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Supply chain integration and its relationship with the business performance of metal-mechanics small and medium-sized enterprises

Integración de la cadena de suministro y su relación con el desempeño de negocio de las PyMES del giro metal mecánico

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Abstract
Small and medium-sized enterprises (SMEs) in Latin America demonstrate productivity levels of 32% and 43%, respectively, when compared to large companies. This lower productivity places them at a disadvantage in accessing the global value chain. According to the OECD/ECLAC (2012), factors that help SMEs improve their business performance include access to knowledge and information (from customers and suppliers) and the implementation of managerial systems, such as supply chain integration (SCI). This research examines the relationship between SCI and the business performance of metal-mechanics manufacturing SMEs in the metropolitan zone of Guadalajara (ZMG), Jalisco, Mexico. The findings indicate that supplier integration, internal integration, and customer integration have a positive and significant impact on business performance.

Keywords: supply chain integration; customer integration; internal integration; supplier integration; business performance
JEL Classification: L14; L25; L61

Resumen
Las empresas pequeñas y medianas en Latino América presentan niveles de productividad de 32% y 43%, respectivamente, comparadas con las empresas grandes. Esta baja productividad las coloca en desventaja para acceder a la cadena de valor global. De acuerdo con la OECD/ECLAC (2012), los factores que ayudan a las PyMES a mejorar su desempeño de negocios incluyen el acceso al conocimiento (de clientes y proveedores) y la implementación de sistemas gerenciales, tales como integración de la cadena de suministro (SCI). Esta investigación examina la relación entre SCI y el desempeño de negocio de las PyMES manufactureras del giro metal mecánico, en la zona metropolitana de Guadalajara, Jalisco, Mex. Los resultados indican que la integración de proveedores, integración interna, e integración del cliente tienen un impacto positivo y significativo en el desempeño de negocio.

Palabras clave: integración de la cadena de suministro; integración del cliente; integración interna; integración de proveedores; desempeño de negocio
Clasificación JEL: L14; L25; L61

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1. Introduction

On the one hand, the OECD/ECLAC (2012) states that SMEs in Latin America struggle to access the global value chain due to their low performance and productivity. Small companies exhibit a productivity level of 32%, while medium-sized companies reach 43%, both significantly lower when compared to large companies. On the other hand, the OECD/ECLAC notes that factors enabling SMEs to improve their business performance include access to knowledge and information (from customers and suppliers) and the implementation of managerial systems, such as supply chain integration (SCI).

In this context, Alfalla-Luque et al. (2015) and Ralston et al. (2015) emphasize that competition today occurs between supply chains rather than individual companies. They also suggest that linking management processes within supply chain management is a key strategy for creating value, improving efficiency and responsiveness, and achieving competitive advantage.

Similarly, Qi et al. (2017) highlight that the integrative capacities of the supply chain are crucial to company performance, as they enable manufacturers to collaborate strategically with their supply chain partners and collaboratively manage intra- and inter-company processes. This strategic positioning allows manufacturers to achieve efficient and effective flows of products, services, information, money, and decisions, ultimately delivering maximum value to the customer (Flynn et al., 2010; Huo, 2012; Zhao et al., 2008). Other authors, such as Georgise et al. (2014) and Dametew et al. (2016), concur, adding that the supply chain integration process is identified as both a capability and a critical factor for strong company performance. This performance is influenced by the actions of companies that integrate their supply chains, where collaboration plays a fundamental role in achieving customer satisfaction.

Regarding the effects of SCI, some authors suggest that the short-term benefits of implementing SCI are primarily reflected in operational performance, while medium- and long-term benefits are observed in financial performance (Tarifa-Fernandez & De Burgos-Jiménez, 2017). Conversely, other authors argue that SCI provides short-term improvements in the financial performance of the focal company, while in the long term, it enhances value creation for the customer, which ultimately, though partially, contributes to financial benefits for the focal company (Annan et al., 2016).

In line with the above, this research focuses on analyzing the relationship between supply chain integration (SCI) and the business performance of metal-mechanics manufacturing SMEs in the metropolitan zone of Guadalajara (ZMG), Jalisco, Mexico. To the best of my knowledge, this is the first study to investigate this topic specifically within the metal-mechanics manufacturing SMEs in this geographic area.

From an academic perspective, this paper contributes to expanding the body of knowledge in the fields of supply chain integration and SME studies. As for the practical implications for practitioners and policymakers, this research provides empirical evidence of the positive and significant impact of SCI on the business performance of manufacturing SMEs in the metropolitan zone of Guadalajara (ZMG), Jalisco, Mexico. It also suggests the appropriate sequence for implementing SCI components to optimize resource usage and achieve the desired outcomes. These points are further elaborated in the results and discussion sections of this document.

2. Literature review

2.1. SCI and business performance

Small and medium-sized enterprises (SMEs) in Latin America play a key role as the backbone of economic growth. They are flexible and adaptable; however, they are highly vulnerable to the effects of the global landscape (Talib et al., 2023). In Mexico, SMEs represent 99% of formal companies and are responsible for 71% of formal employment. Despite this, they remain fragile, have limited access to dynamic markets, exhibit suboptimal productivity levels, and contribute minimally to the country's exports. SMEs need to adopt associative models with other companies to generate economies of scale and shared assets, which can improve their performance to competitive levels (Dini & Stumpo, 2020).

It is crucial for SMEs to implement the concepts outlined in the definition of SCI provided by Stevens and Johnson (2016), which states: “Supply chain integration (SCI) is the alignment, linkage, and coordination of people, processes, information, knowledge, and strategies throughout the supply chain, across all points of influence and contact, to facilitate the efficient and effective flow of materials, money, information, and knowledge, in response to customer needs.”

Supply chain integration is a multidimensional concept, allowing for various SCI configurations that can be tailored to different dimensions. Each company can place varying degrees of emphasis on each SCI dimension (Devaraj et al., 2007; Frohlich & Westbrook, 2001). As a result, the relationship between SCI and company performance will be influenced by the chosen SCI pattern (Afshan, 2013).

Some authors argue that SCI is composed of two components: external integration and internal integration. Others suggest that SCI comprises three components, with external integration being further divided into supplier integration and customer integration, alongside internal integration. External integration emphasizes the importance of establishing close relationships with both suppliers and customers to align inter-company strategies, practices, and processes in synchronized, collaborative efforts (Stank et al., 2001). Internal integration refers to the extent to which a manufacturer aligns their organizational strategies, practices, and processes into synchronized systems to meet customer requirements and interact efficiently with suppliers (Kahn & Mentzer, 1996).

According to Swink et al. (2007) and Afshan (2013), the three dimensions of SCI have varying impacts on a company's business performance. In this regard, Flynn et al. (2010) found that internal integration and customer integration are more strongly related to operational and business performance than supplier integration. However, Zhang and Huo (2013) reported that both supplier integration and customer integration have a positive impact on a company's financial performance.

