Complexity to Understanding Consumer Behavior from the Marketing Perspective

Lead Guest Editor: Jorge Arenas-Gaitán
Guest Editors: Borja Sanz-Altamira and Patricio E. Ramírez-Correa

Complexity of Understanding Consumer Behavior from the Marketing Perspective

Complexity of Understanding Consumer Behavior from the Marketing Perspective

Lead Guest Editor: Jorge Arenas-Gaitán
Guest Editors: Borja Sanz-Altamira
and Patricio E. Ramírez-Correa

Editorial Board

Contents

Editorial

Complexity of Understanding Consumer Behavior from the Marketing Perspective

Jorge Arenas-Gaitán [ID],[1] **Borja Sanz-Altamira** [ID],[1] **and Patricio E. Ramírez-Correa**[2]

[1]*Departamento de Administración de Empresas y Marketing, Universidad de Sevilla, 41018, Spain*
[2]*School of Engineering, Universidad Católica del Norte, Larrondo 1281, Postal Code 1781421, Coquimbo, Chile*

Correspondence should be addressed to Jorge Arenas-Gaitán; jarenas@us.es

1. Introduction

Technology has significantly changed consumers' lives and is likely to shape the future of business and marketing in particular. As an illustration, changes in technology have afforded marketers access to consumers and massive amounts of data on patterns of their behaviors that someone has to transform before they can be useful for decision-making. This rapid evolution in technology and its effect on the growth of the complexity of business environments are giving rise to both opportunities and challenges from a marketing perspective, deserving research attention. Therefore, researchers should make an effort to study how organizations can take advantage of these opportunities and face these challenges. In this context, advancing the analysis of nondeterministic marketing problems is imperative.

The distinction between simple, complicated, complex, and chaotic systems provides an excellent context for solving strategic marketing problems. Too often marketing strategies are based on simple and at best complicated systems in which the relationship between causes and effects requires analysis. When in actual fact marketing operates in complex systems such as markets, where cause and effect can only be perceived in retrospect, marketers need to embrace this complexity and evolve strategies for dealing better with these challenges. In order to develop effective marketing strategies, we need to better understand the new trends in consumer behavior which could enable companies to adapt and to make better decisions. The main complexity is dealing with the increasing product variety and changing consumer demands, which is forcing marketers to abandon undifferentiated marketing strategies and even niche marketing strategies and to adopt a mass customization process interacting one-to-one with their customers. Today, new technologies and new sources of information about consumer behavior are emerging and can help managers to understand this in great detail: big data, neuromarketing, interactive communication media, and so forth.

This special issue gathers original and constructive contributions dealing with these questions in order to improve our knowledge of the complexity of marketing in understanding the new consumer. Therefore, the papers address the recent advances of marketing in meeting the new consumer trends and present effective marketing strategies to face the upcoming technological challenges. This special issue analyzes four major topics that show the complexity of consumer behavior from the marketing perspective: the adoption of new technologies, the value cocreation in virtual environments, the factors that influence purchasing behavior, and different elements of postpurchase behavior, such as satisfaction and word-of-mouth.

2. Adoption of New Technologies

In today's world, new products and new technologies are emerging every day. It is important to know the reasons why one technology is more successful than another [1]. Technology acceptance models, such as TAM [2] or UTAUT [3], make it possible to understand these reasons. This special issue includes two papers on this subject.

The first one, "Key Factors for In-Store Smartphone Use in an Omnichannel Experience: Millennials vs.

Nonmillennials" by A. Mosquera et al., aims to identify the key factors that influence customers' intentions to use smartphones in-store along with their actual behavior, differentiating between millennials and nonmillennials, as millennials are considered digital natives and early adopters of new technologies. The results of this research indicate that habit, performance expectancy, and hedonic motivation are the strongest predictors of in-store smartphone use for both groups (millennials and nonmillennials). However, the study shows that the only differences between these two groups with regard to the use of smartphones in-store are the effects of behavioral intention and habit on use behavior. Managers should bear in mind that, although the mobile phone is revolutionizing the purchasing process, the physical store is still the preferred channel to make purchases. It is important for retailers to think of the physical store not only in terms of sales generation, but also as a means of enriching the user's engagement with the consumer experience and the services that can only be offered in the physical channel.

