Supply Chain Integration and Sustainable Supply Chain Performance in the Food Manufacturing Industry: The Moderating Role of Flexible Culture

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Abstract

Purpose

This research employs the relational view theory to investigate the impact of supply chain integration (SCI) on sustainable supply chain performance (SSCP) in food supply chains, while also assessing the extent to which a flexible culture moderates this relationship.

Methodology

We conducted interviews with 11 top managers and collected and analysed 315 survey responses from the food manufacturing industry in the UK and Greece.

Findings

The findings confirm that, in global food supply chains: (i) internal integration is a prerequisite for stronger external integration; (ii) internal integration positively relates to SSCP, but this relationship is mediated by external integration; (iii) customer and supplier integration positively influence SSCP; and (iv) flexible culture moderates the link between SCI and SSCP.

Practical Implications

Managers should strengthen SCI to improve SSCP and foster flexible cultural values both within their food manufacturing firms and across their supply chains to achieve higher SSCP.

Originality/Value

The study extends relational view theory by demonstrating that SCI enhances SSCP in global food supply chains, while also highlighting the critical moderating role of flexible culture in this relationship.

Keywords:

Sustainability, Sustainable supply chain performance, Supply chain integration, Flexible Culture, Competing value framework.

Introduction

The food industry plays a vital economic role by supporting consumer needs, with global production exceeding US$14 trillion annually (Rejeb *et al.*, 2022). This complex sector encompasses procurement, transportation (including temperature-controlled logistics), processing, and waste management (Kumar *et al.*, 2022). Evolving due to population growth, urbanization, and sustainability demands (Kumar *et al.*, 2022; Rejeb *et al.*, 2022), food supply chains uniquely intersect with ecosystems, public health, and socioeconomic equity. They must simultaneously address environmental impacts (e.g., emissions, water use), social responsibility (e.g., fair labor), and economic viability (e.g., small farm support) across global networks (de Lima *et al.*, 2025). However, the sector faces significant sustainability challenges, including escalating food waste, greenhouse gas emissions, ecological damage, and excessive water use, which collectively undermine its sustainability performance (de Lima *et al.*, 2025; Ghadge *et al.*, 2020).

Due to the persist problems in the industry, the sustainability of food supply chains has been at the forefront of research and practice due to its environmental and social footprint and the significant contribution to climate change (Ghadge *et al*., 2020; Kumar *et al*., 2022). For example, according to de Lima *et al*. (2025), agricultural supply networks are flooded with bad labour conditions, environmental degradation, deforestation, modern day slavery, negatively impacting both society and environmental, thereby, affecting the long-term sustainability of food supply chains. These have been accompanied, however, by increasing pressure and concerns from stakeholders such as sustainability activists, customers, and other stakeholders for food supply chains to adopt sustainability in their supply chains (Kamble *et al*., 2020), making it imperative to further assess and measure the sustainability performance of food supply chains (Osei *et al*., 2023). Transport infrastructure, ineffective supply chain coordination, cold supply chains and lack of sustainability culture have been identified as factors that hinder the ability of many food supply chains to achieve better sustainability performance (Zanoni and Zavanella, 2012; Krishnan *et al*., 2021).

Despite extensive research on food supply chain sustainability, many food manufacturers still struggle to transition to sustainable practices, underscoring the need for further study (Ghadge *et al*., 2020). Key factors, such as supply chain integration (SCI), are critical for improving sustainable supply chain performance (SSCP) (Gopal and Thakkar, 2016; Kang *et al*., 2018). Given the global nature of food supply chains, effective coordination among

stakeholders is essential for timely delivery, accurate environmental assessments, and strong SSCP (Braziotis *et al*., 2013; Govindan, 2018; Osei *et al*., 2023). SCI is categorized into internal integration (cross-functional collaboration within a firm) and external integration (collaboration with suppliers and customers, thus, supplier and customer integration) (Flynn *et al.*, 2010; Weingarten and Longoni, 2015). Internal integration ensures employees develop sustainability skills, sustainability orientation (Cerchione *et al.*, 2018), while external integration facilitates joint sustainability planning, practice adoption, and policy compliance, visibility, and environmental compliance (de la Fuente *et al.*, 2008; Han and Huo, 2020; Baah *et al.*, 2022; Donkor *et al*., 2024), ultimately enhancing SSCP.

According to Formentini and Tatichi (2016), to respond to the sustainability concerns, mitigate environmental impacts and pressure from customers and other stakeholders, food manufacturing firms need to restructure their internal governance mechanisms and work closely with suppliers and customers (SCI). Although, several food manufacturing firms have experienced backlash and criticism for poor sustainability performance, most firms are beginning to harness SCI to successfully implement sustainability practices (Hongquan and Abdullah, 2023). This implies that SCI, if fully exploited, can help several food manufacturing firms to overcome sustainability challenges, but existing studies focusing on food how supply chains can harness SCI to improve sustainability are still lacking in the literature (Kumar *et al.*, 2022; Heydari, 2024). Osei *et al*. (2024) reignited the need for the extant literature to continually explore the impact of SCI on the sustainability performance especially in food manufacturing firms.

The Relational View Theory (RVT) underscores the importance of collaboration within food manufacturing firms and across their supply chains to enhance SSCP. RVT posits that sharing information, resources, and knowledge among partners fosters competitive advantage (Dyer *et al.*, 2018), making it relevant to studying SCI and SSCP. While prior research (e.g., Osei *et al*., 2024) has proposed sustainability strategies for the food sector, no study has explicitly examined how internal (cross-functional collaboration), and external (supplier/customer collaboration) integration collectively improve SSCP. Extending RVT, this research investigates SCI's role in boosting sustainability. Formentini and Taticchi (2016) suggest that strong internal integration enables better engagement with suppliers and customers, facilitating the adoption of sustainability practices (Baah *et al.*, 2022). However, empirical evidence remains scarce. We argue that in food supply chains, internal integration

drives external integration, which in turn mediates the relationship between internal integration and sustainability performance—a claim yet to be thoroughly tested.

Research demonstrates that organisational culture (OC) plays a pivotal role in implementing sustainable supply chain strategies (Carter and Rogers, 2008; Osei *et al.*, 2024). The RVT highlights that effective collaboration across supply chains, depends on trust, information sharing, coordination, and joint decision-making—factors that align with the flexible (developmental and group) cultural dimensions of the Competing Values Framework (CVF) (Quinn and Cameron, 1999). Flexible cultures, characterized by adaptability, teamwork, innovation, training, and long-term orientation, are particularly conducive to sustainability initiatives (Wijethilake *et al*., 2023; Osei *et al.*, 2024), enabling firms to strengthen SCI and enhance sustainable supply chain performance (SSCP). When these cultural values permeate across supply chain partners, they amplify the positive impact of SCI on SSCP, suggesting a moderating role of flexible culture in this relationship—a critical yet underexplored area in current literature.

To address these gaps, the research aims to answer the following questions:

RQ1: How do internal and external SCI relationships influence SSCP in food supply chains and does external integration mediate internal integration and SSCP?

RQ2: Does flexible culture moderate the SCI-SSCP relationship? How?

To address these questions, we employed a mixed-methods approach, focusing on food manufacturing industries in the UK and Greece. These countries were selected not only due to their heavily criticized food supply chains—particularly for transboundary environmental impacts (Ghadge *et al*., 2020) and declining sustainability performance—but also because they represent distinct yet complementary contexts. The UK offers insights into a large, industrialized market with stringent regulations, while Greece provides perspectives from a Mediterranean economy with strong agricultural ties and unique sustainability challenges.

The rest of the paper is structured as follows: the next section reviews the literature on SCI, SSCP, flexible culture, RVT and subsequently presents the hypotheses and the conceptual model. Next, the methodology followed by the results and analysis of the study are presented. Subsequently, the discussion of the findings and implications for theory and practice are highlighted. Lastly, the conclusion, limitations and suggestions for future study are presented.

Review of Related Literature and Hypothesis Development

Sustainable Supply Chain Performance (SSCP)

Carter and Rogers (2008) define sustainable supply chain management (SSCM) as the strategic, transparent integration of an organization's social, environmental, and economic objectives through coordinated inter-organizational processes to enhance long-term performance. Effective SSCM improves the triple bottom line (TBL)—economic, social, and environmental performance—across the supply chain, leading to sustainable supply chain performance (SSCP) (Das, 2017). Economic performance involves cost reduction and increased profitability, while social performance focuses on improving employee welfare and societal well-being (Pagell and Gobeli, 2009; Das, 2017). Environmental performance includes eco-friendly initiatives, carbon footprint assessments, reduced resource consumption, and compliance with standards like ISO 14000 (Hassini *et al.*, 2012; Kang *et al.*, 2018; Shaw *et al.*, 2020), and compliance with domestic environmental and social responsibilities further reinforces SSCP (Castka and Corbett, 2015; Shaw *et al.*, 2020).

Food supply chains have been found to be highly energy intensive, using a range of temperature-controlled equipment in production, storage, and distribution, leading to negative environmental impacts and an increased contribution to climate change (de Lima *et al.*, 2025; Ghadge *et al.*, 2020). Anastasiadis *et al.* (2020) also highlighted the low sustainability performance of Greek food supply chains. The food supply chains are further characterised by a complicated transport network (resulting in high level of emissions), ineffective supply chain coordination, cold supply chains and lack of sustainability culture and these factors have been identified as hindering their ability to achieve better sustainability performance (Zanoni and Zavanella, 2012; Krishnan *et al.*, 2021).

The criticality and the low sustainability performance associated with the food supply chains has led to increased pressure from various stakeholders and pressure on food manufacturing firms to effectively implement sustainable practices (Kamble *et al.*, 2020). These provide evidence that stimulate the need for further research into how food supply chains could increase their SSCP. There is also an ongoing need for researchers to identify the various ways in which the sustainability performance of the firms in the industry can be improved. Currently, the adoption of SCI and the implementation of sustainability-oriented practices are

considered critical to achieving better SSCP, but there is paucity of research on how this can be achieved (Kang *et al.*, 2018; Shee *et al.*, 2018).

Supply Chain Integration (SCI)

Flynn *et al.* (2010) defined SCI as the coordination of efforts and resources in the form of business processes that are closely linked both within and outside the boundaries of a company for the purpose of creating value for customers (Kujala *et al.*, 2022) and improving the supply chain performance. In this study, SCI is categorised into two main dimensions, namely, *internal,* and *external* (customer and supplier) integration. *Internal* integration simply involves firms coordinating their internal processes, functions, and structures. *External* integration, on the other hand, involves the close coordination and working relationship between firms, customers, and suppliers to achieve supply chain objectives (Flynn *et al.*, 2010; Weingarten and Longoni, *2015*).

To gain competitive advantage, supply chain partners must share critical information—such as market data, demand forecasts, sustainability metrics, and joint product development—while aligning their systems (Flynn *et al.*, 2010; Linnenluecke and Griffiths, 2010; Zailani *et al.*, 2019). External integration, particularly through supplier and customer collaboration, is vital for innovation and knowledge acquisition (Ayoub *et al.*, 2017). A supply chain achieves sustainability only when all partners adopt sustainable practices (Kang *et al.*, 2018; Pedersen *et al.*, 2021; Rey-Garcia *et al.*, 2021), highlighting the need for further research on how SCI enhances SSCP. SCI is especially crucial in food supply chains, where coordination among suppliers, manufacturers, and customers ensures efficient delivery (Braziotis *et al.*, 2013; Krishnan *et al.*, 2021). Emerging technologies like blockchain could further strengthen such integration (Cozzio *et al.*, 2023).

