

Identification and quantification of barriers to HACCP implementation: Evidence from Ontario Food Processing sector.

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ABSTRACT

This article explores the barriers that prevent the adoption of HACCP system by food processing firms in Ontario, Canada. The study identifies four key groups of barriers that prevent firms from adopting HACCP system in their food safety control programs, namely questionable appropriateness, scale of change, low priority and financial constraints. The severity of barriers is significantly different between the HACCP implementers and non-implementers while such differences are substantially higher for the barriers that have been grouped into questionable appropriateness of HACCP system relative to other barriers.

INTRODUCTION

Hazard Analysis Critical Control Point (HACCP) system has acquired a widespread consensus as the most effective and economically efficient approach to food safety control which is based on risk assessment and process control rather than end product testing (Worsfold and Griffith, 2003). HACCP is a structured system that aims to identify the points in the manufacturing process at which hazards (biological, physical or chemical) might occur and to continuously monitor and control these points in an attempt to ensure that products meet pre-specified performance criteria thereby reduces the prevalence of food-borne diseases (Marriott, 1999; Mortimore and Wallace, 1998; NACMFC, 1992). HACCP system is universally endorsed by international bodies such as Codex Alimentarius Commission, Food and Agriculture Organization, and World Health Organization. During the last few years, it has been mandated by U.S. federal regulations for seafood, meat, poultry, and has been proposed for fruit juice. Many other industrialized nations have mandated HACCP for part or all of their food industries.

Canadian Food Inspection Agency (CFIA) in 1991 developed the Food Safety Enhancement Program (FSEP) to encourage and support the development, implementation and maintenance of HACCP system (CFIA, 2003). However, as of the present HACCP-based food safety system is voluntary in Canada, except for the federally registered fish and seafood processing establishments and meat slaughter establishments exporting to the U.S. Recently, the CFIA has proposed mandatory requirements for the implementation of the FSEP in all federally registered plants including registered storage facilities.

Despite the wider endorsement of the benefits of HACCP system, food safety literature indicates that the successful implementation of HACCP have been limited and food operators not embracing it with the anticipated enthusiasm (Ehiri, Morris and McEwen 1995; Panisello et al., 1999; Taylor 2001; Panisello and Quantick, 2001; Taylor and Taylor, 2004a). An individual firm does not have incentives to take in to account the negative external effect of losing consumer confidence for whole range of food products where even a single case of food-borne illness outbreak scares the consumers away from the similar food products (McEachern et al 1999; Report of the Meat Regulatory and Inspection Review, 2004). Small and medium enterprises (SME) in food processing sector seems to be a special concern in this context because it has been recognized that SMEs have greater difficulty in implementing HACCP for reasons of their size, lack of technical expertise, economic resources, or the nature of their work (WHO, 1999). The role of governments and professional trade bodies in facilitating HACCP implementation and devising strategies to overcome barriers that are faced by SMEs were highlighted (WHO, 1999; Mayes and Mortimore, 2001). However, there is a paucity of research on identifying and quantifying barriers to successful HACCP implementation especially those faced by SMEs (Worsfold and Griffith, 2003; Taylor and Taylor 2004a).

Moreover, related literature suggests that further efforts are needed to disentangle and distinguish between “incentives/disincentives” and “barriers” in HACCP implementation decisions. If a firm has correctly perceived the expected costs and expected benefits of HACCP implementation and non-adoption decision is optimal if net benefits are zero. Such non-adoption decisions are unrelated to the presence of barriers but related to the perceived incentives and when there are no expected net benefits firms

do not have incentives in implementing HACCP. Some of the barriers identified in the literature such as “lack of resources and time”, “lack of support from top management” “lack of external financing available” (WHO, 1999; Panisello and Quantick, 2001) are seems to be absence of incentives to implement HACCP rather than barriers. In contrast, a presence of barrier is more likely, if a firm perceive net benefits by implementing HACCP yet ended up not implementing it.

The objective of this paper is to identify a set of barriers that prevent food processing firms implementing HACCP and quantify the perceived severity of these barriers and to explore whether there are systematic categories of barriers that are relatively more important than others. To best of our knowledge this is the first survey based study that collected establishment level information about perceived costs and benefits of HACCP adoption together with firm’s perception of severity of barriers that they faced in their HACCP implementation. Mostly, quality assurance managers or owner/operators were the respondents and questions were designed to elicit information about the importance of HACCP in the effectiveness of food safety control in their operations, importance of HACCP for the business performance of their operations, motivations to implement HACCP, expected costs and benefits of HACCP implementation, divergence between expected and actual costs and benefits of HACCP, and finally severity of barriers in their decision to HACCP implementation. The study collects the above information of HACCP system at firm level from 134 food processing firms in Ontario, Canada using a mailed questionnaire. The sample was stratified across three industries (meat, dairy, and fruits and vegetables) and across three jurisdictional categories (federally registered, provincially licensed, and municipally inspected). The

larger sample size of the study by both industry type and firm sizes could provide more widely applicable findings about the nature of barriers to HACCP implementation compared to the existing case studies (see for example Taylor and Taylor 2004a; Taylor and Taylor 2004b).

