Article

Design of a structural equation model to evaluate the strategic prospective of SMEs.

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Abstract: Queretaro is currently one of the states with the highest growth rate in the automotive industry. In the last five years, the number of companies has increased, reaching more than 300 small and medium-sized companies in the sector. However, they show a high degree of ignorance and lack of strategic foresight, which translates into poor planning in the short, medium and long term and low competitiveness, leading many of them to failure. This paper presents the results of a study within a strategic foresight evaluation with the development of a Structural Equation Model that allows the analysis of foresight and strategic planning within the automotive SMEs in the state of Queretaro. The study analyzes the necessary indicators to be evaluated and establishes the relationship of dependence between the variables, which is necessary to create the constructs of the model. It is confirmed that the adjustment of the model used is adequate for the evaluation of SMEs. The contributions of the research were: A theoretical contribution related to strategic foresight within SMEs and the construction of the structural equation model to evaluate strategic foresight in automotive SMEs in the state of Queretaro.

Keywords: Strategic Foresight Model; Structural Equations; Pymes

1. Introduction

In Mexico, the automotive industry represents one of the sectors with the greatest potential for development, so much so, that it is currently considered the second largest sector in the country's economy, and at the same time it is identified as a key sector in the generation of sources of employment and in the development of new strategies for the development and strengthening of the country's economy [1]. The National Institute of Statistics and Geography (INEGI) since 2017 points out in its reports the accelerated development of the automotive industry in Mexico, and the positive effect it has had on the search of new potential markets, and the consolidation of the economic system in various regions of the country, as well as the development of the business sector devoted to the automotive industry [2]. The state of Queretaro is a national benchmark for the development of small and medium-sized enterprises (SMEs) in the automotive sector, represented by more than 300 companies that are linked to global value chains and have a strong participation in foreign markets with the United States, Canada, Europe and Asia [3].

Thus, in [4, 5] it is pointed out that the automotive industry has evolved in recent years facing various challenges in business and competitiveness in production processes with the use of new technologies. The industry is based on basic principles such as production flow control, quality control and efficiency.

In the case of Mexico, the situation of the automotive industry behaved in an unstable manner during the first two quarters of this year, presenting a mixed crisis situation, mainly represented by an economic crisis and a sanitary crisis, both generated by the current SARS-CoV-2 (Covid-19) sanitary emergency. The aforementioned, caused production to be paralyzed and exports in this area to decrease; data show that this situation led to a decrease in production of about 40%, while exports were affected with a decrease of more than 41%; which can be considered as a very unfavorable scenario for the sector

and the country, if we take into account the impact of the automotive sector in the dynamics and economic structure of the country [6].

While in Latin America, the Economic Commission for Latin America and the Caribbean (ECLAC) points out that one of the most important sectors is the automotive sector, because it favors the transformation, differentiation and distribution of production in the countries of the region. In addition, it improves local capacities, is a source of employment and enables the creation of productive chains at the local and regional level [7].

In this sense, in recent years this sector has shown a greater degree of investment, mainly in countries such as Mexico and Brazil, increasing production and at the same time, exports to Central America and Europe. Figure 1. Shows production per type of vehicle in the main countries of the automotive sector in Latin America.

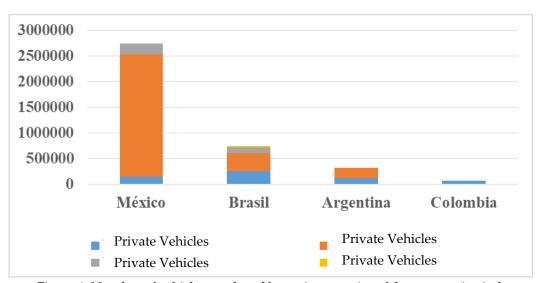


Figure 1. Number of vehicles produced by main countries of the automotive industry in Latin America, 2019.

The automotive sector in Queretaro has been part of the state's industrial development process, so much so, that since 2003 the sector has shown a growth in its impact on the state's gross value added (GVA) [8, 9]. This is due, to the investment and interest of several companies to establish themselves in the state, which led to a greater dynamism in the sector, reaching more than 20% of the total investments made in the state.

