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Cultivating circular supply chain practices in agri-processing SMEs in developing countries

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Abstract

Purpose – This study investigates the key factors driving the adoption of circular supply chain practices (CSCPs) among agricultural processing small- and medium-sized enterprises (SMEs) in developing countries.
Design/methodology/approach – Guided by the extended technology-organisation-environment framework, it adopts a qualitative approach using semi-structured interviews with academics, industry experts, and chief executive officers from agricultural processing SMEs in Vietnam.
Findings – The findings reveal novel, context-specific drivers of CSCPs shaped by SMEs' operational and institutional environments. It also highlights the mediating role of organisational and interorganisational factors in determining how technological and environmental factors translate into adoption decisions.
Originality/value – This study contributes to knowledge and practice by being among the first to explore the drivers of CSCP adoption in agricultural processing SMEs in developing countries. It develops a framework of adoption drivers and introduces a strategic matrix to guide CSCP adoption, aligning implementation pathways with firms' internal readiness and external influences.

Keywords Circular supply chain practices, Adoption, Agriculture, SMEs, Developing countries
Paper type Research article

1. Introduction

Traditional linear supply chains in agriculture undermine the sustainability of agricultural landscapes by extracting resources from the environment and discarding post-use materials at various stages of the chain (Farooque *et al.*, 2019b). Thus, without changes in sourcing, production, and disposal practices, current consumption rates risk resource depletion. While nearly one-third of food (1.3 billion tons) is lost within the agri-food supply chain (Lavelli, 2021), 820 million people still suffer from food deprivation worldwide (Sundgren, 2022). Tackling this decline in agricultural sustainability, therefore, requires a fundamental shift in supply chain management, with circular supply chain management emerging as a transformative solution that transitions from the linear "take-make-use-dispose" approach to systems prioritising material circularity (Farooque *et al.*, 2019b).

Circular supply chain management is the integration of the circular economy (CE) into supply chain management (Lahane *et al.*, 2020) to circulate materials at their highest value while minimising waste (Kühl *et al.*, 2022). The fundamental principles of circular supply

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chains (CSCs) are to reduce material usage, prolong product life and recreate new values of materials throughout the supply chain (Bocken *et al.*, 2016). Adopting CSCs enhances firm profitability while simultaneously reducing emissions and conserving natural resources (Amico *et al.*, 2025). Therefore, several recent studies have advocated for implementing CSCs to enhance sustainability (Dwivedi *et al.*, 2023; Malhotra, 2024). However, CSCs remain an emerging practice globally, even in developed economies (Carissimi *et al.*, 2023). For example, in regions such as the United States, Europe, and Japan, supply chains have only recently begun to undergo a circular transformation (Agyabeng-Mensah *et al.*, 2022; Amico *et al.*, 2025). The situation is even worse in the developing countries in terms of the state of CSC implementation, where awareness of CSCs is still emerging among supply chain actors (Do *et al.*, 2022; Hoang *et al.*, 2024), particularly among small- and medium-sized enterprises (SMEs) (de Jesus Pacheco *et al.*, 2024; Ghosh *et al.*, 2023).

Indeed, SMEs across all industries in developing countries lag significantly in implementing CSCs (Dadsena *et al.*, 2026). This lag is particularly evident in the agricultural industry (Hoang *et al.*, 2024). Such a shortfall presents a critical challenge because advancing sustainable agriculture through CSCs is not feasible without including SMEs, which drive economic growth and significantly impact the environment. SMEs comprise about 90% of businesses and account for 50%–60% of worldwide environmental pollution (Dey *et al.*, 2022). Given their substantial presence and impact, SMEs are indispensable stakeholders within the agricultural value chain, making their adoption of CSCs essential for achieving global sustainable agriculture.

However, despite the recognised benefits of circular supply chain practices (CSCPs), many SMEs remain hesitant to adopt them, perceiving them as burdensome (Suchek and Franco, 2024). One of the key reasons for this hesitation is that CSCPs remain a relatively new area of research (Woldeyes *et al.*, 2025). Particularly, there are limited studies on CSCs focussing on SMEs in developing countries (Ghosh *et al.*, 2023; Zhang *et al.*, 2023), highlighting a key area that remains underexplored. Only 5% of CE research focuses on emerging economies (Mhatre *et al.*, 2023), and 6 of the top 50 CSC studies are from developing or underdeveloped countries (Zhang *et al.*, 2023). Regarding studies on CE enablers and barriers in supply chains, existing research is concentrated in developed countries, with limited evidence from developing ones (Amico *et al.*, 2025). The unique characteristics of SMEs in developing countries, especially their resource constraints, along with the ineffective application of sustainability principles from developed contexts (Hoang *et al.*, 2024), underscore the need for empirical evidence on adoption drivers specific to this context. In response, this study addresses the calls by Zhang *et al.* (2023) for further research on CSCPs in developing countries, and by Bocken *et al.* (2025) to explore sectoral and regional variations and factors behind low adoption.

This study focuses on the post-harvest stage, as it represents the most significant source of food loss and waste in developing countries, accounting for 20%–30% of total food waste in the food supply chain (Krishnan *et al.*, 2020). Specifically, it targets agricultural processing SMEs due to their crucial role as intermediaries between producers and customers. Improving CSCP adoption at this stage can encourage similar practices across the supply chain through knowledge sharing and capability building (Cole and Aitken, 2020).

Thus, this research aims to gain a comprehensive understanding of the key drivers influencing CSCP adoption among agricultural processing SMEs in developing countries, using the technology-organisation-environment (TOE) framework. Given the complex nature of CSCP adoption, shaped by external pressures alongside technical and organisational changes (Chembessi *et al.*, 2022), a holistic analytical approach is required to understand the factors of CSCP adoption. The TOE framework captures these factors while remaining flexible to the contextual realities of agricultural SMEs in developing countries (Baker, 2012; Hwang *et al.*, 2016). Additionally, to better capture the collaborative nature of CSCs, this study extends the TOE framework by adding interorganisational factors, a key dimension often overlooked (Sila, 2013) but critical for both closed- and open-loop collaboration in CSCP

adoption (Farooque *et al.*, 2019b). Accordingly, the study answers the following research questions:

RQ1. What are the key drivers within the technological, organisational, environmental and interorganisational contexts that influence the adoption of CSCPs by agricultural processing SMEs in developing countries?

RQ2. How do CSC capabilities developed through these key drivers influence the adoption of CSCPs in agricultural processing SMEs in developing countries, considering internal readiness and external factors?

To address the research questions, agricultural processing SMEs in Vietnam are selected as subjects of investigation through semi-structured interviews. As one of the world's leading agricultural exporters (The World Bank, 2020), Vietnam processes around 120 million tons of raw materials annually (VCCI, 2025), generating substantial waste and by-products. This emphasises the urgent need for effective management of the significant by-products and waste generated by the agricultural sector, alongside ensuring safe and resource-efficient food production. Additionally, concentrating on one location facilitates a more thorough analysis and minimises the influence of contextual differences, especially in agriculture's regional settings (Do *et al.*, 2022).

By answering the above research questions with empirical evidence, this study makes four notable contributions to the understanding of CSCP adoption in agricultural processing SMEs in developing countries. First, the study offers new insights into the key drivers of CSCP adoption that are unique to this context. Second, it extends the TOE framework by introducing interorganisational factors as a distinct fourth dimension to reflect the networked nature of CSCs. Third, it explores the interplay among technological, organisational, environmental and interorganisational factors, offering a nuanced perspective on how these dimensions collectively shape adoption decisions. Finally, building on this understanding, the study presents a strategic matrix for CSCP adoption specifically tailored to agricultural processing SMEs. This matrix offers a practical roadmap to guide firms along their circularity journey, aligning recommended pathways with their levels of internal readiness and prevailing external influences.

2. Literature review

2.1 Circular supply chain practices in the agricultural industry

Circular supply chain management applies CE principles to minimise waste and generate competitive advantage (Batista *et al.*, 2018). While closed-loop supply chains focus on managing forward and reverse flows and green supply chains emphasise environmental performance, CSCs go further by integrating both closed- and open-loop flows across industries, enabling more effective restoration and regeneration. Consequently, CSCPs offer a more practical and holistic approach to achieving economic, social, and environmental objectives (Farooque *et al.*, 2019b).

