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Scientific articles

Medición de la innovación no tecnológica en empresas del sector mármol del Estado de Puebla, utilizando PLS-SEM

Measurement of non-technological innovation in marble companies of the State of Puebla, using PLS-SEM

Medição da inovação não tecnológica em empresas do setor de mármore do Estado de Puebla, utilizando PLS-SEM

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Resumen

El principal objetivo de la investigación fue analizar elementos de la innovación no tecnológica, priorizando las variables de los beneficios y los sacrificios entre las empresas dedicadas al mármol y los clientes finales, con el propósito de determinar su grado de satisfacción y lealtad, para ello se realizó una investigación cuantitativa, no experimental de tipo transversal en la que se aplicaron 76 encuestas *in situ* en los municipios de Tecali de Herrera y Tepeaca, en el estado de Puebla. La recolección de datos se llevó a cabo durante el periodo de enero a marzo del 2024. Se utilizó la técnica PLS-SEM (*Partial Least Squares Structural Equation Modeling*, por sus siglas en inglés), los datos recabados fueron modelados en el *software* Smart PLS (versión 3.3.2). Los resultados demostraron una buena capacidad predictiva del modelo de investigación, se detectó un alto grado de correlación entre las variables de satisfacción del cliente y la lealtad a las empresas, de igual forma se demostró que la relación entre los beneficios y los sacrificios influyen en la satisfacción de los clientes. Los hallazgos revelaron que las estimaciones obtenidas para el modelo tienen un impacto significativo en la lealtad de los clientes. Los resultados de este estudio serán útiles para que los dueños de las empresas pueden generar estrategias competitivas. De manera adicional, se recomienda extender este estudio en otras regiones del estado añadiendo nuevas variables.

Palabras clave: Satisfacción del cliente, lealtad de los clientes, modelo causal, pequeñas empresas, innovación no tecnológica.

Abstract

The main objective of the research was to analyze elements of non-technological innovation, prioritizing the variables of benefits and sacrifices between companies dedicated to extract, process and sell marble and final customers to determine their satisfaction degree and loyalty. For this purpose, it was used quantitative, non-experimental cross-sectional research, 76 on-site surveys were applied in the municipalities of Tecali de Herrera and Tepeaca, in the state of Puebla. Data collection was gathered from January to March 2024, the PLS-SEM (Partial Least Squares Structural Equation Modeling) technique was used to process the data, the data collected were modeled in the Smart PLS *software* (version 3.3.2). The results demonstrated a good predictive capacity for the research model, a high degree of relation was detected between the variables of customer satisfaction and loyalty to companies, in the same way it

was demonstrated that the relationship between benefits and sacrifices influence customer satisfaction. The findings revealed that the results obtained for the model have a significant impact on customer loyalty. The results of this study will be useful for business owners to generate competitive strategies. Additionally, it is recommended to extend this study in other regions of the state by adding new variables.

Keywords: Customer satisfaction, customer loyalty, causal model, small businesses, non-technological innovation.

Resumo

O objetivo principal da pesquisa foi analisar elementos de inovação não tecnológica, priorizando as variáveis de benefícios e sacrifícios entre empresas dedicadas ao mármore e clientes finais, a fim de determinar o seu grau de satisfação e fidelização, para esse fim. pesquisa quantitativa, não experimental, transversal, onde foram aplicados 76 inquéritos in loco nos municípios de Tecali de Herrera e Tepeaca, no estado de Puebla. A coleta de dados foi realizada no período de janeiro a março de 2024, foi utilizada a técnica PLS-SEM (Partial Least Squares Structural Equation Modeling), os dados coletados foram modelados no *software* Smart PLS. (versão 3.3.2). Os resultados demonstraram uma boa capacidade preditiva do modelo de investigação, detectou-se um elevado grau de compensação entre as variáveis de satisfação dos clientes e lealdade às empresas, da mesma forma que foi demonstrado que a relação entre benefícios e sacrifícios influencia a satisfação dos clientes. Os resultados revelaram que ases estimativas obtidas para o modelo têm um impacto significativo na fidelização do cliente. Os resultados deste estudo serão úteis para os empresários gerarem estratégias competitivas. Adicionalmente, recomenda-se estender este estudo para outras regiões do estado adicionando novas variáveis.