Currently, the state has about 316 companies within the automotive industry, which in most cases have been affected by the shutdown of the automotive industry due to the current health crisis, so that production has been reduced by 70% of production capacity. It is expected that the recovery process will be slow and that by the end of 2020 production will reach about 80% of the production prior to the beginning of the pandemic, the forecast is that by the year 2023, the maximum production capacity in the sector will be reached.

In relation to strategic foresight, through different researches [10-13] strategic planning is defined as a management and decision-making tool where managers define the strategic objectives and goals to be achieved in the long term. In other words, strategic foresight consists of anticipating the future, taking into account current events, which allows for the study of possible scenarios and the adoption of strategies to fulfill the vision proposed by the company.

In spite of this, trends may not be favorable, however, the prospective makes it easier to take corrective actions to minimize the possible effects; if the scenario is optimistic, the company's position is maintained.

In view of the above, it is necessary for SMEs to have an adequate strategic foresight that allows them to foresee the medium and long term in order to avoid possible failures. In the case of SMEs in the automotive sector, this is of vital importance, since they generate more than 15% of the sources of employment and close to 20% of the total production of

the manufacturing industry. By analyzing the above data, it is necessary to achieve the insertion of SMEs in the dynamics of large companies in the automotive industry, which will allow the development of strategies to expand their future production and achieve trade openness [14].

Based on this premise, the objective of this research is to develop a structural equation model (SEM) that makes it possible to evaluate the strategic prospective in the SMEs of the automotive sector in the state of Queretaro, as well as the dimensions that compose it, conceiving an integral perspective of the company. Probabilistic sampling was used to determine the number of surveys to be applied to the total sample of SMEs. The research is based on the selection by a group of experts of the indicators involved in strategic foresight. The study focuses on obtaining the SEM model that allows the evaluation of strategic foresight. To conclude, the evaluation indicators of the model adjustment were analyzed to determine if it is correct and adequate to evaluate the strategic foresight of the automotive SMEs.

The article is divided as follows: the first part corresponds to the introduction, where the objective of the research is presented, the second part is the materials and methods, where the methodology applied in the research is defined, then the results obtained are shown and conclusions are reached to respond to the objective of the research, and the article ends with the bibliographical references used in the research.

2. Materials and Methods

In the particular case of this study, the process of selection and validity of the variables was through experts. The following considerations were taken into account for the selection of the specialists:

- To be an academic or practical expert related to the study of strategic planning and foresight.
 - To present a broad knowledge of the area of study of SMEs.

In summary, 10 experts were selected who met the required profile, 5 dimensions were identified from the analysis of the experts, and 25 variables were selected for the study (see table 1).

Next, a cross-sectional study was carried out by means of a survey in which 325 people related to strategic foresight within the automotive SMEs in Queretaro participated, which facilitated the analysis and construction of the model with the SPSS 24 program, AMOS 24, which allows the construction of the Structural Equations Model.

Table 1. Dimensions and variables selected for the analysis.

Abbreviation	Dimensions	Variables or indicators		
INV		Investment		
COST		Costs		
FINC	Economic- Financing			
RENT	Financial	Profitability		
IMP		Tax		
PLAN		Planning		
SCLT		Customer Satisfaction		
PVENT		Sales Policy		
OMERC	Marketing	Market Orientation		
RCLTPV		Customer-Supplier Relationship		
EPROD		Product Strategy		
PAMB		Environmental Policy		
MDESC	Environmental	Waste Management		
EMBI	Environmental	Environmental Strategy		
CAMB		Training and Environmental Awareness		
LOG		Logistics		
TIC		Information Technologies		
CALID	Technological	Quality Certification		
CINNOV		Innovation Capability		
CTECN		Technological Capacity		
CLAB		Work Climate		
GHUM	Human	Human Resources		
CAPAD		Training and Education		
CORG	Resources	Organizational Culture		
SREC	EC Selection and Recruitment			

For the construction of the database, respondents were asked whether: Is there an influence on the relationship between variable k with strategic foresight?

