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RESEARCH ARTICLE OPEN ACCESS

Sustainable Synergies: Harmonising Financial Performance and Food Safety Management for Sustainability

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Received: 31 August 2024 | **Revised:** 20 July 2025 | **Accepted:** 16 August 2025

Funding: The authors received no specific funding for this work.

Keywords: enablers | food industry | food safety management system | supply-chain integration | sustainable financial performance

ABSTRACT

To evaluate how multi-level enablers strengthen food-safety-management systems (FSMS) and, in turn, enhance sustainable financial performance (SFP) in export-oriented Asian food supply chains. Survey data from 324 food-processing firms in China and Vietnam were analysed with structural-equation modelling. The model combined organizational, supply-chain, and broad-context enablers with three FSMS dimensions (ecosystem, quality standards and robustness). Supply-chain integration exerts the strongest direct effect on SFP, while internal enablers alone are insufficient. FSMS explains 37% of the total enabler–SFP link and significantly moderates the infrastructure → SFP pathway: when ecosystem practices are strong, infrastructural investment translates into higher SFP; when they are weak, returns taper off. External assistance amplifies these benefits only where food-safety administration support is present. This is the first empirical study to demonstrate that combining enablers across three contextual layers yields superior financial gains via FSMS, thereby extending Enablers Theory to a dynamic emerging-economy setting. Managers should prioritize cross-firm integration and cultivate partnerships with regulators and NGOs to unlock FSMS-driven financial returns. Policy makers can accelerate sector-wide SFP by incentivizing collective FSMS initiatives and reinforcing food-safety administration services.

1 | Introduction

Enablers represent managerial or enterprise areas required for a successful organization (Akbari and Hopkins 2022; Ali et al. 2023; Kumar et al. 2022). A growing number of studies highlight how Enabler theory contributes to food supply chain management (Dora et al. 2022; Kirezieva, Luning, et al. 2015; Warr 2014; Kumar et al. 2022; Maiberger and Sunmola 2023). Factors are likely to impact three main contexts: the organizational level, relating to sufficient internal resources; the collaborative structure of the supply chain; and the "broad" environment, encompassing food safety administration, agro-climatic conditions, and public policy (Kirezieva, Jacxsens, et al. 2015). In such environments, supply chain management features, including buyer connections, supplier management, purchasing, technology, and more, are of the essence. Nevertheless, recent studies have been limited to examining the presence of Enablers at only one level (Fotopoulos et al. 2011; Van Asselt et al. 2010; Xiong et al. 2017; Arpanutud et al. 2009; Garcia Martinez et al. 2007; Warr 2014; Isakson 2017).

Regarding controlling and improving the Food Safety Management System (FSMS), critical frameworks include FS rules and requirements (Wang, Kumar, et al. 2022; Yadav et al. 2020; León-Bravo et al. 2019; Kumar et al. 2022). Therefore, FSMS constructs a framework consisting of uniform criteria, audit processes,

and shared acceptance (Irani and Sharif 2016; Mensah and Julien 2011). Additionally, as Quality standards are unable to control FS, manufacturing food requires a plethora of prerequisites and management support activities, resulting in less emphasis on other criteria and activities (Kafetzopoulos et al. 2013).

Sustainable Financial Performance (SFP) is inevitably the corporation's purpose. By integrating effective supply chain strategies, organizations can achieve SFP through financial savings via lower energy usage, decreased waste, and enhanced management of resources (Rodríguez-González et al. 2022). In the food supply chain management, an essential component of Total Quality Management (TQM) is FSMS, the exorbitant integration of which comes with considerable cost implications (Quang et al. 2016; Fernandes et al. 2017; Bui et al. 2022; Rincon-Ballesteros et al. 2021). While studies have examined the relationship between quality management systems and SFP, the connection between FSMS and SFP remains unclear. Companies applying FSMS expect a sanguine transformation in SFP (Kafetzopoulos and Gotzamani 2014a), which has not piqued the interest of academics. Nevertheless, considering the complex link between food safety and supply chain management, it is feasible that an effective FSMS can have a major effect on efficient supply chain management and low expenses, contributing to enhanced SFP.

Despite extensive research, the way Enablers function across multiple levels (organizational, supply chain, and "broad" environment) within the food industry is still not well understood. Additionally, the relationship between FSMS and SFP remains under-explored. This study seeks to thoroughly analyse Enablers across these levels and clarify the connection between FSMS and SFP. By focusing on the organizational structures and practices related to Enablers, the paper will deliver practical guidance for food industry managers and policymakers, ultimately bridging significant gaps in the existing literature.

The upcoming parts cover: Section 2 demonstrates a research framework and structures the hypotheses. Section 3 presents the research methodology. Afterwards, in Section 4, factor and structural equation modelling validate the proposed hypotheses among Enablers, FSMS, and SFP. Thereupon, the results and inferences are discussed prior to this paper's value and future directions in Section 6.

2 | Literature Review

2.1 | Food Safety Management System

FSMS refers to a customized system that incorporates quality assessment and regulatory standards into business processes (Ortega et al. 2015; Thilmany et al. 2021; Wang, Kumar, et al. 2022; Jacxsens et al. 2011). Nevertheless, FSMS aspects are derived from the FS requisitions of EU food safety laws, the FDA's Code of Federal Regulation (FDA 2001), Codex guidelines, and ISO 22000 standards (ISO 2005). They consist of Ecosystem, Quality standard principles, and other elements.

Ecosystem includes the fundamental conditions and practices to sustain a sanitary zone (ISO, 2005). Generally, various guidelines are altered from BSI EN ISO22002-1 (ISO 2009), including working environment, maintenance services, risk measurement, and sanitisation (Pham, Pham, et al. 2022; Quang and Hara 2019; Pham, Truong Quang, et al. 2022).

