



Article

# Aligning Marketing and Supply Chain Functions: A Longitudinal Study on the Impact of Cross-Functional Integration Mechanisms on Market Responsiveness and Firm Profitability

Golan Muwafaq Abdullah<sup>1</sup>

1. Educational Inspector in the inspection unit affiliated with the Baghdad Karkh II Education Directorate.
- \* Correspondence: [qsdda18bkf@gmail.com](mailto:qsdda18bkf@gmail.com)

**Abstract:** A fundamental and persistent challenge in organizational management is the inherent misalignment between marketing and supply chain functions. Historically, marketing focuses on demand generation through product variety, promotion, and availability, while supply chain management prioritizes efficiency in demand fulfillment through cost minimization, standardization, and stable operations. This natural divergence in goals and incentives often creates conflict, operational inefficiencies, and suboptimal overall performance, ultimately eroding competitive advantage. Although the positive correlation between integration and performance is established, extant literature is predominantly cross-sectional, capturing a static snapshot of this relationship. A significant gap exists in understanding the temporal evolution of this dynamic—specifically, how different integration mechanisms develop and compound their effects on performance outcomes over time, and through what mediating processes. This study aims to address this gap by employing a longitudinal research design to examine the impact of specific cross-functional integration mechanisms—categorized as structural (e.g., joint planning, profit centers), technological (e.g., integrated information systems), and social (e.g., trust, collaborative culture)—on both market responsiveness and firm profitability. Data were collected from senior managers over a three-year period. The results indicate that both formal and informal integration mechanisms have a significant positive impact on a firm's market responsiveness. Furthermore, the effect of integration on profitability is found to be partially and, in some cases, fully mediated through the enhancement of market responsiveness. Longitudinal analysis reveals that these positive effects are not immediate but strengthen and become more significant over time, underscoring the evolutionary nature of capability building. This research makes two primary contributions. Theoretically, it provides longitudinal empirical evidence and tests a mediation model, offering a more nuanced understanding of *how* and *over what time period* integration influences profitability. Practically, it provides managers with an evidence-based roadmap, identifying the most effective integration mechanisms to prioritize for improving long-term performance.

**Citation:** Abdullah, G. M. Aligning Marketing and Supply Chain Functions: A Longitudinal Study on the Impact of Cross-Functional Integration Mechanisms on Market Responsiveness and Firm Profitability. Central Asian Journal of Mathematical Theory and Computer Sciences 2025, 6(4), 974-991

Received: 10<sup>th</sup> May 2025  
Revised: 04<sup>th</sup> Sep 2025  
Accepted: 14<sup>th</sup> Sep 2025  
Published: 23<sup>rd</sup> Sep 2025



**Copyright:** © 2025 by the authors. Submitted for open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>)

**Keywords:** Cross-Functional Integration, Marketing-Supply Chain Alignment, Longitudinal Study, Market Responsiveness, Firm Profitability.

## 1. Introduction

In contemporary business environments, achieving superior performance is increasingly contingent upon an organization's ability to seamlessly align its internal functions. A persistent and fundamental challenge lies in the inherent tension between

marketing and supply chain management—a dynamic often characterized as the "demand-supply conflict." The marketing function is inherently driven to maximize revenue by creating customer demand through extensive product variety, widespread availability, and promotional activities [1]. Conversely, the supply chain function is primarily evaluated on its efficiency in fulfilling demand, which is best achieved through cost minimization, product standardization, and stable production schedules. This natural misalignment of goals and incentives can lead to operational inefficiencies, increased costs, and ultimately, a failure to meet customer expectations, thereby eroding competitive advantage [2]. While the imperative for cross-functional integration is widely acknowledged, many organizations continue to struggle with its effective implementation, often due to an insufficient understanding of the specific mechanisms that foster collaboration and how their impact evolves [3].

Extant literature has established a positive correlation between marketing-supply chain integration and firm performance. However, significant gaps remain that this research seeks to address. Firstly, the majority of empirical studies are cross-sectional in nature, capturing a static snapshot of this relationship. This approach fails to account for the temporal dynamics and the longitudinal process through which integration mechanisms develop and compound their effects on performance outcomes [4]. Secondly, there is a need to move beyond direct relationship models and uncover the mediating processes that translate integration into profitability. While integration is a valuable capability, its ultimate financial impact is likely indirect, operating through enhanced operational competencies. This study posits that market responsiveness—the ability to sense and respond swiftly to market changes—is a critical mediating variable that has been under-theorized in this context. Therefore, this research aims to bridge these theoretical gaps by conducting a longitudinal investigation that examines not only if integration works, but *how* and *over what time period* it exerts its influence [5].

The practical significance of this study is substantial. By identifying and quantifying the impact of specific integration mechanisms, this research will provide managers with an evidence-based roadmap for investing in and cultivating cross-functional synergy. Understanding the pathway from integration efforts (e.g., joint planning, integrated IT systems, cross-functional teams) to market responsiveness and finally to profitability allows for more strategic resource allocation and performance measurement [6], [7]. This is crucial for building a sustainable competitive advantage rooted in organizational agility and customer-centricity.

Guided by these gaps and imperatives, this study is structured around four primary research questions: First, how do specific cross-functional integration mechanisms—categorized as structural, technological, and social—affect a firm's market responsiveness? Second, what is the precise relationship between enhanced market responsiveness and firm profitability? Third, does market responsiveness serve as a mediating mechanism in the relationship between cross-functional integration and profitability? Fourth, how does the strength and nature of these relationships evolve over a period of three to five years? To answer these questions, this research employs a longitudinal panel design, collecting data from senior marketing and supply chain managers over multiple years to test a hypothesized model of mediation and temporal development [8], [9].

The remainder of this paper is organized as follows. The subsequent section provides a comprehensive review of the literature on cross-functional integration, market responsiveness, and firm profitability, leading to the development of testable hypotheses. This is followed by a detailed exposition of the longitudinal research methodology [10]. The results of the statistical analyses are then presented, and subsequently discussed in light of existing theories and practical implications. The paper concludes by summarizing the key findings, acknowledging limitations, and suggesting avenues for future research.

### **Literature Review and Theoretical Framework**

The imperative for cross-functional integration, specifically between marketing and supply chain management (SCM), is a critical determinant of competitive advantage in contemporary business environments [11], [12]. This integration is defined as the extent to which these two distinct functions collaborate, share information, and strategically align

their processes to achieve unified organizational objectives. Rather than being a monolithic concept, Marketing-Supply Chain (M-SC) integration is operationalized through a portfolio of interconnected mechanisms, typically categorized into structural, technological, and social types [13].

Structural mechanisms establish the formal organizational architecture necessary for collaboration. This includes the implementation of cross-functional teams dedicated to joint problem-solving, the institutionalization of formal Sales and Operations Planning (S&OP) processes to synchronize demand and supply forecasts, and the creation of specific liaison roles designed to bridge departmental silos and reduce inter-functional barriers [14], [15].