A Likert scale was used with the following criteria:

- 1. No influence (1)
- 2. Very little influence (2)
- 3. Little influence (3)
- 4. Moderately influential (4)
- 5. Strong influence (5)
- 6. Very strong influence (6)
- 7. Potentially influential (7)

On the other hand, the SEM model approach is a multivariate statistical technique that is used for data analysis, SEM allows to establish relationships and dependence between variables and it is about forming linear equations to determine which ones are independent or dependent [15, 16]. The following model was proposed for this analysis:

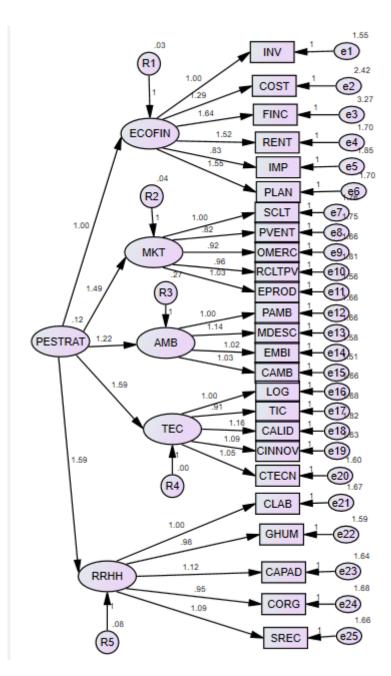


Figure 2. Model for strategic foresight evaluation.

3. Results

The descriptive analysis of the sample is presented in Table 2. It can be seen that high mean values were obtained, which represent a strong influence of the variables within the strategic foresight of the SMEs, the lowest mean was that of financing, which is a moderately influential variable.

Variables	Mean	Median	Standard	Variance
			Deviation	
Investment	5.66	6.00	1.304	1.700
Costs	4.86	5.00	1.634	2.671
Financing	4.27	4.00	1.914	3.664
Profitability	5.20	5.00	1.428	2.039
Tax	5.11	5.00	1.399	1.958
Planning	5.20	5.00	1.433	2.052
Customer Satisfaction	5.37	6.00	1.434	2.057
Sales Policy	5.12	5.00	1.397	1.952
Market Orientation	5.18	5.00	1.382	1.910
Customer-Supplier Relationship	5.15	5.00	1.444	2.084
Product Strategy	5.16	5.00	1.370	1.876
Environmental Policy	4.98	5.00	1.453	2.111
Waste Management	4.95	5.00	1.496	2.239
Environmental Strategy	4.96	5.00	1.428	2.039
Training and Environmental Awareness	5.01	5.00	1.409	1.986
Logistics	5.18	5.00	1.401	1.964
Information Technologies	5.05	5.00	1.388	1.928
Quality Certification	5.15	5.00	1.493	2.229
Innovation Capability	4.99	5.00	1.412	1.994
Technological Capacity	5.08	5.00	1.390	1.933
Work Climate	5.03	5.00	1.431	2.048
Human Resources	5.07	5.00	1.397	1.952
Training and Education	5.11	5.00	1.455	2.117
Organizational Culture	5.04	5.00	1.420	2.016
Selection and Recruitment	5.09	5.00	1.454	2.113

In a second step, the robustness and stability of the data were analyzed through the reliability analysis evaluated by Cronbach's alpha, this coefficient, according to [17], is a quick and reliable way to validate the model and as a metric that weights the existing correlation between the variables that compose it. In [18] it is mentioned that a good value of fit and consistency of Cronbach's alpha is between 0.70 and 0.90. In the study, an alpha value of 0.779 was obtained, which means a good fit, the result is shown in Table 3.

Table 3. Reliability statistics

	Cronbach's alpha based on	Number of	
Cronbach's alpha	standardized elements	elements	
.779	.781	25	

The study of the existing analytical relationships between the variables obtained a significant Chi-Square value, obtaining a value of 492.764 (DF=170, p-value<0.05). Therefore, the model can be considered valid in the first instance [19].

Table 4. Model fit index

the

Chi-square = 492.764
Degrees of freedom = 270
Probability level = .001

As a complement to the analysis, significance of the

variables is obtained and their estimated values are high, indicating a good fit of the variables to the proposed model (The meaning of "***" indicates that it is valid for significance levels of 0.01, 0.05 and 0.1), the results are shown in Table 5.

