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Diffusion Model for Mexican SMEs to Support the Success of Innovation

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Abstract: Developing new and successful products is probably the most critical task of any company. However, developing new products is not only a very complex task but also risky, even more so for an SME. One of the main risks associated with forecasting demand is estimating sales and making decisions regarding production and marketing strategies. This study considers the Bass Model for the pre-launch forecasting of new product demand, and the diffusion of new products in Mexican SMEs. The objective of our proposed model is to represent the level of new distribution developments in a simple mathematical function that has elapsed since the introduction of new products. Therefore, this article exposes the methodology to predict the success of an innovation in SMEs. The experimental validation shows that SMEs represent a driving force in spreading and introducing innovation in the Mexican market in Mexico. The innovation parameter (p) and the imitation parameter (q) are more significant than the stores' sales in general. This result indicates that SMEs in emerging markets represent an effective means of supporting innovation. Furthermore, a robust Bass model was developed to forecast demand with limited data for new products. We analyze the model empirically, concluding that our extension can improve the accuracy of future demand forecast and, more importantly, identify the expected potential in the diffusion of a new product.

Keywords: innovation forecasting; bass model; diffusion models; SMEs; predictive analytics

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1. Introduction

In a post-pandemic scenario, market uncertainty makes product demand forecasts more complex. Moreover, small and medium-sized enterprises (SMEs), which are mainly family-owned, face a substantial economic burden and tension [1]. Under these conditions, gathering most of the knowledge regarding innovation is an urgent need to formulate alternatives for SMEs to strengthen their business models for the different market needs [2].

One of the companies' main challenges is estimating the future demand for new products. In particular, this process is even more complicated in the SMEs innovation process due to several factors. Many SMEs fail to launch new products or services due to pre-existing problems, such as little or no investment in market knowledge, a lack of formal planning and demand forecasting, lack of managerial and technical skills, and limited financial resources [1].

Innovation has become a fundamental requirement for all companies that want to survive in a world characterized by competition, technological change, and crises. The concept of innovation refers to the use of new technologies or management practices in an organization to improve its operations [3]. Some authors claim that SMEs innovate in specific ways, different from the innovation process of large companies [4]. While it is true that there are specific size-specific characteristics, the heterogeneity of the SME sector precludes simple generalizations. This heterogeneity is one of the main reasons why there are contradictory results when comparing levels of innovation between SMEs and large companies. For example, some studies have found evidence that SMEs are generally more innovative [5,6].

On the other hand, some authors found that large companies seem more innovative than SMEs [7,8]. Moreover, scholars agree that innovation is crucial for SMEs' survival [9] and even more critical for an emerging economy [10]. However, despite these findings, surprisingly little is known about how SMEs can better cope with crises using a better innovation management model. Therefore, the principal contribution of this research is to fill this research gap by expanding the body of knowledge in the field and providing more evidence on this phenomenon.

From an SME perspective, innovation typically indicates new products or processes that address customer needs more competitively and profitably than existing ones [11]. However, despite the importance of innovation, only a few articles have been written on how to support the process of innovation within SMEs [12–14], and little attention has been paid to how innovation could be improved using an econometric tool.

Furthermore, specific research related to the study of barriers to SMEs' innovation in Latin America is limited, especially when compared to those carried out in Europe [15], Asia [16], and North America [17]. Additionally, there is not much research in the field of models that support innovation, with a few exceptions, conducted outside of Latin America [18–20].

In recent decades, many studies have been performed on demand forecasting, but not much has been conducted on forecasting the demand for new products. Absolute precision in predicting future demand for innovations is impossible, even in the short term. Nevertheless, new product forecasting serves as a reality check by providing visibility into what is likely to happen. New product demand forecasting is expected to be useful for companies to understand the performance of consumer behavior when necessary. In this research, we focus on forecasting the demand for new products, which has received less attention among scholars [21].