In the second paper entitled "Complexity in the Acceptance of Sustainable Search Engines on the Internet: An Analysis of Unobserved Heterogeneity with FIMIX-PLS" by P. Palos-Sánchez et al., the authors present a technology acceptance model including trust as an external variable added to explain the use of Internet search engines. Based on a method to discover the heterogeneity not observed in the structural model, this research identifies three different user behaviors. This analysis shows how the complexity of the consumer of technological tools can be addressed in a more efficient way through advanced statistical techniques.

3. Value Cocreation in Virtual Environments

Companies have been developing strategies for co-creating value with their clients for some time [4, 5]. However, currently, its importance has grown thanks to the development of virtual communities on the Internet. In the article "Does Use of Different Platforms Influence the Relationship between Cocreation Value-in-Use and Participants' Cocreation Behaviors? An Application in Third-Party Managed Virtual Communities," N. Rubio et al. explore the relationship between perceived cocreation value-in-use and cocreation behaviors in a third-party managed virtual community founded in a theoretical model. On the basis of a structural equation model to assess customer perceptions, an important result of the research supports the conceptualization and dimensions of the value-in-use of the participants of third-party managed virtual communities. This paper illustrates how complex concepts associated with the online consumer behavior can be analyzed through their decomposition into dimensions, and how this task is assisted by modern modeling techniques.

4. Determinants of Consumer Purchasing Behavior

Understanding the motivations that lead a consumer to purchase a product, beyond the price, is a complex issue [6] that can vary significantly from one product to another [7]. This special issue includes this problem for two different products: cars and gastronomic products. Cars are characterized as utilitarian and durable products, while gastronomic products have a greater hedonic component and are highly fungible.

On the one hand, Y. Tian et al. wrote the paper "Research on Supply Chain Stability Driven by Consumer's Channel Preference Based on Complexity Theory" which studies the pricing problem in supply chain with one manufacturer who supplies an identical product as two retailers. The rapid development of Internet technology has led manufacturers to transfer from traditional retailing to the combination of traditional and electronic retailing, using a multichannel selling. The findings indicate that the competitions between retailers are helpful for the manufacturers. However, when the competition is fierce, the traditional and online channel can be replaced by each other, and the system will evolve into a chaotic state.

On the other hand, the paper "Relation of Country-of-Origin Effect, Culture, and Type of Product with the Consumer's Shopping Intention: An Analysis for Small- and Medium-Sized Enterprises" by J. M. Berbel-Pineda et al. addresses the topic of tourists' purchase intention of gastronomic products when they return to their home. The authors find that the gastronomic culture of the tourists and their evaluation when testing the products during the trip are the key elements that influence their intention to carry on buying these products. However, the country of origin of the gastronomic products also affects tourists' purchase intention. The results provide strategies for those small gastronomic companies willing to compete in the international market.

5. Postpurchase Behavior

Finally, in the paper "Predicting Thalasso Tourist Delight: A Hybrid SEM—Artificial Intelligence Analysis", A. J. Sánchez-Medina et al. study two important elements of postpurchase behavior [8]: the satisfaction and the word-of-mouth. Consumer satisfaction is a complex subject because it is necessary to analyze several dimensions to explain it accurately. In this sense, the authors study the influence of these variables on the global satisfaction perceived by thalassotherapy customers. They find a strong relationship between the dimensions and their satisfaction, and also between their level of satisfaction and their intention to generate word-of-mouth. To conclude, they identify the key elements to delight customers.

6. Conclusions

A set of papers revealing the complexity of analyzing consumer behavior from the marketing point of view has been collected over this issue. Beyond globalization, and of the billions of potential customers that companies can find on the Internet, today organizations have the opportunity to address smaller market segments and even to customize their offers. Therefore, companies face increasingly heterogeneous markets, where success is difficult. Entering the mind of consumers and understanding their purchasing behavior

constitute one of the greatest challenges in which researchers should be involved.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Jorge Arenas-Gaitán
Borja Sanz-Altamira
Patricio E. Ramírez-Correa

References

[1] F. J. Rondan-Cataluña, J. Arenas-Gaitán, and P. E. Ramírez-Correa, "A comparison of the different versions of popular technology acceptance models a non-linear perspective," *Kybernetes*, vol. 44, no. 5, pp. 788–805, 2015.