Barriers to adoption of HACCP system

The factors that could influence the adoption of practices to enhance firm's food safety status are complex and multifaceted. Panisello and Quantick (2001) assert that reasons for not implementing HACCP seem far more complicated than imagined and cannot be solely explained in terms of unwillingness by manufacturers but rather by the presence of several technical barriers that may impede the benefits of the application of the HACCP system. Moreover, since firm level benefits that are attributable to HACCP implementation are intangible (Golan, et al., 2000; Caswell, 1998; Holleran, Bredahl and Zaibet, 1999; Caswell, Bredahl and Hooker, 1998), disentangling between the absence of incentives and the barriers to adoption is a formidable research challenge. Even when the firm level net benefits from adopting a given technology are tangible and substantial, failure to make use of such technologies and unrealized profits continues to puzzle economists. For instance, energy efficient electrical retrofits proven to have a very high rate of return at the individual firm level (far in excess of economy-wide average cost of capital; see de Groot, Verhoef and Nijkamp, 2001; Van Soest and Bulte, 2001; Decanio, 1998; Decanio, 1993; Gruber and Brand, 1991; Sutherland, 1991; Ross, 1989). Yet, firms' reluctance to realize these profits is one of the most pervasive anomalies in energy economics that continues to puzzle economists. Presence of barriers that prevent firms

from adopting such profitable technologies has become a plausible explanation (DeCanio, 1998).

The issue of barriers to HACCP implementation was complex and characterized by confusion and inconsistencies. Indeed, a key issue for the study as a whole was the definition of a rigorous categorization of 'barriers'. In many cases issues that were identified as barriers by enterprises reflected business decisions rather than an absolute constraint on their operations. For example, was the implementation of HACCP hampered because of the absence of investment funds or the opportunity cost of other investment options (for example new product development) that would have had to be foregone? A further overriding issue was the level of awareness and perceptions of the 'appropriateness' of HACCP. This was a complicated issue; if enterprises did not perceive the need to implement HACCP they were unlikely to spend time informing themselves and/or exploring the options and associated costs and benefits of HACCP implementation. Perception of the "appropriateness of HACCP" has been often confused as the "lack of management commitment" (Panisello and Quantick, 2001; Codex Alimentarius, 1997). Unless the management is convinced that HACCP system is the best approach to deliver the firm specific goals of food safety controls, the management commitment may not be forthcoming.

Non-adoption of HACCP by food processing enterprises was generally associated with two main factors. In some cases there appeared to be a net cost from the adoption of HACCP, reflecting for example the lack of coherent benefits because of the types of market supplied by the enterprise. In others, there was evidently a net benefit, but this was not perceived by the enterprise, perhaps because many of the benefits were

intangible or reflecting the lack of record-keeping. Quite different strategies and policies need to be adopted to address these two scenarios. More generally, many food processing enterprises had weak and/or biased perceptions of the likely costs and benefits associated with the adoption of HACCP. Thus, there may be very weak incentives for them to adopt HACCP on a voluntary basis. Among small and medium-sized enterprises in particular there were widespread perceptions that HACCP is difficult and costly to implement and 'inappropriate' to the scale and/or type of their operation. An awareness of the barriers that prevent adoption of HACCP system is important at all the levels of stakeholders involved in the safety of the food chain. Along with private initiatives, more targeted policies could be formulated to overcome such barriers thereby facilitate the wider adoption of HACCP system especially in the sectors that are particularly known to be laggards such as SMEs, and catering and restaurants.

Survey of the Ontario Food Processing Industry

A structured questionnaire was developed using a comprehensive list of factors motivating HACCP adoption, costs and benefits and barriers through the information gathered by existing literature. The draft questionnaire was revised on the basis of the feedback received from a group of senior quality managers. The questionnaire was elicited through a postal survey of 1295 meat, dairy and fruit and vegetable processing establishments in Ontario over the period May to July 2004. Within this sample there were 201 postal delivery failures indicating that addresses were non-existent. A reminder was sent to all non-respondents after six weeks and after a further two weeks each non-responding establishment was telephoned. During this process, 50 establishments indicated that they did not undertake processing and were discarded from the survey.