The research question we addressed in this paper is how the Bass Model can be used to support and improve the innovation process in SMEs. We also seek to provide additional information for managers of SMEs on the importance of the Bass Model to enhance the function of innovation and the launch of new products. We use the Bass model as it has supported innovation planning. The fundamentals of the product cycle curve guide us to ensure innovation success and a more significant impact on SMEs. Likewise, it represents excellent support for making projections and future scenarios with little data, so it is helpful for innovation in SMEs in two main aspects: (1) planning and (2) prediction purposes. The explanatory factors behind these deterministic behaviors were developed by Rogers [22]. According to this author, diffusion is the process by which an innovation spreads over time through specific channels among market members. This line of work was more oriented to consumer behavior, where positive analyses are carried out on the variables that affect the probability of adoption of the innovation and the time horizon in which it occurred. According to Arellano [23], adopting an innovation depends on several factors, such as the relative advantage of the innovation concerning pre-existing products, its compatibility with the life habits of the potential adopter, the complexity of its use, or the possibility of using it before production.

Therefore, this study aims to demonstrate the impact of the innovation process on SMEs, specifically on new products using the Bass Model [24]. The Bass Model provides a well-known, parsimonious empirical method for adding identification and measurement to diffusion theory-based studies such as the present one. We use the general Bass model, considering statistical tools and mathematical models that have proven to be the best for identifying the parameters and correlations necessary to estimate the demand for innovation. Finally, we propose that SMEs use the information to make the right decisions over time, ensuring the success or permanence of most new products launched by firms.

Specifically, this work focuses on the relationship between innovation's success and its demand's level of assertiveness. After reviewing the literature on SME innovation practices, we will present our theoretical framework and analyze the two hypotheses tested. In the end, we offer the results of our data analysis to emphasize our main conclusions.

2. Literature Review

2.1. Innovation in SMEs

SMEs are recognized as one of the main contributors to economic development and job growth and play a crucial role in the emerging markets economy [25]. The OECD [26] also recognizes the importance of SMEs as job creators, while Lawless [27] shows that younger companies are influential job creators. In Latin America, SMEs represent 99.5% of regional firms (with almost 9 out of 10 classified as micro-enterprises) and generate 60% of formal productive employment [26]. SMEs are more vulnerable to crises [28]. Still, they are flexible, entrepreneurial, embedded in communities, and even more innovative than larger companies [29]. SMEs have been shown to possess unique abilities to respond effectively to crises and ultimately become stronger [30]. Some scholars have found innovation a valuable tool for an SME to survive a problem [31–33].

Research into innovation related to SMEs has been conducted in different aspects. For example, Gu et al. [34] present the effect of internal and external sources on innovation. Gao and Hafsi [35] examined the impact of business owners' characteristics on their firms. Bala Subrahmanya [36] established the features of innovative SMEs. Finally, Battistella et al. [37] proposed a methodology for implementing innovation in SMEs. On the other hand, researchers have highlighted the differences between a limited number of highly innovative small firms and many non-innovative firms [38].

The innovation process implies uncertainty and heterogeneity, making its structural analysis complex. In particular, the timing of the resulting innovations and their introduction is characterized by randomness. Furthermore, it is difficult for SMEs to innovate because of various barriers that slow down or inhibit the innovation process [39]. As a result, many SMEs have faced severe problems developing or adopting services/products, processes, or management systems [11,38]. Some of these obstacles to innovation are mentioned in the literature, such as the lack of financial resources, the inadequacy of management and marketing, the lack of qualified workers, the weakness in information and external links, and the difficulty in coping with government regulations limit their competitiveness [39–41].

Therefore, SMEs are under enormous pressure to survive in the market as they operate with limited resources, making them risk-averse [41]. Either way, SMEs' success and survival will depend on their ability to incorporate innovations into their main strategies [42]. Studies have shown that SMEs contributed to the significant innovations of the 20th century [40]. SMEs have some advantages due to their size. Many are flexible and have strong customer relationships, allowing them to respond quickly to market and technology changes. Small businesses tend to have good internal communications, and many have a dynamic and entrepreneurial management style [40]. In addition, SMEs often explore new technical spaces. In short, innovation in small firms can be more efficient and effective [43].