In summary, the three dimensions of SCI are generally considered to be customer integration, internal integration, and supplier integration (Baharanchi, 2009). Therefore, from this point forward, this document will refer to SCI as consisting of these three dimensions: customer integration, internal integration, and supplier integration.

2.2.1. Customer integration

Customer expectations are continually increasing, requiring frequent follow-ups to ensure full satisfaction. By adopting a demand-focused perspective, firms can achieve two key outcomes: first, they gain valuable new insights, and second, they develop a deeper understanding of the role of supply chain management in maintaining competitiveness (Priem & Swink, 2012). This focus enables manufacturers to accelerate product delivery processes, improve production planning, and reduce inventory obsolescence by utilizing accurate information from customer demand and preferences (Flynn et al., 2010; Swink et al., 2007).

The customer relationship process is critically important and requires significant attention, as it encompasses several key concepts (Lambert & Enz, 2017). It provides a framework for developing and maintaining customer relationships and helps formulate business and marketing strategies for selected customers, including segmenting them within each group. Once the company identifies its key customers based on long-term value, it can work on product customization to enhance customer loyalty, among other benefits. The customer relationship process aims to develop partnerships with a select group of customers, and once these partnerships are established, multi-functional teams collaborate with this critical segment to create customized product and service agreements.

The relationship with critical customers requires the development of core competencies due to the specialized interactions involved, and it also generates new core competencies in the process. This enhanced relationship helps manufacturers gain a deeper understanding of customer requirements and improve demand forecasting, enabling them to deliver higher quality products at lower costs with increased flexibility, ultimately leading to better financial performance (Flynn et al., 2010). Additionally, manufacturers must collaborate with customers to plan and solve problems together, improving delivery performance. Moreover, sharing objectives, costs, and profits fosters alignment between partners (C. Wong et al., 2012).

In line with the previous point, Pakurár et al. (2019) suggest that customer integration ensures products meet or exceed the value characteristics expected by the customer. Meanwhile, Ozpolat and Dresner (2018) emphasize that integrative capacity allows partners to detect and address communication or information gaps in a timely manner, which helps maintain trust between them. Additionally, this integration helps both parties reduce transaction costs, leading to lower overall business costs (Rosenzweig et al., 2003).

Baharanchi (2009) notes that customer integration has a greater impact on product innovation compared to internal and supplier integration. From a different perspective, Huo et al. (2016) found that customer integration indirectly influences financial performance through operational performance, benefiting both the customer and supplier. Customer integration also impacts quality management practices and the overall quality performance of the company (Sun & Ni, 2012). Furthermore, Yu et al. (2013) suggest that customer integration enhances financial performance through the mediating effect of customer satisfaction.

Therefore, the first hypothesis is proposed as follows:

H1: *Customer integration has a positive impact on the business performance of the company.*

2.2.2. Internal integration

Internal integration refers to the alignment of departments within a company, ensuring they operate as components of an integrated process. This approach eliminates functional barriers and promotes cooperation to meet customer requirements, rather than maintaining the traditional silos associated with specialization and departmental divisions (Qi et al., 2017; Zhao et al., 2008).

Turkulainen et al. (2017) suggest that different types of internal integration exist, depending on the type of integration required and the mechanism used. Managers must be able to identify the necessary type of integration and the corresponding integration mechanism. When determining the type of integration, firms should consider options such as aligning objectives, achieving synergies, creating knowledge, sharing information, and managing interdependencies. For integration mechanisms, firms should evaluate options such as standardization, centralization, equipment structure, the role of the integrator, and relationship-building.

Regarding empirical research, Beheshti et al. (2014) found evidence from Swedish manufacturing companies indicating that any movement in internal integration, whether toward customer integration or supplier integration, leads to financial benefits. Similarly, Alfalla-Luque et al. (2015), in their study of international manufacturing plants, discovered that internal integration not only impacts company performance but also supports and enables customer and supplier integration. Internal integration plays a critical role in supply chain integration, and they recommend that managers prioritize implementing internal integration to streamline and optimize the entire supply chain integration process.

Similarly, Saeed et al. (2005) found positive evidence of the relationship between internal integration and operational performance, including process efficiency and logistics service performance (Germain & Iyer, 2006; Stank et al., 2001). Flynn et al. (2010) also suggest that internal integration forms the foundation of SCI and is positively related to a firm’s operational performance.

Therefore, the second hypothesis is proposed as follows:

H2: *Internal integration positively impacts the business performance of the company.*

2.2.3. Supplier integration

In a general sense, many supply chain activities were historically considered part of purchasing activities. However, given the growing importance of these activities, more attention is now dedicated to them, with the necessary resources allocated to effectively manage the supply chain (Mentzer et al., 2008). From a resource-based view theory perspective, supplier integration is driven by the desire to leverage the capacity and resources of external partners to complement internal capabilities, ultimately helping to achieve the organization’s established objectives (Feyissa et al., 2019).

The relationship between buyer and supplier has been extensively studied, and the literature identifies two general types of relationships: collaborative and competitive. On the one hand, the collaborative relationship is characterized by cooperation, mutual benefits, and trust-based exchanges. On the other hand, the competitive relationship involves tough negotiations, a focus on price, short-term contracts, and multiple suppliers (Seçkin & Şen, 2018). Supplier integration, naturally, focuses on the collaborative model.

Using a similar approach to that mentioned in the customer integration section, Lambert and Enz (2017) recommend first identifying key suppliers and then segmenting them within each group. This segmentation should be based on the suppliers' impact on the long-term success of the company. As with customer integration, the purpose of supplier integration is to develop partnerships with a small group of suppliers. Multi-functional teams are then created to collaborate with these selected suppliers, developing customized product and service agreements.

Among the benefits of supplier integration, Maleki and Cruz-Machado (2013) found in their empirical research that it improves productivity and reduces waste. Similarly, Xu et al. (2014) provide empirical evidence of the significant effects of supplier integration on a company's business performance. Baharanchi (2009) also found that supplier integration positively impacts product innovation, largely due to the substantial amount of data and information exchanged during transactions between companies. Moreover, supplier integration has a greater impact on quality than the other two dimensions of SCI.

Additionally, Huo et al. (2016) found that supplier integration indirectly influences financial performance through operational performance improvements oriented toward both suppliers and customers. Lee et al. (2007) reported that supplier integration positively impacts cost containment, while Droge et al. (2012)noted that it enhances customer delivery performance. Prajogo and Olhager (2012) and Feyissa et al. (2019) also found that long-term relationships between focal firms and their suppliers have a positive effect on supplier integration and the performance of focal firms. Similarly, Srinivasan and Swink (2015) indicated that supplier integration has a positive impact on company performance.