Principles of Quality Standards is a science-based approach to managing risks and processes (Duong et al. 2022; Arvanitoyiannis et al. 2009; Pham, Truong Quang, et al. 2022). Quality standards are universally required for controlling foodborne risks (Truong Quang and Hara 2018; Quang and Hara 2019). Codex developed Quality standards with seven principles. These initiatives encompass risk evaluation, composed of inspection, detection, and evaluation; Critical Control Points (CCPs) detection; boundaries establishment; process supervision; corrective practices; validation process; archives and documentation (Pham, Pham, et al. 2022; Quang and Hara 2019; Truong Quang and Hara 2018).

Furthermore, FSMS consists of legal and standardized procedures, including traceability, nonconformity management, validation, verification, and continual improvement. With regard to traceability, it means a capability to track and monitor food, feed, food-producing creatures, and materials. Additionally, nonconformity control is a documented process of detecting and handling harmful items when surpassing critical boundaries for CCP(s). Importantly, the process of validation consists of gathering proof that control measures are working effectively. Next, verification utilizes methodologies, processes, tests, and assessments to ascertain the functioning of a measure. Lastly, FSMS must actively seek certification or registration from an external party, conduct self-evaluation, or declare compliance to improve performance.

2.2 | Enablers on FSMS

In prior studies, Enablers are referred to as "key success factors" interchangeably (Arpanutud et al. 2009; Kafetzopoulos and Gotzamani 2014a; Walsh and Leva 2019; Warr 2014). Ronald Daniel originally introduced the concept of "Enablers" to management literature in 1961. He argued that industry-specific enablers are vital to organisational success (Daniel 1961). On the basis of Daniel's suggestion, Rockart reintroduced enablers in 1979 by presenting them as a tool for identifying what information top executives need. Initially meant to pinpoint the information demands of business leaders, enabler's application now encompasses all aspects of business management (Formentini et al. 2022; Khandelwal and Ferguson 1999).

Regardless of whether an organization is a profit-making entity or not, and irrespective of its size or geographic reach, enablers may be applicable in all of these contexts (Chang 2020; Wronka 2013). When conducting a strategic evaluation, enablers serve as a diagnostic mechanism for examining the key features of the sector within which the organization is active. According to the theory, businesses should concentrate on the 20% of enablers that generate 80% of the overall impact on their success or failure, as opposed to examining all of them. Clearly, the enablers' hypothesis assists a company in gaining a strategic advantage over rival firms.

Academic studies have offered multiple interpretations for the enabler theory. Rockart (1979) characterized enablers as the few areas whose results, if adequate, will guarantee the organization's competitive success. Enablers are defined by Boynton and Zmud (1984) as "those few things that must go well to ensure success", the standard definition of enablers applicable across all industries. To meet their goals, organisations often face complexity in decision-making and managerial processes, due to the presence of multiple factors that must be considered. This complexity can be diminished by employing the enabler theory. The enabler theory assists the organization in focusing on the critical enablers that facilitate the achievement of its desired goals. The enabler concept provides a more intelligent method for determining which project elements must be included and which can be omitted. It may also serve as a mechanism for assessing an organisation's effectiveness in meeting its strategic objectives.

The enabler theory is broadly utilized in supply chain contexts (Ab Talib and Hamid 2014). Green supply chain (e.g., Dou et al. (2018)), supplier management (e.g., Grimm et al. (2014)), and sustainability have been studied using this methodology (e.g., Luthra et al. (2015)). Previous literature has pinpointed several key elements necessary for supply chain managers to effectively manage their operations, including technological infrastructure, leadership commitment, collaborative partnerships, quality of service, availability of resources, governmental backing, and a skilled workforce.

Within food supply chains, identifying and analysing enablers helps to minimize error and upgrade FSMS (Mensah and Julien 2011; De Boeck et al. 2018; Warr 2014). However, several scholars make no distinction between barriers and facilitators. Therefore, the literature review advocates that enablers become the highest priority in food companies (Irani and Sharif 2018). Specifically, two conditions are required to obtain a record of enablers. Firstly, FSMS should be analysed at three environmental levels, namely organization, supply chain, and broad context. Subsequently, the productive FSMS can solely be attributed to extracted components. In previous papers, the enablers contributing to FSMS are standardized factors in the food-safety process, leadership, human capital, technology, infrastructure, and equipment (Zeng and Lu 2021; Yadav et al. 2023). Further, the supply chain is characterized by the interdependence of businesses (Kirezieva, Jacxsens, et al. 2015). As enterprises have established more enhanced safety and quality management, collaboration and assistance develop FSMS and outcomes (Odongo et al. 2016) impacting FSMS (Kirezieva, Luning, et al. 2015; Kumar and Nath Banerjee 2014).

Food-safety administration, agro-climatic (in places having leafy greens), and public policy environments illustrate the "broad contexts" impacting the FSMS (Kirezieva, Jacxsens, et al. 2015). Since the chief focus lies on financial perspectives, FS administration becomes the primary aspect concerning the "broad environment" Such familiar instances as examinations and scrutiny, motivators (penalties and encouragement), data and education, and sampling or surveillance belong to this enforcement approach (Rouvière and Caswell 2012; Odongo et al. 2016). Baert et al. (2011) is one of the rarest papers analyzing a public FSMS standard in the absence of administration systems. Moreover, Kirezieva, Jacxsens, et al. (2015) filled a gap by addressing the impacts of safety administration, a sub-sector in the "broad contexts" The full set of previously identified enablers is summarized in Table 1.

2.3 | Sustainable Financial Performance

Multiple sub-dimensions assessed SFP. Ukko et al. (2019) evaluated performance by one inaccurate and invalid metric (Diamantopoulos et al. 2012; Sarstedt and Wilczynski 2009). Nonetheless, it is not a concern provided three standards are reached: homogeneous items, items for the respondents, and a concrete purpose (Bergkvist and Rossiter 2007, 2009). Additionally, Okafor et al. (2021) and Kyere and Ausloos (2021) evaluated SFP via revenue growth, profit, firm value, ROA, ROE, and Tobin's Q (Clegg et al. 2013; Pham, Truong Quang, et al. 2022). Normally, the cost is a key performance indicator in SFP. This statistic, however, reflects only past performance (Quang et al. 2016; Pham, Truong Quang, et al. 2022).

