

Impact of Supply Chain Integration on Operational Performance: Insights from Manufacturing Firms in Emerging Economies

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Abstract- Purpose: *The aim of the study is to investigate the effect of the dimensions of supply chain integration (internal integration, supplier integration, and customer integration) to operational performance of manufacturing companies in emerging economies.*

Design/Methodology/Approach: *The survey design applied was quantitative cross-sectional survey design which entailed the collection and analysis of data of 342 manufacturing companies in several emerging economy environments. The hypothesized relationships were verified using multiple regression.*

Results: *Supply chain integration has a significant effect on operational performance with the three integration dimensions explaining a total of 61% of the variance ($R^2 = 0.610$, $p < 0.001$). They all proved to be true: internal integration ($\beta = 0.283$, $p = 0.001$), supplier integration ($\beta = 0.226$, $p = 0.001$), and customer integration ($\beta = 0.347$, $p = 0.001$). The strongest predictor came out as customer integration.*

Practical Implications: *The importance that manufacturing firms in the emerging economies ought to focus on complete supply chain integration strategies, especially customer integration initiatives should be given high levels of priority. The internal integration must be built based on the external collaboration and the supplier integration is needed to maintain the reliability of supply and efficiency.*

Originality/Value: *The research fills a research gap since the study presents empirical results on the impact of supply chain integration in the specific context of the emerging economy, where institutional voids and the unavailability of resources pose specific obstacles.*

Keywords- *Supply Chain Integration, Internal Integration, Supplier Integration, Customer Integration, Operational Performance, Emerging Economies, Manufacturing Firms.*

I. INTRODUCTION

Companies operating in the manufacturing industry in the emerging economies are experiencing unprecedented challenges such as the continuously changing customer demands, intense cost pressures, and supply chain disruptions (Agyabeng-Mensah et al., 2020; Bag et al., 2021). In order to be competitive, such firms should establish fast supply chain performance that will allow them to respond quickly to any market turbulence and operational excellence (Kumar et al., 2021; Tukamuhabwa et al., 2015). The Supply Chain Integration (SCI) has become a strategic capability that is of paramount importance to allow companies to synchronise their operations, exchange information and cooperate with both internal and external stakeholders (Shukor et al., 2020; Wang et al., 2015).

SCI involves process, information, and resource alignment and coordination across the supply network, the supplier to the customer (Ambulkar et al., 2016). With efficient integration, manufacturing companies will be able to save money, better the quality, increase speed, and become more flexible (Munir et al., 2020; Yu et al., 2014). Although it has been identified to be important, the association between the integration of the supply chain and the operational performance is still in a complex state, with the empirical studies producing mixed outcomes.

The developed economies and emerging ones have contextual peculiarities such as institutional voids, infrastructure limitations, regulatory uncertainty, and the absence of them (Huo et al., 2019; Yuen et al., 2019). Previously conducted studies have given most attention to mature markets and there is a gap of knowledge on integration practices in an emerging

economy environment (Asamoah et al., 2012). The multidimensionality of SCI that includes internal integration, supplier integration, and customer integration makes it more difficult to gain insight into its performance implications (Danese et al., 2020; Zhao et al., 2015).

This research fills these gaps by explaining the effect of various dimensions of SCI on operational performance in manufacturing companies based in emergent economies. The study is aimed at investigating:

- (1) the role of internal integration on operational performance,
- (2) the role of supplier integration on operational performance,
- (3) the role of customer integration on operational performance, and
- (4) the comparative role of each dimension.

The contribution of the study is triple. To begin with, it offers empirical information in the context of emerging economies. Second, it provides an all-encompassing picture of the overall impact of these three dimensions of integration by examining them together at the same time. Third, it offers valuable recommendations to managers on the allocation of emphasis on integration efforts to gain operational excellence.

II. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1. Theoretical Foundation

A connection that exists between supply chain integration and operational performance is based on various theoretical viewpoints. According to the Resource-Based View (RBV), integration is a dynamic capability that allows firms to organize resources across organizational boundaries, which allows competitive advantage to be achieved (Bag et al., 2020; Defee et al., 2009). The Relational View states that the competitive advantage is created through the inter-organizational relationships and collaborative capabilities (Dyer and Singh, Ivanov, et al., 2017). Transaction Cost Economics (TCE) describes how integration helps to lower transaction costs, namely, by reducing opportunism and enhancing coordination (Brinch et al., 2017; Niu et al.,

2021). Dynamic Capabilities View states that companies should seek to initiate, capture, and redefine resources in a dynamic way due to environmental changes (Ali et al., 2021; Teece, 2018).