Therefore, the third hypothesis is proposed as follows:

H3: *Supplier integration positively impacts the business performance of the company.*

3. Methodology

3.1. Sample and data collection

According to the Instituto Nacional de Estadística, Geografía e Informática (INEGI, 2015), the manufacturing sector in Mexico is of key importance, contributing 48.2% to the country's total GDP. Within this sector, the metal-mechanics manufacturing subsector represents 14.2% of the total manufacturing sector in terms of the number of firms, with 94.9% of these being micro-enterprises, ranking third in job creation within the sector. Specifically, in the state of Jalisco, the metal-mechanics subsector has shown significant growth in exports, increasing from $541.3 million USD in 2018 to $829.1 million USD in 2022—a 53% increase (IIEG-Jalisco, 2024).

With this in mind, the research was conducted in the metropolitan area of Guadalajara, Jalisco, Mexico (ZMG), by interviewing the supply chain management heads of 102 firms. These firms are SMEs within the metal-mechanics subsector, each employing between 6 and 250 people. The list of selected firms was obtained from the Directorio Estadístico Nacional de Unidades Económicas (DENUE), a database managed by INEGI (2015), an autonomous public organization in Mexico responsible for collecting and processing data. INEGI produces and maintains reports that include information such as firm identification, location, economic activity, and size, among other responsibilities related to data collection and reporting.

The INEGI database listed 792 firms in the ZMG, but 201 of them did not provide a telephone number or email address, reducing the number to 521. In some cases, responses were not obtained, the person in charge was unavailable, or the requested information was considered confidential or not available for disclosure. Ultimately, 102 interviews were successfully completed. This sample size of 102 firms falls within the range necessary to produce statistically robust results when using a structural equation model with partial least squares (Hair et al., 2011; Marcoulides & Chin, 2013; Reinartz et al., 2009). This method, based on variance analysis, is particularly recommended when the research objective focuses on predicting and explaining the variance of constructs or key latent variables (Hair et al., 2012).

3.2. Structure of the instrument

The instrument consists of four multi-item measures based on a 7-point Likert scale, ranging from 1 (Totally Disagree) to 7 (Totally Agree). The questionnaire used for data collection was designed and created by analyzing and comparing indicators and concepts supported by several authors. This process resulted in a final abridged questionnaire of 31 items, represented as observable indicators in the theoretical model (see Figure 1). A complete description of these indicators, along with the consulted authors, is presented in Tables 1, 2, 3, and 4, respectively.

The first measure is customer integration (CUS INT), which is composed of three dimensions: customer alignment (CUS ALI), customer collaboration (CUS COL), and customer information sharing (CUS INF). Each dimension is assessed with three items, as shown in Table 1.

Table 1. CUS INT measure

Variable	Dimension	Item	Description	References
Customer Integration	CUS ALI (Customer Alignment)	CIA1	Our systems and processes are aligned with our customer needs	(Annan et al., 2016) (Flynn et al., 2010) (Wiengarten et al., 2016)
		C1A2	We have common goals and interests with our key customers	
		CIA3	We offer dedicated capacity for our key customers	
	CUS COL (Customer Collaboration)	CIC1	We design responsibilities jointly with our key customers	(Alfalla-Luque et al., 2015) (Annan et al., 2016) (Feyissa et al., 2019) (Flynn et al., 2010) (Qi et al., 2017) (Yuen & Thai, 2017)
		CIC2	We maintain close and frequent contact with our key customers	
		CIC3	There is mutual support and assistance between our key customers and our company	
	CUS INF (Customer Information Sharing)	CII1	Our key customers share their marketing information with us	(Flynn et al., 2010) (Frohlich & Westbrook, 2001) (Huo et al., 2016) (Wiengarten et al., 2016)
		CII2	We share our production plans with our key customers	
		CII3	Our key customers share their demand planning and demand projection information with us	

Source: Own elaboration based on the literature reviewed

The second measure is internal integration (INT INT), which, like CUS INT, is composed of three dimensions: internal alignment (INT ALI), internal collaboration (INT COL), and internal information sharing (INT INF). Each of these dimensions is also assessed with three items, as listed in Table 2.

Table 2. INT INT measure

Variable	Dimension	Item	Description	References
Internal Integration	INT ALI (Internal Alignment)	IIA1	We have integrated systems within the company across internal functional areas	(Alfalla-Luque et al., 2015) (Annan et al., 2016) (C. W. Y. Wong et al., 2013) (Qi et al., 2017) (Flynn et al., 2010)
		IIA2	Joint administration works well in all important decisions	
		IIA3	We maintain visibility in operations and processes across all areas and levels	
	INT COL (Internal Collaboration)	IIC1	We consult between internal departments before making decisions that affect us	(Annan et al., 2016) (Feyissa et al., 2019) (Flynn et al., 2010) (Yuen & Thai, 2017)
		IIC2	We utilize cross-functional teams for process improvements	
		IIC3	We plan jointly with all internal departments to anticipate and solve supply chain problems	
	INT INF (Internal Information Sharing)	III1	We share ideas, information, and resources across internal departments	(Feyissa et al., 2019) (C. W. Y. Wong et al., 2013) (Yuen & Thai, 2017)
		III2	We share operational information across internal functions	
		III3	We emphasize the information flow between purchasing, inventories, sales, and distribution	

Source: Own elaboration based on the literature reviewed

The third measure, supplier integration (SUP INT), also consists of three dimensions: supplier alignment (SUP ALI), supplier collaboration (SUP COL), and supplier information sharing (SUP INF). As with the previous measures, each dimension is assessed using three items, as listed in Table 3.

Table 3. SUP INT measure

Variable	Dimension	Item	Description	References
Supplier Integration	SUP ALI (Supplier Alignment)	SIA1	Our systems and processes are aligned with our key customers' needs	(Annan et al., 2016) (Huo et al., 2016) (Wiengarten et al., 2016) (Yuen & Thai, 2017)
		SIA2	We have continuous improvement joint programs with our main suppliers	
		SIA3	Our main supplier offers us dedicated capacity resources	
	SUP COL (Supplier Collaboration)	SIC1	We maintain long-term relationships with our key suppliers	(Alfalla-Luque et al., 2015) (Annan et al., 2016) (Qi et al., 2017) (Wiengarten et al., 2016) (Yuen & Thai, 2017)
		SIC2	We develop responsibilities jointly with our main suppliers	
		SIC3	We plan, project, and refill collaboratively with our main suppliers	
	SUP INF (Supplier Information Sharing)	SII1	We share demand projections with our main supplier	(Feyissa et al., 2019) (Flynn et al., 2010) (Huo et al., 2016) (Wiengarten et al., 2016) (Yuen & Thai, 2017)
		SII2	We plan in real-time and cooperatively with our main suppliers	
		SII3	Our main supplier shares its production capacity with us	

Source: Own elaboration based on the literature reviewed

The fourth measure and independent variable is business performance (BUS PER), which is structured with two dimensions: marketing performance (MKT PER) and financial performance (FIN PER). Each dimension is assessed using two items, as listed in Table 4.