Most CSCP studies focus on technical materials in manufacturing, with limited attention to agriculture (Batista *et al.*, 2018; Cahyadi *et al.*, 2024), leaving a gap in understanding the factors influencing their application to biological materials in agriculture. This trend in sustainability supply chain studies is attributed to the suitability of restoration processes like reuse, repair, refurbishing, and remanufacturing for durable, non-perishable materials rather than biological materials (Batista *et al.*, 2018). Meanwhile, biological materials are perishable, contamination-prone, and closely tied to ecosystems, with by-products often treated as waste (Le *et al.*, 2023), hence requiring tailored circular approaches. For example, unlike metals or plastics, biological materials are subject to strict food safety regulations, making CSCP adoption highly dependent on regulatory compliance and technical expertise in storage, processing, and quality control.

Accordingly, for regenerating biological materials, the narrowing, slowing, and closing practices proposed by Bocken *et al.* (2016) are more applicable than principles aimed at

restoring technical materials, such as reuse, repair, refurbishing, and remanufacturing. Therefore, this study conceptualises CSCPs using three types: narrowing practices (reducing resource use and environmental impact per unit); slowing practices (extending product shelf-life while ensuring safety); and closing practices (reintegrating post-use outputs into production).

2.2 Factors influencing CSCP adoption in SMEs in developing countries

CSCs are a relatively new concept, still in the early stages of research (Kühl *et al.*, 2022; Woldeyes *et al.*, 2025). Current literature predominantly explores CE-related practices within large organisations (Chakraborty *et al.*, 2023; Dey *et al.*, 2022; Lahane *et al.*, 2020) and in developed countries (Zhang *et al.*, 2023), rather than exploring the specific context of CSCs in SMEs in developing countries (de Jesus Pacheco *et al.*, 2024; Ghosh *et al.*, 2023).

Thus, a gap remains in understanding the factors that influence CSCP adoption among SMEs in developing countries. Due to resource constraints, these SMEs often prioritise economic performance over long-term environmental and social benefits when adopting sustainable practices (Dey *et al.*, 2022). Additionally, insufficient regulation in developing countries often hinders CSCs' implementation in SMEs (Zhang *et al.*, 2023), as many have yet to align with the CE paradigm (Mhatre *et al.*, 2023). In 2019, the OECD reported declining sustainability investments in developing countries, which many researchers attribute to the ineffective application of principles from developed contexts, despite differing local conditions (Hoang *et al.*, 2024). While eco-conscious consumers drive demand in developed nations, lower incomes in developing countries limit demand for sustainable products, reducing incentives for supply chain sustainability.

Food loss and waste patterns also differ: in developing countries, most occur post-harvest (20–30%) due to inadequate infrastructure and inefficient processing, while in developed nations, the consumption stage dominates (40%) due to consumer behaviour (Krishnan *et al.*, 2020; Papargyropoulou *et al.*, 2014). These disparities necessitate context-specific CSCP approaches. Thus, this study focuses on the post-harvest stage in developing countries, targeting agricultural processing SMEs as key intermediaries influencing upstream and downstream supply chains. Enhancing CSCP adoption among processors can incentivise producers, distributors and customers to adopt similar practices through shared knowledge, risk management, and capability improvement (Cole and Aitken, 2020).

Table 1, summarising prior studies on CSC adoption in developing countries, reveals a predominant focus on barriers, particularly organisational and environmental, while giving limited attention to adoption drivers. Additionally, many recent studies examining factors influencing CSCP adoption tend to refer broadly to supply chain collaboration without explicitly distinguishing between open-loop and closed-loop collaboration. This lack of distinction risks overlooking important nuances. For example, collaboration with original suppliers or downstream partners within the same supply chain (closed-loop) may facilitate internal recycling or take-back systems, while collaboration across different supply chains or industries (open-loop) often enables resource recovery through industrial symbiosis or by-product exchange (Farooque *et al.*, 2019b). These distinct forms of collaboration can lead to different types of CSCP adoption, and failing to distinguish between them may overlook important differences in how CSCPs are adopted.

Thus, adopting a holistic perspective on drivers is crucial for understanding their collective impact on CSCP adoption and leveraging potential synergies to enhance the adoption process. Moreover, Table 1 shows that few studies have specifically addressed the unique context of the agricultural sector, particularly within SMEs. To bridge these gaps, this study employs the extended TOE framework to comprehensively examine the drivers of CSCP adoption in agricultural processing SMEs in developing countries.

Table 1. Summary of studies related to CSC adoption in developing countries

Reference	Stream																Types of factors	Industry	Organisational size
	Technological factors							Organisational factors			Environmental factors				Interorganisational factors				
	AEC	AEN	ASO	PCO	PSI	ATR	AOB	TMC	TKN	RER	GOV	CUP	SCP	COP	SCC				
Durdyev *et al.* (2025)	x				x		x	x	x	x	x	x			x		Barriers	Construction	Unspecified
Agyabeng-Mensah *et al.* (2024)								x				x			x		Drivers	Manufacturing	SMEs
Beheshti *et al.* (2024)	x	x					x	x			x	x	x				Drivers	Pharmaceu-tical	Unspecified
Farrukh and Sajjad (2024)	x	x	x					x	x		x	x	x		x		Drivers, barriers	Textile	Unspecified
Poddar *et al.* (2024)	x				x		x		x								Barriers	Fast-moving consumer goods	Unspecified
Shaikh *et al.* (2024)	x							x	x	x	x	x			x		Barriers	Fast-moving consumer goods	Unspecified
Souza Piao *et al.* (2024)	x			x				x		x	x	x			x		Barriers	Waste management	Various sizes
Ting *et al.* (2024)	x	x							x	x	x	x		x	x		Drivers, barriers	Manufacturing	Various sizes
Tseng *et al.* (2024)	x	x	x	x				x	x	x	x	x		x	x		Barriers	Seafood processing	Unspecified
Agarwal *et al.* (2023)	x				x			x	x	x	x	x			x		Barriers	Rubber	Unspecified
Bhattacharya and Kalakbandi (2023)									x	x	x	x					Barriers	Tyre retreading	SMEs

(*continued*)

Table 1. Continued

Reference	Stream: Technological factors AEC	AEN	ASO	PCO	PSI	ATR	AOB	Organisational factors TMC	TKN	RER	Environmental factors GOV	CUP	SCP	COP	Interorganisational factors SCC	Types of factors	Industry	Organisational size
Kumar *et al.* (2023)				x	x			x		x	x	x				Barriers	Food	Unspecified
Amiri *et al.* (2022)	x				x		x	x	x	x	x	x			x	Barriers	Manufacturing	Unspecified
Do *et al.* (2022)	x	x					x		x	x	x	x			x	Drivers, barriers	Seafood processing by-products	Various sizes
Majumdar *et al.* (2022)				x	x		x	x	x	x	x	x			x	Barriers	Textile and clothing	<1,000, 1,000–5,000, >5,000 employees
Orji *et al.* (2022)		x						x	x	x	x	x	x	x	x	Drivers	Manufacturing	30–500 employees
Chen *et al.* (2021)									x		x	x		x		Drivers	Manufacturing	Listed
Kumar *et al.* (2021)	x			x				x	x	x	x					Barriers	Agriculture	Unspecified
Lahane and Kant (2021)	x			x				x	x	x	x	x	x		x	Barriers	Automotive plastic	>10,000 employees
Farooque *et al.* (2019a)	x	x		x				x	x	x	x	x			x	Barriers	Food	Various sizes
Sharma *et al.* (2019)		x			x					x	x				x	Barriers	Food	>10,000 employees
Mangla *et al.* (2018)	x							x	x		x	x			x	Barriers	Unspecified	Unspecified

Note(s): AEC – Awareness of economic benefits; AEN – Awareness of environmental benefits; ASO – Awareness of social benefits; PCO – Perceived compatibility with existing operations and objectives; PSI – Perceived simplicity in understanding and application; ATR – Ability to trial; AOB – Ability to observe application and outcomes; TMC – Top management commitment; TKH – Technical know-how for CSCPs; RER – Resource readiness; GOV – Government regulations and policies on CE; CUP – Customer pressure; SCP – Social community pressure; COP – Competitive pressure; SCC – Supply chain collaboration

Source(s): Authors' compilation

3. Theoretical framework

This study adopts the TOE framework (Depietro *et al.*, 1990), a widely used organisation-level framework for examining innovation adoption (Baker, 2012; Hwang *et al.*, 2016). As a management innovation, CSCPs involve complex adoption processes shaped by stakeholder pressures as well as technical and organisational changes (Chembessi *et al.*, 2022). Therefore, a CSCP adoption model must account for technological, organisational, and environmental factors (Hwang *et al.*, 2016). The TOE framework is well-suited to this purpose due to its broad applicability and flexibility in selecting context-specific variables (Baker, 2012).

