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Article

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Article

Toward Sustainable Performance in the Hotel Food Supply Chain: Influences of Quality Management Practices and Digital Integration

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Abstract: This study addresses a gap in the literature on how quality management practices within the food supply chain can be effectively integrated with digital technologies to enhance Food Supply Chain Sustainable Performance (FSCSP) in the hospitality and tourism sector in Egypt. Thus, a quantitative approach was employed, with data being collected through both online and in-person surveys from employees with sufficient knowledge of their hotel's food products, food supply chain, and quality management practices in five-star hotels in Egypt. SPSS and WarpPLS-SEM techniques were used to analyze the research data. The findings showed that Food Supply Chain Quality Management (FSCQM) practices positively influence both FSCSP and Supply Chain Digital Integration (SCDI), with SCDI serving as a mediator in the relationship between FSCQM and FSCSP. This study is helpful for hospitality businesses in developing economies because it shows how important it is to combine digital innovation with strong quality management to improve operating efficiency and gain a competitive edge in terms of sustainability. This involves fostering a technology-driven culture that encourages creativity, innovation, transparency, and information-sharing among employees to ensure the successful integration of FSCQM practices with hotels' digital competences.

Keywords: food supply chain quality management; supply chain digital integration; food supply chain sustainability; hotels; Egypt



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1. Introduction

In the fast-changing global market, businesses face unprecedented challenges and opportunities driven by globalization, technological advancements, and intensifying competitive pressures (Elshaer and Marzouk 2022). These forces have transformed the business landscape, making continuous improvements across all facets of operations not just desirable, but essential for survival and growth. Among these factors, the supply chain holds a critical position, particularly in the hospitality sector, where the quality and reliability of the supply chain directly influence customer satisfaction, operational efficiency, and overall business success. Ensuring high-quality management standards throughout the supply chain is, therefore, not just a strategic objective but a necessity for companies aiming to thrive in this complex environment.

With its unique supply chain dynamics, the hospitality industry presents distinct challenges and opportunities in terms of managing quality. Unlike in manufacturing, where supply chains are typically linear and focused on producing and distributing goods, hospitality supply chains are more intricate, involving a diverse range of suppliers and stakeholders (Stifanich et al. 2018). For instance, hotels must coordinate with upstream suppliers of food, beverages, linens, and other essentials while also managing relationships with downstream partners, including customers (Zhong et al. 2016), who, in this context, also act as suppliers, contributing their time, preferences, and feedback (Khalifa et al. 2024). The quality of the supply chain in hospitality is thus multifaceted, encompassing not only the physical goods and services provided by suppliers but also the overall reliability, flexibility, and responsiveness of the supply chain network (Elshaer and Marzouk 2019). Therefore, adapting quickly to customer-driven changes and meeting diverse and evolving needs is pivotal for sustaining a competitive edge and fostering customer loyalty.

In recent years, integrating digital technologies into supply chain management has emerged as a pivotal strategy for enhancing quality and sustainability within the hospitality industry (Sarfraz et al. 2023). Digital solutions like advanced data analytics, real-time tracking systems, and integrated management platforms enable more efficient, transparent, and responsive supply chains (Ibrahim and Falasi 2014). These technologies facilitate better coordination among supply chain partners, allow for more accurate forecasting and demand planning, and enhance the ability to respond swiftly to disruptions or changes in customer preferences. As customer expectations continue to evolve, the adoption of digital supply chain integration becomes increasingly important for hotels seeking to deliver consistent quality and sustain a competitive advantage (Hussain and Malek 2022).

The Egyptian food industry, particularly within the hospitality sector, offers a compelling context for exploring the interplay between supply chain quality management and digital integration (Abou Kamar et al. 2023). Egypt is classified as an emerging market owing to its increasing economic potential and enhanced status in global logistics (Alsetoohy and Ayoun 2018; Alsetoohy et al. 2019), as demonstrated by its rise in the index of Agility Emerging Markets Logistics, where it ranked 18th out of 50 nations in 2024, up from 21st in 2023. This rating emphasizes Egypt's advancement in logistics and supply chain efficacy (State Information Service 2024), rendering it a perfect case study for analyzing supply chain issues and opportunities in a rapidly growing market (Galal 2024). However, the industry also faces significant challenges, including complex supply chain networks, diverse stakeholder interests, and increasing pressure to adopt sustainable practices. In this context, there is a pressing need to examine how quality management practices within the food supply chain can be effectively integrated with digital technologies to enhance sustainable performance and overall business outcomes (Lim et al. 2022; Yang and Wei 2013). Despite the growing recognition of these issues, there remains a gap in the literature concerning how these practices interact within emerging markets like Egypt, where the challenges and opportunities may differ from those in more developed markets.

This study aims to address this gap by investigating how the integration of Food Supply Chain Quality Management (FSCQM) practices with Supply Chain Digital Integration (SCDI) can enhance Food Supply Chain Sustainable Performance (FSCSP) in the Egyptian hospitality industry. The research seeks to understand not only the direct effects of these practices on hotel performance but also the challenges and opportunities associated with their implementation. By focusing on the Egyptian context, this study provides valuable insights into how businesses in emerging markets can leverage quality management and digital integration to drive sustainable performance and achieve competitive advantages. Consequently, the study is driven by the following primary research objective.

RO: To what extent do quality management practices, digital integration, and sustainable performance interact within the food supply chain of the hospitality industry? This question is crucial, as it explores the interconnectedness of these three critical areas, shedding light on how they collectively contribute to enhancing food supply chain management, which, in turn, enhances the hotel performance and customer satisfaction.

This study aims to address the existing knowledge gap by providing an in-depth examination of how the integration of Food Supply Chain Quality Management (FSCQM) practices with Supply Chain Digital Integration (SCDI) can enhance Food Supply Chain Sustainable Performance (FSCSP) in the Egyptian hospitality industry. While much of the literature on supply chain management and digital integration has focused on developed markets, there is a distinct lack of research exploring how these practices interact within the specific context of emerging markets like Egypt. This study will fill this gap by offering a comprehensive analysis of how FSCQM and SCDI practices are implemented in Egypt, where businesses face unique challenges such as limited infrastructure, resource constraints, and regulatory frameworks that differ from those in more developed economies.

The findings will advance our knowledge of how digital technology may support sustainable supply chain practices in emerging economies, particularly in sectors like hospitality that are facing increasing pressure to operate more sustainably. According to the Agility Emerging Markets Logistics Index (2024), the countries with the best performance in the general index were driven by a number of factors, most notably changing improving sustainability practices and digital environments ([State Information Service 2024](#)). Thus, by examining the relationship between quality management, digital integration, and sustainability in the food supply chain, this study will provide insight into how these practices can be effectively adapted to the Egyptian context.

The subsequent literature review will delve into the key themes of SCQM practices, SCDI, and FSCSP in hotels. This exploration will provide the theoretical foundation for empirical investigation and highlight the existing gaps in the literature that this research aims to fill. By systematically reviewing the relevant literature, the study will establish the context for the research, justify the focus on the Egyptian hospitality sector, and underscore the relevance of the research questions posed.

In conclusion, this study aims to add to the expanding body of knowledge on food supply chain management in the hospitality industry, with a particular focus on emerging markets. By examining the integration of quality management practices and digital technologies, the research aims to offer practical insights that can help businesses navigate the complexities of the modern food supply chain and achieve sustainable performance outcomes.