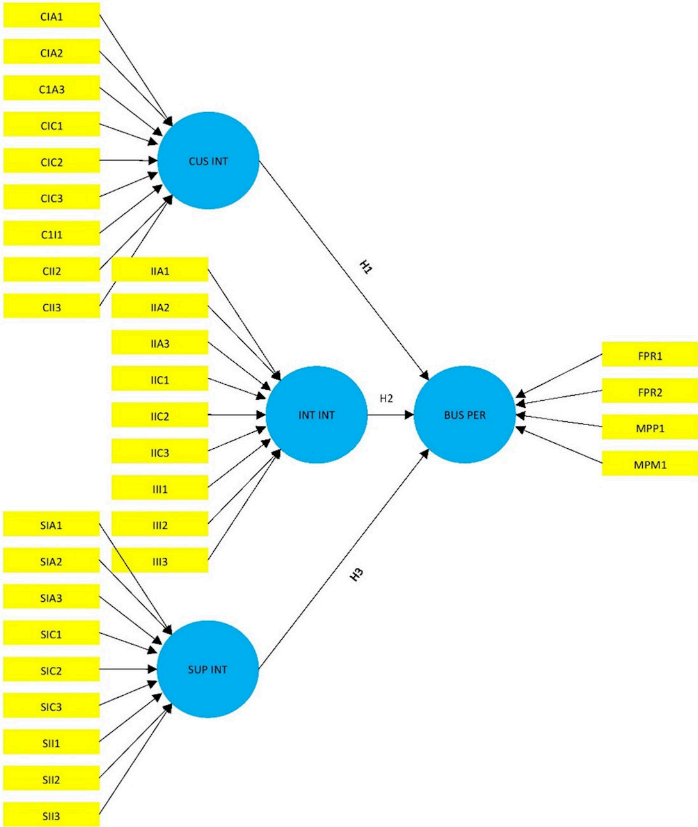
Table 4. BUS PER measure

Variable	Dimension	Item	Description	References
Business Performance	MKT PER (Marketing Performance)	MPP1	We maintain an acceptable profit level	(Afshan, 2013) (Feyissa et al., 2019) (Flynn et al., 2010) (Qi et al., 2017)
		MPM1	We maintain an acceptable market share level	
	FIN PER (Financial Performance)	FPR1	We maintain an acceptable ROA level	(Afshan, 2013) (Flynn et al., 2010) (Qi et al., 2017)
		FPR2	We maintain an acceptable ROI level	

Source: Own elaboration based on the literature reviewed

Based on the structure of the instrument described in this section, the theoretical model is presented in Figure 1.

Figure 1. Theoretical model



Source: Own elaboration based on SmartPLS 3 software

3.2.1. Measurement model and structural model

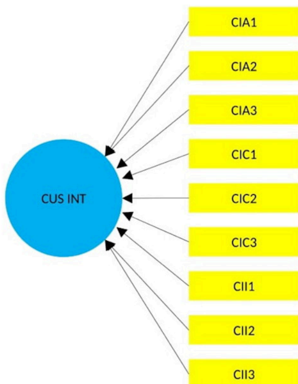
PLS-SEM is characterized by two fundamental elements: the measurement model and the structural model. The measurement model represents the relationships between latent variables or constructs and their observable variables or indicators. The structural model, also known as the path model or nomogram, represents the hypotheses and relationships between variables. PLS-SEM first tests the measurement model, followed by the structural model.

The measurement model evaluates reliability and validity. This research used formative models, which were assessed through three steps (Hair et al., 2019): convergent validity, collinearity of indicators, and significance and relevance of the indicators.

Convergent validity for formative models is analyzed by testing whether it is correlated with a reflective measure of the same construct, a process known as redundancy analysis (Chin, 2010). An R^2 value of 0.64 or higher is considered ideal to demonstrate that the formative construct shows convergent validity.

The convergent validity analysis for the first measurement, CUS INT, is detailed in Figures 2 through 4.

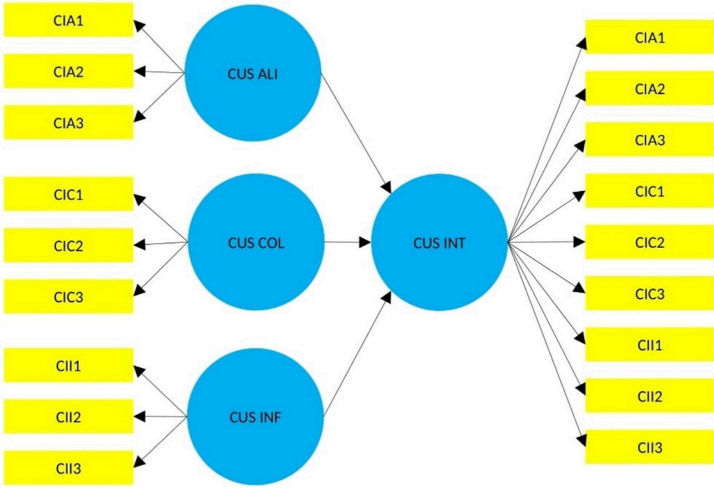
Figure 2. Convergent validity: initial construct for CUS INT (as shown in Figure 1)



Source: Own elaboration based on SmartPLS 3 software

In the next step, a hierarchical component model (HCM) was employed to conduct the redundancy analysis, as recommended by Becker et al. (2012) and Sarstedt et al. (2019). This approach allows for the introduction of latent variables that group observable indicators in a logical and congruent manner. See Figure 3.

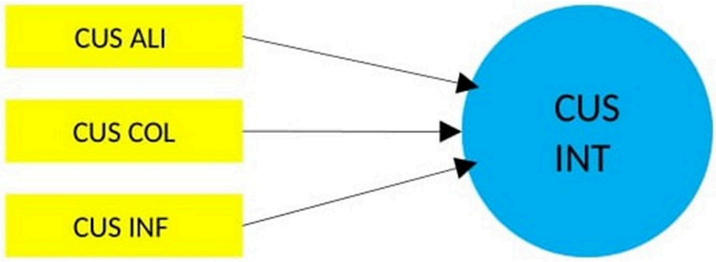
Figure 3. Convergent validity: HCM for CUS INT (reflective-formative)



Source: Own elaboration based on SmartPLS 3 software

After processing the redundancy analysis, the representation of CUS INT was generated, showing latent variables in place of observable indicators in the new arrangement, as presented in Figure 4.

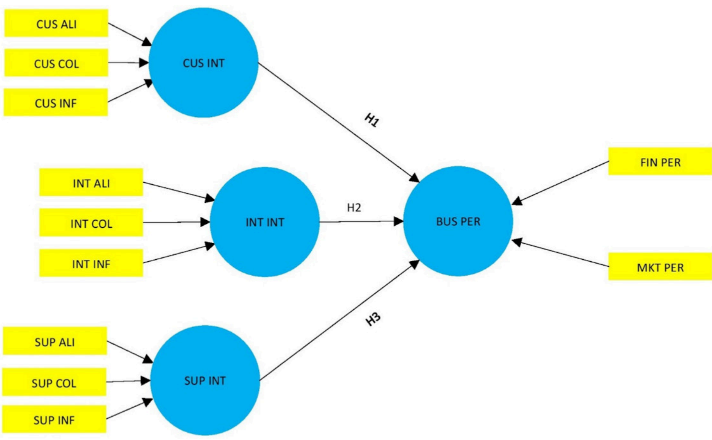
Figure 4. Convergent validity:latent variable for CUS INT



Source: Own elaboration based on SmartPLS 3 software

The same process, outlined in Figures 2 through 4, was applied to the other three measures for the convergent validity analysis. As a result, all four measures now display their latent variables instead of the observable indicators. Using these new configurations, the revised model is presented below in Figure 5.