[2] F. Davis, A technology acceptance model for empirically testing new end-user information systems: Theory and results,.

[3] V. Venkatesh, J. Y. L. Thong, and X. Xu, "Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology," *MIS Quarterly*, vol. 36, no. 1, pp. 157–178, 2012.

[4] V. Prahalad, C. K, and Ramaswamy, "Co-creation experiences: the next practice in value creation," *J. Interact. Mark*, vol. 18, no. 3, p. 14, 2004.

[5] C. Prahalad and V. Ramaswamy, "Co-creating unique value with customers," *Strategy & Leadership*, vol. 32, no. 3, pp. 4–9, 2004.

[6] C. Wee, S. Ta, and K. Cheok, "Non-price determinants of intention to purchase counterfeit goods," *International Marketing Review*, vol. 12, no. 6, pp. 19–46, 1995.

[7] J. Rondán-Cataluña, J. Arenas-Gaitán, and P. Ramírez-Correa, "Un análisis empírico de las recomendaciones comerciales en los sitios de redes sociales," *Ingeniare. Revista chilena de ingeniería*, vol. 22, no. 3, pp. 431–434, 2014.

[8] R. A. Westbrook, "Product/Consumption-Based Affective Responses and Postpurchase Processes," *Journal of Marketing Research*, vol. 24, no. 3, p. 258, 1987.

Research Article

Does Use of Different Platforms Influence the Relationship between Cocreation Value-in-Use and Participants' Cocreation Behaviors? An Application in Third-Party Managed Virtual Communities

Natalia Rubio ⓘ**, Nieves Villaseñor** ⓘ**, and Maria Jesús Yague** ⓘ

Marketing Department, Autonoma University of Madrid, 28049, Spain

Correspondence should be addressed to Nieves Villaseñor; nieves.villasenor@uam.es

Despite an increasing amount of research on cocreation value, research on participants' value-in-use in third-party managed virtual communities remains limited. This study explores how participants perceive value-in-use through their participation in third-party managed virtual communities and the influence of the participants' value-in-use on three cocreation behaviors typical of these communities: information searching, feedback, and coinnovation activities. Participant value-in-use is a multidimensional construct consisting of five dimensions: informational value, entertainment value, social integrative value, personal integrative value, and community interactivity. We also consider whether use of different platforms (website, mobile app, or both) exerts a moderating effect on this cocreation process and identify significant differences in the relationships proposed based on the platform the participants use to access the virtual community. The research is contrasted empirically using the virtual community TripAdvisor. The PLS-SEM method is used to test the model proposed. In comparing the website and mobile app models, the results show significantly stronger effects on the relationships in the route "informational value-participants' value-in-use-information searching" for the website. Also, we find a stronger route for personal integrative value-participants' value-in-use-feedback among users of the mobile app than for website users. In the case of participants who use only one platform (website or mobile app) rather than both (website and mobile app), the weight of use of one technology rather than both is significantly greater in coinnovation. This study enriches previous studies that advance theories of cocreation value and provides companies with practical guidance to identify and encourage cocreation behaviors and enhance the perceived value-in-use of virtual community participants.

1. Introduction

The advent of Internet and increased accessibility of smartphone devices have enabled a new age of interaction and substantially influenced traditional lifestyles. Individuals' new forms of communication and consumption through Internet have dramatically changed companies' marketing practices, which face increasingly competitive global contexts with more sophisticated consumers and a growing need for greater efficiency and customer satisfaction—that is, more complex business environments. Internet users currently favor dynamic informative websites (social networking, virtual communities, etc.) to express their beliefs and comments on services or products, among other behaviors [1]. Multiple

traditional companies' websites lack such capabilities due to their static nature and deficiency in cocreating value with users who will be involved in long-term activities. Companies that can exploit information and communication technologies to encourage cocreation value-in-use will, however, ensure their survival and improve their firms' business results.