Palavras-chave: Satisfação do cliente, fidelização do cliente, modelo causal, pequenas empresas, inovação não tecnológica.

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Introduction

The Mexican Geological Service (2018) states that marble mining began in the municipality of Tecali de Herrera and surrounding areas in 1970. Since then, Puebla state has become a leader in this sector, in 2017 Puebla's marble production by itself represented 3.8% of national production. The main marble-producing mining centers in the state are Amozoc, Puebla, Tepexi de Rodríguez, Tecali de Herrera and Tepeaca. From the list mentioned, the last two municipalities represent the study region of this work.

According to a study carried out in the Tecali de Herrera area by the General Mining Coordination, the main actors in the marble distribution chain are:

1) Marble extractors: groups of *ejidatarios,* owners of lands where the deposits are located; 2) marketers: private companies that guarantee their supply by purchase contracts with the *ejidatarios,* 3) workers: people who extract and process mineral, 4) intermediaries: they collect raw material, 5) brokers: commission agents, who search for merchandise for selling, focus on wholesale purchases; 6) distributors: owners of lapidaries, ornament stores and craft stores, generally using intermediaries to obtain raw material and polished or unpolished slabs to be transformed; and, finally, 7) end consumer: a segment that has become increasingly relevant and is related to the world of architecture and interior decoration (General Mining Coordination, 2015, p. 21).

In recent years, Puebla has remained within the top 10 places in the national ranking of marble producing states (Mexican Geological Service, 2018). However, the methodological contributions on innovation in the marble sector are precarious, the same happens with studies that include more members involved in the process.

The General Mining Coordination (2015) secure that there are two main challenges for marble sector, the first is about knowledge about the uses and properties of marble, which is scarce in consumer markets, a fact that contributes significantly to the fact that the national demand for this material has remained at relatively moderate levels. The second is that the main demanders of marble products belong to people or companies with high purchasing power, such as luxury hotels, residential areas, airports, construction companies, wholesale stores, among others. However, the Mexican Geological Service (2018) confirms that, in recent years, the Mexican economy growth has been conditioned by structural and historical factors that have limited national development, suddenly increased and widespread due to

the impact of the coronavirus pandemic and the measures to suspend not elemental activities, caused a drastic contraction of the national economy.

Marble companies in the municipalities of Tecali de Herrera and Tepeaca in the state of Puebla are involved, among other considerations, in customer perceptions, which is why delving into purchasing behavior is essential for them to maintain a competitive position in the market. In other words, if the perception of marble product acquisition is positive, so will be the degree of satisfaction, which together will lead to customer loyalty and retention.

The innovation process has focused especially on producers and merchants, omitting the other members of the chain, such as customers and users. This has caused a lag in issues such as customer satisfaction, shopping experience and loyalty, for that reason marble companies must pay attention to preferences and needs of these to meet and exceed their expectations.

In addition to the studies on innovation, variables of various dimensions are added, such as those based on marketing and organization, thus enriching multidisciplinary studies. However, Román Bermeo and Vilema Escudero (2017) affirm that, despite the interest aroused in the academic community, there are few studies carried out with the aim of explore in depth on its nature and scope. With reference to the situation in Mexico, López López and Villarreal Peralta (2017) assert that it is a field that remains considerably unexplored, which represents a scenario of great interest for academic research. Although studies on technological innovation are much more numerous than those related to non-technological innovation (Godin, 2008), this fact only serves as motivation to delve deeper into the subject and contribute to the literary collection.

Literature review

Non-technological innovation

For Albornoz (2009), innovation applied to companies represents the purpose of improving their competitive position by incorporating new technologies and knowledge of different kinds. The innovation process includes several activities that go beyond scientific and technological activities and encompass financial and commercial organizations.

Regarding the innovation taxonomy, the Oslo Manual (2018) proposes that it is divided as follows:

1) Goods or services. It corresponds to the introduction of a new or significantly improved goods or service, in terms of its characteristics or defined use.