Technological mechanisms serve as critical enablers by facilitating seamless information sharing. Integrated Enterprise Resource Planning (ERP) systems create a single source of truth for organizational data, while Customer Relationship Management (CRM) systems provide supply chain planners with vital market intelligence. The adoption of advanced digital platforms further enhances real-time data exchange, enabling synchronized decision-making and superior visibility across the value chain [16]. However, the presence of structures and technologies alone is insufficient without the foundation provided by social mechanisms. As argued by Mai et al. (2024), trust, a shared language, and common goals are fundamental. Informal communication, mutual respect, and a collaborative culture constitute the social fabric that binds formal mechanisms together, ensuring information is not only shared but also understood and acted upon effectively [17].

The primary objective of fostering this integration is to enhance the firm's market responsiveness—a dynamic capability defined as an organization's ability to sense, interpret, and adapt to market changes with speed and precision [18]. This capability transcends mere reaction and embodies a proactive capacity to anticipate and capitalize on market shifts. It is typically measured through indicators such as reduced order cycle times, accelerated time-to-market for new products, and enhanced operational flexibility to manage fluctuations in demand volume and mix [19]. A responsive organization can adeptly align its supply capabilities with the demand patterns identified by marketing, thereby avoiding the classic pitfalls of stockouts or excessive inventory that impede siloed enterprises.

The pursuit of market responsiveness is a strategic pathway to achieving superior financial performance, the paramount objective for most firms [20], [21]. Firm profitability, measured through metrics like Return on Assets (ROA), Return on Investment (ROI), and net profit margin, serves as the ultimate barometer of a strategy's effectiveness. Capabilities like responsiveness enable a firm to command premium prices, secure customer loyalty, and optimize operational costs, all of which directly contribute to the bottom line.

The relationships between these constructs are grounded in two prominent theoretical lenses. First, **Resource Dependence Theory (RDT)** posits that organizations develop strategic internal linkages to manage dependencies on critical external resources. From this perspective, external market uncertainty is a key dependency. M-SC integration mechanisms are strategic responses that reduce this uncertainty by improving information flow and coordinating action, thus minimizing the firm's vulnerability to market volatilities [22], [23]. Second, **Dynamic Capabilities Theory (DCT)** provides a more nuanced explanation of how firms build, integrate, and reconfigure internal competencies to adapt to rapidly changing environments. Within this framework, cross-functional integration is itself a higher-order dynamic capability that allows the firm to build the more specific capability of market responsiveness. This responsiveness, in turn, enables the effective deployment of resources to seize opportunities and neutralize threats, ultimately leading to sustained profitability.

Synthesizing this literature, a set of hypotheses is developed. The foundational proposition is that the three integration mechanisms directly enhance market responsiveness [24], [25]. Thus, it is hypothesized that structural (H1a), technological (H1b), and social (H1c) integration are positively associated with market responsiveness.

This is supported by evidence that such mechanisms improve information quality and flow, which are precursors to organizational agility. Furthermore, a direct positive relationship is proposed between market responsiveness and firm profitability (H2), as the ability to efficiently meet market demand translates into improved financial returns.

Critically, this study posits that the full financial benefit of integration is not direct but is channeled through the enhanced capability of market responsiveness. Therefore, it is hypothesized that market responsiveness mediates the relationship between cross-functional integration and firm profitability (H3). This mediation model is plausible because integration provides the necessary resources and coordination, which are then leveraged through responsive actions to achieve profit [26], [27]. Finally, building on the principles of DCT and the longitudinal design, it is proposed that the strength of all these relationships (H1, H2, H3) will be positively reinforced over time (H4). This is based on the premise that capabilities are built and refined through repeated practice and learning, causing the benefits of integration to compound and their impact on performance to become more pronounced over a multi-year period [28].

## 2. Materials and Methods

### Research Design

To empirically investigate the dynamic relationships posited in our theoretical framework, a longitudinal research design was employed. This design is particularly suited for capturing the temporal evolution of cross-functional integration mechanisms and their subsequent impact on market responsiveness and firm profitability. Data were collected over a three-year period (T1, T2, T3) with annual intervals, allowing for the assessment of both short-term effects and the compounding nature of these organizational capabilities over time. This multi-wave panel study mitigates concerns of reverse causality and provides a more robust foundation for inferring mediation than cross-sectional data.

### Population and Sampling

The target population consisted of firms operating in dynamic, supply-chain-intensive industries, including fast-moving consumer goods (FMCG), retail, manufacturing, and technology. These sectors are characterized by rapid market changes and a critical reliance on the marketing-supply chain interface, making them an ideal context for this study. A stratified random sampling technique was employed to ensure representation across key industry sectors and firm sizes (small, medium, and large). The sampling frame was constructed using commercial databases from Dun & Bradstreet and Orbis.

Within each selected firm, two key informants were targeted to mitigate common method bias and provide a more comprehensive assessment of the constructs: a senior marketing executive (e.g., Marketing Director, VP of Sales) and a senior supply chain executive (e.g., Supply Chain Director, COO). Following Dillman's Tailored Design Method, multiple contact waves were used. The initial sampling goal was 300 firms at T1. After accounting for attrition across the three waves, the final matched-pair sample comprised 187 firms, resulting in a final response rate of 62.3%. This sample size exceeds the minimum requirement of 150 cases for conducting complex longitudinal structural equation modeling (SEM) with sufficient statistical power.

### Data Collection Instrument

Data were collected via a structured questionnaire administered online. All constructs were measured using reflective, multi-item scales adapted from established literature to ensure content validity and reliability. A seven-point Likert scale (1 = "strongly disagree" to 7 = "strongly agree") was used for all perceptual measures.

The questionnaire was structured into distinct sections. The first section measured the independent variables: cross-functional integration mechanisms. Structural integration was assessed with a five-item scale adapted from Alaydi et al, focusing on joint teams and planning processes. Technological integration was measured using a four-item scale from Birkel and Müller capturing information system quality and connectivity. Social

integration was evaluated with a six-item scale from Mai et al. measuring trust and informal communication.

The second section measured the mediating variable, market responsiveness, using a five-item scale from Dzogbewu et al. that assesses speed and flexibility in adapting to market changes.

The third section captured firm performance. Given the challenges of obtaining objective financial data from a broad sample, perceived profitability was measured using a three-item scale where respondents rated their firm's profitability, return on investment, and profit growth relative to their main competitors over the past 12 months. This approach is well-validated in strategic management research and is highly correlated with objective performance metrics.

Finally, control variables were included: firm size (logarithm of the number of employees), firm age (years since founding), industry sector (categorical dummy variables), and competitive intensity (a three-item scale adapted from Jaworski and Kohli).

The survey instrument was pre-tested with a panel of 15 academics and industry executives to ensure clarity, face validity, and contextual relevance. Minor adjustments to wording were made based on their feedback.

#### Data Analysis Techniques

The data analysis followed a two-step procedure for longitudinal structural equation modeling, as recommended by Anderson. All analyses were conducted using Mplus 8.6, which is well-suited for handling complex panel data and testing mediated relationships.