Figure 5. Final model



Source: Own elaboration based on SmartPLS 3 software

Once the structural model was defined, as shown in Figure 5, it was assessed using the following tests: a) Collinearity b) Evaluation of the algebraic sign, magnitude, and statistical significance of the path coefficients c) Evaluation of R^2 d) Evaluation of the effect sizes (f^2)

4. Results

4.1. Measurement model

a) Convergent validity was confirmed for all four measures, with R^2 values of 1.0 for each, exceeding the recommended threshold of 0.64.

b) Collinearity of indicators was analyzed using the variance inflation factor (VIF). VIF values equal to or greater than 5 suggest potential collinearity issues. In this research, all VIF values were within the accepted range, as shown in Table 5.

Table 5. Outer VIF values

Indicator	CUS ALI	CUS COL	CUS INF	INT ALI	INT COL	INT INF	SUP ALI	SUP COL	SUP INF	FIN PER	MKT PER
VIF	1.376	1.509	1.281	1.690	1.801	1.779	1.691	2.057	1.945	3.269	3.269

c) Significance and Relevance: The results for the significance and relevance of the indicators are presented in Table 6.

Table 6. Significance and relevance

Indicator	External Weight	t (>1.96)	Significance (p<0.05)	External Load (>0.5)
CUS ALI	0.983	7.881	0.000	
CUS COL	0.076	0.31	0.757	0.541
CUS INF	-0.069	0.357	0.721	0.308
INT ALI	0.928	6.698	0.000	
INT COL	0.468	2.35	0.019	
INT INF	-0.534	2.215	0.027	
SUP ALI	0.535	2.309	0.021	
SUP COL	0.369	1.469	0.142	0.857
SUP INF	0.253	1.014	0.311	0.801
FIN PER	0.074	0.312	0.755	0.855
MKT PER	0.938	4.581	0.000	

For indicators showing non-significant external weights, all except CUS INF have external load values higher than the minimum required threshold of 0.5, indicating their absolute importance or contribution to the construct. Therefore, it is appropriate to retain them in the construct. Regarding CUS INF, Hair et al. (2019) suggests that when an indicator shows non-significant weight and an external load below 0.5, the next step is to evaluate whether the construct's conceptualization and theoretical relevance justify keeping it as part of the measure. In this case, the decision was made to retain CUS INF, considering that the concept it represents ("Information integration") is significant and relevant ($p < 0.05$) in the second measure, Internal Integration (INT INF), and has absolute importance (external load > 0.5) in the third measure, Supplier Integration (SUP INF).

4.2. Structural model

a) Collinearity of indicators was analyzed using the variance inflation factor (VIF). VIF values equal to or greater than 5 suggest potential collinearity issues. In this research, all VIF values were within the accepted range, as shown in Table 7.

Table 7. Collinearity

	VIF (<5)
CUS INT - BUS PER	1.310
INT INT - BUS PER	1.209
SUP INT - BUS PER	1.361

b) Evaluation of Algebraic Sign, Magnitude, and Statistical Significance: The results for the algebraic sign, magnitude, and statistical significance of the path coefficients are listed in Table 8.

Table 8. Algebraic sign, magnitude and statistical significance

	Path Coefficient	p 95% (<0.05)
CUS INT - BUS PER	0.305	0.004
INT INT - BUS PER	0.310	0.005
SUP INT - BUS PER	0.326	0.000

All path coefficients show a positive sign and are statistically significant, confirming the validity of the previously proposed hypotheses:

H1: Customer integration positively impacts the business performance of metal-mechanics manufacturing SMEs in the ZMG (Mexico).

H2: Internal integration positively impacts the business performance of metal-mechanics manufacturing SMEs in the ZMG (Mexico).

H3: Supplier integration positively impacts the business performance of metal-mechanics manufacturing SMEs in the ZMG (Mexico).

The magnitude of the path coefficients indicates that supplier integration (SUP INT) has the greatest impact on business performance (0.326), followed by internal integration (INT INT) with a value of 0.310, and customer integration (CUS INT) with 0.305.

c) Evaluation of R^2: R^2 measures the predictive power of the model. In this case, it indicates the amount of variance in the business performance construct explained by the antecedent constructs, which in this model are customer integration (CUS INT), internal integration (INT INT), and supplier integration (SUP INT). This R^2 value of 0.523 falls within the range from moderate to substantial.

d) Evaluation of Effect Size (f^2): The effect size reflects the change in the predictive value of the model (R^2) when an exogenous construct is omitted. In other words, it indicates whether the omitted construct has a substantive impact on the endogenous constructs.