Innovation efforts are expected to increase long-term economic performance but imply substantial risks because most expenses are irreversible and uncertain future outcomes [44]. In addition, SMEs may be unable to exploit new products due to their limited organizational and marketing capacities. Other studies look at cultural barriers to innovation, such as reluctance to change, a tendency to ignore procedure, a focus on short-term requirements, a lack of strategic vision, and the spread of a culture of blame [39,45]. However, the main problems of SMEs are due, in particular, to the scant attention devoted to organizational and managerial issues, especially in innovation [46].

2.2. Forecasting Demand and Innovation

Innovation and new products could mean different things to different audiences. Throughout the paper, we will refer to innovation as the ability to launch, generate or produce new products. When discussing the demand for new products, we must consider specific problems. First, the new product forecast has little credibility and a low level of accuracy due to the lack or absence of historical data since it is only based on assumptions.

Second, the time required to develop the new product forecast is longer because it requires manual attention. Finally, uncertainty and data scarcity occur regarding new products [21].

Some marketing and technology forecasting authors have attempted to model the time-dependent aspects of innovation diffusion processes and the properties of the life cycle curve, that is, the process by which the adoption of a new product or technology spreads and grows to replace an existing product. We can assume that the quantity demanded of a product depends on preferences or tastes, which in turn depends on the product's necessity, usefulness, convenience, and competitive technological power. In our investigation, we will use smartphones as the reference product [47].

Demand forecasting is an iterative process to estimate the number of products or services customers buy. Several approaches are available in demand forecasting, including formal and informal methods. Demand forecasting can determine prices, assess future capacity requirements, or make marketing decisions. Therefore, it is imperative for companies to produce the required quantities at the right time and to organize the various elements in the production processes well in advance. Over the past few decades, many studies have been performed on demand forecasting, but not much has been conducted on forecasting the demand for new products [21].

Regarding the demand for new products, there are issues to consider. First, the new product forecast has little credibility and a low level of accuracy due to the lack or absence of historical data since it is only based on assumptions. Second, the time required to develop the new product forecast is longer because it requires manual attention. Finally, uncertainty and data scarcity occur regarding new products [21].

Forecasting the demand for new products is a process that determines a reasonable estimate of achievable sales under various conditions. Introducing new products in the "new normal" market implies significant risks for the companies since it requires a considerable part of their total profit. A product failure causes substantial economic losses. In addition, the short product life cycle is forcing managers to generate more demand forecasts. An accurate prediction is vital to the success of new products. Forecast demand for a mature-stage product is not problematic. However, forecasting future sales of a new product with a short or no story is complicated.

Therefore, accurate growth forecasts for an innovative product are essential for crucial marketing decision variables such as output, product attributes, promotion, distribution, and price [48]. Unfortunately, little has been thoughtfully developed on this topic with scientific rigor in Mexico and emerging markets. However, those produced in first-world countries depend significantly on the production companies' culture, technological development, and discipline. Therefore, before starting an innovation process, most companies must design a well-planned innovation process using market research, scientific decision-making, and modeling.

2.3. Bass Model Application

Over the last forty-five years, the Bass Model has emerged as a good tool for modeling the adoption of various new product and service innovations [22]. Bass's model provides one way to address this problem for forecasting innovation [49]. The model was named in honor of Professor Frank M. Bass. This model has been used for more than 30 years to forecast the innovation diffusion and penetration of new products [50,51]. Its mathematical formulation is based on models of epidemic spread [52] that describe how and at what speed a viral disease can be spread among a potentially contagious population.

In the literature review, the most cited work is that of Bass [49], which has already become a classic. In the decades after the Bass model emerged, most reported diffusion models were based on it. In addition, several pieces of research have appeared, including one in Latin America by Weissmann [53] that addresses the methodology of comparing U.S. and Argentina products.

According to the literature, two main factors influence consumers' purchasing decisions. One is the influence of other consumers who have bought the product and have

recommended it through word of mouth (WOM), which is considered one of the most important factors influencing consumers' purchasing decisions, especially about imitators [54]. The other is the influence of the media and advertising, among other factors. Therefore, several researchers have studied product sales forecasting, and forecasting models have been developed, taking into account relevant factors; among them, the Bass model considers these factors as external and internal coefficients [48].

Considering the Harvard Business Review study on the hypothesis that large companies choose to develop and launch new products and venture into new market segments (niches), historically, in general, for every ten new developments in the manufacturing sector, only two are successful [55].