Among the various supply chain practices that are conducive to achieving SSCP (Pagell and Wu, 2009; Ghadge *et al.*, 2020), SCI has been considered critical because of the need to share resources and inputs among the various partners for the successful implementation of sustainability practices (Kang *et al.*, 2018; Donkor *et al.*, 2024; Osei *et al.*, 2023). Chauhan *et al.* (2022) found that SCI enables manufacturing firms to attain the sustainable developmental goals (SDG) through teamwork. Although innovative technology such as blockchain, industry 4.0, robotics and other artificial intelligence have recently been identified as drivers of sustainability (Dora *et al.*, 2021; Friedman and Ormiston, 2022), close collaboration between

supply chain partners is required to improve sustainability performance (Krishnan *et al.*, 2021) and ensure that end customers are satisfied and receive their food deliveries (Dani, 2019).

Manufacturing firms must collaborate closely with external partners to implement sustainability practices (Vachon and Klassen, 2008). Integrating with suppliers and customers enables access to critical information and resources for faster sustainability performance evaluation. Studies show such alignment provides strategic insights for sustainable sourcing, packaging, and measurement strategies (Blome *et al.*, 2014; Weingarten and Longoni, 2015). Supplier integration facilitates environmental impact assessments (e.g., life cycle analysis) and supports sustainability standard adoption (Adesenya *et al.*, 2020; Wijethilake *et al.*, 2023). We contend that food manufacturing requires sustainable supply chain collaboration to assess environmental and social impacts while enhancing SSCP. Thus, robust internal integration is essential for effective external integration and improved sustainability performance.

Organisational Culture and the Competing Value Framework

OC represents the shared beliefs, values, and assumptions within a firm (Desphande *et al.*, 1993; Cao *et al.*, 2015) that influence strategy adoption and responses to external demands like sustainability (Cadden *et al.*, 2020; Osei *et al.*, 2023). Firms implementing sustainability practices should incorporate governance mechanisms, including sustainability-oriented culture (Formentini and Taticchi, 2016). The CVF (Quinn and Rohrbaugh, 1983) is widely used in supply chain research to analyse organizational value orientations (Mani *et al.*, 2018) and identify culture types relevant for sustainability implementation (Cao *et al.*, 2015). The CVF's flexibility-control dichotomy classifies OC into four types: group (clan), developmental (adhocracy), rational (market), and hierarchical cultures. Research shows developmental and group cultures (the flexible orientations) are particularly conducive to sustainability practices and performance (Osei *et al.*, 2023), which is why we focus on these two culture types in this study.

Group culture emphasises the use of teamwork and encouraging employees to work in teams to achieve organisational goals, while developmental culture involves the use of long-term plans, education, and development of employees, ensuring employee growth -and encouraging of creativity and innovation (Cao *et al.*, 2015). Cadden *et al.* (2020) pointed out that the presence of flexible cultural values is conducive to the implementation of supply chain strategies. Through group and developmental culture, firms can encourage creativity, innovation, teamwork among employees, internal functions, and departments for the successful

implementation of sustainability practices (Linnenluecke and Griffith, 2010; Wijethilake *et al.*, 2023). Glover *et al.* (2014) validated the usefulness of developmental culture by showing that firms with a long-term orientation are more likely to be successful in the implementing sustainability practices. Thus, the institution and increased use of flexible culture in focal firms and across their supply chain can regulate and support the improvement of the sustainability performance when adopted.

Group culture focuses on the consistent use of training and development, open communication, and participative decision-making with the goal of building strong cohesion, morale and most importantly teamwork. These help to forge a closer relationship between focal firms, customers, and suppliers (Cameron and Quinn, 2011; Cao *et al.*, 2015). The values inherent in this culture enable effective collaboration in the supply chain to win in a competitive environment and enhance mutual understanding among supply chain partners (Cao *et al.*, 2015; Wijethilake *et al.*, 2023). Thus, the group culture ensures a stronger SCI by collaborating on the necessary information, resources, knowledge, and skills required to achieve higher SSCP. We argue that in a firm with a high level of group culture, SCI is likely to be intensified resulting in an increased SSCP.

Developmental cultures emphasise flexibility, change, and external control (Cao *et al.*, 2015). Organisations embracing these values foster growth, innovation, risk-taking, and entrepreneurial behaviors to achieve strategic objectives (Linnenluecke and Griffith, 2010; Cameron and Quinn, 2011). Such cultures promote knowledge-sharing and creative collaboration both within firms and across supply chains, thereby strengthening internal and external integration. We contend that developmental cultural values enhance the internal-external integration relationship and facilitate supply chain coordination to achieve higher SSCP in food manufacturing. Firms with strong flexible cultures are thus more likely to attain superior SSCP outcomes.

Notably, existing literature has not sufficiently explored how developmental and group cultures specifically contribute to improving SSCP in manufacturing, particularly within food supply chain contexts.

Hypotheses Development

Relational View Theory (RVT)

The RVT posits that competitive advantage emerges from dyadic and network relationships between firms, processes, and routines (Dyer and Singh, 1998). Extending business processes to external partners enables firms to accumulate such advantage. Dyer *et al.* (2018) further argue that sharing information, resources, knowledge, and investments with supply chain partners enhances competitive advantage. RVT suggests that active supplier/customer engagement and knowledge sharing are particularly effective for improving SSCP. In food manufacturing, strong SCI enables better responses to sustainability demands (particularly from retailers) and more comprehensive environmental impact assessments. We contend that consistent resource, knowledge, and information sharing among partners is essential for achieving higher SSCP in this sector. This theoretical foundation supports a positive relationship between SCI and SSCP in global food supply chains.

Internal integration and Sustainable Supply Chain Performance

Williams *et al.* (2013) highlight internal integration's critical role in enabling flexibility and optimal performance, particularly for implementing new strategies. Kang *et al.* (2018) identify key internal prerequisites for sustainability performance: environmental commitment, top management support, resource availability, supply management capabilities, and robust performance systems. This implies food manufacturers can enhance sustainability through management commitment and employee training on environmental and social practices across the supply chain. Formentini and Taticchi (2016) further emphasize that internal governance mechanisms facilitate successful sustainability implementation. Establishing such mechanisms and raising sustainability awareness across departments creates pathways for effective practice adoption. By building these foundations, firms can form sustainability teams to share knowledge and innovative ideas, ultimately strengthening both sustainability performance and RVT's applicability.

Few scholars such as Han and Huo (2020) have found a positive relationship between internal integration and environmental performance. However, studies linking internal integration and SSCP are limited. Training employees to be sensitive to environmental issues (Han and Huo, 2020) and continuously involving employees in sustainability planning improves sustainability education and training, which subsequently increases the social and

environmental performance. Hence, we argue that food manufacturing firms with sustainability-sensitive departments, functions and sustainability teams and employees—along with formal internal governance mechanisms for sustainability established through internal integration to facilitate sharing sustainability ideas, creativity, and knowledge (RVT)—can implement sustainability practices in their supply chains and their supply chains and thereby achieve higher SSCP (*see Fig. 1*). We hypothesise that, in the food manufacturing supply chains;

H1a. *Internal integration has a positive influence on sustainable supply chain performance.*

Han and Huo (2020) further found that internal integration is very important in forming collaborations with customers and suppliers for the purpose of green supply chain management. Formentini and Taticchi (2016) emphasised that successful sustainability implementation and close collaboration with external partners starts with impressive internal systems and governance structures. Osei *et al.* (2023) reiterated that formidable internal integration systems in food manufacturing firms provide a foundation for the firms to build good and strong teams with their external supply chain partners to improve sustainability performance. Thus, in the context of sustainability, it is highly necessary for food manufacturing firms to establish a well-structured internal integration to enhance their relationship with external supply chain partners to achieve high levels of sustainability performance. This justifies the need to further investigate the relationship between internal and external integration, especially for sustainability performance enhancement.

Building on this, we argue that internal integration is essential for fostering effective sustainability collaboration with customers and suppliers. Kang *et al.* (2018) highlight how internal integration enables external integration with these partners. Applied to food supply chains—where customers and suppliers are critical for sharing information and resources to achieve higher SSCP—focal firms with strong internal integration can establish knowledgeable sustainability teams. These teams facilitate integration with external partners, enhancing the ability to address environmental, social, and economic challenges (RVT). Thus, successful external collaboration for sustainability performance in food manufacturing hinges on robust internal integration. We posit that strong external sustainability collaboration requires internal integration, operationalized through sustainability teams (*see Fig. 1*). Therefore, we hypothesize that in food manufacturing supply chains:

H1b*: Internal integration is a prerequisite to a successful external integration and has a positive relationship with both customer and supplier integration.*

Customer Integration and Sustainable Supply Chain Performance

Previous studies (eg., Kang *et al.*, 2018; Han and Huo, 2020; Donkor *et al*., 2024) have reported on the relevance of customer involvement for sustainability performance. Gelhard and von Delft (2016) and Kang *et al.* (2018) found that customer involvement is very important for the implementation of sustainability practices. Based on this, we argue that customer integration is positively related to SSCP in the food supply chains. In the food supply chains, customers, which are mostly the mainstream retailers exert sustainability pressure on the supply chain. Since retailers also receive first-hand information about the sustainability requirements of their customers' (second tier customers), it is highly necessary for focal manufacturers to work closely with first-tier customers (retailers) to respond to their sustainability requirements.

Through a strong customer integration, environmentally friendly measures such as decomposition and pollution control methods can be shared, leading to improved production and design of environmentally friendly products (Blome *et al.*, 2014) proving the RVT. Close integration with customers means that focal food manufacturing firms can now tailor production to meet the various sustainability requirements of customers and introduce more environmentally friendly and innovative products, resulting in increased demand and profitability (economic performance). Furthermore, when customers are involved in sustainability decisions, comprehensive information, ideas, skills, and resources needed to meet the social and environmental needs of different stakeholders are obtained (Weingarten and Longoni 2015; Han and Huo 2020; Osei *et al.*, 2023). From the perspective of the RVT, firms with strong customer integration can obtain relational resources such as knowledge, information and technology, needed for attaining a higher SSCP from customers. Therefore, we hypothesise that, in the supply chains of food manufacturing firms;

H2*: Customer integration positively influences sustainable supply chain performance.*

Supplier Integration and Sustainable Supply Chain Performance

Integration with suppliers has been found to be crucial to the success of sustainability performance (Mani *et al.*, 2018; Caicado *et al.*, 2019). Pagell and Wu (2009) also expressed the need to build a strong relationship with suppliers to improve firms' SSCP. Mani *et al.* (2018) also highlighted that the social activities of suppliers in a supply chain have a significant impact on people and society. As most food supply chains extend across borders, their negative impacts are felt across multiple economies or nations (Osei *et al.*, 2024). This highlights the need for suppliers in different food supply chains to adopt sustainable practices. Input from

suppliers is needed to measure sustainability impacts and to perform other functions such as LCA. Formetini and Taticchi (2016) found that supplier certification is as a step towards the implementation of sustainability practices in supply chains. Kang *et al.* (2018) and Weingarten and Longoni (2015) also confirmed the relevance of involving suppliers in sustainability decisions. In this research, we argue that supplier integration in the supply chain is necessary to improve SSCP.

