Implementing ISO 22000 in a Sri Lankan Frozen Puff Pastry SME: Process, Challenges and Staff Involvement

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Abstract

The purpose of this case study is to investigate the process and outcome of implementing the ISO 22000 Food system within the context of a small to medium-sized business in Sri Lanka. This investigation employed the use of thematic analysis on data collected through interviews, observations and document analysis. Four themes were identified through the thematic analysis process: formalizing the informal, resource/infrastructural conflict, hygiene (visual) vs integrity of data, and compliance behavior vs. deep knowledge. The results indicate that through the successful implementation of ISO 22000:2018, that successfully took the informal method of production and transformed it into an organized zone-by-zone structure. However, these findings also highlight that the lack of consistent and reliable power supply is still a major barrier to maintaining a proper cold chain, which is essential for food safety. Furthermore, the data revealed that while employees have significantly improved the visual aspect of cleanliness within the facility, a very serious issue exists concerning the integrity of data collected on safety logs. Most of the observations related to employees express a lack of genuine commitment towards the hygiene protocols. Therefore, the current research demonstrates creating a culture that values data integrity and consistent behaviors. Businesses must stop focusing on punitive bureaucratic compliance and instead adopt a more holistic approach by placing an emphasis on sustainable safety.

Keywords: *Food Safety Management System (FSMS); Frozen puff pastry; ISO 22000:2018; Thematic analysis.*

INTRODUCTION

The food safety standards, such as ISO 22000, provide a comprehensive framework for managing all aspects of food product safety throughout the supply chain by minimizing risks related to manufacturing and distribution (Granja *et al.*, 2021). ISO 22000 is based on the Hazard Analysis and Critical Control Point (HACCP), offering a systematic approach to identifying and preventing hazards (ISO 22000, 2018). Food Safety Management Systems (FSMS) have demonstrated success in compliance and operational performance across numerous contexts, from Iraq to India (Alkhafaji and Herrera, 2021). However, small-scale industries face unique challenges in applying these standards.

Frozen puff pastry is highly susceptible to microbial contamination and temperature abuse across multiple stages of manufacture, storage, and distribution. Unlike many food categories, puff pastry manufacturers must maintain an effective FSMS throughout the entire cold chain (Rumjuankiat, 2016). In Sri Lanka, food producers are primarily small-scale with limited financial and technical capabilities, making adequate FSMS implementation difficult to achieve, despite the market opportunity and consumer confidence benefits that certification offers.

This study focuses on a small frozen puff pastry manufacturing company located in the Colombo District, Sri Lanka, which was in the early stages of adopting ISO 22000 at the time of research. The company's constrained resources make it a representative case for Small and Medium-Sized Enterprises (SMEs) in Sri Lanka and provide real-time insights into implementation challenges that can be used to

guide other small producers toward achieving food safety certification.

The available literature is sparse on FSMS integration in small-scale industries in developing countries, particularly Sri Lanka. Most guidelines are designed for resource-rich organizations and are difficult for small producers to comprehend and afford. The present study, therefore, addresses a gap in knowledge by investigating the process of implementing ISO 22000 in a small-scale setting, identifying the key challenges, examining staff involvement, and tracing practical food safety outcomes.

Research Aim and Objectives

This study aims to –

(i) examine the process followed in implementing ISO 22000 in a frozen puff pastry manufacturing company,
(ii) identify the challenges and barriers during the implementation stage,
(iii) assess the impact of the FSMS on food safety performance, and
(iv) evaluate staff awareness and involvement in the ISO 22000 process.

MATERIALS AND METHODS

Study Area and Case Company

The research was conducted at a small-scale frozen puff pastry manufacturing company situated in the Homagama industrial zone, Colombo District, Western Province, Sri Lanka. Homagama was selected due to its status as a peri-urban industrial area with a significant small-scale manufacturing presence and infrastructure that reflects the systemic challenges common to Sri Lankan SMEs, including inconsistent power supply and variable water quality. The case company was selected as a 'critical case' because it produces a high-risk frozen food product relying heavily on manual labor, and was undergoing live FSMS implementation, enabling real-time data collection. The company lacked a dedicated Quality Assurance (QA) department, with food safety responsibilities distributed across existing roles, a condition representative of many Sri Lankan SMEs.