Regarding the importance of knowledge spillover phenomena, Hau and Chung-Yee [56] deal with a section in their compendium of emerging economies on the diffusion of technological knowledge and innovation in countries such as Mexico; According to these authors, managing demand and innovation management well is a learning process.

More sophisticated works concerning the Bass model, such as Han & Zang [57], include the variable of free sampling and the diffusion of new products and their impact on sales, which several companies have adopted; the objective is to plan strategies for innovation sales.

Bass's model assumes that potential buyers of innovation can be divided into two segments:

Innovators: People who buy the product first are influenced only by an external communication.

Imitators: Individuals who buy if others have already purchased the product; this segment is influenced by word of mouth or the 'internal communication' [56].

3. Research Methods

3.1. Bass Model

The Bass Model is the first formal explanation of adopting new products in a market, and in this article, particularly for SME innovation in its three classifications [22,48]. Some extensions are proposed, and the limitations that motivate the proposals are discussed. In our work, analyzes were carried out with SMEs in Mexico. The primary objective is to compare the parameters of adoption and diffusion of innovation clients according to Kang [57].

Bass was inspired by the Diffusion of Innovation (DOI) as the most widely cited theoretical framework. Diffusion could be understood as a process by which an innovation is communicated, through specific channels, over time among members of a social system [58]. Some factors influence customers' decisions to accept or reject an innovation. The first is a relative advantage over previous solutions known on the market. Another is compatibility, understood as the degree to which an innovation or product can be adapted to the life of the product's user. The third factor is the ease of use of the new solution. The easier the product is to use, the faster the recipient will start using it. The last two factors are the ability to verify and test innovation before its adoption and visibility, the degree to which the use of an innovation is visible to others. This factor is essential in disseminating information about innovation and arousing the interest and willingness to have a particular product on the part of imitators, which can be a reason for purchase [59].

Rogers' model established that the adoption curve is normally distributed because of a learning effect. This theory classifies individuals into five categories according to when they adopt a new product, namely:

(1) innovative;
(2) early adopter;
(3) early majority;
(4) late majority;
(5) lagging (see Figure 1).

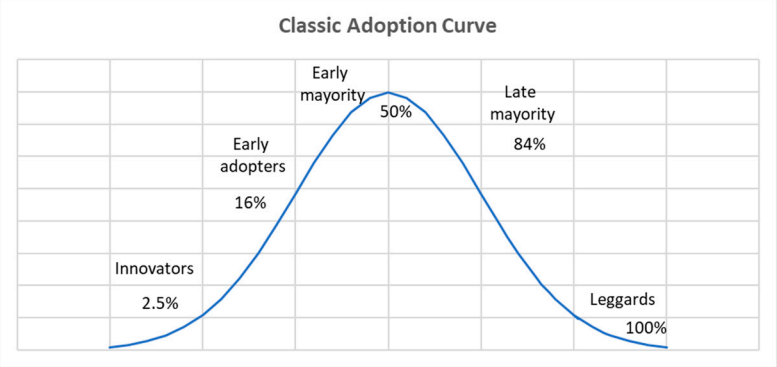

Figure 1. Adoption Curve. Source: The authors adapted from Rogers (1995).

The categorization proposed by Rogers [22] offers several advantages. First, it is easy to use. Second, because it provides specific and mutually exclusive standardized categories, the results can be compared, replicated, and generalized. Third, because the underlying diffusion curve is assumed to be normal, continued product acceptance can be predicted and link them to adopter categories. Based on this classification, which segments consumers according to the moment of the product's life cycle, Bass mathematically formalized his model and then tested it with data from eleven durable consumer products. He obtained significant results when contrasted with the actual results vs. the predicted ones.

Bass's model does not assume that innovators in one industry will always be innovators in others. This model does not use the standard deviations from the mean to classify adopters. It does not presume that the adoption path is a normal distribution [60]. Due to this, Bass's model works better for significant (new) or discontinuous (unique) innovations, as well as for minor (variations on an existing innovation) or continuous innovations (build on a current innovation) types of innovations.