Supplier integration for sustainability means that the food manufacturing firms can obtain the necessary sustainable raw materials, innovative ideas and skills needed to respond quickly to the increasing sustainability demands of customers (Blome *et al*., 2014; Yu *et al*., 2014), thus validating the RVT. Furthermore, sustainability pressures from the retailers and other stakeholders can best be addressed through an integrative effort with suppliers. Integrating suppliers into the implementation of sustainability decisions provides the suppliers with a sense of sustainability focus and enables them to identify and implement the necessary practices needed to protect the environment and society. Integration also provides suppliers with the necessary information and support on some of the more environmentally friendly means of extracting and transporting raw materials (Osei *et al.*, 2023). From the perspective of RVT, integration with suppliers creates an environment in which customers and suppliers, as well as the team from the focal food manufacturing firms, set the sustainability goals and share the relational resources needed to achieve an improved SSCP (*see Fig. 1*).

Therefore, in this research, we hypothesise that, in the food manufacturing supply chains:

H3*: Supplier integration has a positive influence on sustainable supply chain performance.*

The Mediation Role of External Integration

In this research, we argue that the positive relationship between internal integration and SSCP is partly explained for by external integration with the supply chain partners (customers and suppliers). Focal manufacturing firms with a high internal integration can form an effective integration with the customers and suppliers in the supply chain. Although studies such as Formetini and Taticchi (2016) and Kang *et al.* (2018) have argued about the importance of internal systems for sustainability implementation, the knowledge, support, resources, ideas, and technology needed to implement the sustainability practices in the supply chain are mostly obtained from customers and suppliers (Wang *et al*., 2021).

Throughout the food supply chains, the focal manufacturing firms can integrate the cross-border sustainability requirements of different stakeholders if customers and suppliers are involved in the joint setting and implementation of sustainability goal (Vachon and Klassen, 2008). According to the RVT, a strong collaboration of information, knowledge, skills, innovative ideas, resources and capabilities between the focal firms and their supply chain partners can enable the acquisition of comprehensive sustainability information, accurately measure the social and environmental impacts of the supply chain, and at the same time swiftly respond to the continuously increasing demand for sustainable products. This suggests that regardless of the effectiveness of internal integration, the focal food manufacturing firms still need to integrate with customers and suppliers in the supply chain to achieve a higher SSCP. We therefore argue that external integration may explain the positive relationship between internal integration and SSCP (*see Fig. 1*). Based on this, we hypothesise that, in the food manufacturing supply chains.

H4*: External integration mediates the relationship between internal integration and sustainable supply chain performance.*

The Moderating Effect of Flexible Culture

A flexible culture which encompasses both group and development cultures (according to the CVF), is characterised by long-term goal and development focus, resource extraction, goal achievement, teamwork, relationship development, training and development, risk-taking, dynamic entrepreneurship, open communication, innovation, and creativity (Cameron and Quinn, 2011; Cao *et al*., 2015). Kok *et al.* (2019) identified the need to change organisational culture to accommodate new organisational change or dynamics. In sustainable supply chain collaboration, different supply chain partners need to coordinate their efforts and necessary resources to achieve higher SSCP. Therefore, regulating the sustainability partnership with these set of values is likely to instil sustainability consciousness to achieve higher SSCP (Osei *et al.*, 2023). For example, guiding the supply chain relationship with both developmental and group cultural values can ensure adoption of resource extraction, human relations, training, and development by the focal food manufacturing firms, increases the sensitivity of the supply chain to environmental issues, while increasing the responsiveness of the supply chain to societal issues (social performance).

Rasheed *et al.* (2024) found that workplaces fostering strong interpersonal relationships and HR flexibility enhance innovation and performance, unlike those with high power distance.

A culture that encourages creativity, teamwork, and risk-taking drives sustainability-oriented innovation, enabling effective governance (Formentini and Taticchi, 2016) and stronger internal and external collaboration. We argue that food manufacturers embracing group-based and developmental cultural values improve supply chain integration (SCI), leading to superior sustainable supply chain performance (SSCP). Firms with flexible cultures would likely outperform rigid ones, as these values strengthen SCI and sustainability outcomes (*see Fig. 1*). However, the moderating role of flexible culture in advancing sustainability practices and SSCP remains underexplored in literature. In the light of this, we hypothesise that in the food manufacturing supply chains:

H5a: *The positive relationship between internal integration and external integration is intensified when flexible culture (group and developmental cultures) is adopted.*

H5b: *The positive relationship between SCI and SSCP is intensified when flexible culture (group and developmental cultures) is adopted.*

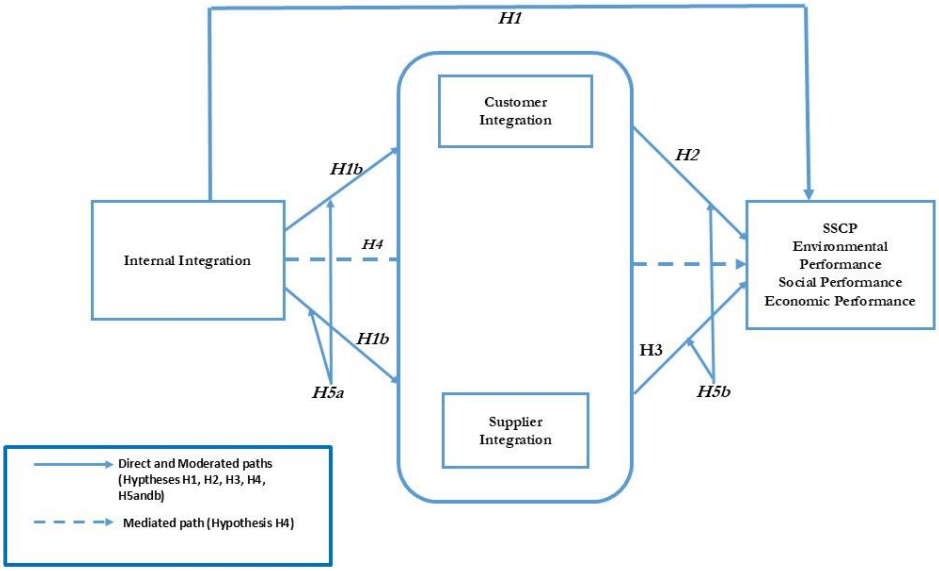

Figure 1. Conceptual Framework. Source: Author's Own Work

Research Methodology

Methodology

This study adopted a mixed-methods research design, primarily employing a quantitative-dominant approach (Tashakkori *et al.*, 1998) given the well-established validity and reliability of the measurement scales for SSCP, SCI, and flexible culture. However, to gain deeper contextual insights and capture managerial perspectives on the interplay between these constructs, qualitative interviews were conducted prior to the quantitative survey. The interviews served two key purposes: (1) to identify additional industry-specific items for measuring SSCP within the food manufacturing sector, and (2) to enrich the study by incorporating practitioners' views on the practical implementation of SCI and SSCP (Silverman, 2006). This sequential qualitative-quantitative approach strengthened the survey instrument and provided a more nuanced interpretation of the statistical findings, ensuring a holistic understanding of the research problem (Shaw *et al.*, 2020). The integrated analysis of both datasets enhanced the robustness and practical relevance of the study's conclusions.

Sampling and Data Collection

We conducted the study in the food manufacturing industry in the UK and Greece. The selection of both UK and Greek food manufacturing sectors provides a robust comparative framework for studying sustainable supply chain performance (SSCP) due to their contrasting yet interconnected market dynamics. The UK represents a mature, highly regulated industrialized food system facing complex sustainability pressures from globalised supply chains (Kirwan *et al.*, 2017), while Greece exemplifies a Mediterranean agricultural economy grappling with climate vulnerability and traditional production methods (Doukas *et al.*, 2025). This duality allows for examining how SCI and flexible culture operate across different institutional environments, regulatory intensities, and supply chain complexities. The UK's advanced sustainability policies and Greece's emerging green transition efforts create a natural experiment for assessing universal versus context-specific drivers of SSCP. Moreover, their shared EU membership ensures comparable baseline sustainability standards while maintaining distinct operational realities, enhancing the generalizability of findings to both developed and transitioning food economies. The inclusion of Greece additionally addresses the literature's Northern European bias, providing crucial Southern European perspectives on sustainable food systems.

Initially targeting UK firms, the study expanded to Greece to ensure broader generalizability and mitigate potential data limitations. This expansion was driven by the continuous decline in sustainability performance (Henningsson *et al.,* 2004; Anastasiadis *et al.,* 2020; Ghadge *et al.,* 2020) observed in both industries within the target countries, and by the availability of relevant manufacturing firms possessing global supply chains in Greece. The study initially begun in the UK, however, due to the difficulty in collecting data, it was extended to include the food manufacturers in Greece. The inclusion of the firms in Greece was possible due to the similarities in the supply chain activities of the firms in the food industry in both countries. Due to the high levels of environmental and societal impact associated with the supply chains of the food manufacturing firms, it has become highly imperative for their sustainability performance to be studied further. For instance, Ghadge *et al.* (2020) asserted that the food supply chains are energy intensive and characterised by high levels of carbon emissions, and therefore, urges supply chain researchers to investigate the various ways of mitigating the negative impact of the supply chains.

We sourced 30,000 UK and Greek food manufacturers from FAME (Financial Analysis Made Easy) and personal contacts. Focusing on large-scale, profitable firms (following Gualandris and Kalchschmidt's 2016 finding that profitable firms adopt sustainability practices), we used stratified sampling by size, profitability, product type, location, and email validity (Table 1). Our initial sample included 1,535 firms (1,135 UK, 400 Greece). From these, we contacted 35 firms (both small and large scale) and secured interviews with 11 top managers (2 CEOs, 2 COOs, 2 Operations Directors, 1 Accounts Manager, 2 Managing Directors, 1 Production Support Manager, and 1 Director). The interviewed firms comprised 4 large and 7 small manufacturers processing cooked/ready-made foods, fresh meat, seafood, and chocolate. The limited response rate resulted from COVID-19 pandemic constraints during research and industry managers' general reluctance to participate.

The survey was distributed via email, with four follow-up rounds. Of the initial 959 contacts (after removing invalid, duplicate, bounced, and declined responses), we received 375 responses, with 315 being usable (60 discarded due to missing/incomplete data). This yielded a 32.8% response rate. The lower-than-ideal participation was attributed to COVID-19 workplace pressures and recipients being unavailable. Such response rates are common in operations management research, as firms often prioritize profit-generating activities over surveys (Karjalainen and Kempainen, 2008). Previous studies have reported even lower rates (<10%) (Levernburg, 2005; Wymer and Regan, 2005; Karjalainen and Kempainen, 2008).

However, Hulland *et al.* (2010) confirm that PLS analysis remains reliable with samples under 500, making our dataset suitable for statistical testing.

Low response rate indicates issues with non-response bias. To assess non-response bias, we employed Armstrong and Overton's (1977) recommended approach, comparing early (UK: n=180; Greece: n=36) and late respondents (UK: n=79; Greece: n=20) using χ^2 tests. Results showed no significant differences at $p<0.05$. We further validated these findings through ANOVA (Lorentz *et al.*, 2013) and t-tests examining SCI, SSCP, and flexible culture dimensions. All tests confirmed no significant differences between response waves or country groups, allowing safe merging of datasets for analysis.

Table 1: Demographic Information (**n=315**)

	Frequency	**Percentage (%)**	**Mean**	**Std. Deviation**
Respondents' Characteristics				
Position			3.82	2.374
CEO	78	24.8		
Supply chain Manager	53	16.8		
Marketing/sales Manager	25	7.9		
Finance Manager/Accountant	23	7.3		
Line Manager/Supervisor	34	10.8		
General Manager	57	18.1		
Others/Directors	45	14.2		
Firms' Characteristics				
Number of Employees			3.42	0.670
0-9	2	.6		
10-49	26	8.3		
50-249	130	41.3		

250 or more	157	49.8		
Turnover Level (€ Millions)			4.56	0.840
Less than 2	2	.6		
Between 2 and 10	23	7.3		
Between 10 and 15	70	22.3		
20 and Above	220	69.8		
Working Years with Customers			4.45	0.773
<5	7	2.2		
5-10	33	10.5		
10-15	87	27.6		
>15	188	59.7		
Working Years with Suppliers			4.41	0.838
<5	14	4.4		
5-10	28	8.9		
10-15	89	28.3		
>15	184	58.4		

To avoid potential respondent bias, we adopted constructs which described the common SCI, SSCP and cultural values practiced in almost every firm.