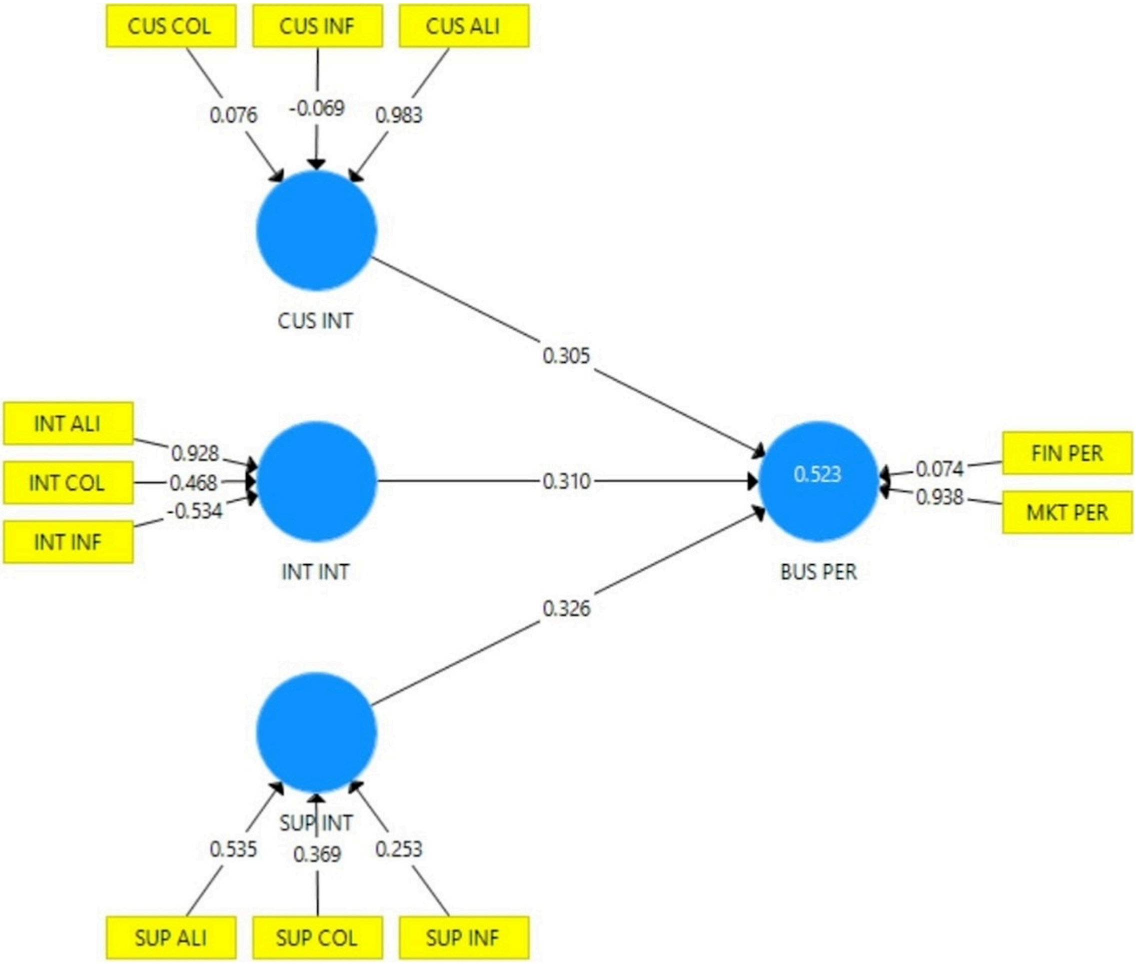
Table 9. R2 result and effect sizes (f^2)

Evaluation	
R^2 result	**R^2**
BUS PER	0.523
Effect sizes	**f^2**
CUS INT - BUS PER	0.118
INT INT - BUS PER	0.181
SUP INT - BUS PER	0.201

The effect size values range between medium and high, with supplier integration (SUP INT) showing the largest effect size, followed by internal integration (INT INT) in second place, and customer integration (CUS INT) in third place.

The final model, along with the corresponding results, is shown below in Figure 6, after the data was processed using SmartPLS 3.

Figure 6. Full model



5. Discussion

Barney (1991) and Wernerfelt (1984) suggest that each company possesses a unique set of resources and capabilities, which can generally be classified as physical capital, human capital, and organizational capital. Among these, companies have core capabilities that form the basis for competitive advantage. This explains why company performance varies, as each firm has access to different resources and capabilities. In line with this, the OECD/ECLAC (2012) highlights that factors enabling SMEs to improve their business performance include access to knowledge and information (from customers and suppliers) and access to managerial systems, such as supply chain integration. A firm's decision on how to configure, utilize, and deploy these factors is crucial for its business performance. Therefore, it is important to first identify the resources and capabilities involved in the interrelationship between supply chain partners, and then determine the appropriate timing and method for their implementation.

As noted by several authors, there are various SCI configurations, and selecting the most suitable one for each firm is crucial. On the one hand, it helps optimize available resources, while on the other, it ensures that SCI implementation aligns with the firm’s overall objectives and strategies. In line with this, the present research analyzed the relationship between SCI and the business performance of metal-mechanics manufacturing SMEs and found that customer integration, internal integration, and supplier integration all have a positive and significant effect on the business performance of metal-mechanics SMEs in the ZMG (Guadalajara, Jalisco, Mexico). To the best of my knowledge, this is the first study to focus specifically on SCI and metal-mechanics SMEs in the ZMG.

Regarding the predictive value of the proposed model, the R^2 value of 0.523 falls within the moderate to substantial range, as indicated by Hair et al. (2019). In terms of managerial implications, this research provides empirical evidence (Tables 8 and 9) showing that the independent variable, supplier integration, has the greatest impact on the dependent variable, business performance, followed by internal integration in second place and customer integration in third place. Considering that SMEs typically have limited or restricted access to resources, and therefore must prioritize resource allocation to specific strategies (Ataseven & Nair, 2017), these findings suggest that firms should prioritize the sequence of SCI implementation as follows: supplier integration, internal integration, and customer integration, to optimize expected improvements.

This research may also be valuable for managers seeking to acquire knowledge and information from their customers and suppliers (intellectual capital) to enhance the company's competitiveness (Sanchez-Gutierrez et al., 2016) and support their efforts to participate in the global value chain (OECD/ECLAC, 2012). Success in the global value chain relies on an integrative and collaborative coexistence among its members, rather than maintaining competitive relationships, as competition now occurs between supply chains rather than between individual firms (Qi et al., 2017). As some authors have noted, markets are becoming increasingly demanding, and firms must participate in the global value chain to avoid the risk of becoming obsolete or disappearing altogether (Vázquez Ávila, 2015).

It is important to note that this research specifically focuses on supply chain integration and its impact on business performance. However, the supply chain field is vast, and there are many other approaches beyond the concept of integration that may also influence business performance. Additionally, this study is limited to metal-mechanics SMEs in the geographic area of the metropolitan zone of Guadalajara, Jalisco, Mexico. For future studies, it may be valuable to extend the research to other sectors or types of businesses, which could generate additional knowledge and improvements in supply chain management.

References

Afshan, N. (2013). The performance outcomes of dimensions of supply chain integration: A conceptual framework. *Verslas: teorija ir praktika, 14*(4), 323–331. https://doi.org/10.3846/btp.2013.34

Alfalla-Luque, R., Marin-Garcia, J. A., & Medina-Lopez, C. (2015). An analysis of the direct and mediated effects of employee commitment and supply chain integration on organisational performance. *International Journal of Production Economics, 162*, 242–257. https://doi.org/10.1016/j.ijpe.2014.07.004

Annan, J., Boso, N., & Essuman, D. (2016). Investigating the path from supply chain integration to business performance: Evidence from a Sub-Saharan African economy. *International Journal of Business and Management, 11*(6), 225. https://doi.org/10.5539/ijbm.v11n6p225

Ataseven, C., & Nair, A. (2017). Assessment of supply chain integration and performance relationships: A meta-analytic investigation of the literature. *International Journal of Production Economics, 185*, 252–265. https://doi.org/10.1016/j.ijpe.2017.01.007

Baharanchi, S. H. (2009). Investigation of the impact of supply chain integration on product innovation and quality. *Scientia Iranica, 16*(1 E). https://scientiairanica.sharif.edu/article_3195.html

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99–120. https://doi.org/10.1177/014920639101700108

Becker, J., Klein, K., & Wetzels, M. (2012). Hierarchical latent variable models in PLS-SEM: guidelines for using reflective-formative type models. *Long Range Planning, 45*(5-6), 359–394. https://doi.org/10.1016/j.lrp.2012.10.001