The theory and practice of contemporary marketing [2] are steeped in Service Dominant Logic (SDL) [3]. According to SDL, value cocreation is a crucial concept widely researched in offline environments. Despite consensus that virtual communities constitute ideal ecosystems for development of cocreation processes, their study is more recent and limited in the digital environment [4].

Claffey and Brady [5] identify three main types of virtual community—member-initiated, firm-hosted, and third-party managed. Member-initiated virtual communities are established by like-minded individuals and can be socially or professionally oriented. Examples include Android Free Software Communities. Firm-hosted virtual communities are created by firms to involve their customers in various cocreation activities, such as product design, product testing, product/service support, relationship building, understanding consumer value perceptions, and increased word-of-mouth communication. Third-party managed virtual communities are established by a third party to facilitate exchange of products, services, and information (e.g., eBay, TripAdvisor). Given the specific characteristics of different virtual communities, deeper analysis is needed of the cocreation models that occur in each type [5].

The definition of value cocreation as a complex process and its measurement through multidimensional scales have been researched for member-initiated and firm-hosted communities [6–15]. Compared to other types of virtual communities, however, study of value cocreation in third-party managed virtual communities is underdeveloped [16]. Studies of value cocreation in this type of community [16–19] have limited the cocreation process to proactive participation of users to exchange relevant information, knowledge, and experiences (i.e., generation and transmission of content).

Based on the tenets of SDL, this research views value cocreation in a third-party managed virtual community as the process of creating perceived value-in-use for the community through service exchanges within the ecosystem of all actors (consumers, potential consumers, various service firms housed on the platform, and managers of the website itself) [2]. From this perspective, it is unclear how users cocreate community value-in-use, how this value can be assessed, and how such value is reflected in their cocreation behaviors in the community.

Thanks to the proposal of an integrative model of value cocreation in third-party managed virtual communities, and more specifically in virtual communities of travelers, we can answer the following questions: What dimensions make up participants' cocreation value-in-use? What are the cocreation behaviors? What influence does participants' cocreation value-in-use exert on current cocreation behaviors? Do the relationships among participants' cocreation value-in-use and current cocreation behaviors remain for participants who use website and mobile app and those who use both platforms?

Answering the questions proposed has great importance for management. It will help managers of third-party managed virtual communities to identify and focus their marketing efforts on the dimensions that both increase the community's value through the value-in-use that its participants perceive and stimulate cocreation behaviors. The long-term survival and value of the virtual community, as well as the results for firms housed in the community, depend greatly on a satisfactory value cocreation process.

This study's first theoretical contribution is thus to develop an integrative framework of user cocreation value for third-party managed virtual communities. It makes this contribution by identifying (1) the dimensions that constitute users' cocreation value-in-use in this context and (2) the relationship of users' cocreation value-in-use to value cocreation behaviors. Further, in a virtual context, we must remember that today's consumers are digital, hyperconnected, and accustomed to using multiple devices (smartphones, tablets, and desktop computers) [20]. Prior research shows that each type of platform has its own characteristics, which condition the participation of Internet users [16]. This study thus considers the possible moderating effect of the platform/s used in the relationship of the effect of participants' cocreation value-in-use on cocreation behaviors, distinguishing between participants who only use one platform to access the virtual community (whether website or mobile app) and those who use both website and mobile app to access the virtual community. The moderating effect considered enables analysis of the full process of user value cocreation in the third-party managed virtual community from a multiplatform perspective.

This study's empirical contribution extends the infrequent use of a multidimensional focus to measure both participants' cocreation value-in-use and cocreation behaviors related to virtual communities of travelers. This type of third-party virtual community is of great interest, as it has revolutionized the travel industry and the traveler's behavior [19]. For example, TripAdvisor, an important virtual community of travelers, accumulates 455 million users per month and over 600 million comments [21]. Nor has research analyzed how the type of platform used to access the virtual community of travelers influences the value cocreation process, even though real data show that 85% of travelers have consulted this type of community to plan their trip, 46% of whom use mobile apps at the destination [22]. Prior research on value cocreation in virtual communities of travelers has focused primarily on detecting its antecedents and results. Antecedents identified include characteristics of the environment—such as ease of use, perceived utility, quality of information, attractiveness of the medium [9, 11, 23], and individuals' motivations [9, 11, 12, 18, 24–28]. Consequences analyzed include the influence of participation in the community on brand equity and/or intention to use the products or services housed in the community [29, 30] and intention to use and recommend these to the community itself [16, 31].

