

# A Global Perspective of HACCP Implementation in Dairy Industry

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## Review Article

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## ABSTRACT

Milk and other dairy products are considered as vital sources of nutrients by large segments of the population from all over the world. However, unhealthy practices in dairy farming, contamination of milk products at several stages of production and even during retailing processes are believed to account for a substantial portion of foodborne infections in many countries. Therefore, risk management of dairy processing using performance measures recommended by quality systems such as HACCP has developed into a legal obligation for most of the countries around the world. The Hazard Analysis by Critical Control Point (HACCP), a preventive approach through assessment of biological, chemical and physical safety hazards in food, has been advocated by the FDA and WHO as an effective procedure for authorizing food safety in commercial food production units. However, several dairy industries across the world exhibit non-implementation of HACCP despite their growing awareness of its importance. In order to warrant the safety of dairy products, it is, therefore, indispensable to examine the level of HACCP implementation in dairy industries across the world, the challenges faced by them and the benefits associated with successful implementation. Since food safety is an international challenge, the present review aims to capture the global scenario of HACCP implementation in the dairy industry of several developed and developing countries from across the world. Research works related to business, management and food research specific to HACCP implementation in the dairy sector were selected from prominent databases and reviewed. In the end, key implications of the review and policy recommendations for the future are discussed.

## INTRODUCTION

Dairy products are considered vital sources of nutrients by large segments of the population from all over the world. However, before 21<sup>st</sup> century when pasteurization of milk was an unknown concept, milk contributed significantly to transmission of diseases such as typhoid, foot and mouth disease, anthrax, tuberculosis, etc. [1]. Even with pasteurization of milk in practice, between 2009 and 2010, the EU encountered 58 alerts reporting harmful pathogens in dairy products such as Salmonella, coliforms, mold formation, etc. In India, a survey conducted by FSSAI (The Food Safety

and Standards Authority of India) revealed that 70% of the milk samples verified failed to comply with the quality standards in terms of fat % and Solids-Not-Fat%. Adulteration of milk with water, detergents and glucose and reconstitution of milk with skimmed milk powder was revealed by a report published by The National Survey on Milk Adulteration conducted in 2011 [2].

In response to such statistics, much attention has been directed towards production processes and features associated with milk products such as microbial count, milk cell count, level of pesticide contamination, foreign body contamination, etc. by introducing Food Safety Management Systems (FSMS) such as the International Standard Organization (ISO 9000), and Hazard Analysis Critical Control Point (HACCP) [3]. Notermans et al. defined HACCP as 'the systematic means of controlling microbiological, chemical or physical hazards' arising from handling and food processing operations even before they transpire [4]. HACCP was first introduced in 1971 in collaboration with NASA by the Pillsbury Company for verifying the quality of first food products supplied to the astronauts in space [5,6]. HACCP was later adopted internationally to control hygiene practices at processing and production stages of food products through the joint efforts of ISO (International Organization for Standardization), FAO/WHO (Food and Agriculture Organization), NAMCMF (The National Advisory Committee on Microbiological Criteria for Foods), FSIS (The Food Safety and Inspection Service) and the FDA (Food and Drug Administration) in the 1980s [7].

Since food safety is an international challenge and several studies have suggested relatively poor administration of food safety measures among developing countries in comparison to the developed countries [8-10], the present review aims to capture the global scenario of HACCP implementation in terms of status of HACCP system in different countries, costs of implementation, motivation, barriers and benefits of implementing HACCP.