Interview Analysis

Semi-structured interviews were conducted and recorded. The average time for each of the interviews was 40 minutes. Due to the smaller number of interviews and technicality of concepts under study, we employed the manual coding technique (Isangula *et al.*, 2024). In analysing the interviews, we employed the suggestions of Miles *et al.* (2014) as depicted in Fig. 2. Saturation was achieved on the 10th interview.

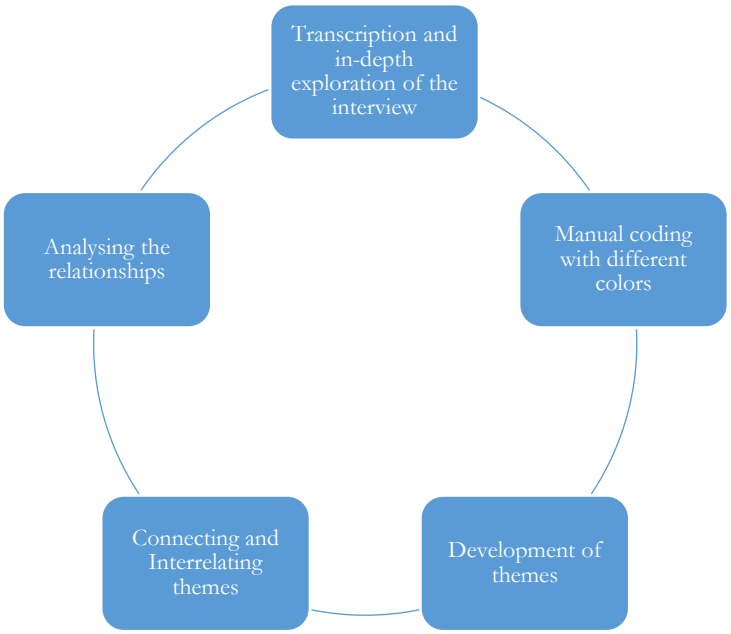

Figure 2. Interview Analysis Process. Source: Author's Own Work.

All interviews were recorded with participant consent after providing consent forms and ensuring anonymity. Due to COVID-19 constraints, most interviews (all but two) were conducted by telephone. Transcripts were prepared in Microsoft Office, refined for clarity, and manually coded in Word using multiple techniques (process, in-vivo, descriptive, causation coding) to analyse SSCP, OC, and SCI linkages (Miles *et al.*, 2014). Color-coding distinguished concepts (OC, SCI, SSCP) for thematic analysis, with codes later exported to Excel. Two researchers performed coding, resolving discrepancies to ensure intercoder reliability. The qualitative analysis aimed to reveal SSCP practices and support quantitative findings.

The major themes comprised SSCP, OC, and SCI and the corresponding sub-themes encapsulated the individual dimensions of SSCP, OC and SCI. However, our focus was to reveal how the firms measure SSCP (*see Table 2*) and assess the role of SCI and OC in the improvement of SSCP in the industry, since the constructs for OC and SCI have been well-developed. The results from the relationship between the concepts together with quotations from the respondents are presented at the discussion section.

Table 2. Classification of the measures of sustainable supply chain performance

Environmental Performance	Social Performance	Economic Performance
-Reduction in Carbon footprint -Reduction in water usage -Reduction in energy usage -Waste recycling -Increase in reuse of waste products -Sustainable sourcing of raw materials	-Improvement in health and safety -Increase in societal developmental projects -Local employment -Improvement in equal opportunity -Consistent employee training	-Decrease in cost of manufacturing -Improvements in distribution cost -Increased investment Increased cost of raw materials -Increased cost of finance -Improvement in sales revenues -Improvement in lead time

Development of Survey Instrument

Two separate web-based surveys with same questions but different languages (English and Greek) were designed for the respondents in the UK and Greece respectively. The surveys were designed with the University's account on Qualtrics mainly to ensure effective and cost-effective collection of data and legitimacy (Dillman, 2011). Since the scales for all the dimensions of the SCI, group culture and developmental culture have been well-developed and their reliability and validity well-tested, multi-item scale was used to improve internal consistency (Ketokivi and Schroeder, 2004) (*see appendix 1*). During the interview, the respondents were asked to identify the ways and the constructs used in assessing their SSCP. Table 2 reveals the items used in assessing SSCP in this study. However, as part of the reasons for the interviews and as earlier indicated, the qualitative interviews revealed certain sustainability practices peculiar to the food industry and these practices were included in the survey items. The new and additional items are *italicised* and have *asterisks (*)* associated with them (*see Appendix 1*). The items include environmentally friendly projects- EV1, sustainable extraction of raw materials- EV2, sustainable societal development projects- SP1 and Local resident employment- SP6.

Since the survey was conducted in the UK and Greece simultaneously, two separate surveys, one in English and other in Greek were designed.

The questionnaire was initially developed in the English language and the back-translation approach (Tyupa, 2011) was used in developing the survey for the responders in

Greece. First, a professor translated the English version to Greek, and then another operations management expert in Greece translated the Greek version back to English. The back-translated version was then compared with the original to determine any discrepancies in the wordings and sentences. A pre-test with 10 operations management academics and then 5 managers in the industry was conducted. The questionnaire was refined and updated based on the results from the pre-test. A further pilot test with 15 managers was further conducted. The reliability and internal consistency using Cronbach Alpha were subsequently tested.

A 7-point Likert type scale questionnaire was developed, and the respondents were asked to indicate the extent to which they agree with the items from (1= "strongly disagree"; 7= "Strongly agree"). Constructs for measuring SSCP, SCI and flexible culture were in the first, second and third sections respectively. *Appendix 1* contains the various constructs and their associated literatures from which they were extracted. In the last section, respondents were asked to provide information on their demographics (*see Table 1*). We used turnover and firm size as control variables as firms with large employees and profitability are better at implementing and improving sustainability performance (Gualandris and Kalschmidt, 2016).

Analysis and Results

Outer Model

Content validity was not an issue as the constructs were carefully developed from literature review (*see Appendix 1*), interviews and tests. Confirmatory Factor Analysis (CFA) and Exploratory Factor Analysis (EFA) with PLS-SEM (PLS 3.2.9) were performed to determine the validity and reliability of the constructs of each latent variables (Ringle *et al.*, 2015). The package was suitable due to normality issues in the data. After subjecting the dataset to a normality test using recommendations from Shapiro-Wilk (Shapiro) (Shapiro and Wilk, 1965), we discovered a strong normality issues in the data, therefore, PLS-SEM in lieu of covariance-Based SEM techniques was found to be suitable for analysis. The data was therefore analysed using PLS 3.2.9.

Table 2 depicts the factor loadings, AVE and the T-values of the measuring items used in assessing the convergent validity of each of the constructs. The factor loadings ranged between .531-.845 while the AVE scores for all the variables except environmental performance ranged between .521-.674 exceeding the threshold of .500 (Fornell and Larcker,

1981). The T-values for all the constructs were good indicating that most of the variances in each of the items are explained by the variables.

Table 3: Reliability, Convergent Validity and Discriminant Validity

Constructs (Reliability and Validity)	**Factor Loadings (Range)**	**T-values**
Sustainable Supply Chain Management		
Environmental Performance (ENVP) (α=.819, CR=0.867, AVE=.488)		
ENVP1	.531	11.310
ENVP2	.697	14.820
ENVP3	.771	16.739
ENVP4	.795	16.813
ENVP5	.778	17.382
ENVP6	.731	17.629
ENVP7	.535	11.434
Economic Performance (ECP) (α=.855, CR=0.890, AVE=.538)		
EP1	.774	17.667
EP2	.823	18.349
EP3	.730	13.997
EP4	.611	13.040
EP5	.746	17.354
EP6	.747	18.110
EP7	.686	12.803
Social Performance (SP) (α=.826, CR=0.874, AVE=.537)		
SP1	.719	17.896
SP2	.737	17.135
SP3	.784	12.837
SP4	.778	12.917
SP5	.747	14.551
SP6	.620	11.093
Supply Chain Integration		
Internal Integration (INTI) (α=.851, CR=0.890, AVE=.574)	.733	22.591
II1	.766	21.592
II2	.776	22.200
II3	.811	23.905
II4	.763	21.744

II5	.690	19.734
II6		
Supplier Integration (SI)		
(α=.871, CR=0.899, AVE=.531)		
SI1	.653	18.369
SI2	.779	20.392
SI3	.783	21.289
SI4	.744	22.203
SI5	.805	23.016
SI6	.557	12.977
SI7	.724	21.175
SI8	.750	20.617
Customer Integration (CI)		
(α=.845, CR=0.883, AVE=.521)		
CI1	.735	17.878
CI2	.792	17.852
CI3	.678	15.122
CI4	.769	20.625
CI5	.612	14.054
CI6	.745	19.441
CI7	.704	19.664

Flexible Culture (GC and DC)		
Group Culture		
(α=.843, CR=0.889, AVE=.616)		
GC1	.793	20.635
GC2	.679	12.633
GC3	.845	22.250
GC4	.828	20.351
GC5	.770	35.078
Developmental Culture		
(α=.878, CR=0.912, AVE=.674)		
DC1	.768	35.078
DC2	.874	49.858
DC3	.842	45.822
DC4	.855	53.634
DC5	.738	22.539

Cronbach Alpha and composite reliability were used in determining the reliability of the constructs. As presented in Table 2, the values were above the threshold value of .700 (Fornell and Larcker, 1981). Additionally, we assessed the discriminant validity and the correlations among the latent variables were compared to the square root of the AVE of each of the latent variables. As presented in Table 4, the square root of the AVE indicated in bold, and italics were larger than the correlations among the latent variables indicating a good discriminant validity (Fornell and Larcker, 1981).

Table 4: Discriminant Validity

Var.	CI	ECP	ENVP	DC	GC	INTI	SP	SI
CI	***0.722***							
ECP	0.253**	***0.734***						
ENVP	0.120**	0.410**	***0.699***					
DC	0.135*	0.321*	0.254*	***0.775***				
GC	0.288**	0.204**	0.152**	0.111**	***0.785***			
INTI	0.553**	0.072**	0.406**	0.212*	0.689**	***0.758***		
SP	0.119**	0.203**	0.342**	0.312*	0.145ns	0.284**	***0.733***	
SI	0.448**	0.047ns	0.223**	0.237**	0.279**	0.263**	0.069*	***0.728***
Mean	6.082	6.092	6.083	6.085	6.111	6.139	6.135	6.081
ST.Dev	0.700	0.693	0.638	0.634	0.691	0.693	0.677	0.683

Notes: ***n=315***, the square root of the average variance extracted in indicated on the diagonal in bold and italics, CI-customer integration, ECP-economic performance, ENVP-environmental performance, GC-group culture, INTI- internal integration, SP-social performance, SI-supplier integration, ST.DEV-standard deviation, ns=not supported, $p<0.05$, **$p<0.01$.