2. Literature Review

2.1. Cocreation and Determination of Community Value-in-Use. The fundamental premises of SDL provide a suitable framework for how value is created. Within the framework of this new logic [2, 3], organizations do not create and deliver value to passive consumers. Rather, value is cocreated or "jointly created" by multiple actors—for example, stakeholders, firms, and customers—always including the beneficiary (premises 6 and 10, respectively) [2]. That is, value is created in a unique way and determined phenomenologically by the beneficiary. Along these lines, Prahalad and Ramaswamy [32] stress that cocreation provides value in itself, since it allows the actor to coconstruct personalized value to suit his/her context. A personalized cocreation experience reflects

how the individual chooses to interact with the experience environment that another actor (e.g., the firm) facilitates. Cocreation comes from the interaction of an individual located in specific time and space in the context of a concrete act. Organizations should always take into account the fact that the more they focus on the consumer's context and adjust to the individual's vital environment, the greater the value of cocreation is. According to Kohler et al. [25] and Füller [33], virtual communities represent ideal contexts for studying cocreation, since they constitute spaces in which dialogue is encouraged among actors who intervene in these communities and enables these actors to develop themselves fully, thus becoming direct participants in their own cocreation experiences.

In sum, SDL highlights that value is always cocreated among multiple actors and determined by the beneficiary through perceived value-in-use. **Value-in-use** is customers' experiential evaluation of a product or service proposition beyond its functional attributes and in accordance with their individual motivation, specialized competencies, actions, processes, and performance [34]. Following SDL, Tynan and McKechnie [35], and Zhang et al. [9], this study defines **community value cocreation** as the process of creating **perceived value-in-use** for an online community through network relationships and social interactions among all actors in the ecosystem [4]. The focus of this study is to present a metric that helps to assess the value-in-use of online community participants in the process of community value cocreation and to determine how this value influences cocreation behaviors.

2.2. Dimensions of Value-in-Use for Participants in Third-Party Managed Virtual Communities. Prior research suggests that cocreation value-in-use is a multidimensional concept [4, 34]. The subdimensions identified by the literature on cocreation are experience, personalization, and relationship [34]. These subdimensions are closely linked to users' willingness to cocreate community value-in-use. Online community participants' value-in-use refers to actors' motivations to participate actively in the process of community value cocreation [4]. To understand the motives of virtual community participants, we draw on the well-established uses and gratifications paradigm. Based on the theoretical framework of Dholakia et al. [27] and Nambisan and Baron [26], we propose five categories of value that motivate participation in virtual communities. These include informational value; community interactivity; and social, personal, and entertainment value. (1) Informational value is value the participant derives from acquiring and strengthening his/her understanding of the environment; (2) community interactivity refers to benefits derived from establishing and maintaining two-way communication with other actors in the virtual community; (3) social integrative value involves strengthening consumer's ties with relevant others; (4) personal integrative value involves strengthening the individual's credibility, status, and confidence; and (5) entertainment value is derived from the fun and relaxation involved in interacting with users.

The five categories of motivation mentioned above have been widely validated in prior studies of cocreation in virtual communities, by being contrasted for participants in virtual brand communities [9, 10, 13, 36], and in online collaborative forums [8] and experiments [20]. Based on the review performed here, this study adopts the idea that cocreation value-in-use for third-party managed virtual communities is a multidimensional concept composed of the five motivational values presented above.

2.3. Cocreation Behaviors in Third-Party Managed Virtual Communities. In the online context, cocreation behaviors have been limited to individuals' participation in brand communities, digital platforms, and social networks and to generation and exchange of content [26]. Different studies synthesize the definitions and dimensions of cocreation identified in virtual environments [6, 7, 12, 18, 23, 37, 38].