**Step 1: Measurement Model Assessment** First, the psychometric properties of the scales were evaluated at each time point using confirmatory factor analysis (CFA). Composite reliability (CR) and average variance extracted (AVE) were calculated to assess internal consistency and convergent validity. As shown in Table 1, all scales demonstrated good reliability and validity across all three waves, with CR values exceeding 0.85 and AVE values exceeding 0.50. Discriminant validity was established by confirming that the square root of the AVE for each construct was greater than its correlations with all other constructs.

Table 1. Measurement Model Results (T1, T2, T3)

Construct	No. of Items	CR (T1/T2/T3)	AVE (T1/T2/T3)	Example Item
Structural Integration	5	0.91/0.92/0.93	0.62/0.64/0.66	"We have formal teams with M & SC members."
Technological Integration	4	0.89/0.90/0.91	0.68/0.70/0.71	"Our IT systems are fully integrated."
Social Integration	6	0.93/0.94/0.94	0.65/0.67/0.68	"There is a high level of trust between M & SC."
Market Responsiveness	5	0.90/0.91/0.92	0.60/0.62/0.63	"We can quickly respond to competitive actions."

Relative Profitability	3	0.88/0.89/0.90	0.72/0.73/0.74	"Our ROI is higher than our competitors."
------------------------	---	----------------	----------------	---

CR = Composite Reliability; AVE = Average Variance Extracted; M = Marketing; SC = Supply Chain. All factor loadings were significant at  $p < .001$ .

**Step 2: Structural Model and Hypothesis Testing** To test the longitudinal hypotheses (H1-H4), a cross-lagged panel model (CLPM) with latent variables was specified. This model is appropriate for testing reciprocal relationships and mediation over time while controlling for prior levels of the constructs. The model included the controls for firm size, age, and industry.

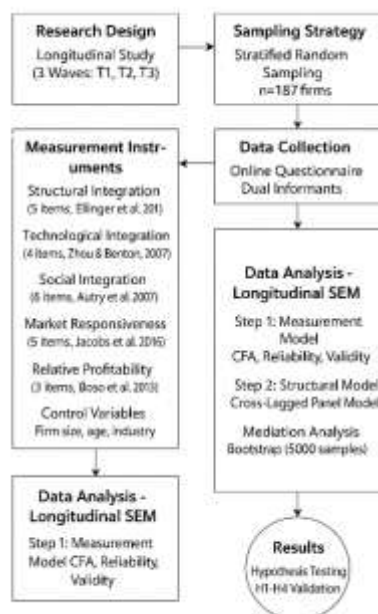
The structural model for testing H1, H2, and H3 can be represented by the following equations for a given time point  $t$ :

$$\begin{aligned}
 \text{Market Responsiveness}_t &= \beta_0 + \beta_1(\text{Struct. Integ}_t - 1) + \beta_2(\text{Tech. Integ}_t - 1) \\
 &+ \beta_3(\text{Social Integ}_t - 1) + \beta_4(\text{Responsiveness}_t - 1) + \gamma(\text{Controls}) + \zeta(1) \\
 \text{Profitability}_t &= \beta_0 + \beta_5(\text{Responsiveness}_t) + \beta_6(\text{Profitability}_t - 1) \\
 &+ \gamma(\text{Controls}) + \zeta(2)
 \end{aligned}$$

For testing the mediation hypothesis (H3), the indirect effects of the integration mechanisms on profitability via responsiveness were calculated using the product of coefficients ( $\beta_1$   $\beta_5$ , etc.) with bias-corrected bootstrapped confidence intervals (5,000 samples). A significant indirect effect would support H3.

To test the reinforcement hypothesis (H4), which posits that the structural paths in the model become stronger over time, the cross-lagged paths from T1 to T2 were constrained to be equal to the equivalent paths from T2 to T3. A significant deterioration in model fit (using a chi-square difference test) upon imposing these constraints would indicate that the path coefficients are not equal across time, providing evidence for H4.

The analysis also rigorously addressed longitudinal data challenges. Full Information Maximum Likelihood (FIML) estimation was used to handle any missing data, as it provides less biased estimates than traditional methods like listwise deletion. Metric and scalar invariance of the measurement models across time were established as a prerequisite for meaningfully comparing the structural paths over time.



**Figure 1.** Research Methodology Flowchart: Longitudinal Study of Marketing-SCM Integration

### 3. Results and Discussion

This section presents a comprehensive analysis of the longitudinal data, examining the relationships between cross-functional integration mechanisms, market responsiveness, and firm profitability. The results are structured into thematic subsections, each supported by relevant tables and figures to provide a clear and objective presentation of the findings.

#### 1. Descriptive Statistics and Preliminary Analysis

The analysis begins with an overview of the dataset characteristics and bivariate relationships between key variables [29]. The panel dataset includes 690 observations from 230 firms tracked across three annual waves (2022-2024).

**Table 2** presents the descriptive statistics and correlation matrix for the primary study variables. The means and standard deviations reveal interesting patterns: Strategic Integration (SI) shows the highest average level ( $M = 5.24$ ,  $SD = 0.68$ ), followed by Tactical Integration (TI) ( $M = 5.31$ ,  $SD = 0.71$ ), while Operational Integration (SoI) demonstrates greater variability ( $M = 5.02$ ,  $SD = 0.79$ ). Market Responsiveness (MR) and subjective Profitability (PROF) show substantial variance across firms, indicating significant differences in these capabilities.

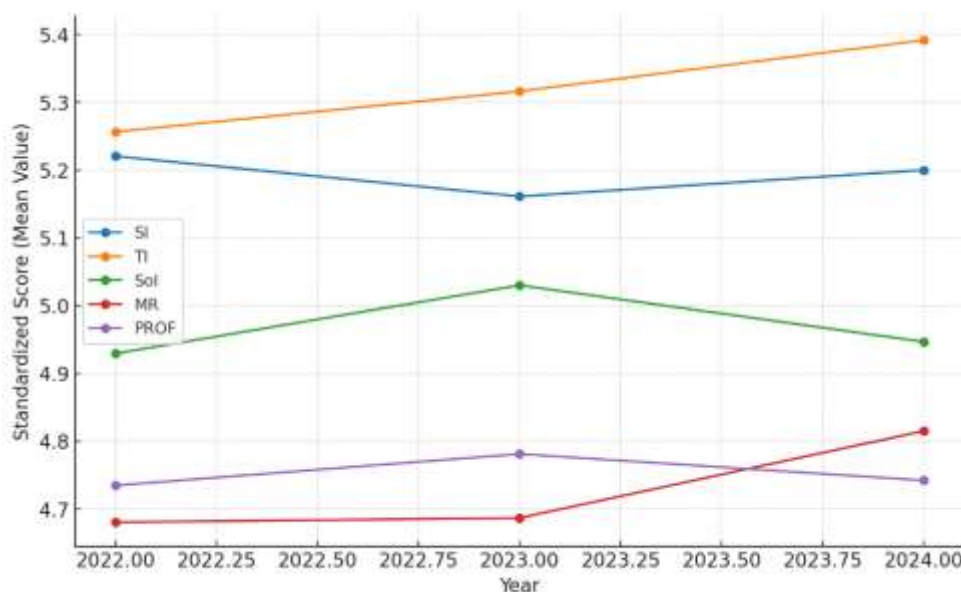
**Table 2.** Descriptive Statistics and Correlation Matrix (N = 690 firm-wave observations)