Variation Inflation Factors (VIF) values of all the items ranging between 1.511-2.962 were within the threshold of <3.0 eradicating the problem of multicollinearity (Hair *et al.*, 2020). As the data were obtained with the same set of questions in both countries, we tested for the issue of common method variance (CMV) using Harman's single-factor test (Podsakoff *et al.*, 2003). The test revealed 8 items each with eigenvalues of more than 1.0, explaining 64.578 per cent of the total variance. The first factor explained 42.690 per cent of the total variance. We also performed Full Collinearity VIF (FCVIF) which showed values of <3.3. These indicate that CMV is not an issue in the data.

We also tested for the issue of measurement equivalence, for the two categories of responses, the original correlations were greater than 5% quantile (Henseler *et al.*, 2013).

Additionally, we performed the permutation-based confidences levels to assess if there were any significant difference between the means and variances across the groups.

Inner (Structural) Model

In this study, the definition of the strengths of the regression coefficients was adopted from Cohen's (1988), where coefficients of .50 and above were considered as strong, .30~0.2 are considered as moderate effect, and 0.1 are considered as low effect.

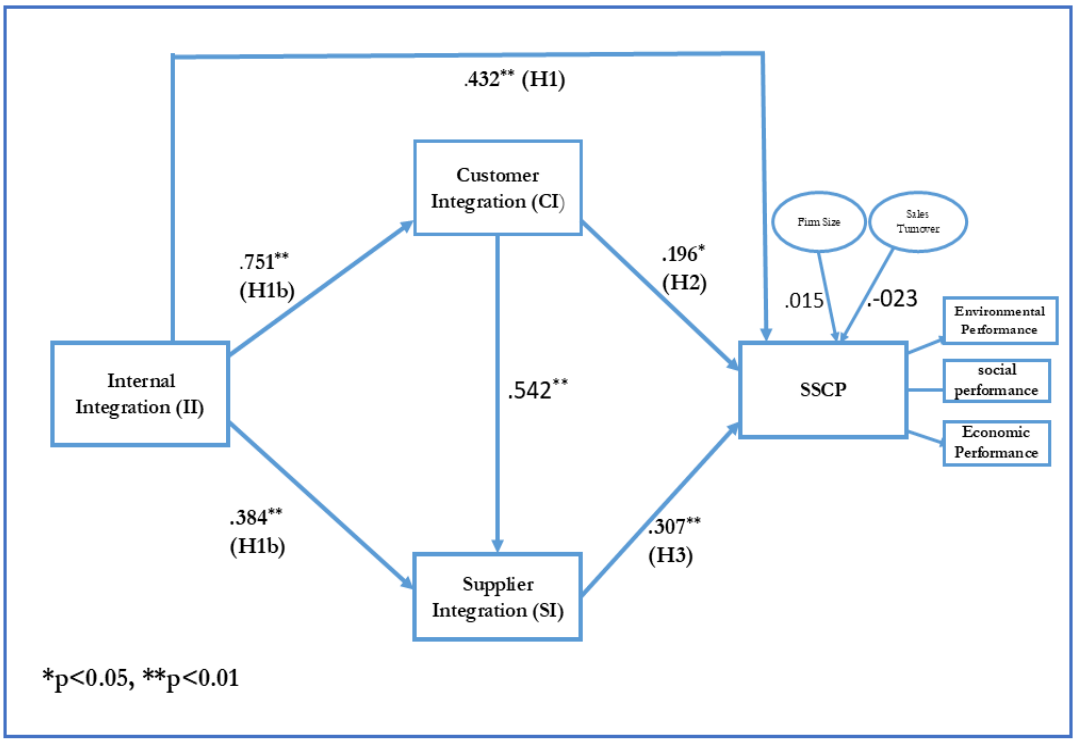

Figure 3. Structural model with results. Source: Author's Own Work.

SSCP and flexible culture were treated as second order constructs. Internal integration was found to have a positive relationship with customer integration (β=.751, p<0.01, R^2 =0.564) and supplier integration (β=.384, p<0.01, R^2 =0.756) supporting Hypothesis *H1b* which sought to examine the positive impact of internal integration on customer integration. Furthermore, internal integration was found to possess a positive effect on SSCP (β=.432, p<0.01, R^2 =0.756) supporting Hypothesis *H1a* which highlights the impact of internal integration on SSCP (thus, environmental, social and economic performance). The R^2 values demonstrate strong explanatory power, with the models accounting for over 50% of the variance in both customer

integration and SSCP. However, while customer integration shows an R^2 value exceeding 50%, the model's relatively low predictive power suggests that additional independent variables may play a significant role in explaining customer integration outcomes.

We also found a positive relationship between customer integration and SSCP (β=.196, p<0.05, R^2 =.756) supporting Hypothesis *H2*, which sought to confirm the positive impact of customer integration on SSCP. Supplier integration was also found to possess a positive relationship with SSCP (β=.307, p<0.01, R^2 =.756) supporting Hypothesis *H3* which hypothesised a positive impact of supplier integration on SSCP. Again, The R^2 values of the models demonstrate strong predictive power, explaining over 50% of the variance in SSCP. This indicates that both customer and supplier integration are effective predictors of SSCP performance.

Mediating Role of External Integration

Table 5 provides an overview of the indirect effect of external integration on the relationship between internal integration and SSCP which was tested at bias-corrected 95% confidence interval and a significance level of *p<.01* and *p<.05*. Customer and supplier integration individually had mediating effect on internal integration-SSCP relationship. And both customer and supplier integration jointly (*β=.126, p<0.01*) mediated the internal integration-SSCP relationship, supporting Hypothesis *H4* which hypothesised the mediation role of external integration on the relationship internal integration and SSCP.

Table 5: Indirect Effect of External Integration

	Indirect Effect	**Bias-corrected 95% confidence interval**			**Hypothesis Testing (p-values)**
		Bias	**Lower Bound**	**Upper Bound**	
II-> CI -> SSCP	0.150	0.003	0.011	0.275	(0.009) Supported
II -> SI -> SSCP	0.119	0.001	0.054	0.208	(0.000) Supported
H4: II -> CI -> SI -> SSCP	0.126	0.006	0.048	0.242	(0.002) Supported

II-internal integration; SCI- supply chain integration; SSCP-sustainable supply chain performance, Ext. Integration-External integration. $^{*}p<0.05$, $^{**}p<0.01$.

Moderating Effects of Flexible Culture

Table 6: Moderating Effect of Flexible Culture

Interactive Effect	**External Integration (Original sample)**	**T-values**	**SSCP**	**T-values**
Flexible Culture	0.442 **	7.700	0.232 **	4.143
II*Flexible Culture	0.235 *	0.193	-	
SCI*Flexible Culture	-		0.365 *	1.451

II-internal integration; SCI- supply chain integration; SSCP-sustainable supply chain performance, Ext. Integration-External integration; $^{*}p<0.05$, $^{**}p<0.01$.

The direct effect of flexible culture on external integration was positive and supported. Our results also found an interaction effect between internal integration and flexible culture (II*flexible culture), the coefficient was positive (.235) supported at $p<0.05$ (*see Table 6*). In Fig. 4, firms with prevalent flexible culture had high levels of internal integration whereas firms with low levels flexible culture had lower levels of internal integration. These highlight the moderating strength of flexible culture on the internal and external integration relationship, thereby, supporting Hypothesis *H5a* which sought to investigate the positive moderating role of flexible culture on the internal-external integration relationship.

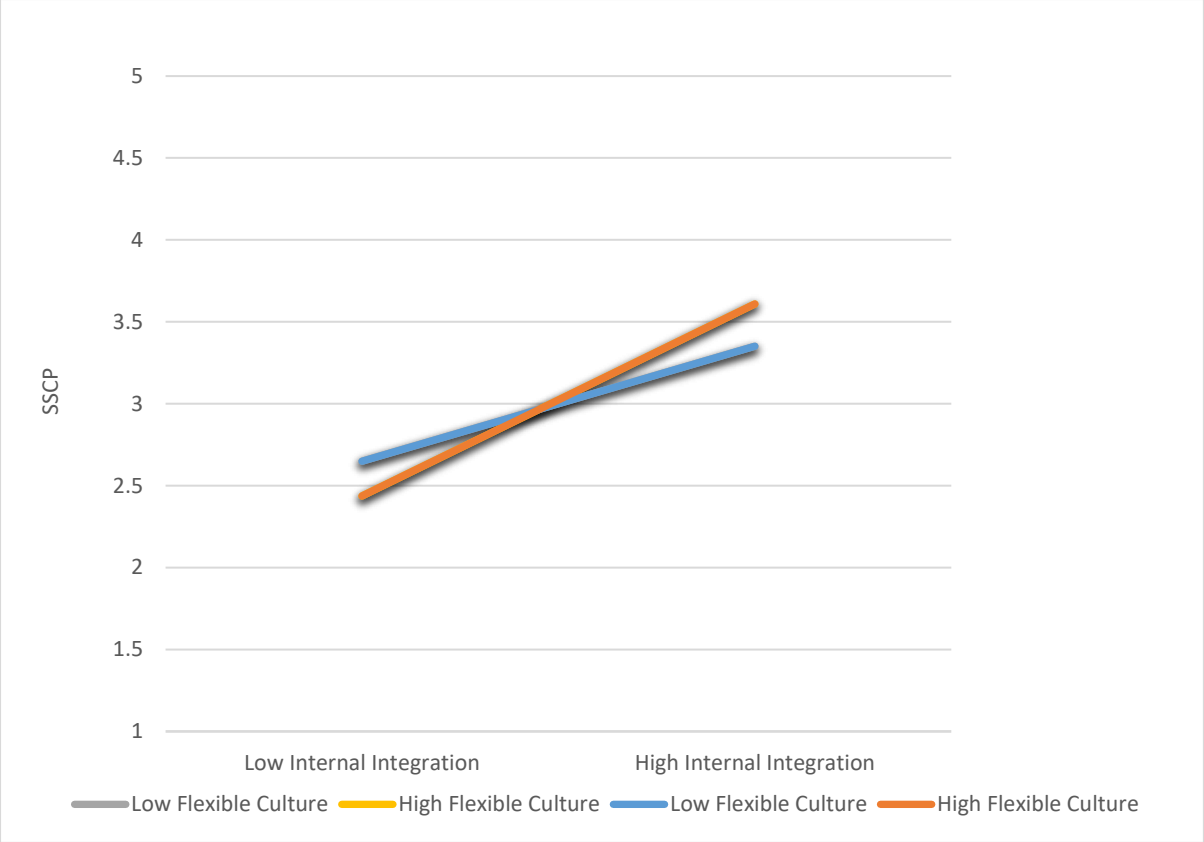

Figure 4. Moderating effect of flexible culture. Source: Author's Own Work.

Similarly, the direct effect between flexible culture and SSCP was positive and fully supported. Again, our research confirmed an interactive effect between SCI and flexible culture (*see Table 5*). Food manufacturing firms with lower levels of flexible culture have considerably lower levels of SCI and SSCP compared to firms with prevalent flexible culture who have higher of levels of SSCP and SCI. This accounts for the moderating effect of flexible culture on the SCI-SSCP relationship, thereby, confirming Hypothesis *H5b* which conceptualised the positive moderating effect of flexible culture on the SCI-SSCP relationship.