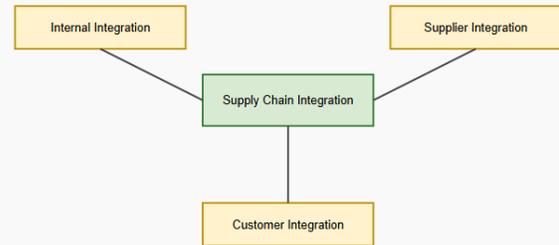


Figure 1. Supply Chain Integration Dimensions.

2.2. Supply Chain Integration

The concept of Supply Chain Integration is used to refer to the level of strategic collaboration of a firm with its partners and the management of intra- and inter-organizational functions to create an efficient flow of services, products, information, and decisions (Alfalla-Luque et al., 2015; Ralston et al., 2017). Studies single out three main areas: internal integration (coordination across functions within the company), supplier integration (collaborative relations with upstream partners), and customer integration (collaboration with the customers downstream) (Mackelprang et al., 2020).

2.3. Internal Performance and Integration

Cross-functional collaboration and coordination among the different functions of the organization are referred to as internal integration (Huo et al., 2015; Schoenherr et al., 2015). It helps companies to eliminate silos, coordinate activities and align resources to shared goals. Such coordination lowers the lead times, lowers inventory expenses, and enhances the use of resources (Polyviou, et al., 2019; Manavalan and Jayakrishna, 2019). It has been identified that internal integration improves operational performance by making the process more effective in terms of forecasting, planning, and fulfilling orders (Bai et al., 2020; Wong et al., 2020). Therefore:

H1: There is a positive significant impact of internal integration on operational performance of manufacturing firms in the emerging economy.

2.4. Supplier Integration and Performance

Supplier integration is the establishment of long-term collaborative relations with major suppliers having the features of information exchange, mutual planning, and co-ordination (Aslam et al., 2020; Saghiri, 2011). It allows companies to have the stable access to good supplies, lower the costs of procurement, minimize the lead times and increase responsiveness (Chavez et al., 2017; Horn et al., 2014). The integration with suppliers enhances knowledge transfer that can be used to improve manufacturing and product quality (Ellstrom et al., 2021; Kim and Nguyen, 2021). Supplier integration in the context of emerging markets where supply-related uncertainties are present

minimizes the transaction costs and establishes trust (Chen et al., 2017; Wong et al., 2020). Therefore:

H2: Supplier integration positively significantly impacts on operational performance of manufacturing firms in emerging economies.

2.6. Conceptual Framework

This paper allows developing a conceptual framework that considers the direct impacts of three dimensions of SCI on the operational performance of manufacturing companies in emerging economies. The conceptual framework is given in figure 2.

Conceptual Framework — Hypothesized Path Coefficients
 H1 (Internal Integration → Operational Performance): $\beta = 0.283^{***}$
 H2 (Supplier Integration → Operational Performance): $\beta = 0.226^{***}$
 H3 (Customer Integration → Operational Performance): $\beta = 0.347^{***}$
Note. Internal Integration, Supplier Integration, and Customer Integration are depicted as independent variables, and the hypothesized positive relationships between them (H1, H2, H3) and Operational Performance are the dependent variable.

III. RESEARCH METHODOLOGY

3.1. Research Design

This paper will use a quantitative cross-sectional survey as a research method to verify the hypotheses (Creswell and Creswell, 2018; Saunders et al., 2019). The deductive method uses the existing measurement scales that are modified based on the previous research that has been validated.



Figure 2. Research Methodology Flowchart.

3.2. Population and Sampling

The target population will comprise manufacturing companies in the emerging economies under sectors such as food and beverage, textile, electronics, automotive, pharmaceutical and consumer goods. The purposive sampling included respondents who were sufficiently knowledgeable about supply chain practices senior managers, supply chain managers,

operations managers, procurement managers, and logistics managers having at least two years of experience (Kumar, 2019; Sharma, 2017).

In accordance with the rules of multivariate analysis, the research was aimed at at least 300 valid answers (Hair et al., 2019; Adobor, & McMullen, (2018)). Online survey, email and face to face distribution led to 367 respondents who completed the questionnaire. The response rate of 93.2% was found to offer 342 responses that were valid to analyze after the screening.