In Bass's basic model, the number of consumers who buy a new product at a given moment in time is a function of the demand of the innovating individuals (who acquire the new product regardless of what other consumers do) and of the demand for imitators (who consume a product because others do). Mathematically, the Bass model is an exponential function defined as follows.

$$N(t) = m \times \left(\frac{1 - e^{-(p+q)(t)}}{1 + \frac{q}{p} e^{-(p+q)(t)}} \right)$$

The basic model parameters are

m: is the size of the market; it is the maximum number of consumers who can purchase the product (which does not mean the entire population of the country or region under analysis, but only the potential buyers).

p: innovation coefficient. It is the probability that an innovator buys or adopts the product in period "*t*" (it can be interpreted as the rate at which a consumer spontaneously buys it).

q: imitation coefficient. It is the probability that an imitator will adopt the new product. This coefficient captures the effect of word of mouth, the communication between innovators and imitators whereby the latter learn from and copy the former. It is also called the contagion effect. This coefficient reflects the effect existing consumers can have on potential new consumers. It is also called the coefficient of internal influence, unlike p, which is the coefficient of external influence.

From the basic equations to further detail the components [51], we have:

$$S(t) = [p + (q/m)\, N(t-1)]\, [m - N(t-1)] \quad (1)$$

where:

N (t) = number of consumers who adopted the product at a time (t).

S (t) = number of new consumers who embraced the product in period t.

Consequently:

$$S(t) = N(t) - N(t-1)$$

According to Weissmann [53], Equation (1), it can be interpreted that S (t), the number of new consumers who purchase the product at time t, is equal to the product between the probability that a new consumer buys the product at time t (first bracket) and the number of consumers who have not yet adopted the product (second bracket). It is important to note that, in this first bracket, q (the probability that an imitator adopts the product) is multiplied by the proportion of consumers who have already purchased the product, reflecting their influence on new consumers or imitators.

Given the parameters m, p, and q, it is possible to plot the adoption curve of a new product, generally called S curves (because of their sigmoidal shape). Intuitively, a high value of p indicates that the new product will be adopted quickly, even though it has a low probability of imitation (see curve 1 in Figure 2). At the same time, a low level of p will make adoption slower, even if q has a high value, because the imitators have a reduced group of innovators to imitate (see curve 2 of Figure 2). From this descriptive analysis, it is observed that in the case of curve 1, the peak of consumers is reached quickly, while in curve 2, the rise arrives with an unavoidable delay.

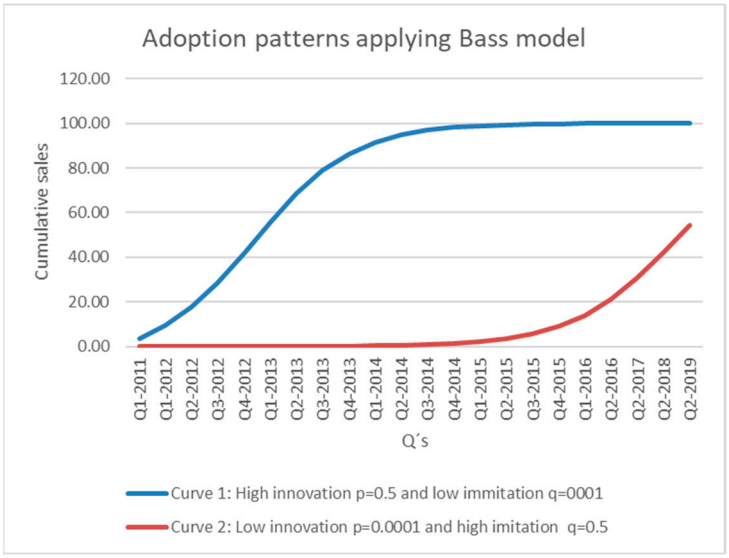

Figure 2. Adoption Patterns. Source: The authors.

3.2. Hypothesis

To formulate the hypotheses, we worked on the possible variables that impact a new product's performance and future sales in Mexico. Two hypotheses were developed to validate our research based on some triggering questions.