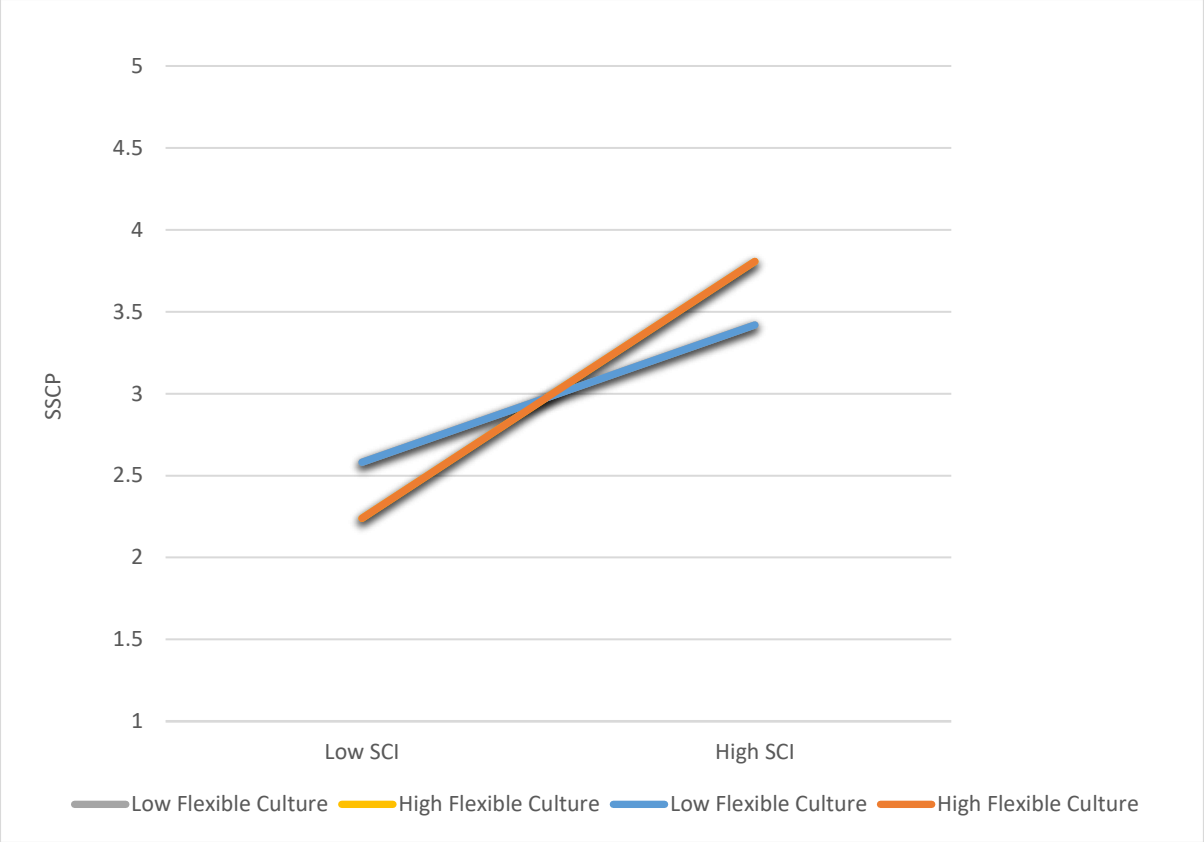

Figure 5. Moderating effect of flexible culture. Source: Author's Own Work.

Robustness Checks

In Table 7, the individual dimensions of SCI all had positive relationship with environmental, social, and economic performance, explaining the positive interaction between SCI and SSCP. However, models 2, 4 and 6 each indicated higher coefficients for the impacts of SCI on environmental, social, and economic performance. Same models also revealed a strong relationship between the interaction effects on the environmental, social, and economic performance.

Table 7: Hierarchical Regression Analysis

	Environmental Performance		**Social Performance**		**Economic Performance**	
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**

Constant	5.007	1.156	5.261	1.135	5.065	1.883
Sales	.078^{ns}	.029**	.051^{ns}	.032^{ns}	.101^{ns}	-.028^{ns}
Turnover						
Firm Size	.058*	.037*	.063**	.040**	.183*	.006^{ns}
II	.408**	.053**	.470**	.481**	.310**	.311**
SI	.246**	.062**	.237**	.239**	.289**	.285**
CI	.138*	.056*	.142*	.147*	.266**	.269**
II*FC	-	.121**	-	.211**	-	.185**
SCI*FC	-	.202**	-	.224**	-	.054**
R^2	.081	.656	.048	.048	.061	.632
Adjusted R^2	.075	.650	.635	.587	.055	.626
F	13.623**	171.648**	7.883**	165.328**	10.058**	159.620**

II-internal integration, CI-customer integration; SI- supplier integration; SSCP-sustainable supply chain performance. $^{*}p<0.05$, $^{**}p<0.01$

Firm size and sales turnover had no influence on the SSCP of the firms, this could be attributed to sustainability being considered as a requirement of every supply chain in many countries.

Assessment of the PLS-SEM-based Structural Model

We also assessed the fit of the structural model using the predictive capability (R^2), predictive relevance (Q^2) and unobserved heterogeneity for the purpose of determining the potential replication of the observed values and the heterogeneity in the data (Akter *et al.*, 2017). The R^2 values >.50, Q^2 > .120 (highest 0.329), standardised root mean square residual (SRMR) <.08 (good), goodness of fit (GoF) > .35 (good) and Non-formed Index (NFI) > .66 (good). Other parameters such as D_ULS, D_G and RMS-Theta all met the threshold, confirming a good model fit.

Table 8: Summary of the findings

Hypotheses (Path)	**Path Coefficients (t-values)** **p-values**	**Conclusions**
H1a: II -> SSCP	.438 (7.223) **	**Supported**
H1b: II - > CI	.751 (19.603) **	**Supported**
II - > SI	.384 (5.756) **	**Supported**
H2: CI - > SSCP	.190 (2.419) **	**Supported**
H3: SI - > SSCP	.311 (3.842) **	**Supported**
H4: II -> CI - > SSCP	.127 (3.400) **	**Supported**
H5a: II*Flexible Culture -> Ext. Integration	.078 (10.769) *	**Supported**
H5b: SCI*Flexible Culture -> SSCP	.025 (1.451) *	**Supported**

II-internal integration, CI-customer integration; SI- supplier integration; SSCP-sustainable supply chain performance, Ext. Integration-External integration. *p<0.05, **p<0.01

Discussion

The results from the interview confirmed the decision-making power of customers (retailers) in initiating sustainability practices in the food manufacturing supply chains. Within the context of sustainability, there is a reversal supply chain where the information and instructions rather flow from the downstream customers to the focal food manufacturing firms and upstream suppliers. With this, one respondent said:

> *The retailers recognise the need and what the retailers do in my opinion is pass the problem down the supply chain to their suppliers and the suppliers provide the solution to the effectiveness of sustainability*

This study confirms our hypothesis that internal integration positively influences sustainable supply chain performance (SSCP) in food supply chains. The significant relationship between internal integration and SSCP demonstrates that robust cross-functional teamwork, seamless internal data integration, real-time interdepartmental coordination, and

regular training meetings are critical for enhancing environmental, social, and economic performance in this sector. High levels of managerial support, organizational commitment, and collaborative teamwork foster a sustainability-oriented culture, motivating employees to actively pursue the supply chain's sustainability objectives (Sehnem *et al.*, 2019). These findings indicate that internal integration is essential for cultivating an organizational environment that empowers employees to address sustainability challenges and effectively implement sustainable practices across food supply chains.

Notably, our results contrast with prior studies (e.g., Kang *et al.*, 2018; Osei *et al.*, 2023) that found internal integration to be insignificant for sustainability management practices and performance. This divergence highlights the context-specific nature of internal integration's role, particularly in the food industry where operational alignment and sustainability culture are pivotal for performance outcomes. Regarding the critical of internal integration to SSCP, one respondent said:

> *Over the past few years, we have tried to use our employees to drive our sustainability goals. What we do is to always keep them informed of the sustainability goals that we have established in the supply chain and guide them in achieving that. We have a special sustainability team which drive this move and the team consists of trained individuals from different departments*

We also argued that in the food supply chains, though external integration is highly necessary for sustainability performance, a successful external integration depends on the effectiveness of internal integration. This was confirmed by the positive relationship between internal and external integration found in the study. This implies a strong internal integration manifesting in the form of teamwork within the internal boundaries of the focal food manufacturing firms is necessary for strong customer and supplier integration with their supply chain partners. This aligns with studies (e.g., Zhao *et al.*, 2011; Han and Huo, 2020) which also confirmed the criticality of internal integration to strong collaboration with customers, however, not in a specific industrial settings like this study. A strong coordination of internal functions in the organisation promotes coordination between customers and suppliers from different countries to work collaboratively towards solving sustainability issues associated with the food supply chain (Accorsi and Manzini, 2019; Braziotis *et al.*, 2013; Krishnan *et al.*, 2021).

Han and Huo (2020) similarly confirmed this finding across multiple industries, emphasizing how internal integration facilitates external integration in greening supply chains. This suggests that manufacturing firms with robust internal integration can develop and train effective teams of sustainability specialists (Yu *et al.*, 2014). Such teams are better positioned

to collaborate with suppliers and customers throughout food supply chains to enhance sustainability performance. Strong cross-departmental coordination and internal functional alignment within food manufacturing firms enable the development of strategic solutions to environmental (Liu *et al.*, 2018; Han and Huo, 2020), social, and economic challenges. Furthermore, this internal cohesion naturally extends to stronger integration with external partners, including customers and suppliers (Amoako *et al.*, 2020). With regards to this, one respondent provided that:

> *Yes, customers play a major role in achieving sustainability performance. We have collaborative groups inside our firm and across the customer base and we meet and solve all sustainable issues together*

The study further found the crucial role flexible culture plays in forging a stronger relationship inside the focal food manufacturing firms and between the supply chain partners. Meaning, the existence of the flexible cultural values in the focal food manufacturing firms can enable effective internal integration. Additionally, the outcome of the study implies that regulating the supply chain relationship (SCI) with both group and developmental cultural values could be rewarding as firms can attain optimum performance both in their supply chains and sustainability. This aligns with the findings of Osei *et al.* (2023) which revealed a positive relationship between group and developmental cultures and external integration, however, this research focuses on the critical moderating role of the cultural values on the internal and external integration relationship. Developmental and group cultural values spanning around involvement and encouragement of employee commitment, concerns, seeking for growth, acquisition and sharing of resources, accomplishment of objectives and productivity through teamwork, sharing of skills and knowledge -and encouraging risk-taking are critical to the success of the SCI in food supply chains (Cao *et al.*, 2015).

Moreover, maintaining high levels of these cultural values ensures that employees are well-trained in the skills and knowledge required for integration, enabling strong and effective relationships with both customers and suppliers in the supply chain. The spirit of teamwork between focal firms and external supply chain partners, along with the sharing of resources, knowledge, skills, and competencies, strengthens SCI and contributes to optimal supply chain performance and SSCP in food supply chains. This suggests that both internal and external integration are likely to be enhanced in an environment where flexible cultural values dominate.

Consistent with the findings of Han and Huo (2020), which confirmed the mediating role of external integration in the relationship between internal integration and green supply chain performance, our study also supports the mediating effect of external integration on the link between internal integration and SSCP in food supply chains. This implies that, regardless of how well-developed internal integration may be, closer collaboration with customers and suppliers remains essential for achieving higher SSCP—particularly in food supply chains, where sustainability challenges are complex, and stakeholder alignment is critical.

In food supply chains, customer integration significantly drives supplier integration, as food manufacturers must collaborate closely with customers and extend this coordination to suppliers. The study confirms a positive link between customer integration and sustainable SSCP, aligning with findings from Weingarten and Longoni (2015) and Blome *et al.* (2014), who similarly connected customer integration to improved sustainability performance. While Kang *et al.* (2018) highlighted customer integration's role in enabling sustainable management practices and subsequent performance gains, this study differentiates itself by focusing exclusively on the food manufacturing sector, unlike Kang et al.'s and others broader multi-industry approach. Such integration is critical for joint environmental initiatives, including collaborative green packaging design and shared sustainability planning (Yu *et al.*, 2014), underscoring its industry-specific relevance in food supply chains.

Customer integration takes shape through the continuous exchange of production plans, collaborative process and design decisions, and joint sustainability initiatives. Food manufacturing firms benefit further from customer-led sustainability audits (Osei *et al.*, 2024) as well as specialized knowledge and skills provided by customer experts. This close collaboration reinforces RBV, as the alignment of data, information, and resources between firms and their customers enhances SSCP in the food industry (Dyer *et al.*, 2018). Highlighting the impact of customer integration, one respondent noted that:

> *....Our customers set and dictate what sustainability standards we need to manufacture to, they audit us regularly, they liaise with stakeholders, they provide feedback they ensure we are BRC excite, they operate the wastage rate*

Our study confirms a positive relationship between supplier integration and SSCP in food supply chains, aligning with findings from Blome *et al.* (2014), Weingarten and Longoni (2015), and Kang *et al.* (2018) which all confirmed the influence of supplier integration on sustainability performance and practices, though their research was not industry specific. Highly integrated suppliers enable food manufacturers to access sustainable resources, share

facilities, co-design eco-friendly products, and implement sustainability strategies. Suppliers further enhance environmental performance through sustainable raw material extraction (Yu *et al.*, 2014) and emission monitoring during transportation. Since supply processes generate significant environmental and social impacts (Adesanya *et al.*, 2020), collaborative sustainability planning with suppliers is critical for improving SSCP.

As most of the food manufacturing firms are global and have international suppliers - and sustainability is currently measured across the chain, a stronger relationship with suppliers ensures the supply chains react proactively to environmental and social issues through the implementation of sustainable practices which may include global sourcing practices and monitoring environmental impacts from the suppliers' activities (Adesanya *et al.*, 2020; Jiang et al., 2020). Suppliers of the food manufacturing firms are also able to improve the resilience of supply chains through the design of sustainable products and ensure focal firms react quickly to the unexpected increment in demand. Based on this, one of the respondents said:

> *we come together as a group, and we discuss everything in the group with regards to performance and sustainability issues*

A flexible culture plays a critical role in moderating the relationship between supply chain integration SCI and SSCP in food supply chains, as confirmed by this study. Group culture fosters strong teamwork and networks among supply chain partners (Wijethilake *et al.*, 2023; Osei *et al.*, 2024), enabling the sharing of ideas, resources, skills, and sustainability-related information—thereby validating the RBV theory. The findings suggest that in food supply chains, customer teams communicate sustainability requirements and collaborate on solutions, while suppliers provide sustainable materials and share critical knowledge to help manufacturers implement these practices in production and transportation. This demonstrates that successful sustainable supply chain integration depends on high levels of trust (Mora-Monge *et al.*, 2019) and, more importantly, a flexible culture. In essence, flexible cultures—embodied in group and developmental values—create an environment where sustainable practices thrive.

The presence of a flexible culture enhances partners' ability to freely exchange skills, resources, tacit knowledge, and capabilities, motivating them to pursue long-term sustainability goals while working collaboratively toward superior SSCP. Supporting this,

Osei *et al.* (2023) emphasize that developmental and group cultures drive higher sustainability performance by fostering creativity, innovation, and knowledge-sharing. These cultural values provide access to a broader pool of ideas and expertise, essential for addressing environmental and social challenges across the supply chain. Without such a culture, achieving meaningful SSCP becomes significantly harder, underscoring the indispensable role of flexibility in sustaining long-term supply chain sustainability. As stated by one of the respondents:

> *We are still adjusting ourselves to the sustainability production. That is why, we have engaged the expertise of our customers and suppliers in achieving. We have occasional meetings where we access the sustainability practices we have introduced and their effectiveness. The customers and suppliers make several suggestions as to why we can improve the performance.*

A flexible culture is particularly critical in moderating the relationship between supply chain integration SCI and SSCP, but its impact varies depending on environmental factors. In dynamic and innovation-driven industries—such as food supply chains, where sustainability demands rapidly evolve—group culture fosters adaptability, enabling partners to build strong collaborative networks (Wijethilake *et al.*, 2023; Osei *et al*., 2024). This aligns with the RBV, as flexible cultures facilitate the exchange of ideas, resources, and sustainability-related knowledge, which are essential in volatile markets (Ketchen and Hult, 2007). However, in stable or highly regulated environments (e.g., commodity-based supply chains), rigid efficiency-focused cultures may dominate, reducing the necessity for flexibility (Bortolotti *et al.*, 2015).

The strength of flexible culture also depends on external pressures. For instance, in food supply chains, where stakeholder demands for sustainability are high, developmental and group cultures thrive because they promote creativity and knowledge-sharing—key drivers of SSCP (Osei *et al.*, 2023). Conversely, in low-uncertainty industries with minimal sustainability pressures, hierarchical or market-driven cultures may prevail, as they prioritize cost control over adaptability (Pagell and Wu, 2009). Empirical studies in operations management confirm that flexible cultures are most effective in environments requiring rapid innovation, such as sustainable supply chains, where partners must continuously align resources with shifting regulations and consumer expectations (Gimenez and Tachizawa, 2012). Thus, while flexible culture is indispensable in dynamic contexts, its influence diminishes in stable, transaction-oriented supply chains where efficiency and standardization take precedence.

Theoretical Contributions

From the Resource-Based View Theory (RVT) perspective, our study makes three key contributions to the literature on SCI, SSCP, and OC in food supply chains. First, we demonstrate that internal integration is a critical prerequisite for successful external integration and SSCP in food supply chains—a finding that addresses a significant gap in existing research. While prior studies (e.g., Weingarten and Longoni, 2015; Blome *et al.*, 2014) have examined SCI and sustainability performance, they focused primarily on external integration in *multi-industry* contexts. Similarly, Kang *et al.* (2018) investigated SCI's role in sustainable management practices but emphasised only supplier and customer integration without specific attention to the food industry, thus with all these studies, neglecting the unique dynamics of food supply chains.

Food supply chains present a unique context for sustainability research due to their direct interdependence with ecological systems, societal health, and global equity challenges. Unlike many manufacturing sectors, food systems must simultaneously address environmental impacts (e.g., water use, GHG emissions from agriculture), social responsibility (e.g., fair labour in farming), and economic viability (e.g., smallholder farmer livelihoods) across complex, geographically dispersed networks (de Lima *et al.*, 2025). The industry's "farm-to-fork" visibility requirements create unparalleled traceability demands that test integration capabilities, while consumer pressures for ethical sourcing (e.g., deforestation-free supply chains) necessitate cultural adaptability beyond typical buyer-supplier relationships (Heldt and Beske-Janssen, 2022).

Additionally, unlike other industries, food supply chains face heightened pressures related to perishability, traceability, and stringent regulatory requirements (e.g., food safety standards, organic certifications), which demand seamless internal coordination before effective external collaboration can occur (Cross *et al.*, 2008). Given the lack of prior research examining SCI-SSCP relationships in food supply chains, our study makes a critical contribution by empirically demonstrating that strong internal integration—including interplant coordination and cross-departmental collaboration (Cheng *et al.*, 2016)—serves as a fundamental prerequisite for enhancing external partnerships and improving sustainable supply chain performance in food supply chains. By establishing this "internal-first" dependency**,** our work advances the theoretical understanding of SCI in sustainable food systems and offers

practical guidance for firms seeking to optimize their sustainability outcomes through integration.

Second, our study makes a significant theoretical contribution by empirically establishing external integration's mediating role in the relationship between internal integration and sustainable supply chain performance (SSCP) within food supply chains - a crucial mechanism that previous SCI-SSCP research had failed to adequately address. While scholars like Weingarten and Longoni (2015) examined these integration dimensions separately, our findings reveal how internal integration's benefits are substantially amplified when extended through external collaboration channels. This mediation effect corroborates Jiang *et al.*'s (2020) assertion that external integration serves as the most pivotal factor for environmental and social performance enhancement. The results demonstrate that food manufacturing firms achieve optimal SSCP not merely through strong internal coordination, but when these internal capabilities facilitate active exchanges of sustainable resources, innovative ideas, and specialized knowledge with supply chain partners (Lu *et al.*, 2018).

By simultaneously confirming both the mediating mechanism and the direct positive relationship between external integration (encompassing customer and supplier dimensions) and SSCP, our research provides a more nuanced understanding of how integration capabilities operate hierarchically in food supply chains -where internal readiness enables effective external partnerships that collectively drive sustainability performance. These insights advance SCI theory by clarifying the sequential relationships between integration types while offering practical guidance for food companies seeking to optimize their sustainability outcomes through staged integration approaches.

Third, our study breaks new ground by empirically validating flexible culture (encompassing group and developmental cultures) as a critical moderator of both internal-external integration dynamics and the broader SCI-SSCP relationship in food supply chains. The industry’s short product lifecycles and vulnerability to disruptions (e.g., climate impacts, recalls) amplify the need for flexible culture as a moderator, enabling rapid adaptation—a dynamic less pronounced in sectors like textiles or pharmaceuticals, where production timelines and regulatory frameworks differ (Beske *et al.*, 2014). While recent literature has increasingly examined external integration's role in sustainability performance (Adesanya *et al.*, 2020; Jiang *et al.*, 2020) and proposed various SSCP improvement strategies (Ghadge *et al.*, 2020), the cultural enablers of these relationships remain underexplored.

Our work also distinctively advances beyond generic OC studies in three key aspects: First, where prior supply chain research often treats culture as a static, monolithic construct, we demonstrate how specific flexible cultural dimensions (group cohesion and developmental adaptability) actively reshape integration effectiveness. Second, unlike studies focusing on culture's direct effects, we reveal its contingent value - showing how flexible cultures amplify the returns on integration investments when sustainability pressures are high. Third, we provide empirical evidence that these cultural attributes serve as boundary conditions for SCI's performance outcomes, particularly in food supply chains where rapid adaptation to sustainability demands is paramount. These findings carry important implications: they suggest that food supply chains cannot treat integration as a purely structural or technical exercise - cultivating flexible cultural values becomes essential to unlock SSCP gains. By establishing this moderator effect, our research not only fills a critical gap in SCI literature but also reorients discussion toward the cultural foundations of sustainable supply chain transformation, which has received less attention in extant literature.

This research contributes meaningfully to general management literature by demonstrating that in today's dynamic business environment, firms practicing robust cross-functional and cross-organizational collaboration with customers and suppliers gain critical access to strategic information, enabling more effective policy implementation that drives competitive advantage and market expansion (Pianese *et al.*, 2023). Furthermore, the study advances management knowledge by revealing how flexible culture—particularly the interplay of group cohesion and developmental adaptability—serves as a vital enabler for enhancing strategic execution and overall business performance, highlighting organisational culture's transformative role in converting conventional strategies into high-performance systems.

Our findings also extend RVT by demonstrating that flexible culture—encompassing group cohesion and developmental adaptability—acts as a critical relational mechanism that enhances inter-organisational collaboration in sustainability contexts. While RVT emphasises that strategic resources embedded in inter-firm relationships create competitive advantage (Dyer and Singh, 1998), we show that these relational benefits depend on cultural readiness to foster knowledge-sharing and adaptive responses—a nuance underexplored in prior RVT literature. This insight bridges RVT with contingency theory by revealing that integration effectiveness is contingent on cultural alignment, particularly in high-regulation food sectors where developmental culture's emphasis on experimentation enables adaptation to evolving

sustainability standards (Sousa and Voss, 2008). Additionally, our study enriches dynamic capabilities theory (Teece, 2007) by positioning flexible culture as a meta-capability that determines how firms reconfigure integration mechanisms to address sustainability challenges, thus advancing beyond RVT's static resource-combination view.