Research Design and Philosophy

An interpretivist philosophical stance guided this research, recognizing that compliance and food safety culture are socially constructed phenomena shaped by workers' lived experiences, resource constraints, and behavioral habits. A qualitative exploratory case study design was adopted to capture the nuances of ISO 22000 implementation within a single, information-rich organizational context. This approach is appropriate where boundaries between the phenomenon and its environment are not clearly distinguishable, as is the case for FSMS embedded in production operations (Yin, 2018).

Sampling Strategy

Purposive sampling using a Maximum Variation Sampling (MVS) approach was employed to select participants spanning multiple hierarchical levels from the business owner/food safety team leader to production floor workers. A total of 10-12 participants were recruited across six functional roles: Food Safety Team Leader (1), Production Supervisor (1), QA Officer (1), Production Workers (6-7), Stores Supervisor (1), and Purchasing Assistant (1). Inclusion criteria required full-time employment, direct operational involvement, and participation in the FSMS implementation process.

Data Collection Instruments

Three complementary instruments were employed in accordance with methodological triangulation:

(i) *ISO 22000:2018 Gap Analysis Checklist:* A structured checklist covering all clauses (4–10) of the standard was developed to objectively assess compliance against the ISO 22000:2018 requirements. Each item was rated during a walk-through audit and physical verification of conditions, with findings recorded as compliant, partially compliant, or non-compliant.

(ii) *Semi-Structured Interviews:* Role-specific interview guides were developed for each participant category. Interviews were conducted in Sinhala (participants' native language), lasted 30 - 45 minutes, and were audio-recorded with informed consent. Transcripts were translated into English for analysis.

(iii) *Direct Observation Protocol:* Field observations were conducted during production shifts, focusing on personal hygiene practices, cross-contamination risks, temperature control, and real-time documentation behaviors. Observation notes were used to verify or contrast interview-reported behaviors.

Data Analysis

Qualitative data from interviews and field notes were analyzed using the six-phase thematic analysis framework proposed by Braun and Clarke (2006): familiarization, generation of initial codes, searching for themes, reviewing and refining themes, defining and naming themes, and reporting. Deductive coding was applied using ISO 22000 clause references, while inductive codes emerged from participant narratives. Methodological triangulation was applied by converging findings across all three data sources to enhance internal validity and reduce social desirability bias.

Ethical Considerations

Informed consent was obtained from all participants. Both the organization's identity and individual participants were anonymized in all reports. Research activities were carried out in a manner that did not interfere with production operations or create unsafe conditions on the factory floor.

RESULTS AND DISCUSSION

The Process of Implementation: Formalizing the Informal

The thematic analysis of data from all three sources revealed a central theme of *'formalization of the informal*.' Prior to implementation, the company operated with no documented

food safety procedures, no pest control records, no critical control points or operational prerequisite programs, and no physical zoning separating raw and finished product areas. High-risk activities such as butter rolling were performed in undesignated spaces, including corridors.

The implementation process followed a structured roadmap beginning with a gap analysis, followed by the formation of a Food Safety Team, development of core documentation (Food Safety Policy, HACCP plan, PRPs), physical restructuring of the production facility, employee training, and preparation for internal audit. A key early deliverable was the establishment of a Goods Received Note (GRN) numbering system to enable raw material traceability.

Physical restructuring was among the most observable outcomes. The production floor was reorganized into a clearly delineated zone-by-zone structure separating raw material reception, production, and finished product storage areas. A hygiene entry buffer zone was created at the facility entrance. These changes align with the zoning requirements of ISO 22000 Clause 8.2 (Prerequisite Programs) and transformed what was previously a chaotic, ad-hoc layout into a linear, controlled workflow. These findings are consistent with Nair *et al.* (2023), who similarly found that physical restructuring and documentation development were the primary visible outcomes of early FSMS implementation in Indian SMEs.

