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Supply Chain Integration as a Driver of Sustainable Competitive Advantage: Evidence from Ethiopian Manufacturing Industry

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Supply Chain Integration as a Driver of Sustainable Competitive Advantage: Evidence from Ethiopian Manufacturing Industry

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Abstract

Background: Compared to alternative sectors, the manufacturing industry offers unparalleled avenues for capital accumulation, the exploitation of scale economies, and the centralization of technological innovation. In Ethiopia, the beverage and food manufacturing industry has long played a central role in the country's industrial landscape. However, it is characterized by small firms, weak supply chain integration, limited technological progress, and low-value products, making it less competitive internationally.

Objective: To evaluate the empirical effect of supply chain integration on sustainable competitive advantage among large-scale food and beverage manufacturing firms in Addis Ababa and Sheger cities, Ethiopia.

Methodology: This explanatory study evaluates the relationship between supply chain integration (SCI) and sustainable competitive advantage (SCA) among food and beverage manufacturers located in Addis Ababa and Sheger, Ethiopia. We employed structural equation modelling (SEM) on survey data from a sample of 293 firms selected using purposive and stratified sampling techniques. The measurement model was validated through exploratory and confirmatory factor analyses using SPSS 27 and AMOS 23.

Result: The data satisfied all prerequisite assumptions for factor analysis, yielding high KMO measures for SCA (0.900) and SCI (0.878), paired with significant Bartlett's test results ($p < 0.001$). Additionally, the structural model exhibited excellent goodness-of-fit metrics, including a GFI of 0.965, a CFI of 0.996, and an RMSEA of 0.035. Empirical findings revealed that while supply chain integration exerts a positive direct impact on sustainable competitive advantage, this relationship is statistically negligible ($\beta = 0.002$, $p = 0.973$). Consequently, the proposed hypothesis was rejected.

Conclusion: Despite the lack of statistical significance for this direct path, the study offers critical theoretical and managerial insights for stakeholders and policymakers aiming to bolster industrial competitiveness within Ethiopia's manufacturing domain.

Keywords: SCA, SCI, Food and beverage manufacturing industry, SEM, SPSS, AMOS.

1. INTRODUCTION

Industrial production fuels economic advancement by facilitating capital development, scaling efficiencies, and fostering technological breakthroughs (Szirmai, 2013; UNIDO, 2013). Its expansion is especially beneficial for lower-income countries and is strongly associated with export growth and significant poverty reduction (Attiah, 2019).

The global food and beverage manufacturing industry has entered a period of sustained expansion, and Africa has become an increasingly attractive destination for manufacturing investment due to its growing consumer base (increasing income), favorable demographics (urbanization), and industrial development initiatives (Tschirley et al., 2014).

Within Ethiopia's industrial landscape, the food and beverage subsector serves as a primary driver of structural development, commanding a dominant share of manufacturing enterprises, value added, and employment. As the largest manufacturing segment, it generates more than one-third of the total industrial workforce opportunities while maintaining a notable trajectory in export performance (Eshetie, 2018; Hotessa & Robe, 2020).

To enhance their economic and industrial contribution, manufacturing firms need to establish and maintain a sustainable competitive advantage (SCA) that supports long-term performance and resilience. The core architecture of sustainable competitive advantage (SCA) dictates the execution of distinct, value-generating mechanisms that structurally resist rival replication (Linda et al., 2022). Beyond insulation from market imitation, achieving SCA requires the strategic isolation of operational determinants that fortify a firm’s market positioning Deszczyński, (2021); Singh et al., (2020a), thereby enhancing organizational agility amidst highly volatile macroeconomic landscapes and shifting consumer demands (Awwad et al., 2013).

Industrial operations depend on the synchronized flow of resources and finished goods across an interconnected network spanning vendors, producers, logistical intermediaries, and end-market vendors. This systemic alignment, conceptualized as supply chain integration, serves to optimize collaborative workflows and ensure punctual distribution cycles (Hendijani & Saeidi Saei, 2020a). By integrating upstream, internal, and downstream activities, SCI improves cost efficiency, flexibility, customer service, and overall supply chain performance (Dametew et al., 2020), making it vital for achieving and SCA (Al-Kamel et al., 2021a).

Accordingly, this research models the nexus between supply chain integration and sustainable competitive advantage inside Ethiopia's food and beverage processing industry, delineating its empirical boundaries to manufacturing firms situated within Addis Ababa and the surrounding Sheger jurisdiction.

1.1 Statement of the Problem

While a vast body of literature associates macro-level supply chain management with organizational performance and the realization of a sustainable competitive advantage, Chileshe & Phiri, (2022); Zhao et al., (2013), evidence on the aspects of supply chain integration (SCI) remains limited. Although supply chain integration (SCI) driven by synchronized collaboration across suppliers, manufacturers, distributors, and consumers is recognized for enhancing operational productivity, its explicit role in fostering a sustainable competitive advantage remains under-examined within developing economies (Alahmad, 2021a). Consequently, targeted empirical investigations remain particularly scarce within the food and beverage manufacturing sector. Crucially, empirical insights regarding these relationships are heavily contingent upon industry and geographic contexts. For instance, Al-Kamel et al., (2021); Doering et al., (2019) highlight the capacity of SCI to bolster competitiveness within the service sector, whereas Eslami et al. (2022) isolate its effects within highly digitized manufacturing ecosystems. Furthermore, studies by Hendijani & Saeidi Saei, (2020); Siagian et al., (2021) evaluates broader manufacturing paradigms in Iran and Indonesia, respectively. In similar localized inquiries, Zhang et al. (2022) dissect the dynamics of China's e-commerce landscape, while Cheng, (2022) constrains their investigation to the computer technology industry.

Concurrently, empirical evidence from Mogaka, (2024)demonstrates positive, statistically significant correlations between competitive advantage and specific operational dimensions namely functional, supplier, customer, and technological integration within the Kenyan food and beverage manufacturing sector. However, the present inquiry diverges from this earlier study in two fundamental ways. First, our structural operationalization of supply chain integration (SCI) relies on distinct indicator variables. Second, while Mogaka (2024) focuses on immediate competitive advantage (CA), this study evaluates sustainable competitive advantage (SCA), a construct governed by entirely different conceptual and theoretical boundaries.

Empirical and theoretical research gaps in Ethiopian food and beverage manufacturing industry: existing studies acknowledge that the food and beverage industry is Ethiopia's largest manufacturing subsector in terms of employment, enterprise concentration, and contribution to industrial output(Eshetie, 2018). However, despite its economic significance, the sector continues to face structural challenges, including weak supply chain integration, fragmented logistics, and limited capability development, which undermine its long-term competitiveness. Previous research has largely examined internal and external integration practices separately rather than as a comprehensive strategic capability(Balda & Singh, 2020). Furthermore, although studies have linked sustainable supply chain management to organizational performance through competitive advantage, they provide limited explanation of how supply chain integration itself translates into sustainable competitive advantage within developing-country contexts(Shebeshe & Sharma, 2024). This study addresses these empirical and theoretical gaps by conceptualizing supply chain integration as an integrated organizational capability and examining its direct relationship with sustainable competitive advantage. The study also contributes to the literature by revealing that the direct effect of supply chain integration on sustainable competitive advantage is statistically insignificant in the Ethiopian manufacturing context, suggesting that contextual factors such as institutional, infrastructural, and market constraints may weaken relationships commonly supported in developed economies.