Table 5. Estimated values and significance of the variables

			6			
			Estimate	S.E.	C.R.	P
ECOFIN	<	PESTRAT	1.000			
MKT	<	PESTRAT	1.490	.335	4.443	***
AMB	<	PESTRAT	1.219	.282	4.324	***
TEC	<	PESTRAT	1.589	.349	4.550	***
RRHH	<	PESTRAT	1.592	.346	4.596	***
INV	<	ECOFIN	1.000			
COST	<	ECOFIN	1.293	.317	4.072	***
FINC	<	ECOFIN	1.638	.387	4.233	***
RENT	<	ECOFIN	1.515	.327	4.631	***
IMP	<	ECOFIN	.833	.242	3.449	***
PLAN	<	ECOFIN	1.547	.332	4.661	***
SCLT	<	MKT	1.000			
PVENT	<	MKT	.822	.167	4.930	***
OMERC	<	MKT	.916	.173	5.303	***
RCLTPV	<	MKT	.957	.180	5.301	***
EPROD	<	MKT	1.032	.181	5.686	***
PAMB	<	AMB	1.000			
MDESC	<	AMB	1.136	.181	6.259	***
EMBI	<	AMB	1.017	.167	6.092	***
CAMB	<	AMB	1.032	.167	6.169	***
LOG	<	TEC	1.000			
TIC	<	TEC	.909	.164	5.553	***
CALID	<	TEC	1.157	.189	6.114	***
CINNOV	<	TEC	1.092	.179	6.107	***
CTECN	<	TEC	1.046	.174	6.018	***
CLAB	<	RRHH	1.000			
GHUM	<	RRHH	.977	.157	6.235	***
CAPAD	<	RRHH	1.121	.171	6.569	***
CORG	<	RRHH	.946	.156	6.062	***
SREC	<	RRHH	1.093	.169	6.486	***

Finally, an analysis is made of the goodness-of-fit indicators that define whether the construct is adequate to carry out evaluations of the strategic foresight of SMEs and the degree of relevance of the variables in the analysis of strategic foresight. In the case of the CMIN/DF, a value of 1.084 was obtained, according to [20-22], which is considered a good fit value at values below 3, the result in this research is good. The mean square error (RMR) index was also evaluated, which measures the variances and covariances of the sample and whether these differ from the estimates obtained, in researches such as that of [23-25] a good result is considered the closer the values are to zero, in the present research a value of 0.077 was obtained. Therefore, the RMR estimates obtained are good, another very important indicator is the goodness of fit index (GFI), it takes values between 0 and 1, authors such as [26, 27] express that the closer to 1, the better goodness of fit the model will have, in the case study a GFI=0.959 was obtained, which represents an excellent value of fit of the model so it is reliable to use it for the evaluation of strategic foresight. Other indicators obtained for the model fit are the normalized fit index (NFI) which includes the number of degrees of freedom of the model analyzed, which reaches a value of 0.911, with values higher than 0.9 considered as good [28, 29], another one is the RMSEA (Root Mean Square Error of Approximation) that reaches a value of 0.013, which is lower than the significance level of 0.05, and therefore evidences a good fit of the overall model [30]. The results can be seen in table 6.

Table 6. Goodness-of-fit values

Model	RMR	GFI	NFI	RMSEA
Default model	.077	.959	.911	.013
Saturated model	.000	1.000	1.000	
Independence model	.269	.698	.00	.082

The model obtained has a good goodness of fit, and is optimal for strategic foresight analysis of the variables that comprise the strategic foresight.

5. Conclusions

- 1. Strategic foresight is an important element within SMEs as it allows the management of processes and products, it also helps to identify threats and opportunities that may arise in the long term, it helps to face new competencies in the market, as well as to identify trends in the international market and its insertion in the stock market of the large company.
- 2. The use of a Likert scale and reliability analysis made it possible to determine the Economic-Financial, Marketing, Environmental, Technological and Human Resources dimensions, which are suitable for measuring strategic foresight. These dimensions were complemented by a set of pertinent indicators to measure the dimensions of the strategic perspective, a construct that facilitated the evaluation and the formulation of strategies aimed at improving SME management.
- 3. The proposed model is based on the generally known definition of strategic foresight and, based on structural equations, it is adequate to evaluate this process in automotive SMEs and could even be generalized to other industries. The model fits perfectly into the perspective, and complies with the following assumptions: 1) Indicators at ordinal measurement level, 2) Indicators with a Likert scale of 7 criteria, higher than the established 4 criteria, 3) Inclusion of all relevant variables in the model, 4) A minimum sample of 325 individuals, which exceeds the requirements of the model, 5) A minimum of 5 indicators per dimension, higher than the methodological requirements, and 6) A total of 25 indicators, which is in the optimal range.

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