, there is a growing demand to ensure higher standard of food quality and safety and to provide evidence of meeting safety requirements. With the globalization of the food and beverage industry, international bodies such as World Health Organization (WHO), Food and Agriculture Organization (FAO) of the United Nations and tea importing countries in particular are much concerned on the health of the people who consume tea, and have formulated very stringent food safety laws. Hence, the future production of such an export driven beverage product in large scale would not be economically viable, and the compliance to such food safety laws has become a compulsion to market them throughout the world. If not, the product has to be restricted to the country of production or a few countries where strict regulations are not imposed,

which usually pay a relatively less price for the product (Anon, 2005).

The acronym HACCP, which stands for Hazard Analysis and Critical Control Points, is a food safety management meta system to prevent food safety hazards or to ensure product quality. In the current scenario, HACCP has become an essential pre-requisite for the industry, which maximizes product quality and safety, gains acceptance and competitiveness in the international market with stringent regulations. For thirty years, the HACCP has become an internationally recognized and accepted method for food safety assurance. While it was originally developed to ensure microbial safety of foodstuffs, it has been further broadened to include chemical and physical hazards (Anon, 1996).

Sri Lanka Tea Board (SLTB) warns that European buyers can insist on more stringent health standards for local tea exports from year 2006. European Union (EU) government authorities have declared that they will not enforce new HACCP standards until 2008-2009 although the standards were introduced 2006. But European companies importing tea from Sri Lanka can still insist that our exports comply with the HACCP standards. The EU introduced its new HACCP standards in January 2006, for imports. Tea is the Sri Lanka's main food item that exports to the EU and is expected to feel the hardest impact of new EU HACCP standards.

Sri Lanka export around 10 percent of its total tea exports (25 to 30 million kg) to the EU. However only about 40 tea factories have already implemented the standards, about 85 are in the process of implementing and over 500 factories have not even started implementing it. The cost of bringing production lines under the latest HACCP standards can range from Rs 500,000 upwards, to over Rs 10 million, depending upon the state of the factories. However, European buyers of Sri Lanka tea and other food products are free to insist on the new standards as a marketing tool. Companies in Europe have already been informed to demand increasingly higher health and safety standards from exporters, to position their products as more health conscious. Russia buys around 20 percent of total Sri Lankan tea exports and it is only a matter of time for them too to ask for similar standards. The Tea Board is also keeping a wary eye on Middle Eastern countries that are also known to follow higher European standards. Russia and the Commonwealth of Independent States countries, and the Middle East, consume around 75 percent of Sri Lanka's total 290 million kilograms of tea exports (Anon, 1995).

All agro-based industries have small and medium scale units. Those industries started during the colonial era with the traditional methods, but have now been equipped with new technologies, except the tea industry. Generally, whether small or medium, the tea industry has always had some sort of quality assurance, but medium-scale companies have traditionally had an increased level of controls. As a result, companies in this field have implemented the HACCP system (Anon, 2006). With this background the aim of this paper is to explore major benefits, costs and constraints of HACCP adoption in the tea processing industry.

### METHODOLOGY

The section presents the method used in this study which was carried out in four phases.

**Phase 1:** An exploratory approach was adapted to get an idea on different ways of adoption of HACCP in up country and low country tea factories, both with and without HACCP certification. Since the tea factories with HACCP certification are limited, such factories were purposively selected for the survey.

**Phase 2:** A pre tested semi-structured questionnaire was plotted to assess the benefits, costs, and constraints of adoption of HACCP safety management system. In addition, formal discussions with responsible authorities were held. Cross sectional interviews were also held with top and middle level managers and workers of the factories with HACCP certification in order to identify the benefits and remedial measures to rectify the identified problems through formal discussions with top management and other responsible authorities

such as Sri Lanka Standards Institute, SGS Lanka and Tea Association of Sri Lanka. Then the necessary adjustments were made in the pre-tested questionnaire.

