

The HACCP System: An Analysis of Its Benefits and Shortcomings in Business Practices in the Era of the SARS COV-2 Pandemic

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Abstract

The HACCP system is the world's leading food quality assurance system. Its history and benefits are widely recognized and further debated. However, in the context of the current SARS CoV-2 pandemic, few studies address the extent to which companies in the food industry are prepared for risks such as the deliberate release of this virus into the food circuit. Acts of terrorism of this kind are not new to democratic states, and their impact and prevention are the subject of other approaches, namely TACCP (Threats 'Analysis and Critical Control Points) and VACCP (Vulnerabilities' Analysis and Critical Control Points - focused on vulnerabilities in the food chain). This paper aims to discuss the characteristics and limitations of the HACCP system, as well as the paradigms proposed by the new approaches. We believe that this theorization is necessary to signal the need for increased efforts to monitor threats that may come from criminal organizations.

Key words: HACCP, TACCP; VACCP; risks in the food circuit; SARS CoV-2.

J.E.L. classification: Q18

1. Introduction

HACCP is often considered an international and institutionalized certification whose purpose is to maximize product safety in the food industry (Kafetzopoulos, Evangelos & Kafetzopoulos, 2013).

Companies adopting HACCP must design effective controls to reduce the risk of contamination acceptable levels, which is essential to avoid potential hazards that can lead to unsafe products. The fundamental function of HACCP is to control the critical stages of the production process, thus giving producers the opportunity to control the quality of production, rather than simply inspecting finished products (Arvanityannis and Kassaveti, 2009). In this way, manufacturers have the chance to apply a scientific methodology to identify and prevent potential hazards and to avoid products that do not meet scientific parameters. In the literature on food safety management, numerous studies have confirmed that HACCP not only guarantees the safety of finished foods, but also provides significant protection for both consumers and companies (Kafetzopoulos et al., 2013; Vilar et al., 2012).

2. Literature review

The year 1975 marks, in the United States, the incipient thinking about food risks. There were published four papers which included "HACCP system" notions in google academic. Thus, Hopkins W.C. Jr., following practical research at Louisiana State University and Agricultural &

Mechanical College, published *The Application of the Haccp Concept to the Breaded Shrimp Industry* (Hopkins, 1975).

Quinn T., director of the Division of Regulatory Guidance of the Bureau of Food and Drug Administration, found the food area vulnerable and, through his presence at the 18th Annual Educational Conference of the Food and Drug Law Institute, Inc. and the Food and Drug Administration advocated for the situation in the FDA Plans and Activities in the Food Area (Quinn, 1975).

On the opposite, only in 2020 (until November) there were 3200 works that address the concept of "HACCP system". In order to better understand the magnitude and importance of product quality, in the period 1975 – 2020, researchers worked through a significant number of publications. Thus, of more than 24300 articles that include the phrase "HACCP system", approximately 22400 refer to "HACCP system food" and of these almost 17900 papers cover "HACCP system meat". Sanitary veterinary expertise eliminates, through specific controls, the risk of zoonoses (Sanitary Veterinary Norm, 2002). It is noteworthy the existence of numerous articles that refer to the implementation of the HACCP system, respectively 17600 titles in the same period.

Trafialek and Kolanowski researching the food business environment in Poland, concluded that only in the meat and beverage sector, the average results of audits in certified enterprises were significantly higher than in non-certified ones. The authors also specify that "the functioning of HACCP principles in practice was assessed much lower than the system implementation in all food business groups"(Trafialek and Kolanowski, 2017). If certification schemes are temporary, the company does not have excellent food safety practices.

Any research starts from a level of knowledge, to which it brings arguments according to studies. In this sense, the 18700 research works of the "HACCP system review" are important from the period between 1975 and 2020.

3. Research methodology

In this paper we aim to identify the characteristics, understood the benefits and limitations of the HACCP system, as shown in the literature, and to highlight how other approaches in the field of food safety can contribute to better risk management in the context of the current pandemic. The study thus proposes a qualitative analysis of the literature on HACCP.

HACCP, as a preventive control system, refers to food safety. The implementation of the HACCP system is useful for practical reasons; for example, the manufacturer cannot afford or control the finished products completely. The study aims to identify the characteristics of this system. As a result, exposing the benefits and limitations of the HACCP system has the role of awareness and action, in favor of quality. The review of the scientific literature in the field makes it possible to highlight the general and particular aspects of the accumulation of procedures applied systematically in practice, adequate scientific and technological knowledge to plan, control and document the production of food safely.

HACCP should consider all types of potential food safety hazards - regardless of their type (biological, chemical and physical) - that may occur naturally in food, as a result of technological processes or as a result of exposure to the environment, or accidentally. These issues cannot be covered without a proper bibliographic study.