2. Literature Review

2.1. *The Interplay Between Food Supply Chain Quality Management (FSCQM) Practices and Food Supply Chain Sustainable Performance (FSCSP)*

SCQM refers to quality control throughout the supply chain, encompassing everything from raw material procurement to the final delivery of the product. SCQM holds particular importance in the food industry due to stringent regulations and high consumer expectations for food safety, freshness, and overall quality. This is critical because failure to comply with these standards can be dangerous to health and detrimental to consumer trust ([Aung and Chang 2014](#)). Hence, effective and efficient SCQM practices not only ensure that the product is consistently delivered on time and reduce waste but also enhance customer satisfaction through meeting or exceeding expectations. Over the years, SCQM has seen the development of various models and frameworks that are intended to improve overall performance and ensure product safety. For example, Total Quality Management (TQM) and Six Sigma are proven methodologies that have been widely adopted and proven effective across various industries ([Vanichchinchai and Igel 2009](#)). TQM emphasizes continuous improvement and customer focus, integrating quality management into all business aspects and fostering a culture of quality ([Talib et al. 2011](#)), while Six Sigma, on the other hand, focuses on reducing process variation and eliminating defects through a structured, data-intensive approach ([Antony 2004](#)). In terms of specifically addressing food safety, the Hazard Analysis Critical Control Point (HACCP) system is crucial for identifying, evaluating, and controlling hazards that are significant for food safety ([Radu et al. 2023](#)). Thus, adopting these SCQM practices is crucial for ensuring that all stages of the food

supply chain, from production to consumption, adhere to stringent quality standards, thus minimizing risks and enhancing overall performance (Kafetzopoulos et al. 2013).

Moreover, sustainable initiatives in food supply chains promote healthy and sustainable production and consumption patterns, making them a critical focus for food service providers and hospitality operators. Sustainable supply chain management is defined as “the management of material and information flows, as well as cooperation among companies along the supply chain, while taking into account goals from all three dimensions of sustainable development—economic, environmental, and social—and stakeholder requirements” (Seuring et al. 2008). Consequently, a sustainable food supply chain (FSC) integrates principles of sustainability and supply chain management, addressing these dimensions in alignment with stakeholder expectations. The environmental dimension emphasizes minimizing negative impacts on the ecosystem, the social dimension focuses on enhancing stakeholder welfare, and the economic dimension aims for long-term profitability while reducing adverse consequences. Implementing sustainable practices within FSCs not only enables hotels to fulfill corporate responsibilities but also enhances efficiency, optimizes resource usage, and improves financial performance (i.e., return on assets and equity). Subsequently, more attention to the integration of environmental, social, and economic considerations has been paid lately in regard to food procurement by food services (Alsetoohy and Ayoun 2018; Alsetoohy et al. 2019, 2021).

The critical role of SCQM extends beyond mere quality assurance, as it is also a key driver of sustainable performance in food supply chains. It was argued that it is crucial to develop and implement a more advanced and innovative coordination mechanism in terms of scope and depth between SCQM and FSCSP (Kumar et al. 2021, 2023). Therefore, the concept of SCQM has progressed to encompass social, environmental, and financial aspects of the supply chain (Kumar et al. 2023). In essence, sustainable performance involves balancing economic, environmental, and social objectives, which can sometimes be in conflict with each other (Da Silva et al. 2023). In the food industry context, SCQM can significantly reduce waste, optimize resource use, and ensure compliance with sustainability standards. These standards in the hospitality sector refer to predefined rules, procedures, and methods established to systematically assess, measure, audit, and communicate a hotel’s social and environmental behavior or performance (Lee et al. 2012). Integrating circular economy principles into SCQM practices, such as reducing waste and maximizing resource efficiency, further supports sustainable performance (Genovese et al. 2017). This approach not only helps minimize the environmental impact of food production and distribution but also enhances economic viability by reducing costs associated with waste management and resource procurement. In the hotel industry, where food safety and quality are paramount, SCQM is crucial to ensuring that food products meet high standards. Therefore, implementing SCQM practices in hotels has been linked to improved waste management and resource efficiency, thereby supporting the broader goals of Sustainable Supply Chain Management (SSCM) (Kafetzopoulos et al. 2013). By focusing on sustainability, hotels can enhance their brand reputation, meet regulatory requirements, and satisfy consumers’ growing demand for sustainable practices. Thus, we argue that:

H1. *FSCQM practices positively affect FSCSP in hotels.*

2.2. *The Interplay Between Food Supply Chain Quality Management (FSCQM) Practices, Supply Chain Digital Integration (SCDI), and Food Supply Chain Sustainable Performance (FSCSP)*

In recent years, the emergence of digital technologies has led to substantial advancements in SCQM through SCDI. SCDI refers to the application of digital technologies to improve the efficiency, transparency, and responsiveness of supply chains. Technologies such as the Internet of Things (IoT), blockchain, and artificial intelligence (AI) have been increasingly adopted to improve various aspects of supply chain management, including SCQM (Yadav et al. 2022). For instance, IoT devices can provide real-time monitoring of food products, ensuring that they are stored and transported under optimal conditions. Blockchain technology offers enhanced traceability and transparency, allowing stakeholders

to verify the origin and quality of food products, which is crucial in preventing food fraud and ensuring food safety (Rejeb et al. 2022). The integration of SCDI with SCQM practices has transformative potential in the food industry. AI and machine learning algorithms can analyze large datasets to predict potential quality issues and supply chain disruptions, enabling proactive management (Jagtap and Rahimifard 2019). This predictive capability is particularly valuable in the hotel industry, where timely and high-quality food service is essential. Therefore, by leveraging these technologies, hotels can enhance their SCQM systems, ensuring that all food products meet the required standards and are delivered to customers in the best possible condition.

The synergistic effects of combining SCQM and SCDI practices have the potential to drive significant improvements in FSCSP. This synergy is particularly important in the context of the hotel industry, where both quality and sustainability are critical concerns. The Resource-Based View (RBV) and Dynamic Capabilities Theory suggest that integrating SCQM with SCDI can create a competitive advantage by enhancing the agility, resilience, and sustainability of supply chains (Flynn and Flynn 2005; Teece 2007; Schoemaker et al. 2018; Saragih et al. 2020; Burgess et al. 2023). For example, the use of blockchain technology in conjunction with SCQM practices can provide unparalleled traceability, ensuring that all stages of the supply chain comply with sustainability standards (Rejeb et al. 2020; Rejeb et al. 2022). Furthermore, digital technologies can help hotels and other food service providers to better manage their supply chains by optimizing inventory levels, reducing waste, and improving overall efficiency (Liang 2013; Annosi et al. 2021; Jagtap et al. 2021). This is particularly relevant in the Egyptian food industry, where the adoption of advanced technologies is still in its nascent stages (Abou Kamar et al. 2023). By integrating digital solutions with traditional SCQM practices, Egyptian hotels can address unique challenges such as supply chain fragmentation, varying supplier quality, and regulatory compliance issues.

The Egyptian food industry presents a unique context that impacts the implementation of SCQM and SCDI practices. One of the primary challenges is the complexity of the supply chain network, which often involves multiple stakeholders and spans various geographical regions (Chakraborty et al. 2022). This complexity can lead to inconsistencies in quality management practices and outcomes, especially when working with small and medium-sized enterprises (SMEs) that may not have the resources or expertise to implement advanced SCQM systems (Kumar et al. 2021). Additionally, the rapid pace of technological advancements presents both opportunities and challenges for the Egyptian food industry. While technologies like blockchain and IoT offer promising solutions for enhancing traceability and quality control, their implementation requires significant investment and technical expertise, which may not be readily available in the region (Zhao et al. 2019). Nonetheless, the integration of these technologies with SCQM practices can significantly improve the industry's sustainable performance, helping to meet the growing consumer demand for transparency and sustainability in food products. Furthermore, the Egyptian food industry is characterized by a diverse range of suppliers, from large multinational corporations to small local producers (Abou Kamar et al. 2023). This diversity can pose challenges in maintaining consistent quality standards across the supply chain. However, it also presents an opportunity to leverage digital technologies for better coordination and integration among supply chain participants (Rejeb et al. 2022). Accordingly, by adopting SCDI, Egyptian hotels and other food service providers can enhance their SCQM practices, ensuring that all suppliers meet the required quality and sustainability standards. Therefore, as illustrated in Figure 1, we propose that:

H2. *FSCQM positively affects SCDI in hotels.*

H3. *SCDI positively affects the food supply chain's sustainable performance in hotels.*