### **The principles of HACCP**

Even though, the implementation of HACCP differs across different production units, certain principles of HACCP are commonly adopted by all the food industries [11-15]. As the first principle of HACCP, hazard analysis of all physical hazards such as fragments of metals, glass pieces, stones, jewelry or foreign bodies such as hair, insects, etc., chemical hazards such as toxins, pesticides, allergens, drug residues, etc. and biological hazards such as parasites, mold, bacteria, etc. is carried out [16]. From the hazard analysis, the stages of production which require critical control such as sanitization of storage containers, conditions of the milking barn, etc., are identified as Critical Control Points (CCPs). CCPs are derived from various sources and differ for every product and every facility based on the differences in raw materials used, facilities, equipment, etc. Therefore, every milk product requires an individual HACCP programme. Critical limits are then established by controlling factors such as temperature, visual appearance, etc. As the fourth principle, monitoring procedures are established based on the derived CCPs. Monitoring involves three important aspects: the monitoring of system operations, verifying the system for deviation from determined controls and documentation of the assessment performed. While monitoring, if hazards are identified, appropriate corrective actions are implemented. For instance, alarms can be introduced for warning the production staff when critical limits for temperature are approached during the production process. Documentation and record keeping is emphasized by the sixth principle of HACCP. As the final principle, a suitable verification procedure is established. Verification if compliance to the designed HACCP programme has been achieved, if monitoring systems used were correct, testing of equipment used for monitoring, monitoring records, consumer feedback records, etc. is carried out.

To succeed in the aforementioned principles of HACCP, five pre-requisites are recommended by the CAC [13]: 1) Team members are identified from all the operational units of the particular plant from different disciplines such as engineering, microbiology, production, quality control, etc. For effective HACCP implementation, the selected members are trained in all aspects of monitoring and documenting the procedure. 2) A complete description of the product including the raw materials used, kinds of packaging done, storage requirements, etc. is prepared 3) Potential consumers are identified 4) Steps involved in the production are listed 5) The practicality of the previous step is verified on-site.

### **Government regulations**

Governmental commitment is important to persuade the food industries to adopt food safety certification measures. In countries such as Brazil, the USA, the EU and Canada, the system of HACCP is mandated by the government for control of milk and other dairy products. Apart from government regulations, non-governmental bodies such as APEDA (Agricultural and Processed Food Export Development Authority) and MFPI (Ministry of Food Processing Industries) also offer HACCP certification.

In 1994, the HACCP approach was mandated by the US government for seafood exported and sold commercially within the US [17]. In the case of the European Union (EU), the HACCP system differs across the European countries. The first attempt to devise a common legislation across the EU was carried out in the form of three directives, DIR 91/493 for the fishery, DIR 92/46 for dairy and DIR 92/5 for meat. An additional DIR 93/43/EEC was later introduced for emphasis on

hygiene processes<sup>[18]</sup>. Regulation 852/2004 of EU legislation states the FBO (Food business operator) to be largely responsible for ensuring food safety to and to ensure compliance to recommended microbiology and temperature controls throughout the production process by implementing HACCP principles<sup>[19]</sup>. In the UK, BRC standards emerged in 1998, which is based on the Global Standard for Food Safety, which later gained international popularity for its emphasis on HACCP based approach for food safety<sup>[20]</sup>. In South Asia, food legislation has been found to be beneath the standards prescribed by Codex and requires up gradation to include the latest procedures of safety such as HACCP, GMP, etc.<sup>[21]</sup>.

In India, apart from certification of end-products, the BIS (Bureau of Indian Standards) also offers certification of systems or processes such as the IS/ISO 9000 for certifying the quality of systems, IS/ISO 14000 for certification of environmental management and HACCP integrated ISO 9000 system for hygiene certification. The BIS also has plans in progress to introduce a stand-alone certification for HACCP in India. In addition, the Indian government bears 50% of HACCP implementation costs for enterprises of any size. The ministry of the small-scale industry is currently offering support to SMEs for HACCP implementation and for securing ISO 9000 certification<sup>[21]</sup>. The HACCP certified state of companies such as Mother Dairy indicates the ascent of Indian governmental policies in supporting enterprises to obtain certification.

### **Status of HACCP Implementation**

Since several dairy industries across the world exhibit non-implementation of HACCP despite their growing awareness of its importance and in order to warrant the safety of dairy products, the level of HACCP implementation in dairy industries across the world was examined.