Methodologically, prior studies on Ethiopian manufacturing have predominantly relied on descriptive analyses, correlation techniques, and traditional regression models, which are limited in capturing complex causal relationships among latent constructs and often ignore measurement error. In addition, many studies have inadequately validated measurement instruments and have used geographically narrow or sectorally heterogeneous samples, limiting the generalizability of their findings. This study addresses these limitations by adopting an explanatory research design and employing Covariance-Based Structural Equation Modeling (CB-SEM) using AMOS to simultaneously estimate measurement and structural models. The study further strengthens methodological rigor through a two-stage validation process involving Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA), and by using purposive and stratified sampling to collect data from 293 food and beverage manufacturing firms in Addis Ababa and Sheger, thereby providing more robust and context-specific evidence.

This study sought to answer the following basic research question:

- What is the empirical effect of supply chain integration on sustainable competitive advantage among large-scale food and beverage manufacturing firms situated in Addis Ababa and Sheger cities, Ethiopia?

2. Related Literature Review and Hypotheses Development

2.1 Conceptual Literature related to the study variables

2.1.1 Concept of Sustainable Competitive Advantage

To establish a clear conceptual foundation for this variable, it is essential to trace its theoretical origins through the distinct yet interrelated concepts of competition, competitiveness, and competitive advantage.

In strategic management, competition is conceptualized as the systemic conflict or struggle among actors pursuing finite resources, commercial opportunities, or distinct goals (Sigalas, 2015). Conversely, competitiveness reflects a firm's practical proficiency in navigating this environment effectively. As a result, maintaining elevated competitiveness acts as an indispensable critical success factor (CSF) for business durability and scaling (Parnell, 2008). Grounded in these definitions, competitive advantage comprises those targeted strategic parameters through which a firm establishes meaningful differentiation or executes superior performance in core metrics namely efficiency, quality, innovation, and client accommodation vis-à-vis its rivals (Na & Kang, 2018; Wang, 2013).

Scholarly consensus indicates that a comprehensive understanding of competitive advantage encompasses three fundamental facets: discerning its origins, assessing the factors that sustain it over time, and identifying the mechanisms used to capture its benefits (Wu & Chen, 2012). Given the long-term strategic implications of the second facet, this study specifically focuses on the determinants influencing sustainable competitive advantage **(SCA)** within the food and beverage manufacturing industry.

SCA transcends conventional, short-term competitive advantage by emphasizing structural longevity and resilience. Without this sustainability, an organization remains inherently vulnerable to market disruptions (Lasserre, 2003). Crucially, achieving SCA extends beyond mere operational effectiveness; it requires firms to either perform entirely distinct activities

from rivals or execute similar activities in fundamentally unique and superior ways (Satar, 2023).

2.2.2 The Concept of Supply Chain Integration

Integration is broadly defined as the formal or informal process of aligning diverse groups or functions to collaborate on a unified business objective(Leuschner, et al., 2013; Schweiger, 2016). Within strategic management, structural integration is a critical industry determinant for organizational positioning (Parnell, 2008; Porter, 1998). Among its various manifestations, the concurrent integration of suppliers and customers represents the most complex and challenging configuration(Fabbe-Costes & Jahre, 2008). Consequently, this inquiry isolates supply chain integration (SCI) as its focal construct, empirically evaluating its role as a fundamental antecedent of sustainable competitive advantage within the Ethiopian food and beverage manufacturing domain.

Firms across all industries must continuously negotiate with both upstream resource suppliers and downstream buyers of finished products or services(Min & Mentzer, 2004). The nature of these inter-firm relationships directly dictates operational efficiency and the fluid movement of goods and services across the value chain. Consequently, firms that develop superior SCI capabilities are better positioned to sustain their market competitiveness over time (Sadler, 2007).

2.3 Theoretical Literature

2.3.1 Theoretical Framework: Anchoring SCI and SCA

To critically evaluate the structural relationship between Supply Chain Integration (SCI) and Sustainable Competitive Advantage (SCA), this study is anchored in two complementary strategic perspectives: the Resource-Based View (RBV) and Dynamic Capabilities Theory (DCT). Together, these theories explain why integrated supply chains are not merely operational tools, but strategic assets that yield long-term resilience and market dominance.

Crucially, this framework is deployed to satisfy the primary objective of this study: to empirically evaluate the degree to which macro-level SCI structurally influences the realization of SCA within the specific geographic boundaries of Addis Ababa and Sheger , Ethiopia. By combining RBV and DCT, the study models how cross-border relational assets and adaptive workflows interact within a resource-constrained, developing-country context.

2.3.2 The Resource-Based View (RBV) and SCI as an Inter-firm Asset

The Resource-Based View posits that a firm can achieve SCA if it possesses and deploys resources that are valuable, rare, inimitable, and non-substitutable (VRIN) (Barney, 1991). While traditionally focused on internal assets, the expansion of RBV into the relational view argues that critical, value-generating advantages frequently span organizational boundaries through collaborative networks (Dyer & Singh, 1998).

From this perspective, SCI encompassing both upstream supplier integration and downstream customer integration represents a socially complex, path-dependent relational asset (Flynn et al., 2010a). The seamless sharing of proprietary information, joint problem-solving, and synchronized strategic planning cannot be easily replicated by competitors (Ataseven & Nair, 2017; Leuschner, et al., 2013).

Directing this theoretical lens toward the Ethiopian landscape, a core objective of this research is to ascertain whether this inter-firm asset configuration successfully translates into a robust, inimitable core competency for domestic enterprises. Grounded in RBV, this study tests the traditional assumption that highly integrated supply chains directly yield superior organizational positioning (SCA) when subjected to the operational parameters of large-scale food and beverage processors (Fig. 1).

2.3.3 Dynamic Capabilities Theory (DCT) and Supply Chain Responsiveness

While RBV focuses primarily on resource possession and configuration, Dynamic Capabilities Theory explains how firms alter, reconFig., and deploy these resources to maintain alignment with rapidly changing and volatile environments (Teece et al., 1997). In contemporary manufacturing, severe market volatility, raw material supply disruptions, and evolving customer preferences require continuous strategic adaptation (Chowdhury & Quaddus, 2016). Within this domain, SCI acts as an operational manifestation of a firm's dynamic capabilities, enabling organizations to sense market shifts in real time, accelerate distribution cycles, and optimize systemic resource configuration.