H4. *SCDI mediates the relationship between SCQM practices and FSCSP in hotels.*

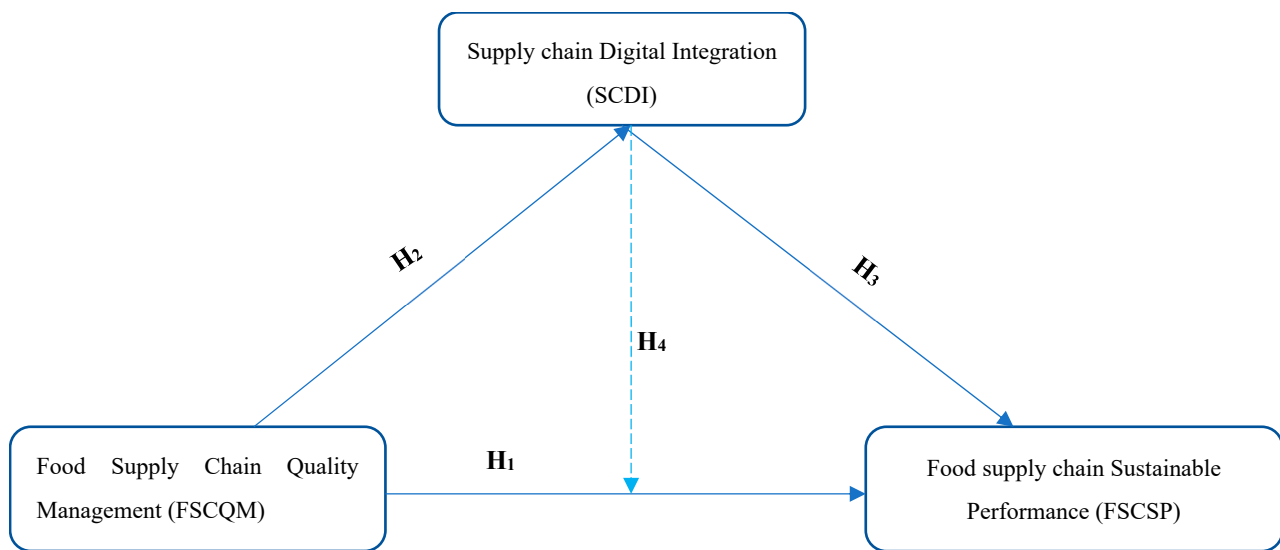


Figure 1. Theoretical Framework of Food Supply Chain Sustainability.

3. Methods

3.1. Respondents and Data Collection Procedures

Egypt's five-star hotels were chosen for the sample due to their strong economic growth, strict food quality regulations, and cutting-edge technology in various fields, including the food supply chain. Data were collected through both online and in-person surveys from May to June 2024. The questionnaires targeted managers and supervisors of food and beverage operations, as well as staff involved in the food supply chain and food quality in hotels representing virtually all five-star hotels in Egypt. Our sample included purchasing staff, food and beverage controllers, managers and supervisors, executive chefs, chefs, directors, and hotel managers. These participants were selected because they possessed sufficient knowledge of their hotel's food products, food supply chain, and quality management practices. Additionally, they had a clear understanding of their hotel's advanced technology and performance reports. Regarding the actual data collection, the guideline of multiplying the number of items by 10 was used to calculate the sample size for the current study based on the guidelines established by [Hair et al. \(2010\)](#). Therefore, with 19 items, the target sample size was 190 respondents. Initially, a total of 132 self-administered surveys and 87 online surveys were completed, yielding 219 responses. After disqualifying 11 responses, the final sample size was reduced to 208, resulting in an effective response rate of 94.4%. A detailed demographic profile of the participants is illustrated in [Table 1](#).

Of the 208 participants involved in the study, 59% were male and 41% were female. Approximately 32% of the respondents held supervisory positions, 27% were managers, and 20% served as directors of operations. Around 73% of the participants were married. The majority of the participants (34%) were aged between 30 and 40 years. Regarding educational attainment, 79% of the respondents possessed a bachelor's degree. In terms of professional experience, nearly 38% of the participants had accumulated between 5 and 10 years of work experience, 28% had less than five years, and 25.4% had between 10 and 15 years. Lastly, 40.4% of the respondents were employed in the food and beverage departments; 26.4% were employed in the purchasing department, and the remaining participants were employed in the quality control and kitchen departments.

Table 1. Characteristics of the Respondent Sample.

Characteristics	Frequency	%
Gender		
Male	123	59%
Female	85	41%
Marital status		
Single	42	20%
Married	152	73%
Separated	13	6%
Widow	1	1%
Age		
20–<30 years	54	26%
30–<40 years	71	34%
40 to <50 years	54	26%
50–60 years	21	10%
Over 60 Years	8	4%
Level of Education		
Less than College	19	9%
Bachelor	165	79%
MSc/MBA	19	9%
PhD	5	3%
Experience		
<5 years	59	28.3%
5–<10 years	78	37.5%
10–<15 years	53	25.4%
>15 years	18	8.6%
Job position		
Employee	29	13.9%
Supervisors	66	31.7%
Manager	56	26.9%
Director	42	20%
Hotel managers	15	7.2%
Department		
Food and beverages	84	40.4%
Quality Control	35	16.8%
Purchasing	55	26.4%
Kitchen	34	16.3%

3.2. Measures

The constructs and measurement items were selected from relevant prior research. These items were meticulously refined from existing academic sources and further enhanced through discussions with a panel of experts to ensure their accuracy and logical coherence within the hospitality sector. According to the provided recommendations, certain modifications in the wording of certain items are needed to align them with the hotel industry. Consequently, nine measurement indicators for Food Supply Chain Quality Management (FSCQM) practices, including quality strategy and leadership, process integration and management, and supply chain relationship management, were extracted from [Hong et al. \(2019\)](#) and [Lee et al. \(2021\)](#). Additionally, we used [Zhao and Liu's \(2024\)](#) indicators (six items) to measure the Supply Chain Digital Integration capability (SCDI). Measures related to Food Supply Chain Sustainable Performance (FSCSP) were retrieved from [Yadav et al. \(2024\)](#). The initial section of the survey was assessed using a seven-point Likert scale from 1 (strongly disagree) to 7 (strongly agree), while the second

section included demographic details such as gender, age, education, working department, and experience.

3.3. Exploratory Factor Analysis

We used SPSS software version 24 to examine and validate the scale for this research. To assess the reliability and validity of the study's scale, we employed an Exploratory Factor Analysis (EFA) and Cronbach's alpha, in that order (El-Sherbeeney et al. 2024). Before conducting the EFA, the data were evaluated to ensure their suitability for factor analysis. The correlation matrix had a significance value of 0.000, and Bartlett's test of sphericity yielded a highly significant result ($p = 0.000$) with a value of 2967.156, rejecting the null hypothesis that the correlation matrix is an identity matrix. The sample was deemed appropriate for factor analysis, with a Kaiser–Meyer–Olkin (KMO) score of 0.752. Additionally, the Cronbach's alpha coefficient of 0.880 indicated a strong level of internal reliability. The findings demonstrated a strong correlation within the dataset, confirming its appropriateness for factor analysis. EFA with Varimax rotation identified five factors with eigenvalues greater than one—namely, supply chain relationship management, quality strategy and leadership, process integration and management, Supply Chain Digital Integration capability, and Food Supply Chain Sustainable Performance—collectively explaining approximately 74% of the variance, exceeding the minimum threshold of 60% set by Hair et al. (2012). As shown in Table 2, the factor loadings for all items under each factor surpassed the 0.50 threshold (Hair et al. 2014).

Table 2. Rotated Component Matrix.