### **In developing countries**

A review of the studies conducted in developing countries revealed several non-conformities to HACCP adoption by the dairy industry. Karaman studied the SMEs of Turkey involved in dairy processing and monitored their compliance to food standards at three levels, on-farm while producing and while handling food and reported non-compliance to various methods of hygiene<sup>[22]</sup>. For e.g., the products were not refrigerated or stored using temperature controls as suggested by HACCP. The on-farm practices were found to lack hygiene. Employees were not available in sufficient numbers and in addition, exhibited poor hygiene in terms of their hair restraints, uniforms, etc. Monitoring of end-products for the microbial count was also not performed consistently by these units.

A study conducted in China to assess the compliance of selected dairy companies to the guidelines prescribed by EU reported that of the 31 indicators mandated by EU legislation, more than half the indicators were achieved by almost all the units studied<sup>[23]</sup>. However, the researcher observed that the dairy units lagged in certain aspects such as determination of corrective action when discrepancies from CCPs were encountered, poor record keeping and insufficient quality control of the product for e.g., a few products were found to expire well before their expiry date, during extreme conditions such as winter or during transportation. On comparing the food safety compliance between the dairy and fish processing industry of Tanzania revealed that both the sectors lacked adherence to hygiene principles, storage systems such as refrigerators, supervision of raw materials used and implementation of CCPs<sup>[24]</sup>.

A satisfactory level of HACCP adherence was revealed by the dairy industry of Siberia and Brazil. In the dairy industry of Brazil, even though the food handlers exhibited a satisfactory level of hygiene, non-compliance in terms of physical conditions such as the state of the buildings, storage facilities, production facilities, etc., and in terms of documentation was observed. Overall, satisfactory compliance with HACCP as well as other food safety measures such as SSOP, GMP, etc. was revealed by the industry. The Siberian dairy industry revealed entirely operational HACCP systems in place except for smaller enterprises which were found to face greater barriers in the implementation of HACCP<sup>[25]</sup>. Their HACCP teams comprised of approximately 5 members, who were well-educated with University degrees, possessed substantial work experience and were from different disciplines such as chemistry, food technology, economics, microbiology, etc. Lack of compliance by SMEs was also reported in India, who studied dairy units situated in different districts of Nepal and revealed poor compliance with regard to most of the 42 safety practices studied<sup>[26]</sup>. An overview of the status of HACCP implementation in India can be understood from Figure 1<sup>[21]</sup>.

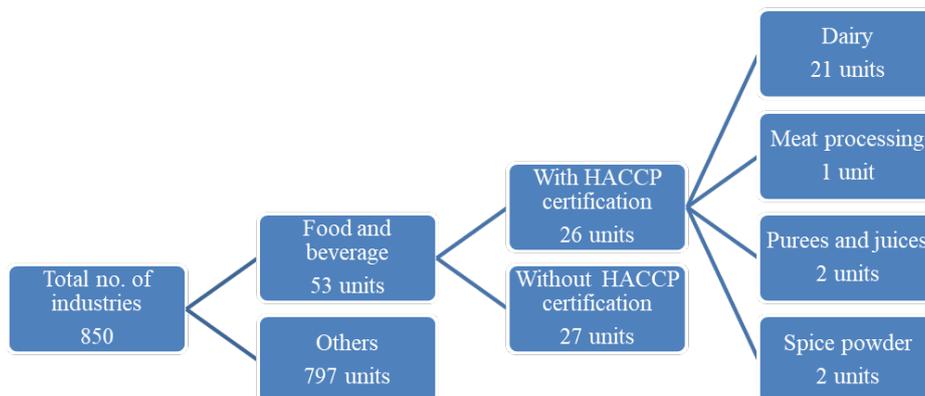


Figure 1. Status of HACCP implementation in India.