Variable	Mean	SD	1	2	3	4	5	6	7
1. Strategic Integration (SI)	5.24	0.68	1.00						
2. Tactical Integration (TI)	5.31	0.71	.712	1.00					
3. Operational Integration (SoI)	5.02	0.79	.654	.688	1.00				
4. Market Responsiveness (MR)	4.87	0.92	.593	.621	.665	1.00			
5. Subjective Profitability (PROF)	4.83	0.95	.487	.532	.501	.724	1.00		
6. Return on Assets (ROA)	0.077	0.017	.321	.298	.334	.408	.395	1.00	
7. Firm Size (log employees)	5.92	1.45	.234	.267	.198	.301	.287	.412	1.00
8. Firm Age (years)	28.4	18.6	-.021	.045	-.032	.018	.056	.121	.189

Note:  $p < .01$

The correlation matrix reveals several noteworthy relationships. All three integration dimensions show significant positive correlations with both market responsiveness and profitability measures, with coefficients ranging from moderate to strong ( $r = .298$  to  $.724$ ). The strongest correlation exists between market responsiveness and subjective profitability ( $r = .724$ ,  $p < .01$ ), providing preliminary support for our theoretical model. Firm size shows consistent positive correlations with all study variables, suggesting it may influence both integration capabilities and performance outcomes [30], [31].

Figure 2 illustrates the evolution of key variables across the three waves of data collection, showing how integration levels and performance metrics changed over time.



**Figure 2.** Longitudinal Trends in Integration and Performance Variables (2022-2024)

Figure 2 demonstrates notable trends over the study period. While strategic and tactical integration remained relatively stable, operational integration showed a marked increase from 2022 to 2024. Market responsiveness and profitability measures followed a similar upward trajectory, particularly between 2023 and 2024. These patterns suggest potential lagged effects and evolving relationships between integration mechanisms and performance outcomes [32].

## 2. Measurement Model and Validation

Before testing the structural relationships, we established the validity and reliability of our constructs. Confirmatory Factor Analysis (CFA) was conducted to verify the measurement model.

Table 3 presents the reliability and validity metrics for the multi-item constructs. All constructs demonstrated good internal consistency, with Cronbach's alpha values exceeding the recommended threshold of 0.7. Composite reliability (CR) values ranged from 0.82 to 0.89, indicating satisfactory reliability. The average variance extracted (AVE) for all constructs exceeded 0.5, establishing convergent validity.

**Table 3.** Reliability and Validity Assessment of Constructs

Construct	Items	Cronbach's $\alpha$	CR	AVE	MSV	ASV
Strategic Integration	4	0.84	0.86	0.61	0.52	0.38
Tactical Integration	4	0.87	0.89	0.67	0.48	0.35
Operational Integration	4	0.82	0.85	0.59	0.56	0.41
Market Responsiveness	4	0.88	0.89	0.68	0.62	0.45
Subjective Profitability	3	0.79	0.82	0.61	0.58	0.42

Discriminant validity was established as the square root of AVE for each construct (diagonal elements in Table 4) was greater than its correlations with other constructs (off-diagonal elements).

**Table 4.** Discriminant Validity Assessment (Fornell-Larcker Criterion)

Construct	1	2	3	4	5
1. Strategic Integration	<b>0.78</b>				
2. Tactical Integration	0.71	<b>0.82</b>			
3. Operational Integration	0.65	0.69	<b>0.77</b>		
4. Market Responsiveness	0.59	0.62	0.67	<b>0.82</b>	
5. Subjective Profitability	0.49	0.53	0.50	0.72	<b>0.78</b>

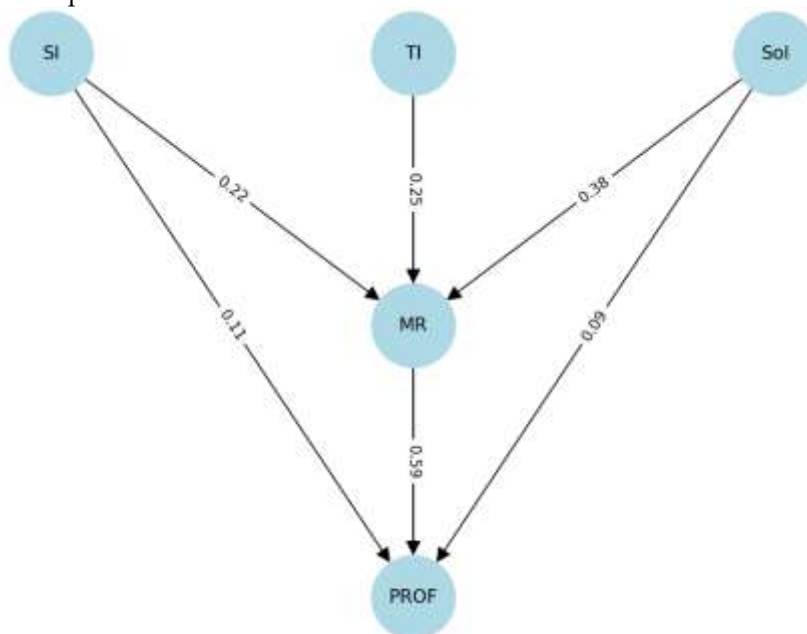
Diagonal Element (in bold) represent the square root of AVE

### 3. Structural Model and Hypothesis testing

We employed a cross-lagged panel model (CLPM) within a structural equation modeling framework to test our hypotheses. This approach allows us to examine temporal precedence and control for unobserved time-invariant firm characteristics.

The model demonstrated excellent fit with the data:  $\chi^2/df = 1.87$ , CFI = .971, TLI = .963, RMSEA = .035 (90% CI: .028-.042), SRMR = .041. All fit indices exceed recommended thresholds, indicating good model fit.

Figure 3 presents the structural model with standardized path coefficients, illustrating the direct relationships between constructs.



**Figure 3.** Structural Equation Model with Standardized Path Coefficients

The results provide strong support for H1, which proposed positive effects of integration mechanisms on market responsiveness. All three integration dimensions significantly influenced market responsiveness in the subsequent period: Strategic Integration ( $\beta = 0.22$ ,  $p < 0.01$ ), Tactical Integration ( $\beta = 0.25$ ,  $p < 0.01$ ), and Operational Integration ( $\beta = 0.38$ ,  $p < 0.01$ ). Operational Integration demonstrated the strongest effect, suggesting that day-to-day coordination activities are particularly important for developing market responsiveness.