Item	SCDI	FSCSP	QSL	PIM	SP
SCDI1	0.847		0.335	−0.185	0.118
SCDI2	0.773			0.340	−0.115
SCDI3	0.749	0.307		0.178	
SCDI5	0.698	0.188	0.157	0.109	0.430
SCDI4	0.685	−0.121	0.153	0.311	
SCDI6	0.645	0.410	0.248	0.244	
FSCSP3		0.938			
FSCSP1		0.844	0.288		0.249
FSCSP4	0.162	0.626	0.478	0.172	−0.155
FSCSP2		0.621	0.344	0.307	
QSL1		0.199	0.789	0.112	0.190
QSL2	0.302		0.737		0.251
QSL3	0.150	0.161	0.635	0.242	
PIM1	0.128		0.142	0.845	0.193
PIM2	0.238	0.125		0.774	0.161
PIM3	0.284	0.315	0.374	0.604	
SP2	−0.203	0.375		−0.132	0.819
SP1	0.253		0.112	0.329	0.791
SP3			0.379	0.250	0.749

3.4. Analysis of Data

The normality of the data was evaluated using the one-sample Kolmogorov–Smirnov test in SPSS software version 24. The results of the study showed that the p -values for all indicators were below 0.05, indicating that the data do not follow a normal distribution. Thus, PLS-SEM, WarpPLS software ver.0.8 has been selected based on the novel idea of the current study because of its outstanding capacity to assist and contribute to the development of theories. This approach is particularly good at negotiating the complexities of complex model systems, allowing for theoretical assumptions to be empirically tested (Hair et al. 2021). Apart from its proficiency in handling non-normal data, PLS-SEM is particularly helpful in examining and validating causal–predictive relationships that form the theoretical basis of hypothesis testing and model construction. PLS-SEM is well known for its capacity to increase predicted accuracy and clarify variables at the same. The

theoretical developments and practical applications resulting from the model's predictions are both improved by this double function.

3.5. Common Method Bias

Before collecting data, proactive measurements were implemented to diminish the risk of common method bias (CMB). This involved guaranteeing respondent anonymity, offering precise guidance, and strategically arranging variables to hide the expected connections. Following data collection, rigorous statistical techniques were utilized to assess the CMB. Harman's initial single-factor analysis found that none of the factors is explained more than 32% of the variance, referring that dataset does not have significant common method bias, which is below the 50% threshold. Moreover, a thorough evaluation of collinearity was conducted, and all variance inflation factors (VIFs) were found to be below the recommended threshold of 3, as suggested by Hair et al. (2021). Thus, the average of R^2a is significantly higher than the method variances R^2b , confirming that CMB did not artificially inflate the construct relationships (El-Sherbeeney et al. 2024). This further solidifies the fact that CMB has no significant effect on our research data.

3.6. The Measurement Model

We assessed the convergence validity under two circumstances. Initially, the loadings need to be higher than 0.70. Additionally, AVE should exceed the minimum threshold value of 0.50. Table 3 shows that convergent validity is established when factor loadings are greater than 0.7, and AVE surpasses 0.5 for all constructs. Furthermore, we evaluated the discriminant validity (DV) using the heterotrait–monotrait (HTMT) ratio of correlations (Henseler et al. 2015). Table 4 indicates that DV is confirmed for all constructs as the values are under 0.85, demonstrating that the construct is conceptually distinct. Furthermore, the HTMT inference test also indicates that none of the confidence intervals include the value of 1 at both the lower and higher bounds of 2.5% and 97.25%, respectively. Finally, we assessed reliability through the use of composite reliability (CR). Table 4 demonstrates that the values surpassing 0.70 indicate that both first- and second-order constructs have achieved reliability.

Table 3. Measurement Model Evaluation for FSCQM, SCDI, and FSCSP Constructs.

Construct/Item	Loadings	Mean	SD
Food Supply Chain Quality Management practices (FSCQM) ($\alpha = 0.681$, CR = 0.825, AVE = 0.611)			
Quality strategy and leadership ($\alpha = 0.750$, CR = 0.857, AVE = 0.667)			
QSL1: Hotel managers could convey the hotel's policy of Food Supply Chain Quality management timely and accurately.	0.82	5.817	1.161
QSL2: Hotel managers can proactively address food quality issues and consistently enhance Food Supply Chain Quality management practice.	0.846	5.813	0.862
QSL3: To manage food supply chain quality activities, the managers are responsible for introducing food supply chain quality performance measurement to all partners.	0.783	5.846	0.712
Process integration and management ($\alpha = 0.776$, CR = 0.870, AVE = 0.691)			
PIM1: The hotel and its partners collaboratively establish and implement quality inspection systems within the food supply chain process.	0.857	5.615	0.877
PIM2: Each member of the food supply chain is obligated to provide mutual support in resolving food quality issues.	0.85	5.673	0.889
PIM3: The hotel focuses on minimizing process errors and provides clear process guidance documents to its supplier.	0.786	5.707	0.893

Table 3. Cont.

Construct/Item	Loadings	Mean	SD
Supply chain relationship management ($\alpha = 0.783$, CR = 0.874, AVE = 0.699)			
SCRM1: The partners in the food supply chain are actively involved in food production within the hotel.	0.855	5.341	1.275
SCRM2: The hotel selects food supply chain partners strictly in accordance with the quality of food products or the services they provide.	0.773	4.822	1.504
SCRM3: The hotel provides education and technical assistance to the partners as well as shares information with them.	0.877	5.519	1.045
Supply Chain Digital Integration Capability ($\alpha = 0.890$, CR = 0.916, AVE = 0.647)			
SCDI1: Hotel can integrate the design and development process through digital/information technology.	0.844	5.625	1.019
SCDI2: Hotel can integrate the procurement process through digital/information technology.	0.731	5.178	1.338
SCDI3: Hotel can integrate the production and manufacturing process through digital/information technology.	0.815	5.548	0.921
SCDI4: Hotel can integrate the logistics and warehouse process through digital/information technology.	0.801	5.538	0.867
SCDI5: Hotel can integrate the sales/order process through digital/information technology.	0.839	5.495	1.208
SCDI6: Hotel can integrate information with supply chain partners through digital/information technology.	0.789	5.865	0.682
Food Supply Chain Sustainable Performance ($\alpha = 0.821$, CR = 0.883, AVE = 0.654)			
FSCSP1: Our hotel has shown improved economic performance in the last 3 years.	0.889	5.837	0.902
FSCSP2: Our hotel has improved its environmental performance in the last 3 years.	0.718	5.721	0.816
FSCSP3: Our hotel has improved its social performance in the last 3 years.	0.832	5.966	0.914
FSCSP4: Our hotel has improved its socio-economic performance in the last 3 years.	0.786	6.058	0.802

Table 4. Heterotrait–monotrait ratio (HTMT)—Matrix.

Construct/Variable	SCDI	FSCSP	QSL	PIM	SCRM
Supply Chain Digital Integration Capability (SCDI)					
Food Supply Chain Sustainable Performance (FSCSP)	0.474				
Quality strategy and leadership (QSL)	0.668	0.596			
Process integration and management (PIM)	0.611	0.491	0.607		
Supply chain relationship management (SCRM)	0.422	0.333	0.539	0.465	
Food Supply Chain Quality Management (FSCQM)	0.741	0.62			

(good if <0.90, best if <0.85).

4. Results

The inner model evaluation was conducted to evaluate the robustness and predictive ability of the research constructs, using the coefficient of determination (R^2) and predictive relevance (Q^2) values as indicators. The model demonstrated both high reliability and predictive accuracy. An R^2 value of 0.34 was reported, indicating that 34% of the variation in FSCSP could be explained by the FSCQM practices and SCDI variables. Additionally, SCDI accounted for 38% of the variance in FSCSP ($R^2 = 0.38$) in hotels, reflecting a high level of explanatory power (Chin 2010). The Q^2 values (0.370 and 0.334), both greater than zero, confirmed the predictive validity of the research model (Hair et al. 2012). Moreover, since all the variance inflation factor (VIF) values for the first- and second-order constructs were below 3, there was no evidence of multicollinearity affecting the study model (Hair et al. 2012). The internal structure model was analyzed using 5000 bootstrap samples, which showed no sign changes and featured bias-corrected confidence intervals at 95%. As shown in Figure 2 and Table 5, all the relationships among the research variables were positive and significant ($p < 0.001$), providing support for the research H1, H2, and H3.