However, scholars have noted that the original TOE framework lacks interorganisational factors that can critically affect the adoption of inter-firm systems (Sila, 2013). In response, some studies have extended the TOE framework to incorporate an interorganisational dimension. This extension is particularly relevant in the context of CSCs, which inherently rely on both closed-loop flows within the same supply chain and open-loop flows that involve cross-supply chain collaboration to recover value from waste (Farooque *et al.*, 2019b). To reflect the dual-loop nature of CSCPs and to capture the full spectrum of factors influencing their adoption, this study extends the TOE framework by incorporating interorganisational factors as a fourth dimension. As technological and organisational factors are directly managed within the firm, they demonstrate firms' internal readiness. Interorganisational factors, while involving external partners, are also considered part of internal readiness to highlight the firm's proactive efforts and strategic preparedness to collaborate effectively across supply chains. In contrast, environmental factors, being beyond the firm's direct control, represent external influences (Depietro *et al.*, 1990).

These factors collectively affect CSC capability, referring to a firm's ability to integrate and realign competencies to support CSC initiatives (Agyabeng-Mensah *et al.*, 2022). This capability, in turn, enables firms to effectively adopt CSCPs within the agricultural supply chain. Accordingly, using the extended TOE framework, this study develops a theoretical model (Figure 1) to identify and analyse key drivers affecting the adoption of CSCPs by agricultural processing SMEs in developing countries.

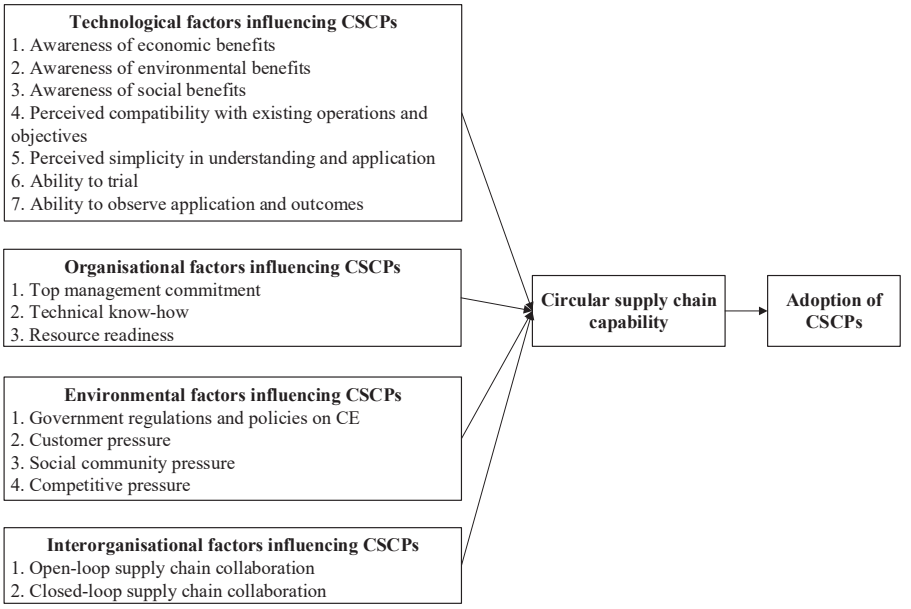

Figure 1. Theoretical framework for the drivers of CSCP adoption in agri-processing SMEs

3.1 Technological factors

Technological factors refer to the perceived characteristics and availability of CSCPs that influence adoption (Baker, 2012). *Awareness of benefits* is a key driver of CSCP adoption, as it helps justify implementation (Sehnem *et al.*, 2019). *Economically,* CSCPs help reduce costs, create revenue from waste, while enhancing brand reputation and attracting sustainability-focused investors (Suchek and Franco, 2024). *Environmentally,* CSCPs reduce resource consumption, waste, and emissions through cross-industry material circulation (Dey *et al.*, 2022; Lahane *et al.*, 2020). *Socially,* CSCPs generate employment in waste management, support community development, and improve public health and workplace conditions by reducing environmental risks (Sehnem *et al.*, 2019).

Perceived compatibility with existing operations and objectives is crucial for CSCP adoption among agricultural processing SMEs in developing countries, where resources are limited (Rocca *et al.*, 2023). SMEs are more likely to adopt CSCPs that align with their goals and integrate easily into current operations. *Perceived simplicity in understanding and application* of CSCPs also supports adoption, as straightforward practices reduce the need for extensive training or major changes, lowering the learning curve, especially for resource-constrained SMEs (Smerecnik and Andersen, 2011). *The ability to trial* CSCPs strengthens adoption by allowing SMEs to test practices on a small scale, reducing uncertainty and enabling informed decisions (Nordin *et al.*, 2022). Finally, *the ability to observe application and outcomes* builds trust and reduces perceived risk, as SMEs gain confidence from seeing proven outcomes (Nordin *et al.*, 2022).

3.2 Organisational factors

Organisational factors refer to a firm's readiness for CSCPs, which involves its evaluation of how well-prepared it is to effectively adopt these practices (Lokuge *et al.*, 2019). *Top management commitment* reflects a firm's engagement with CSCPs, which plays a crucial role in raising awareness, integrating practices, and allocating resources (Centobelli *et al.*, 2021). It is especially vital for SMEs, where sustainability awareness is often low, and adoption is typically driven by market survival. *Technical know-how* for CSCPs further supports adoption through readiness in knowledge and expertise (Durdyev *et al.*, 2025) in areas such as agricultural waste treatment, resource optimisation, and circular design. *Resource readiness* emphasises a firm's flexibility in configuring and reconfiguring its resources to meet CSCP requirements (Lokuge *et al.*, 2019). This flexibility is crucial for SMEs in developing countries, where limited resources require flexible responses to ongoing challenges and opportunities (Agyabeng-Mensah *et al.*, 2022).

3.3 Environmental factors

Environmental factors, including influences from governments, customers, communities, and competitors, are external drivers of CSCP efforts (Kitsis and Chen, 2021). Failure to meet these expectations can result in reputational damage, financial loss, and legal risks. *Government regulations and policies on CE* are key drivers of CSCP adoption, influencing firms through enforcement and incentives such as subsidies and tax breaks (Centobelli *et al.*, 2021; Farooque *et al.*, 2019a). *Customer pressure* refers to customer requirements for firms to adopt CSCPs. Using their purchasing power, customers increasingly demand CSCP adoption (Agyabeng-Mensah *et al.*, 2024), pressuring firms to respond to retain trust and sales. *Social community pressure* shapes firms' awareness of sustainability expectations from local community groups and residents (Centobelli *et al.*, 2021). It compels firms to adopt CSCPs to maintain community approval and their social licence to operate. Finally, *competitive pressure,* referring to the influence of industry peers, drives CSCP adoption as firms follow competitors to stay competitive, often accelerating their investment in environmental innovation in response (Chen *et al.*, 2021).