2) Process. It relates to the implementation of new or improved production and distribution methods, carried out using computer equipment, techniques or programs.
3) Marketing. The implementation of a new marketing method involving significant changes in design, packaging, positioning, promotion or price.
4) Organizational. Associated with developing new methods in company practices, in the workplace or in the way the entity's external relations are managed.

The Chilean government (2012) in its seventh innovation survey indicates that innovation can be classified according to the use of technology. In other words, if it is applied to products or services, it is known as technological innovation, while innovation related to marketing and organization is defined as non-technological innovation.

Marketing innovation includes efforts related to the development and introduction of new marketing methods not previously used by firms and involves the development of new activities required for their introduction. This classification also includes the acquisition of knowledge, machinery, equipment and other capital goods from abroad, as well as training activities. Preparations for this type of innovation are linked to the development of four types of instruments: preparation for the introduction of new marketing methods in product design or packaging, in pricing, in product positioning and promotion (Oslo Manual, 2018).

An organizational innovation refers to the development of new organizational methods applied to business practices or to the company's external relations (Godin, 2008). Likewise, Kamien and Schwartz (1982) assert that this classification focuses mainly on non-technological innovations (strategy, management, organizational, marketing, aesthetic changes and the like); organizational innovation is shown to be the most important factor when explaining the behavior of innovative companies; in all cases, it improves innovation. However, it is particularly relevant in sectors with technological disadvantages.

Customer satisfaction and loyalty

Nowadays, companies have become aware of the strategic importance of having a portfolio of loyal and satisfied customers. Therefore, it is not surprising that customer loyalty is a priority issue for both businessmen and academics. According to Peña Escobar, Ramírez Reyes and Osorio Gómez (2015), customer loyalty consists of measuring, managing and creating value to convert satisfied customers into loyal customers. In addition, they state that it is easier and cheaper to keep an already won customer than to win new customers. This

does not mean abandoning new business, but it is crucial for any company, in any sector, in any market to have loyalty strategies based on planning and creating mutual benefits.

The complexity immersed in the concepts of loyalty and customer satisfaction have served as the basis for the development of multidisciplinary studies that allow this relationship to be evaluated from different perspectives and merging different concepts at the same time, serving as a basis for decision-making (Falk, Hammerschimdt and Schepers, 2010).

For Arenal (2016), the degree of customer satisfaction is a dimension that allows access to the level of loyalty to a product or a company, for example, a customer who is not satisfied will take the action of stopping consuming the product and therefore look for a substitute. On the other hand, a well-served customer will maintain some form of commercial ties with the company, but only until they find a better offer that exceeds their expectations. Likewise, Carvache-Franco, Carvache-Franco, Macas and Orden (2018) define customer satisfaction as the evaluation that the customer makes of the product or service offered on what they expect to receive, in other words, if expectations are met or exceeded.

On the other hand, for Gupta and Zeithaml (2006) the concept of loyalty is usually measured in terms of frequency of repetitive purchase, purchase volume, purchase of additional products offered by the same company or through attitudinal criteria, such as the repurchase intention, the chance to recommend to others use a specific good or product or the probability of changing brands and buying more. In this sense, for Grande (1996), fidelity or loyalty can be defined as "the propensity to buy the same brand or frequent the same establishment to satisfy the same need" (p.167).

Loyalty is the result of various factors such as user experience, recognition, perceived quality, associations with the brand or product, among others. The most important is the user experience, since loyalty cannot be conceived until the product has been purchased or tested (León and Olabarría, 1991).

Reference framework. An approach to the marble sector

The definition of marble, according to Betancourt Chávez, Lizárraga Mendiola, Narayanasamy, Olguín Coca and Sáenz López (2015), is the following: "A metamorphic stone that changes depending on variables such as pressure, heat and temperature, which can reach a high degree of crystallization and allows polishing" (p. 3). From the position of Guillem López (2001), its primary use is centered on its architectural use such as wall

cladding, bathrooms, waiting rooms, lobbies of large hotels, hospitals and banks, to name a few. Its implementation as a structural element, sculpture material, funerary art, among others, is quantitatively less important.