This provided a valid sample frame of 1,044 establishments. Of these, 134 provided a fully completed questionnaire, with an overall response rate of 12 percent.

The postal questionnaire was designed to collect a large body of information from each respondent because of the complexity of processes of HACCP adoption, the trade-off being a lower response rate overall. Among the 134 responding firms 19 percent were dairy processors, 70 percent were meat processors and 10 percent were fruit and vegetable processors (Table 1). Respondents in each sub-sector provided a somewhat representative sample of the Ontario food processing sector although comparison across the sectors is made problematic by the small sample sizes in some cases.

General Information of food safety controls among the respondents

As expected, respondents attached a very high priority to managing product safety as a strategy in enhancing their competitiveness, with an average importance score of 4.76 on a five-point scale from very unimportant (1) to very important (5) (Figure 1). Indeed, establishments placed food safety assurance at the same level as assuring product quality, with no significant difference in importance score between the two at the five percent level. Factors such as controlling costs of production and pricing were given a much lower importance in the competitiveness of respondents.

In order to assess the perceptions of food processing establishments regarding the role of various practices on the overall effectiveness of food safety controls, respondents were asked to judge the importance of HACCP, GMP and a range of other controls on a five-point scale from 'very important' (5) to 'very unimportant' (1). Across the sample as a whole, GMP and traceability were considered to be the most important practices in achieving effective food safety controls, with a recall system and HACCP of secondary

importance (Figure 2). Even among establishments that had fully implemented HACCP, GMP was considered of more importance to the effectiveness of food safety controls, although not significantly so. Among respondents that had not implemented HACCP, the mean importance score for GMP was much greater than for HACCP. Further, the importance score attached to HACCP was lower for non-implementing establishments than for implementing establishments. On the one hand this could represent an *ex post* rationalization for having implemented/not implemented HACCP. On the other, it could reflect perceptions that HACCP is not central to effective food safety controls given the particular characteristics of the establishment. The results of the in-depth case studies suggest that this latter explanation is most prevalent. For example, smaller establishments in particular are of the view that HACCP is not appropriate to their scale of operations.

Respondents were asked, in the same manner as above to judge these same food safety controls on the performance of their business. Again GMP and traceability were considered to be of greatest importance to their business performance, with recall systems and HACCP of lesser importance (Figure 3). Establishments that had not implemented HACCP were less likely to consider HACCP to be an important factor influencing the performance of their business. Interestingly, however, establishments that had implemented HACCP considered GMP and traceability to be of greater importance to their business performance, suggesting that they may not have experienced any significant gains in their market share or profitability as a result of HACCP adoption. In all cases, ISO 9000 was considered of least importance to business performance.

Information about the HACCP system among the respondents

Of the respondents to the survey, 38 percent had fully implemented HACCP (Figure 4). Of these, 86 percent had had their HACCP system verified by an external body. A further 19 percent were in the process of implementing HACCP and five percent had plans to implement. However, 37 percent had no established plans to implement HACCP.

There were differences in the HACCP status of respondents across the industry sector (Table 2). Around one third of both meat and dairy processing plants had fully an operational HACCP system. However, a further 42 percent of establishments in the meat processing sector were in the process of implementation, compared to only 13 percent in the dairy processing sector. Around 49 percent of the dairy processing plants had no plans to implement HACCP! The number of respondents in the fruit and vegetable processing sector is not sufficiently large to make a valid comparison.

There were also differences in rates of HACCP implementation by establishment size (Table 3). Around 61 percent of small firms had no plans to implement HACCP, compared to nine percent of medium-sized establishments and zero large establishments. All of the large establishments had HACCP or were in the process of implementation. Around 59 percent of medium-sized establishments also had a fully-operational HACCP system.

A very large proportion (96%) of the large establishments indicated that their customers required them to have implemented HACCP (Table 4). In the case of small establishments, however, only 20 percent indicated that their customers required them to have HACCP. Across the three sectors, customers required HACCP to be implemented

by their suppliers most frequently in the case of fruit and vegetable processing and least frequently in the case of meat processing.

Respondents were asked to indicate the difficulty of implementing HACCP on a five-point. Over 50 percent considered HACCP implementation to be difficult or very difficult (Figure 5). Only 10 percent considered implementation to be easy or very easy. There was no significant difference in mean difficulty scores at the five percent level across establishment size or sector (Table 5).