A few academics advocate measuring performance by Return on Investment (ROI) (Fernandes et al. 2017; Duong et al. 2022). Quang et al. (2016) were not in consonance with them as ROI does not objectively reflect owner-managed firms. This indicator is beneficial for analyzing comparable firms but is limited to analysis across sectors (Yang et al. 2022; Duong et al. 2022).

Correspondingly, growth metrics, namely revenue, profitability, and productivity growth, are almost meaningless when comparing organizations across industries (Kazancoglu et al. 2021). Compared to efficient clothing firms, a poor software enterprise (a fast-growing field) has better revenue/profit.

2.4 | The Impact of Enablers on SFP

Three primary levels are scrutinized: organization, supply chain, and administration (Kafetzopoulos and Gotzamani 2014a; Lu et al. 2021; Song et al. 2018; Warr 2014; Chaoniruthisai et al. 2018).

2.4.1 | The Organisational Level

Since top management is accountable for the FSMS performance, its leadership becomes the central aspect. Top management support exhibits a commitment (Maiberger and Sunmola 2023; Odongo et al. 2016; Isakson 2017), ensures the availability of materials and personnel (Fotopoulos, Kafetzopoulos, and Psomas 2009; Maiberger and Sunmola 2023), initiates policy, and updates the scheme (ISO, 2005; Nyarugwe et al. 2016). Significantly, it is essential for managers to institute the duties and grant the authorities for employees (ISO, 2005).

Human capital, facilities, and workplace environment should be provided by the organisation to execute FSMS (ISO, 2005). Employee behaviour is frequently cited as the most difficult obstacle (Maiberger and Sunmola 2023; Fotopoulos, Kafetzopoulos, and Psomas 2009). Nyarugwe et al. (2016) claimed that worker behaviours show an employee's attitudes, expertise, and perspectives towards FS. Meanwhile, worker participation (Fotopoulos,

TABLE 1 | Existing enablers for FSMS.

Researchers			Roth et al. (2008)	Fotopoulos, Kafetzopoulos, and Psomas (2009)	Wilcock et al. (2011)	Mensah and Julien (2011)	Kafetzopoulos and Gotzamani (2014a)	Kirezieva, Luning, et al. (2015)	Kirezieva, Jacxsens, et al. (2015)	Xiong et al. (2017)	Lu et al. (2021)	Zhao et al. (2021)
Time			2008	2009	2011	2011	2014	2015	2015	2017	2021	2021
Food chain type			Food sector	Food sector	Food sector	Food sector	Nutrition, agricultural products, and beverages	Leafy greens	Fresh produce	Pork	Food sector	Agro-food
Nation			USA	Greece	Canada	The UK	Greece	12 countries	Spain, Belgium, Norway	China	Chile	China
Organisational level	Leadership	Devotion	—	—	V	V	—	—	—	—	—	—
		Awareness	—	—	—	V	—	—	—	—	—	—
		Food-safety culture	—	—	—	V	—	—	—	—	—	—
	Human resource management	Communication	—	—	V	—	—	—	—	—	—	—
		Devotion	—	V	—	—	V	—	—	—	—	—
		Training	V	—	V	V	V	—	—	—	—	—
		Awareness	—	V		V	—	—	—	—	—	—
		Participation	—	—	V	—	—	—	—	—	—	—
	Devices and infrastructure		—	V	—	—	V	—	—	—	—	—
	Technology		—	—	—	—	V	—	—	—	—	—
	Standardised process		—	V	—	V	V	V	—	V	—	—
Supply chain	Confidence in buyer–supplier connections		V	—	—	—	—	—	—	—	—	—
	Cooperative supply chains		—	—	—	V	—	V	—	—	V	V
	Goal market (local or global)		—	—	—	—	—	—	—	V	—	—
	External assistance		—	—	V	—	—	V	—	—	—	—
Broad environment	FS administration		—	—	—	V	—	V	V	—	V	
	Agro-climatic environment		—	—	—	—	—	—	V	—	—	—
	Public policy environment		—	—	—	—	—	—	V	—	V	—

Kafetzopoulos, and Psomas 2009; Kirezieva, Luning, et al. 2015; Maiberger and Sunmola 2023), understanding and abilities (Kafetzopoulos and Gotzamani 2014a), awareness (ISO, 2005), and coaching (Blanchard and Thacker 2023; Xiong et al. 2017; Maiberger and Sunmola 2023) demonstrate an overview picture of human resources. Second, facilities are valuable to FSMS. Numerous researchers (Kirezieva, Luning, et al. 2015; Maiberger and Sunmola 2023; Odongo et al. 2016; Isakson 2017) considered working conditions. Additionally, finance and technology are not acknowledged by ISO 22000:2005. Nevertheless, past research identified them as impediments due to their acute impacts (Chaoniruthisai et al. 2018; Barbancho-Maya and López-Toro 2022).

2.4.2 | The Supply Chain

2.4.2.1 | Integration. Interactions likely impact FSMS performance at the supply chain (Odongo et al. 2016). Kirezieva, Luning, et al. (2015) underpinned this claim by verifying that food enterprises with sophisticated FSMS and reliable systems create supportive supply chains. Other researchers define supply chain characteristics as a set of contextual elements (Nayak and Waterson 2019; Macheka et al. 2017; Kumar and Nath Banerjee 2014). These findings lack comprehensive data regarding the cooperation and FSMS contribution.

Firms benefit from enhanced quality performance thanks to supply chain collaboration. Clements et al. (2008) confirmed that "closer" connections between suppliers and producers lead to a multitude of business advantages. In accordance with (Kirezieva, Luning, et al. 2015), a collaborative supply chain is determined by an expectation of critical stakeholders, a relationship with suppliers, and the extent of information flow. Despoudi et al. (2018) stated that solid collaboration between manufacturers and partners is associated with a low risk of Postharvest Food Losses as well as a small percentage of low-quality peaches in Greece. Previous studies strongly suggest measuring cooperation via information sharing and exchange, collaborative problem-solving, continual enhancement, preparing, and specifying objectives to assess the engagement degree (Kumar and Nath Banerjee 2014; Dania et al. 2018; Lu et al. 2021).