Mexico has large areas of rock outcrops composed of carbonate rocks that offer potential as dimensional stones. There are very important marble producing areas, of which two stand out: 1) The *Lagunera* region, located on the borders of Coahuila, Durango and Zacatecas, and 2) Puebla. In addition to these areas, there are other important producing states, such as Querétaro, Hidalgo, Oaxaca and Jalisco (General Mining Coordination, 2015).

According to the National Institute of Statistics and Geography (INEGI, 2024), despite the large surface area mentioned, current production is concentrated in the states of Puebla, Durango and Coahuila, which together generate fifty percent of the total gross production of marble. The Mexican Geological Service (2018) maintains that, at the state level, 80 plants of various capacities are registered for the treatment of non-metallic minerals; among which 56 plants for marble, onyx, travertine and calcium carbonate stand out.

Materials and methods

Research focus, scope and design

According to the guidelines of Hernández-Sampieri and Mendoza (2018), the research had a quantitative approach since it used a statistical method to verify the hypotheses raised, the design is non-experimental, of a transversal type. Likewise, the scope was exploratory and descriptive, to process the data collected, a software called Smart PLS (version 3.3.2) was used.

Study region

The General Mining Coordination (2015) states that Puebla has a wide geological and mining potential; specifically, the natural stone sector is an extremely traditional and complex one in Mexico, since it involves various activities and actors involved. According to data from the Mexican Geological Service (2018), Puebla has 217 municipalities, of which five are classified as the main marble-producing mining centers: Amozoc, Puebla, Tepexi de Rodríguez, Tecali de Herrera and Tepeaca. The study region is focused on the end customers and users who purchase marble products from the last two municipalities mentioned, to which the on-site survey was applied from January to March 2024.

Sample size and sampling

The sample was selected using a non-probabilistic sampling method using the convenience and snowball method. The reason for selecting this type of sampling was based on its usefulness for the design of the study, which does not primarily seek a "representativeness" of the subjects in the population, but rather a meticulous and controlled selection with characteristics previously determined in the statement of the problem (Hernández-Sampieri and Mendoza, 2018).

According to López-Roldán and Fachelli (2015), an infinite population is any population with 100,000 units or more, such as clients and users, since it would be a mistake to rely solely on government tourism indices, given that the range of clients in this sector includes various members other than tourists. To calculate the sample size, the infinite population formula was used, giving a total of 76 surveys to be carried out.

Development of the primary information collection instrument

Following the recommendation of the Oslo Manual (2018), a questionnaire was designed that was as brief as possible, structured and with clear instructions. It should be noted that it is not possible to cover all the main and secondary topics in a single survey, which is why a survey was designed with closed questions with a total of 19 items with Likert scale responses. Table 1 shows which topics correspond to each question.

Table 1.- Survey summary

Variable	Item	Subject
Innovation in marketing and organization	IM1	New products
	IM2	Diversification of payment methods
	IM3	Perceived quality
	IM4	Promotion techniques
	IM5	Improving employee care
	IM6	Installation or delivery services at home
	IM7	Investment in technology
Benefits per-ceived	BP1	Feeling of reward
	BP2	Social bond
	BP3	Support with heavy products
	BP4	Speed in attention and service
Customer sacri-fices	SC1	Transfer time
	SC2	Logistics costs
	SC3	Economic sacrifice
Satisfaction	SF1	Level of satisfaction
	SF2	Probability of repurchase
Loyalty	LE1	Competence
	LE2	Positioning
	LE3	Preference
Demographics	DE1	Age
	DE2	Gender
	DE3	Academic degree
	DE4	Profession

Source: Own elaboration based on literature

For data analysis, a structural equation model based on covariance and factor analysis was used, which according to Marín-García and Alfalla -Luque (2019) has recently been widely disseminated in social sciences, is called PLS-SEM, which aims to predict latent variables and is based on the estimation of ordinary least squares.