This dynamic perspective directly addresses a pivotal objective of this inquiry: to investigate the structural effect of SCI under volatile, emerging-market condition**s.** In the context of

Addis Ababa and Sheger cities, food and beverage manufacturing firms operate within an environment characterized by low-tech processing regimes and structural vulnerabilities.

Consequently, this study leverages DCT not just to confirm standard operational efficiencies, but to fulfill the critical objective of exposing the "Direct Path Paradox." Specifically, the framework is used to examine how severe localized friction points such as institutional, infrastructural, and logistical constraints can disrupt or completely decouple the expected transmission path between a firm's dynamic supply chain capabilities and its long-term sustainable advantage (Fig. 1).

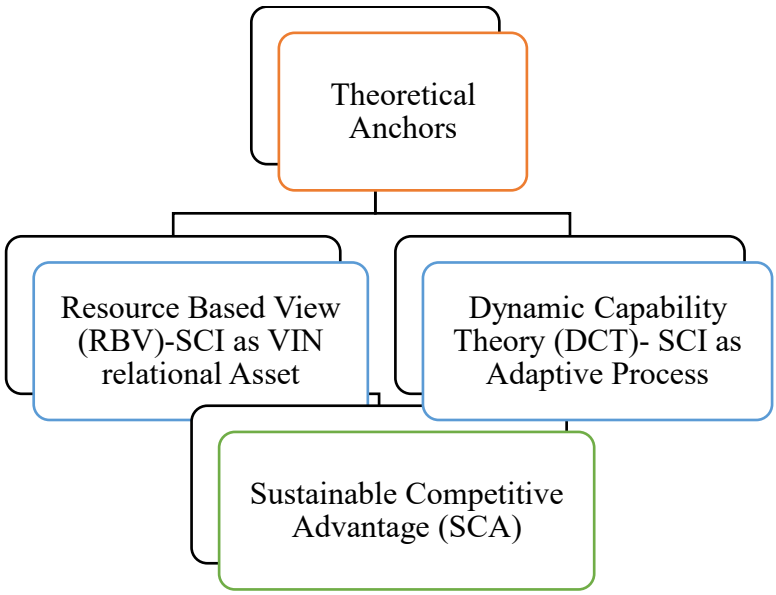


Fig. 1 Study theoretical framework, Source: Authors, 2025

2.4 Research Hypothesis

Supply chain integration (SCI) denotes the systemic alignment and synchronized collaboration across distinct transactional nodes, fundamentally bridging upstream vendors, manufacturers, logistical intermediaries, downstream distributors, and end-consumers (Alahmad, 2021b; Zhao et al., 2013). The strategic synthesis of supply chain management functions generates substantial operational advantages, characterized by compressed lead times, systemic cost minimization, heightened informational transparency, and expedited product deployment cycles (Adebanjo et al., 2018). Consequently, these enhancements reinforce overall business performance by fostering organizational resilience, operational flexibility, and continuous innovation (Shokri Kahi et al., 2017; Siagian et al., 2021b).

Because of these extensive outcomes, the strategic management of the supply chain remains a critical imperative across both product- and service-oriented sectors (Khasasin, 2020).

Despite these documented benefits, empirical perspectives diverge regarding the precise mechanism through which SCI impacts firm competitiveness and long-term sustainability. While mainstream literature argues that integrating internal and external supply chain dimensions significantly optimizes business outcomes, counter-arguments suggest that heightened inter-firm interdependence introduces operational risks that warrant deeper investigation (Ataseven, 2017; Duoming & Chin, 2022). Nevertheless, empirical evidence from manufacturing contexts reinforces that comprehensive supply chain integration is indispensable for protecting market share and maintaining a distinct competitive advantage amid intensifying globalization (Liu et al., 2020; Xu et al., 2019). Minimizing these vulnerabilities therefore requires firms to devise and implement synchronized SCI strategies and technologies both internally and externally to optimize their strategic positioning (Masa'deh et al., 2018).

In summary, establishing robust, collaborative relationships with value chain partners is a pivotal mechanism for bolstering and sustaining firm competitiveness (Park et al., 2021; Tarifa Fernández, 2022). Based on these theoretical and empirical foundations, it is argued that greater levels of integration directly translate into improved sustainable competitive capabilities. Thus, the following research hypothesis is proposed:

H1**:** Supply Chain Integration (SCI) has a significant positive effect on Sustainable Competitive Advantage (SCA).