2.4.2.2 | External Assistance. Tighter market requirements have shifted the cost of food-safety monitoring from retailers to upstream suppliers. Consequently, businesses seek external financial assistance for investment (Isakson 2017; Rincon-Ballesteros et al. 2021; Unnevehr 2022). It is implied that legislative and market research, financial and technological help provided by governments, NGOs, industry group associations, and financial institutions is needed to integrate FSMS (Babich and Tang 2012; Kirezieva, Luning, et al. 2015; Xiong et al. 2017). Without external financing, firms struggle to obtain FSMS certification, and without technology, firms struggle to communicate, worsening transparency and FSMS.

2.4.3 | FS Administration

Kirezieva, Luning, et al. (2015) situate food-safety (FS) administration within the "broad context" of governance influences. Focusing on this single dimension follows Rouvière and Caswell (2012) and enables a sharper test of enforcement effects. We differentiate direct administration, including on-site audits, surprise or scheduled inspections, product sampling, and surveillance at plants, retail outlets, or export terminals (Rouvière and Caswell 2012; Odongo et al. 2016), from indirect administration, which relies on off-site document scrutiny and third-party certification oversight (Rouvière and Caswell 2012).

Enforcement tools are both punitive and supportive. Punitive actions such as fines, litigation, licence revocation, plant closure, product seizure and "naming and shaming", raise the expected cost of non-compliance (Rouvière and Caswell 2012). Supportive actions such as training, advisory visits, tax deductions, positive labels and matched grants, lower adoption costs and build capability (Nanyunja et al. 2016; Rouvière and Caswell 2012). Since an authoritative yet facilitative administrative environment enhances both organisational credibility and market access, we expect it to improve financial returns, we state the following hypotheses H1a–f:

H1a–f. *Human resource management, Top management support, Infrastructure, Integration, FS administration, and External assistance are the enablers that most consistently translate into stronger sustainable financial performance* (*SFP*).

2.5 | The Moderator Role of FSMS Between Enablers and SFP

A robust FSMS delivers multiple advantages, such as higher revenue (Song et al. 2018), tighter supply-chain connectivity (Rincon-Ballesteros et al. 2021; Chaoniruthisai et al. 2018), lower recall and insurance costs, greater customer satisfaction (Fotopoulos et al. 2011) and continuous system enhancement. Such benefits translate into superior SFP, as evidenced by quality-management-system research (Ebrahimi and Sadeghi 2013; Kafetzopoulos and Gotzamani 2014a) and by work that links high output quality directly to financial returns (Barbancho-Maya and López-Toro 2022; Lu et al. 2021).

Beyond its direct contribution, FSMS is expected to condition how enablers translate into financial outcomes. Deeply embedded quality-standard routines allow internal enablers to be monetized more quickly; a mature ecosystem amplifies returns from supply-chain integration and infrastructural investment; and a crisis-ready system (robustness) enables firms to keep operations steady, allowing benefits stimulated by external assistance or regulation to flow through to profit. Following the contingency logic of moderation (Awang 2015), we therefore posit:

H2a–c. *The FSMS strengthens the positive effects of enablers on SFP, such that these effects are greater when* (*a*) *Quality Standards*, (*b*) *Ecosystem maturity*, *and* (*c*) *Robustness are high*.

The complete research model incorporating these relationships appears in Figure 1. It illustrates a three-layer causal architecture. At the base are six enablers: the organisational trio of human-resource capability, top-management support and infrastructure; the supply-chain lever of integration; and two contextual levers that is, food-safety (FS) administration and

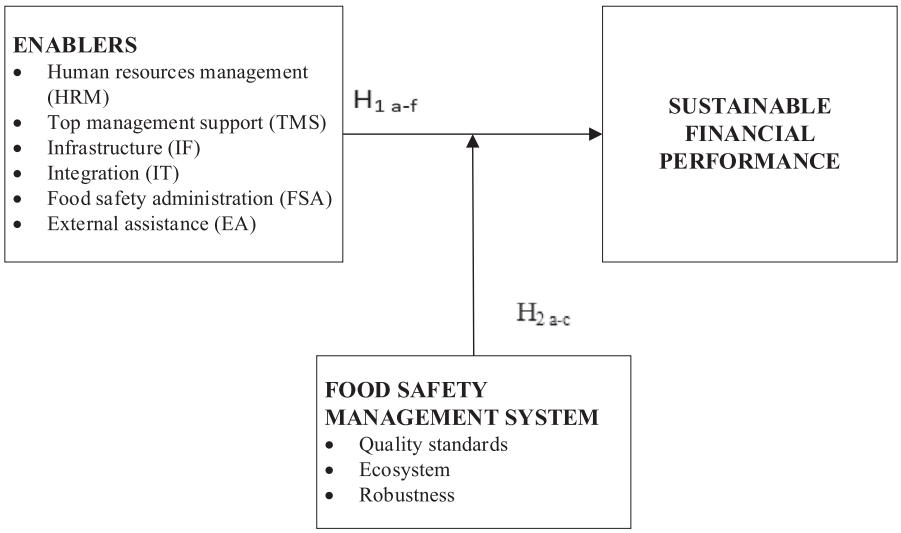

FIGURE 1 | Research model.

external assistance. All six are hypothesised to raise Sustainable Financial Performance (SFP) directly (H1a–f arrow), but they are also channelled through a higher-order Food-Safety-Management System (FSMS) construct whose dimensions are quality standards, ecosystem maturity and robustness (H2a–c arrow).

The figure further depicts FSMS as a contingency: the arrows show that each of its three dimensions strengthens the enabler → SFP link (H2a–c), clarifying when and why investments in people, processes, and external partnerships translate into superior returns. In short, the model integrates resource-based and institutional perspectives by proposing that multi-level enablers improve financial outcomes both directly and indirectly through, and in interaction with, a well-embedded FSMS; this configuration has been especially relevant to export-oriented food chains in emerging economies.