Challenges and Barriers: Resource Infrastructure Conflict

The analysis identified a pervasive tension between the technical requirements of ISO 22000 and the financial and infrastructural realities of the case company. This theme of 'resource-infrastructure conflict' manifested across financial, human, and physical dimensions.

Management identified financial resource limitations and the absence of trained personnel as the primary barriers. Infrastructure-related non-conformances identified through the gap analysis included a lack of designated personal hygiene entry areas, moisture-damaged walls and ceiling around air-conditioning units, damaged wooden equipment (rolling pins), and use of non-food-grade adhesives for packaging. These findings align with Paunescu *et al.* (2018) and Baş *et al.* (2007), who identified infrastructure deficits and economic obstacles as the most universally cited FSMS implementation barriers in developing economies.

A notably distinct challenge was the unreliability of the national electricity grid. Power outages disrupted cold chain continuity, forcing production stoppages or reliance on a seldom-operational generator. This external infrastructure vulnerability is particularly critical for frozen food producers, as cold chain integrity at −18°C is a non-negotiable food safety requirement. Lindner Logistics (2023) highlights cold chain disruption as one of the most serious risks in the frozen food supply chain. The fact that this challenge arises from external infrastructure outside the company's direct control distinguishes it from internal barriers and underscores the systemic nature of FSMS implementation challenges in Sri Lanka.

Impact on Food Safety Performance: Visual Hygiene vs. Data Integrity

Implementation produced measurable improvements in the physical hygiene conditions of the facility. Retrospective comparison between pre- and post-implementation states confirmed that high-risk surfaces were sanitized, insect control devices were installed and operational, raw materials and waste were physically segregated, and the air-conditioning unit area was cleaned and properly maintained. Wooden and damaged equipment was replaced with stainless steel alternatives. These physical improvements represent meaningful progress in addressing biological and physical hazard risks inherent in frozen puff pastry production (Ayu *et al.*, 2023).

However, a critical gap emerged between visual improvements and data integrity. Observations revealed instances of 'pencil-whipping', where staff recorded temperature log entries without actually measuring thermometer readings. This practice creates a fundamental

Table 1: Triangulation of data sources - Implementation process.

Data Source	Key Finding	ISO 22000
Gap Analysis (Documents)	No existing documentation, no pest control, no CCP/OPRP, no hygiene buffer zones at baseline.	Clauses 7.5, 8.2, 8.5
Interviews (Food Safety Team)	Steps included: preparing FSMS documentation, assigning responsibilities, defining CCPs, and assigning GRN numbers for traceability.	Clauses 5.3, 7.5, 8.3
Direct Observation	Physical zoning visible post-implementation; raw materials and finished products physically separated. Flowcharts filed rather than posted.	Clause 8.2.4

Table 2: Triangulation of data sources - Challenges and barriers.

Data Source	Key Finding	ISO 22000
Gap Analysis (Documents)	No designated personal hygiene entry area; damaged wooden rolling pin; ceiling moisture damage; non-food-grade packaging adhesives.	Clauses 7.1.3, 8.2.4
Interviews (Management)	Lack of financial resources for training; lack of trained human resources; limited knowledge of the standard.	Clause 7.1 (Resources)
Observation	Power cuts interrupt cold chain; generator rarely used; flour dusting creates ongoing floor hygiene challenge despite linear layout.	Clause 8.2 (Utilities)

Table 3: Triangulation of data sources - Food safety performance.

Data Source	Key Finding	ISO 22000
Gap Analysis (Baseline)	Finished products and waste stored together; no temperature recording in place.	Clauses 8.5.2, 8.7
Interviews (Staff/Team)	Increased cleanliness; flies controlled quickly; ability to trace all production via GRN number.	Clauses 8.3, 8.2.4
Observation	High-risk surfaces look sanitized; temperature logs filled in without checking thermometers ('pencil-whipping').	Clause 8.7 (Monitoring)

disconnect between monitoring records intended to confirm food safety and the actual safety status of the facility. The 'hardware' of food safety culture, physical controls, cleaning equipment, and zoning, has been established; while the 'software', the behavioral discipline of accurate data recording, remains underdeveloped.

