

## Collaboration and Supply Chain in Mexican Manufacturing SMEs

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### Resumen

En un ambiente de los negocios demasiado incierto, insertados en un mercado cada vez más competitivo y en una economía globalizada, la colaboración surge como una alternativa no solamente para eficientar la cadena de suministro, sino además como una estrategia empresarial que puede generar un mayor nivel de crecimiento de las organizaciones, en especial de las pequeñas y medianas empresas. Asimismo, las actividades de colaboración están siendo adoptadas e implementadas por un número cada vez mayor de empresas, y no sólo son sinónimo de intercambio de información, sino también de buenas prácticas de comunicación, compartir riesgos y generación de conocimiento. Por lo tanto, el objetivo central de este estudio de investigación es conocer los efectos que ejercen de las actividades de colaboración en la cadena de suministro de las pequeñas y medianas empresas, considerando para ello una muestra de 346 empresas asentadas en el Estado de Aguascalientes (México). Los resultados obtenidos muestran que las actividades de colaboración tienen efectos positivos significativos en la cadena de suministro de las pequeñas y medianas empresas de Aguascalientes.

**Keywords:** *Collaboration, supply chain, SMEs*

### Abstract

Living in an uncertain business environment, incrementally competitive markets and globalized economy, collaboration is an alternative not only to make more efficient supply chains, but also as a business strategy that can generate greater levels of business growth, specially in Small and Medium Enterprises (SMEs). Equally, collaboration activities have been adopted and implemented in more companies, these are not only a synonym of information exchange but as best practices of communication, risk sharing and knowledge generation. Therefore, the main objective of this research is to expose the effects of collaboration activities on supply chains in SMEs, by considering a sample of 346 companies operating in the state of Aguascalientes, México. The obtained results show that collaboration activities have positive and significant results on supply chains of SMEs in this state.

**Keywords:** *Collaboration, supply chain, SMEs.*

## 1. INTRODUCTION

The current millennium is essentially characterized by its business uncertainty derived from market and economy globalization and from a higher level of competitiveness, which provokes a strong pressure among companies, essentially among Small and Medium-Sized Enterprises (SMEs), to reorient and adopt new business strategies that allow them not only to market participation but to survive. In this sense, the current literature in business management has presented collaboration as one of the most used strategies in companies; mainly because it allows businesses, basically SMEs, to share costs of products distribution along the supply chain, and to reduce risks in such activity.

In this sense, collaboration not only plays an essential role in business strategies but also has a close relation to supply chain management. It is because collaboration allows participant companies to share efforts to achieve the same goals and objectives at a shorter time and lower costs (Cannella & Ciancimino, 2010). Therefore, sharing not only SMEs efforts but also its resources and capacities during these collaboration activities helps to solve main issues in the supply chain (Seifert, 2003), generating with it greater possibilities to achieve higher levels of business performance, and in consequence, better competitiveness level of businesses.

At the same time, by sharing goals and objectives through collaboration between companies permit the elimination of inefficiencies, such as, not on-time products deliveries or lack of coordination to meet customer requirements, which commonly happen in the supply chain (Cannella & Ciancimino, 2010). In order to solve this kind of problems, companies can implement better flows of information generated throughout its supply chain, by implementing a collaboration system that allows SMEs to have such information in real time so its requirements and products delivery system become efficient (Holweg *et al.*, 2005).

This way, since 1980 when the programs of rapid response were implemented by a great deal of businesses (Hunter, 1990) the collaboration projects modify in a great percentage the modus operandi and processes of supply chains. This mainly because the adoption and implementation of collaboration activities in various projects considerably improved not only raw materials flows but also information among participating companies. Also, it intensified the alliances and cooperation between SMEs, and completely transformed business strategies, organizational culture and cooperative of a considerable number of companies, which allow a greater level of efficiency and effectiveness of the supply chain in commercialized products (Cannella & Ciancimino, 2010).