3 | Research Methodology

3.1 | Sample Design

Asia's food industry has evolved prominently, with China and Vietnam ranking among the key exporters in the agricultural and fisheries domains. Therefore, the authors disseminated Chinese and Vietnamese versions of surveys to 1000 managers using digital platforms and direct distribution. Three hundred and twenty-four firms responded, which are fishery (48.7%), agriculture (41%), and beverages (6.8%). They are SMEs (71.6%), with just 17.1% being large organizations and 11.3% being micro-firms. Approximately 40.9% of the respondents hold positions as CEOs, directors, or trading managers.

3.2 | Construction of the Instrument and Measures

Through reliability and validity testing, the study narrows down the measuring variables to the most theoretically relevant indicators. Moreover, a panel consisting of four scholars, three executives, and two consultants examined and adjusted the 5-point Liker scale questionnaire (Tables A1 and A2).

3.3 | Preparation

With a threshold value of 3, 14 observations were excluded (Hair et al. 2019). All variables demonstrated univariate normality with skewness and kurtosis remaining below 1, implying multivariate normality. The scatter plot indicated consistent error terms (Homoscedasticity). Additionally, the histogram and Normal Q-Q plots demonstrated standard error terms. Moreover, early and later responses showed no massive distinction.

3.4 | Evaluation Method

Exploratory Factor Analysis (EFA) was used to determine the fundamental structure of variables that had not undergone reliability and validity analysis. The resultant scales were improved using Confirmatory Factor Analysis (CFA) to assess whether the criteria and loadings matched the pre-established theory. EFA was performed on a 50% randomized sample, while CFA utilized the entire sample ($n = 324$), thereby applying the measures in a substantive setting and enhancing their generalizability (Kline 2013). Multi-collinearity, unidimensionality, scale reliability, and construct validity were examined (Awang 2015). Utilizing SEM through path examination and bootstrapping through statistical tools IBM SPSS version 25.0 and AMOS, the model and hypotheses were evaluated.

4 | Results

4.1 | Construct Reliability and Validity

On a random half of the research sample, EFA obtains the latent constructs of Enablers for principal components analysis (PCA). The data validity for factor analysis was evaluated prior

to PCA, demonstrating coefficients in the correlation matrix ≥0.3. Variables were kept based on theoretical alignment, factor loading strength, and statistical robustness. Items such as "External assistance from non-governmental organisations" and "External assistance from financial institutions" were excluded due to unsatisfactory statistics results. These items had low factor loadings, below the commonly accepted threshold of 0.6, which would have undermined discriminant validity and inflated measurement error. While theoretically relevant, these variables failed to meet inclusion criteria. Therefore, retaining them could have introduced multicollinearity, model misfit, and the internal inconsistency of the construct (Hair et al. 2019; Hinkin 1995). The broader construct of "External Assistance" remained intact, represented by three statistically valid items: support from commercial entities, supply chain partners, and governmental agencies. As a result, this exclusion of NGO and financial instituition assistance does not compromise, but rather strengthens, the model's validity.

After removing "External assistance from non-governmental organisations" and "External assistance from financial institutions," six components were created: "Human resource management", "Top management support", "Integration", "FS administration", "External assistance", and "Infrastructure" (Table 2). Good testing results are observed, such as Kaiser-Meyer-Olkin 0.872, Bartlett's test of Sphericity 1685.232, $p=0.00$, Eigenvalue >1, and MSA >0.743. Moreover, factor loadings exceed 0.6, and the six components successfully explain 69.605% of the total variance, indicating strong construct validity. Likewise, data suitability for factor analysis and EFA extracted the latent components of FSMS and SFP (Table 2). To sum up, factor loading and reliability statistics are reported in Table 2.

Sub-models adopted CFA with the Maximum likelihood estimation approach. The derived latent components confirmed a satisfactory match to the empirical data (Table 2), satisfying comprehensive testing of construct, convergent, discriminant, and nomological validities.

Table 3 further confirms the internal consistency of FSMS with Cronbach's alpha >0.750. Further, the mean inter-item correlations reflect a substantial connection among items (>0.6) (Awang 2015). These reliability statistics are transparently displayed in Table 3.

4.2 | Estimation

Regarding evaluating the hypothesized structural model, a SEM technique with two steps is applicable (Awang 2015; Hinkin 1995). With a sample size exceeding 250, more than 30 measured variables, and model fit indices aligning well with the data, the theoretical model is considered to be empirically supported. Table 4 outlines the goodness-of-fit indices for each model. The evaluation of model fit included multiple widely accepted indices to provide a comprehensive validation of the model (Awang 2015).

The Chi-square statistics for the enablers, implementation, and measurement models all fell into the preferred threshold, indicating strong model fit. Furthermore, RMSEA values ranged from 0.038 to 0.057, below the threshold of 0.08, suggesting a good approximation of population fit. IFI, TLI, and CFI values exceeded the 0.90 benchmark, while those of GFI for all models were above the acceptable threshold of 0.5. These indices collectively support the reliability and validity of the structural model (Awang 2015; Hinkin 1995).

4.3 | Moderator Model

The hypotheses were validated by hierarchical and moderated multiple regression analysis. Model 1 examined the main effects of six enablers on SFP, establishing their direct influence. Model 2 expanded this by incorporating the moderating variables, specifically the three dimensions of FSMS: Quality Standards, Ecosystem, and Robustness. Finally, the technique of Zedeck (1971) examined the hypothesized interaction effects. The authors modified variables for the means to be zero (Cohen et al. 2013; Jaccard and Turrisi 2003). Following the mean cantering of the variables and entering the three potential moderators, Model 3 validated the moderator effects of Quality Standards, Ecosystem, and Robustness between Enablers and SFP. Thus, it showed the evaluation of how FSMS conditions alter the strength or direction of the enabler–SFP relationships.