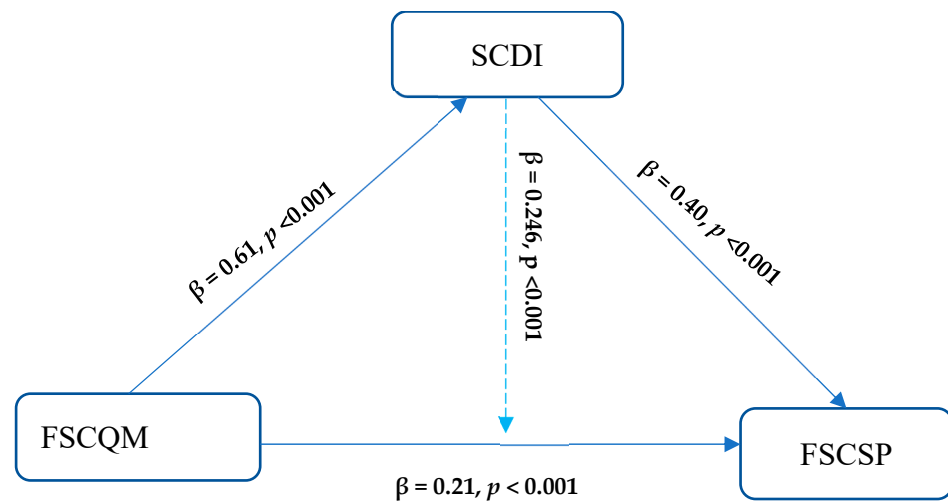


Figure 2. Path Analysis of FSCQM, SCDI, and FSCSP Relationships.

Table 5. Hypothesis Testing Results for FSCQM, SCDI, and FSCSP Relationships.

Hypothesis	Relationship	β -Value	Decision
H1	FSCQM \rightarrow FSCSP	0.21	Supported
H2	FSCQM \rightarrow SCDI	0.61	Supported
H3	SCDI \rightarrow FSCSP	0.40	Supported
H4	FSCQM \rightarrow SCDI \rightarrow FSCSP	0.246	Supported

The mediation hypothesis was evaluated using two methods: the bootstrapping re-sampling approach (Shrout and Bolger 2002) and the Baron and Kenny (1986) method for mediation analysis. We employed 5000 bootstrap samples with 95% bias-corrected confidence intervals (CIs), following the recommendations of Hayes (2017). In the bootstrapping procedure, a mediation effect is considered significant if the confidence interval (CI) does not include zero. If neither the upper limit (CIUL) nor the lower limit (CILL) of the confidence interval includes zero, there is a 95% confidence that the mediation effect is not zero, thus supporting the alternative hypothesis (Hayes 2017). The results revealed that the standardized indirect effect of FSCQM on FSCSP through SCDI was 0.246 (CILL = 0.227, CIUL = 0.529), supporting H4. The effect of FSCQM practices on FSCSP remained positive and significant even without the mediating variable. When the mediator was included, the direct effect of FSCQM practices on FSCSP decreased but remained significant, indicating that SCDI mediated the association between FSCQM practices and FSCSP. The total effect of FSCQM practices on FSCSP, combining both the direct and indirect effects, was 0.456 (0.21 + 0.246).

5. Discussion

This research focuses on the direct relationships between FSCQM, SCDI, and FSCSP, including how FSCQM affects FSCSP and SCDI and the impact of SCDI on FSCSP. Additionally, the study emphasizes the mediating role of SCDI in the relationship between FSCQM and FSCSP. The key contribution of this work is identifying how SCDI mediates the interaction between FSCQM and FSCSP.

The study's findings demonstrated that FSCQM positively impacts FSCSP in hotels ($\beta = 0.21, p < 0.001$), a result that is corroborated by the existing academic literature. Souza and Alves (2018) argue that integrating quality management practices with sustainability initiatives enhances both environmental and economic performance by minimizing waste and optimizing resource use. Similarly, Zink (2007) highlight that quality management systems contribute to sustainability through continuous improvement and stakeholder engagement. Further, Yu et al. (2019) provide evidence that robust quality management

practices are linked to better environmental performance, as firms effectively manage resources and reduce waste. [Thomas-Francois et al. \(2017\)](#) extend this finding to the hospitality industry, showing that hotels with strong quality management in their food supply chains achieve higher sustainability levels. Practical evidence from [Khan et al. \(2020\)](#) supports this by demonstrating that hotels with effective quality management experience improvements in operational efficiency and sustainability. Furthermore, [Benavides-Velasco et al. \(2014\)](#) confirm that quality management enhances sustainability in food supply chains within the hospitality sector by reducing environmental impact and increasing social responsibility. Collectively, these studies underscore the positive impact of FSCQM on FSCSP, suggesting that effective quality management can significantly improve sustainability outcomes in hotel food supply chains.

Furthermore, the notion that FSCQM positively enhances ($\beta = 0.61, p < 0.001$) SCDI in hotels is well supported. This aligns with earlier research, as [Basu et al. \(2018\)](#) demonstrate that effective quality management practices improve process reliability and communication, thereby facilitating the adoption of digital technologies. Similarly, [Saeed et al. \(2024\)](#) find that practices like continuous improvement and standardization in quality management help create a flexible supply chain environment, making it easier to integrate digital tools. [Dutta et al. \(2021\)](#) emphasize that robust quality management systems streamline operations, facilitating the integration of digital solutions. [Ahmed et al. \(2021\)](#) also highlight that firms with strong quality management are better at using digital technologies to enhance supply chain visibility and coordination. Practical examples, such as those from [Yağmur et al. \(2024\)](#), show that hotels with effective quality management practices are more successful at implementing digital solutions, leading to better operational efficiency. Additionally, [Shevtshenko et al. \(2022\)](#) demonstrate that quality management helps in the digital transformation of supply chains by improving data accuracy and communication. Overall, these findings suggest that good FSCQM significantly enhances SCDI, improving supply chain performance in the hotel industry.

Moreover, our study demonstrated that SCDI significantly enhances ($\beta = 0.40, p < 0.001$) the FSCSP in the hotel industry. This research supports the hypothesis that there is a positive relationship between SCDI and FSCSP. The adoption of digital technologies enables hotels to more effectively monitor and manage their supply chains, resulting in better sustainability outcomes. SCDI can improve energy efficiency, streamline logistical resources, and minimize distribution and transportation distances. [Junge and Straube \(2020\)](#) acknowledge that their study did not cover the impact of other key supply chain performance activities on sustainability. However, many companies are exploring the financial viability of big data technology and are beginning to implement its potential ([Dhar et al. 2022](#)). SCDI fosters collaboration with external supply chain partners by aligning organizational strategies, processes, and practices, which facilitates information sharing among different organizations ([Li and Lin 2006](#)). Moreover, digital tools help ensure compliance with regulatory standards, reducing the environmental impact of food supply chains and improving the overall sustainability of hotel operations.

Furthermore, the study found that SCDI positively mediates ($\beta = 0.246, p < 0.001$) the relationship between FSCQM and FSCS practices in hotels. [Nayal et al. \(2022\)](#) further support this by showing that digital integration enhances sustainability outcomes. [Annosi et al. \(2021\)](#) add that digital supply chain practices help achieve sustainability goals by optimizing resource use and reducing waste. These findings indicate that SCDI plays a crucial mediating role in translating the benefits of FSCQM into enhanced sustainable performance in the hotel industry's food supply chains. These studies collectively emphasize that SCDI is not just a supplementary tool but a critical component that bridges the gap between effective FSCQM and enhanced sustainable performance. Digital integration facilitates the implementation of quality management practices by improving coordination, enhancing process efficiencies, and enabling better decision-making. As such, SCDI plays a pivotal role in translating the advantages of FSCQM into tangible improvements in the food supply chains' sustainability of the hotel sector. This highlights

the value of investing in digital technologies to bolster both operational effectiveness and environmental stewardship.

6. Theoretical Implications

This work enhances the current literature on FSCQM and FSCSP by examining the insufficient empirical information concerning the mediating function of SCDI. It emphasizes that the enhancement of FSCQM can elevate SCDI, resulting in improved sustainable outcomes. The research corroborates the claim in the existing literature that, within hospitality organizations, especially in developing countries, these elements must be considered when cultivating corporate cultures and making decisions to guarantee food supply chain procedures are congruent with societal norms and values.

Beyond the context of underdeveloped countries, the findings also have additional implications. In more developed countries, where digital supply chain integration is frequently more sophisticated, the report emphasizes how crucial it is to continuously innovate FSCQM in order to stay competitive. Even in fiercely competitive global marketplaces, this work shows critical competencies for aligning with changing stakeholder expectations and attaining sustainable performance by illustrating how FSCQM propels SCDI activities.