2.5 Conceptual Framework

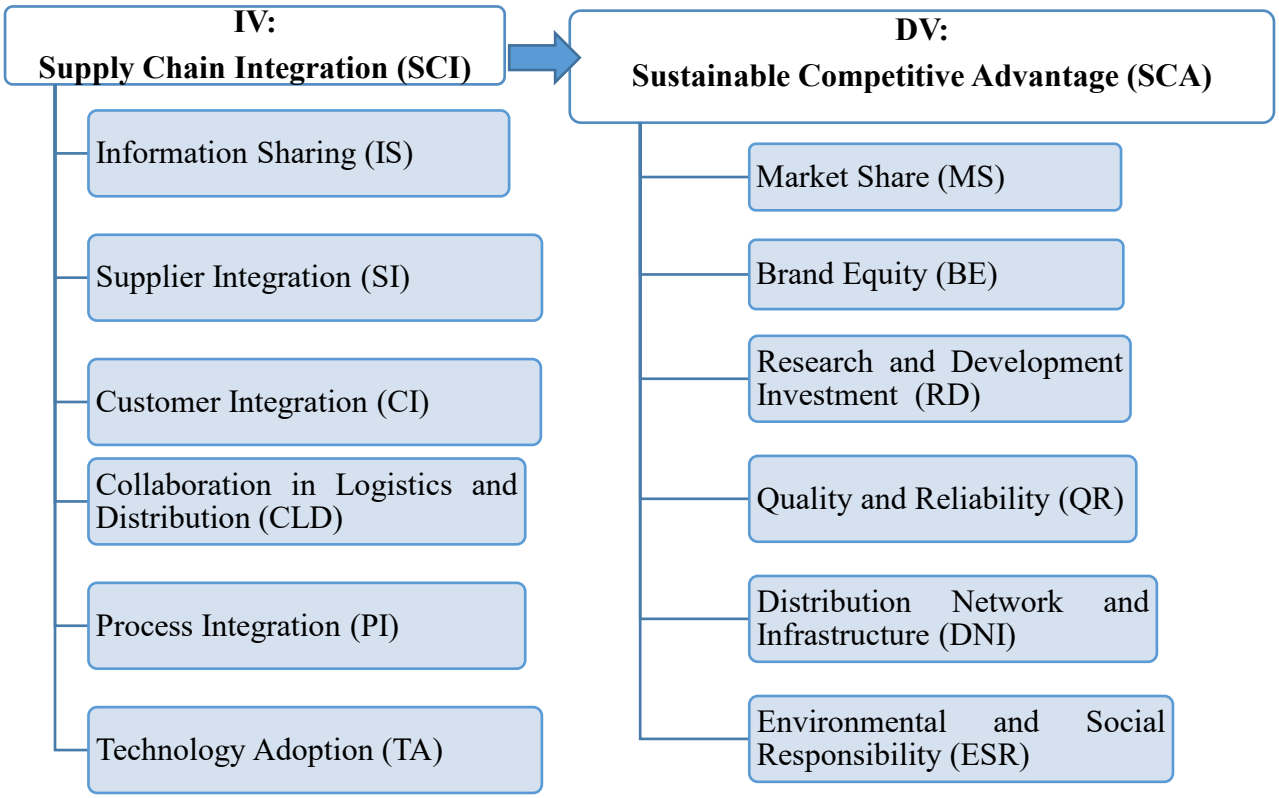


Fig. 2 Conceptual framework, Source: Authors, 2025

3. MATERIALS AND METHODS

3.1 Research design and target population

To rigorously map and evaluate the structural pathways linking supply chain integration (SCI) to sustainable competitive advantage (SCA), this inquiry deploys an explanatory research design (Babbie, 2011; Kumar, 2012; Ragab & Arisha, 2017). This causal framework allows for a definitive assessment of the structural paths between the latent constructs under investigation. The empirical scope is strictly bounded to large-scale food and beverage manufacturing firms maintaining active operations within the twin metropolitan jurisdictions of Addis Ababa and Sheger City, Ethiopia. Dynamically isolating this specific manufacturing cohort provides an accurate cross-section of the country's primary industrial engine. Structurally, the target population is stratified across three mutually exclusive industrial sub-sectors:

- **Food Manufacturers:** Including flour, confectionery, and edible oil processing plants.
- **Alcoholic Beverage Manufacturers:** Comprising breweries, wineries, and liquor distilleries.

- **Non-Alcoholic Beverage Manufacturers:** Primarily focusing on bottled water production facilities.

3.2 Sampling Design

This study employed a dual-stage sampling design combining proportionate stratified and purposive sampling techniques (Bryman, 2012; Kumar, 2012). The unit of analysis was the individual manufacturing firm, while the unit of observation comprised senior managers who possessed comprehensive knowledge of their firm's strategic operations, supply chain dynamics, and market orientation practices. To maintain data integrity and prevent cross-contamination of responses, exactly one senior manager was surveyed per sampled firm, ensuring each questionnaire uniquely represented a single corporate entity.

Out of the 1,103 food and beverage manufacturing industries registered in Ethiopia, approximately 64% (n = 706) are operating within Addis Ababa and Sheger City. To achieve a statistically representative baseline, a sample size equivalent to 45% of this regional population (N = 318 firms) was targeted.

Following the data collection phase, usable and complete responses were secured from 293 managers out of the initially targeted 318 sample firms, yielding a robust final response rate of 92.1%.

Table 1 Distribution of Sample Size and Response Rates by Sub-sector

Manufacturing Sub-sector	Target Sample (N)	Usable Questionnaires Returned (n)	Response Rate (%)
Wheat, Spaghetti, and Biscuits	82	72	87.8%
Edible Oil Refineries	36	42	116.7%*
Candy and Chewing Gum	18	15	83.3%
Brewing, Winemaking, and Liquor	64	60	93.8%
Bottled Water	118	104	88.1%
Total	**318**	**293**	**92.1%**

Source: Authors, 2025

3.3 Data Collection Instrument

Primary data for this study were collected utilizing a highly structured, self-administered questionnaire targeted at senior managers within the sampled food and beverage manufacturing industries. The instrument was meticulously designed to extract empirical data

directly aligned with the specific research objectives and hypotheses of the study (Adams et al., 2007; Kumar, 2012).

To maximize the response rate and ensure statistical viability during the data analysis phase, the questionnaire was predominantly composed of closed-ended questions. This design choice minimizes respondent fatigue, standardizes data entry, and facilitates robust quantitative evaluation.

3.4 Instrument Development and Measurement Scale

The primary survey instrument consisted of structured, closed-ended items evaluated via a five-point Likert response format anchored from 1 (Strongly Disagree) to 5 (Strongly Agree) to capture the core behavioral and perceptual dimensions of the target respondents. This continuous psychometric design facilitates robust covariance estimations, aligning with standard empirical protocols for structural equation modeling (Jebb et al., 2021; Joshi et al., 2015; Kumar, 2012).

Additionally, a limited number of qualitative, open-ended questions were embedded at the end of the instrument to capture nuanced operational insights not fully addressed by the standardized items (Castillo-Montoya, 2016; Yusoff et al., 2021).

The measurement dimensions for the focal variables were operationalized based on validated scales established in the existing literature. Specifically, the independent variable, supply chain integration (SCI), was measured using a total of 30 items distributed across six core indicators: supplier integration, customer integration, logistics and distribution collaboration, process integration, technology adoption, and information sharing. Concurrently, the dependent variable, sustainable competitive advantage (SCA), was operationalized through 27 items capturing six core indicators, namely MSmean, BE, RD, QR, DNI, and ESR.

3.5 Ethical Assurance Process

To safeguard participant well-being, this study strictly adhered to institutional and international research ethics protocols. Data collection was grounded in informed consent, with senior managers fully briefed on the study's academic scope prior to participation. Engagement was entirely voluntary, granting respondents the uninhibited right to withdraw at any phase without penalty. Finally, absolute anonymity and confidentiality were guaranteed;

no individual or corporate identifiers were collected, and all data were aggregated and securely processed strictly for academic analysis.

Statement of AI Assistance: The AI tool was not used to conceptualize the study, analyze data, interpret empirical results, or formulate the theoretical arguments, all of which remain the original contribution of the researchers.

3.6 Methodological rationale for sequential EFA and CFA

While split-sample validation is ideal, EFA and CFA were executed sequentially on a single dataset (n = 293). In organizational research, this is an established convention when obtaining separate samples is constrained by population limits or field accessibility (Howard, 2023; Lorenzo-Seva, 2021). To safeguard statistical validity, EFA functioned as an exploratory filter to establish initial dimensional boundaries and isolate poorly performing items. Subsequently, CFA applied strict goodness-of-fit parameters to rigorously confirm the definitive measurement framework. This dual-stage validation strategy ensures that the subsequent structural path coefficients are estimated from highly dependable, uncontaminated latent constructs.

3.7 Empirical Model Specifications

To evaluate the hypothesized direct path linking the latent constructs, this inquiry leverages covariance-based structural equation modelling (CB-SEM) via AMOS 23 (Hair et al., 2025; Kline, 2018; Sarstedt et al., 2020). This advanced multivariate framework simultaneously estimates the measurement validation and structural pathways, making it uniquely suited for rigorous hypothesis confirmation. Specifically, the structural model isolates and quantifies the direct path coefficient between the exogenous capability framework, supply chain integration (SCI), and the endogenous strategic outcome, sustainable competitive advantage (SCA) (Fig. 3).