3.3. Measurement of Variables

Measurement of all variables was made to be in five-point Likert scales (1 = strongly disagree to 5 = strongly agree) based on the already existing research. Supply Chain Integration was assessed as a three dimensional measure:

- Internal Integration (5 items): Cross-functional collaboration, information sharing, and coordination are modified according to Schoenherr et al. (2015) and Huo et al. (2015).

- Supplier Integration (5 items): Collaborative relationships, information exchange, and joint planning is based on Chavez et al. (2017).
- Customer Integration (5 items): Customer collaboration, demand information sharing, and joint planning modified in accordance with Shee et al. (2018).

The Operational Performance scale included twelve items (four dimensions based on Gligor et al. (2019) and Mascariolo, J., & Holcomb, M. C. (2008)) to measure the scale:

- Cost Performance (3 items): manufacturing cost, and cost competitiveness.
- Quality Performance (3 items): Quality of products and the level of defects.
- Performance in Delivery (3 items): Timeliness of delivery and speed of delivery.
- Flexibility Performance (3 items): Capability of altering product mix and responding to requests.

3.4. Data Analysis

Data analysis was done by use of SPSS version 28.0. Preliminary data screening, descriptive statistics,

Exploratory Factor Analysis (EFA) to estimate construct validity, Cronbach’s alpha to assess reliability, and multiple regression analysis to test hypothesis were all used to conduct the analysis (Hair et al., 2019; Tabachnick and Fidell, 2019). Variance Inflation Factor (VIF) and tolerance values were used to determine Multicollinearity.

IV. RESULTS

4.1. Demographic Profile

Table 1 shows demographics of the respondents and the organizations. Supply chain managers made 32.7% of the respondents and operation managers made 28.4%. The majority of the respondents were experienced (41.8 percent) with 5-10 years. The food and beverage industry had 24.3% representation of the sample and medium sized companies (101-500 employees) made up 38.6% of them.

Table 1. Demographic Profile of Organizations and Respondents

Characteristic	Category	Frequency	Percentage (%)
Respondent Position	Senior Executive	27	7.89
	Supply Chain Manager	112	32.7
	Operations Manager	97	28.4
	Procurement Manager	64	18.7
	Logistics Manager	42	12.3
	Total		342
Work Experience	3–5 years	63	18.4
	5–10 years	143	41.8
	10–15 years	94	27.5
	More than 15 years	42	12.3
	Total		342
Industry Sector	Food and Beverage	83	24.3

Characteristic	Category	Frequency	Percentage (%)
	Textiles and Garments	67	19.6
	Electronics	60	17.5
	Automotive Components	53	15.5
	Pharmaceuticals	44	12.9
	Consumer Goods	35	10.2
	Total	342	100.0
Firm Size (Employees)	51–100	93	27.2
	101–500	132	38.6
	More than 500	117	34.2
	Total	342	100.0

4.2. Descriptive Statistics

Table 2 displays descriptive statistics of variables of study. Based on the classification: very low 1.00-1.80, low 1.81-2.60, moderate 2.61-3.40, high 3.41-4.20, and very high 4.21-5.00. The mean score in supply chain integration was 3.61 (SD = 0.589), meaning that

its implementation is high. The mean in the operational performance was 3.72 (with SD = 0.641), and the highest mean was obtained in the quality performance at 3.81.

Table 2. Descriptive Statistics for Study Variables

Variable/Dimension	Mean	Std. Deviation	Level of Agreement
Supply Chain Integration	3.61	0.589	High
Internal Integration	3.68	0.682	High
Supplier Integration	3.54	0.731	High
Customer Integration	3.61	0.695	High
Operational Performance	3.72	0.641	High
Cost Performance	3.63	0.748	High
Quality Performance	3.81	0.687	High
Delivery Performance	3.76	0.704	High
Flexibility Performance	3.69	0.723	High

Note. Level of Agreement according to the classification of 5-point Likert scale: 1.00–1.80 = very low, 1.81–2.60 = low, 2.61–3.40 = moderate, 3.41–4.20 = high, 4.21–5.00 = very high.



Figure 3. Level of Supply Chain Integration (Mean Scores).