**Phase 3:** Thirty three respondents were interviewed by using a corrected questionnaire. The respondents were presented with list of costs suggested by the previous studies. They were asked to rank each of those according to their importance relative to the overall cost of implementing HACCP in their tea factories. If a cost had not been incurred, respondents were instructed to allocate a rank of zero. Comments made by the factories on barriers and benefits to the adoption of the HACCP were listed and given to the respondents to rank using a five point Likert scale ranging from "Strongly agree" (5) to "Strongly disagree" (1).

**Phase 4:** The responses to benefits and constraints were analyzed using Factor and Cluster Analysis (Miller and Myers, 1999), and costs were descriptively analyzed with Statistical Package for Social Sciences (SPSS, 13.0).

### RESULTS AND DISCUSSION

#### *Benefits of HACCP Adoption*

To get a clear idea regarding the major benefits that have resulted after implementation of HACCP, mean importance scores of all the benefits were derived by descriptive statistic. According to the mean importance scores derived from descriptive statistics, most of the respondents were benefited low level of product wastage while majority disagreed (Table 1) to "low level of production costs".

**Table 1- Mean importance scores in descending order of benefits of HACCP adoption:**

Variables	Mean
Low level of production wastage	4.65
Low risk of low quality product reaching the market	4.48
Punctuality of production process	4.45
Staff awareness of food safety	4.35
Motivation of production staff	4.35
Improve factory image in the market	3.90
Ability to access new market	3.84
Ability to increase share of existing market	3.81
High level of labour productivity	3.58
Able to obtain high price for the product	3.23
Low level of production costs	2.26

The eleven benefits that presented to the respondents were reduced into three key factors

namely; “profit oriented benefits” (1), “production oriented benefits” (2) and “internal efficiency” (3) by using Principal Component Analysis. On the basis of the factor loadings, these three factors were interpreted as follows (Table 2).

**Table 2 - Factor loadings derived from Varimax rotation for the benefits of HACCP adoption:**

Benefits of adoption of HACCP	Factor 1	Factor 2	Factor 3
Ability to increase share of existing market	0.876		
Low level of production cost	0.876		
Ability to access new market	0.873		
Improve factory image in the market	0.780	0.345	
Motivation of production staff	0.721		0.375
Low level of production wastage	-0.595		0.499
Low risk of low quality product reaching the market		0.751	
High level of labour productivity		0.688	
Able to obtain high price for the product	0.402	0.685	
Punctuality of production process			0.832
Staff awareness of food safety		0.580	0.632

**Factor 1:** The benefits that loaded most heavily on this factor included “Ability to increase share of existing markets”, “Low level of production costs”, “Ability to access new market” “Improve image of the factory” and “Motivation of production staff”. Almost all of these variables express “*profit oriented benefits*” through the HACCP adoption.

**Factor 2:** The benefits that loaded most heavily on this factor were “low risk low quality product reaching the market”, “high level of labour productivity” and “able to obtain high price for the product”. This suggests that this factor was associated with “*production oriented benefits*” for the HACCP adoption.

**Factor 3:** The benefits that loaded most heavily on this factor were “punctuality of the production process” and “staff awareness of food safety procedure” loaded heavily on this factor. This suggests that this factor was associated with “*Internal efficiency*” as a benefit for the adoption of HACCP.

It is evident from the response to the survey that the decision of individual factories on adoption of HACCP was benefited by a different combination of

factors, reflecting their own particular characteristics and circumstances. For example, some factories were benefited predominantly by profit oriented benefits and/or internal efficiency, while other were benefited by the internal efficiency. Therefore, to identify the systematic similarities/differences in the benefits of the HACCP adoption, respondent were clustered according to their loading on each of the three identified factors.

To identify the most appropriate classification of respondent a *k*-mean cluster analysis was undertaken. Based on the cluster means for the derived factor scores and cluster sizes, following descriptors were derived (Table 3).