Supply chain integration (SCI) = $\beta 0+\beta 1*$supplier integration (SI) $+\beta 2*$customer integration (CI) + $\beta 3*$collaboration in logistics and distribution (CLD) + $\beta 4*$process integration (PI)+ $\beta 5*$technology adoption (TA) + $\beta 6*$information sharing (IS)+ error term (ϵ)…….. (1)

Sustainable competitive advantage (SCA) = $\beta 0+\beta 1*$market share MS+ $\beta 2*$brand equity (BE)+ $\beta 3*$research and development investment (RD) + $\beta 4*$quality and reliability (QR) + $\beta 5*$distribution network infrastructure (DNI) + $\beta 6*$environmental and social responsibility (ESR)+ error term (ϵ)……..…….. (2)

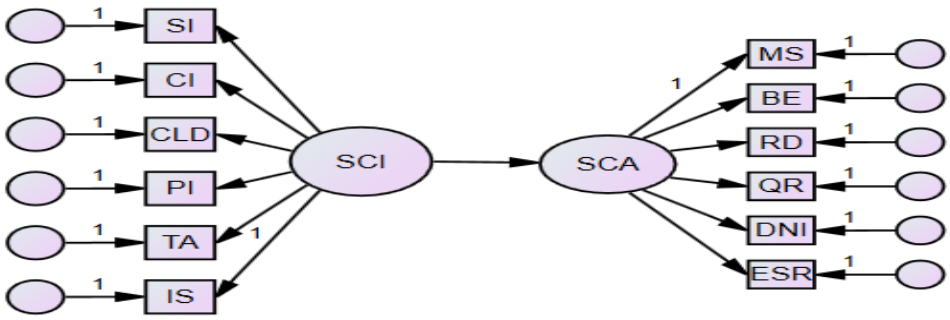


Fig. 3 SEM, Source: AMOS 23, 2025

4 RESULTS AND DISCUSSION

To evaluate the empirical data and test the hypothesized structural paths, this study adopted a rigorous, two-step analytical framework.

In the *first phase*, the psychometric properties of the research instrument were evaluated. Exploratory Factor Analysis (EFA) was initially conducted using IBM SPSS (v.27) to discover underlying latent dimensions and establish initial item retention criteria. This was systematically followed by Confirmatory Factor Analysis (CFA) using IBM SPSS AMOS (v.23) to rigorously validate the measurement model's goodness-of-fit, convergent validity, discriminant validity, and internal consistency reliability.

In the *second* phase, structural equation modelling (SEM) was deployed to evaluate the hypothesized direct path linking supply chain integration (SCI) to sustainable competitive advantage (SCA).

4.1 Measurement Model

To assess the validity of the measurement model, multiple statistical tests were conducted. To determine the underlying factor structure, an EFA was conducted using principal axis factoring combined with an oblique promax rotation. Only factors achieving eigenvalues of 1.0 or greater were retained. The analysis successfully extracted a six-factor structure for both supply chain integration and sustainable competitive advantage. However, three specific items within the SCA construct (RD4, ESR2, and ESR4) were removed from the final scale because they failed to meet the required factor loading thresholds. The appropriateness of the data for factor analysis was verified using the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity. The KMO values reached 0.900 for the sustainable competitive advantage (SCA) construct and 0.878 for supply chain integration (SCI), demonstrating

excellent and meritorious sampling adequacy, respectively. Furthermore, Bartlett's test yielded statistically significant results for both constructs ($p < 0.001$), proving that the variables share sufficient correlation. Collectively, these diagnostics confirm that the dataset is highly suited for both factor analysis and subsequent covariance-based structural equation modeling (CB-SEM).

Post-EFA, Cronbach's alpha, construct validity, and composite reliability were evaluated (Hair et al., 2025). The SCA (27 items; alpha = 0.922) and SCI (30 items; alpha = 0.842) scales demonstrated strong internal consistency, exceeding the 0.70 threshold. Thus, both are reliable for subsequent CFA and structural model testing (Kline, 2018).

All dimensions of both constructs exhibited strong factor loadings. For SCA, the loadings across its dimensions were as follows: MS (0.726-0.887), BEe (0.777-0.890), RDe (0.836-0.888), QRe (0.774-0.861), DNIe (0.810-0.911), and ESRe (0.798-0.975) (see Fig. 4). For SCI, the dimensions also displayed robust loadings: SI (0.836-0.917), CI (0.826-0.898), CLD (0.842-0.901), PI (0.818-0.857), TA (0.822-0.887), and IS (0.841-0.903) (see Fig. 5). Taken together, these findings confirm that both the SCA and SCI constructs possess strong reliability and validity, fully supporting further structural analysis.

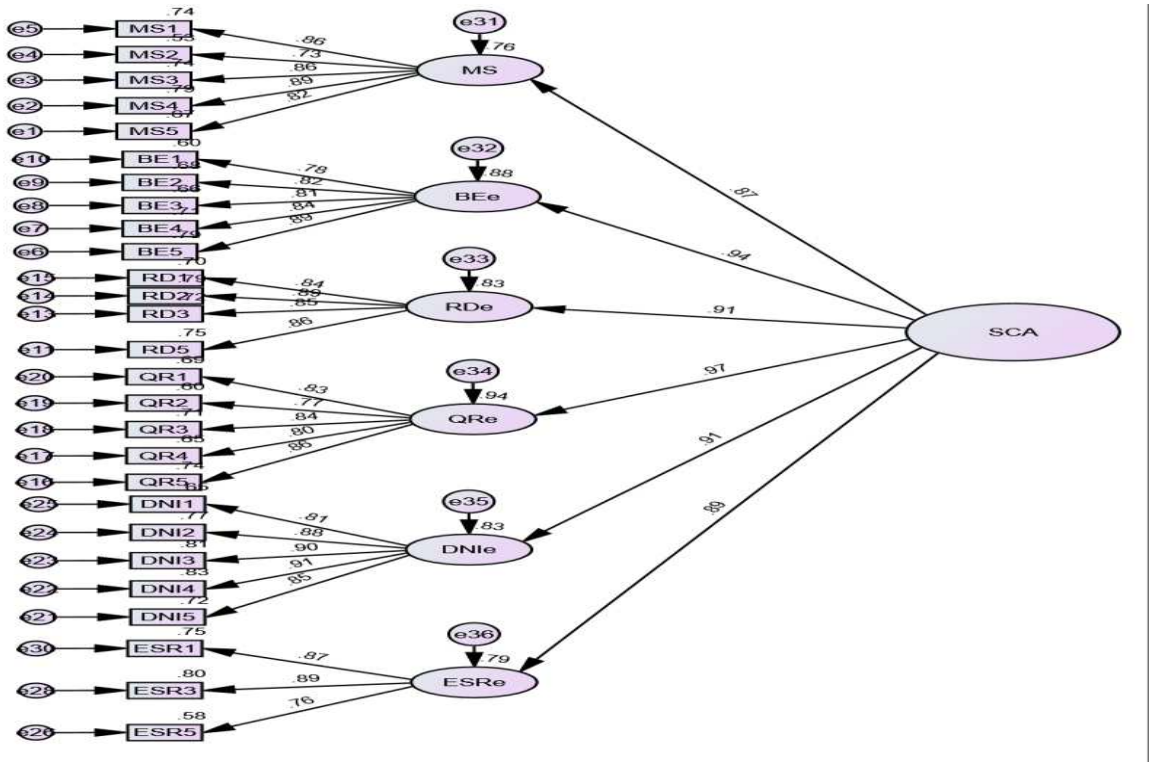


Fig. 4 Higher-order measurement model of sustainable competitive advantage (SCA)

Model fitness result shown $\chi^2/df = 2.117$, GFI = 0.912, AGFI = 0.893, RMR (0.053), RMSEA = 0.060. The model fitness indices fit with the standard.