The application of this method was carried out in four stages. The first consisted of the description of the model, for which the variables to be used were graphically represented and the research hypotheses were developed; the second stage focused on the validity and reliability of the measurement model or also called external model, where an assessment exercise of the structural model was carried out using Cronbach's alpha and the composite reliability coefficient in which the individual reliability of the reagents was reviewed. Subsequently, the convergent validity was analyzed by using the average variance extracted Average Variance Extracted (AVE). Finally, regarding discriminant validity, the Fornell-Larcker criterion was used.

Results

The surveys were administered on-site. To avoid paper printouts, a Google form was used; data collection was carried out using a mobile device. After downloading the data, they were downloaded to Excel and exported to the Smart PLS statistical program (Version 3.3.2) for processing and modeling. Table 2 shows the demographic data of the respondents.

Table 2.- End customer's demographic data

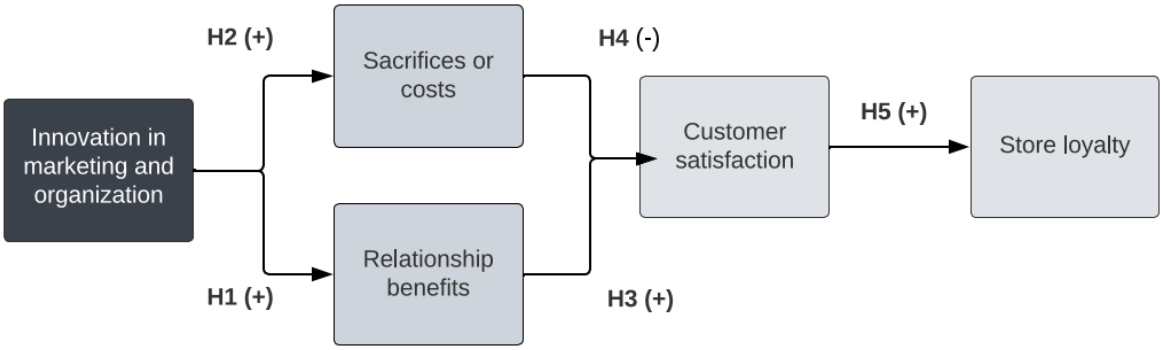
	Customers	**Amount**	**%**
Gender	Women	27	35.52
	Men	49	64.47
Age	21 – 30 years	19	25.00
	31 – 40 years	23	30.26
	41– 50 years	21	27.63
	51– 60 years	6	7.89
	61 – 70 years	7	9.21
Educa-tion level	Secondary	9	11.84
	Preparatory	19	25.00
	Degree	38	50.00
	Mastery	10	13.16
Occu-pation	Businessman	19	25.00
	Employee	9	11.84
	Doctor	3	3.95
	Teacher	4	5.26
	Housewife	4	5.26
	Builder	8	10.53
	Architect	15	19.74
	Civil engineer	11	14.47
	Worker	3	3.95

Source: Own elaboration

Stage 1: Description of the theoretical and structural model

The main dimension was non-technological innovation combined with other variables such as benefits and sacrifices perceived by customers, as well as satisfaction and loyalty. The theoretical model was developed based on the literature review, and it can be observed that it is composed of five constructs or variables, from which five hypotheses arise, which are described after Figure 1.

Figure 1.- Theoretical model (graphic representation of the variables studied and the development of hypotheses.)