### In developed countries

In contrast to the scenario found in most of the developing countries, the developed countries exhibited better adherence to HACCP. A study conducted in the UK among selected dairy and ice-cream processing plants revealed the presence of a well-organized HACCP system in place [27]. Most of the units studied had followed HACCP principles for six months and posited that setting up of a HACCP system required 12 to 18 months for the units. The units also exhibited thorough documentation, even though they considered it to be an arduous task.

In the study conducted in 2002 specific to the dairy industry of Spain, it was observed that most of the respondents agreed upon HACCP being an important measure of food safety [28]. This study reported an interesting finding that the dairy units of Mandrid exhibited a willingness to implement HACCP even if mandatory regulations were absent, in spite of the extra efforts required for implementing such a system, however, failed to believe that the system after implementation would impart significant changes in the outcome of products.

Effective implementation of HACCP principles, studied the manufacturing industries of Ireland [29]. The units studied exhibited a well-organized HACCP team with complete knowledge of CCPs and corrective actions to be followed in response to hazard identification. However, the researchers expressed dissatisfaction to the extent of training offered to the staff involved with the production. Among the different food sectors studied such as meat, fruit, dairy, etc., excellent adherence to HACCP system was found with respect to the meat sector.

Satisfactory results were also reported among dairy companies of Japan, where implementation of food safety from basic to advanced levels could be found [30]. However, a comparison between producing units of different sizes revealed that the smaller enterprises were much behind in their HACCP implementation status. The lack of commitment was found to stem from their insufficient resources related to finance, training, staff, knowledge, etc. Such smaller enterprises ominously exhibited lack of hygiene, knowledge of hazard identification, identification of CCPs and subsequently, implementation of corrective actions. Similar results were also reported in (2005) who observed that because of their limited resources, smaller enterprises could establish only general hygiene as opposed to advanced food safety measures [21]. The other barriers encountered by SMEs in implementing HACCP have been listed in Table 2.

However, a certain study conducted in the UK reported dissatisfaction in terms of hazard identification, awareness on the significance of the hazard identified and implementation of appropriate control measures [31]. Even though hazard identification was carried out, it was practiced without clarity so that significant hazards were ruled out as non-significant and vice-versa.

### Barriers to HACCP Implementation

The success of HACCP implementation often depends on the joint decisions made by the HACCP team members and top management of the manufacturing units along with the availability of other resources such as finance, staff, knowledge, etc. The barriers resulting in non-implementation of HACCP specific to dairy industry studied by several researchers have been analyzed and compared between the developed and developing countries.

**Insufficient knowledge**

An analysis of the difficulties experienced by dairy industries around the world in implementing the HACCP system revealed that the barriers encountered varied between countries. Insufficient knowledge as a barrier to HACCP implementation was found to be commonly prevalent in both developing and developed countries. Karaman et al., who assessed the status of HACCP implementation in Turkey, reported that almost half of the dairy industry managers lacked knowledge of HACCP as well as other food safety systems while the other half perceived the HACCP technique to be too expensive to implement [32]. Factors impeding implementation of food safety management systems using the Pareto tool revealed 'limited knowledge' to be the biggest barrier encountered by industries [33]. The authors posited that lack of knowledge among industry personnel stemmed from inadequate qualification of the team members, thereby making it difficult for them to understand the technical terminologies associated with HACCP. Management related aspects such as lack of proper structure, planning, training, etc., also attributed to insufficient knowledge and awareness of HACCP principles. Herath et al. who studied 26 dairy processing units along with other meat and fruit processors of Canada also emphasized the need for propagating awareness regarding the drawbacks of traditional procedures that are still being used by several food industries and the benefits of implementing HACCP in order to encourage compliance of HACCP [34].