4.3. Validity and Reliability

Construct validity was verified by the Exploratory Factor Analysis. In the case of supply chain integration, KMO = 0.872 and the test by Bartlett was significant ($kh^2 = 2847.63, p < 0.001$). EFA took three factors that describe 67.42% of the variance (Table 3). In the case of operational performance, KMO = 0.891 and the test of Bartlett was significant ($kh^2 = 3126.54, p < 0.001$). EFA has obtained four factors that explain 71.85% variance (Table 4).

Table 3. Supply Chain Integration Factor Loadings

Item	Internal Integration	Supplier Integration	Customer Integration
II1–II5	0.768–0.815	—	—
SI1–SI5	—	0.759–0.806	—
CI1–CI5	—	—	0.769–0.812

Note. Factor Analysis: Principal Axis Factoring. Rotation: Promax. Total Variance: 67.42%. Only primary loadings >0.50 shown.

Table 4. Factor Loadings of Operational Performance

Item	Quality	Delivery	Flexibility	Cost
QUAL1–QUAL3	0.815–0.847	—	—	—
DELI1–DELI3	—	0.794–0.831	—	—
FLEX1–FLEX3	—	—	0.778–0.815	—
COST1–COST3	—	—	—	0.791–0.826

Note. Extraction Method: Principal Axis Factoring. Rotation: Promax. Total Variance: 71.85%. Only primary loadings >0.50 shown.

The value of the alpha (Table 5) was more than 0.70, which is a confirmation that it is reliable. The internal consistency of supply chain integration ($\alpha = 0.886$) and operational performance ($\alpha = 0.912$) was excellent.

Table 5. Reliability Statistics

Variable/Dimension	Cronbach's Alpha	Number of Items
Supply Chain Integration	0.886	15
Internal Integration	0.867	5
Supplier Integration	0.879	5
Customer Integration	0.871	5
Operational Performance	0.912	12
Cost Performance	0.852	3
Quality Performance	0.869	3

Variable/Dimension	Cronbach's Alpha	Number of Items
Delivery Performance	0.841	3
Flexibility Performance	0.833	3

4.4. Multicollinearity and Correlation

The values of VIF were between 1.524 and 1.867, and the values of tolerance were between 0.536 and 0.656, so no multiple collinearity was observed (Table 6). All correlations were found to be positive and at the significance level of $p < 0.01$, correlation analysis (Table 7) showed that all relationships were positive.

Table 6. Multicollinearity Diagnostics

Independent Variable	Tolerance	VIF
Internal Integration	0.612	1.634
Supplier Integration	0.536	1.867
Customer Integration	0.656	1.524

Table 7. Correlation Matrix

Variable	1	2	3	4
1. Internal Integration	1			
2. Supplier Integration	0.487*	1		
3. Customer Integration	0.541*	0.448*	1	
4. Operational Performance	0.624*	0.587*	0.673*	1

Note. ** Correlation is significant at the 0.01 level (2-tailed).

4.5. Hypothesis Testing

The model was found to explain 61% of variance in operational performance through a multiple regression analysis (Table 8) with the $R^2 = 0.610$, $F = 176.28$ and $p < 0.001$. All the three integration dimensions showed

high positive impacts: internal integration ($\beta = 0.283$, $t = 6.847$, p less than 0.001), supplier integration ($\beta = 0.226$, $t = 5.392$, p less than 0.001), and customer integration ($\beta = 0.347$, $t = 8.534$, p less than 0.001). The greatest effect was observed in customer integration.

Table 8. Multiple Regression Analysis Results

Model Summary	Value
R	0.781
R ²	0.610
Adjusted R ²	0.606
F-statistic	176.28***

Independent Variables	β	t-value	Sig.	Decision
Internal Integration	0.283	6.847	0.000	H1 Supported
Supplier Integration	0.226	5.392	0.000	H2 Supported
Customer Integration	0.347	8.534	0.000	H3 Supported

Note. Dependent Variable: Operational Performance. *** $p < 0.001$.

The table 9 is a summary of the hypothesis testing, which validates all the hypotheses.

Table 9. Summary of Hypothesis Testing Results

Hypothesis	Relationship	β	t-value	Sig.	Result
H1	Internal Integration → OP	0.283	6.847	0.000	Supported

Hypothesis	Relationship	β	t-value	Sig.	Result
H2	Supplier Integration → OP	0.226	5.392	0.000	Supported
H3	Customer Integration → OP	0.347	8.534	0.000	Supported

Note. OP = Operational Performance. All the relationships of significance at $p < 0.001$.