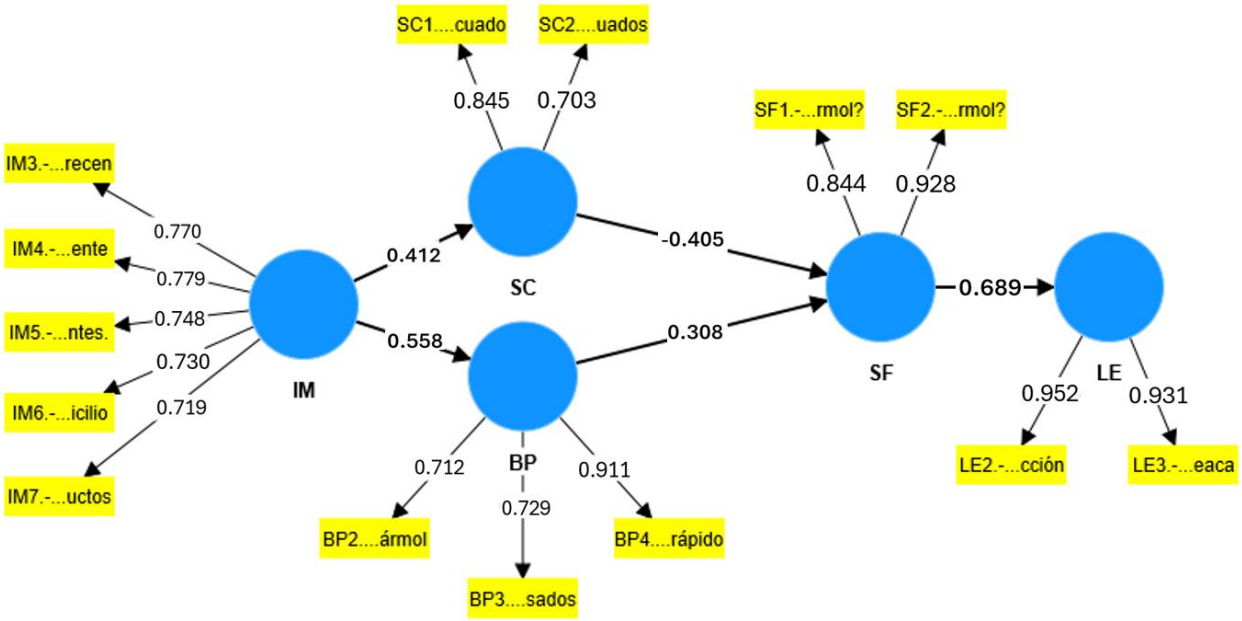
Source: Own elaboration

Research hypothesis

- H1. Customers' appreciation of the efforts made by marble companies in non-technological innovation has a positive and significant effect on perceived benefits.
- H2. Customer perception of non-technological innovation in marble companies has a positive and significant effect on customer perceived sacrifices or costs.
- H3. Perceived benefits have a positive and significant effect on customer satisfaction.
- H4. Sacrifices and costs have a negative and significant effect on customer satisfaction.
- H5. Satisfaction towards companies has a positive and significant effect on customer loyalty.

Figure 2 represents the estimation of the theoretical model modeled in the software, already with the data of the variables loaded and reproduced in Smart PLS. In this model it is observed that the factors loadings of each indicator, the standardized regression coefficients or also known as path coefficients are acceptable. Nunnally and Bernstein (1994) have classified the weighting of these indicators as follows: if the value is less than 0.7 it is considered a “modest” level, generally used in exploratory studies; if the value is 0.8 to 0.9 it is considered a more advanced stage of the research.

Figure 2.- Structural model



Source: Prepared by the authors based on data obtained from Smart PLS

Stage 2: Internal consistency

To determine the reliability of the construct, an analysis was performed using the Cronbach alpha coefficient (CA) and the composite reliability of the construct (CR) as measures of internal consistency. Cronbach's Alpha increases as the correlation between the items increases, its maximum value is 1 and its minimum is 0, although sometimes it can be negative. Values of 0.7 or even 0.6 are commonly accepted as indicators of acceptable reliability, values greater than 0.8 represent excellent reliability (Fornell and Larcker, 1981).

Stage 3: Convergent Validity

Regarding Composite Reliability, this is higher than 0.7 in the constructs, a favorable result according to Nunnally and Bernstein (1994), which represents internal consistency in the constructs of the model; in other words, it symbolizes a good degree of convergent validity. According to Fornell and Larcker (1981), convergent validity indicates that a set of indicators or items represent a single underlying construct. This statement is validated with the Average Variance Extracted (AVE), which measures that the variance of the construct can be interpreted through the selected indicators; they suggest 0.5 as the lower limit of an acceptable AVE, which represents that more than 50% of the variance of the construct is due to its indicators. In this way, the adjustment of the indicators is significant, and it is presumed

that they are highly correlated. Both the values of internal consistency and convergent validity can be seen reflected in Table 3.