Such strategies or structural changes were carried out several companies that motivated even more companies, researchers, academics and professionals in the sciences for management,

to develop new theoretical models that could significantly improve the structure of supply chains, by implementing collaboration activities (Lee & Whang, 2003). Therefore, in the pursue of not only of defining both concepts but to define its relationships; between collaboration and supply chain, the Council of Operations Management has consider pertinent to formalize: 1) how the information flows can be applied to improve inventory controls and 2) how the collaboration activities among companies can improve and enhance the policies for inventory control.

Besides, one of the first theoretical models that were presented in literature, and more accepted one by academics and researchers, was developed by Holweg *et al.* (2005), which defines that there should be a synchronization in decisions making within the supply chains of companies participating in the collaboration, which will improve and strengthen policies for inventory control. At the same time, Holweg *et al.* (2005) identified four fundamental elements that would significantly improve inventories control in companies that implement collaboration activities: *a*) supply chain configuration (apply collaboration activities), *b*) collaboration in inventories planning (information interchange), *c*) collaboration in inventories management (stocks) and, *d*) collaboration in inventories planning and management (supply chain synchronization).

## 2. LITERATURE REVIEW

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In the literature on sciences for management on this century is generally presented by researchers and academics as the information era; which means companies, specially SMEs, have considered collaboration as a business strategy and an essential resource to achieve more and better competitive advantages (Dyer & Singh, 1998). Similarly, in the literature it is presented a close relationship between the collaboration activities and the supply chain, which has been analysed and discussed by several researchers, academics and professionals since 1990. Then, after accepting this relationship as essential both concepts have been defined in different forms (Holweg *et al.*, 2005; Simatupang & Sridharan, 2005), and can be organized in two main categories: focus on processes and focus on relationships (Cao *et al.*, 2010).

First, the relationship between collaboration and supply chain can be considered as a business process, in which supply chain's stakeholders work together to achieve common goals and objectives (Mentzer *et al.*, 2000; Sheu *et al.*, 2006). A literature review establish that every time there are more companies that give more importance to other activities, such as, planning activities (Kaufman *et al.*, 2000), cross-functional processes integration (Lambert *et al.*, 1999), supply chain activities coordination (Kim, 2000), achievement of goals of the supply chain (Peck & Juttner, 2000), development of alliances and collaboration strategies (Stuart & McCutcheon, 1996), establishment of information sharing parameters (Lamming, 1996), and to various options of subcontracting (Heriot & Kulkarni, 2001).

Second, the relationship between collaboration and the supply chain can be also considered as a long-term relationship between stakeholders, through which they can co-ordinately work by sharing information, resources and risks to achieve goals of every company participating in this collaboration (Ellram & Hendrick, 1995; Golicic *et al.*, 2003). For this reason, companies are willing to adopt and implement collaboration activities that share in a voluntary forma its human, financial and technical resources with the aim not only to create a better business model but to generate better competitive advantages (Bowersox *et al.*, 2003).

On the other hand, during the last decades in the literature on management sciences it has been recognized intermediaries as strategic stakeholders that can help to not only improve its supply chain activities but to obtain more and better competitive advantages and to increment its level of competitiveness (Hult *et al.*, 2007). There are various industrial examples in the literature such as Nokia, Procter & Gamble, Toyota o Zara, which achieve sustainable competitive advantages and a greater level of competitiveness by adopting and implementing collaboration activities with its main supply chain' stakeholders (Lee, 2004).

This kind of companies adopting and implementing collaboration activities in its supply chain and extending its business activities beyond the simple acquisition of economical benefits by systematically and strategically aligning its supply chain operations with its superior collaborative stakeholders compared to its main competitors (Burke & Vakharia, 2002). Then, collaboration creates a greater efficiency and efficacy level in the supply chain in SMEs, which allows to confirm that there is a close relationship between collaboration activities and supply chains.