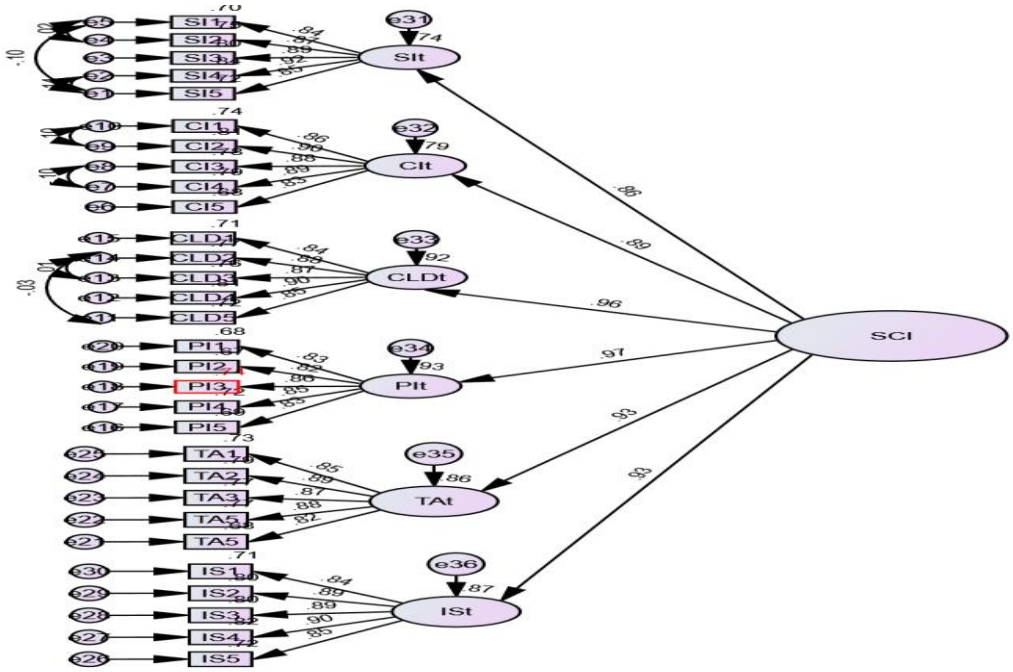


Fig. 5 Higher-order measurement model of supply chain integration (SCI)

The model fitness result for SCI shown that, $\chi^2/df = 3.938$, NFI = 0.918, CFI = 0.957, TLI = 0.954, RMR (0.030), and RMSEA (0.056). The model fitness indices fit with the standard.

Overall, both models demonstrate satisfactory goodness-of-fit for further structural analysis(Goretzko et al., 2024; Sahoo, 2019).

The measurement models for both sustainable competitive advantage (SCA) and supply chain integration (SCI) demonstrated robust reliability and validity, confirming their suitability for subsequent structural modeling.

Table 2 ***Psychometric properties***

Constructs	Indicators	Factor Loading	Cronbach's Alpha Value	CR	AVE	MSV	ASV
SCI	SIt	0.86	0.842	0.912	0.762	0.669	0.544
	CIt	0.89		0.914	0.761	0.693	0.568
	CLDt	0.96		0.947	0.754	0.727	0.528
	PIt	0.97		0.924	0.699	0.534	0.502
	TAt	0.93		0.920	0.745	0.697	0.632
	ISt	0.93		0.930	0.767	0.524	0.504

SCA	MS	0.87	0.922	0.918	0.692	0.412	0.286
	BEe	0.94		0.880	0.711	0.398	0.271
	RDe	0.91		0.917	0.689	0.421	0.294
	QRe	0.97		0.940	0.758	0.436	0.309
	DNIe	0.91		0.919	0.739	0.429	0.301
	ESRe	0.89		0.914	0.679	0.448	0.318

Source: Authors' data analysis 2025, SPSS AMOS output

Table 2 outlines the reliability and validity diagnostics for the multi-item constructs. Internal consistency is well-established, with Cronbach's alpha values exceeding the 0.70 benchmark (0.842 for SCI and 0.922 for SCA) and Composite Reliability (CR) scores surpassing 0.70 for all dimensions (ranging from 0.880 to 0.947). Convergent validity is also confirmed, as all standardized factor loadings exceed 0.50 (ranging from 0.86 to 0.97) and all Average Variance Extracted (AVE) values comfortably surpass the 0.50 threshold (ranging from 0.679 to 0.767) (Hair et al., 2021; Sarstedt et al., 2020). Finally, discriminant validity is satisfied because the Maximum Shared Variance (MSV) and Average Shared Variance (ASV) metrics remain strictly below their respective AVE scores across all dimensions, proving that the latent factors are statistically distinct(Cheung et al., 2024; Ertugrul-Akyol, 2019).

Table 3 Discriminant Validity for SCA

Construct	**MS**	**ESRe**	**BEe**	**DNIe**	**RDe**	**QRe**
Market share (MS)	**0.832**					
Environmental and social responsibility (ESRe)	0.462	**0.843**				
Brand equity (BEe)	0.517	0.548	**0.830**			
Distribution network and infrastructure (DNIe	0.494	0.522	0.611	**0.870**		
Research and development investment (RDe)	0.481	0.506	0.587	0.642	**0.860**	
Quality and reliability (QRe)	0.539	0.563	0.621	0.668	0.655	**0.824**

Source: Authors' data analysis 2025, SPSS AMOS output

Table 3 displays the discriminant validity evaluation for the Sustainable Competitive Advantage (SCA) dimensions utilizing the Fornell–Larcker criterion. The diagonal entries (in bold or representing the leftmost values of each row) correspond to the square root of the Average Variance Extracted for each sub-construct, while the off-diagonal values denote inter-construct correlations. Discriminant validity is fully supported because the for every

single dimension (ranging from 0.824 to 0.870) strictly exceeds its highest correlation with any other latent variable. This confirms that all six SCA factors are statistically distinct and capture unique underlying variance.