Table 3.- Structural model measuring instrument

Variable	Item	Factor loading	Cronbach's alpha CA	Composite reliability CR	Average Variance Extracted AVE
F1. Non-tech-nological in-novation	IM3	0.770	0.710	0.821	0.536
	IM4	0.779			
	IM5	0.748			
	IM6	0.730			
	IM7	0.719			
F2. Perceived benefits	BP2	0.712	0.708	0.820	0.540
	BP3	0.729			
	BP4	0.911			
F3. Sacrifices and costs	SC1	0.845	0.766	0.782	0.508
	SC2	0.703			
F4. Customer satisfaction	SF1	0.844	0.737	0.881	0.787
	SF2	0.928			
F5. Customer loyalty	LE2	0.952	0.873	0.940	0.887
	LE3	0.931			

Source: Prepared by the authors based on data obtained from Smart PLS

Stage 4: Discriminant validity

At this stage, discriminant validity was calculated using the Fornell-Larcker criterion, which found evidence of discriminant validity (Table 4) in which it was observed that all the highest loads were found in their own constructs. Therefore, discriminant validity demonstrated that the construction of each variable is different from the others.

Table 4.- Correlation matrix according to the Fornell-Larcker criterion

	Benefits	Innovation	Loyalty	Sacrifices	Satisfac-tion
Benefits	0.735				
Innovation	0.553	0.732			
Loyalty	0.473	0.489	0.942		
Sacrifices	0.211	0.555	0.062	0.677	
Satisfaction	0.672	0.449	0.574	0.171	0.887

Source: Prepared by the authors based on data obtained from Smart PLS.
Note: Square roots of AVE are shown diagonally.

After achieving the evaluation and analysis of the measurement instrument, the hypotheses were tested by executing a bootstraping process using several subsamples of 500, as supported by Hair, Black, Babin, and Anderson (2010). Table 5 shows the results of the hypothesis contrast, where the five hypotheses have a significant influence with their respective latent variables, as initially assumed. For Martínez Ávila and Fierro Moreno (2018), the level of significance is established from the value of the Student t test derived from the resampling or bootstrapping process, which is a non-parametric technique (there are no initial parameters; it is tested whether the paths between variables are feasible), which evaluates the accuracy of the PLS estimates.

Table 5.- Hypothesis testing

Hypothesis	Causal relationship	Path coefficients (standardized β)	Student t statistic (Boostraping)	P-value	Result
H1	Non-technological innovation –> Benefits of the relationship	0.576	8.980	0.000	Accepted
H2	Non-technological innovation –> Sacrifices or costs	0.403	6.355	0.002	Accepted
H3	Benefits of the relationship –> Customer satisfaction	0.598	8.355	0.000	Accepted
H4	Sacrifices or costs –> Customer satisfaction	0.298	3.098	0.042	Accepted
H5	Customer satisfaction –> Store loyalty	0.712	9.028	0.000	Accepted

Source: Prepared by the authors based on data obtained from Smart PLS.

path coefficients: 0.75 means substantial, 0.50 is moderate, 0.25 represents weakness in the relationship between constructs (Hair *et al.*, 2010)

Discussion

This study validates the existence of a positive relationship between customer satisfaction and loyalty, which is in line with the study by Berry, Seiders and Grewal (2002), who claim that the antecedent of loyalty to the establishment is customer satisfaction. Through this work, it was found that satisfaction acts as a mediating element between perceived benefits and sacrifices and costs.

The results obtained contributed to creating evidence on the positive effects of non-technological innovation. In addition, their interpretation was based on research expressed in literature. The study carried out coincides with that of Kafetzopoulos and Psomas (2016), where they specify that marketing innovation positively affects customer satisfaction. Likewise, Kotler (1972) suggests that high customer satisfaction rates may be the best indicator of a company's future benefits.