Barriers to implementation of HACCP

Through a review of the literature and analysis of the case studies, a number of potential barriers to the implementation of HACCP were identified (WHO 1999; Panisello and Quantick, 2001; de Groot, Verhoef and Nijkamp, 2001; Worsfold and Griffith, 2003). Respondents were asked to indicate the importance of each on a five-point scale from 'very important' (5) to 'very unimportant' (1). Across the sample as a whole, the most important barriers were associated with finance, namely internal budgetary constraints, problems obtaining external funding and other investments being considered more important, as well as existing food safety controls being considered adequate, the scale of changes required to existing production practices and the overall scale of the changes being considered overwhelming (Table 6).

The fact that food safety was not considered a sufficiently important investment and HACCP going against the ways in which things had traditionally been done were considered relatively unimportant barriers to HACCP implementation.

In order to better characterize the barriers to HACCP implementation, these importance scores were subject to principle components analysis. Overall, there were four factors with eigenvalues greater than one, which collectively explained around 61 percent of the variation in responses across the sample as a whole. These are detailed in Table 7. The barriers that loaded most heavily on to factor one were “perception that HACCP is not suitable for the firm”, “perception that firm’s scale of operations is too small for HACCP”, “perception that current food safety control are sufficient,” “uncertainty about whether future regulatory requirements met by HACCP”, and “uncertainty about potential benefits from HACCP.” This factor is associated with **questionable appropriateness** of HACCP, which accounts for 39 percent of the variation across the sample. The second factor has heavy weightings for “scale and scope of changes needed to present food safety controls,” “wide scale facility upgrading required for HACCP implementation” and “scale and scope of changes needed prior to adopting HACCP”. This suggests that this factor is associated with **scale of change**, which accounts for around nine percent of the variation. Factors three and four each account for around six percent of the variation across the sample. Factor three has heavy loadings for “greater priority given to other issues” and “food safety investments being a low priority,” suggesting this is associated with **low priority**. Barriers loading heavily on to the fourth factor were “difficulty in obtaining budgetary funding” and “internal budgetary constraints”. This factor is associated with **financial constraints** to the adoption of HACCP.

Severity of barriers between HACCP implementers and non-implementers

The barriers could be operated in a different way between the firms that have fully implemented HACCP systems and firms that have not implemented HACCP. The mean importance scores for each of the barriers for the HACCP implementers and non-implementers are calculated (Table 8). These mean scores are compared using Mann-Whitney U test and Z values of the test and p values are also reported in Table 8. Highly significant differences of the mean importance scores between the HACCP implementers and non-implementers were found for 18 out of the 22 barriers, suggesting that the perceived severity of various barriers are very different among the HACCP implementers and non-implementers.

As expected, mean importance score values of all the barriers are relatively higher for the non-implementers (Table 8) indicating that perceived severity of the barriers are in general higher for the non-implementers. However, the greatest differences of the severity of the barriers between the HACCP implementers and non-implementers are found to be on the barriers that are related to the “questionable appropriateness” of HACCP for the firm. On the other hand most of the barriers that are related to “scale of change” seem to have smaller divergence between HACCP implementers and non-implementers. This finding emphasizes the importance of educating and perhaps successful models of HACCP adoptors across variety of business firms and demonstration tours for prospectus HACCP implementers would be recommended.

Conclusions

This paper has provided the most detailed analysis to date of the barriers associated with the implementation of HACCP and other enhanced food safety controls

in the Canadian/Ontario food processing sector. Overall, GMP and traceability are considered by food processors as the most important practices in terms of the efficacy of their food safety controls and business performance, even among plants where HACCP has been implemented. In most cases, the surveyed plants considered their existing food safety controls to be satisfactory, although there were significant differences across plant size and sectors. This suggests that there may be only weak incentives for many firms that have not adopted HACCP to do so.

The results suggest that the predominant barriers to the implementation of HACCP were associated in general with finance such as internal budgetary constraints, problems of obtaining external funding, and other investments considered more important. Using principle component analysis to identify broader cross-cutting factors that act as barriers to implement HACCP, however, a rather different picture emerged, with the “questionable appropriateness” of HACCP coming through as the dominant barrier to HACCP adoption. Clearly, firms’ unreceptive attitude towards the HACCP system’s suitability, potential to garner benefits, and ability to enhance the current food safety status are affecting together to erect an important barrier that prevent firms from adopting HACCP system. The factor identified as “questionable appropriateness” is able to account about 39 percent of the variation of responses given to the 22 barriers across the sample. In addition, barriers that are heavily loaded into the “questionable appropriateness” factor seem to have a far greater importance as a barrier to the HACCP non-implementers compared to the firm that have implemented HACCP and the mean importance score values for the HACCP implementers and non-implementers for such barriers are significantly different. For instance, for the HACCP non-implementers,

barriers that are involved with the factor of “questionable appropriateness” such as “perception that current food safety controls are sufficient” are even more important than “internal budgetary constraint” which recorded the highest mean score as a barrier for the entire sample. Thus, the level of awareness and perceptions of the ‘appropriateness’ of HACCP seems to be far more important barrier that must be addressed in order to facilitate the adoption of HACCP. Clearly, if enterprises did not perceive the need to implement HACCP they were unlikely to spend time informing themselves and/or exploring the options and associated costs and benefits of HACCP implementation.