Initially, the parameters for Enablers were estimated in Model 1, see Table 5. The standardized regression coefficients for two Enablers are statistically meaningful with standardized parameter estimates of 0.348 ($p<0.01$) for Integration and 0.172 ($p<0.01$) for FS administration, which underpins H1d and H1e. The other four factors remain insignificant. Consequently, the direction of the latter connection is the reverse of what is proposed in H1a–c,f.

An increase in variance explained (R^2) upon introducing the interaction term indicates a moderated connection (Zedeck 1971; Jaccard and Turrisi 2003). Model 3 reinforces the hypothesis which Quality standards, Ecosystem, and Robustness control a connection between Enablers and SFP. Moderation is facilitated for only one out of 18 relationships: Infrastructure X Ecosystem with a standardised parameter estimate of -0.244 ($p<0.1$). The 5.5% variance is explained by Model 3 upon providing the interaction terms. Since interaction effects are hard to notice and impact volume is minor (Aguinis et al. 2005; Chaplin 1991), the finding entails a remarkable contribution.

Once the appreciable interaction between Enablers and FSMS occurs, plotting the connections and examining their particular method applies the approach proposed by Aiken et al. (1991) and Jaccard and Turrisi (2003). As the regression lines of the link between Enablers and disruption cross over, one interaction is not comparable (Aiken et al. 1991). This denotes the modified independent variables (Ecosystem) have distinct outcomes at the predictor variable's extremes (Infrastructure). Figure 2 visually demonstrates this interaction. When Infrastructure rises, SFP improves slightly if the business adopts Ecosystem at a low level. At high ecosystem levels, the infrastructure–SFP slope turns negative. This supports (partially) H2c that at a low level of FSMS professionals, namely Robustness, it results in a rise in the adoption of Infrastructure for safer food supply chains and improves SFP.

TABLE 2 | Validity testing.

Criteria	Items	Factor loading	Cronbach's α	AVE[a]	CR[b]	(Corr)²[c]
Human resource management (HRM)	HRM1	0.839[c]	0.839	67.415	0.892	0.674
	HRM2	0.827				
	HRM3	0.790				
	HRM4	0.828				
Top management support (TMS)	TMS1	0.886	0.863	70.979	0.907	0.710
	TMS2	0.874				
	TMS3	0.818				
	TMS4	0.789				
Infrastructure (IF)	IF1	0.869	0.833	75.115	0.900	0.751
	IF2	0.861				
	IF3	0.870				
Integration (IT)	IT1	0.780	0.798	62.382	0.868	0.622
	IT2	0.845				
	IT3	0.759				
	IT4	0.77				
FS administration (FSA)	FSA1	0.802	0.819	65.300	0.882	0.653
	FSA2	0.831				
	FSA3	0.840				
	FSA4	0.756				
External assistance (EA)	EA2	0.849	0.742	66.000	0.853	0.660
	EA3	0.858				
	EA4	0.723				
FSMS (PER)	QS	0.958	0.949	90.822	0.967	0.907
	E	0.943				
	R	0.957				
Sustainable financial performance (SFP)	FIN2	0.863	0.894	70.472	0.922	0.704
	FIN3	0.854				
	FIN4	0.845				
	FIN5	0.820				
	FIN6	0.813				

[a]Average Variance Extracted = $\sum\lambda_i^2/n$ (the number of items $i = 1, n$; λ_i: the standardised factor loading).
[b]Composite reliability = $(\sum\lambda_i)^2/[(\sum\lambda_i)^2 + (\sum\delta_i)^2]$ (the number of items $i = 1, n$; λ_i, the standardised factor loading; δ_i, the associated error term).
[c]Squared correlation = the maximum squared correlation between the factor of interest and other factors.

5 | Discussion and Policy Implications

5.1 | Impact of Enablers on SFP

The SEM results confirm that Integration exerts the strongest positive influence on Sustainable Financial Performance (SFP), reinforcing the value of cross-firm data sharing, joint problem solving, and shared improvement goals reported in earlier studies (Rincon-Ballesteros et al. 2021; Isakson 2017; Maiberger and Sunmola 2023; Kirezieva, Luning, et al. 2015). By contrast, internal enablers alone do not yield a measurable SFP gain, indicating that in dynamic export chains, collaborative capabilities outweigh stand-alone, intra-firm initiatives. The significant effects of Integration and Food-Safety (FS) Administration on SFP echo evidence that robust regulatory oversight and supportive inspections strengthen quality-management standards (Kirezieva, Luning, et al. 2015; Nanyunja et al. 2016; Zhao et al. 2021) and corroborate on the importance of a credible enforcement climate.

TABLE 3 | Reliability testing of FSMS.

FSMS	Cronbach's α	Number of items	Item mean	Inter-item correlations (Minimum–Maximum)	Mean of item-total correlation
Quality standards	0.942	7	3.566	0.781–0.832	0.81
Ecosystem	0.931	8	3.540	0.694–0.804	0.76
Robustness	0.956	11	3.521	0.717–0.828	0.80

TABLE 4 | Model fit indices.

Statistics	Enablers model	Implementation model	Measurement model	Preferred threshold
Chi-square (χ^2)	277.262	581.403	6.637	$0 \leq \chi^2 \leq 2df$
df	194	296	4	—
RMR	0.041	0.029	0.012	<0.08
RMSEA	0.038	0.057	0.047	<0.08
χ^2/df	1.429	1.964	1.659	<3
IFI	0.972	0.960	0.997	>0.90
TLI	0.966	0.955	0.992	>0.90
CFI	0.971	0.959	0.997	>0.90
GFI	0.922	0.871	0.991	>0.5

5.2 | The Moderating Role of FSMS Between Enablers and SFP

A moderation analysis clarifies why some enablers convert more efficiently into financial value. As theorised by Hair et al. (2019), the ecosystem dimension of the Food-Safety-Management System (FSMS) conditions the Infrastructure to SFP pathway: intensive ecosystem practices amplify the financial return from capital investments, whereas weak ecosystem routines dampen the same relationship. Robustness imposes a similar conditioning effect, suggesting that crisis-preparedness capabilities help firms monetise physical or technological upgrades more fully.