Even in developed countries, as observed, in a study conducted in the UK, lack of knowledge was reported to be the main cause of non-compliance to HACCP [31]. However, Vela and Fernandez who studied dairy units along with meat and fish processing units of Madrid using the Gillings model made an interesting observation that the industries possessed sufficient awareness and knowledge regarding the HACCP system, however, lacked a thorough understanding of identification of pre-requisites for implementation of HACCP system [27]. According to Karaman et al., inadequate physical conditions of the industries and financial resources formed the major reasons for the inability of identifying pre-requisites of HACCP implementation [32]. However, it is interesting to note that Tomasevic 2016) reported a complete understanding of pre-requisite programs among the Siberian dairy units studied [25].

**Financial barriers**

From Table 1 and 2, it is evident that financial barriers were also often experienced by dairy industries while implementing HACCP. Herath et al. identified the barriers encountered by selected food processing units of UK and grouped them into four major categories [34]. Of them, budget restrictions such as lack of funding to set up the HACCP system were reported as the major reason for neglecting HACCP by all the three industries, namely, dairy, meat, and fruit processors. Peristeropoulou, et al. considered payment offered to consultants and certification body as a major financial barrier encountered by the dairy industry studied [35].

**Other barriers**

Other barriers encountered by the dairy industries were found to be lack of motivation and training posited that training of staff and the effort in ensuring that they consistently followed the principles of HACCP made implementation of HACCP difficult for dairy industries [24,26,30,36]. Peristeropoulou, et al. observed that the production staff often lacked commitment for HACCP owing to their unwillingness to break traditional habits and adapt to new behaviors [35]. Lack of managerial skills, uncertainty regarding the outcome of HACCP, lack of staffing was also identified as important barriers impeding HACCP implementation [21,27,30,34].

**Table 1.** Barriers faced in developing countries.

Region	Barriers
India	Unavailability of capital, experts, managerial skills and knowledge in SMEs [21].
Turkey	Lack of knowledge, awareness. Physical conditions and finance, Flexibility of government regulations for SMEs [22,32].
Serbia	Lack of motivation among staff and insufficient training [24].
Greece	Costs of infrastructure, staff training, motivation, knowledge, commitment, documentation [35].

**Table 2.** Barriers faced in developed countries.

Region	Barriers
Spain	Uncertainty in HACCP outcome, lack of knowledge on pre-requisites [27].
Canada	Finance, lack of awareness regarding food safety, uncertainty with appropriateness and outcome of HACCP [34].

UK	Lack of knowledge <sup>[31]</sup> .
	Training and motivation of staff <sup>[26]</sup> .
Japan	Lack of finance, training, motivation, commitment, knowledge, and staffing in SMEs <sup>[30]</sup> .

**Benefits of HACCP Implementation**

A range of benefits was reported by different studies pertaining to the dairy industry as resulting from HACCP implementation. It is interesting to note from Table 3 that most of the studies did not report an increase in sales as a benefit of HACCP implementation. In fact, the review revealed that HACCP increases product cost, thereby affecting sales. Herath, et al. revealed an interesting finding that the dairy, meat and fruit processor units of Canada studied exhibited no difference before and after HACCP implementation <sup>[34]</sup>. Similarly, Masengu, et al. who studied dairy processing units of Zimbabwe dealing with fresh milk and sour milk reported sales of the units to be independent of HACCP implementation <sup>[37]</sup>. Even though the managers of these dairy units believed HACCP implementation to be a significant predictor of their sales, retailers of these milk products confirmed that sales were majorly dependent on brand loyalty, taste and availability of the product, rather than food safety certification. In fact, the study revealed that the company showing the highest sales in Zimbabwe was not HACCP certified. Such studies further emphasize that awareness of the benefits of HACCP should be propagated not just among the producers, but also among the consumers. However, Peristeropoulou, et al. as well as Masengu, et al. recorded an increase in sales as a result of HACCP implementation <sup>[35,37]</sup>. Peristeropoulou et al. as a result of HACCP implementation in a specific Greek dairy industry observed significant improvement in hygiene practices and subsequently safety of products <sup>[35]</sup>. As a result, the dairy manufacturer easily retained and attracted new consumers and could approach the international market with greater confidence. The costs of refunds reduced as a result of quality assurance of products and in the end, sales increased significantly.