For the study, two main research questions were posed:

Q1. *How do we develop a mathematical model that supports SMEs' innovation in Mexican SMEs?*

Q2. *How do we differentiate innovators from imitators in a potential market to predict future scenarios?*

Specifically, hypothesis 1 aims to establish the relationship between the Bass model and the success of an innovation. The second hypothesis is focused on how the Bass model is an acceptable approximation for future scenarios and predictive analyses when historical data is unavailable. Therefore, the following hypotheses are proposed:

H1. *The Bass model is a management tool to improve the new product launch strategy.*

H2. *The Bass model establishes future scenarios for innovation with some accuracy.*

The time series of historical smartphone sales were considered; the variables are quarterly "sales" in units. The original Bass formula was used to estimate the product life curve and the projection with the support of the RStudio software (See Figure 3). In the research, the intention is to demonstrate that the Bass model supports and improves the innovation strategy in SMEs.

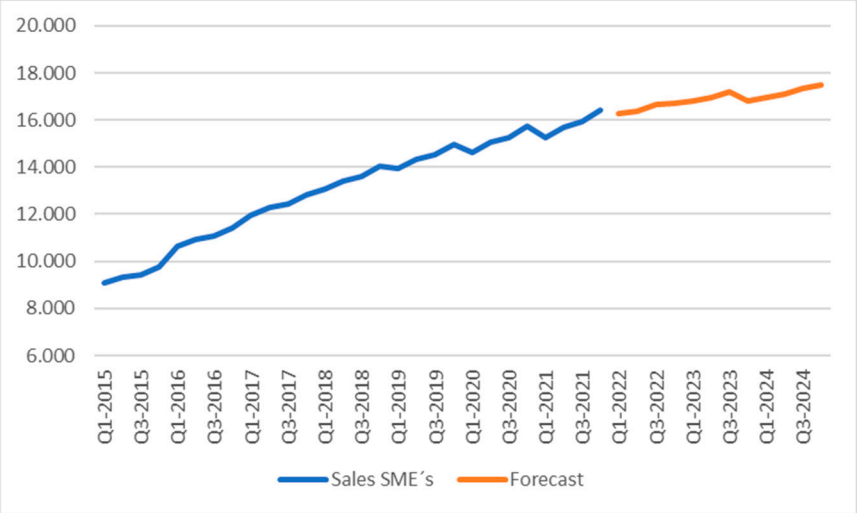

Figure 3. Sales history and Forecast in México SME's (in millions). Source: The authors with data from Sava (2022).

4. Empirical Analysis and Hypothesis Test Results

This section aims to show the empirical estimation and forecasting procedures. The companies analyzed in this study are SMEs that offer manufactured products (smartphones) and services and represent Mexico's most significant sales volume.

Very few countries are as closely related as Mexico and the United States, yet they understand each other very weakly. They are very close but seem so distant in many things. The two countries have become increasingly dependent on each other in recent years. In addition, they share a maritime and land border in North America. Our research focuses only on Mexico.

According to Selltiz [61], secondary data is also used to formulate research hypotheses; but using them requires an ability to formulate many questions related to the research problem. Therefore, the basic principle for using available statistics is to be flexible concerning how research questions are formulated. We use a public database based on sales data from Amazon, "Mercado Libre," and other online sales sites, as well as physical purchase statistics [62].

The mobile phone industry is highly innovative, and the smartphone is becoming the standard configuration among the different types of mobile devices and the fastest growing market segment. The entry of smartphones into the mobile communications sector has been characterized by introducing technological changes that have been both intangible (the operating system) and tangible (the hardware). Technical change and the proliferation of new products have made the telecommunication industry extremely dynamic, even if market shares are highly concentrated in the hands of a few companies [63]. That is why we consider smartphones as a product that represents essential innovations in a product.

In 2020, mobile phone sales were expected to generate US$12.09 billion in revenue in Mexico. In 2019, 89% of mobile phone users in Mexico used smartphones, and the estimated number of smartphone users was 75.4 million. For our research, user statistics, the number of smartphones from 2015 to 2021 in Mexico, and sales explicitly made by SMEs were considered [62]. We do this to estimate innovation parameters and make a comparison that supports our conclusions. In his original article, Bass used annual figures. This study uses quarterly records and Bass's original algorithm using the statistical software R.