3.4 Interorganisational factors

Interorganisational factors, specifically closed-loop and open-loop supply chain collaboration, are critical for integrating CE into supply chains (Sudusinghe and Seuring, 2025). Such collaboration facilitates information and resource sharing and helps firms, especially resource-constrained SMEs, manage uncertainty (Agyabeng-Mensah *et al.*, 2022). However, understanding of collaboration in CSCs remains limited (Sudusinghe and Seuring, 2025), particularly regarding the complementary roles of closed- and open-loop supply chains in enabling CE implementation (Kalverkamp, 2018).

Closed-loop supply chain collaboration involves coordination with supply chain partners to strengthen traceability, reverse logistics, and quality control within the same supply chain, while also supporting joint design that embeds value recovery early (Farooque *et al.*, 2019a, b, Sudusinghe and Seuring, 2025). Meanwhile, *open-loop supply chain collaboration* facilitates CSCP adoption through cross-sector or cross-chain partnerships, enabling value recovery beyond the focal supply chain (Farooque *et al.*, 2019b), such as by-product exchanges in eco-industrial parks (Sudusinghe and Seuring, 2025).

4. Research methodology

4.1 Data collection

Research on CE within supply chain contexts is still emerging (Woldeyes *et al.*, 2025). Accordingly, this study adopts an exploratory approach to investigate a multifaceted and under-researched phenomenon by building understanding from participants' perspectives (Creswell and Creswell, 2018). Guided by the flexible TOE framework, which allows variables to be tailored to different research contexts, the study focuses on identifying the key factors influencing the adoption of CSCPs. As these factors may vary across contexts, examining agricultural processing SMEs in developing countries can offer new theoretical insights.

In line with this objective, the research attempts to elaborate the theory, i.e. TOE framework, which involves "using preexisting conceptual ideas or a preliminary model as a basis for developing new theoretical insights" (Fisher and Aguinis, 2017, p. 441). This approach is particularly suitable for emerging research areas, allowing researchers to develop, expand, and refine existing theoretical ideas to better explain empirical observations (Fisher and Aguinis, 2017). To achieve this, semi-structured interviews were conducted with academics, industry experts, and practitioners in agricultural processing SMEs in Vietnam. These participant groups were selected to capture complementary perspectives on CSCP adoption, thereby enhancing data diversity and the findings' reliability. Semi-structured interviews with open-ended questions enabled in-depth exploration of nascent phenomena such as CSCPs, while remaining flexible enough to capture new insights as themes emerge during the research process (Flick, 2022).

In this study, SMEs were defined following the OECD (2024) definition: small enterprises have 10–49 employees, and medium enterprises have 50–249 employees. The interview protocol (Appendix) was translated from English to Vietnamese using a back-forward translation method and pretested with academic experts for clarity. Purposive sampling (Flick, 2022) was used to recruit suitable participants through sources such as LinkedIn, industry news, and the researcher's professional contacts to ensure diversity in organisational size, location and experience in CSCPs to reduce potential bias. The inclusion criteria were:

(1) Academics or industry experts with relevant expertise in CSCPs, selected for their diverse knowledge and experience in CE projects across various contexts.

(2) Practitioners (e.g. owners, chief executive officers (CEOs), or managers in operations, supply chain, and logistics) from agricultural processing SMEs in Vietnam, each having at least five years of experience to ensure practical, in-depth insights into operations and CSCP adoption.

Overall, 19 interviews, each lasting 45–86 min, were conducted face-to-face or online, including four with researchers and industry experts, and 15 with CEOs of agricultural processing SMEs across Vietnam. Participant demographics, summarised in Table 2, show a diverse range of SME sizes (12–249 employees) and experience levels (5–30 years), with all firms operating for at least five years. Ethical approval was obtained from the affiliated university prior to data collection.

4.2 Data analysis

A thematic analysis proposed by Braun and Clarke (2006) was conducted to analyse the interview data. This approach allows themes and patterns to emerge directly from the data. The interview responses were transcribed, coded and analysed in NVivo 12. Regarding code generation, in open coding, data from interview transcripts were collected, and key concepts were grouped into broad initial categories (first-order concepts) (Braun and Clarke, 2006; Gioia *et al.*, 2013). Next, axial coding was conducted by identifying relationships among the first-order concepts and aggregating them into higher-order themes (second-order themes). Finally, axial code themes were integrated into overarching dimensions shaping the framework. The resulting data structure derived from this coding process is presented in Figure 2.

The sample size was determined by data saturation, which was reached when interviews no longer generated new insights. Saturation was assessed through ongoing review of transcripts and coding. This practice aligns with Guest *et al.* (2006), who suggest that thematic saturation typically occurs after 12 interviews.

Table 2. The profile of participants

Group 1: Agricultural processing SMEs

Participant code	Position	Industry experience (Years)	Number of employees	Firm's years of establishment	Business activity
A1	CEO	6	12	5	Processing
A2	CEO	10	14	5	Farming and processing
A3	CEO	12	30	7	Processing
A4	CEO	7	50	5	Farming and processing
A5	CEO	5	20	5	Processing
A6	CEO	7	45	5	Processing
A7	CEO	5	20	5	Processing
A8	CEO	30	245	30	Processing
A9	CEO	25	200	25	Farming and processing
A10	CEO	6	45	6	Farming and processing
A11	CEO	5	15	5	Processing
A12	CEO	13	76	11	Processing
A13	CEO	15	27	8	Processing
A14	CEO	6	15	6	Farming and processing
A15	CEO	19	249	13	Processing

Group 2: Academics and industry experts

Participant code	Position	Industry experience (Years)	Expertise area
B1	Academic	10	Agriculture
B2	Industry expert	15	Agriculture and environment
B3	Industry expert	7	Agriculture and CE
B4	Industry expert	5	Agriculture and CE