**Table 3 - Cluster means for factor scores derived from k - means clustering:**

Factors	Cluster				
	1	2	3	4	5
1. Profit oriented benefits	0.23	1.60	-0.73	0.48	0.12
2. Production oriented benefits	-0.97	-1.58	-0.54	0.80	1.02
3. Internal efficiency	-1.59	0.57	0.37	1.13	-0.70
Proportion of respondents (%)	12.9	6.4	35.4	19.3	25.8

**Cluster 1:** Around 13 percent of the factories can be classified as *profit oriented*, benefited through the HACCP adoption. *Production related* benefits as well as *internal efficiency* were less important benefiting factor than for respondent as whole.

**Cluster 2:** Around six percent of the respondents can be classified as *commercially driven* benefits. In this case *profit oriented* benefits and *internal efficiency* were the important benefiting factors to the respondents. *Production related* benefiting factor was less important.

**Cluster 3:** Around 35 percent of the respondents can be classified as *internal efficiency* driven. For these factories *profit oriented* benefits and *production related* benefits were less important. Highest amount of respondents were in this cluster.

**Cluster 4:** Around 19.3 percent of respondents benefited through the all factors.

**Cluster 5:** Around 26 percent of the respondent can be classified as *production related* benefited, it was the main benefit received of this cluster respondents and profit oriented benefits were lesser important than for respondent as whole.

**Costs of HACCP Adoption**

There was a great variation in the adoption of HACCP between individual respondents. For example, Even though 78.8 percent of respondents judged external training courses to be the most important cost with adoption of HACCP, nine percent

of the respondents not incurred that costs. Seventy two percent of the respondents judged that documentation as an important cost while 15 percent not incurred that as a cost. External consultants and supervisory staff time also incurred as a higher cost component compare to others. Study found that most of the factories not disrupted their production process to adopt the HACCP meta system (Table 4).

**Table 4 - Rank scores for costs of HACCP adoption:**

Cost component	Rank one (%)	Zero rank (%)
1. External training causes	78.8	9
2. Documentation	72.7	9
3. External consultant	66.7	6
4. Supervisory staff time	66.6	12
5. Alteration of tea factory	63.7	15
6. Scientific layout of factory	63.7	12
7. Purchase of new equipments	60.6	6
8. Production staff time	60.6	3
9. Disruption of production	3	97

Note: Rank one mean proportion of respondents giving rank one and zero rank mean proportion of respondent giving rank zero.

**Constraints of HACCP adoption**

To get a clear idea regarding the major constraints that faced with the implementation of HACCP, Mean Importance Scores of all the constraints were derived by descriptive statistic (Table 5).

**Table 5 - Mean importance scores for the constraints for HACCP adoption:**

Constraints	Mean
Training of workers	4.33
Budgetary constraints	3.42
Changes in the production process	3.18
Problem in obtaining external funding	3.18
HACCP is difficult to implement because of internal organization of the factory	2.94
Greater priority given to other issues than enhancing our food safety controls	2.42
Scale of operation is too small to have HACCP	2.12
Thought it best to wait and see the experiences of other factories	1.91
Considered that costs of implementing HACCP likely to get cheaper over time	1.79

Results revealed that the training of workers is a major constraint for majority of factories followed by budgetary constraints. The expectation on “reduction of implementation cost over the time” was the least constraint out of the given constraints. The nine constraints that presented to the respondents were reduced into three key factors namely; “Attitude of management” (1), “Internal environment” (2) and “Monitory problems” (3) by the Principle Component Analysis. On the basis of the factor loadings, three factors were interpreted as follows (Table 6).

**Table 6 - Factor loadings derived from Varimax rotation for the constraints of HACCP adoption:**

Variable	Factor 1	Factor 2	Factor 3
Training of workers	0.895		
Budgetary constraints			0.117
Changes in the production process	0.821		
Problem in obtaining external funding	0.783		
HACCP difficult to implement because of internal organization	0.581		0.557
Greater priority given to other issues than enhancing our food safety controls		0.925	
Scale of operation is too small to have HACCP		0.925	
Thought it best to wait and see the experiences of other factories			0.890
Considered that costs of implementing HACCP likely to get cheaper over time			0.681

**Factor 1:** Among the constraints that this factors included were namely “thought it best to wait and see the experiences of other factories”, “scale of operation is too small to have HACCP”, “considered that costs of implementing HACCP likely to get cheaper over time” and “greater priority given to other issues than enhancing our food safety controls”. Almost all those variables collectively express the *Management Attitudes* constraints for the HACCP adoption.