The study highlights the wider influence of SCDI in enhancing FSCSP under a range of market scenarios by presenting a thorough model that investigates the relationship between FSCQM and FSCSP. In order to achieve sustainability and gain a competitive edge, it emphasizes how crucial it is to align with stakeholder interests and preserve the integrity of the food supply chain. Transparency and digital innovation in supply chain procedures are closely related to business success in both developing and developed markets.

The study also shows that fulfilling stakeholder expectations for sustainable performance and guaranteeing quality improvements are the results of a long-term strategy that integrates the digital supply chain, improves quality, and yields quality business advantages. The principles of a responsible business strategy are in line with this, which is important for both established and new markets. The article offers useful advice for a variety of hospitality contexts worldwide by theoretically explaining the importance of these practices and how they can be modified across different market maturity levels.

7. Managerial Implications

This study examines how FSCQM, mediated by SCDI, enhances sustainable performance in hospitality institutions within emerging economies. It suggests that hotels should incorporate digitalization into their food supply chain culture, decision-making processes, and sustainability goals. By doing so, they can address stakeholder concerns, differentiate themselves from competitors, gain greater social legitimacy, and strengthen public support. For practitioners in Egyptian hotel organizations, this study added empirical support to the theory by demonstrating how supply chain integration methods and the implementation of digital transformation affect overall sustainable supply chain performance. The analysis findings give decision-makers fresh empirical evidence that, in order to effectively raise the feasible degree of integration in supply chain networks, digital technologies must be adopted. This is critical for practitioners because the degree of integration, mutual trust, and quality of data and information among SC partners are directly related to their hotels' capacity to establish trustworthy information-sharing, coordination, and organizational linkages. It is true that DT adoption in the hospitality industry can improve partner collaboration, trust, and dependability, including between suppliers and customers (Liu and Chiu 2021). It is concluded that SCDI directly and favorably affects FSCSP. This indicates that digital technologies possess the ability to enhance integration both inside and outside. Through the integration of digital technology and the improvement of quality methodologies, SC managers in service firms can use this information to increase SC efficiency.

Through the application of these strategies, long-term success is achieved in terms of revenue, profitability, client base, market share, and the provision of environmentally friendly product options, in addition to an improvement in environmental performance.

According to the findings of the study, SCDI changes the relationship that exists between FSCQM and FSCSP. This can be achieved through the establishment of quality criteria, policies that promote social and environmental sustainability, a green distribution strategy, standardized operating processes, skilled resources, evaluation methodologies, and cutting-edge software.

In addition, the study highlights the indirect links that exist between efficient management of the quality of the food supply chain and performance, and it suggests that SCDI may be an important aspect in this underlying relationship. Hotels need to implement SCDI to improve their sustainable performance. For accomplishing this, it is necessary to cultivate a culture that is driven by technology and that promotes creativity, innovation, transparency, and information sharing among working personnel. It is possible to make this program easier to implement by establishing digital objectives, developing internal communication channels, and providing training on recent technological advancements. The ability of digital platforms to enable organizations to collect information, make informed decisions, and decrease risks makes them indispensable in a wide variety of diverse industrial sectors. It is possible for efficient digital food supply chain management to result in increased production, financial savings, and a competitive edge.

Identifying market possibilities, enhancing their capabilities, and driving innovation are all things that FSCQM and SCDI assist hospitality institutions in performing. The cultivation of solid relationships with clients is of the utmost importance, and the enhancement of access to digital platforms affords considerable benefits to food supply chains. The combination of these strategies has the potential to revolutionize the growth of a company and produce outstanding outcomes. The purpose of this article and other research that is comparable to it is to advocate for the implementation of digital platforms in food supply chains in order to improve capacities, boost performance, and produce sustainable results.

8. Limitations and Future Research

Future research should focus on overcoming the limitations identified in this study. Primarily, this study is based on a sample size of 208 respondents from a specific sector (five-star hotels), which may restrict the applicability of the results to other categories of service establishments or businesses. This study is a cross-sectional analysis conducted in a single country, comprising a sample of 208 respondents. Future empirical studies may replicate this research by examining the hypotheses in different nations and industries and by creating longitudinal studies utilizing mediation models to more effectively elucidate the long-term relationships between the constructs. Furthermore, the outcomes are anticipated to differ for developed countries with strengthened organizational capabilities and access to ICT resources.

In addition, the study emphasizes the significance of SCDI in mediating the linkages between FSCQM and sustainable performance. However, it does not investigate potential moderating variables that could impact these interactions. Further research could explore these elements to offer a more intricate comprehension. Furthermore, the current study utilizes a purely quantitative research methodology (a 100% self-administered survey), which may overlook more nuanced responses and non-verbal communication data that may be obtained through qualitative or mixed research approaches. Qualitative research methods, including in-depth interviews and observation, are regarded as solutions to address some informational shortcomings inherent in quantitative case studies (Goldstein and Drucker 2006).

Finally, the objective of this study was to identify how quality management practices within the food supply chain can be effectively integrated with digital technologies to enhance food supply chain performance. Therefore, an analysis of the impact of varying degrees of digital maturity on the efficacy of quality management systems would provide significant insights. By addressing these restrictions and researching these areas, there is the potential for significant contributions to the field and an improvement of our understanding of Food Supply Chain Quality Management and sustainability in the hotel business.

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Institutional Review Board Statement: We do confirm that this research survey has been reviewed by the ethical committee and determined that it used appropriate procedures to minimize risks to human subjects and that adequate provision was made for the confidentiality and data anonymity of participants in any published record. Additionally, this study is being conducted in accordance with the Declaration of Helsinki, and the protocol was approved in April 2024 by the Ethics Committee of the Faculty of Tourism and Hotels, University of Sadat City. Any data obtained in connection with this study will remain anonymous. Finally, we consider the participant who voluntarily decides to participate in this study as an approved informed consent.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data supporting the reported results are not publicly available. Data were obtained from internal sources and are available from the corresponding author upon reasonable request.

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References

- Abou Kamar, Mahmoud, Omaima Munawar Albadry, Samar Sheikhsouk, Mohammed Hasan Ali Al-Abyadh, and Omar Alsetoohy. 2023. Dynamic Capabilities Influence on the Operational Performance of Hotel Food Supply Chains: A Mediation-Moderation Model. *Sustainability* 15: 13562. [\[CrossRef\]](#)
- Ahmed, Shehzad, Tahera Kalsoom, Naeem Ramzan, Zeeshan Pervez, Muhammad Azmat, Bassam Zeb, and Masood Ur Rehman. 2021. Towards Supply Chain Visibility Using Internet of Things: A Dyadic Analysis Review. *Sensors* 21: 4158. [\[CrossRef\]](#) [\[PubMed\]](#)
- Alsetoohy, Omar, and Baker Ayoun. 2018. Intelligent agent technology: The relationships with hotel food procurement practices and performance. *Journal of Hospitality and Tourism Technology* 9: 109–24. [\[CrossRef\]](#)
- Alsetoohy, Omar, Baker Ayoun, and Mahmoud Abou-Kamar. 2021. COVID-19 Pandemic Is a Wake-Up Call for Sustainable Local Food Supply Chains: Evidence from Green Restaurants in the USA. *Sustainability* 13: 9234. [\[CrossRef\]](#)
- Alsetoohy, Omar, Baker Ayoun, Saleh Arous, Farida Megahed, and Gihan Nabil. 2019. Intelligent agent technology: What affects its adoption in hotel food supply chain management? *Journal of Hospitality and Tourism Technology* 10: 286–310. [\[CrossRef\]](#)
- Annosi, Maria Carmela, Federica Brunetta, Francesco Bimbo, and Marianthi Kostoula. 2021. Digitalization within food supply chains to prevent food waste. Drivers, barriers and collaboration practices. *Industrial Marketing Management* 93: 208–20. [\[CrossRef\]](#)
- Antony, Jiju. 2004. Six Sigma in the UK service organisations: Results from a pilot survey. *Managerial Auditing Journal* 19: 1006–13. [\[CrossRef\]](#)
- Aung, Myo Min, and Yoon Seok Chang. 2014. Traceability in a food supply chain: Safety and quality perspectives. *Food Control* 39: 172–84. [\[CrossRef\]](#)
- Baron, Reuben M., and David A. Kenny. 1986. The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology* 51: 1173–82. [\[CrossRef\]](#)
- Basu, Rana, Prabha Bhola, Indranil Ghosh, and Pranab K. Dan. 2018. Critical linkages between quality management practices and performance from Indian IT enabled service SMEs. *Total Quality Management & Business Excellence* 29: 881–919.
- Benavides-Velasco, Carlos A., Cristina Quintana-García, and Macarena Marchante-Lara. 2014. Total quality management, corporate social responsibility and performance in the hotel industry. *International Journal of Hospitality Management* 41: 77–87. [\[CrossRef\]](#)
- Burgess, Patrick Robert, Funlade T. Sunmola, and Sigrid Wertheim-Heck. 2023. A review of supply chain quality management practices in sustainable food networks. *Heliyon* 9: e21179. [\[CrossRef\]](#) [\[PubMed\]](#)
- Chakraborty, Debarun, Nripendra P. Rana, Sangeeta Khorana, Hari Babu Singu, and Sunil Luthra. 2022. Big Data in Food: Systematic Literature Review and Future Directions. *Journal of Computer Information Systems* 63: 1243–63. [\[CrossRef\]](#)
- Chin, Wynne W. 2010. How to Write Up and Report PLS Analyses. In *Handbook of Partial Least Squares*. Berlin and Heidelberg: Springer, pp. 655–90.
- Da Silva, Bibiana Porto, Ricardo Augusto Cassel, Priscila Wachs, and Tarcisio Abreu Saurin. 2023. The influence of sustainability on the complexity of food supply chains. *Production & Manufacturing Research* 11: 2217439.