Advantages related to consumers such as an increase in customer trust as a result of HACCP implementation as reported by Karaman et al. were reported by several studies <sup>[22]</sup>. Enhanced consumer retention in response to HACCP implementation was also reported by studies <sup>[24,26]</sup>. Musaj, et al. monitored the techniques used by a certain yogurt processing unit in Kosovo and recognized the need for an automated pasteurization process for the achievement of HACCP, the implementation of which resulted in a favorable microbial status of the end-products, thereby enhancing shelf-life of the products <sup>[38]</sup>. The decreased microbial count was also reported by other studies <sup>[26,36]</sup>. Henson, et al. revealed enhanced motivation among production staff as a result of HACCP implementation <sup>[8]</sup>.

**Table 3.** Benefits of HACCP implementation.

Region	Advantages
Brazil	The decrease in the microbial count of products <sup>[36]</sup> .
Zimbabwe	Improved hygiene and sales <sup>[37]</sup> .
Turkey	Resolved legal problems, improved consumer trust <sup>[32]</sup> .
Serbia	Food safety, consumer retention, and product quality <sup>[24]</sup> .
Kosovo	Reduced microbial count, enhanced longevity and reduction in consumer complaints <sup>[38]</sup> .
Greece	Improved hygiene, reduced cases of food poisoning, expansion of the market, penetration of the international market, consumer retention, consumer attraction, increase in sales, decrease in the cost of refunds and warranties <sup>[35]</sup> .
UK	Customer retention, attracting new customers, reduced microbial count and improved motivation of staff <sup>[26]</sup> .

**Cost of HACCP Implementation**

A comparison of major costs incurred by different industries across different countries for implementing HACCP has been illustrated in Table 4. Among the dairy and ice-cream processing plants of the UK as studied by Henson, the major costs incurred varied across different plants <sup>[26]</sup>. For instance, certain units hired external consultants for HACCP support, thereby incurring major consultation costs, while the others failed to do so. However, a major cost of implementation incurred by all the production plants was found to be the excessive time required for documentation. In fact, the surveyed units stated that while most of their other expenses matched their expectations, they had vastly underestimated the time and resources required for record-keeping. Record keeping includes extensive documentation of various aspects of HACCP such as information on team members, the intention of adopting HACCP, characteristics of the product, and

details on manufacturing, monitoring, CCPs, corrective actions, verification and validation of procedures. Maintenance of such different records, namely, training, processing, corrective action, and verification has been put forth as a time-consuming procedure also by several other studies [19,25].

A study of Siberian dairy industry revealed the cost of product investigation to be the major cost incurred. In fact, costs related to the purchasing of new facilities or establishing new infrastructure or costs related to the excessive investment of staff time were not considered as significant as the cost of product investigation [25]. From an overall comparison made from Table 1, it can be observed that all the studies pertaining to dairy industry mentioned external consultant and documentation as a major cost of implementation while the other industries emphasized much on the cost of testing samples for HACCP adherence.

**Table 4.** Major costs of implementation incurred across different industries.

Industry type	Region	Major costs of implementation
Dairy industry	Serbia	Cost of product investigation Hiring an external consultant Staff training New equipment Documentation [25]
	UK	Hiring an external consultant Cost of documentation [19,26]
	Greece	Cost of monitoring, costs of testing, managing interventions, purchasing, installation of cleaning systems and disinsectization systems [35]
	India	Hiring external consultant [39]
Food and beverage industry	New Zealand	Cost of laboratory tests [40]
Meat industry	Serbia	Cost of production [25]
Food industry	Greece	Cost of analyzing Cost of equipment [41]