The research also refines RVT's assumptions by demonstrating that (1) cultural flexibility governs how integration resources (e.g., joint planning systems) are utilised, and (2) sustainability performance follows a cultural threshold effect—where only firms with sufficient adaptability fully capitalise on integration investments. This challenges RVT's implicit assumption of uniform relational efficacy across cultural contexts and provides a more granular framework for analysing SCI in dynamic sustainability environments (Wiengarten *et al.*, 2019). By empirically mapping how specific cultural dimensions condition SCI-SSCP relationships, we offer a contextualized application of RVT to food supply chains, where both relational stability and adaptive capacity are critical. These findings suggest that future RVT applications must account for cultural contingencies and dynamic capability foundations, particularly in industries requiring simultaneous collaboration and agility.

Managerial implications

The findings of this study offer actionable insights for food industry practitioners seeking to enhance sustainability performance through improved integration and cultural alignment. For large food manufacturers, we recommend establishing a dedicated sustainability leadership structure, including a Chief Sustainability Officer who oversees cross-functional teams to drive environmental and social initiatives. These firms should implement formal supplier development programs, such as joint sustainability training and co-investment in renewable energy logistics solutions, to reduce emissions in raw material sourcing (Shafiq *et al.*, 2017; Jiang *et al.*, 2020). Given their scale, large manufacturers can leverage digital traceability systems to monitor ethical sourcing compliance across global supply chains while engaging customers through innovation labs to co-develop sustainable packaging alternatives (Yu *et al.*, 2014; Han and Huo, 2020).

For small and medium-sized food producers, more pragmatic approaches are needed due to resource constraints. These firms should focus on incremental but impactful measures, such as forming local supplier cooperatives to collectively invest in sustainable packaging or waste-reduction technologies (Al-Omoush *et al.*, 2023). Simplified sustainability certification

pathways—starting with basic food safety standards before progressing to full environmental management systems (Formentini and Taticchi, 2016)—can help smaller firms build credibility without overwhelming costs. Monthly collaborative workshops with nearby farmers or suppliers and distributors can foster knowledge-sharing on sustainable practices while maintaining lean operations.

Both large and small firms must prioritize cultural enablers by embedding group and developmental values into daily operations. This includes instituting sustainability teams and extending it to supply chain partners, creativity and innovative enablers, long-term sustainability development plans, employee reward systems for sustainability innovations and hosting quarterly supply chain forums to align partners on long-term environmental goals (Osei *et al.*, 2023). Critically, food manufacturers should tailor their approaches based on product perishability and supply chain complexity—for instance, fresh produce suppliers may focus on cold-chain emissions reduction, while packaged goods firms might prioritize circular packaging design with retailer input (Ghadge *et al.*, 2020). These targeted strategies, grounded in the study's findings, provide a roadmap for achieving measurable sustainability improvements across different tiers of the food industry. Additionally, it can be gleaned from the above that, there are likely to be sustainability outcomes for firms with low, moderate and high level of flexibility (*see Table 9*).

Table 9: Flexible Culture Levels, SSCP Outcomes, and Managerial Strategies in Food Manufacturing

Flexible Cultural Level	Expected SSCP Outcomes	Managerial Strategies for Cultural Change
Low Flexibility	✓ Limited sustainability improvements ✓ Reactive compliance	• Conduct cultural audits to identify gaps • Implement basic cross-functional sustainability training • Establish clear sustainability KPIs for departments
Moderate Flexibility	✓ Steady SSCP gains, ✓ improved cross-departmental collaboration	• Foster interdepartmental sustainability task forces • Reward innovative sustainability solutions • Develop supplier/customer sustainability workshops
High Flexibility	✓ Industry-leading SSCP, ✓ Proactive innovation in sustainability	• Embed sustainability in all decision-making processes • Create open innovation platforms with supply chain partners

		• Implement continuous learning programs (e.g., circular economy training)

Conclusion, Limitations, and Future Research

This study empirically examines how supply chain integration (SCI) influences sustainable supply chain performance (SSCP) in UK and Greek food supply chains. Through interviews and surveys, the findings reveal that internal integration serves as a prerequisite for external integration in sustainability contexts, with both demonstrating positive impacts on SSCP. While robust internal integration is essential for SSCP improvement, strong collaboration with customers and suppliers remains equally critical. Given the pivotal role of these external partners, effective external integration proves necessary for achieving higher levels of SSCP across the supply chain.

Furthermore, aligning internal and external integration with flexible cultural values enhances SSCP achievement in food supply chains. Food manufacturers can strengthen internal sustainability efforts by ensuring cross-departmental alignment toward shared sustainability goals and policies. Concurrently, they can advance sustainability by actively engaging customers and suppliers in co-developing sustainability programs, objectives, and implementation strategies that improve environmental, economic, and social performance.

As food manufacturers pursue higher sustainability performance, cultivating flexible cultural values can accelerate sustainability implementation both internally and across supply chain networks. A group culture proves particularly valuable for fostering internal cohesion and strengthening collaborative relationships with customers and suppliers for sustainability outcomes. Meanwhile, a developmental culture enables firms to leverage employee creativity through training while enhancing sustainability knowledge across supply chain partners via education—critical for driving improved sustainability performance.

National institutional contexts further shape how cultural dimensions influence integration practices. For instance, the UK's market-driven governance and emphasis on corporate sustainability reporting may amplify the role of developmental culture in fostering SCI-SSCP linkages, whereas Greece's more hierarchical business culture could prioritize group cohesion over experimentation. Such variations imply that while flexible culture remains universally valuable, its implementation must align with local institutional logics—whether

regulatory (e.g., EU vs. non-EU food safety regimes) or socio-economic (e.g., collectivist vs. individualist norms). Future cross-national studies could test these contingencies, particularly in emerging economies where informal networks often supplement formal integration (Silvestre *et al.*, 2020).

While this study offers valuable insights into UK and Greek food manufacturing firms, its limited generalisability stems from its industry- and country-specific focus, as well as a small interview sample that may not fully capture diverse perspectives. A larger or more varied participant pool could have shifted results by revealing different challenges, insights, sub-cultures or operational nuances. Future research should validate the framework in other industries, cultural contexts (particularly developing economies), expand the number of interviews, and explore additional moderators like supply chain innovativeness or social capital. Longitudinal studies and investigations into post-pandemic resilient strategies would further strengthen understanding, while mixed-method approaches could enhance robustness and applicability.

DECLARATION OF INTEREST

The authors certify that they have no affiliations with or involvement in any organization or entity with any financial or non-financial interest in the subject matter or materials discussed in this manuscript.

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APPENDIX

1. Variables, Measuring items and their Related Literature

Indicate your response on 7-point Likert Scale from (1-Strongly Disagree, 7-Strongly Agree)

Sustainable Supply Chain Performance

Variables	Constructs	Literature
Environmental Performance	*EV1: Supply chain's implementation of environmentally friendly projects**	Sarkis (2006); Vachon and K (2008); Hassini et al. (2012); Kang et al. (2018)
	*EV2: Sustainable extraction of raw materials**	
	EV3: Water consumption	
	EV4: Energy consumption	
	EV5: Carbon footprint reduction	
	EV6: Frequency of waste recycling	
	EV7: Compliance to environmental standards	
Social Performance	*SP1: sustainable societal developmental projects**	
	SP2: health and safety of employees	
	SP3: Employee training and development	
	SP4: Equal opportunity for advancement	
	SP5: Motivation of employees	
	*SP6: Local resident employment**	
Economic Performance	EP1: Manufacturing cost	
	EP2: Distribution cost	
	EP3: Lead time	
	EP4: Delivery performance	
	EP5: Investment	
	EP6: Operational Cost	
	EP7: Sales Revenue	

2. Supply Chain Integration

Variables	Constructs	Literature
Internal Integration	INT1: Data integration among internal functions INT2: cross-functional teams in NPD INT3: System-wide information system integration INT4: real-time integration among functions INT5: cross-functional teams in new process development INT6: inter-departmental meetings	Stank et al., (2001); Narasimhan and Kim (2002); Naor et al. (2008); Flynn et al. (2010); Cao et al. (2015)
Customer Integration	CI1: Sharing of production plans with customers CI2: Sharing of data via computerisation systems CI3: Sharing of Point of Sales information CI4: Product and process design decisions CI5: Survey of customers' needs CI6: System coupling with customers CI7: involvement in sustainability decision	
Supplier Integration	SI1: Decision about quality SI2: involvement in sustainability decision SI3: Product design process involvement SI4: Procurement practices SI5: Benchmarking and results sharing	

	SI6: Sharing of demand forecasts SI7: Quick ordering systems SI8: Sharing of information through information technology	

Flexible Culture

Variables	Constructs	Literature
Group Culture	**GC1:** Development of human resource and employee commitment GC2: Acquiring resources through teamwork GC3: Task and goal accomplishment through teamwork GC4: Empowering employees to use teamwork for objective achievement GC5: Productivity and efficiency through teamwork	Naor et al. (2008); Liu et al. (2010); Cameron and Quinn (2011); Cao et al. (2015); Yunus et al. (2016); Organisational Culture Assessment Instrument
Development Culture	**DC1: Importance of** development of new ideas and product. DC2: Initiation of change in employees DC3: Commitment to innovation and development DC4: Encouragement of creativity in employees DC5: Production orientation	

3. INTERVIEW GUIDE

Variables	Questions
General Questions on SSCP	1. In your firm or generally in the industry what factors do you consider having a huge impact on the supply chain sustainability performance? 2. Is sustainability performance measured across the supply chain or firm level?
Environmental Performance	3. Has the supply chain established any environmentally friendly projects? Can you specify some of the projects carried out by the company? 4. What measures have the supply chain put in place to ensure sustainable; • Water consumption • Energy consumption 5. What is/are being done by the supply chain to ensure the control of carbon footprint, waste recycling and sustainable raw material extraction.
Social Performance	**6.** What particular actions are taken by the firm to improve health and safety of employees, establish societal developmental projects, equal opportunity for advancement, employ locally motivate and satisfy employees?

Economic Performance	7. Has the firm experienced an improvement in the economic performance of the supply chain after instituting sustainability measures? 8. Can you comment on how the firm performs in terms of unit manufacturing cost, ordering cost, manufacturing lead time, delivery time, investment, operational cost and the profitability level of the firm?
General question on Integration	9. What factors do you consider as affecting the supply chain integration efforts of the firm? 10. What factors can be considered as impeding the integration activities of the firm?
Internal Integration	11. What measures/systems have been put in place to ensure the internal departments collaborate effectively?
Customer Integration	12. How does the firm collaborate with customers? Does the firm have a fixed system for exchanging information with customers?
Supplier Integration	13. How does the firm collaborate with suppliers? Does the firm have a fixed system (s) for exchanging information with the suppliers?
Customer and Supplier and SSCP	14. Do the customers of the firm play a major in achieving higher sustainability? How does this happen?

	15. Do the suppliers of the firm play a major role in achieving higher sustainability in the supply chain? How does this happen?
Organisational Culture	16. Can you describe the kind of culture practiced in your organisation? What values are considered as very important in the organization? 17. Which part of the organizational values affect the sustainability performance of the supply chain performance? Which values in the organization greatly influence the firms decision to integrate internally and integrate with customers and suppliers?
Demographic	18. What is your position in the firm?

(Source: Author's Own Work)