These results suggest a number of potential strategies through which the implementation of HACCP might be facilitated and enhanced through cooperation and coordination between policy makers and industry organizations. First, there is a fundamental need for improve the awareness about the training materials and modules that address the fundamental staffing issues associated with the implementation of HACCP might be alleviated. Second, for a need to be established through which food safety managers can exchange experiences and/or identify ‘best practices’. Finally, a series of case studies should be undertaken based around pilot/demonstration plants through which the process and implications of HACCP implementation might be made ‘more visible’ to business decision-makers in the Ontario food processing sector.

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Table 1. Firm size and sub-sectors of establishments responding to the survey:

Firm Size (no of employees)	Number of firms (percentage)			Group Total
	Dairy	Meat	Fruit & Vegetables	
Small (<= 20)	15 (11.2%)	61 (45.5%)	1 (0.7%)	77 (57.5%)
Medium (>20 & ≤ 100)	10 (7.5%)	18 (13.4%)	4 (3.0%)	32 (23.9%)
Large (> 100)	1 (0.7%)	15 (11.2%)	9 (6.7%)	25 (18.7%)
Group Total	26 (19.4%)	94 (70.1%)	14 (10.4%)	134 (100.0%)

Table 2. Status of HACCP implementation by industry sub-sector:

HACCP status	Number of Establishments (%)		
	Dairy	Meat	Fruit and Vegetables
Fully operational	9 (34.6%)	32 (34%)	10 (71.4%)
In the process of implementing	11 (42.3%)	12 (12.8%)	3 (21.4%)
Have planned to implement	3 (11.5%)	4 (4.3%)	-
No plan to implement	3 (11.5%)	46 (48.9%)	1 (7.1%)
Total	26 (100%)	94 (100%)	14 (100%)

Table 3. Status of HACCP implementation by establishment size:

HACCP status	Number of Establishments (%)		
	Small	Medium	Large
Fully operational	11 (14.3%)	19 (59.4%)	21 (84%)
In the process of implementing	13 (16.9%)	9 (28.1%)	4 (16%)
Have planned to implement	6 (7.8%)	1 (3.1%)	-
No plan to implement	47 (61%)	3 (9.4%)	-
Total	77 (100%)	32 (100%)	25 (100%)

Table 4. Customer requirement for HACCP:

Whether Customers Require HACCP	Number of Establishments (%)		
	Small	Medium	Large
Yes	15 (19.7%)	26 (81.2%)	24 (96.0%)

	Number of Establishments (%)		
	Dairy	Meat	Fruit and Vegetables
Yes	12 (46.15%)	40 (43.01%)	13 (92.8%)

Table 5. Level of overall difficulty in implementing HACCP

Sector	Mean Score
Dairy	3.50
Meat	3.54
Fruit and Vegetables	3.75

Establishment Size	Mean Score
Small	3.52
Medium	3.54
Large	3.63
Total	3.56

Table 6 Barriers faced by firms in implementing HACCP system

Barriers to the implementation of HACCP	Mean Score
Implementation of HACCP impeded by internal budgetary constraints	3.49 (a)
Current food safety controls considered sufficient	3.40 (a)
Problems obtaining external funding	3.40 (a)
Lot of changes to our production processes needed before HACCP could be put in place	3.37 (a)
The things needing to be done in order to implement HACCP overwhelmed us	3.36 (a)
Other investments considered more important	3.36 (a)
Lot of changes to our food safety controls needed before HACCP could be put in place to support the implementation of HACCP	3.10 (b)
Wide scale upgrading of the plant needed before HACCP could be put in place	3.02 (b), (c)
Scale of operation is too small to have HACCP	2.96 (b), (c)
Not sure whether the implementation of HACCP would meet future regulatory requirements	2.96 (b), (c)
Uncertain about the potential benefits of implementing HACCP	2.94 (b), (c)
HACCP difficult to implement because of internal organization of the company	2.90 (b), (c)
Concerned that HACCP would reduce our flexibility in production	2.88 (c)
Thought it best to wait and see the experiences of other companies before implementing ourselves	2.82 (c), (d)
Did not really see HACCP as suitable for our plant	2.78 (c), (d)
Not sure whether the implementation of HACCP would meet our customers requirements	2.76 (c), (d)
Considered that costs of implementing HACCP likely to get cheaper over time	2.71 (c), (d)
Greater priority given to other issues than enhancing our food safety controls	2.65 (d)
Food safety issues not considered sufficiently important to warrant the investment	2.61 (d), (e)
HACCP goes against all of the ways in which we have traditionally done things	2.39 (e)

scores are strongly disagree =1; strongly agree = 5; items with same letters are not significantly different to each at 5% level based on Wilcoxon sign rank test