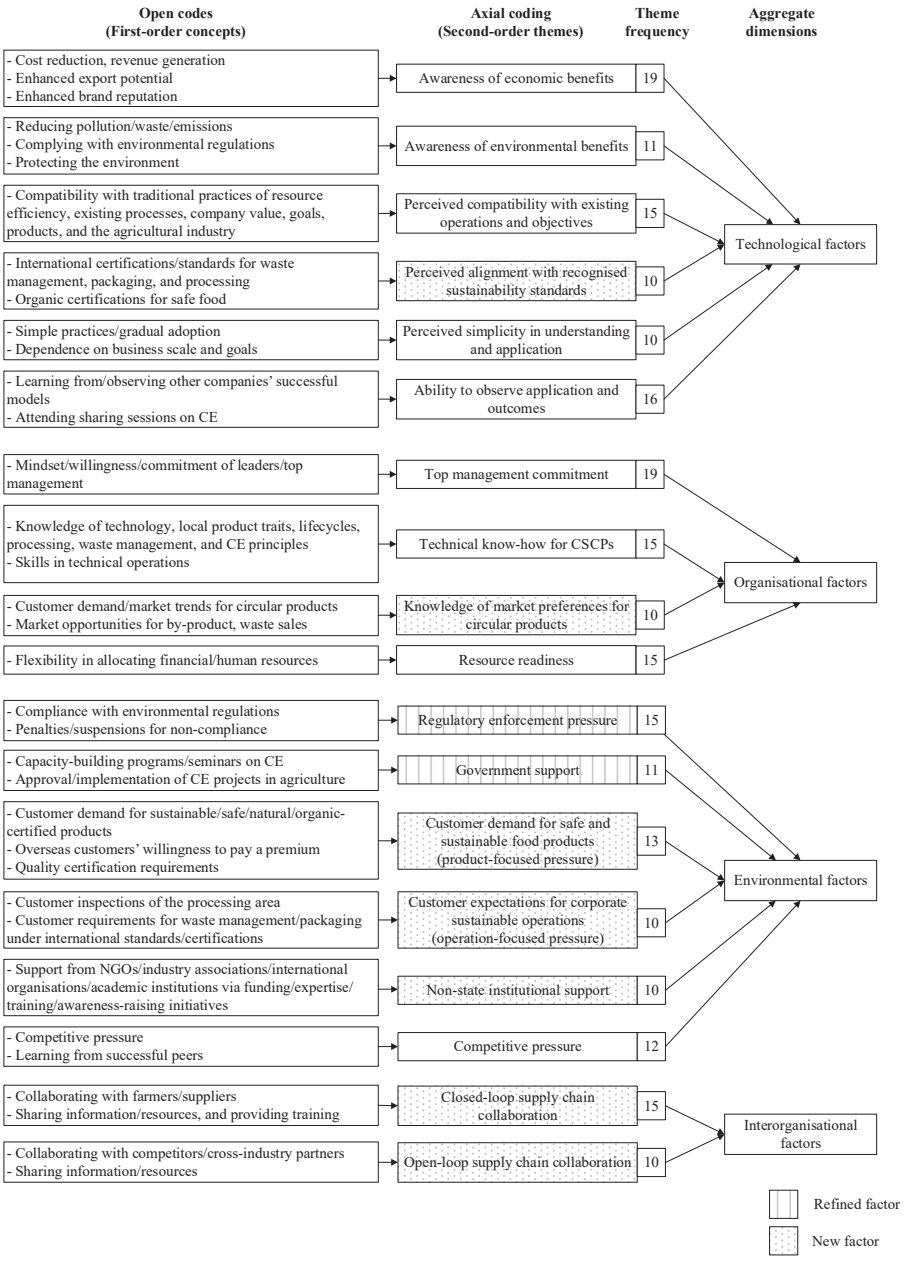

Figure 2. Data structure (Codes, dimensions and frequency of themes)

4.3 Trustworthiness

To strengthen the rigour of this study, the trustworthiness of qualitative research was assessed using four criteria: credibility, transferability, dependability, and confirmability (Korstjens and Moser, 2018). The methods used to meet these trustworthiness criteria are presented in Table 3 with reasons.

Table 3. Methods for meeting trustworthiness criteria

Criteria	Methods	Reasons
Credibility	- Triangulating data from internal company reports, websites, and news sources to strengthen evidence - Validating key findings with interviewees to verify accuracy and address misinterpretations - Conducting follow-up contacts to clarify ambiguous responses	To ensure that the findings accurately represent participants' perspectives and are free from misinterpretation
Transferability	- Providing thick descriptions of the interview context, as detailed in Table 2	To enable assessment of whether the findings can be generalised or applied to other contexts
Dependability	- Using purposive sampling to select information-rich participants - Ensuring confidentiality of informants to support dependable findings	To ensure the stability of the findings over time
Confirmability	- Transcribing and electronically archiving all interviews - Documenting the thematic identification and analysis process - Using an interview protocol based on a literature review	To ensure that the findings objectively reflect the data, rather than the researchers' own interpretations or biases

5. Findings

The key drivers of CSCP adoption are identified and organised into a data structure, with theme frequencies reflecting how many interviewees mentioned each theme, as shown in Figure 2. These frequencies provide an indication of the relative prominence of themes, with more frequently mentioned drivers suggesting greater importance. This interpretation is complemented by attention to how participants articulated their views (e.g. emphatic versus tentative expressions), allowing for a more contextualised understanding of the perceived importance of each driver. As Guest *et al.* (2012) note, combining code frequency with contextual emphasis allows the influence of themes to be assessed more accurately. Additional illustrative quotes are provided in the Supplementary file, and Figure 3 presents the framework of drivers of CSCP adoption.

5.1 Technological factors

Technological factors shape SMEs' perceptions of the benefits and feasibility of CSCP adoption. Among these, ***awareness of economic benefits*** emerged as the main driver, with interviewees highlighting financial gains from resource recovery and waste valorisation. For example, A8 noted that *"we repurpose cassava peels … to generate significant revenue"*, while A4 explained that *"rather than purchasing coal, we utilise methane gas collected during wastewater treatment."* Several interviewees also linked CSCPs to improved brand reputation and access to sustainability-oriented markets. The data further show that economic value is perceived not as a co-benefit, but as the primary basis for broader sustainability outcomes, as reflected in A10's view that *"economic benefits are the core factor in driving environmental and social impacts"*.

Accordingly, ***awareness of environmental benefits*** was mentioned less frequently and was typically framed narrowly around *"comply[ing] with mandatory environmental regulations set by the government"* (A8), *"reduc[ing] emissions during processing"* (B3), and waste minimisation. In contrast, ***awareness of social benefits*** was mentioned by only three interviewees, likely because social benefits are perceived as indirect outcomes rather than primary motivators (Sehnem *et al.*, 2019), suggesting it is not a key driver.

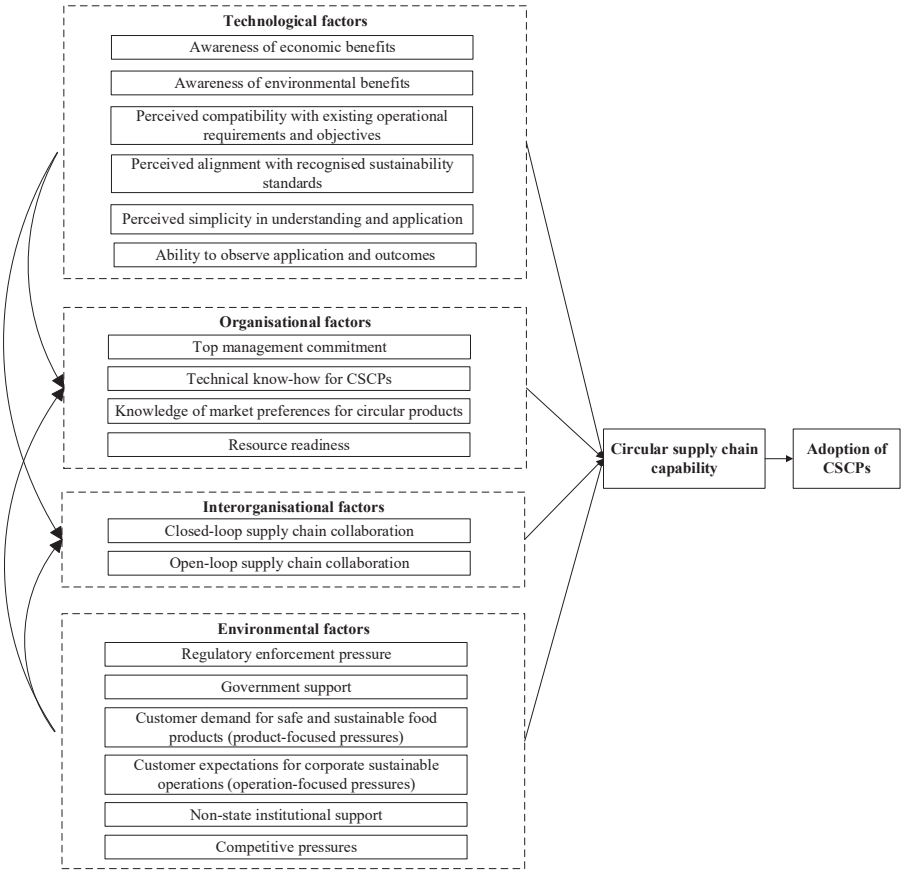

Figure 3. Framework of drivers of CSCP adoption in agri-processing SMEs

Perceived compatibility with existing operations and objectives emerges as an important factor for SMEs, helping to reduce disruption during adoption. Many SMEs associate CSCPs primarily with closing practices such as recycling and reuse, rather than slowing or narrowing resource flows. Some had already implemented these closing practices before recognising them as CSCPs, making adoption a natural progression. For example, A5 noted that *"the principles of CSCs are compatible with our ginseng products . . .,"* while A13 highlighted that *"macadamia shells can be processed into activated charcoal . . . and sometimes sold at a higher price than macadamia nuts themselves."*

Perceived alignment with recognised sustainability standards was occasionally mentioned by the interviewees as a driver that facilitates adoption by enhancing brand reputation and attracting sustainability-conscious consumers. Although standards such as GlobalG.A.P., JAS, EU Organic, USDA Organic, and ESG frameworks do not explicitly mandate circularity, they often promote related principles such as safe production, reduced harmful inputs, pollution control, and waste management. While some focus on farming, they directly impact processing inputs, prompting SMEs to collaborate with farmers for compliance. As A6 noted, *"we adopt CSCPs to meet customer requirements under Global G.A.P standards, including the requirement to manage and process by-products and waste."*

Perceived simplicity in understanding and application was occasionally mentioned by the interviewees, with many SMEs favouring straightforward, gradual practices and avoiding

CSCPs seen as *"overly complex"* or requiring *"significant technical expertise"* (B1). However, the perishability of biological materials adds complexity, requiring specialised knowledge and timely processing to prevent spoilage. Consequently, many SMEs adopt CSCPs selectively, prioritising feasible practices suited to their current learning capacity.