Table 4 Discriminant Validity for SCI

Construct	SIt	CIt	CLDt	PIt	TAt	ISt
Supplier integration (SIt)	**0.873**					
Customer integration (CIt)	0.769	**0.872**				
Collaboration in logistics and Distribution (CLDt)	0.828	0.855	**0.868**			
Process integration (PIt)	-0.034	-0.061	0.727	**0.836**		
Technology adoption (TAt)	0.802	-0.028	0.692	-0.097	**0.863**	
Information sharing (ISt)	0.804	0.830	0.795	-0.001	-0.066	**0.876**

Source: Authors' data analysis 2025, SPSS AMOS output

Table 4 presents the discriminant validity results for the Supply Chain Integration (SCI) construct evaluated via the Fornell–Larcker criterion. The diagonal entries represent the square root of the Average Variance Extracted for each dimension, while the off-diagonal metrics capture inter-construct correlations. Discriminant validity is satisfied as each sub-construct's (ranging from 0.836 to 0.876) strictly exceeds its highest correlation with any other latent variable. This demonstrates that all six SCI dimensions are statistically unique and represent distinct empirical constructs.

4.2 Structural Model

Hypothesized relationships were tested using Covariance-Based Structural Equation Modeling (CB-SEM) executed in AMOS 23. The structural model specifically evaluated how supply chain integration (SCI) impacts sustainable competitive advantage (SCA) among firms operating in the Ethiopian food and beverage sector.

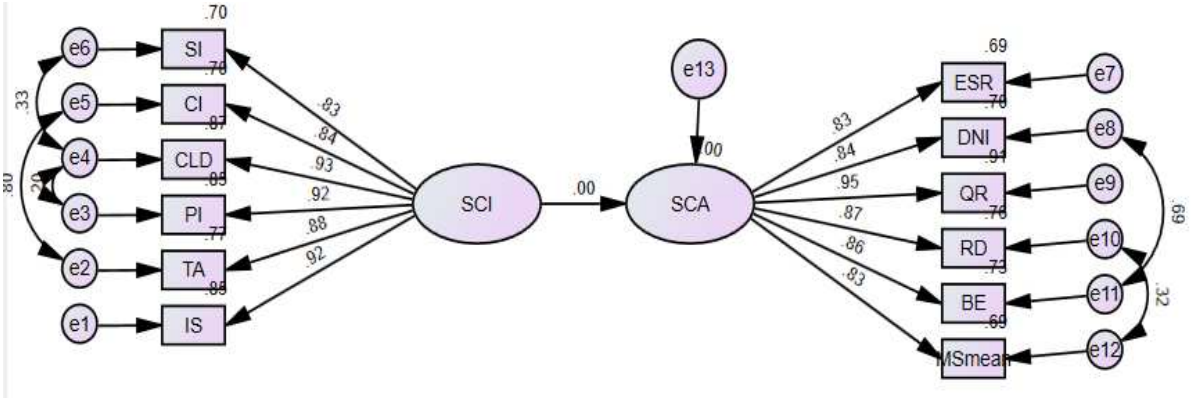


Fig. 6 Structural Equation Model (SEM), Source: AMOS 23, 2025

As presented in Table 5, the structural model exhibited an excellent overall fit to the data (Goretzko et al., 2024; Hair et al., 2025). The absolute fit indices indicated high model adequacy, evidenced by a non-significant chi-square relative to degrees of freedom (x^2/df = 1.352, p = 0.052), minimal residual error (RMR = 0.025), and robust goodness-of-fit values GFI = 0.965; AGFI = 0.943). Furthermore, the incremental fit indices consistently exceeded standard thresholds; NFI = 0.985, RFI = 0.979, IFI = 0.996, TLI = 0.994, and CFI = 0.996. Coupled with a low Root Mean Square Error of Approximation; RMSEA = 0.035, these indices confirm a well-specified structural model that is highly suitable for hypothesis testing.

Table 5 Goodness-of-Fit Indices for the Structural Model

Goodness-of-Fit result										
χ^2/df	**P**	**RMR**	**GFI**	**AGFI**	**NFI**	**RFI**	**IFI**	**TLI**	**CFI**	**RMSEA**
1.352	.052	.025	.965	.943	.985	.979	.996	.994	.996	.035

Source: AMOS data processing, 2025

4.3 Hypotheses Testing

To evaluate the hypothesized relationships, path analysis was performed using a two-tailed test at the 5% significance level (alpha = 0.05), with the results summarized in Table 5. Standard errors, p-values, and Critical Ratios (CR, or t-statistics) were generated using bootstrapping with 5,000 subsamples via the bias-corrected confidence interval method.

The structural path estimates revealed that supply chain integration (SCI) has a positive but statistically insignificant direct effect on SCA (beta = 0.002, CR = 0.033, p = 0.973). Consequently, the primary hypothesis predicting a direct relationship is not supported, aligning with the findings of prior literature (Cao & Zhang, 2011a; Flynn et al., 2010b).

While the direct structural path was non-significant, the measurement model demonstrated robust properties. SCI loaded significantly onto all six of its underlying dimensions (information sharing, technology alignment, process integration, logistics collaboration, customer integration, and supplier integration), confirming its validity as a second-order, multidimensional construct (Liu et al., 2020). Similarly, SCA was strongly explained by its reflective indicators, verifying its multidimensional operationalization. Taken together, these findings indicate that SCI does not directly drive SCA within the studied context, suggesting that the integration-to-performance mechanism may operate through underlying indirect or mediating pathways, such as innovation, operational performance, or relational capabilities.

Table 6 Structural path coefficients and hypothesis testing results

DV		**IV**	**β**	**S.E.**	**C.R.**	**P**	**Result (hypothesis)**
SCA	<---	SCI	.002	.062	.033	.973	Reject (H1)
IS	<---	SCI	1.000				
TA	<---	SCI	.950	.040	23.966	***	Accepted
PI	<---	SCI	.945	.035	26.712	***	Accepted
CLD	<---	SCI	.982	.035	27.760	***	Accepted
CI	<---	SCI	.919	.043	21.211	***	Accepted
SI	<---	SCI	.933	.045	20.890	***	Accepted
ESR	<---	SCA	1.000				
DNI	<---	SCA	1.037	.059	17.676	***	Accepted
QR	<---	SCA	1.146	.053	21.804	***	Accepted
RD	<---	SCA	1.123	.059	18.985	***	Accepted
BE	<---	SCA	1.041	.057	18.365	***	Accepted
MS	<---	SCA	1.047	.060	17.474	***	Accepted

Source: AMOS 23, 2025

5 Discussion

The primary objective of this study was to examine the direct relationship between supply chain integration (SCI) and sustainable competitive advantage (SCA) within the specific context of the Ethiopian food and beverage industry. The structural model analysis revealed an unexpected finding: while SCI functions as a highly valid, robust multidimensional higher-order construct that heavily loads onto all six of its sub-dimensions (supplier, customer, process, logistics, technology, and information integration), its direct path to SCA

was positive but statistically non-significant (beta = 0.002, CR = 0.033, p = 0.973). Consequently, the primary hypothesis proposing a direct positive effect was not supported.