In this sense, recent investigations published in the literature have established that in an uncertain businesses environment it is not enough to get higher business performance. On the contrary, it is suggested that companies and its main stakeholders should increase its collaboration strategies and to significantly improve its business model with the aim of increase its coordination and integration of resources (Walter *et al.*, 2001; Burke & Vakharia, 2002; Berghman *et al.*, 2006; Hult *et al.*, 2007). As a result, a great number of companies, among them SMEs, have demonstrated to obtain important results from developing more efficiently its supply chain, which has been achieved by increasing its collaboration activities among companies and its main collaborators (Frohlich, 2002).

Similarly, there is theoretical and empirical evidence published in the current literature, which exposure that collaboration is more than a simple transaction and coordination of supply chain activities. On the contrary, it establishes that collaboration can be considered as a fundamental strategy that increases interaction among companies that participate in collaboration activities (Frohlich, 2002; Vakharia, 2002). Moreover, collaboration can be seen from two positions: collaboration in systems and collaboration as strategy (Wognum *et*

*al.*, 2002). These approaches can generate greater levels of supply chain efficiency, more competitive advantages and therefore, higher competitive levels.

Similarly, it is not possible to find literature that explicitly recognized both collaboration in systems and collaboration as strategy. However, it is important to separately analyse each concept because each has different effects on the collaborative business' performance (Wognum *et al.*, 2002). Thus, collaboration in systems refers to the existing relationship between the supply chain and its stakeholders, through the implementation of efficient and effective communication system. This allows every company to prepare for the adoption and implementation of a planning and supply of products manufactured by enterprises (Sanders & Premus, 2005; Rai *et al.*, 2006).

In consequence, several researchers and academics have concluded that various investigations published in the current literature that it is possible to confirm that collaboration in systems is a process based on common platform among companies and its main stakeholders throughout the supply chain. Also, stakeholders are totally open to share information generated in its supply chain, which makes easier both coordination and management of all collaboration tasks to achieve; on one hand, planning and supply of manufactured products required (Sanders & Premus, 2005). Additionally, it improves inventory policies and in consequence there is a better market performance of companies collaborating (Kim & Lee, 2010).

Strategic collaboration is generally considered in the current literature as a higher level of relationships and interactions performed in manufacturing companies and its main stakeholders that work in collaboration (Johnson, 1999; Hult *et al.*, 2007), which go beyond a simple collaboration system. Besides, strategic collaboration is essential to develop supply chains, because commonly main stakeholders in SMEs participate in collaboration activities and implement several planning activities throughout the supply chain to achieve goals and specific objectives, in both short and long term, that have been established every company that work in the collaboration framework (Kim & Lee, 2010).

Despite of the various theoretical and empirical contributions about the efforts in companies, especially in SMEs, to gain greater integration levels by supply chain collaboration and its main stakeholders (Stank *et al.*, 2001; Sanders, 2007), it is not possible to find in the current literature a clear distinction between collaboration in systems and strategic collaboration, to which it is important that researchers carry out investigations that allow better understanding not only about the existing differences between both concepts but also the various effects of collaboration onto supply chains (Wognum *et al.*, 2002).

Furthermore, it is essential to recognize the importance of collaboration among main stakeholders in supply chains not only for companies' success but also for higher growth and

performance levels (Kim & Lee, 2010). Additionally, Sanders (2007) concluded that collaboration among firms has a positive impact on supply chains but not on its business performance, therefore it is necessary future research on collaboration activities that have strong influence and sequence implications in business performance, with the aim that companies collaborating not only have a positive effect on its supply chain but on its business performance.

Similarly to Sanders (2007) other researchers and academics have concluded that collaboration activities effectively have a positive and significant impact on the supply chain but not in its business performance (Kim *et al.*, 2006). In this sense, Kim *et al.* (2006) have proposed, in their research that there should be a clear distinction in the adoption and implementation of collaboration activities at both levels, strategic and information systems level. This means that it is necessary to distinguish collaboration in systems and strategic collaboration among companies because it is well defined then collaboration among companies will significantly increase efficiency and effectiveness in the supply chain and in consequence a positive effect on its business performance.