Regarding organizational innovation, a study carried out by Damanpour (1991) identified ten variables that are linked to innovation: specialization, functional differentiation, management attitudes towards change, professionalism, centralization, sources of technical knowledge, administrative intensity, idle resources, internal and external communication. That is, the variables used were correct, but future work could include more variables to strengthen the model. In addition, Peters, Riley, Siedschlag, Vahter and McQuinn (2018) pointed out that for small medium enterprises (SME) related with the service field in Germany, Ireland and the United Kingdom, non-technological innovation is linked to a greater increase in competitiveness.

Generally, customers behave and display purchasing behavior aligned with their level of satisfaction based on their own perception, that is, according to the way they perceive and interpret the world around them (Arnould , Price and Zinkhan , 2005). Marble companies are recommended to continuously monitor their customers' behavior to detect the presence of changes that affect their interests, since customer satisfaction will mainly affect future purchasing behavior, this implies a long-term perspective.

Innovation must now be studied outside of laboratories and must therefore be understood as a learning process where the common denominator is knowledge, but also the result of its application. In other words, the influences of the environment are collected, the company is transformed through the acquired knowledge and this knowledge is poured back into the market, transforming it in turn into a new reality that must be captured, again, to modify the company's performance (Vilaseca -Requena, Torrent- Sellens and Jiménez-Zarco, 2003).

Finally, we differ from Damampour and Evans (1984), who claim that non-technological innovations are considered less effective because they are less observable, more complex to implement and relatively less advantageous. Although studies on the adoption of technological innovation are much more numerous than those related to non-

technological innovation (Godin, 2008), this fact only serves as motivation to delve deeper into the subject and contribute to the literary collection.

Conclusion

This paper presents a methodology based on the PLS-SEM analytical tool in social sciences, for which the problems of marble companies were selected, a little-studied field in which there is little or no literature that attempts to explain the phenomenon of non-technological innovation through causal models.

The results show an adequate predictive capacity of the research model. In addition, the hypotheses proposed in the theoretical model were verified, which serves as a basis for creating possible solutions to the current problem and allows us to explain the complex relationship between companies and customers. These hypotheses were verified through real facts for their acceptance, that is, through observable facts.

In accordance with the objective of this work, it is concluded that non-technological innovation has a significant impact on both customer satisfaction and loyalty. According to the results, it is confirmed that non-technological innovation has a moderate effect on company-customer benefits (β=0.576; H1) and a weak relationship between non-technological innovation and sacrifices (β=0.403; H2). Regarding the impact on customer satisfaction, positive and negative relationships were detected; the influence of benefits on customer satisfaction is also moderate (β=0.598; H3), while the result of the sacrifice variables with satisfaction represents the weakest coefficient of the model (β=0.298; H4). Finally, the positive relationship between customer satisfaction and customer loyalty to stores is confirmed (β=0.712; H5), this value is the only substantial one in the model.

The results obtained in this research offer empirical evidence that non-technological innovation is essential for developing marble companies and improving their competitiveness. This innovation exerts a notable influence on customer satisfaction and loyalty. In summary, there are two main resolutions of this research. First, it suggests that decision makers in marble companies consider non-technological innovation in their strategies an integral part of the innovative culture, which can be seen in improving not only the product, but also the service offered. Second, directing the resources of companies so that they are aligned with the needs of customers.

While measuring innovation is, in itself, a difficult task, in companies dedicated to primary activities there are additional complications due to the complexities inherent to the

sector. To mention a few, we can highlight the fact that companies do not show a tendency towards cooperation, the vast majority are family-run businesses, the technological aspect is not the pillar of companies, and they do not have the tools to expand into new markets, including international ones.

Returning to the OECD proclamation (2010), in recent years there has been an increase in interest in non-technological forms of innovation and their contribution to productivity, primarily in countries where industrial and structural specialization limits the scope of technology-based R&D activities, as is the case in the marble sector.

Future lines of research

Recommendations for future work include increasing the sample size to strengthen the statistics and results. Likewise, we invite the inclusion of more members involved in the process, such as major tourist hotels, residential areas, airports, construction companies, wholesale stores, among others. The main limitation of this research was identified as the fact that it focused solely on innovation in marketing and organization, leaving aside innovation in goods and services, as well as innovation in process.

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