The Paradox of Direct Supply Chain Integration Effects:

This empirical non-significance stands in contrast to classic supply chain literature that argues a streamlined, highly integrated supply chain inherently yields immediate competitive superiorities(Frohlich & Westbrook, 2001). However, it directly echoes an emerging body of critical scholarship indicating that the integration-performance mechanism is far more nuanced and rarely linear(Cao & Zhang, 2011b; Flynn et al., 2010b).

By establishing that SCI does not directly translate into SCA, this study aligns with Flynn et al. (2010), who observed that internal and external connectivity do not automatically secure marketplace advantages unless matched with strategic alignment. In the context of a developing economy like Ethiopia, merely integrating logistics, sharing information, or adopting shared technology platforms with suppliers and customers may serve as a baseline operational necessity a "qualification criteria" or entry ticket to the market rather than a distinct source of long-term sustainability.

Theoretical Interpretation Through the Lens of the Resource-Based View (RBV):

From a resource-based view (RBV) perspective (Barney, 1991), for a capability to generate a sustainable competitive advantage, it must be valuable, rare, imperfectly imitable, and non-substitutable (VRIN). While structural integration across the Ethiopian food and beverage sector optimizes systemic flow, the technologies and process protocols utilized are often commercially available and easily replicated by competitors. Therefore, basic structural connectivity fails to meet the strict criteria of a VRIN resource on its own.

Instead, these findings heavily support the tenets of dynamic capabilities theory (Teece, 2018; Teece et al., 1997). This perspective suggests that supply chain integration behaves as a foundational zero-order operational capability. It provides the infrastructure necessary to communicate and collaborate, but it requires a secondary, transformative mechanism an indirect pathway to generate isolating mechanisms that rivals cannot replicate.

Explaining the Non-Significant Direct Path:

The lack of a direct relationship strongly implies that the value generated by SCI is captured, converted, and transmitted through intermediate organizational variables. In the highly volatile manufacturing sector (food and beverage) of Addis Ababa and Sheger City,

infrastructure deficits, foreign currency shortages, and raw material volatility mean that integration efforts are often consumed by day-to-day firefighting rather than strategic positioning.

Therefore, SCI likely acts as an incubator for other critical competencies:

Innovation Capability: Deep integration and information sharing with customers and suppliers allow firms to sense shifting market trends rapidly, facilitating localized product or packaging innovation that competitors cannot easily copy(Soosay et al., 2008).

Operational Performance: Seamless process and logistics collaboration yield internal efficiencies, cost reductions, and superior quality, which collectively construct the pillars of competitive pricing and brand equity(Sukati et al., 2012).

Relational Capital: The trust and shared long-term visions developed through supplier-customer integration build social capital that buffers the firm from systemic shocks, securing supply chains in volatile regulatory environments(Rosales et al., 2018).

Ultimately, these findings shift the academic discourse surrounding developing economies from asking whether supply chain integration creates a competitive advantage to exploring how and under what conditions it transmits its strategic value.

6 CONCLUSION

Centered on the Ethiopian food and beverage industry, this research analyzed the empirical link between supply chain integration (SCI) and sustainable competitive advantage (SCA). The geographical and sector scope specifically targeted manufacturing enterprises operating within Addis Ababa and Sheger City. By examining this dynamic within a developing East African economy characterized by unique operational bottlenecks, infrastructure deficits, and escalating market competition this research provides critical, context-specific empirical evidence to the broader supply chain literature.

The structural equation modeling results revealed that while SCI functions as a highly robust, multidimensional higher-order construct that strongly governs its constituent dimensions, it does not exert a statistically significant direct effect on SCA. This counterintuitive finding indicates that structural connectivity and information flows alone do not automatically translate into a sustainable marketplace advantage. Instead, the strategic value of SCI is likely captured, converted, and transmitted through underlying indirect pathways and secondary

operational mechanisms, such as enhanced innovation capabilities, heightened operational efficiency, and the accumulation of relational capital.

Consequently, this study offers vital practical and strategic insights for industry managers and policymakers. Rather than viewing supply chain integration as an ultimate objective or a mere administrative checklist, organizations must approach it as a foundational strategic capability. External connectivity must be deliberately aligned with internal capabilities to successfully cultivate long-term competitiveness and corporate sustainability in volatile business environments.

7 RECOMMENDATIONS

Drawing upon the empirical insights generated by this research, the following practical interventions are offered to guide corporate executives, regulatory authorities, and industry practitioners operating within Ethiopia's food and beverage manufacturing ecosystem:

Pivot from Direct Exploitation to Capability Bundling: Since the direct path between supply chain integration (SCI) and sustainable competitive advantage (SCA) was found to be non-significant, managers must stop viewing integration as an independent driver of competitiveness. Instead, firms should explicitly bundle SCI with internal, transformative organizational capabilities. Strategic investments must be directed toward enhancing internal innovation capacity, refining process architectures, and cultivating relational capital. This ensures that the operational efficiencies gained from external connectivity are effectively converted into distinct marketplace advantages.

Prioritize Advanced Digital Infrastructure: To move past baseline operational "firefighting," companies should actively implement robust information systems and digital platforms, such as enterprise resource planning and cloud-based supply chain management modules. These technologies are crucial for standardizing communication, improving downstream/upstream transparency, and facilitating real-time data exchange among supply chain partners thereby laying the operational foundation needed for higher-order strategic planning.

Optimize Multi-Dimensional Integration: While it may not directly yield SCA, structural integration remains a fundamental requirement for market survival. Managers should

continuously optimize coordination across all six identified dimensions specifically targeting supplier integration, customer alignment, and logistics collaboration to minimize transaction costs and buffer the firm against systemic macroeconomic shocks.

Foster Ecosystem-Wide Collaborative Networks: Industry stakeholders and sector associations should spearhead the creation of collaborative institutional networks. By facilitating structured partnerships among manufacturers, agricultural suppliers, local distributors, and third-party logistics providers, the industry can collectively mitigate severe localized bottlenecks, such as raw material volatility and infrastructure deficits, ultimately lifting sector-wide competitiveness.

Implement Targeted Policy Frameworks and Capacity-Building: Policymakers and development institutions should design macro-level interventions tailored to the specific needs of manufacturing hubs in Addis Ababa and Sheger City. This includes upgrading technological infrastructure, streamlining trade logistics regulations, and sponsoring capacity-building programs focused on supply chain coordination and technological adoption. Such institutional support is essential for improving the overall productivity, resilience, and long-term sustainability of the Ethiopian food and beverage industry.

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Authors contribution:

- Kumala Tolessa: Conceptualization, methodology, formal analysis, original draft preparation, and writing.
- Professor Zerihun Ayenew**:** Methodology, review, editing, and final manuscript approval.
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Data availability

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declaration:

Competing Interest

The authors declare that they have no competing interests.

Consent to participate

Informed consent was verbally obtained from all individual respondents prior to data collection, and all participants voluntarily agreed to participate in the study.

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