After this literature review it is possible to establish the following research hypothesis:

***H1: the higher level of collaboration, the higher level of supply chains***

### **3. RESEARCH METHODOLOGY**

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In order to test the research hypothesis in this investigation an empirical research was carried out. In particular, this was established in SMEs operating in the Aguascalientes state, Mexico. To determine the theoretical framework it was necessary to access the Mexican Enterprises Information System (SIEM from its acronym in Spanish) in 2010, which has at that time 1,242 registered companies, ranging from 5 to 250 employees. Also, a survey designed to be completed by managers or owners of the selected SMEs. This was applied through a personal interview to a sample of 400 companies, with random sampling, and a maximum error of  $\pm 4.5\%$  and a confidence level of 95%, which represented more than 23% of total SMEs, validating 346 surveys that in total represented 87% of the sample.

#### **3.1. Dependent Variable**

The scale used in this research to measure the supply chain variable was adapted from Wisner (2003), that measure it through 20 items and a 5 points Likert, where 1 = totally disagree and 5 = totally agree. For this the supply chain variable was constructed from the arithmetic mean of the 20 items.

#### **3.2. Independent Variable and Control**

The independent variable used in this research was collaboration, which is defined by a one-dimensional scale. It was measure through a 5 points Likert scale with where 1 = totally

disagree and 5 = totally agree. Besides, collaboration was measured with a scale of 5 items and adapted from Heide and John (1990), Zaheer *et al.* (1998) and Corsten and Felde (2005). From the answers obtained the survey was constructed and the collaboration variable by the arithmetic mean of the five items. This way of constructing the variable is presented by Hughes (2001) and García, Martínez, Maldonado *et al.* (2009). Similarly, two control variables, size and company age, were incorporated because in the literature it is considered that these two variables can have significant and positive effects. Such variables were organized as follows:

**Size.** This variable was measure through the mean of employees in 2008.

**Age.** This variable was measured through the number of years of the company since its opening or creation.

### 3.3. Validity and Reliability

For this investigation, to evaluate reliability and validity of the two scales used a confirmatory factor analysis (AFC) was applied, using the method of maximum likelihood with EQS 6.1 software (Bentler, 2005; Brown, 2006; Byrne, 2006). In addition, the reliability of the scales was measured through the Cronbach alpha and Composite Reliability Index (CFI) defined by Bagozzi & Yi (1988). Both values of the scales satisfied the minimum value of 0.7 for alpha Cronbach and CFI as they provide sufficient evidence of reliability and justify internal validity of the two scales (Nunally & Bernstein, 1994; Hair *et al.*, 1995).

Table 1 shows findings from the application of the AFC and these suggest that the theoretical model of collaboration and supply chain offer a good data fit ( $S-BX^2 = 944.238$ ;  $df = 274$ ;  $p = 0.000$ ;  $NFI = 0.818$ ;  $NNFI = 0.850$ ;  $CFI = 0.863$ ;  $RMSEA = 0.079$ ). Moreover, all factors of related items were significant ( $p < 0.01$ ), the factors loads are higher than 0.6 (Bagozzi & Yi, 1988) and the Extracted Variance Index (EVI) of the related pair of constructs are higher than 0.5 recommended by Fornell and Larcker (1981).

**Table 1: Internal consistency and convergent validity of the theoretical model**

Variable	Indicator	Factor Loadings	Robust t-Value	Cronbach Alpha	CRI	EVI
Collaboration	CO1	0.830***	1.000 <sup>a</sup>	0.858	0.860	0.554
	CO2	0.844***	21.100			
	CO3	0.724***	12.957			
	CO4	0.698***	14.740			
	CO5	0.600***	11.363			
Supply Chain	CS1	0.718***	1.000 <sup>a</sup>	0.957	0.960	0.553
	CS2	0.746***	11.078			
	CS3	0.703***	10.922			
	CS4	0.694***	10.069			
	CS5	0.641***	11.077			
	CS6	0.632***	10.139			
	CS7	0.696***	10.273			
	CS8	0.779***	9.787			
	CS9	0.752***	11.026			
	CS10	0.880***	12.366			
	CS11	0.741***	11.614			
	CS12	0.643***	10.106			
	CS13	0.748***	11.574			
	CS14	0.750***	11.034			
	CS15	0.802***	12.042			
	CS16	0.734***	12.218			
	CS17	0.792***	11.325			
	CS18	0.681***	10.282			
	CS19	0.828***	12.513			
	CS20	0.759***	11.410			
$S-BX^2$ (df = 274) = 944.238; p < 0.000; NFI = 0.818; NNFI = 0.850; IFC = 0.863; RMSEA = 0.079						

a = Value parameters in the identification process

\*\*\* = p < 0.01

In the Table 2 the discriminant validity is shown through two tests. First, with an interval of 95% of dependability, none of the individual elements of the factors contains the value 1.0 (Anderson & Gerbing, 1988). Second, the variance extracted among each couple of constructs of the model is superior that it's corresponding VEI (Fornell & Larcker, 1981).



Therefore, we can conclude that this investigation paper shows enough evidences of reliability and convergent and discriminant validity.

**Table 2: Discriminant validity of the measurement of the theoretical model**

Variables	Collaboration	Supply Chain
Collaboration	<b>0.554</b>	0.104
Supply Chain	0.264 - 0.380	<b>0.553</b>

Diagonal represent the variance-extracted index, while above the diagonal the shared variance (squared correlations) are represented. Below under the diagonal the 95% confidence interval for the estimated factors correlations is provided.

#### 4. RESULTS

To test the formulated hypothesis of this research and therefore the level of influence of collaboration activities on SMEs supply chains operating in Aguascalientes, a regression analysis was conducted through ordinary least square (OLS), using the following model:

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$$Supply\ Chain_i = b_0 + b_1 \cdot Collaboration_i + b_2 Size + b_3 Age + \varepsilon_i$$

Where, *Supply Chain<sub>i</sub>* represent the companies supply chain of companies participating on the collaboration. *Collaboration<sub>i</sub>* corresponds to collaboration activities from manufacturing enterprises and its own stakeholders. *Size*, represents the average number of employees and *Age<sub>i</sub>* the operating years of companies. The model was estimated (Table 3) and it is possible to observe that independent variables have a Variance Inflection Factor (VIF) near 1, therefore the existence of multi-collinearity is discarded.

**Table 3. Relationship between Collaboration and Costs (n = 346)**

Variables	Supply Chain
<b>Collaboration</b>	0.242*** (3.239)
<b>Size</b>	0.030 (0.509)
<b>Age</b>	0.192** (2.055)
VIF more high	1.026
F - Value	7.506***
R <sup>2</sup> Adjusted	0.267
Below each standardized coefficient, in parenthesis, statistical value t-student. * = $p \leq 0.1$ ; ** = $p \leq 0.05$ ; *** = $p \leq 0.01$	

Table 3 shows that greater used of collaboration activities in SMEs positively and significantly influence supply chain (standardized coefficient = 0.242 y  $p < 0.01$ ) in consequence it is possible to confirm the formulated hypothesis. However, evidence in this investigation demonstrate that the company size does not affect SMEs supply chain, mainly because there is no statistically significant variable (standardized coefficient = 0.030), but company size has significant effects on supply chain, although less than collaboration (standardized coefficient 0.192 y  $p < 0.05$ ). Validity of the model is examined by contrasting adjusted  $R^2 = 0.267$  and F value = 7.506 ( $p < 0.01$ ). The independent variables have a VIF of 1.026, which is near 1 and therefore it is possible to discard multi-collinearity conditions in variables.

## 5. CONCLUSIONS AND DISCUSSION

The obtained results in this investigation allow establishing two main propositions. First, the adoption and implementation of collaboration activities help SMEs, especially operating in Aguascalientes, Mexico, to significantly improve its supply chains. In other words, supply chains of SMEs will be more efficient and effective as they adopt and implement collaboration in all practices with shareholders. Therefore, collaboration should be consider

not only as business strategy but as a way of daily work established in all departments and functional areas in the company, which will allow businesses to have a more efficient supply chain.

Second, collaboration activities among shareholders of SMEs can be orientated to two central aspects: a systems collaboration approach, which means business have to incorporate the necessary changes in order to develop or interchange information generated along the supply chain with stakeholders and themselves should interchange information with manufacturing companies. In consequence, as SMEs are compromised on information sharing with other companies that participate in collaborative practices the will improve not only its supply chain but its knowledge level and business performance of all SMEs collaborating.

The second central aspect is the strategic orientation that means an adoption and implementation of collaboration activities as a business strategy through the whole organization, where teamwork among workers and employees are a constant, and all employees have to have a positive attitude towards team working with others inside and outside the company. If companies make its employees adopt such type of responsibility then SMEs would not have problems to develop collaboration activities, and consequently these could not only improve its supply chain but its overall business performance, that means greater benefits for all actors of the supply chain.

On the other hand, there is a growing number of companies that are considering collaboration activities in their strategies, because these becoming aware of the multiple benefits from these practices, mainly because collaboration not only allow supply chain efficiency but survival in this competitive market. Also, SMEs that do not integrate collaboration initiatives in its daily activities will have more problems and will reduce its opportunities to significantly improve its supply chain but will have serious obstacles to achieve greater growth and performance.

Similarly, managers/owners of SMEs in Aguascalientes state have to internally change in order to create an appropriate environment for the adoption of collaborative practices, especially with its shareholders, because without this the implementation will be more

complicated. Besides, SMEs managers have to synchronize its workers compensations and rewards with those implemented in its stakeholders businesses, in a way that these are similar so workers feel they are working in similar conditions.

Additionally, according to this research findings if SMEs managers in Aguascalientes want to significantly improve its efficiency and effectiveness of supply chains, then it would be required to develop practices that allow organizations to exploit resources and capabilities of other companies to which these are collaboration, mainly when sharing information and knowledge to develop new products and services, which could complement or substitute commercialized products in all the supply chain. This way, if managers have the necessary skill to take advantage of knowledge and information created through the supply chain, then they will increase their opportunities to achieve goals and objective defined in collaborative work.

Finally, it is necessary to define the main limitations of this research. First, the scales used to measure both collaboration activities as well as supply chains, because there were only considered one-dimension variables with 5 items to measure collaboration and 20 items for supply chain. Then, future research should consider other factors to corroborate these findings. A second limitation is the information collection process, where only qualitative variables were considered to measure both constructs; it would be convenient to incorporate quantitative variables in future investigations.

A third limitation is that the questionnaire was only applied to managers/owners of SMEs in Aguascalientes, which may affect results if other population is analysed. Therefore, future research should apply the instrument to customers and SMEs suppliers. A fourth limitation is that companies having from 5 to 250 workers were only considered. Therefore, it would be convenient to corroborate results that future investigations include companies with less than 5 workers, which in fact represent more than 60% of total companies.

The last limitation is that a large percentage of SMEs in the Aguascalientes state considered the requested information as confidential therefore data collected may not reflect reality of

collaboration activities and supply chains. In consequence, future research might to consider companies associations, groups of entrepreneurs, clients and suppliers, this in order to reduce as much as possible the information falsity; and to corroborate this results obtained, through triangulation of data obtained from SMEs with that of its customers and suppliers, which will allow more valid information and a reduction of error rate.

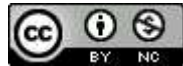
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