- Dhar, Bablu Kumar, Sabrina Maria Sarkar, and Foster K. Ayittey. 2022. Impact of social responsibility disclosure between implementation of green accounting and sustainable development: A study on heavily polluting companies in Bangladesh. *Corporate Social Responsibility and Environmental Management* 29: 71–78. [CrossRef]
- Dutta, Gautam, Ravinder Kumar, Rahul Sindhwani, and Rajesh K. Singh. 2021. Digitalization priorities of quality control processes for SMEs: A conceptual study in perspective of Industry 4.0 adoption. *Journal of Intelligent Manufacturing* 32: 1679–98. [CrossRef]
- Elshaer, Abdallah M., and Asmaa M. Marzouk. 2019. *Labor in the Tourism and Hospitality Industry: Skills, Ethics, Issues, and Rights*. New York: Apple Academic Press.
- Elshaer, Abdallah M., and Asmaa M. Marzouk. 2022. Memorable tourist experiences: The role of smart tourism technologies and hotel innovations. *Tourism Recreation Research* 49: 445–57. [CrossRef]
- El-Sherbeeney, Ahmed M., Omar Alsetoohy, Samar Sheikhsouk, Sijun Liu, and Mahmoud Abou Kamar. 2024. Enhancing hotel employees' well-being and safe behaviors: The influences of physical workload, mental workload, and psychological resilience. *Oeconomia Copernicana* 15: 765–807. [CrossRef]
- Flynn, B. B., and E. J. Flynn. 2005. Synergies between supply chain management and quality management: Emerging implications. *International Journal of Production Research* 43: 3421–36. [CrossRef]
- Galal, Saifaddin. 2024. Contribution of Travel and Tourism to GDP in Egypt 2005–2023. Available online: <https://www.statista.com/statistics/1317338/contribution-of-travel-and-tourism-to-gdp-in-egypt/#:~:text=In%202022,%20travel%20and%20tourism,19%20pandemic%20on%20the%20sector> (accessed on 15 June 2024).
- Genovese, Andrea, Adolf A. Acquaye, Alejandro Figueroa, and S. C. Lenny Koh. 2017. Sustainable supply chain management and the transition towards a circular economy: Evidence and some applications. *Omega* 66: 344–57. [CrossRef]
- Goldstein, Harvey, and Joshua Drucker. 2006. The Economic Development Impacts of Universities on Regions: Do Size and Distance Matter? *Economic Development Quarterly* 20: 22–43. [CrossRef]
- Hair, Joe F., Jr., G. Tomas M. Hult, Christian M. Ringle, Marko Sarstedt, Nicholas P. Danks, and Soumya Ray. 2021. *Partial Least Squares Structural Equation Modeling (PLS-SEM) Using R: A Workbook*. Cham: Springer Nature.
- Hair, Joe F., Jr., Marko Sarstedt, Christian M. Ringle, and Jeannette A. Mena. 2012. An assessment of the use of partial least squares structural equation modeling in marketing research. *Journal of the Academy of Marketing Science* 40: 414–33. [CrossRef]
- Hair, Joe F., Jr., Marko Sarstedt, Lucas Hopkins, and Volker G. Kuppelwieser. 2014. Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research. *European Business Review* 26: 106–21. [CrossRef]
- Hair, Joe F., Jr., William C. Black, Barry J. Babin, and Rolph E. Anderson. 2010. *Multivariate Data Analysis*, 7th ed. Englewood Cliffs: Prentice-Hall.
- Hayes, Andrew F. 2017. *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*. New York: Guilford Publications.
- Henseler, Jörg, Christian M. Ringle, and Marko Sarstedt. 2015. A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science* 43: 115–35. [CrossRef]
- Hong, Jiangtao, Yi Liao, Yibin Zhang, and Zhefu Yu. 2019. The effect of supply chain quality management practices and capabilities on operational and innovation performance: Evidence from Chinese manufacturers. *International Journal of Production Economics* 212: 227–35. [CrossRef]
- Hussain, Matloub, and Mohsin Malek. 2022. How do dynamic capabilities enable hotels to be agile and resilient? A mediation and moderation analysis. *International Journal of Hospitality Management* 106: 103266. [CrossRef]
- Ibrahim, Maha, and Saoud A. Falasi. 2014. Employee loyalty and engagement in UAE public sector. *Employee Relations* 36: 562–82. [CrossRef]
- Jagtap, Sandeep, and Shahin Rahimifard. 2019. The digitisation of food manufacturing to reduce waste—Case study of a ready meal factory. *Waste Management* 87: 387–97. [CrossRef]
- Jagtap, Sandeep, Linh Duong, Hana Trollman, Farah Bader, Guillermo Garcia-Garcia, George Skouteris, Jie Li, Pankaj Pathare, Wayne Martindale, Mark Swainson, and et al. 2021. *IoT Technologies in the Food Supply Chain*. London: Academic Press, pp. 175–211.
- Junge, Anna Lisa, and Frank Straube. 2020. Sustainable supply chains—Digital transformation technologies' impact on the social and environmental dimension. *Procedia Manufacturing* 43: 736–42. [CrossRef]
- Kafetzopoulos, Dimitrios P., Evangelos L. Psomas, and Panagiotis D. Kafetzopoulos. 2013. Measuring the effectiveness of the HACCP Food Safety Management System. *Food Control* 33: 505–13. [CrossRef]
- Khalifa, Gamal S. A., Abdallah M. Elshaer, Kashif Hussain, and Ahmed K. Elnagar. 2024. What drives customers' participation behaviour? Unveiling the drivers of affective satisfaction and its impacts in the restaurant industry. *Journal of Hospitality and Tourism Insights*. [CrossRef]
- Khan, Rao Aamir, Adnan Mirza, and Muhammad Khushnood. 2020. The role of total quality management practices on operational performance of the service industry. *International Journal for Quality Research* 14: 439–54. [CrossRef]
- Kumar, Anish, Sachin Kumar Mangla, Pradeep Kumar, and Malin Song. 2021. Mitigate risks in perishable food supply chains: Learning from COVID-19. *Technological Forecasting and Social Change* 166: 120643. [CrossRef]
- Kumar, Anup, Santosh Kumar Shrivastav, Avinash K. Shrivastava, Rashmi Ranjan Panigrahi, Abbas Mardani, and Fausto Cavallaro. 2023. Sustainable Supply Chain Management, Performance Measurement, and Management: A Review. *Sustainability* 15: 5290. [CrossRef]