This finding echoes concerns raised by Fotopoulos *et al.* (2009), who observed that documentation burden in small businesses can lead to retrospective or falsified record completion. The integrity of CCP monitoring records is foundational to ISO 22000 Clause 8.7, and compromised records undermine the entire verification function of the FSMS. Strengthening data culture requires behavioral interventions beyond initial training, including digital monitoring tools and organizational accountability mechanisms.

Staff Awareness and Involvement -Compliance Behavior vs. Deep Understanding

Prior to implementation, employees received no formal food safety training and routinely brought meals through production areas, indicating an absence of basic food safety culture (ISO 22000 Clause 7.3). Post-implementation interview data demonstrated significant improvement in stated awareness; employees could articulate hygiene protocols, including the 20-second handwashing rule and expressed a sense of personal responsibility for consumer safety.

However, observations during production revealed a gap between stated knowledge and actual practice. During high-production periods, employees reverted to quick rises rather than completing the 20-second handwashing protocol. Visible, enforceable rules such as wearing full uniforms and abstaining from jewellery were consistently followed, suggesting that compliance is more robust where non-conformance is immediately detectable. Invisible controls requiring self-regulation, such as handwashing duration, were less consistently observed.

This finding is consistent with Alzhrani and Shatwan (2024), who distinguish between knowledge transfer through training

Table 4: Summary of thematic findings.

Data Source	Key Finding	ISO 22000 Clause
Process	Formalization of the Informal	Butter rolling in the corridor (pre) → Zoned production areas (post)
Challenges	Resource-Infrastructure Conflict	Management citing financial barriers (interview) vs. power cuts stopping production (observation)
Performance	Visual Hygiene vs. Data Integrity Gap	Surfaces cleaned (observation) but logs filled without checking thermometers (observation)
Staff	Compliance Behavior vs. Deep Understanding	Staff verbalize 20-second rule (interview) but perform quick rinse (observation)

and genuine behavioral commitment. Lee *et al.* (2021) argue that food safety culture the shared values and norms that shape behavior is the critical variable differentiating organizations with a certificate on the wall from those that consistently produce safe food. Building this culture in an SME context requires participatory approaches where floor-level staff are involved in designing the protocols they are expected to follow (Rihawi, 2024).

CONCLUSION

This study examined the implementation of ISO 22000:2018 in a small-scale frozen puff pastry manufacturer in Homagama, Sri Lanka, exploring the process, challenges, food safety outcomes, and staff involvement. The findings demonstrate that ISO 22000 implementation is feasible for resource-constrained SMEs and yields meaningful structural and operational improvements, including physical zoning, traceability systems, pest control, and improved equipment hygiene.

However, the research reveals a critical gap between visual hygiene improvements and genuine data integrity. Pencil-whipping recording monitoring data without taking actual measurements represents a systemic failure of the food safety culture that certification alone cannot resolve. Similarly, a gap exists between employees' stated knowledge of safety protocols and their actual behavior under production pressure, indicating that training has improved awareness but has not yet cultivated deep behavioral commitment.

The primary barriers to implementation were financial, infrastructural, and external (particularly unreliable electricity supply), rather than motivational. This finding suggests that policy interventions supporting infrastructure investment and providing financial incentives for SME certification would substantially improve food safety outcomes at the sector level.

The usefulness of this study lies in its provision of a practical, context-specific account of FSMS implementation for other Sri Lankan SMEs. The limitations include its focus on a single organization, an eight-month observation window, and potential social desirability effects in participant responses.

Future research should examine the longitudinal impact of ISO 22000 on profitability and waste reduction in Sri Lankan SMEs, investigate the cost-benefit ratio of low-cost digital HACCP monitoring tools, and conduct comparative studies across frozen food sub-sectors to determine whether the data integrity gap is a SME-wide phenomenon.

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Conflict of Interest

The authors declare that there is not any conflict of interest regarding the publication of this manuscript. In addition, issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy have been completely observed by the authors.

Life Science Reporting

No life science threat was in this research.

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