Given that companies are at a crossroads when estimating the diffusion or launch of their new products, it is advantageous to apply the Bass model. Therefore, in the present study, statistics or records of smartphone users and sales were used to estimate the parameters of p and q and take them as a reference for the case of Mexican SMEs. First, the parameters p, q, and R^2 were estimated using the original Bass formula (line 266). Then, with the support of the Rstudio statistical tool, tests and calibrations were performed until the results presented in Table 1 were obtained.

Table 1. Parameters estimations.

Smartphones Sales	p	q	R^2
Total users Mex.	0.0008	0.0366	0.9906
Total sales Mex.	0.0027	0.0312	0.4514
Pymes sales Mex.	0.0034	0.0427	0.4880

Source: The authors.

Based upon collected historical data, the Bass model was created. Then, using the Bass methodology in combination with the statistical package R (R version 4.0.3 (2020-10-10). R was created in 1993 by Ross Ihaka and Robert Gentleman of the Department of Statistics at the University of Auckland, Auckland, Australia), the estimation of the parameters obtained for smartphone users, as well as sales in general (all companies) and sales in particular of SMEs in these technological devices are shown in Table 1.

In the case of the diffusion of smartphones in Mexico, the potential population is the universe of individuals who have declared using smartphones and also the record of sales of smartphones through companies in general and specifically sales through SMEs. These data were obtained through secondary sources [62]. The results obtained through the original Bass algorithm allow us to get values with initial conditions for p and q that, given their definition, belong to the interval (0, 1) and the sum of both also belongs to this interval—knowing that the larger the innovation parameter (p), the more propensity for faster diffusion of the product, and the smaller the innovation parameter, the lower the rate of diffusion and sale of the product.

With the results obtained, there is evidence that, at least in Mexico, SMEs represent a driving force to spread and introduce innovation in the Mexican market; both the innovation parameter (p) and the imitation parameter (q) are more significant than the sales of stores in general. This result indicates that SMEs in emerging markets represent an effective means of supporting innovation.

The sample that was taken were SMEs that sell smartphones in Mexico. SMEs represent 75% of the sales of these devices in Mexico. There are 580 thousand SMEs in Mexico, of which 6.5% sell smartphones [62].

Based on the review of the literature and the results of investigations that were considered, for example [51], which indicates that to determine the patterns of diffusion of new technologies and innovation, the results suggest that the parameters of innovation and imitation represent undoubtedly relevant factors for planning and forecasting the demand for new products.

Therefore, the findings supported the hypotheses posed. Using the same model dynamics but for predictive purposes, the original Bass algorithm is run in the statistical software RStudio, obtaining the following results for the sale of smartphones in SMEs in Mexico (Figure 3). The projection of smartphone sales of SMEs would reach almost 18 million units in the fourth quarter of 2024.

5. Discussion

We formulated two research questions. First, how do we develop a mathematical model that supports SMEs' innovation in Mexican SMEs? Second, how do we differentiate innovators from imitators in a potential market to predict future scenarios? We found through the

evidence that it is possible to develop a tool, using the Bass model, to identify the parameters of innovation and imitation that give more information about consumers' behavior.

We also formulate two hypotheses: the Bass model could be a management tool to improve the new product launch strategy, and the same model could establish future scenarios for innovation with some accuracy. Through the investigation, the hypotheses were verified, the Bass model under the necessary assumptions and the trigger variables such as sales represent a handy tool to better plan the innovation of SMEs in an uncertain market. It establishes the bases to predict the success of a launch and the construction of future scenarios as a planning and operational strategy for innovation.

This study describes and applies the Bass model as a resource to identify the progression of sales or diffusion of a product, focusing its approach on innovation or new products. One of the main steps is to estimate the innovation parameters (p's) and the imitation parameters (q's). With the presentation of the case, we identified that the sales of electronic devices such as smartphones show that the Mexican consumer is more an imitator than an innovator. Furthermore, we find evidence that in the last seven years, the sale of this device has been spreading at an increasing rate, except during 2020, due to the COVID-19 pandemic. On the other hand, there is a marked seasonality at the quarterly level in both historical series; sales increase from the first quarter (Q1) to the fourth quarter (Q4). More specifically, the series of total sales of smartphones are less prone to imitation than the series of sales in SMEs. Nevertheless, the sales of SMEs represent 82% of total sales [64].