4. Findings

One of the most important and complex paradigms in operations management is the role of safety management systems in business practices. However, while a wide range of studies have considered the safety of production processes in relation to workers, little research takes into account the implications of management systems for product safety. Investments in the implementation of HACCP require a variety of financial and non-financial resources, including machinery, equipment and human resources, but the costs of implementation as well as the expected benefits of HACCP are not yet clear.

Small companies may be overwhelmed by the trade-off between profit uncertainty and risk reduction due to their low production volume (Wengle, 2016). A case study of Polish dairy companies showed that the implementation of HACCP could have some negative effects, such as increased administrative costs as well as unit costs, but at the same time, the implementation of such a system can lead to increasing employee autonomy and improving product quality, as well as documentation control (Górna, 2008). The above disadvantages seem to conflict with the idea that product safety management contributes to the management of a company's operations (Maruchek et al., 2011). Therefore, it is necessary to use a more objective approach to identify the true causal relationship between the implementation of HACCP and its financial and operational results.

From an operational perspective, HACCP was developed as a safety management system focused on production quality control. Initial research in the field of the relationship between improving quality and business performance has highlighted various advantages of such safety management, such as improved profitability and reduced costs (e.g., Anderson et al., 1994).

HACCP certified firms can gain a competitive advantage in the market due to the low number of operational accidents as well as product recalls (Bai et al., 2007). Firms that have not implemented HACCP are more likely to have their products contaminated during the production process because they do not manage systematically the potential risks of food hazards. In other words, companies that adopt HACCP may face fewer sanctions resulting from food safety violations and lower long-term product withdrawal costs. Operational improvements resulting from the implementation of the HACCP may also lead to higher operating revenues compared to entities that do not adopt this system.

Nganje et al. (2006) found that small meat companies in the United States that implemented HACCP became more profitable than those that did not implement the system. Another study that focused on the effectiveness of quality systems (ISO 9001) and food safety (HACCP) indicated that the effective implementation of HACCP has contributed to the profitability of small and medium enterprises in the Greek food sector (Kafetzopoulos and Gotzamani, 2014).

However, as HACCP was never designed to operate for any unidentified hazard, it cannot be considered a sufficient model for food safety. Consequently, the food safety management system based on HACCP (Hazard Analysis Critical Control Point) cannot counteract the dangers associated with the atypical COVID-19 pandemic, forcing the food industry to change its food safety management systems at different levels.

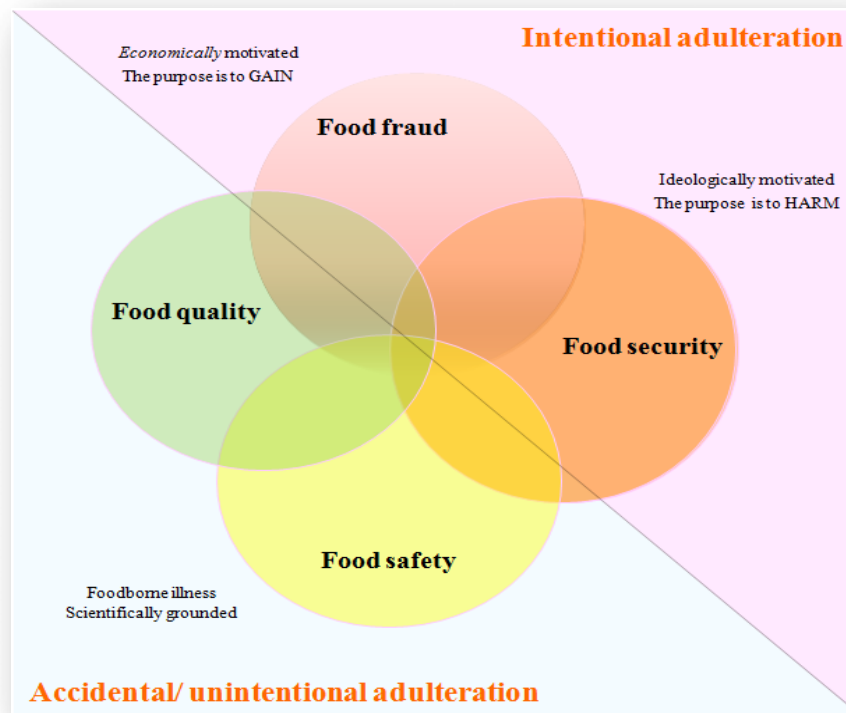
Currently, food sector organizations face a unique challenge in controlling COVID-19 exposure. Not only must they keep their facilities clean and employees safe, but they must also ensure that they do not create additional exposure for their suppliers or customers, and thus dangerous incidents can overlap. This generates an overlap of responsibilities, of work tasks. At the same time, the possibility of intentional transmission of COVID-19 cannot be ruled out, and this remains unidentified in the HACCP approach. As HACCP is only concerned with food safety (prevention of unintentional contamination of food), it addresses only one of the 4 elements of a food control system, which are:

- (1) Food safety: prevents and combats intentional, ideologically motivated alteration that causes food to be harmful to health.
- (2) Combating food fraud: refers to the identification of intentional, economically motivated alteration that may cause the products to be harmful to health.