**The motivation for HACCP adoption**

Assessing the motivation of industries behind HACCP implementation, it was interesting to note an increase in profit/sales was hardly identified as the major motivator for ensuring safety. In the study conducted by Tomasevic et al., desire to improve quality and safety of products was recognized as the reason for HACCP compliance. Consumer preference for certified products was found to be the biggest motivator of HACCP implementation by Herath, et al. [34]. The researchers, in addition, found that this drive was more powerful than the mandatory government regulations in influencing the industry’s conviction to implement HACCP. This was also confirmed by after conducting a Pareto analysis of several motivating factors revealed ‘need to satisfy customers’ as the major motivator of food industries [33]. Following customer satisfaction, government regulations were identified as potential motivators. It was also pointed out that flexibility in HACCP terms offered by the government in Turkey was an important reason for non-compliance of small and medium scale dairy processors in that region [32]. Enhanced reputation, competence, opportunities for export and cost reduction were also identified a few other major motivators.

**Conclusion**

A comparison of the status of HACCP implementation between developed and developing countries revealed that most of the cases in developed countries revealed successful implementation of HACCP while reports of developing countries revealed dissatisfaction with regard to HACCP compliance. To understand the reasons behind such a difference in HACCP implementation, the barriers, motivators, benefits, and costs experienced by the industries were further studied.

Overall, the studies revealed HACCP implementation to be an arduous task involving great cost and time, which needs to be overcome by the industries in order to relish the numerous advantages of HACCP. The common barriers encountered by the dairy companies, which were lack of knowledge, awareness, and motivation, were found to be the same between developing and developed countries. With regard to costs of implementation, a comparison across different sectors revealed hiring of external consultants and time spent on documentation to be the major costs incurred

by the dairy industry while the other industries such as meat processors incurred product testing as the major cost. Substantial studies were not available to make an effective comparison between the developed and developing countries in terms of cost of implementation, motivation, and benefits of HACCP specific to the dairy sector, thereby emphasizing the need for future studies in this area. However, the available studies revealed advantages related to the product such as quality of products, the safety of products, etc. as well as advantages related to the processing unit such as consumer retention, attraction, legal compliance, etc. as a result of HACCP implementation. A significant finding from the review is that consumer retention, product quality, and product safety were considered more important by the dairy companies and not increase in sales. Not many studies reported sales/profit either as a motivator for HACCP implementation or as a benefit of HACCP implementation.

### **Implications**

The status of HACCP implementation as studied in developed and developing countries have the following implications:

- Instead of the expectations of government for voluntary compliance from producers, implementation of strict disciplinary action on defaulters will assist in the betterment of HACCP implementation.
- If the policymakers take into account the shortage of experts in HACCP and the costs of implementation of HACCP experienced by different industries, several industries can be made to comply with the HACCP standards.
- As suggested by Satin and Psomas, et al., securing certification such as ISO 9000 will help the industries in establishing the desired level of organization, which in turn will assist in the easy implementation of HACCP [21,42]. In fact, companies with certifications such as ISO 22000 exhibited better compliance to HACCP system and better achievement of HACCP objectives than the non-certified ones.
- Apart from introducing policies, modifying such policies to meet the reality based on the situation in respective nations can also ensure success in HACCP implementation. The findings derived in relation to the common barriers, motivators, and costs encountered during HACCP implementation have the following implications in terms of policies and practices.
- Lack of awareness and knowledge as a barrier to HACCP implementation can be overcome by associating HACCP not only with exported foods but also with foods commercially sold within the country.
- Documentation as a barrier can be overcome through the use of electronic documentation, which will significantly reduce paperwork and make the entire process of record keeping more user-friendly as experienced by Peristeropoulou, et al. in a Greek dairy company [35].
- To overcome the financial constraints of industries pose a major barrier, banks can play a role by extending loans for voluntary implementation of HACCP.
- Up gradation of training programmes for the betterment of knowledge on HACCP principles should be recognized as an important need.
- Allocating substantial budget for conducting publicity campaigns, introducing rewarding schemes and bilateral programs to attract experts from foreign countries from international agencies such as FAO, WHO, etc., can be carried out to support the industries in adopting HACCP.

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