Our work focuses efforts on modeling the diffusion and projection of new products. This practice represents an advance in innovation planning in SMEs in Mexico. Decision-making from the commercial, financial, and operational point of view is fundamental and illustrates the positive impact of analyzing through this diffusion mechanism. Specifically, with the exposition of this case, there is evidence that it is possible to estimate the diffusion curve and the expected behavior of sales of a new SME product in an emerging market such as Mexico. Previous research has shown that products such as washing machines, cell phones, and new technologies, in general, require time to mature and grow in the generation of theories, the definition of concepts, test methods, and various test prototypes to model the diffusion of innovation [65].

Finally, the results of the use of the model are consistent; however, the combined effect of using the Bass model with other technological devices could yield different results, but this dynamic would lead to a gradual reduction in the certainty of the diffusion and its predictive purposes.

6. Conclusions

6.1. Theoretical Implications

In the literature, we find a growing interest in modeling and forecasting the demand for innovative products due to the quick pace of technological change [66,67]. To achieve this purpose, the Bass model is a widely respected and used diffusion model.

This work focused on the characteristic elements of SMEs in Mexico and their commercial dynamics and diffusion of new products. The central objective was to propose a model that will approximately represent the behavior of the life cycle, projection, and diffusion levels of innovation, based on the users and sales of a technological device such as a smartphone.

We could estimate the innovation (p) and imitation (q) components by applying the Bass model and the RStudio programming language. With the results obtained, there is evidence of the following:

1. It is possible to model the commercial dynamics for the planning of an innovation.
2. The coefficient of innovation in Mexico is higher in SMEs than in the general business environment. Specifically, the speed of diffusion of a new product explained by the innovation factor is faster in SMEs.
3. The coefficient of imitation is higher in SMEs than in the general business environment.
4. A periodic initial baseline forecast can be generated for innovation planning purposes.

5. The benefits derived from this estimate will be reflected in operational planning and the potential diffusion of innovation in SMEs for decision-making.

The lessons learned in this case from Mexico for other emerging markets are evidence that SMEs represent a driving force for innovation and the generation of new products.

6.2. Managerial Implications

These findings have important managerial implications for the strategies of companies competing in specific product markets. First, this article builds a diffusion model proposal, including calculating the parameters of innovation (p) and imitation (q), particularly for SMEs, with evidence to improve the new product launch strategy. Second, the model supports efforts to build a projection at different levels for operational planning purposes and the marketing plan. With this model, SMEs can predict their potential market and project to define periods for planning and optimization operations.

Our research shows that a crisis such as the pandemic can unlock the enormous potential for SMEs only if they are open-minded, willing, and prepared to look for potential opportunities. Companies can recognize new opportunities in a rapidly changing environment and must be aware of their core competencies. Exploiting and applying their competencies can quickly pool unused resources into new business models during a crisis.

The model can support SMEs in two main areas

(a) Plan new products with less margin of error, anticipating events with the visibility provided by the model, and

(b) Generate future scenarios, specifically project sales in units, money, or any measurement unit. These scenarios represent an essential administrative tool for decision-making, for example, accelerating the production of innovation, carrying out promotions to encourage demand, and changing prices, among others.

6.3. Limitations and Future Research

Future lines of research could extend these conclusions by addressing the shortcomings of this study. For example, reviewing their practices by sector would be beneficial due to the diversity of industries to which small businesses belong. Furthermore, all indicators to measure firm performance should be considered to gain a comprehensive and in-depth view of the relationship between SME innovation practices, external support, and athletic performance and survival.

Since the proposed model has the basic desirable properties, more research is also needed to incorporate marketing programming variables, dynamic potential market, negative word of mouth, and competition in this model. Finally, more research is required in different countries due to the adoption pattern of an innovative product that is not transferable to another country [51].

The model only applies to Mexico in general. It cannot necessarily apply to Latin America or emerging markets. It does not apply to the U.S., Europe, or Asia. However, the same methodology can be used to calculate the coefficient of innovation and the coefficient of imitation in particular for each country. That is the added value of our investigation.

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