The ability to trial CSCPs was not viewed as a key driver because most interviewees noted trials often require significant time and resources. As A1 explained, *"trials are costly for small businesses like ours, so we do not test them ourselves. Instead, if we see that others have implemented them successfully, we will follow."* Unlike easily trialled digital tools, CSCPs typically involve more complex operational changes, making trials less feasible. This observation aligns with the findings of Hwang *et al.* (2016) that trialability varies across contexts.

The ability to observe application and outcomes was frequently highlighted, as successful peer examples reduced uncertainty and built confidence in proven practices. Visible results, such as turning by-products into safe, value-added food products, demonstrated both feasibility and benefits. This result-driven application was found to be especially important in agriculture, where product safety directly affects human health.

5.2 Organisational factors

Organisational factors influence CSCP adoption by ensuring SMEs possess the necessary commitment and resources. Our results show that ***top management commitment*** emerges as a central organisational driver of CSCP adoption, being consistently highlighted across all interviews as critical to strategic direction and resource allocation. In SMEs, where owners often double as CEOs, this commitment shapes both the decision to adopt and the capacity to sustain CSCPs. As A9 emphasised,*"the mindset and willingness of leaders to act is very crucial."*

Technical know-how for CSCPs was also frequently mentioned, reflecting its importance in enabling agricultural SMEs to tailor practices to their unique operational contexts. Rather than relying on generic knowledge, they emphasise expertise suited to *"product traits, local climate, and biological lifecycles" (A6)*. For example, unlike many durable industrial products, extending product life is not always beneficial for agricultural products. Perishability and food safety constraints may make immediate processing or valorisation more viable, requiring expertise to identify the best circular solution.

Knowledge of market preferences for circular products emerged as a new factor enabling SMEs to align CSCPs with demand. As A4 noted, firms need to assess whether *"customers are willing to pay more for products that adopt CE principles,"* which helps shape circular offerings. A4 also illustrated this through the practice of *"recover[ing] water vapor during the distillation of coconut nectar … and sell[ing] it to a shampoo manufacturer"*. This is especially important where consumers may be cautious about by-product-based products. Awareness of markets for waste and by-products also helps SMEs identify commercial opportunities, further encouraging CSCP adoption.

Resource readiness was frequently mentioned, underscoring its importance in shaping how SMEs approach CSCP adoption. Unlike large firms with extensive resources, SMEs often focus on flexibility by incrementally reallocating limited financial and human resources rather than investing heavily up front. As B3 noted, *"SMEs need to adopt circular technologies that are as cost-effective as possible, as economic efficiency remains the priority"*. Consequently, they tend to prioritise low-disruption, cost-effective practices before gradually scaling up.

Across the interviews, organisational factors were linked to both technological opportunities and external pressures rather than being viewed in isolation. Awareness of CSCP benefits and favourable external conditions could stimulate interest, but adoption occurred only when firms had sufficient organisational capabilities to translate that interest into practice. This highlights the mediating role of organisational capabilities. As noted by A4, *"Currently, ESG and CE trends are growing globally, especially in Europe. If we can adjust*

our internal operations and build the capacity to implement these circular practices, it will enhance our export potential and market expansion, creating a competitive advantage for our business."

5.3 Environmental factors

Environmental factors indicate that agricultural SMEs often adopt CSCPs reactively to meet external demands and demonstrate symbolic compliance, rather than proactively pursuing innovation. ***Government regulations and policies on CE*** emerge from the interview findings as two distinct drivers: regulatory enforcement pressure and government support (Kuei *et al.*, 2015) due to their differing characteristics. ***Regulatory enforcement pressure*** was mentioned frequently, with Vietnam's 2020 Environmental Protection Law and its stricter CE-related provisions cited as key motivators due to penalty risks. As A8 noted, CSCPs help avoid *"government-imposed penalties or suspensions,"* while B2 highlighted that strict regulations *"force SMEs to change their operations."* However, SMEs often respond reactively by meeting minimum requirements because of limited resources and the novelty of CE regulations. In contrast, ***government support***, such as incentives and training, appeared limited in practice. It was often underutilised due to procedural complexity and limited awareness, and mainly supported compliance-focused practices such as waste sorting or reduced chemical use.

As CSCPs are not explicitly required, the findings suggest that, instead of direct customer pressure, two customer-related drivers influence adoption: ***customer demand for safe and sustainable food products*** and ***customer expectations for corporate sustainable operations***. The first one is related to what is produced. Domestic customers value features like biodegradable packaging and additive-free products, but remain price-sensitive. In contrast, international customers, particularly from sustainability-focused markets, expect stricter standards aligned with circular principles, motivating SMEs to adopt CSCPs through product upgrades to stay competitive. The second dimension relates to how products are produced. International buyers increasingly expect sustainable operational practices, such as waste treatment and pollution control, creating market incentives for CSCP adoption. As A8 mentioned, *"overseas customers visited our business and inspected the surrounding area to check for any environmental pollution. Thanks to the adoption of a CE, we have managed to process cassava residues instead of discarding them into the environment, thus preventing pollution."*

Social community pressure, though recognised in the literature, appears weak in Vietnam, with only two interviewees mentioning it. Although interest in sustainability is growing among younger generations, low public awareness of CSCPs limits its influence. Instead, ***non-state institutional support*** emerges as a new driver. NGOs, industry associations, international organisations, and academic institutions help bridge policy and practice by providing training, funding, and awareness-raising initiatives, thereby strengthening SME capacity and motivation. As A5 noted, *"over the last month, with the funding from Worldwide Fund for Nature, we reduced a total of 4,883 single-use plastic bottles, equivalent to 73.3 kg of plastic no longer released into the environment."*

Competitive pressure was occasionally mentioned by the interviewees, with SMEs following successful peers to enhance reputation, demonstrate symbolic compliance, and stay competitive, particularly in export markets where sustainability credentials increasingly shape buyer decisions. Exposure to leading firms also facilitates adoption through benchmarks and practical guidance.

5.4 Interorganisational factors

Interview findings confirm the relevance of interorganisational factors in shaping CSCP adoption and reflect the cross-industry nature of circular flows. ***Closed-loop supply chain collaboration*** was mentioned more frequently than open-loop collaboration and was described

mainly as upstream collaboration with farmers and suppliers, rather than across the full supply chain (Farooque *et al.*, 2019b). SMEs report limited influence over downstream actors; as A7 noted, *"we cannot significantly influence customers . . . but we can impact the production and farming processes."* Instead, collaboration with farmers is emphasised, for example, to *"ensure that no chemical fertilisers or pesticides are used"* (A13), supporting CSCP adoption through improved input quality and environmental compliance.

Meanwhile, ***open-loop supply chain collaboration*** involves cross-industry partnerships to share resources, exchange knowledge, and manage waste. As A13 noted, *"a company itself needs the strength of other businesses to improve sales, access stronger capital sources, and expand its market,"* while B4 emphasised that *"to use resources efficiently, processing SMEs need to collaborate within an ecosystem, as it is challenging to implement circular practices alone"*. These collaborations enabled broader resource recovery beyond firm boundaries but were typically opportunistic rather than systematically pursued.

Across the interviews, interorganisational factors were described as an important mediating mechanism through which technological opportunities and external business conditions translated into CSCP adoption. While these opportunities and pressures could encourage interest, collaboration enabled SMEs to turn them into actual practice, especially when internal resources were limited. As A10 noted, *"when I see other companies performing better, it motivates me to reflect on our practices and proactively seek collaboration with supply chain partners to enhance our operations to adopt CSCPs."*

Overall, the findings confirm, refine, and extend existing knowledge on CSCP adoption in agricultural processing SMEs in developing countries. Nine drivers aligned with prior studies, reflecting SMEs' preference for practical, low-risk, and financially viable solutions. Two drivers were refined to capture the government's dual role in enforcement and support. Importantly, this study identifies seven underexplored context-specific drivers, highlighting the growing importance of market signals and third-party support, especially for export-oriented SMEs. Notably, customer pressure was not directly reported; instead, interviewees mentioned two customer influence-related drivers reflecting product-focused and operations-focused pressure. Accordingly, these have also been incorporated into our framework (Figure 3). In contrast, three drivers, namely awareness of social benefits, the ability to trial, and social community pressure, were only rarely mentioned and not emphasised, suggesting that they do not sufficiently drive the CSCP adoption of the agricultural SME in emerging economies. Hence, they were omitted from the data structure (Figure 2) and the final framework (Figure 3), which is contextualised for the agricultural SMEs in emerging economies. With the above confirmation, refinement, and elimination of CSCP adoption drivers in agricultural processing SMEs in developing countries, RQ1 is considered comprehensively addressed.

6. Discussion

6.1 Capability-driven CSCP adoption process

The findings suggest that CSCP adoption among agricultural processing SMEs in developing countries is capability-driven rather than directly triggered by individual drivers. As shown in Figure 3, technological, organisational, interorganisational, and environmental factors shape CSC capability, which in turn enables CSCP adoption. Adoption therefore depends not only on recognising opportunities or pressures but also on whether firms can convert them into actionable practices.

A key insight is the central role of an economic-first logic in shaping this capability-building process, which reflects a pragmatic, survival-oriented strategy. SMEs assess CSCPs primarily in terms of immediate economic value, rather than viewing environmental or social benefits as primary motivations. Unlike large firms, which typically have the greater capacity to respond proactively to innovation and regulatory demands (Dadsena *et al.*, 2026), our data suggest that SMEs often respond more reactively to short-term opportunities and immediate

external pressures. In this context, CSCP adoption is often seen not as a radical transformation, but as an extension of existing operations when practices are economically viable and operationally compatible. Because perishability and limited resources reduce room for experimentation (Do *et al.*, 2022), observability is more influential than trialability, as visible peer examples reduce uncertainty and help firms judge feasibility.

The findings further highlight the mediating role of organisational and interorganisational factors in building CSC capability, through which technological and environmental factors are translated into CSCP adoption. Awareness of CSCP characteristics and availability may generate interest, but adoption depends on whether SMEs possess sufficient organisational readiness and interorganisational support to convert that interest into practice. In this sense, these factors do not merely filter external and technological influences; they form the capability base by enabling SMEs to develop relevant knowledge, reallocate resources, strengthen commitment, and collaborate beyond firm boundaries. Through such collaboration, SMEs can access external knowledge, pool limited resources, and overcome capability constraints, thereby supporting sustained CSCP adoption. This finding is consistent with Chowdhury *et al.* (2022), who emphasise the importance of internal factors in enabling adaptation and new practice adoption, and with Carissimi *et al.* (2023), who identify stakeholder collaboration as a key enabler of circular practices across supply chains.

Similarly, external influences from governments, non-state institutions, customers, and competitors (environmental factors) further motivate SMEs to strengthen internal capabilities as a means of compliance, competitiveness, and survival. In many cases, these external demands do not directly lead to CSCP adoption. The adoption only occurs when SMEs actively respond by adjusting internal processes, reallocating resources, upskilling staff, and strengthening supply chain collaboration to meet those expectations.

Overall, the findings suggest that CSCP adoption is a capability-driven process. Rather than responding directly to individual drivers, SMEs adopt CSCPs when technological, organisational, interorganisational, and environmental factors collectively build CSC capability. In this process, organisational and interorganisational factors play a mediating role by translating technological opportunities and environmental influences into that capability. CSC capability then shapes firms' capacity and willingness to act, determining whether available opportunities are realised in practice.

6.2 Strategic matrix of CSCP adoption

Drawing on the TOE framework, this study introduces a matrix to capture distinct pathways of CSCP adoption based on internal readiness and external influences (Figure 4). In relation to RQ2, the matrix helps explain how the key drivers shape firms' CSC capability and how, in turn, that capability influences the adoption of CSCPs. *Internal readiness* reflects the extent to which firms have adopted key enablers through internal decisions and efforts, capturing the combined contribution of technological, organisational, and interorganisational factors (Hwang *et al.*, 2016). In contrast, environmental factors, such as regulations or customer pressures, are *external influences* beyond the firm's direct control (Depietro *et al.*, 1990).

Internal readiness and external influences each range from low to high based on the number of relevant factors reported by each firm. Internal readiness was measured by counting the technological, organisational, and interorganisational factors reported and grouping the total into six ordered levels. External influences were measured in the same way using environmental factors. Combining these two six-level dimensions produced a 6×6 matrix with 36 cells. This matrix explains variation in CSCP adoption by showing how different combinations of internal readiness and external influences shape CSC capability, which in turn influences CSCP adoption. Thus, even under similar external influences, firms may follow different adoption pathways depending on their internal readiness. The quadrants represent these distinct pathways, while movement across them reflects changes in capability development and responsiveness to external influences. A firm's position in the matrix

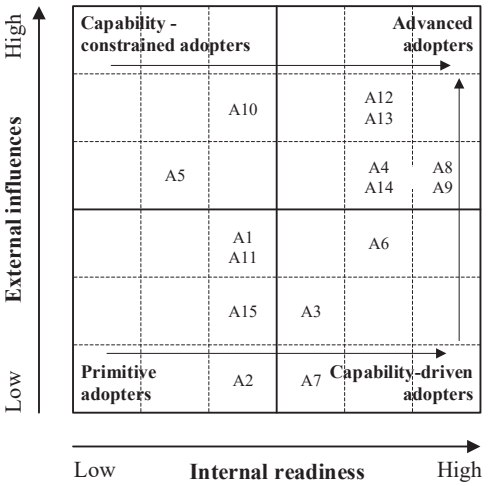

Figure 4. Strategic matrix of CSCP adoption

therefore helps explain both its current adoption pattern and its likely progression towards more advanced CSCP adoption.

The most advantageous position for CSCP adoption is the **Advanced adopter's** quadrant, where firms combine high internal readiness with strong external influences. Here, CSC capability is both well developed and actively deployed, enabling firms to translate external influences and technological opportunities into practice. The cases of A4, A8, A9, A12, A13, and A14 illustrate this pathway, where firms align internal capabilities with demanding external requirements. For example, A12 explained that foreign customers and organic certification standards required the firm to "*avoid fossil fuels . . . in processing*" and to control "*contaminants like* SO_2", noting that "*by applying CE principles, we gain a competitive advantage, particularly when customers conduct inspections of our production facilities and raw material sources*". This finding suggests that strong adoption does not arise from external pressure alone, but from the firm's capability to respond to it. Firms in this quadrant should ***lead*** CSCP adoption by scaling practices across operations, aligning with international standards, pursuing higher value-added circular innovations, and strengthening both closed- and open-loop supply chain collaboration (Simatupang and Sridharan, 2002). Hence, their additional strategic role is not only to adopt, but to influence industry norms by diffusing routines, standards, and credible examples that lower uncertainty for other SMEs.

Primitive adopters (A1, A2, A11, A15), with low internal readiness and limited external influence, tend to show limited CSCP adoption because they lack both strong incentives and sufficient capability to respond. For these firms, the priority is not broad transformation but foundational capability building. Rather than imitating Advanced adopters entirely, they should ***prepare*** by starting with proven, low-risk practices observed in peer firms to reduce uncertainty. A clearer understanding of CSCP characteristics and the firm's business model can help identify feasible entry points that address resource constraints, protect short-term survival, and support gradual adoption. At this stage, organisational factors are especially important. In most cases, top management commitment is central, as reflected in A2's view that "*the leader is the most important factor . . .*", because it helps identify needed expertise, mobilise resources, and motivate teams (Centobelli *et al.*, 2021), thereby enabling other organisational capabilities to develop. By starting with manageable actions and staying alert to market trends, such as demand for upcycled food products, Primitive adopters can strengthen internal readiness. Their most likely early movement is therefore towards the Capability-

driven quadrant, with later progression to Advanced adopters. Direct movement to the Advanced adopters quadrant is unlikely unless they can quickly access and effectively leverage external support and resources.

Capability-driven adopters (A3, A6, A7) exhibit relatively high internal readiness but limited external influence, enabling them to pursue CSCPs proactively through internal capabilities. As A6 explained, *"there must be collaboration among multiple parties. We participate in a cooperative as part of an ecosystem to connect with other businesses in processing passion fruit peels"*. This argument indicates that some firms build interorganisational capabilities even without strong external pressure, positioning them well for more advanced adoption. However, their main challenge is not initiating adoption, but converting internal capability into strategic advantage as external conditions evolve. To move towards the Advanced adopters quadrant, these firms should ***innovate*** by further strengthening their ability to anticipate and capture emerging external opportunities. Rather than waiting for external mandates, capability-driven adopters should proactively leverage external support, such as government programs, NGO initiatives, and sustainability-focused funding or advisory services to accelerate CSCP implementation. Particularly, they should prioritise higher-value circular innovations over lower-value options such as composting (Do *et al.*, 2022). By positioning themselves as early movers and boosting visibility through certifications and branding, they can respond more effectively when customer demands, regulatory requirements, or competitive pressures increase, translating internal readiness into market recognition and long-term competitiveness.

Capability-constrained adopters (A5, A10), by contrast, face strong external influences but insufficient internal readiness. In these cases, external pressure and support create motivation for adoption, but capability gaps restrict implementation. A10 illustrated this dynamic, noting that *"seeing other businesses embrace the CE encourages me to take similar steps . . ."*. To survive under strong external influences, these firms need to move towards the Advanced adopters quadrant by better aligning internal readiness with external conditions. Given their limited readiness, the most feasible pathway is to ***build*** internal capabilities by using collaboration and external support as sources of borrowed capability. Such collaborations can help compensate for internal weaknesses and accelerate more effective CSCP adoption. They should therefore prioritise the most business-critical external pressures and actively leverage available support. Key actions include leveraging support from both government and non-state institutions through training programs and pilot projects and collaborating with supply chain partners for resources and knowledge (Kuei *et al.*, 2015). Strengthening top management commitment is also crucial to prioritise action and translate external influences into implementation.

Overall, the strategic matrix answered RQ2 by showing that CSCP adoption is shaped by how internal readiness and external influences jointly build and activate CSC capability. The key drivers affect firms' ability to develop and use this capability, while quadrant positions reflect different conditions under which it is built and applied. Movement across quadrants therefore represents different pathways through which firms strengthen CSC capability and progress towards more advanced CSCP adoption. Firms in the Primitive adopters quadrant strengthen their internal readiness and pursue a staged adoption pathway by first progressing to the Capability-driven adopters quadrant before advancing to the Advanced adopters quadrant. In contrast, firms in the Capability-constrained adopters quadrant that face strong external influences should seek to leverage external support to accelerate their transition to the Advanced adopters quadrant.

7. Conclusion

7.1 Theoretical implications

Theoretically, this study advances understanding of CSCP adoption in agricultural processing SMEs by explaining adoption as a capability-mediated process shaped by the interaction

between internal readiness and external influences. This perspective builds on the TOE framework and responds to calls for more context-sensitive research on CSCs in developing countries, particularly to better understand the underlying reasons for low adoption (Bocken *et al.*, 2025; Zhang *et al.*, 2023).

First, the study extends the TOE framework by introducing interorganisational factors as a distinct fourth dimension, capturing the relational and networked nature of CSCs. This extension is consistent with prior research emphasising the central role of collaboration in CSCs (Farooque *et al.*, 2019a). It highlights that CSCP adoption is not determined solely within firm boundaries, but is also shaped by supply chain relationships that enable or constrain access to knowledge, resources, and markets.

Second, the findings extend the conventional TOE view, which typically treats technological, organisational, and environmental contexts as independent antecedents of adoption decisions (Baker, 2012; Tornatzky and Fleischer, 1990), by suggesting that these factors may also operate interdependently, with organisational and interorganisational factors playing a gatekeeping role. By highlighting this mediating effect, the study deepens the understanding of internal dynamics in adoption processes among SMEs in developing countries. It also paves the way for developing an extended TOE-based theoretical model that explicitly captures the interdependencies among technological, organisational, environmental, and interorganisational factors.

Finally, the study offers insight into the decision logic underpinning CSCP adoption in a developing country context, which differs from that observed in developed settings (Hoang *et al.*, 2024). Agricultural SMEs in developing countries are strongly influenced by economic benefits and top management commitment, reflecting a pragmatic, survival-oriented approach to sustainability. This insight can inform future theoretical frameworks by better capturing the sector-specific complexities and operational limitations these SMEs face.

7.2 Practical implications

This study provides actionable insights for SME managers, policymakers, and support organisations seeking to promote the adoption of CSCPs in developing countries. For agricultural SMEs, it introduces a strategic matrix that categorises firms based on their internal readiness and the external influences they face. This matrix serves as a practical tool to help firms identify suitable pathways towards CSCP adoption. Moreover, it supports the design of targeted, context-specific strategies aligned with each firm's capacity and external environment.

For governments, the findings highlight the importance of prioritising policy efforts that engage SME leaders and clearly demonstrate the tangible economic value of CSCP adoption. Practical measures include implementing targeted awareness-raising initiatives to showcase cost savings and market opportunities, while also fostering leadership engagement to strengthen strategic commitment to circular practices. The study also highlights that government support is often underutilised due to complex administrative procedures and limited awareness among SMEs. To improve effectiveness, governments should ensure clear and consistent regulatory enforcement, embed CSCP initiatives within existing development policies, simplify access to financial and technical support, and develop practical adoption roadmaps tailored to the capacities of SMEs. More importantly, policy should not assume that external pressure alone will drive adoption; it should also create a supportive environment to help SMEs build the internal capabilities needed to respond. These efforts must reflect the realities in which SME decisions are often guided by feasibility and business survival.

For support organisations such as NGOs and industry associations, it is essential to enhance targeted financial and technical support while facilitating collaboration across the supply chain. Notably, many SMEs tend to associate CSCPs mainly with closing practices, such as recycling or reuse. Therefore, raising awareness of alternative approaches, such as narrowing

and slowing practices (Bocken *et al.*, 2025), is critical to helping SMEs recognise additional entry points and opportunities for applying CSCPs across their operations.

7.3 Limitations and future research

This study has certain limitations that open pathways for future research. First, it is based on semi-structured interviews with a small sample size and aims at refining theory rather than testing. It provides a foundation for future research to develop testable hypotheses and apply large-scale quantitative methods, such as surveys, to validate the proposed framework and assess the relative influence of different drivers.

Second, the study focuses exclusively on agricultural processing SMEs in a developing country. While the proposed framework is likely applicable to similar settings, cross-country comparative studies are needed to examine how institutional, regulatory, and cultural variations influence CSCP adoption.

Finally, this study does not examine the relationships among the influencing factors, CSC capability, and CSCP adoption proposed in the conceptual framework. These relationships can be explored further in future research.

Appendix
Interview protocol

Part 1 – Introduction

Can you share your current role and your experience with CSCPs in Vietnam's agricultural industry?

Part 2 – Influencing factors

(1) What dimensions of the technological factors influence CSCP adoption in agricultural processing SMEs in Vietnam or within your firm?

(2) What dimensions of the organisational factors influence CSCP adoption in agricultural processing SMEs in Vietnam or within your firm?

(3) What dimensions of the environmental factors influence CSCP adoption in agricultural processing SMEs in Vietnam or within your firm?

(4) What dimensions of the interorganisational factors influence CSCP adoption in agricultural processing SMEs in Vietnam or within your firm?

(5) How do these factors influence the adoption process?

Supplementary material

The supplementary material for this article can be found online.

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