Figure 4. Structural Model Path Coefficients.

V. DISCUSSION AND CONCLUSIONS

5.1. Discussion of Findings

This research article has discussed the effect that integration of supply chains has on operational performance by manufacturing companies in the emerging economies. The three SCI dimensions had a major positive impact on the operation performance and collectively contributed to 61 percent variance. The importance of integration as a key to operational success is supported by this high level of explanation (Ali et al., 2021; Bag et al., 2020).

Internal integration ($b = 0.283$) facilitates the cross-functional coordination, which reduces the lead times and enhances the use of resources (Huo et al., 2015). This observation is in line with the claims by RBV that internal capabilities are resources that contribute to

competitive advantage (Defee et al., 2009). In emerging economies that are characterized by scarcity of external resources, internal resources leverage through integration will be important.

The integration of suppliers ($b = 0.226$) allows to ensure reliability in supply, lower costs, and increase reactivity (Chavez et al., 2017; Horn et al., 2014). Although important, the comparatively low coefficient can indicate the difficulties in the emerging economies such as fluctuating ability of the suppliers and the limitation of infrastructure. Supplier integration decreases the costs of coordination and opportunism risks as seen through TCE perspective (Brinch et al., 2017).

The customer integration ($b = 0.347$) revealed the very strongest impact, which stated the fact that customer collaboration is the most significant factor that can drive operational performance. That is indicative of the significance of market intelligence in dynamic emerging markets with customer preferences changing fast (Mubarik et al., 2021). Customer integration will augment sensing, seizing, and transforming competencies (Carvalho et al., 2011; El Baz & Ruel, 2021).

The ranking of customer integration as the strongest, internal as the second and supplier integration as the third indicates that in the emerging economies, downstream integration would most benefit the operations. Nevertheless, each of the dimensions is still a major source of contribution, which underscores the importance of integration strategies being holistic.

5.2. Theoretical and Practical Implications

The research is relevant to the supply chain theory because it presents empirical data on the context of emerging economies by showing that the beneficial effects of integration are not only limited to developed markets (Alfalla-Luque et al., 2015; Ralston et al., 2017). It provides an extensive insight into the overall impact of all three dimensions at the same time (Shukor et al., 2020). The results affirm various theoretical approaches such as RBV, relational view, TCE as well as dynamic capabilities view.

The high overall effect (61% variance explained) will be of interest to the practitioners as it highlights the

relevance of supply chain integration as a strategic priority. Managers are expected to: (1) emphasize customer integration efforts to become market savvy and responsive;

(2) build internal integration as a base to external collaboration using cross-functional or integrated teams;

(3) invest in strategic supplier relationships by sharing information and planning together;

(4) balance technological enablers and relational capabilities; and

(5) establish measures of integration progress and performance results (Gligor et al., 2019).

5.3. Limitations and Future Research

The existence of a number of limitations implies the research directions in the future. To begin with, the cross-sectional design will restrict the ability of the research to make causal inferences that longitudinal studies might follow integration and performance in the long-term (Agyabeng-Mensah et al., 2020). Second, single respondents are prone to the common method bias in perceptual measurements; a combination of subjective and objective performance data on many respondents should be used in future studies (Dubey et al., 2019). Third, replication studies are necessary to generalize findings to all other emerging economies (Yuen et al., 2019). Fourth, direct effects were only analyzed in the current study and moderate factors like environmental uncertainty, firm size, industry nature, and technological capabilities should be investigated in future research (Farahani et al., 2017; Gligor and Holcomb, 2013). Fifth, mediating processes that elaborate on the role of integration on performance require research. Lastly, since digital technologies change the supply chains, the future studies must address the ways in which blockchain, IoT, and AI could support new forms of integration.

5.4. Conclusion

This paper has shown that the integration of supply chains greatly boosts the performance in the manufacturing companies in the emerging economy. The three dimensions internal integration, supplier integration and customer integration all play an important role with customer integration having the most significant effect. These results support the fact that even in the emerging markets where challenges

are likely to be experienced, companies that adopt effective integration practices will gain a lot in terms of operation. With the growing global manufacturing percentage in newly developed economies, the capacity to combine supply chain activities both internally and externally becomes ever more prominent in the way to success in competition. This paper offers theoretical and practical recommendations that will assist manufacturing companies in their quest to achieve an improved supply chain integration and operational excellence.

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