Table 7. Factor loadings of barriers to HACCP Implementation:

Barriers	1 st Factor	2 nd Factor	3 rd Factor	4 th Factor
Internal budgetary constraints	0.094	0.196	0.300	0.716
Difficulty in obtaining external funding	0.134	0.129	0.167	0.845
Relative importance of other investments	0.319	0.319	0.573	0.244
Scale and scope of changes prior to adopting HACCP	0.015	0.707	0.237	0.171
Food safety investment being a low priority	0.384	0.196	0.735	0.088
Greater priority given to other issues	0.158	0.207	0.753	0.181
Internal organization of the company	0.132	0.507	0.501	0.175
Scale and scope of changes to food safety controls	0.037	0.759	0.386	0.003
Uncertainty about meeting customer requirements by HACCP	0.541	0.163	0.563	0.111
Uncertainty about potential benefits from HACCP	0.647	-0.054	0.507	0.207
Perception that current food safety control are sufficient	0.711	0.074	0.350	0.218
Perception that cost of HACCP adoption would be cheaper over time	0.058	0.142	-0.083	0.165
Overwhelmed by things to be done to adopt HACCP	0.210	0.556	-0.030	0.252
Tendency to learn from other's experience act	0.627	0.240	0.106	0.421
Uncertainty about whether future regulatory requirements meet by HACCP	0.676	0.169	0.170	0.320
Perception that firm's scale of operation is too small for HACCP	0.810	0.233	0.203	0.002
Perception that HACCP is not suitable for the firm	0.855	0.151	0.170	0.020
Perception that HACCP would reduce the flexibility of operations	0.538	0.277	0.200	0.181
Wide scale facility upgrading required for HACCP implementation	0.371	0.722	0.088	0.140
Perception that HACCP goes against our traditional methods	0.544	0.590	0.055	0.055
Difficulty in getting help and advises	0.452	0.016	0.018	0.496
Perception that firm did not have the skills for implement HACCP	0.354	0.423	0.072	0.229
Proportion of variation explained by each factor (%)	39.24%	9.20%	6.70%	5.97%

Table 8. Severity of barriers to HACCP implementers and non-implementers

Barrier to HACCP implementation	HACCP IMPLEMENTED		Mann-Whitney U Test	
	YES	NO	Z-Score *	P value
	Mean score			
Perception that firm's scale of operation is too small for HACCP	2.13	3.57	-5.977	0.000
Perception that current food safety control are sufficient	2.81	3.84	-5.435	0.000
Uncertainty about meeting the customer requirements by HACCP	2.19	3.19	-5.057	0.000
Perception that HACCP is not suitable for the firm	2.17	3.23	-4.833	0.000
Tendency to learn from other's experience	2.37	3.16	-4.819	0.000
Uncertainty about whether future regulatory requirements meet by HACCP	2.50	3.30	-4.521	0.000
Internal organization of the company	2.44	3.25	-4.23	0.000
Uncertainty about potential benefits from HACCP	2.48	3.29	-4.151	0.000
Difficulty in obtaining external funding	3.00	3.69	-4.139	0.000
Relative importance of other investments	2.96	3.64	-3.899	0.000
Difficulty in getting help and advises	2.37	2.97	-3.86	0.000
Internal budgetary constraints	3.13	3.76	-3.526	0.000
Food safety investment being a low priority	2.27	2.86	-3.302	0.001
Perception that HACCP would reduce the flexibility of operations	2.56	3.13	-3.086	0.002
Perception that HACCP goes against our traditional methods	2.12	2.61	-2.77	0.006
Greater priority given to other issues	2.38	2.86	-2.584	0.010
Perception that firm did not have the skills for implement HACCP	2.55	3.00	-2.554	0.011
Wide scale facility upgrading required for HACCP implementation	2.77	3.21	-2.431	0.015
Scale and scope of changes needed to present food safety controls	2.92	3.23	-1.583	0.113
Overwhelmed by things to be done to adopt HACCP	3.19	3.49	-1.276	0.202
Perception that cost of HACCP adoption would be cheaper over time	2.67	2.74	-0.598	0.550
Scale and scope of changes needed prior to adopting HACCP	3.35	3.39	-0.186	0.853