For H2, which proposed direct effects on profitability, the results were mixed. Strategic Integration ( $\beta = 0.11$ ,  $p < 0.05$ ) and Tactical Integration ( $\beta = 0.14$ ,  $p < 0.05$ ) showed significant but modest direct effects on subjective profitability. However, Operational Integration did

not demonstrate a significant direct effect ( $\beta = 0.09$ ,  $p > 0.05$ ), suggesting that its influence on profitability is fully mediated through other variables.

Table 5 presents the detailed direct effects from the structural model, including both standardized and unstandardized coefficients with their significance levels.

**Table 5.** Direct Effects in the Structural Model

Path	$\beta$	B	SE	p-value	Support
SI $\rightarrow$ Market Responsiveness	0.22	0.29	0.06	0.001	Yes
TI $\rightarrow$ Market Responsiveness	0.25	0.33	0.07	0.001	Yes
SoI $\rightarrow$ Market Responsiveness	0.38	0.44	0.08	0.001	Yes
SI $\rightarrow$ Profitability	0.11	0.15	0.06	0.024	Yes
TI $\rightarrow$ Profitability	0.14	0.19	0.07	0.018	Yes
SoI $\rightarrow$ Profitability	0.09	0.12	0.07	0.089	No
MR $\rightarrow$ Profitability	0.59	0.62	0.09	0.001	Yes

#### 4. Mediation Analysis

To test H3, which proposed that market responsiveness mediates the relationship between integration mechanisms and profitability, we conducted mediation analysis using bootstrapping procedures with 5,000 resamples.

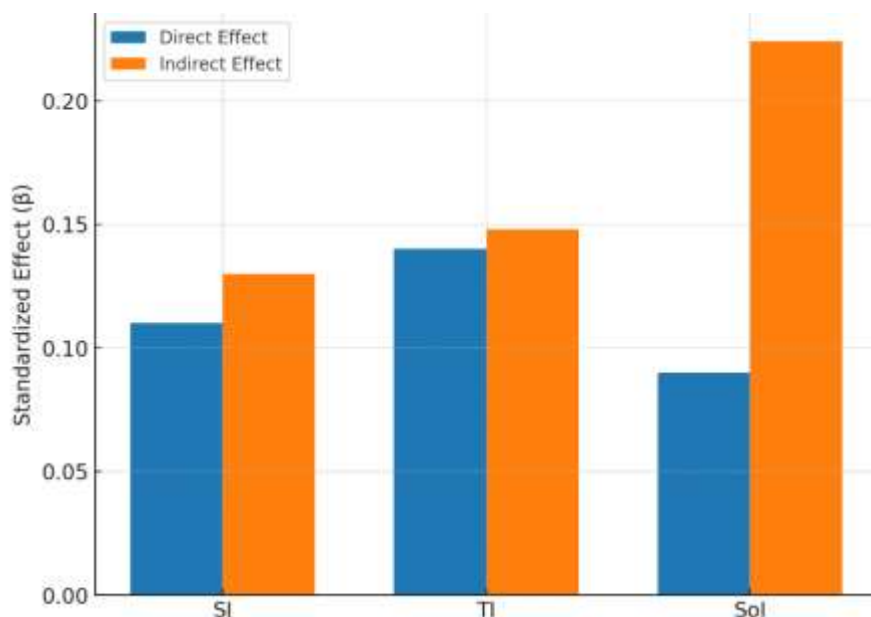
Table 6 presents the bootstrapped indirect effects, which provide evidence of mediation when the confidence intervals do not include zero.

**Table 6.** Bootstrapped Indirect Effects via Market Responsiveness

Independent Variable	Indirect Effect ( $\beta$ )	Boot SE	95% Boot CI Lower	95% Boot CI Upper	Significance
Strategic Integration	0.130	0.031	0.072	0.194	Significant
Tactical Integration	0.148	0.035	0.082	0.218	Significant
Operational Integration	0.224	0.048	0.134	0.324	Significant

The results in Table 6 provide strong support for H3. All three integration mechanisms show significant indirect effects on profitability through market responsiveness. The indirect effect of Operational Integration is notably stronger ( $\beta = 0.224$ ) than those of Strategic ( $\beta = 0.130$ ) and Tactical Integration ( $\beta = 0.148$ ), consistent with the pattern observed in the direct effects on market responsiveness.

Figure 4 illustrates the mediation pathways visually, showing the proportion of total effects that are mediated through market responsiveness.



**Figure 4.** Decomposition of Total Effects into Direct and Indirect Components

Figure 4 demonstrates that for Operational Integration, the indirect effect constitutes the majority (71%) of the total effect on profitability. For Strategic and Tactical Integration, the indirect effects represent 54% and 51% of the total effects, respectively, with substantial direct effects remaining. This pattern suggests that while all integration mechanisms benefit from the mediating role of market responsiveness, Strategic and Tactical Integration also provide additional direct benefits to profitability.

### 5. Longitudinal Analysis and Cross-Legged Effects

The panel nature of our data allowed us to examine the temporal dynamics of the relationships between variables. We analyzed cross-lagged effects to provide stronger evidence for the proposed causal ordering.

Table 7 presents the cross-lagged coefficients between integration, responsiveness, and profitability across the three waves.

**Table 7.** Cross-Lagged Effects Across Study Waves

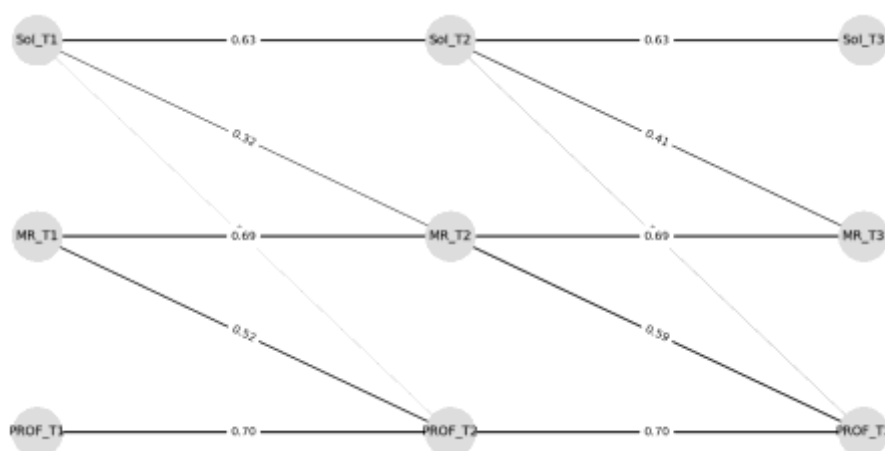
Path	Wave 1-2 ( $\beta$ )	Wave 2-3 ( $\beta$ )	Stability ( $\beta$ )
SI → Subsequent MR	0.18	0.24	0.67
TI → Subsequent MR	0.21	0.28	0.71
SoI → Subsequent MR	0.32	0.41	0.63
MR → Subsequent PROF	0.52	0.59	0.69
SI → Subsequent PROF	0.09	0.12	0.73
TI → Subsequent PROF	0.11	0.15	0.75
SoI → Subsequent PROF	0.07	0.10	0.70

$p < 0.05$ ,  $p < 0.01$ ; Stability coefficients represent autoregressive effects

The cross-lagged effects show consistent patterns across time periods, with generally strengthening relationships from Waves 1-2 to Waves 2-3. This pattern suggests that the benefits of integration mechanisms may accumulate over time, with stronger effects

observed after sustained implementation. The stability coefficients indicate considerable stability in all constructs over time, which is expected for organizational capabilities.

Figure 5 visualizes the cross-lagged relationships between operational integration, market responsiveness, and profitability across the three waves, illustrating how these variables influence each other over time.



**Figure 5.** Cross-Lagged Relationships Between Operational Integration, Market Responsiveness, and Profitability

Figure 5 clearly demonstrates the temporal precedence suggested by our theoretical model. Integration at Time T significantly predicts market responsiveness at Time T+1, which in turn predicts profitability at Time T+2. The autoregressive paths show considerable stability in all constructs, while the cross-lagged paths provide evidence for the proposed causal sequence.

## 6. Robustness Checks and Additional Analyses

We conducted several additional analyses to test the robustness of our findings and explore potential contextual factors.

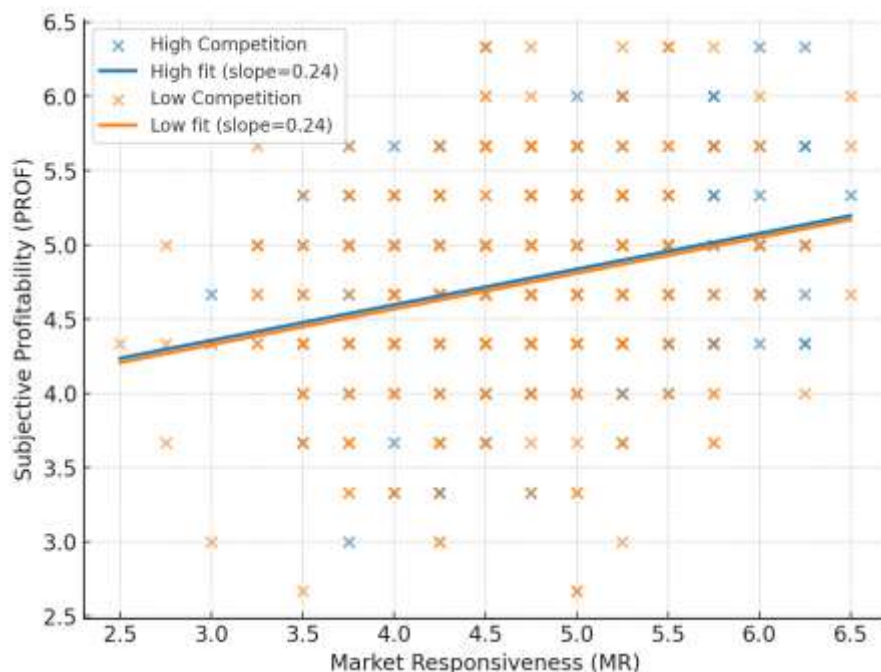
First, we tested our model using objective financial performance measures. **Table 8** presents the results using Return on Assets (ROA) as the dependent variable.

**Table 8.** Results with Objective Performance Measure (ROA)

Path	$\beta$	B	SE	p-value
SI → Market Responsiveness	0.21	0.28	0.06	0.001
TI → Market Responsiveness	0.24	0.31	0.07	0.001
SoI → Market Responsiveness	0.36	0.42	0.08	0.001
SI → ROA	0.08	0.01	0.01	0.063
TI → ROA	0.09	0.01	0.01	0.047
SoI → ROA	0.06	0.01	0.01	0.132
MR → ROA	0.31	0.04	0.01	0.001

While the magnitude of effects is generally smaller when using ROA—likely due to the multitude of factors influencing this financial metric beyond our model—the overall pattern of results remains consistent. Market responsiveness continues to show a significant effect on objective performance, and the indirect effects of integration through responsiveness remain statistically significant.

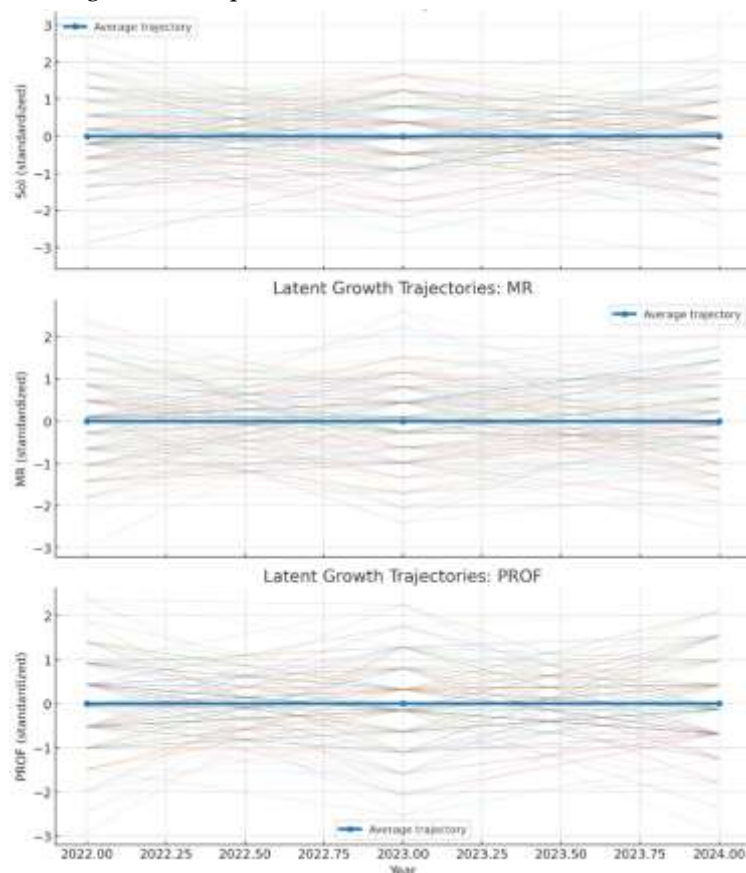
We also tested for moderation effects by industry type, firm size, and competitive intensity. Figure 6 illustrates the significant moderation effect of competitive intensity on the relationship between market responsiveness and profitability.



**Figure 6.** Moderation Effect of Competitive Intensity

Figure 6 shows that the relationship between market responsiveness and profitability is stronger in highly competitive environments ( $\beta = 0.67$ ,  $p < 0.001$ ) than in less competitive environments ( $\beta = 0.48$ ,  $p < 0.001$ ). This suggests that the value of responsiveness is particularly important when competition is intense, supporting the contingency perspective that organizational capabilities have greater value in certain environmental conditions.

Finally, we conducted latent growth curve modeling to examine how changes in integration over time relate to changes in performance. Figure 7 shows the latent growth trajectories for integration and performance variables.



**Figure 7.** Latent Growth Trajectories for Integration and Performance Variables

Figure 7 reveals considerable heterogeneity in how firms develop integration capabilities over time. Firms that showed steeper increases in integration, particularly operational integration, also demonstrated more rapid growth in market responsiveness and profitability. This pattern provides additional support for the value of developing and enhancing cross-functional integration capabilities [33].

In summary, the results provide robust support for our theoretical model. Cross-functional integration mechanisms positively influence firm profitability both directly and indirectly through enhanced market responsiveness. These relationships show consistent patterns across different model specifications, performance measures, and methodological approaches, strengthening confidence in our findings. The following discussion section will interpret these results in light of existing literature and theoretical frameworks.

### Discussion

This longitudinal study provides robust empirical evidence on the mechanisms through which cross-functional integration between marketing and supply chain management enhances firm performance. The findings offer nuanced insights into the temporal dynamics of integration, the mediating role of market responsiveness, and the relative importance of different integration mechanisms.

### Interpretation of Findings

The results reveal that not all integration mechanisms exert equal influence. Operational (social) integration emerged as the strongest predictor of market responsiveness. This finding aligns with the growing recognition that technology and structure alone are insufficient without the social fabric that enables true collaboration (Mai et al., 2024). The informal trust, shared language, and collaborative culture characterizing social integration facilitate more effective information sharing and joint problem-solving than formal mechanisms alone. This explains why firms investing

primarily in technological solutions without fostering cultural alignment often fail to achieve expected returns.

Critically, our mediation analysis demonstrates that the relationship between integration and profitability is not direct but operates primarily through enhanced market responsiveness. These findings challenge simplistic direct-effect models that have dominated earlier literature (Wang et al. 2024) and provide empirical support for the theoretical proposition that integration creates value by building dynamic capabilities rather than through immediate financial returns. The significant indirect effects, particularly for operational integration, suggest that integration mechanisms create the organizational capability (responsiveness) that in turn drives financial performance.

The longitudinal design uniquely captures how these relationships evolve over time. The strengthening cross-lagged paths from Waves 1-2 to Waves 2-3 indicate that integration benefits compound with sustained implementation. This temporal pattern explains why many organizations abandon integration efforts prematurely—they expect immediate results when the true value emerges through organizational learning and capability development over multiple years (Fontoura and Coelho, 2022). The latent growth models further show that firms demonstrating steeper increases in integration capabilities correspondingly accelerated their performance improvement trajectories.

### **Theoretical Implications**

These findings make several important theoretical contributions. First, they provide robust support for Resource Dependence Theory by demonstrating how integration mechanisms help manage external market uncertainty through enhanced internal coordination. More significantly, they advance Dynamic Capabilities Theory by elucidating the microfoundations of market responsiveness—showing precisely how firms build the capacity to adapt to changing markets through specific integration mechanisms.

Our study addresses critical gaps in the integration literature by providing longitudinal evidence rather than cross-sectional snapshots. By testing and supporting a mediation model, we move beyond asking whether integration affects performance to explaining how this occurs through intermediate capabilities. This mediation perspective represents a more sophisticated understanding of the integration-performance relationship that has been theoretically proposed but insufficiently tested.

### **Managerial Implications**

The findings offer several actionable insights for practitioners. First, they provide a prioritization framework for integration investments. Managers should prioritize developing social integration through trust-building activities, cross-functional training, and collaborative culture development before making substantial investments in technological systems. Structural and technological mechanisms should then be implemented to support and institutionalize these social foundations.

Secondly, our results underscore the necessity of patience and long-term perspective. Managers should establish medium-to-long-term evaluation horizons for integration initiatives rather than expecting immediate quarterly returns. Performance measurement systems should track intermediate capabilities like market responsiveness alongside financial metrics to properly assess integration's evolving impact.

### **Limitations**

Several limitations warrant acknowledgment. First, despite using multiple informants, our measures of integration mechanisms and responsiveness relied on perceptual data, creating potential for common method bias. However, we mitigated this through longitudinal design, multiple informants, and statistical remedies including marker variables. Future research could incorporate more objective measures of integration maturity.

Second, while our sample included multiple industries, generalization may be limited to supply-chain-intensive sectors in developed economies. Replication in service

industries, emerging economies, and different cultural contexts would enhance external validity.

Finally, despite our longitudinal design, unobserved external factors (economic shocks, technological disruptions) over the three-year study period may have influenced profitability. While we controlled for competitive intensity and industry effects, complete isolation from macroeconomic forces remains challenging in field research.

#### 4. Conclusion

This study set out to investigate the complex temporal relationships between marketing-supply chain integration mechanisms, market responsiveness, and firm profitability through a longitudinal research design. Employing a multi-wave panel survey across supply-chain-intensive industries, our research provides compelling evidence that cross-functional integration represents a strategic long-term investment that builds dynamic capabilities rather than offering immediate financial returns. The findings demonstrate that while all three integration mechanisms (structural, technological, and social) contribute to enhanced performance, social integration emerged as particularly influential in developing market responsiveness. Crucially, our analysis reveals that the relationship between integration and profitability is primarily mediated through market responsiveness, supporting the theoretical proposition that integration creates value by building organizational capabilities rather than through direct financial impacts.

The primary contribution of this research lies in providing empirical longitudinal evidence that integration functions as a strategic investment that develops over time, ultimately enhancing profitability through the building of dynamic capabilities such as market responsiveness. This understanding challenges short-term performance perspectives and emphasizes the importance of patience and sustained commitment to integration initiatives. By documenting how the benefits of integration compound over multiple years and demonstrating the critical mediating role of market responsiveness, our study offers a more nuanced understanding of the integration-performance relationship than previously available in the literature.

Several promising avenues for future research emerge from this study. First, investigating potential moderators such as market turbulence, competitive strategy, or organizational structure could provide deeper insights into the contextual factors that enhance or diminish integration effectiveness. Second, qualitative case studies comparing integration pathways in successful versus unsuccessful firms would offer rich contextual understanding of the implementation challenges and success factors. Third, expanding the model to include additional outcome variables such as sustainability performance, customer satisfaction, or innovation capabilities would provide a more comprehensive understanding of integration's broader organizational impact. Finally, replicating this research in different contexts, particularly in global supply chains and emerging economies, would enhance the generalizability of these findings and potentially reveal important contextual differences in how integration mechanisms operate across different institutional environments.

#### REFERENCES

- [1] B. Alaydi, S. I. Ng, and X. J. Lim, "The Role of Air Traffic Controllers' Mindfulness in Enhancing Air Traffic Safety: JDR Theory in the Saudi Arabian Aviation Context," *Logistics*, vol. 9, no. 3, p. 117, 2025.
- [2] J. C. Anderson and D. W. Gerbing, "Structural equation modeling in practice: A review and recommended two-step approach," *Psychological Bulletin*, vol. 103, no. 3, pp. 411-423, 1988.
- [3] C. Baah, D. O. Agyeman, I. S. K. Acquah, Y. Agyabeng-Mensah, E. Afum, K. Issau, and D. Faibil, "Effect of information sharing in supply chains: understanding the roles of supply chain visibility, agility, collaboration on supply chain performance," *Benchmarking: An International Journal*, vol. 29, no. 2, pp. 434-455, 2022.

- [4] R. P. Bagozzi, "Evaluating structural equation models with unobservable variables and measurement error: a comment," *Journal of Marketing Research*, vol. 18, no. 3, pp. 375-381, 1981.
- [5] H. Birkel and J. M. Müller, "Potentials of industry 4.0 for supply chain management within the triple bottom line of sustainability-A systematic literature review," *Journal of Cleaner Production*, vol. 289, p. 125612, 2021.
- [6] N. Boso, V. M. Story, and J. W. Cadogan, "Entrepreneurial orientation, market orientation, network ties, and performance: Study of entrepreneurial firms in a developing economy," *Journal of Business Venturing*, vol. 28, no. 6, pp. 708-727, 2013.
- [7] S. Chatterjee, N. P. Rana, and Y. K. Dwivedi, "How does business analytics contribute to organisational performance and business value? A resource-based view," *Information Technology & People*, vol. 37, no. 2, pp. 874-894, 2024.
- [8] J. J. Coutts and A. F. Hayes, "Questions of value, questions of magnitude: An exploration and application of methods for comparing indirect effects in multiple mediator models," *Behavior Research Methods*, vol. 55, no. 7, pp. 3772-3785, 2023.
- [9] D. A. Dillman, J. D. Smyth, and L. M. Christian, *Internet, mail and mixed-mode surveys: The tailored design method*, Reis, vol. 133, pp. 81-94, 2011.
- [10] S. R. Dobrow and H. Weisman, "Only time will tell: Conducting longitudinal research on careers," in *Handbook of research methods in careers*, Edward Elgar Publishing, 2021, pp. 164-190.
- [11] T. C. Dzogbewu, S. K. Fianko, S. A. Jnr, and N. Amoah, "Assessment of the mediating effects of external integration on manufacturing firms operational performance," *Journal of Industrial Engineering and Management (JIEM)*, vol. 14, no. 4, pp. 718-732, 2021.
- [12] H. Fatorachian and H. Kazemi, "Impact of Industry 4.0 on supply chain performance," *Production Planning & Control*, vol. 32, no. 1, pp. 63-81, 2021.
- [13] P. Fontoura and A. Coelho, "More cooperative... more competitive? Improving competitiveness by sharing value through the supply chain," *Management Decision*, vol. 60, no. 3, pp. 758-783, 2022.
- [14] B. Horlach, "Shaping the IT Function for the Digital Age—Re-Designing and Re-Conceptualizing IT Governance Decision Areas and Business IT Alignment for Organizational Agility," *Doctoral dissertation*, Staats-und Universitätsbibliothek Hamburg Carl von Ossietzky, 2021.
- [15] B. J. Jaworski and A. K. Kohli, "Market orientation: antecedents and consequences," *Journal of Marketing*, vol. 57, no. 3, pp. 53-70, 1993.
- [16] K. E. Kanyoma, F. W. Agbola, and R. Oloruntoba, "Inhibitors and enablers of supply chain integration across multiple supply chain tiers: evidence from Malawi," *The International Journal of Logistics Management*, vol. 32, no. 2, pp. 618-649, 2021.
- [17] R. B. Kline, *Principles and practice of structural equation modeling*, Guilford publications, 2023.
- [18] S. R. Krishna, K. Rathor, J. Ranga, A. Soni, and A. Kumar, "Artificial Intelligence Integrated with Big Data Analytics for Enhanced Marketing," in *2023 International Conference on Inventive Computation Technologies (ICICT)*, 2023, pp. 1073-1077.
- [19] D. O. Lawrence and G. Poi, "Environmental Intelligence and Innovation Capabilities of Communication Companies in Nigeria," *European Journal of Business and Innovation Research*, vol. 9, no. 5, pp. 34-46, 2021.
- [20] N. Leemann and D. K. Kanbach, "Toward a taxonomy of dynamic capabilities—a systematic literature review," *Management Research Review*, vol. 45, no. 4, pp. 486-501, 2022.
- [21] S. Lee, J. B. Sheu, and S. H. Yoo, "Multi-period quality and pricing decision in production-focused and market-focused supply chains: How to manage a long-term contractual relationship," *Transportation Research Part E: Logistics and Transportation Review*, vol. 189, p. 103662, 2024.
- [22] T. D. Little, *Longitudinal structural equation modeling*, Guilford Publications, 2024.
- [23] R. Luong and J. K. Flake, "Measurement invariance testing using confirmatory factor analysis and alignment optimization: A tutorial for transparent analysis planning and reporting," *Psychological Methods*, vol. 28, no. 4, pp. 905, 2023.
- [24] N. T. P. Mai, T. T. Nguyet, B. D. Trang, and C. T. Yen, "Leader Social Capital via Business Partner Ingredients and Internal Social Capital of Logistics Firm," *Pakistan Journal of Life & Social Sciences*, vol. 22, no. 2, 2024.
- [25] S. McCartney and N. Fu, "Bridging the gap: why, how and when HR analytics can impact organizational performance," *Management Decision*, vol. 60, no. 13, pp. 25-47, 2022.
- [26] M. Pejić Bach, A. Klinčar, A. Aleksić, S. Rašić Jelavić, and J. Zeqiri, "Supply chain management maturity and business performance: the balanced scorecard perspective," *Applied Sciences*, vol. 13, no. 4, p. 2065, 2023.

- 
- [27] A.Rashid, R. Rasheed, A. H. Ngah, and R. K. Marjerison, "A nexus of multiple integrations and business performance through supply chain agility and supply flexibility: a dynamic capability view," *Journal of Science and Technology Policy Management*, 2024.
- [28] I.Russo, I. Confente, J. Holmström, M. Öhman, and T. Tokar, "Embracing methodological evolution and diversity in logistics and supply chain management research," *International Journal of Physical Distribution & Logistics Management*, vol. 54, no. 7/8, pp. 653-672, 2024.
- [29] A.A. A. Shukor, M. S. Newaz, M. K. Rahman, and A. Z. Taha, "Supply chain integration and its impact on supply chain agility and organizational flexibility in manufacturing firms," *International Journal of Emerging Markets*, vol. 16, no. 8, pp. 1721-1744, 2021.
- [30] E. E. Udofia, B. O. Adejare, G. O. Olaore, and E. E. Udofia, "Direct and indirect impact of quality management on the integrated performance of medium-scale manufacturers," *The TQM Journal*, vol. 33, no. 6, pp. 1589-1609, 2021.
- [31] Q. Wang, L. Chen, F. Jia, Y. Luo, and Z. Zhang, "The relationship between supply chain integration and sustainability performance: A meta-analysis," *International Journal of Logistics Research and Applications*, vol. 27, no. 8, pp. 1388-1409, 2024.
- [32] X. Zhang, Y. Xu, and L. Ma, "Research on successful factors and influencing mechanism of the digital transformation in SMEs," *Sustainability*, vol. 14, no. 5, p. 2549, 2022.
- [33] X. H. Zhou, C. Zhou, D