Assessing the Performance of Food System Towards Consumer Welfare: The Case of Fruit Processing Sector in the North Western Province

T. M. D. N. E. PEIRIS and U. K. JAYASINGHE-MUDALIGE

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

ABSTRACT

This study explores method of Multi-Item Summated Scales to measure perceived performance of the food system and use of an index - Consumer Welfare Index (CWI) - to measure consumer food related welfare. These scales were consisted of range of factors namely food safety, convenience, taste, choice, cost, health and nutrition, ethics, behavior of food companies and origin of food. Those factors reflect the performance of the food system related to consumer welfare derived from food. The CWI was developed, in turn, by weighting the various performance measures according to respondent's measure of importance. It is characterized by Mean Importance Score and Mean Performance Score. A questionnaire-based survey was undertaken with sample of 500 randomly selected consumers in the Wennappuwa electorate from July to August 2006 to collect data. The method of Cronbach alpha was used to measure the reliability of the multiple-item scales, and using Principle Axis Factoring checked the unidimensionality. Multi-Trait Multi method (MTMM) matrix was used to check the construct validity of the scales. Ranking of data based on different sociological variables including gender, education, income and area of living (urban vs. rural). The results suggest that the predominant drivers for the enhanced consumer welfare in this sector are safety of food, health and nutrition, and the origin of food.

KEYWORDS: Consumer Welfare Index (CWI), Food System, Fruit processing sector

INTRODUCTION

The processed food industry is totally depending on its ability to access and manage its supply chain downstream to the producer and upstream to its consumer. The fierce rivalry among the mainland sub continent cultures and similarity in its ingredient base would make Sri Lanka an ideal choice as the lead country in the processed food industry. And also it is an opportunity for millions of producers connected to a large consumer base around the world. When food manufacturing and processing are on the rise, urban consumers demand more processed foods (Braun, 2005). At the same time, rising consumer income and changing lifestyles are creating bigger markets for high value agricultural product like fruits. A widely observed feature of consumer behavior in the global economy has been increasing for processed fruit items like canned fruits in developed countries as well as in developing countries (Athukorala and Sen, 1991). Total fruit production in Sri Lanka is recorded as 254.86t and 32.38t fruits are imported from different countries. From that 3.47t of fruits are used for fruit processing sector. Major products of the fruit processing industry in Sri Lanka are jam, cordials, pickles, canned fruit juices and chutney.

Food system can be defined as the deliberate organization of the production, processing, distribution, selling and consumption of food with the objective of assessing nutritious and affordable foods. Food system aims to allow everyone to access food that is fresh, affordable and free from pesticide residues and safe from genetically modified ingredients (Anon, 2005). Research into food safety and traceability is motivated by concerning about the level of performance of the food system to deliver safe and healthy products which meet consumers' need. Food system performance with respect to food safety and quality standards will be strongly influenced by the structural characteristics of food chains, the strategies of individual firms, and the level of coordination within the food system (Garcia *et al.*, 2004).

It is important to look at the interaction of trust in institutions or individuals on consumer purchasing behavior (Bocker and Hanf, 2000; Eiser *et al.*, 2002). The food companies play a major role and they motivated by increment of profitability derived from the supply of high quality differentiated products which promoting the taste, convenience, nutritional and safety attributes (Mojduszka *et al.*, 2000). Food allergies and poisoning have resulted in a decrease of consumer trust in the performance of the food systems and it is essential to increase the guarantee of food safety and quality (Lobb, 2004). According to the well known ISO 9000:2000 international standard "quality is a degree to which a set of inherent characteristics fulfill requirements" and there is no doubt that quality is relative and does not exist on its own. And also quality perception is not constant in time or location because consumers' needs change (Zalewski and Eulalia, 2006). Consumer concern about the safety of the food they eat has been increasing and highlighted by a number of "food scares" in recent years. The demonstrable quality control system (for example product certification (SLS), ISO 9000 and ISO 14000) and safety standards (for example HACCP) are recommended as the most effective means of reducing food safety hazards. Therefore food safety and food quality like elements are becoming important for consumers when making purchase decisions. For an example, *E. coli* contamination at the Jack-in-the-Box chain of

fast food outlets led to a 25 percent decline in sales in1993 (Hennessy *et al.*, 2002). According to Kramer (1990), consumer activism has forced policy changes in a number of areas important to the agricultural and food industries. Kramer also argues that consumer concerns can translate into market behavior, frequently in volatile ways. Consumer allows them to decide for themselves whether the risks involved in food consumption, sufficient to justify changes in consumption habit. This decision is made on the benefit and accurate information and it is economically efficient for consumers to evaluate own attitudes towards welfare and their willingness to pay for more benefits.

Delivering safe, convenient, clean, nutritious foods at affordable price to the consumer is the responsibility of the food system. Need to investigate food related risk perceptions, factors influencing consumer's trust and sources of information, when food safety issues are concerned. Food systems should be guaranteed that their products are free from chemical residues and microbial contamination like health risks. Because consumers consider food safety as a major factor than the other factors. Therefore food retailers should have direct contacts with consumers, because consumers are the first to loose if food safety is compromised.

According to the literature, attention has been paid to the performance of food system and consumer food related welfare in developed countries mainly for United Kingdom and United State (Henson and Traill, 1998). Henson and Traill evaluated a quality of a food system by using various attributes of a food system which reflect the impact on consumer welfare by developing measurement instrument based on multi item summated scale. This instrument was applied to a national sample of food consumers in the household who's mainly responsible for purchasing food. Scales were developed that encompass a range of factors (constructs) that influence the welfare of a consumer derived from food including food safety, convenience of food, ethical issues associated with food, health and nutrition of food, taste of food, cost of food, choice of food and behavior of food companies. And also they discovered how important each of these constructs is to the consumer when they are making purchase decisions and captured the main aspects of food system that influence consumer welfare (Henson and Traill, 1998).

The focus of this study reported below the development of a measurement instrument to measure the quality of the food system and to find out which characters of food system mainly affect for the overall level of consumer welfare over time, notably in the context of the processed fruit processing sector.

METHODOLOGY

Consumer Welfare Index Concept

The study was developed to hypothesize that the consumer food related welfare derived from food system is associated with the demographic and economic characteristics. The consumer welfare index (CWI) developed in this study is very similar to the index of food related welfare employed in Henson and Trial (2000). The most notable characteristic of the index is its ability to capture both the relative importance of each construct to the consumers who making decisions as well as the performance of the food system which reflect the degree of enhancing the consumer welfare. In turn, the CWI is the weighted sum of two separate scales, namely: 1) Mean Importance Score (MIS); and 2) Mean Performance Score (MPS).

$$CWI = (MIS_i)^* (MPS_i) \quad (1)$$

Derivation of MIS

The MIS for particular constructs demonstrates the relative importance of that construct to decision makers when purchasing processed fruit products. The questioner itemized those nine constructs and respondent were asked to indicate the importance of each when making decisions using seven point Likert Scale from 'strongly disagree' (1) to 'strongly agree' (7).

Derivation of MPS

To derive the MPS for each construct, a set of attitudinal statements were presented to respondents and each statement corresponding to an observable characteristic of the construct. Respondents were asked to consider each statement and indicate the degree to which they agreed on a five point Likert Scale from 'Strongly disagree'(1)to 'Strongly agree'(5). Some statements were reverse-scored to prevent an 'agreement bias. In the process of estimating the MPS for each construct, the aim is to choose the set of indicators that most accurately reflect the variation in the construct they stand for. Initially it was desirable to generate a sufficiently large pool of indicators for a given construct which was then progressively tested and pruned to obtain a reliable and valid measure of that construct (De Vellis, 1991). The reliability of multiple-item scales corresponding to each constructs was tested by estimating the cronbach alpha (Cronbach, 1951) from the scores provided by respondent. While a higher alpha value indicates greater reliability, and *vice versa*, values above 0.7 are generally accepted as internally consistent (Nunnally, 1978). Further with the multidimensional and orthogonal data, related both to the nature of the research and the sample design, such as here, an alpha exceeding 0.5 was considered sufficient. After pruning the scales for reliable items, two constructs namely convenience of food and taste of food had alpha values of 0.70 and 0.72 respectively. And other all constructs had alpha value more than 0.6. Having derived reliable measure of each construct, the remaining indicators in the measurement model were employed to derive multi-item scale values for the defined constructs.

In order to derive a meaningful measure, the multiple indicators for each construct in the measurement model should congregate to a single construct. To test for unidimentionality, the factor loading of the selected indicators was explored to determine whether they were characterized by one specific construct by using principle factor analysis (Henson and Triall, 2000). While there is no criterion to assess whether the derived factor loading are significant, Spector (1992) suggests the indicator which having a minimum value of 0.30 to 0.35 can be taken as loading on to a single factor. At the beginning every constructs had eight items and after checked reliability, some constructs consisted of four items and some constructs had five items (Table1). The construct validity of the scales was examined by assessing convergent and discriminant validity trough the multi-trait multi method matrix (MTMM). This illustrates the correlation between the multi-item scale values for each constructs and some alternative measures of that constructs.

Having confirmed that the multi-item scales provide both reliable and valid measure of nine construct, it was possible to proceed with deriving the MPS. Then CWI was constructed by multiplying MIS and MPS. After deriving CWI for all constructs included in the measurement model was normalized so as to have a maximum value of one. The resulting index values reflected the relative contribution of each construct to the propensity to adopt enhanced consumer welfare.

Table 1- Scale reliability and descriptive statistics:

Scale	Number of Items	Cronbach Alpha	Mean Score
1.) Safety	4	0.646	3.63
2.) Convenience	5	0.704	3.61
3.) Nutrition	4	0.648	3.65
4.) Cost	4	0.625	3.71
5.) Taste	4	0.728	3.89
6.) Ethics	4	0.649	3.80
7). Choice	4	0.654	3.88
8.) Behavior	5	0.624	3.41
9.) Origin	4	0.630	3.63

Data Collection

The next step of this analysis was to collect data from representative sample of consumers in order to validate the hypothesis. A questioner based survey was undertaken of households which responsible for making purchase decision in Wennappuwa electorate in North Western Province from July to August 2006. Respondent were selected purposely in order to include as wide range of consumers by gender, location, age, income, education etc. The survey instrument was pre-tested on 25 sub set of consumers. In total, 500 consumers were included in sample. The questioner consisted of multiple item scales to derive MIS and MPS as well as items to collect consumer information. The main nine constructs which reflect the quality of food system as follows: (1) The safety of food; (2) The convenience of food; (3) The health and nutrition; (4) The cost of food; (5) The taste of food; (6) The ethical issues associated with food; (7) The choice of food; (8) Behavior of food companies; and (9) The origin of food (see Henson and Traill for details, 2000).

RESULTS AND DISCUSSION

MIS shows the substantive difference in the importance ranking across the sample and it reflects the decision making behavior of consumers. The results don't show significant difference in the importance ranking across the sample according to gender, location education and income levels. All consumers in North Western Province considered food safety and origin of food to be the most important constructs when making decisions regarding consumer welfare derived from food system, while taste of food and behavior of food companies were considered to be the least important (Figure1).

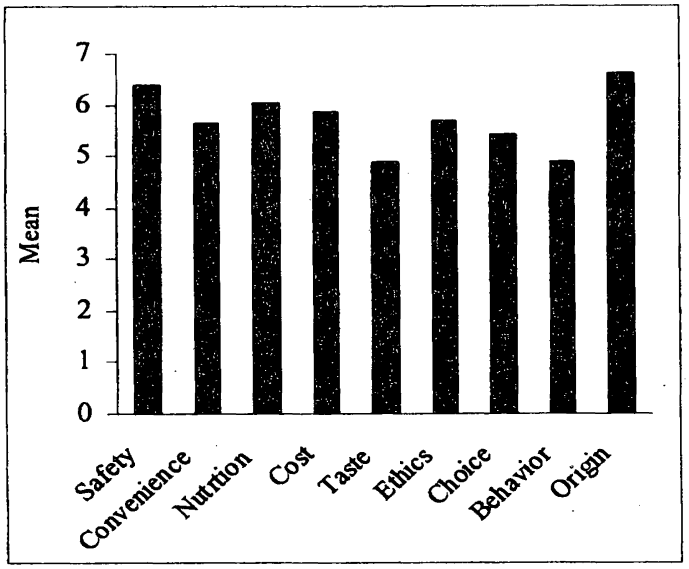

Figure 1 - Mean Importance Scores for food related welfare constructs:

Estimating of the MIS and MPS were used to derive the CWI for each construct. The values of the CWI indicate the relative impact of each construct on the propensity to enhance consumer welfare. According to the results, food safety was the strongest construct and food company behavior was the least important when enhancing consumer welfare in all male and female consumers. And it didn't change with the location, education and income levels. And rural and urban people also more concern about food safety but they considered food company behavior and taste of

Table 2 - Consumer Welfare Index (I) and their rank (R) for constructs (C) based on variables:

C	Gender				Location				Education								Income				
	M		F		R		U		P		S		T		L		M		H		
	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	
Safety	12.6	1	12.4	1	12.3	1	12.4	1	12.4	1	12.5	1	12.2	1	12.9	1	11.3	2	12.2	1	
Convent	10.8	7	10.9	6	11.3	4	10.4	7	10.4	7	11.1	6	11.0	5	10.0	8	18.6	1	10.9	7	
Nutrition	11.6	2	11.8	2	12.2	2	11.3	5	11.7	3	11.7	4	12.0	2	11.8	3	10.8	3	11.7	2	
Cost	10.4	5	11.6	3	11.8	3	11.3	5	11.4	4	11.5	5	11.7	4	11.5	4	10.7	6	11.4	4	
Taste	11.4	8	10.2	8	10.6	8	9.60	9	10.1	8	9.80	8	10.6	7	11.0	6	8.80	8	10.4	5	
Ethics	11.0	6	11.5	4	11.1	6	11.9	2	12.2	2	10.6	7	11.9	3	11.9	2	10.4	7	11.6	3	
Choice	11.5	3	10.9	6	11.0	7	11.4	4	10.8	6	12.3	2	10.2	8	10.1	7	10.6	4	10.9	8	
Behavior	8.70	9	8.90	9	8.10	9	9.70	8	9.30	9	8.20	9	9.20	9	9.30	9	7.80	9	9.30	9	
Origin	11.5	3	11.4	5	11.3	4	11.5	3	11.3	5	11.8	3	10.9	6	11.1	5	10.6	4	11.3	6	

Notes: I and R denote Consumer Welfare Index and Rank, respectively.

food were least important when purchasing. But most significant feature of rural people was they more concern about cost than the urban. The results suggest when people are more educated they highly concern on health and nutrition than the other facts. Although people have high income, there is no significant difference in their purchasing behavior. And it is almost same with low and medium income groups (Table 2).

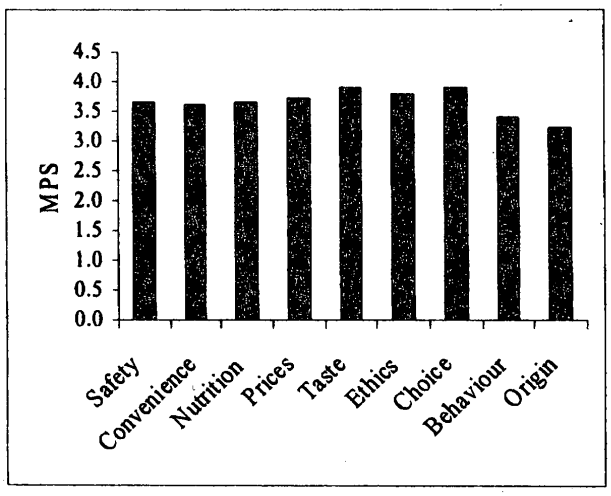

Figure 2 - Mean Performance Scores for food related welfare constructs:

Having confirmed that the multi - item scales provide both reliable and valid measures of the 9 constructs and it is possible to derive the MPS to measure the performance of food system. According to the MPS, food systems were considered the taste of food and choice of food had greater impact on consumer welfare although these were given relatively low importance scores. Therefore it didn't figure as a major factor in decisions when enhance the consumer welfare. Likewise, food systems were considered behavior of food and origin of food had not a greater impact on consumer welfare. But according to the importance score, consumers have considered, origin of food is more important for consumer welfare (Figure 2).

CONCLUSIONS

This paper has described and developed Consumer Welfare Index (CWI) by applying multi-item summated scaling techniques. It reveals the impact of each construct on the propensity to implement the consumer welfare. And CWI reflects how consumer's decision making behavior vary with the demographic and economic characters. Specifically a nine component instrument for the consumer food related welfare has been developed that demonstrates reliability, unidimentionality and construct validity. The study results suggest that the predominant drivers for the implication of enhancing consumer welfare in processed fruit industry are food safety issues, health and nutrition and origin of food. This information is potential to policy makers in identify priorities and assessing the effectiveness of existing interventions. It might also be employed by food business to assess whether marketing efforts are targeted at areas of the food system that consumers judge to be important in terms of their overall food related welfare. The results of this specific study, make a timely contribution to the on going debate on the role of food system for delivering products which are safe, healthy, fresh, affordable and free from pesticides which meet consumer's need.

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