* 2-tailed test

Figure 1. Importance of strategies in competitiveness of respondents:

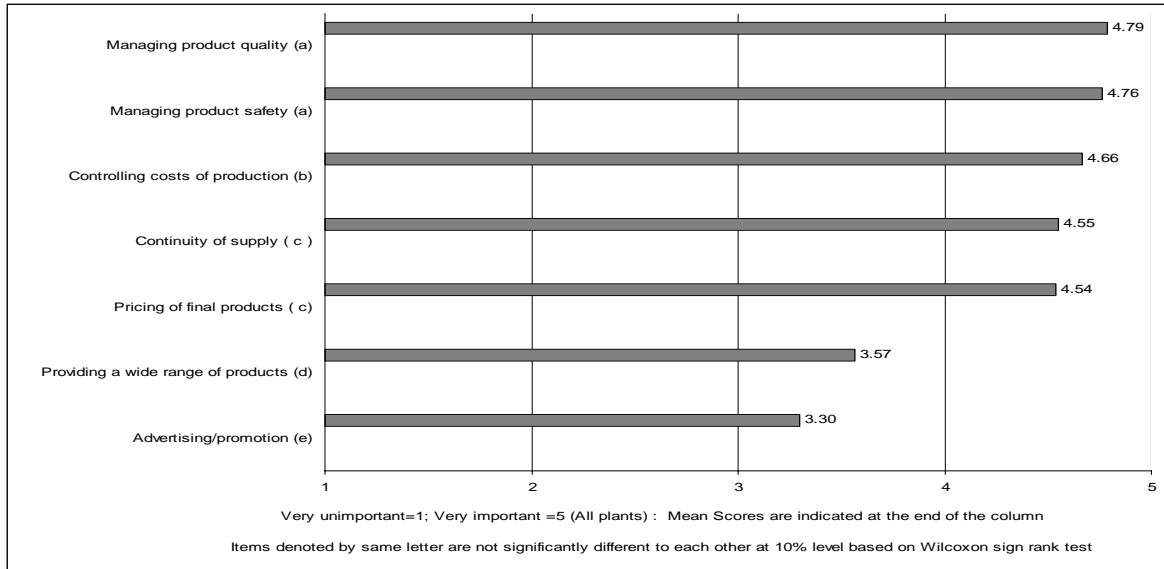


Figure 2. Effectiveness of practices on establishment's food safety controls:

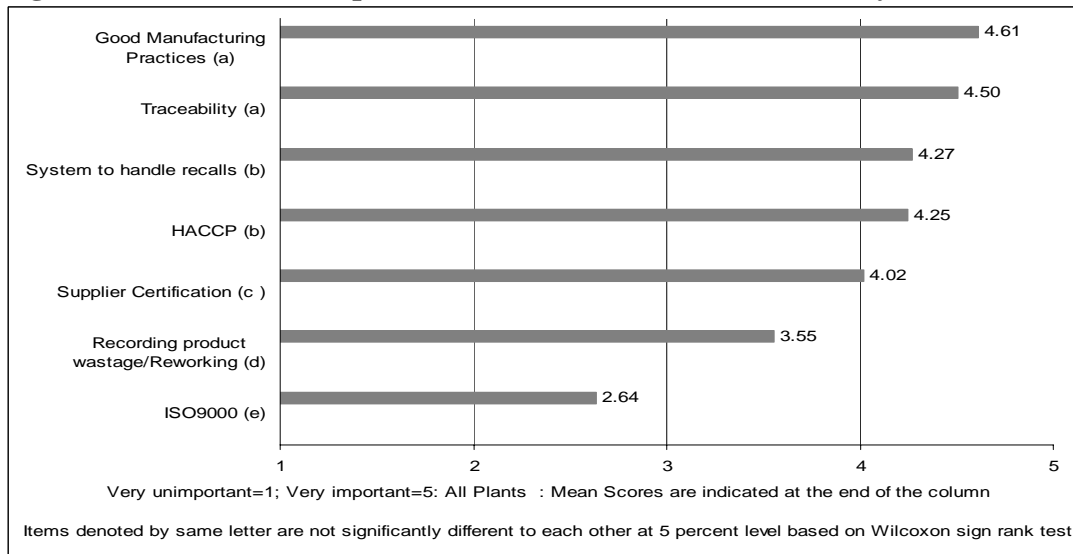


Figure 3. Impact of food safety practices on of practices on business performance:

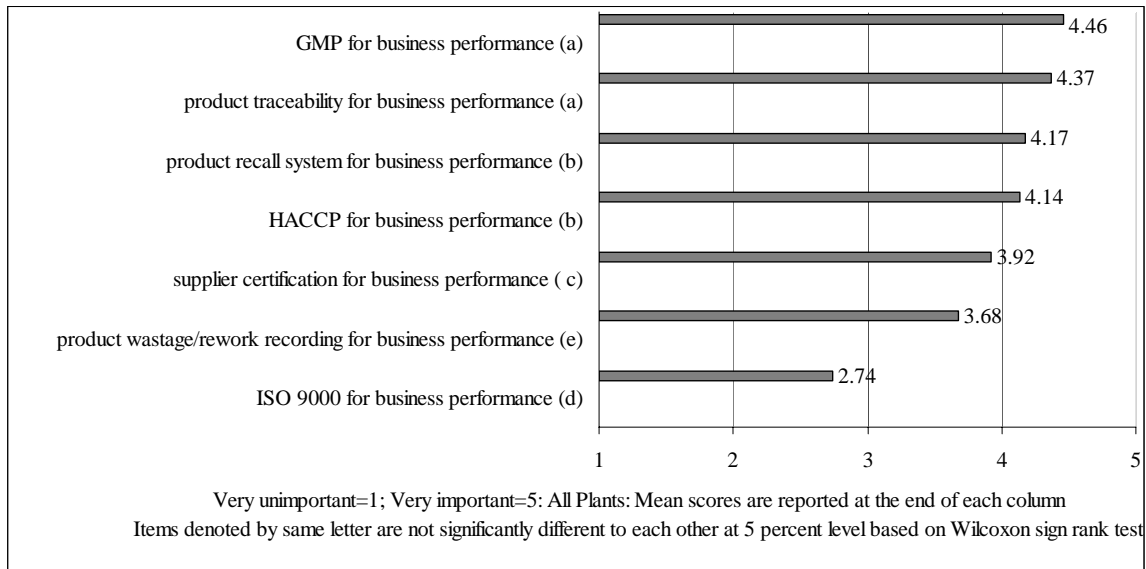


Figure 4. Status of HACCP implementation in respondent establishments:

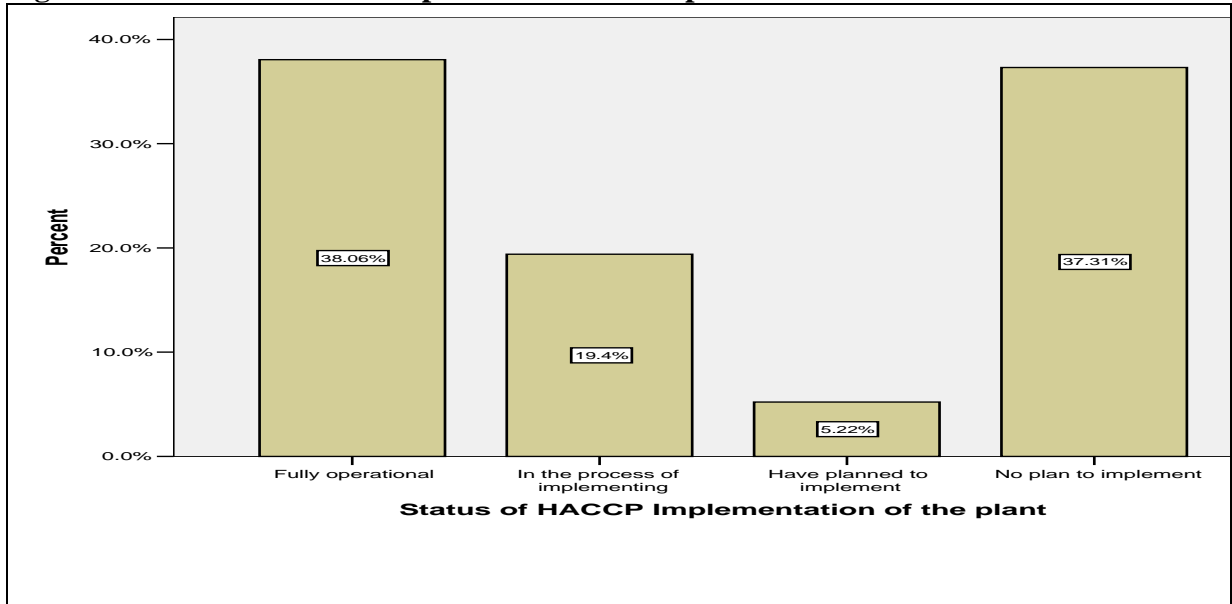


Figure 5. Perceived difficulty of implementing HACCP:

