

# Open Innovation and Market Orientation in Mexican SMEs Automotive Industry

Sandra Yeseani Pinzón-Castro<sup>1</sup> & Gonzalo Maldonado-Guzmán<sup>1</sup>

<sup>1</sup> Departamento de Mercadotecnia, Centro de Ciencias Económicas y Administrativas, Universidad Autónoma de Aguascalientes, Aguascalientes, México.

Correspondence: Gonzalo Maldonado-Guzmán, Departamento de Mercadotecnia, Centro de Ciencias Económicas y Administrativas, Universidad Autónoma de Aguascalientes, Aguascalientes, Avenida Universidad No. 940, C.P. 20231, México. Tel: 52 448-910-8460. E-mail: gonzalo.maldonado@edu.uaa.mx

Received: June 7, 2024

Accepted: September 4, 2024

Online Published: September 26, 2024

doi:10.5539/ibr.v17n5p74

URL: <https://doi.org/10.5539/ibr.v17n5p74>

## Abstract

Nowadays open innovation is becoming a business strategy that is gaining more and more attention from the scientific and business community. However, although the term open innovation was introduced in 2006, little is known about the relationship between open innovation and market orientation, since there are relatively few studies published in the literature that have been oriented in its analysis and discussion. Therefore, the main objective of this research is to fill this gap in the literature and explore the link that exists between open innovation and market orientation, through a research framework that consists of 4 measurement scales, 24 items, 1 hypothesis and an extensive review of the literature. Likewise, a self-administered questionnaire was distributed to a sample of 300 small and medium-sized manufacturing companies in the automotive industry in Mexico, analyzing the data set using confirmatory factor analysis and structural equation models. The results obtained suggest that open innovation has significant positive effects on the market orientation of companies that make up the manufacturing industry.

**Keywords:** Open innovation, market orientation, SMEs, automotive industry

## 1. Introduction

21st century companies are characterized by an intense dynamic that assumes high risks and initiatives that have an essential impact on the economic development of businesses (Bachmann *et al.*, 2021), particularly those initiatives related to promoting innovation (Simpere-Ripoll *et al.*, 2020). However, with the rise of the digital and collaborative economy, manufacturing companies, mainly small and medium-sized enterprises (SMEs), can no longer depend solely on internal innovation processes (Natalicchio *et al.*, 2017), but rather now it is necessary to break the paradigm to adopt open innovation (OI) activities (Yin & Li, 2024), since OI accelerates the time for the creation of new products (Helm *et al.*, 2019), increases activities collaboration between companies (Zhu *et al.*, 2019) and improves market orientation (MO) activities (Yin & Li, 2024).

Additionally, the scientific, academic, and business community have recently focused their attention on the analysis and discussion of the traditional internal innovation closed to an OI (Naseer *et al.*, 2021), essentially because OI makes use of internal and external knowledge and the expansion of markets to encourage innovation activities (Bacon *et al.*, 2019). However, studies previously published in the literature have generally focused on exploring the results of OI, leaving aside the analysis of OI with MO (Yin & Li, 2024). Therefore, exploring the effects of OI on MO activities is of great importance for manufacturing companies, especially for those that make up the automotive industry, since this will allow promoting and encouraging OI not only in large companies, but also in SMEs (Arrigo, 2018; Naseer *et al.*, 2021).

Likewise, most of the studies previously published in the literature that relate OI and MO have generally focused on large companies in developed countries, practically leaving aside their analysis and discussion in SMEs in developing countries (Osoro *et al.*, 2017), which is understandable if one considers that in these types of countries there is a shortage of objective data on the innovation activities carried out by companies. Therefore, it is possible to establish that the existing relationship between OI and MO is considered in the current literature as unfinished and open to debate (Arrigo, 2018), and a call is made to the scientific and academic community to provide robust empirical evidence of the relationship between both constructs (Tjahjadi *et al.*, 2022).

Under this context, with the purpose of complementing and expanding the existing limitation in the knowledge of the link between OI and MO, this study contributes to the literature of OI and MO practices, with the generation of new knowledge and the contribution of robust empirical evidence that allows filling the gap in the current literature. Furthermore, the results obtained may be of interest not only for managers, companies, and business associations but also for public administration and public policymakers with the aim of generating programs and policies that facilitate the adoption and application of activities of OI in manufacturing firms in developing countries.

## 2. Literature Review

### 2.1 Open Innovation

In the last decade, OI is considered by the scientific, academic, and business community as an essential variable, not only to improve the innovation process of manufacturing companies (e.g. Chesbrough & Borgers, 2014; Borgers *et al.*, 2018; Hervas-Olivier *et al.*, 2021; Urbinati *et al.*, 2021), but also to improve the competitive advantages of organizations (OECD, 2018). In this sense, since the introduction of OI term by Chesbrough (2006), the idea of sharing external knowledge and resources to improve the innovation activities of companies has gained the attention of the scientific and academic community at the global level (Bigliardi & Galati, 2016; Popa *et al.*, 2017; Sikandar & Abdul, 2022).

Thus, Chesbrough (2006: 1) defines OI as “*the use of intentional inputs and outputs of knowledge that increases internal innovation and expands markets for the external use of the innovation, respectively.*” Two processes emerge from this conceptualization: on one hand, *inbound open innovation*, which essentially refers to the internal exploitation of knowledge acquired outside the organization and, on other hand, *outbound open innovation*, which refers to the external exploitation of knowledge transformed within companies, into new or improved products or services that are marketed in the markets in which companies participate (Arrigo, 2018). These types of activities significantly reinforce collaborative activities with other companies to improve OI activities (Greco *et al.*, 2016; Hervas-Oliver *et al.*, 2021).

Recently, the idea of the adoption and implementation of OI in large and SMEs manufacturing firms has received much attention in the literature (Vanhaverbeke *et al.*, 2018; Tjahjadi *et al.*, 2020; Sikandar & Abdul, 2022), particularly because the business environment is more dynamic and globalized (Sikandar & Abdul, 2022). In this sense, various researchers, academics, and professionals have considered OI as a successful strategy for manufacturing firms (e.g. Popa *et al.*, 2017; Sikandar & Abdul, 2022), especially because OI provides various opportunities for firms to significantly improve their profit margin and limited resources (Qureshi *et al.*, 2021).

### 2.2 Market Orientation

MO has usually been defined as “*the generation and dissemination of market knowledge and the response to such knowledge within an organization*” (Narver *et al.*, 2004: 335), and its central process is to access, disseminate and use market knowledge (Aydin, 2021). Therefore, MO can significantly affect the degree of openness that manufacturing firms have (Yin & Li, 2024), to offer the market not only new products but also the new businesses entrepreneurship (Song *et al.*, 2015), therefore which is essential to adopt MO in manufacturing companies. Furthermore, there is consensus in the literature that MO can be represented by two separate constructs: receptive orientation and proactive orientation (Iyer *et al.*, 2019; Wang & Liu, 2019); receptive orientation focuses on discovering existing needs of customers and solve them (Narver *et al.*, 2004), while proactive orientation focuses on discovering customers' future needs and detecting new market opportunities (Ozdemir *et al.*, 2017).

Additionally, MO capabilities of companies must be evaluable, inimitable, and non-substitutable to allow them to create and/or improve their competitive advantages (Morgan *et al.*, 2018), since several previously published studies have shown a close relationship between OI and MO activities (e.g. Sok *et al.*, 2013; Ren *et al.*, 2015). Thus, it is possible to find in the literature that the MO of SMEs can be presented, in a context of OI, through the commercialization of new or improved products (Najafi *et al.*, 2016), which is why it is possible to establish that the level of MO plays an essential role in the performance of OI of manufacturing SMEs (Gunday *et al.*, 2011; Kanagal, 2015). However, the relationship between MO and OI activities is an area that has generally been forgotten by the scientific, academic, and business community (Yin & Li, 2024), which is why it is essential that future studies provide robust empirical evidence about the link between both constructs (Yin & Li, 2024).

### 2.3 Open Innovation and Market Orientation

Most of the studies previously published in the literature that analyze the adoption and implementation of OI in companies, have predominantly focused on large companies and multinational companies (e.g. Gassmann &

Enkel, 2007; Parida *et al.*, 2012; Kathan *et al.*, 2014; Bogers *et al.*, 2017), and only a few studies have focused on SMEs (e.g. Popa *et al.*, 2017; Santoro, 2017; Hinteregger *et al.*, 2019; Sadat & Nasrat, 2020), although it has been shown in the literature that the association of SMEs with large companies helps SMEs to complement their limited resources and share risks associated with development and manufacturing of new products or services (Torchia & Calabró, 2019). Therefore, there is little literature on the factors that encourage or hinder SMEs in the adoption of OI activities (Popa *et al.*, 2017; Santoro, 2017).

Additionally, studies that analyze OI in both SMEs and large companies have been guided by systematic reviews and bibliometric analysis using data from Web of Science (e.g. de Paulo *et al.*, 2017; Lopes & de Carvalho, 2018; Fernandes *et al.*, 2019; Gao *et al.*, 2020), and from Scopus (e.g. Md Khudzari *et al.*, 2018; Baas *et al.*, 2020; Sikandar & Abdul, 2022). Other studies have focused on the analysis of OI in the context of new product development (Jiang *et al.*, 2014), new business growth (Li *et al.*, 2014b; Zhou *et al.*, 2014), efficiency in processes (Li & Zhou, 2013; Li *et al.*, 2014a; Zhou *et al.*, 2014) and, recently, with MO (Yu *et al.*, 2016; Arrigo, 2018; Tjahjadi *et al.*, 2022). However, there are few studies published in the literature that analyze the relationship between OI and MO (Arrigo, 2018), especially in the context of emerging economy countries, in which the ability to absorption of new knowledge is too limited (Agri *et al.*, 2018).

A first possible reason may be the difference between researchers and academics on the types and concepts of OI and MO since, for example, some studies were oriented towards the analysis of the entire MO variable (e.g. Naqshbandi, 2018; Tjahjadi *et al.*, 2020), and OI (e.g. Rajala *et al.*, 2012); while other studies focused on specific types such as the proactive orientation of MO (e.g. Arias-Pérez *et al.*, 2021), market-driven innovation (e.g. Arrigo, 2018), outbound or inbound innovation (e.g. Naqshbandi, 2018), and in receptive and proactive MOs that have been recognized as the most important in manufacturing companies (e.g. Yin & Li, 2024).

A second possible reason could be that the results obtained from the studies published in the literature are inconsistent due to the application of different theories such as, for example, the theory of social networks (e.g. Arrigo, 2018), the theory of sustainability and the entrepreneurship (e.g. Tjahjadi *et al.*, 2020), and even some results are based on data without the application of any theory (Naqshbandi, 2018). To provide more consistent results, Yin and Li (2024) applied March's (1991) theory of organizational learning to demonstrate the relationship between OI and MO, finding satisfactory results that allow establishing the existence of a close link between both structures.

Finally, a third possible reason for the inconsistent results may be that the relationship between OI and MO depends on the context being analyzed (Yin & Li, 2024), particularly because MO commonly generates benefits for companies because it leads organizations to anticipate market demand, and this is the basic premise of the implementation of OI activities (Narver *et al.*, 2004). However, the adoption of MO is insufficient because manufacturing companies also require the application of techniques to support the learning required by MO (Iyengar *et al.*, 2015), which is impossible for SMEs to achieve on their own this objective, which requires collaboration with other companies (Kazakov *et al.*, 2021).

Under this context, the essential objective of the adoption and implementation of OI in organizations is to connect manufacturing SMEs with the external competitive environment, which allows them to anticipate and respond to changes in consumer tastes and needs (Arrigo, 2012). Therefore, it is possible to find in the literature that the MO adopted by SMEs will allow them to surpass their main competitors in two essential external capabilities, which will facilitate them to quickly reconfigure their OI activities: (1) the ability to market awareness, and (2) the ability to relate to customers (Arrigo, 2018), the first of which facilitates knowledge of your customers and competitors, and the second of which, knowing the key competitors in the market to search how to overcome them (Day, 2003).

Thus, OI facilitates internal and external flows of knowledge that accelerates the innovation activities of SMEs in the automotive industry, as well as facilitates market expansion for the commercialization of new or improved products (Medase & Barasa, 2019). Therefore, OI promotes interorganizational learning through the exchange of internal and external resources (Tsinopoulos *et al.*, 2018), which are generally invested in innovation activities that allow SMEs to increase their absorption capacity of the ideas and knowledge existing in the market (Slater *et al.*, 2014; Lau & Lo, 2015; Xia & Roper, 2016). Thus, Kim and Mauborgne (2014) considered that the openness of companies' innovation activities is one of the determining factors of the success and growth of MO activities.

Likewise, the search and organization of new ideas and knowledge, both inside and outside SMEs, for the development of new or improved products with commercialization potential, is fundamental in opening up innovation processes (Medase & Barasa, 2019), since the internal resources and knowledge that underlie

innovation activities (Grant, 1996; Katila & Ahuja, 2002; Zhou & Li, 2012), allow companies, including those that make up the industry automotive, capture resources and external knowledge that can significantly improve MO activities (Laursen & Salter, 2006; Yang & Zhang, 2018). Furthermore, it is possible to establish that the internal and external exploitation of ideas and knowledge existing in the market, through the commercialization of new products, is a basic component of OI (Chesbrough, 2003). Thus, considering the information presented, it is possible to propose the following research hypothesis:

*H1: Open innovation has positive effects on the level of market orientation*

### 3. Methodology

To answer the research question posed, the business directory of the Mexican Association of the Automotive Industry (AMIA) was used as a framework of reference, which had 709 SMEs registered as of November 30, 2021, belonging to the companies to various local, regional, and national business organizations and chambers, which is why the empirical study did not focus on a particular business group or association. In addition, the survey was sent to a sample of 400 SMEs selected through simple random sampling, with a maximum error of  $\pm 4\%$  and a reliability level of 95%, applying the survey during the months of January to May 2021 for a marketing company and receiving a total of 300 validated surveys.

OI was measured using the scale of van de Vrande *et al.* (2009) with 7 items, while MO was measured with the Narver and Slater (1990) scale through three factors: *customer orientation* measured with 6 items; *competence orientation* with 5 items; and *interfunctional coordination* with 6 items. All items on the scales used were measured with a 5-point Likert-type scale, with 1 = total disagreement to 5 = total agreement as limits. Furthermore, to evaluate the reliability and validity of the OI and MO scales, a second order confirmatory factor analysis (SOCFA) was applied using the maximum likelihood method with the support of the EQS 6.2 software (Bentler, 2005; Brown, 2006).

Reliability was measured through Cronbach's Alpha and Composite Reliability Index (CRI), while convergent validity was measured through the Average Variance Extracted (AVE) (Bagozzi & Yi, 1988). The results obtained indicate that all the values of Cronbach's Alpha and CRI are greater than 0.7, which provides evidence of the reliability of the scales (Hair *et al.*, 2014), all the items of the related factors are significant ( $p < 0.001$ ), and the size of all standardized factor loadings are greater than 0.60 (Bagozzi & Yi, 1988), providing evidence of the validity of the scales. The results of SOCFA are presented in Table 1 and suggest that the measurement model provides a good fit of the statistical data ( $S-BX^2$  ( $gl = 241$ ) = 775.271; RMSEA = 0.077), a high internal consistency of the constructs.

Table 1. Internal consistency and convergent validity of the theoretical model

| Variable                     | Indicator | Factor Loading | Robust t-value     | Cronbach's alpha | CRI   | AVE   |
|------------------------------|-----------|----------------|--------------------|------------------|-------|-------|
| Open Innovation              | INA1      | 0.676***       | 1.000 <sup>a</sup> | 0.909            | 0.910 | 0.597 |
|                              | INA2      | 0.606***       | 11.193             |                  |       |       |
|                              | INA3      | 0.648***       | 12.083             |                  |       |       |
|                              | INA4      | 0.755***       | 13.891             |                  |       |       |
|                              | INA5      | 0.809***       | 14.774             |                  |       |       |
|                              | INA6      | 0.939***       | 16.730             |                  |       |       |
|                              | INA7      | 0.911***       | 16.353             |                  |       |       |
| Customer orientation<br>(F1) | OCL1      | 0.640***       | 1.000 <sup>a</sup> | 0.909            | 0.910 | 0.635 |
|                              | OCL2      | 0.618***       | 6.516              |                  |       |       |
|                              | OCL3      | 0.739***       | 7.560              |                  |       |       |
|                              | OCL4      | 0.864***       | 9.148              |                  |       |       |
|                              | OCL5      | 0.948***       | 9.363              |                  |       |       |
|                              | OCL6      | 0.910***       | 9.280              |                  |       |       |
| Competition Orientation (F2) | OCO1      | 0.828***       | 1.000 <sup>a</sup> | 0.927            | 0.928 | 0.720 |
|                              | OCO2      | 0.838***       | 20.159             |                  |       |       |
|                              | OCO3      | 0.876***       | 21.607             |                  |       |       |

|                                      |      |          |                    |       |       |       |
|--------------------------------------|------|----------|--------------------|-------|-------|-------|
|                                      | OCO4 | 0.866*** | 1.215              |       |       |       |
|                                      | OCO5 | 0.835*** | 20.039             |       |       |       |
|                                      | CIN1 | 0.832*** | 1.000 <sup>a</sup> |       |       |       |
|                                      | CIN2 | 0.831*** | 20.295             |       |       |       |
| Interfunctional Coordination<br>(F3) | CIN3 | 0.832*** | 20.334             | 0.939 | 0.940 | 0.724 |
|                                      | CIN4 | 0.848*** | 20.974             |       |       |       |
|                                      | CIN5 | 0.888*** | 22.631             |       |       |       |
|                                      | CIN6 | 0.871*** | 21.926             |       |       |       |
| Market Orientation                   | F1   | 0.780*** | 4.510              |       |       |       |
|                                      | F2   | 0.790*** | 5.369              | 0.819 | 0.820 | 0.601 |
|                                      | F3   | 0.756*** | 4.204              |       |       |       |

$S-BX^2$  (gl = 244) = 1,071.684;  $p < 0.000$ ; NFI = 0.826; NNFI = 0.841; CFI = 0.859; RMSEA = 0.077

<sup>a</sup> = Parameters constrained this value in the identification process

\*\*\* =  $p < 0.01$

Additionally, discriminant validity was measured through two tests, which are presented in Table 2. On one hand, the confidence interval test is presented (Anderson & Gerbing, 1988), which establishes that with an interval of 95% confidence level, none of the individual elements of the latent factors of the correlation matrix have the value 1. On the other hand, the variance extracted test is presented (Fornell & Larcker, 1981), which establishes that the variance extracted from each pair of constructs is lower than its respective AVE. Therefore, according to the results obtained from the application of both tests, it is possible to conclude that the two tests demonstrate sufficient evidence of the existence of discriminant validity of the measurement scales used.

Table 2. Discriminant validity of the theoretical model

| Variables          | Open Innovation | Market Orientation |
|--------------------|-----------------|--------------------|
| Open Innovation    | <b>0.597</b>    | 0.184              |
| Market Orientation | 0.305 – 0.533   | <b>0.601</b>       |

The diagonal represents the Variance Extracted Index (IVE), while above the diagonal the variance (squared correlation) is presented, and below the diagonal the estimate of the correlation of the factors with 95% is presented. confidential interval.

#### 4. Results

To respond to the research hypothesis raised in this study, a second order structural equations model (SOSEM) was applied with the support of the EQS 6.2 software (Bentler, 2005; Byrne, 2006; Brown, 2006), analyzing the validity nomological model of the theoretical model of OI and MO through the Chi-square test, through which the results obtained between the theoretical model and the measurement model were compared, obtaining non-significant results which allows establish an explanation of the observed relationships between the latent constructs (Anderson & Gerbing, 1988; Hatcher, 1994). Table 3 shows in greater detail the results obtained from the application of SOSEM.

Table 3. SOSEM results

| Hypothesis  | Structural Relationship              | Standardized Coefficient | Robust t-value |
|---|--------------------------------------|--------------------------|----------------|
| H <sub>1</sub> : The higher the level of open innovation, the higher level of market orientation. | Open Innovation → Market Orientation | 0.565***                 | 5.776          |

$S-BX^2$  (gl = 241) = 775.271;  $p < 0.000$ ; NFI = 0.874; NNFI = 0.896; CFI = 0.909; RMSEA = 0.075

\*\*\* =  $P < 0.01$

Table 3 shows the results obtained from the application of SOSEM and, with respect to hypothesis H1, the results obtained,  $\beta = 0.565$   $p < 0.001$ , indicate that OI has significant positive effects on MO of manufacturing SMEs of the automotive industry. A possible explanation for these effects could be, on one hand, that

manufacturing SMEs have to comply with certain quality standards for the supplies they provide to large vehicle assembly companies, which is why they have to adopt certain innovation activities that are supported by large companies and, on other hand, collaboration with large companies allows SMEs to exchange knowledge, skills and resources that are transformed into new products or services, thereby improving their capacity for OI and their level of MO.

## 5. Discussion

The results obtained in this study have various implications aimed at managers and manufacturing firms, the first of which refers to the fact that the data were derived from the application of 300 surveys to the same number of companies, which allowed the realization of a general analysis of the effects that OI has on MO in manufacturing SMEs in the automotive industry, which is why in future studies the analysis and discussion of these same constructs in case studies or in longitudinal studies in others will be relevant sectors of economic activity. Therefore, from the point of view of the evolution of innovation, the results obtained indicate that OI is considered in current literature as one of the determining factors of MO capabilities (Arrigo, 2018).

A second implication derived from the results obtained is that it has been demonstrated in the current literature that OI has positive effects on MO activities of manufacturing firms, which are essential for the differentiation of the products of those that produce their products main competitors and to satisfy the tastes and needs of its consumers (Medase & Barasa, 2019). Therefore, it is possible to establish that MO derived from internal and external interaction that the manufacturing SMEs of the automotive industry have with other companies are essential in the win-win relationships between the manufacturing SMEs and their consumers, the which commonly generate a higher level of performance of innovation activities (Egbetokun, 2015; Ren *et al.*, 2015).

A third implication emanating from the results obtained is that the development of improved or new products increases the innovation performance activities of manufacturing SMEs (Gunday *et al.*, 2011; Kanagal, 2015), through the creation of an improved awareness among current and potential customers and consumers (Slater *et al.*, 2014; da Costa *et al.*, 2018). Therefore, it is possible to conclude that OI by manufacturing SMEs in the automotive industry facilitates the introduction of new or improved products in those markets in which they participate. However, the constant change in consumer tastes and needs is forcing the various manufacturing SMEs to acquire and/or improve their MO activities to meet these requirements (Gunday *et al.*, 2011).

A fourth implication derived from the results obtained is that commonly in the literature, investment in R&D has been considered the main indicator of OI, and the one that has the greatest effects on MO activities, but this study has considered the two most cited indicators in the literature and those that have the best effects on MO (inbound and outbound OI), so it is possible to establish that the existing relationship between OI and MO can be considered unfinished. Furthermore, in a recent study Arrigo (2018) theoretically demonstrated that OI has significant positive effects on MO, but did not provide empirical evidence of this, which is why this study provides robust empirical evidence of this existing relationship.

A fifth and final implication emanating from the results obtained is that OI not only generates a significant increase in the MO of manufacturing SMEs in the automotive industry, but also generates different internal and external benefits for all participating organizations in OI activities, because they practically share skills, knowledge and resources. Therefore, one of the main benefits generated by manufacturing SMEs is the increase in the profit margin, which provides the economic and financial resources required for the development of R&D activities. Thus, there are some studies published in the literature that have shown that OI has positive effects on the MO practices of organizations (e.g. Arrigo, 2018; Medase & Barasa, 2019).

## 6. Conclusions

The results obtained in this study generate various conclusions, among which the following stand out. A first conclusion refers to the theoretical model of the relationship between OI and MO, since it generated a high internal consistency by establishing a high correlation between the two constructs, thereby allowing the acceptance of the research hypothesis raised. A second conclusion is that this theoretical model has a general vision by incorporating the two components of OI most cited in the literature (*inbound and outbound OI*), as well as the three dimensions of MO also most cited in the literature (*customer orientation, competition orientation, and interfunctional coordination*), which significantly improves the analysis and discussion of the relationship between both constructs.

A third conclusion is that the studies published in the literature that analyze and discuss the relationship between OI and MO are relatively scarce compared to those studies that have been oriented towards the analysis of its conceptualization (Arrigo, 2018), which from our point of view totally lack a substantial contribution. A fourth

conclusion is that the adoption of OI in manufacturing SMEs has increased, especially in those that make up the automotive industry, since most of them are suppliers to large automobile assembly companies, so that it allows them to acquire the knowledge and skills necessary to comply with quality regulations and the improvement or development of new products that satisfy the needs of customers and consumers.

A fifth conclusion is that the effects generated by OI activities on MO practices is a relatively recent topic in the current literature, but it is also true that this relationship is gaining more and more attention from researchers, academics, and industry professionals, which allows us to conclude that the relationship between OI and MO is an unfinished topic that is open to discussion. A sixth is that the analysis of the relationship between both constructs in emerging economy countries, such as Mexico, has not been explored in the current literature, which is why this study provides robust empirical evidence and new knowledge that allows us to conclude that OI increases the MO activities of SMEs in the automotive industry.

### **Acknowledgments**

Not applicable

### **Authors' contributions**

Dr. Gonzalo Maldonado-Guzmán were responsible for study design and revising. Dr. Raymundo Juárez-Del Toro was responsible for data analysis. All authors read and approved the final manuscript. The authors contributed equally to the study.

### **Funding**

Not applicable

### **Competing interests**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### **Informed consent**

Obtained.

### **Ethics approval**

The Publication Ethics Committee of the Canadian Center of Science and Education.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

### **Provenance and peer review**

Not commissioned, externally double-blind peer reviewed.

### **Data availability statement**

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

### **Data sharing statement**

No additional data are available.

### **Open access**

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).

### **Copyrights**

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

### **References**

- Agri, E. M., Kennedy, N. D., Bonmwa, G. O., Acha, O. F., & Zhan-Ming, C. (2018). Technology innovation and sustainable entrepreneurship development in Nigeria: Stakeholders' impact assessment in central Nigeria. *Journal of Economics Management and Trade*, 21(3), 1-16. <https://doi.org/10.9734/JEMT/2018/25512>
- Anderson, J., & Gerbing, D. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin*, 13(1), 411-423. <https://doi.org/10.1037/0033-2909.103.3.411>
- Arias-Perez, J., Velez-Ocampo, J., & Cepeda-Cardona, J. (2021). Strategic orientation toward digitalization to improve innovation capability: Why knowledge acquisition and exploitation through external embeddedness

- matter. *Journal of Knowledge Management*, 25(5), 1319-1335. <https://doi.org/10.1108/JKM-03-2020-0231>
- Arrigo, E. (2012). Alliances, open innovation and outside-in management. *Symphonya, Emerging Issue in Management*, 2(1), 53-65. <https://doi.org/10.4468/2012.2.05arrigo>
- Arrigo, S. (2018). Open innovation and market orientation: An analysis of the relationship. *Journal of Knowledge Economics*, 9(1), 150-161. <https://doi.org/10.1007/s13132-015-0327-7>
- Aydin, H. (2021). Market orientation and product innovation: the mediating role of technological capability. *European Journal of Innovation Management*, 24(4), 1233-1267. <https://doi.org/10.1108/EJIM-10-2019-0274>
- Baas, J., Schotten, M., Plume, A., Cote, G., & Karimi, R. (2020). Scopus as a curated, high-quality bibliometric data source for academic research in quantitative science studies. *Quantitative Science Studies*, 1(1), 377-386. [https://doi.org/10.1162/qss\\_a\\_00019](https://doi.org/10.1162/qss_a_00019)
- Bachmann, J., Ohlles, I., & Flatten, T. (2021). Effects of entrepreneurial marketing on new ventures' exploitative and exploratory innovation: the moderating role of competitive intensity and firm size. *Industrial Marketing Management*, 92(1), 87-100. <https://doi.org/10.1016/j.indmarman.2020.10.002>
- Bacon, E., Williams, M. D., & Davies, G. H. (2019). Recipes for success: conditions for knowledge transfer across open innovation ecosystems. *International Journal of Information Management*, 49(12), 377-387. <https://doi.org/10.1016/j.ijinfomgt.2019.07.012>
- Bagozzi, R. P., & Yi, Y. (1988). On the evaluation of structural equation models. *Journal of the Academy of Marketing Science*, 16(1), 74-94. <https://doi.org/10.1007/BF02723327>
- Bentler, P.M. (2005). *EQS 6 Structural Equations Program Manual*. Encino, CA: Multivariate Software.
- Bigliardi, B., & Galati, F. (2016). Which factors hinder the adoption of open innovation in SMEs? *Technology Analysis & Strategic Management*, 28(8), 869-885. <https://doi.org/10.1080/09537325.2016.1180353>
- Bogers, M., Zobel, A. K., Afuah, A., Almirall, E., Brunswicker, S., Dahlander, L., ... Ter Wal, A. L. (2017). The open innovation research landscape: Established perspectives and emerging themes across different levels of analysis. *Industry and Innovation*, 24(1), 8-40. <https://doi.org/10.1080/13662716.2016.1240068>
- Brown, T. (2006). *Confirmatory Factor Analysis for Applied Research*. New York, NY: The Guilford Press.
- Byrne, B. (2006). *Structural Equation Modeling with EQS, Basic Concepts, Applications, and Programming*. (2nd ed.). London: LEA Publishers.
- Chesbrough, H. (2003). *Open Innovation: The New Imperative for Creating and Profiting from Technology*. Boston, MA: Harvard Business School Press.
- Chesbrough, H. (2006). The era of open innovation. In Mayle, D. (Ed.), *Management Innovation Change* (3rd ed.). London: SAGE Publications, pp. 127-138.
- Chesbrough, H., & Borgers, M. (2014). Explicating open innovation: clarifying an emerging paradigm for understanding innovation. In Chesbrough, H., Vanhaverbeke, W. and West, J. (Eds.), *New Frontiers in Open Innovation*, Oxford: Oxford University Press. Pp. 3-28. <https://doi.org/10.1093/acprof:oso/9780199682461.003.0001>
- da Costa, J. C., Camargo, S. M., Machado, T. A. M., & Didonet, S. R. (2018). The role of marketing capabilities, absorptive capacity, and innovation performance. *Marketing Intelligence & Planning*, 36(4), 410-424. <https://doi.org/10.1108/MIP-11-2017-0312>
- Day, G. S. (2003). Creating a superior customer-relating capability. *MIT Sloan Management Review*, 44(3), 77-82.
- de Paulo, A. F., Carvalho, L. C., Costa, M. T., Lopes, J. E., & Galina, S. V. (2017). Mapping open innovation: A bibliometric review to compare developed and emerging countries. *Global Business Review*, 18(2), 291-307. <https://doi.org/10.1177/0972150916668600>
- Egbetokun, A. A. (2015). Interactive learning and firm-level capabilities in latecomer settings: The Nigerian manufacturing industry. *Technological Forecasting and Social Change*, 99(3), 231-241. <https://doi.org/10.1016/j.techfore.2015.06.040>
- Fernandes, C., Ferreira, J., & Peris-Ortiz, M. (2019). Open innovation: Past, present and future trends. *Journal of Organizational Change Management*, 32(5), 578-602. <https://doi.org/10.1108/JOCM-09-2018-0257>



- Fornell, C., & Larcker, D. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39-50.  
<https://doi.org/10.1177/002224378101800104>
- Gao, H., Ding, X. H., & Wu, S. (2020). Exploring the domain of open innovation: Bibliometric and content analyses. *Journal of Cleaner Production*, 275(1), 1-11. <https://doi.org/10.1016/j.jclepro.2020.122580>
- Gassmann, O., & Enkel, E. (2007). Towards a theory of open innovation: Three core process archetypes. *R&D Management Conference*, 6(9), 1-18.
- Grant, R. M. (1996). Prospering in dynamically competitive environments: Organizational capability as knowledge integration. *Organization Science*, 7(4), 375-387. <https://doi.org/10.1287/orsc.7.4.375>
- Greco, M., Grimaldi, M., & Cricelli, L. (2016). An analysis of the open innovation effect on firm performance. *European Management Journal*, 34(5), 501-516. <https://doi.org/10.1016/j.emj.2016.02.008>
- Gunday, G., Ulusoy, G., Kilic, K., & Alpkan, L. (2011). Effects of innovation types on firm performance. *International Journal of Productions Economics*, 133(2), 662-676.  
<https://doi.org/10.1016/j.ijpe.2011.05.014>
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). *Multivariate Data Analysis* (7th ed.). Harlow, UK: Pearson Education.
- Hatcher, L. (1994). *A Step-by-Step Approach to Using the SAS System for Factor Analysis and Structural Equation Modeling*. Cary, NC: SAS Institute Inc.
- Helm, R., Endres, H., & Hüsig, S. (2019). When and how often to externally commercialize technologies? A critical review of outbound open innovation. *Review of Managerial Science*, 13(2), 327-345.  
<https://doi.org/10.1007/s11846-017-0248-x>
- Hervas-Oliver, J. L., Sempere-Ripoll, F., & Boronat-Moll, C. (2021). Technological innovation typologies and open innovation in SMEs: beyond internal and external sources of knowledge. *Technological Forecasting and Social Change*, 162(1), 1-12. <https://doi.org/10.1016/j.techfore.2020.120338>
- Hinteregger, C., Durst, S., Temel, S., & Yesilay, R. B. (2019). The impact of openness on innovation in SMEs. *International Journal of Innovation Management*, 23(1), 1-12. <https://doi.org/10.1142/S1363919619500038>
- Iyengar, K., Sweeney, J. R., & Montealegre, R. (2015). Information technology use as a learning mechanism: The impact of IT use on knowledge transfer effectiveness, absorptive capacity, and franchisee performance. *MIS Quarterly*, 39(3), 615-642. <https://doi.org/10.25300/MISQ/2015/39.3.05>
- Iyer, P., Davari, A., Zolfagharian, M., & Paswan, A. (2019). Market orientation, positioning strategy and brand performance. *Industrial Marketing Management*, 81(1), 16-29.  
<https://doi.org/10.1016/j.indmarman.2018.11.004>
- Jiang, H., Zhao, S., Yin, K., Yuan, Y., & Bi, Z. (2014). An analogical introduction approach to technology standardization and technology development. *Systems Research and Behavioral Science*, 31(3), 366-382.  
<https://doi.org/10.1002/sres.2272>
- Kanagal, N. B. (2015). Innovation and product innovation in marketing strategy. *Journal of Management and Marketing Research*, 18(1), 1-25. Retrieved from <http://www.aabri.com/copyright.html>
- Kathan, W., Matzler, K., Füller, J., Hautz, J., & Hutler, K. (2014). Open innovation in SMEs: A case study of a regional open innovation platform. *Problems and Perspectives in Management*, 12(1), 161-171.
- Katila, R., & Ahuja, G. (2002). Something old, something new: A longitudinal study of search behavior and new product introduction. *Academy of Management Journal*, 45(6), 1183-1194. <https://doi.org/10.5465/3069433>
- Kazakov, S., Ruiz-Alba, J. L., & Muñoz, M. M. (2021). The impact of information and communication technology and internal market orientation blending on organisational performance in small and medium enterprises. *European Journal of Management and Business Economics*, 30(2), 129-151.  
<https://doi.org/10.1108/EJMBE-04-2020-0068>
- Kim, W. C., & Mauborgne, R. (2014). *Blue Ocean Strategy: How to Create Uncontested Market Space and Make the Competition Irrelevant*. Boston, MA: Harvard Business Review Press.
- Lau, A. K., & Lo, W. (2015). Regional innovation system, absorptive capacity and innovation performance: An empirical study. *Technological Forecasting and Social Change*, 92(3), 99-114.  
<https://doi.org/10.1016/j.techfore.2014.11.005>

- Laursen, K., & Salter, A. (2006). Open for innovation: The role of openness in explaining innovation performance among UK manufacturing firms. *Strategic Management Journal*, 27(1), 131-150. <https://doi.org/10.1002/smj.507>
- Li, L., & Zhou, L. (2013). Manufacturing practices in China. *International Journal of Production Economics*, 146(1), 1-3. <https://doi.org/10.1016/j.ijpe.2013.09.006>
- Li, L., Zhang, L., & Williamowska, K.M. (2014a). The effects of collaboration on build-to-order supply chains: With a comparison of BTO, MTO and MTS. *Information Technology & Management*, 15(2), 69-79. <https://doi.org/10.1007/s10799-014-0179-z>
- Li, N., Sun, M., Bi, Z., Su, Z., & Wang, C. (2014b). A new methodology to support group decision-making for IoT-based emergency response systems. *Information Systems Frontiers*, 16(5), 953-977. <https://doi.org/10.1007/s10796-013-9407-z>
- Lopes, A. P., & Carvalho, M. M. (2018). Evolution of the open innovation paradigm: Towards a contingent conceptual model. *Technological Forecasting & Social Change*, 132(1), 284-298. <https://doi.org/10.1016/j.techfore.2018.02.014>
- March, J.G. (1991). Exploration and exploitation in organizational learning. *Organization Science*, 2(1), 71-87. <https://doi.org/10.1287/orsc.2.1.71>
- Md Khudzari, J., Kurian, J., Tartakovsky, B., & Raghavan, G. S. (2018). Bibliometric analysis of global research trends on microbial fuel cells using Scopus database. *Biochemical Engineering Journal*, 136(1), 51-60. <https://doi.org/10.1016/j.bej.2018.05.002>
- Medase, K., & Barasa, L. (2019). Absorptive capacity, marketing capabilities, and innovation commercialization in Nigeria. *European Journal of Innovation Management*, 22(5), 790-820. <https://doi.org/10.1108/EJIM-09-2018-0194>
- Morgan, N. A., Feng, H., & Whitley, K. A. (2018). Marketing capabilities in international marketing. *Journal of International Marketing*, 26(1), 65-91. <https://doi.org/10.1509/jim.17.0056>
- Najafi, T. S., Sharifi, H., & Najafi-Tavani, Z. (2016). Market orientation, marketing capability, and new product performance: The moderating role of absorptive capacity. *Journal of Business Research*, 69(1), 5059-5064. <https://doi.org/10.1016/j.jbusres.2016.04.080>
- Naqshbandi, M. M. (2018). Organizational characteristics and engagement in open innovation: Is there a link? *Global Business Review*, 19(3), S1-S20. <https://doi.org/10.1177/0972150918757845>
- Narver, J. C., & Slater, S. F. (1990). The effect of a market orientation on business profitability. *Journal of Marketing*, 54(1), 25-35. <https://doi.org/10.1177/002224299005400403>
- Narver, J. C., Slater, S. F., & MacLachlan, D. L. (2004). Responsive and proactive market orientation and new-product success. *Journal of Product Innovation Management*, 21(5), 334-347. <https://doi.org/10.1111/j.0737-6782.2004.00086.x>
- Naseer, S., Khawaja, K. F., Qazi, S., Syed, F., & Shamim, F. (2021). How and when information proactiveness leads to operational firm performance in the banking sector of Pakistan? The roles of open innovation, creative cognitive style, and climate for innovation. *International Journal of Information Management*, 56(2), 1-14. <https://doi.org/10.1016/j.ijinfomgt.2020.102260>
- Natalicchio, A., Ardito, L., Savino, T., & Albino, V. (2017). Managing knowledge assets for open innovation: A systematic literature review. *Journal of Knowledge Management*, 21(6), 1362-1383. <https://doi.org/10.1108/JKM-11-2016-0516>
- OECD (2018). *Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation in the Measurement of Scientific, Technological and Innovation Activities*. 4th ed. Paris: OECD Publishing. <https://doi.org/10.1787/9789264304604-en>
- Osoro, O., Kirama, S., & Vermeulen, P. (2017). Factors affecting engagement and commercialization of innovation activities of firms in Tanzania. *Tanzania Economic Review*, 4(1/2), 73-90. <https://doi.org/10.56279/ter.v4i1-2.11>
- Ozdemir, S., Kandemir, D., & Eng, T. (2017). The role of horizontal and vertical new product alliances in responsive and proactive market orientations and performance of industrial manufacturing firms. *Industrial Marketing Management*, 64(1), 25-35. <https://doi.org/10.1016/j.indmarman.2017.03.006>

- Parida, V., Westerberg, M., & Frishammar, J. (2012). Inbound open innovation activities in high-tech SMEs: The impact on innovation performance. *Journal of Small Business Management*, 50(2), 283-309. <https://doi.org/10.1111/j.1540-627X.2012.00354.x>
- Popa, S., Soto-Acosta, P., & Martinez-Conesa, I. (2017). Antecedents, moderators and outcomes of innovation climate and open innovation: An empirical study in SMEs. *Technological Forecasting & Social Change*, 118(1), 134-142. <https://doi.org/10.1016/j.techfore.2017.02.014>
- Qureshi, M. I., Parveen, S., Abdullah, I., & Dana, L. P. (2021). Reconceptualizing the interventions of open innovation systems between the nexus of quadruple organization cultural dynamics and performance. *Quality and Quantity*, 55(1), 1661-1681. <https://doi.org/10.1007/s11135-020-01078-3>
- Rajala, R., Westerlund, M., & Möller, K. (2012). Strategic flexibility in open innovation—designing business models for open-source software. *European Journal of Marketing*, 46(10), 1368-1388. <https://doi.org/10.1108/03090561211248071>
- Ren, S., Eisingerich, A. B., & Tsai, H. T. (2015). How do marketing, research and development capabilities, and degree of internationalization synergistically affect the innovation performance of small and medium-sized enterprises (SMEs)? A panel data study of Chinese SMEs. *International Business Review*, 24(4), 642-651. <https://doi.org/10.1016/j.ibusrev.2014.11.006>
- Sadat, S. H., & Nasrat, S. (2020). The practice of open innovation by SMEs in the food industry. *Journal of Innovation Management*, 8(2), 26-46. [https://doi.org/10.24840/2183-0606\\_008.002\\_0004](https://doi.org/10.24840/2183-0606_008.002_0004)
- Santoro, G. (2017). Innovation in small and medium enterprises: The impact of open innovation practices on firms' performance. *Global Business and Economic Review*, 19(5), 508-520. <https://doi.org/10.1504/GBER.2017.086601>
- Sempere-Ripoll, F., Estelles-Miguel, S., Rojas-Alvarado, R., & Hervás-Oliver, J.L. (2020). Does technological innovation drive corporate sustainability? Empirical evidence for the European financial industry in catching-up and central and eastern Europe countries. *Sustainability*, 12(6), 1-19. <https://doi.org/10.3390/su12062261>
- Sikandar, H., & Abdul, K.H. (2022). A systematic literature review of open innovation in small and medium enterprises in the past decade. *Foresight*, 24(6), 742-756. <https://doi.org/10.1108/FS-01-2021-0030>
- Slater, S. F., Mohr, J. J., & Sengupta, S. (2014). Radical product innovation capability: Literature review, synthesis, and illustrative research propositions. *Journal of Product Innovation Management*, 31(3), 552-566. <https://doi.org/10.1111/jpim.12113>
- Sok, P., O'Cass, A., & Sok, K.M. (2013). Achieving superior SME performance: Overarching role of marketing, innovation, and learning capabilities. *Australasian Marketing Journal*, 21(3), 161-167. <https://doi.org/10.1016/j.ausmj.2013.04.001>
- Song, J., Wei, Y., & Wang, R. (2015). Market orientation and innovation performance: the moderating roles of firm ownership structures. *International Journal of Research in Marketing*, 32(3), 319-331. <https://doi.org/10.1016/j.ijresmar.2015.03.005>
- Tjahjadi, B., Soewarno, N., Hariyati, H., Nasihatun, N. L., Kustiningsih, N., & Nadyaningrum, V. (2020). The role of green innovation between green market orientation and business performance: Its implications for open innovation. *Journal of Open Innovation: Technology, Market and Complexity*, 6(173), 1-18. <https://doi.org/10.3390/joitmc6040173>
- Tjahjadi, B., Soewarno, N., Jermias, J., Hariyati, H., Fairuzi, A., & Nabilah, A.W. (2022). Does engaging in global market orientation strategy affect HEI's performance? The mediating roles of intellectual capital readiness and open innovation. *Journal of Open Innovation: Technology, Market and Complexity*, 8(29), 1-18. <https://doi.org/10.3390/joitmc8010029>
- Torchia, M., & Calabró, A. (2019). Open innovation in SMEs: A systematic literature review. *Journal of Enterprising Culture*, 27(2), 210-228. <https://doi.org/10.1142/S0218495819500080>
- Tsinopoulos, C., Sousa, C. M., & Yan, J. (2018). Process innovation: Open innovation and the moderating role of the innovation to achieve legitimacy. *Journal of Product Innovation Management*, 35(1), 27-48. <https://doi.org/10.1111/jpim.12374>
- Urbinati, A., Manzini, R., Piacentini, D., & Carretti, C. (2021). Implementing open innovation for radical innovation: three successful cases in the SAES group. *European Journal of Innovation Management*, 25(2),

501-522.

- van de Vrande, V., De Jong, J. P., Vanhaverbeke, W., & De Rochemont, M. (2009). Open innovation in SMEs: Trends, motives and management challenges. *Technovation*, 29(6/7), 423-437. <https://doi.org/10.1016/j.technovation.2008.10.001>
- Vanhaverbeke, W., Frattini, F., Roijakkers, N., & Usman, M. (2018). Front matter. In Vanhaverbeke, W., Frattini, F., Roijakkers, N. and Usman, M. (Eds.), *Researching Open Innovation in SMEs*. Singapore: World Scientific, i-xxv. [https://doi.org/10.1142/9789813230972\\_fmatter](https://doi.org/10.1142/9789813230972_fmatter)
- Wang, Y., & Liu, F. (2019). Proactive or responsive market orientation for stronger service innovation capability: The moderating roles of contractual and relational governance. *Journal of Business and Industrial Marketing*, 35(5), 863-874. <https://doi.org/10.1108/JBIM-05-2019-0185>
- Xia, T., & Roper, S. (2016). Unpacking open innovation: Absorptive capacity, exploratory and exploitative openness, and the growth of entrepreneurial biopharmaceutical firms. *Journal of Small Business Management*, 54(3), 931-952. <https://doi.org/10.1111/jsbm.12220>
- Yang, F., & Zhang, H. (2018). The impact of customer orientation of new product development performance. *International Journal of Productivity and Performance Management*, 67(3), 590-607. <https://doi.org/10.1108/IJPPM-08-2016-0166>
- Yin, M., & Li, J. (2024). How market orientation affects open innovation? Exploring the role of information and communication technology capability. *European Journal of Innovation Management*, 27(6), 1885-1911. <https://doi.org/10.1108/EJIM-08-2022-0401>
- Yu, X., Nguyen, B., & Chen, Y. (2016). Internet of things capability and alliances: Entrepreneurial orientation, market orientation and product and process innovation. *Internet Research*, 26(2), 402-434. <https://doi.org/10.1108/IntR-10-2014-0265>
- Zhou, H., Shou, Y., Zhai, L., Li, L., Wood, C., & Wu, X. (2014). Supply chain practice and information quality: A supply chain strategy study. *International Journal of Production Economics*, 147(3), 624-633. <https://doi.org/10.1016/j.ijpe.2013.08.025>
- Zhou, K. Z., & Li, C. B. (2012). How knowledge affects radical innovation: Knowledge base, market knowledge acquisition, and internal knowledge sharing. *Strategic Management Journal*, 33(9), 1090-1102. <https://doi.org/10.1002/smj.1959>
- Zhu, X., Xiao, Z., Dong, M. C., & Gu, J. (2019). The fit between firms' open innovation and business model for new product development speed: A contingent perspective. *Technovation*, 86(1), 75-85. <https://doi.org/10.1016/j.technovation.2019.05.005>