Beheshti, H., Oghazi, P., Mostaghel, R., & Hultman, M. (2014). Supply chain integration and firm performance: An empirical study of Swedish manufacturing firms. *Competitiveness Review, 24*(1), 20–31. https://doi.org/10.1108/CR-06-2013-0060

Chin, W. W. (2010). How to write up and report PLS analyses. In *Handbook of partial least squares* (pp. 655–690). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-540-32827-8_29

Dametew, A. W., Ebinger, F., Birhanu, &., & Abebe, B. (2016). Supply chain integration for improving performance on manufacturing industries. *Global Journal of Researches in Engineering: J General Engineering, 16*(4). https://globaljournals.org/item/6404-supply-chain-integration-for-improving-performance-on-manufacturing-industries

Devaraj, S., Krajewski, L., & Wei, J. C. (2007). Impact of eBusiness technologies on operational performance: The role of production information integration in the supply chain. *Journal of Operations Management, 25*(6), 1199–1216. https://doi.org/10.1016/j.jom.2007.01.002

Dini, M., & Stumpo, G. (2020). *Mipymes en América Latina: Un frágil desempeño y nuevos desafíos para las políticas de fomento, Documentos de Proyectos (LC/TS.2018/75/Rev.1), Santiago, Comisión Económica para América Latina y el Caribe (CEPAL)*. https://hdl.handle.net/11362/44148

Droge, C., Vickery, S. K., & Jacobs, M. A. (2012). Does supply chain integration mediate the relationships between product/process strategy and service performance? An empirical study. *International Journal of Production Economics, 137*(2), 250–262. https://doi.org/10.1016/j.ijpe.2012.02.005

Feyissa, T. T., Sharma, R. R. K., & Lai, K. (2019). The impact of the core company's strategy on the dimensions of supply chain integration. *The International Journal of Logistics Management, 30*(1), 231–260. https://doi.org/10.1108/IJLM-03-2017-0080

Flynn, B. B., Huo, B., & Zhao, X. (2010). The impact of supply chain integration on performance: A contingency and configuration approach. *Journal of Operations Management, 28*(1), 58–71. https://doi.org/10.1016/j.jom.2009.06.001

Frohlich, M. T., & Westbrook, R. (2001). Arcs of integration: An international study of supply chain strategies. *Journal of Operations Management, 19*(2), 185–200. https://doi.org/10.1016/S0272-6963(00)00055-3

Georgise, F. B., Klause-Dieter, T., & Seifert, M. (2014). Integrating developing country manufacturing industries into global supply chain. *Journal of Industrial Engineering and Management, 10*(1). https://doi.org/10.3926/jiem.845

Germain, R., & Iyer, K. N. S. (2006). The interaction of internal and downstream integration and its association with performance. *Journal of Business Logistics, 27*(2), 29–52. https://doi.org/10.1002/j.2158-1592.2006.tb00216.x

Hair, J. F., M. Hult, G. T., M. Ringle, C., Sarstedt, M., Castillo Apraiz, J., Cepeda Carrión, G. A., & Roldán, J. L. (2019). *Manual de partial least squares structural equation modeling (PLS-SEM)*. OmniaScience. https://doi.org/10.3926/oss.37

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice, 19*(2), 139–152. https://doi.org/10.2753/MTP1069-6679190202

Hair, J. F., Sarstedt, M., Ringle, C. M., & Mena, J. A. (2012). An assessment of the use of partial least squares structural equation modeling in marketing research. *Journal of the Academy of Marketing Science, 40*(3), 414–433. https://doi.org/10.1007/s11747-011-0261-6

Huo, B. (2012). The impact of supply chain integration on company performance: An organizational capability perspective. *Supply Chain Management: An International Journal, 17*(6), 596–610. https://doi.org/10.1108/13598541211269210

Huo, B., Ye, Y., Zhao, X., & Shou, Y. (2016). The impact of human capital on supply chain integration and competitive performance. *International Journal of Production Economics, 178*, 132–143. https://doi.org/10.1016/j.ijpe.2016.05.009

IIEG-Jalisco (2024). *Instituto de Información estadística y geográfica de Jalisco - Industria del metal*. https://iieg.gob.mx/ns/?page_id=19146

INEGI (2015). *Censos Económicos 2014 micro, pequeña, mediana, y gran empresa, estratificación de los establecimientos. Instituto Nacional de Estadística y Geografía*. https://www.inegi.org.mx/

Kahn, K. B., & Mentzer, J. T. (1996). Logistics and interdepartmental integration. *International Journal of Physical Distribution & Logistics Management, 26*(8), 6–14. https://doi.org/10.1108/09600039610182753

Lambert, D. M., & Enz, M. G. (2017). Issues in supply chain management: Progress and potential. *Industrial Marketing Management, 62*, 1–16. https://doi.org/10.1016/j.indmarman.2016.12.002

Lee, C. W., Kwon, I. G., & Severance, D. (2007). Relationship between supply chain performance and degree of linkage among supplier, internal integration, and customer. *Supply Chain Management: An International Journal, 12*(6), 444–452. https://doi.org/10.1108/13598540710826371

Maleki, M., & Cruz-Machado, V. (2013). A review on supply chain integration: Vertical and functional perspective and integration models. *Economics and Management, 18*(2). https://doi.org/10.5755/j01.em.18.2.2968

Marcoulides, G. A., & Chin, W. W. (2013). You write, but others read: Common methodological misunderstandings in PLS and related methods. In *New perspectives in partial least squares and related methods* (pp. 31–64). Springer. https://doi.org/10.1007/978-1-4614-8283-3_2

Mentzer, J. T., Stank, T. P., & Esper, T. L. (2008). Supply chain management and its relationship to logistics, marketing, production, and operations management. *Journal of Business Logistics, 29*(1), 31–46. https://doi.org/10.1002/j.2158-1592.2008.tb00067.x

OECD/ECLAC (2012). *Perspectivas económicas de América Latina 2013: Políticas de Pymes para el cambio estructural*. OECD Publishing. https://doi.org/10.1787/leo-2013-es

Ozpolat, K., & Dresner, M. (2018). A dark side of long-term VMI relationships: Supply chain trust. *Research in Logistics & Production, 8*(2). https://doi.org/10.21008/j.2083-4950.2018.8.2.1

Pakurár, M., Haddad, H., Popp, J., Khan, T., & Oláh, J. (2019). Supply chain integration, organizational performance and balanced scorecard: An empirical study of the banking sector in Jordan. *Journal of International Studies, 12*(2), 129–146. https://doi.org/10.14254/2071-8330.2019/12-2/8

Prajogo, D., & Olhager, J. (2012). Supply chain integration and performance: The effects of long-term relationships, information technology and sharing, and logistics integration. *International Journal of Production Economics, 135*(1), 514–522. https://doi.org/10.1016/j.ijpe.2011.09.001