Thus, some issues related to food fraud may overlap with the definition of food security, while others may be an issue of food quality.

- (3) Food safety: refers to unintentional spoilage of food, which causes food to be harmful to health.
- (4) Food quality: delivery of attributes that influence the value of a product to consumers (figure 1).

Figure no 1. Prevention of unintentional contamination of food



Source: Wayne Labs, 2016

Disadvantages of the HACCP system include the following elements:

- involves a multidisciplinary approach that is not implemented by organizations in general, and requires the participation of all those involved in the food chain
- involves significant time resources and various cultural changes, which are difficult to achieve
- the system involves continuous updates and notations

Addressing intentional threats that may come from criminal organizations, focused on food fraud or simply gaining leverage by making people sick through food, is the basis of Threat Assessment Critical Control Point - TACCP.

TACCP is defined by PAS 96: 2017 as “the systematic risk management by assessing threats, identifying vulnerabilities and implementing controls throughout the production process”. TACCP-controlled threats include economically motivated disruption (EMA) and malicious contamination, blackmail, espionage, counterfeiting and cybercrime. TACCP focuses on identifying specific threats of criminal and harmful activity that may affect food safety (Swainson, 2019). This threat analysis follows HACCP principles and involves building a TACCP team, defining the scope, reviewing current TACCP measures, characterizing threats, developing strategies to mitigate these threats, identifying new or emerging threats, implementing, recording and documenting and auditing / auditing / review (Campden BIS, 2019). The questions and considerations in the TACCP are detailed for different products, spaces and businesses, including security of personnel, control of access to spaces, services, processes and materials and safe storage of transport vehicles (Campden BRI, 2019).

The key to understanding TACCP is to think the whole food circuit from the perspective of a criminal and thus be able to identify and strengthen critical control points. In the established literature, the acronym TACCP is not widespread, and most articles address the phenomenon rather from the perspective of food fraud. However, the cases of criminal episodes in this regard are so important that the Federal Drug Administration (FDA) of the United States has imposed new rules

for processors since 2016 to prevent criminal contamination of food (Spielman, 2019 and Flynn, 2016 in press); and China is the second case of food poisoning in a fast food chain in the last 18 years, in international media reports (Wenwei, 2002). Therefore, the phenomenon of organized crime, including manifested in fast-food chains, must not only be unanimously recognized, but also be met with tools in line with the challenges that may arise. All the more so in the context of the current pandemic, which is difficult to control and in terms of involuntary transmission of the virus, additional protection measures are required along the food circuit.

The VACCP approach is complementary to the TACCP and considers how exposed or susceptible the organization is to food fraud incidents and how the prevention of intentional, economically motivated alteration can be achieved. Qualitative assessments (probability and impact) of threats are similar to those of the TACCP. VACCP can be used practically in the wider supply chain.

While the focus of these approaches is on the behavioral component of the food quality and safety assurance process, traditional methods of eliminating viruses from the diet remain the same:

- Processing of foods at high pressures (300-400 MPa and 522° C for 5 minutes, depending on the type of virus) - results in inactivation of viruses in foods such as fruit juice, shrimp, fish and prepared meat;
- Irradiation of food at doses from 2.7 to 3.0kGy - deactivates food viruses - valid for spices, fruits and vegetables;
- Heating to high temperatures (70° C) - may inactivate viruses, including Coronavirus. Coronavirus is active and stable even at -20 ° C or less for 2 years. Refrigerated food storage (4-8 ° C) does not inactivate Coronavirus.
- Ultraviolet light (245-285 nm) - can protect some foods such as juices, milk, eggs, fruits and vegetables
- Use of chlorine (0.5 mg / L), ozone gas (concentration 20-25 ppm) and chlorine dioxide (2.19 mg / L) or 0.1% sodium and calcium hypochlorite for 1 min - can inactivate the virus in water and the surface of packaged foods (Jawed et al., 2020).

5. Conclusions

Although the HACCP system can bring important benefits such as improving profitability and reducing the costs of a company in the segment, its major disadvantage is that it cannot prevent food fraud or various criminal acts, which is why TACCP and VACCP approaches are needed - taking into account incidents of food fraud and intentional food contamination, together with an analysis of the vulnerabilities where these threats may occur.

These approaches become all the more relevant in the context of the current pandemic, despite the fact that methods of preventing incidents remain the same (various forms of heat treatment, irradiation, use of substances that inactivate viruses, generally). Therefore, the novelty and necessity in preventing various forms of intentional or involuntary contamination along the food chain lies in the behavioral component of actors potentially involved in food processing and management - beyond the classic HACCP scheme, but following its lines nonetheless.

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