On the one hand, we stress that different cocreation behaviors distinguish specific virtual environments. For example, video watching, video commenting, video producing, and video sharing are cocreation behaviors specific to video sharing communities (i.e., [23]). Creating groups and/or events, participating in them, sending and answering invitations to friends, and visiting other users' profiles are behaviors characteristic of social networks [37]. On the other hand, studies of virtual communities identify two cocreation behaviors (see [6, 7]): (1) use of the community through information searching and (2) participation in the community by generating and sharing content with other community members in order to take part in discussions, give feedback, advice on products and/or services, etc. Although some researchers do not consider consumption of content as cocreation behavior in virtual communities and limit cocreation to coproduction of content among actors (e.g., [18]), many studies of virtual environments support cocreation behavior as use of the virtual community to search for information [23]. Coinnovation is another cocreation behavior stressed by studies of cocreation in digital environments [38–40]. Coinnovation as a cocreation behavior is related to users' participation in the community by providing ideas for management of products/services housed on it (for example, proposing new modes of service, identifying new trends or new users, etc.), as well as for the community itself (its content, aesthetics, ease of use, etc.),

Along the lines of Vernette and Hamdi-Kidar [38], this study synthesizes the cocreation behaviors that occur in a third-party managed virtual community into three levels: (1) a low level of cocreation, determined by use of the community to search for information (for example, to plan a trip or make a reservation), (2) a moderate level of cocreation, defined through interaction with other users of the virtual community, creating content and generating feedback (e.g., giving an opinion about a specific hotel or restaurant), and finally (3) a high level of cocreation, in which participants carry out coinnovation activities with both suppliers of the services housed in the virtual community (e.g., proposing new modes of service for a hotel or restaurant) and the platform itself (e.g., proposing a new forum, new interface to simplify the community's website or mobile app, etc.).

2.4. Proposal of a Theoretical Model of Cocreation in Third-Party Managed Virtual Communities. One very important part of value-in-use of third-party managed virtual communities derives from the information on the products/services about which comments are made (e.g., prices, characteristics of products/services, etc.). The information—if it is of good quality, that is, varied, up-to-date, precise, and reliable—enables participants to plan their experiences and find products/services better adapted to their interests and facilitates prepurchase decisions. When participants can undertake such actions, information searching behavior (lurking) very often occurs [8, 9, 11, 13, 20, 28, 33, 41]. Further, both the perception of entertainment and feeling part of the community encourage information searching [23, 42].

Likewise, when users of the third-party managed virtual community evaluate the information exchanged positively, they enjoy themselves and can establish relational ties thanks to community interactivity [43]. When they are recognized as experts for their knowledge of a specific service or brand [13, 20, 33], the feedback they generate will increase, in terms of recommending the product/service to other users as well as communicating failures of the product/service and providing ideas for its improvement [23, 26, 43].

Finally, it is important to note that third-party managed virtual communities are very good ecosystems for developing coinnovation activities [33], since these communities can point in two directions—toward products/services housed in the virtual community and toward management of the community itself. This study argues that perceived value-in-use for third-party managed virtual communities fosters coinnovation activities, since the users who collaborate on them (for example, by proposing new modes of service, identifying trends, or contributing ideas for improvement of the community's website) do so because they are motivated by their knowledge and the recognition gained by participating in this kind of activity (for example, the third-party managed virtual community TripAdvisor gives users who make comments a score based on their level of collaboration in the community). They also do so because they enjoy expressing their creativity while strengthening social ties and obtaining responses to their suggestions [8, 44, 45].

2.5. Moderating Effect of the Use of Various Platforms in the Cocreation Process. "Niche theory" is used to propose the moderating effect of the type of platform used in the relationships established between value-in-use perceived by the user of the third-party managed virtual community and cocreation behaviors. Niche theory was originally developed in animal communities, but Dimmick [46] pioneered its use from the multichannel marketing perspective to argue that consumers tend to make choices about their participation in the channels available (when and how they use the different channels, for how much time, etc.) according to the utility obtained from each channel. A new channel can thus prosper depending on the utility it brings consumers. When a new channel is developed, several things can occur: (1) the most common one is that the new channel coexists with the channels previously used, the channel that offers greater utility partially displacing the one with least utility.