5.3 | Theoretical Implications

This study extends previous research and highlights their distinct contributions to global food safety objectives (Fotopoulos, Krystallis, et al. 2009; Kafetzopoulos and Gotzamani 2014b; Kirezieva, Luning, et al. 2015).

Integration (sharing knowledge, addressing challenges, setting objectives, and promoting initiatives for continuous development) significantly contributes to Sustainable Financial Performance. Meanwhile, "food safety administration" (inspections, incentives, punishment, training, and communication) has a minimal impact on operational performance.

This study contradicts the expectations and prior findings of Kafetzopoulos and Gotzamani (2014b), showing that Integration significantly impacts operational success more than internal factors within the studied organisations. Organizational factors influenced the success of ISO 9001 and HACCP systems, unlike external environments, which showed no evident effect. However, these findings align with those of Kirezieva, Luning, et al. (2015), Luning et al. (2015), and Nanyunja et al. (2016), who substantiated the importance of relationships, supply chain integrity, and the contributions of the private sector and NGOs in improving FSMS. This finding supports the view of Nguyen and Li (2022) that developing economies are propelled by effective governance structures. Business behaviour is shaped by the internal dynamics, external pressures, and regulatory environment. This result supports prior research by Kafetzopoulos and Gotzamani (2014b). The primary theoretical role of moderation is to explain the underlying cause of a connection between two concepts (Hair et al. 2019). Prior research has identified a correlation between these enablers and financial performance (Kafetzopoulos and Gotzamani 2014b), but the underlying reason for this correlation remains unclear. Therefore, the research provides a plausible explanation for this phenomenon.

The research advances the enabler theory for this issue by broadening our understanding of Enablers at multiple levels, as opposed to treating them identically in FSMS application. This is the initial study to emphasize the significance of external support in deploying FSMS effectively. In addition, it offers a deeper conceptual understanding of stakeholder collaboration in food companies and the supportive elements that influence FSMS adoption, leading to improved insight into the success factors linked to market and governance. Lastly, enhancing FSMS by enhancing enablers from multi-level settings results in high sustainable financial performance among food businesses.

TABLE 5 | Parameter estimates of regression models.

	Model 1	Model 2	Model 3
Main effects			
Human resources management (HRM)	0.021	0.003	−0.029
Top management support (TMS)	0.072	0.054	0.049
Infrastructure (IF)	0.054	0.035	0.02
Integration (IT)	**0.348*** **	**0.329*** **	**0.284*** **
Food safety administration (FSA)	**0.172*** **	**0.146** **	**0.11***
External assistance (EA)	0.035	0.023	0.036
Moderators			
Quality standards	—	0.007	0.003
Ecosystem	—	−0.038	−0.089
Robustness	—	0.142	**0.212***
Interaction effects			
Human resources management (HRM)×(QS)	—	—	−0.107
Top management support (TMS)×(QS)	—	—	0.212
Infrastructure (IF)×(QS)	—	—	0.171
Integration (IT)×(QS)	—	—	0.057
Food safety administration (FSA)×(QS)	—	—	−0.17
External assistance (EA)×(QS)	—	—	−0.09
Human resources management (HRM)×(E)	—	—	0.12
Top management support (TMS)×(E)	—	—	−0.035
Infrastructure (IF)×(E)	—	—	**−0.244***
Integration (IT)×(E)	—	—	−0.062
Food safety administration (FSA)×(E)	—	—	0.095
External assistance (EA)×(E)	—	—	−0.024
Human resources management (HRM)×(R)	—	—	0.066
Top management support (TMS)×(R)	—	—	−0.238
Infrastructure (IF)×(R)	—	—	0.028
Integration (IT)×(R)	—	—	−0.127
Food safety administration (FSA)×(R)	—	—	0.048
External assistance (EA)×(R)	—	—	0.035
Model summon R^2	0.287	0.294	0.349

Note: Significance levels: *** for p values under 0.01, ** for those under 0.05, and * for p values under 0.10. (in bold).

5.4 | Managerial Implications

For food-industry practitioners aiming to raise SFP while meeting fast-evolving carbon-reduction targets, three courses of action emerge. First, conduct an FSMS readiness audit that pinpoints integration gaps across suppliers, processors, and distributors; closing these gaps yields the highest direct financial payoff. Second, digitize traceability data and exchange it instantly with upstream and downstream stakeholders so that infrastructure investments—such as cold-chain upgrades—feed immediately into measurable performance gains. Third, leverage government inspection feedback and incentive schemes to sequence capital expenditure sensibly: start with the improvements that the local FS Administration has already prioritized, then expand once those upgrades have been integrated into day-to-day routines. Collectively, these steps enable firms to comply with tightening environmental regulations, participate credibly in carbon-trading platforms, and unlock circular-economy advantages.

5.5 | Policy Implications

Policy-makers in China and Vietnam can accelerate sector-wide adoption of effective FSMS by pairing risk-based inspections with matching-grant programs that defray certification costs for small and medium-sized enterprises. Publishing anonymized inspection outcomes on open data portals would create peer-pressure incentives for continuous improvement, while embedding food-safety criteria into export-license renewals would reinforce private investment in infrastructure. Regional training hubs jointly run by regulators, universities, and industry associations could disseminate best-practice integration templates at scale and strengthen the ecosystem

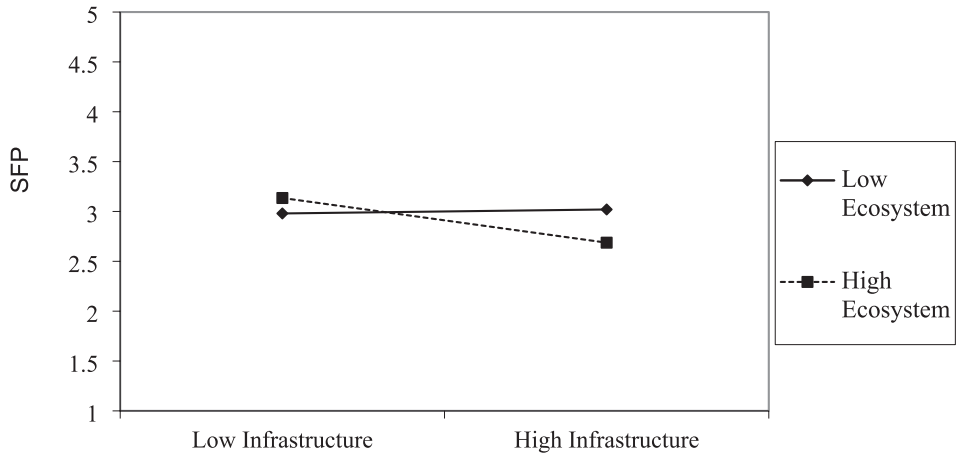

FIGURE 2 | Plots of interactions.

and robustness dimensions that magnify returns on firm-level spending.