- Lee, Joonkoo, Gary Gereffi, and Janet Beauvais. 2012. Global value chains and agrifood standards: Challenges and possibilities for smallholders in developing countries. *Proceedings of the National Academy of Sciences* 109: 12326–31. [CrossRef]
- Lee, Voon-Hsien, Pik-Yin Foo, Garry Wei-Han Tan, Keng-Boon Ooi, and Amrik Sohal. 2021. Supply chain quality management for product innovation performance: Insights from small and medium-sized manufacturing enterprises. *Industrial Management & Data Systems* 121: 2118–42.
- Li, Suhong, and Binshan Lin. 2006. Accessing information sharing and information quality in supply chain management. *Decision Support Systems* 42: 1641–56. [CrossRef]
- Liang, Chih-Chin. 2013. Smart Inventory Management System of Food-Processing-and- Distribution Industry. *Procedia Computer Science* 17: 373–78. [CrossRef]
- Lim, Ai-Fen, Voon-Hsien Lee, Pik-Yin Foo, Keng-Boon Ooi, and Garry Wei-Han Tan. 2022. Unfolding the impact of supply chain quality management practices on sustainability performance: An artificial neural network approach. *Supply Chain Management: An International Journal* 27: 611–24. [CrossRef]
- Liu, Kam Pui, and Weisheng Chiu. 2021. Supply Chain 4.0: The impact of supply chain digitalization and integration on firm performance. *Asian Journal of Business Ethics* 10: 371–89. [CrossRef]
- Nayal, K., Rakesh D. Raut, Vinay Surendra Yadav, Pragati Priyadarshinee, and Balkrishna E. Narkhede. 2022. The impact of sustainable development strategy on sustainable supply chain firm performance in the digital transformation era. *Business Strategy and the Environment* 31: 845–59. [CrossRef]
- Radu, Elena, Adriana Dima, Ecaterina Milica Dobrota, Ana-Maria Badea, Dag Øivind Madsen, Cosmin Dobrin, and Silviu Stanciu. 2023. Global trends and research hotspots on HACCP and modern quality management systems in the food industry. *Heliyon* 9: e18232. [CrossRef] [PubMed]
- Rejeb, Abderahman, John G. Keogh, and Karim Rejeb. 2022. Big data in the food supply chain: A literature review. *Journal of Data, Information and Management* 4: 33–47. [CrossRef]
- Rejeb, Abderahman, John G. Keogh, Suhaiza Zailani, Horst Treiblmaier, and Karim Rejeb. 2020. Blockchain Technology in the Food Industry: A Review of Potentials, Challenges and Future Research Directions. *Logistics* 4: 27. [CrossRef]
- Saeed, Khawaja, Manoj Malhotra, and Sue Abdinnour. 2024. Enhancing supply chain agility through information systems artifacts and process standardization: An empirical assessment. *Journal of Systems and Information Technology* 26: 337–62. [CrossRef]
- Saragih, Jopinus, Adrian Tarigan, Ikbar Pratama, Jumadiah Wardati, and Elba Frida Silalahi. 2020. The impact of total quality management, supply chain management practices and operations capability on firm performance. *Polish Journal of Management Studies* 21: 384–97. [CrossRef]
- Sarfraz, Muddassar, Kausar Fiaz Khawaja, Heesup Han, Antonio Ariza-Montes, and Juan Manuel Arjona-Fuentes. 2023. Sustainable supply chain, digital transformation, and blockchain technology adoption in the tourism sector. *Humanities and Social Sciences Communications* 10: 557. [CrossRef]
- Schoemaker, Paul J. H., Sohvi Heaton, and David Teece. 2018. Innovation, Dynamic Capabilities, and Leadership. *California Management Review* 61: 15–42. [CrossRef]
- Seuring, Stefan, Joseph Sarkis, Martin Müller, and Purba Rao. 2008. Sustainability and supply chain management—An introduction to the special issue. *Journal of Cleaner Production* 16: 1545–51. [CrossRef]
- Shevtshenko, Eduard, Rene Maas, Lea Murumaa, Tatjana Karaulova, Ibrahim Oluwale Raji, and Janek Popell. 2022. Digitalisation of supply chain management system for customer quality service improvement. *Journal of Machine Engineering* 22: 78–90. [CrossRef]
- Shrout, Patrick E., and Niall Bolger. 2002. Mediation in experimental and nonexperimental studies: New procedures and recommendations. *Psychological Methods* 7: 422–45. [CrossRef] [PubMed]
- Souza, João Paulo Estevam, and João Murta Alves. 2018. Lean-integrated management system: A model for sustainability improvement. *Journal of Cleaner Production* 172: 2667–82. [CrossRef]
- State Information Service. 2024. State Information Service. Available online: <https://www.sis.gov.eg/Story/191554/Egypt-Rose-3-Places-in-the-2024-Agility-Emerging-Markets-Logistics-Index?lang=en-us> (accessed on 16 November 2024).
- Stifanich, Ljubica Pilepić, Tomislav Car, and Marina Perišić Prodan. 2018. Information Technology Tools in Hospitality Supply Chain Management. *Supply Chain Management in Hospitality Industry*, 57–71.
- Talib, Faisal, Zillur Rahman, and M. N. Qureshi. 2011. A study of total quality management and supply chain management practices. *International Journal of Productivity and Performance Management* 60: 268–88. [CrossRef]
- Teece, David J. 2007. Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal* 28: 1319–50. [CrossRef]
- Thomas-Francois, Kimberly, Michael von Massow, and Marion Joppe. 2017. Service-oriented, sustainable, local food value chain—A case study. *Annals of Tourism Research* 65: 83–96. [CrossRef]
- Vanichchinchai, Assadej, and Barbara Igel. 2009. Total quality management and supply chain management: Similarities and differences. *The TQM Journal* 21: 249–60. [CrossRef]
- Yadav, Sanjeev, Ashutosh Samadhiya, Anil Kumar, Sunil Luthra, Vikas Kumar, Jose Arturo Garza-Reyes, and Arvind Upadhyay. 2024. The interplay effects of digital technologies, green integration, and green innovation on food supply chain sustainable performance: An organizational information processing theory perspective. *Technology in Society* 77: 102585. [CrossRef]
- Yadav, Sanjeev, Sunil Luthra, and Dixit Garg. 2022. Internet of things (IoT) based coordination system in Agri-food supply chain: Development of an efficient framework using DEMATEL-ISM. *Operations Management Research* 15: 1–27. [CrossRef]

- Yağmur, Yenal, Altan Demirel, and Gül Damla Kılıç. 2024. Top quality hotel managers' perspectives on smart technologies: An exploratory study. *Journal of Hospitality and Tourism Insights* 7: 1501–31. [\[CrossRef\]](#)
- Yang, Ching-Chiao, and Hsiao-Hsuan Wei. 2013. The effect of supply chain security management on security performance in container shipping operations. *Supply Chain Management: An International Journal* 18: 74–85. [\[CrossRef\]](#)
- Yu, Yubing, Min Zhang, and Baofeng Huo. 2019. The impact of supply chain quality integration on green supply chain management and environmental performance. *Total Quality Management & Business Excellence* 30: 1110–25.
- Zhao, Guoqing, Shaofeng Liu, Carmen Lopez, Haiyan Lu, Sebastian Elgueta, Huilan Chen, and Biljana Mileva Boshkoska. 2019. Blockchain technology in agri-food value chain management: A synthesis of applications, challenges and future research directions. *Computers in Industry* 109: 83–99. [\[CrossRef\]](#)
- Zhao, Jun, and Xiao-Yan Liu. 2024. ICT, Supply Chain Digital Integration Capability, and Firm Financial Performance: The Antagonistic Effects of Perceived Government Support and Cognitive Constraints on Digital Transformation. *SAGE Open* 14. [\[CrossRef\]](#)
- Zhong, Jianlan, Yizhong Ma, Yiliu Tu, and Xia Li. 2016. Supply chain quality management: An empirical study. *International Journal of Contemporary Hospitality Management* 28: 2446–72. [\[CrossRef\]](#)
- Zink, Klaus J. 2007. From total quality management to corporate sustainability based on a stakeholder management. *Journal of Management History* 13: 394–401. [\[CrossRef\]](#)

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