Priem, R. L., & Swink, M. (2012). A demand-side perspective on supply chain management. *Journal of Supply Chain Management, 48*(2), 7–13. https://doi.org/10.1111/j.1745-493X.2012.03264.x

Qi, Y., Huo, B., Wang, Z., & Yeung, H. Y. J. (2017). The impact of operations and supply chain strategies on integration and performance. *International Journal of Production Economics, 185*, 162–174. https://doi.org/10.1016/j.ijpe.2016.12.028

Ralston, P. M., Blackhurst, J., Cantor, D. E., & Crum, M. R. (2015). A structure–conduct–performance perspective of how strategic supply chain integration affects firm performance. *Journal of Supply Chain Management, 51*(2), 47–64. https://doi.org/10.1111/jscm.12064

Reinartz, W., Haenlein, M., & Henseler, J. (2009). An empirical comparison of the efficacy of covariance-based and variance-based SEM. *International Journal of Research in Marketing, 26*(4), 332–344. https://doi.org/10.1016/j.ijresmar.2009.08.001

Rosenzweig, E. D., Roth, A. V., & Dean, J. W. (2003). The influence of an integration strategy on competitive capabilities and business performance: An exploratory study of consumer products manufacturers. *Journal of Operations Management, 21*(4), 437–456. https://doi.org/10.1016/S0272-6963(03)00037-8

Saeed, K. A., Malhotra, M. K., & Grover, V. (2005). Examining the impact of interorganizational systems on process efficiency and sourcing leverage in buyer–supplier dyads. *Decision Sciences, 36*(3), 365–396. https://doi.org/10.1111/j.1540-5414.2005.00077.x

Sanchez-Gutierrez, J., Mejia-Trejo, J., Vargas-Barraza, J. A., & Vazquez-Avila, G. (2016). Intellectual capital, impact factor on competitiveness: manufacturing industry SMEs in Mexico. *Measuring Business Excellence, 20*(1), 1–11. https://doi.org/10.1108/MBE-12-2015-0059

Sarstedt, M., Hair, J. F., Cheah, J., Becker, J., & Ringle, C. M. (2019). How to specify, estimate, and validate higher-order constructs in PLS-SEM. *Australasian Marketing Journal, 27*(3), 197–211. https://doi.org/10.1016/j.ausmj.2019.05.003

Seçkin, F., & Şen, C. G. (2018). Conceptual framework for buyer-supplier integration strategies and their association to the supplier selection criteria in the light of sustainability. *Journal of Aeronautics and Space Technologies, 11*(2), 83–106. https://jast.hho.msu.edu.tr/index.php/JAST/article/view/298

Srinivasan, R., & Swink, M. (2015). Leveraging supply chain integration through planning comprehensiveness: An organizational information processing theory perspective. *Decision Sciences, 46*(5), 823–861. https://doi.org/10.1111/deci.12166

Stank, T. P., Keller, S. B., & Daugherty, P. J. (2001). Supply chain collaboration and logistical service performance. *Journal of Business Logistics, 22*(1), 29–48. https://doi.org/10.1002/j.2158-1592.2001.tb00158.x

Stevens, G. C., & Johnson, M. (2016). Integrating the Supply Chain łdots 25 years on. *International Journal of Physical Distribution & Logistics Management, 46*(1), 19–42. https://doi.org/10.1108/IJPDLM-07-2015-0175

Sun, H., & Ni, W. (2012). The impact of upstream supply and downstream demand integration on quality management and quality performance. *International Journal of Quality & Reliability Management, 29*(8), 872–890. https://doi.org/10.1108/02656711211270342

Swink, M., Narasimhan, R., & Wang, C. (2007). Managing beyond the factory walls: Effects of four types of strategic integration on manufacturing plant performance. *Journal of Operations Management, 25*(1), 148–164. https://doi.org/10.1016/j.jom.2006.02.006

Talib, N. A. C., Abd Razak, N., & Mahmud, N. (2023). Enhancing small and medium enterprise performance through supply chain integration: A case study of Malaysia. *Information Management and Business Review, 15*(3(I)), 405–417. https://doi.org/10.22610/imbr.v15i3(I).3551

Tarifa-Fernandez, J., & De Burgos-Jiménez, J. (2017). Supply chain integration and performance relationship: a moderating effects review. *The International Journal of Logistics Management, 28*(4), 1243–1271. https://doi.org/10.1108/IJLM-02-2016-0043

Turkulainen, V., Roh, J., Whipple, J. M., & Swink, M. (2017). Managing internal supply chain integration: Integration mechanisms and requirements. *Journal of Business Logistics, 38*(4), 290–309. https://doi.org/10.1111/jbl.12165

Vázquez Ávila, G. (2015). How innovation in operations increases competitiveness in manufacturing SMES in the metropolitan area of Guadalajara. *Nova Scientia, 7*(15), 597. https://doi.org/10.21640/ns.v7i15.306

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal, 5*(2), 171–180. https://doi.org/10.1002/smj.4250050207

Wiengarten, F., Humphreys, P., Gimenez, C., & McIvor, R. (2016). Risk, risk management practices, and the success of supply chain integration. *International Journal of Production Economics, 171*, 361–370. https://doi.org/10.1016/j.ijpe.2015.03.020

Wong, C., Skipworth, H., Godsell, J., & Achimugu, N. (2012). Towards a theory of supply chain alignment enablers: a systematic literature review. *Supply Chain Management: An International Journal, 17*(4), 419–437. https://doi.org/10.1108/13598541211246567

Wong, C. W. Y., Wong, C. Y., & Boon-itt, S. (2013). The combined effects of internal and external supply chain integration on product innovation. *International Journal of Production Economics, 146*(2), 566–574. https://doi.org/10.1016/j.ijpe.2013.08.004

Xu, D., Huo, B., & Sun, L. (2014). Relationships between intra-organizational resources, supply chain integration and business performance. *Industrial Management & Data Systems, 114*(8), 1186–1206. https://doi.org/10.1108/IMDS-05-2014-0156

Yu, W., Jacobs, M. A., Salisbury, W. D., & Enns, H. (2013). The effects of supply chain integration on customer satisfaction and financial performance: An organizational learning perspective. *International Journal of Production Economics, 146*(1), 346–358. https://doi.org/10.1016/j.ijpe.2013.07.023

Yuen, K. F., & Thai, V. V. (2017). The influence of supply chain integration on operational performance. *The International Journal of Logistics Management, 28*(2), 444–463. https://doi.org/10.1108/IJLM-12-2015-0241

Zhang, M., & Huo, B. (2013). The impact of dependence and trust on supply chain integration. *International Journal of Physical Distribution & Logistics Management, 43*(7), 544–563. https://doi.org/10.1108/IJPDLM-10-2011-0171

Zhao, X., Huo, B., Flynn, B. B., & Yeung, J. H. Y. (2008). The impact of power and relationship commitment on the integration between manufacturers and customers in a supply chain. *Journal of Operations Management, 26*(3), 368–388. https://doi.org/10.1016/j.jom.2007.08.002