Further, when two channels coexist, providing similar utilities, simultaneous use of both can create a reinforcement effect, improving favorable attitude toward and satisfaction with both channels. The new channel may also completely replace the previous one because the new channel clearly has better perceived value, although this is not common. Niche theory has been applied in prior research that explains the interrelations established between perceived value and consumers' behavior (i.e., search for information), considering the coexistence of interactive and traditional media [47] as well as the simultaneous use of mobile Internet, PC Internet, and traditional media [48].

Verleye [20] warns that, in contexts mediated by technology as is the case with virtual communities, the characteristics of the environment (i.e., technologization and connectivity) condition the value cocreation process. More specifically, for the use of social media when organizing and taking vacation trips, Parra-López et al. [49] find that certain factors, such as ease of use and flexibility and clarity of the platform used, determine community participants' value-in-use and type of participation. Thus, from a multiplatform perspective and the premise of niche theory, the cocreation process in a third-party managed virtual community can be expected to vary based on whether the user accesses the virtual community exclusively through a single platform (the community's website or mobile app) or uses both platforms to access the community.

For example, the mobile app involves greater time-space flexibility than the website on the desktop. Prior studies confirm that the mobile app enables the user to overcome constraints of space and time [48], increasing the intensity of the relationships established between community value-in-use and the most advanced cocreation behaviors (for example, feedback and coinnovation), since a tourist can currently access a community of travelers at any time, at any place, to rank and publish reviews, communicate with other members of the community, present his/her ideas or errors identified, etc. Since not enough theoretical evidence has been found to support the corresponding hypothesis, however, the following exploratory research question should be considered:

RQ: What is the moderating effect of the platform/s used (i.e., website, mobile app, or both platforms) on the relationships established between perceived cocreation value-in-use of the third-party managed virtual community and cocreation behaviors?

Figure 1 shows the theoretical model proposed.

3. Methodology

To tackle the research goals proposed, we perform an empirical study of a sample of 600 users of TripAdvisor in Spain who affirm that they share their service experiences through the platform. The information was obtained by telephone survey. The products and services housed on the platform (lodging, restaurants, etc.) encourage analysis of cocreation behaviors insofar as users show high involvement in and personalization of the service experience (for example, preparing the trip).
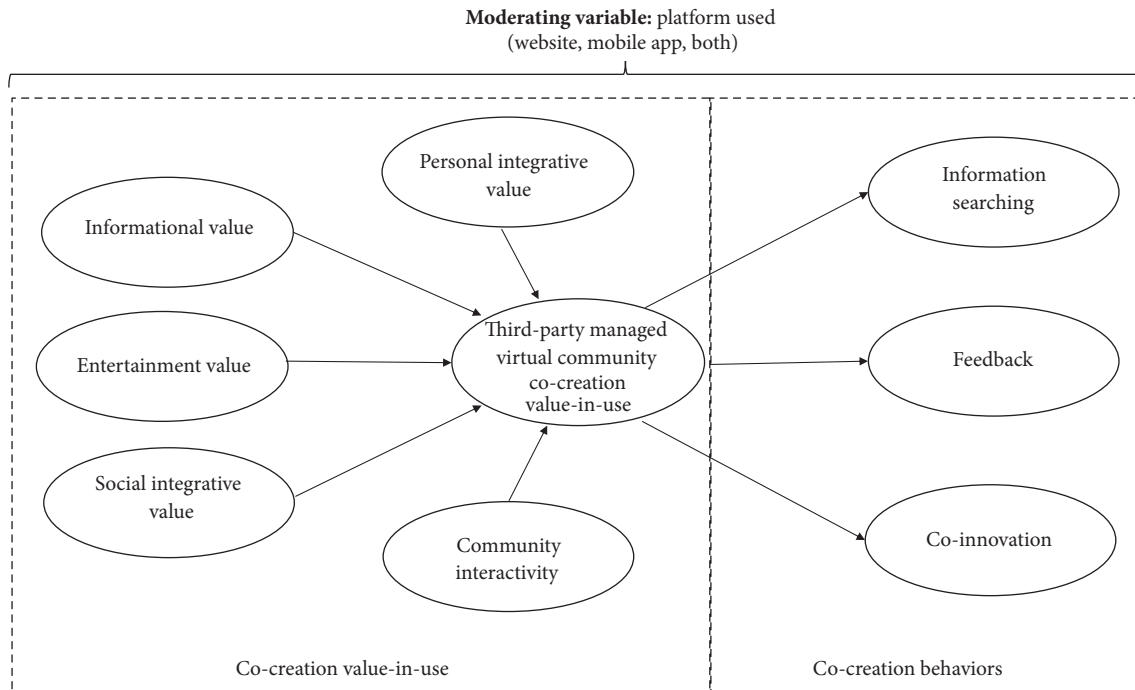
FIGURE 1: Theoretical research model.