**Factor 2:** The constraints that loaded most heavily on this factor were “changes in the production process” and “HACCP difficult to implement because of internal organization of the factory”. This suggests that this factor was associated with *Internal Environment* constraints for the HACCP adoption.

**Factor 3:** The constraints that loaded on this factor were "problem in obtaining external funding" and "budgetary constraints". This suggests that this factor was associated with *Monetary Constraint* for the HACCP adoption.

To identify the systematic similarities and differences in the constraints, a *k*-mean cluster analysis was undertaken as same as in the benefits analysis. Based on the cluster means for the derived factor scores and the cluster size following descriptors were derived (Table 7).

**Table 7 - Cluster means for factor scores derived from *k*-means clustering:**

Factors	Cluster -			
	1	2	3	4
1. Management attitudes constraints	-0.39	2.78	-0.27	-0.11
2. Internal environment constraints	0.92	0.01	-0.13	-1.23
3. Monetary constraints	-0.62	0.03	1.04	-0.82
Proportion of the respondents (%)	33.3	9.09	36.3	21.2

**Cluster 1:** Around 33 percent of the factories were faced with *internal environment* constraints. *Management attitudes* and *monetary constraints* were less important factors than for respondent as a whole.

**Cluster 2:** Around nine percent of the respondents mainly faced with *management attitudes* driven constraints and *internal environment* and *monetary constraints* were less important constraints.

**Cluster 3:** Around 36 percent of the respondents can be classified as *monetary constraints* driven. For those factories *management attitudes* and *internal environment* were not important factors as a whole. This cluster represent, cluster with highest amount of the respondents.

**Cluster 4:** For this cluster, no constraint factors were affected for HACCP adoption.

## CONCLUSIONS

There was a great variation in the benefits derived as a direct result of HACCP adoption in tea factories. Many of the potential benefits of HACCP adoption are intangible. The most widely experienced benefits were the punctuality of the production process and staff awareness of food safety procedures. The main impact of HACCP is to enable business to meet the internal efficiency than obtaining any real competitive advantage over other suppliers. The costs of implementing HACCP vary among individual factories according to their own particular circumstances and prevailing standards, to which they operate. However, the major costs associated with the implementation of HACCP are external training, documentation, external consultants and supervisory

staff time. All the factories faced the difficulty in training of supervisory and production staff. Most of the factories experience monetary constraints than other constraints, presented to the respondent except training of supervisory and production staff. Some factories not faced any constraint factors in the HACCP adoption process because they have modified their factories and management before HACCP becomes mandatory.

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## REFERENCES

- Anon (2004). Annual Report, Central Bank of Sri Lanka, Colombo.
- Anon (1996). Food Safety Unit (Program of Food Safety and Food Aid of World Health Organizations) HACCP: Introducing the Hazard Analysis and Critical Control Point system, World Health Organization. Pp 25-32. Available at <http://www.who.int/entity/foodsafety/publication.htm> (accessed 23 January 2006)
- Anon (2005). Food safety management systems-requirements for any organization in the food chain, International Standard, ISO 22000, published in Switzerland.
- Anon (1995), "No way out", [http://www.nei-envis.org/tea\\_articles.html](http://www.nei-envis.org/tea_articles.html) (accessed 23 January 2006).
- Anon (2006). Quality Enhancement in Food Processing through HACCP, Edited by M. Satin and Maryland, Published in the Asian Productivity Organization 1-2-10 Hirakawacho, Chiyoda-ku, Tokyo, 102-0093, Japan, Available at <http://www.apotokyo.org>. (Accessed 03 August 2006).
- Miller. J. and T. Myers. (1999), Cluster Analysis, Part III Data collection, Preparation, Analysis, and Reporting. Fourth edition by N.K. Malhotra, Published by Pearson Edition (Singapore) Pvt. Ltd, 482 FIE. Patparganj, Delhi 110092, India. pp 584-607.