6 | Conclusion

This article leverages Enablers' theory and analytic methodologies to uncover the characteristics of three-level environments, demonstrating that businesses should concentrate on FSMS to enhance competitiveness. Moreover, food companies need to reinforce control over food safety practices, enforce regulatory-compliant systems and policies, and foster partnerships across international supply chains. In addition, it highlights the responsibilities of various actors within international supply chains, including public institutions, regulatory agencies, and commercial organizations, in advancing and managing FSMS.

However, the quantitative analysis presents some limitations. The survey results might be biased toward management perspectives, and the use of the Likert scale to evaluate Enablers, FSMS, and Sustainable Financial Performance independently could be influenced by managerial perception. The research collects data from 324 firms involved in both production and international trade in two emerging markets, which might limit generalizability.

Despite these drawbacks, the discussion of FSMS implementation based on Enablers and their effects on Sustainable Financial Performance suggests several crucial future research directions. These include developing FSMS evaluation tools to identify opportunities for improving business practices and achieving low-carbon operations. Further studies are encouraged to consider a more extensive array of organizational, industrial, and governmental factors to help food companies build safer and more sustainable global food supply chains.

Additionally, further studies are recommended to recognize the influence of external variables, notably the need for more cooperative and integrated supply chains, on FSMS implementation. This includes analyzing the role of innovative supply chain management practices that support carbon reduction and sustainability in the context of the carbon-trading era. Understanding how these external factors can enhance FSMS effectiveness will provide valuable insights into how food companies can better align their operations with national emission reduction targets and promote a circular economy.

Conflicts of Interest

The authors declare no conflicts of interest.

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Appendix A

Questionnaire

TABLE A1 | Part 1: Demographic characteristics.

Question	Answer	
Current workers in your firm	1–10 11–50	51–250 Over 250
Role of the participants	Supply chain director Quality control supervisor Director/CEO	FS department Different positions
Type of food for international trading	Fish Poultry Dairy	Fruit and produce Beverage Different types
Amount of export on a yearly basis (tons)	Under 500 500–1000 1000–2000	2000–3000 Over 3000
Certificates that the company is abiding by	Quality standards ISO9001 ISO22000 BRC	Global GAP SQF IFS

TABLE A2 | Part 2: Measurement scale.

Construct	Code	Items
HUMAN RESOURCE MANAGEMENT	HRM1	Workers' expertise and proficiency in preventing food hazards
	HRM2	Acknowledgment of staff members' participation in FS management
	HRM3	Employee-provided training courses
	HRM4	Engagement of workers in FS management
TOP MANAGEMENT SUPPORT	TMS1	Executives' dedication to FS management
	TMS2	FS policy
	TMS3	Each individual's duties and levels of authority are specified
	TMS4	Inculcating a commitment to FS across the company
INFRASTRUCTURE	IF1	State-of-the-art infrastructure for managing FS
	IF2	The firm's financial health
	IF3	The firm's techonological condition
INTEGRATION	IT1	Communication and information exchange
	IT2	Addressing new issues that arise regarding product safety
	IT3	Exercises in advance and defining objectives
	IT4	Employing strategies of constant refinement
FS ADMINISTRATION	FSA1	Audits and inspections of FS by governing bodies
	FSA2	Regulatory sanctions
	FSA3	Stimulus
	FSA4	Information and education
EXTERNAL ASSISTANCE	EA1	Financial institutions
	EA2	Commercial entities (such as NAFIDAD, VASEP in Vietnam)
	EA3	Participants in the supply chains
	EA4	Government and regulatory bodies
	EA5	Non-governmental organizations
QUALITY STANDARDS	QS1	Hazards identified at each step
	QS2	The points of which control are taken by a quality standard team
	QS3	Scale of effectiveness in determining quality standard critical limits
	QS4	Monitoring procedures and systems at quality standards
	QS5	Installed corrective actions at quality standards
	QS6	Validation procedures
	QS7	The provision of efficient records and paperwork
ECOSYSTEM	E1	Building and infrastructure construction and planning
	E2	Building design and layout
	E3	The provision of air, water, energy and others
	E4	Waste and sewage disposal among other auxiliary services
	E5	Properness of equipment
	E6	Material procurement administration
	E7	Strategies for limiting the spread of diseases
	E8	Systematic cleaning and disinfection

(Continues)

TABLE A2 | (Continued)

Construct	Code	Items
ROBUSTNESS OF FS MANAGEMENT	R1	Traceability system
	R2	Corrective actions
	R3	Techniques for safely processing potentially harmful products
	R4	Control measurements
	R5	The ability to provide sufficient evidence
	R6	Internal audits
	R7	All required records and documents are properly controlled
	R8	Internal communication
	R9	External communication
	R10	Enhancing and constantly upgrading FS management system
	R11	Activeness in pursuing accreditation or registration
SUSTAINABLE FINANCIAL PERFORMANCE	FIN1	Company's operational costs of the previous year
	FIN2	Company's profitability of the previous year
	FIN3	Financial results of the previous year
	FIN4	Net profit margin of the previous year
	FIN5	Sales growth during the last year
	FIN6	Cash flow of the previous year