As to the sample profile, 45.2% of the survey respondents comment 50% or more of the times they use the platform. The highest percentage of users (74.2% of the sample) uses the platform to comment on hotels, followed by 49.5% who use it to comment on their experiences at restaurants. Slightly over a third also use the platform to comment on flights and vacation rentals.

As to the gender of the participants, 49.7% of the survey respondents were men and 50.3% women. By age, respondents were distributed as follows: 17.7% were under 25 years of age, 29% aged 26-35, 37.2% aged 36-50, 12.2% aged 51-65, and 4% were over 65. By education level, 10.8% of the participants had completed primary school, 39.3% secondary school, and 49.5% university. By family income, 11.2% of the participants had an income of at least 1000 euros/month, 51.8% 1000-2000 euros, 29.7% 2001-3000 euros, and 6.8% over 3000 euros. The participants were primarily members of two- or three-member households (61.2%); 41% did not have children, 23.3% had one child, and 19.5% had two.

The items used to measure the concepts were obtained by adapting scales used previously in the academic literature. First, for perceived value-in-use, the dimensions of informational value and personal integrative value were measured by adapting the scale from Nambisan and Baron [26] and Kuo and Feng [10]. Entertainment value and social integrative value were measured by adapting the scale from Zhang et al. [9]. To measure community interactivity, the scale from Dholakia et al. [27] was adapted. Second, as to cocreation behavior, information searching was measured by adapting the items used in Yi and Gong [50]. For feedback, we adapted the items from Yi and Gong [50], Xu and Li [7], and Hu

et al. [23]. Coinnovation was measured by adapting the scale developed by Tonteri et al. [12].

All scales were measured using 11-point Likert scales from 0 (disagree completely) to 10 (agree completely) (Table 3). To measure the moderating variable in modeling cocreation, we used a single question asking individuals in the sample to indicate whether they participated in the virtual community of travelers using only the website, only the mobile app, or both platforms.

4. Results

Scholars suggest that PLS is frequently used in exploratory research, studies with small sample sizes, and nonnormal data [51]. Given the research aim and data characteristics, the partial least squares (PLS) path modeling is preferred to analyze the data. Regarding sample size issues, this study meets the rule of a minimum sample size, ten times the maximum number of paths in the outer model and inner model. SmartPLS3 was used to analyze the data. In order to estimate the precision of the PLS estimates, a technique of resampling (500 resamples) is used [51]. In this section, the results of the proposed modeling for the general sample and for the different platforms (i.e., website, mobile app, and both platforms) are presented. First, the results of reliability and validity for the sample are confirmed, and, second, the model in Figure 1 is estimated using structural equations, without including the moderating effect [52]. PLS path modeling allows for the conceptualization of a hierarchical component model. In this study, a second-order latent variable (third-party managed virtual community cocreation value-in-use) consists of five underlying first-order latent variables: (1)

TABLE 1: Description of variables according to platform used to access the online travel community.

Variable/Construct	Website + mobile app (n=242)	Website (n=277)	Mobile app (n=80)	F-Snedecor
Co-creation behaviors:				
Information searching	7.94 (1.39)	7.61 (1.56)	7.95 (1.33)	3.69**
Feedback	7.18 (1.41)	6.80 (1.82)	6.97 (1.73)	3.36**
Co-innovation	6.27 (1.65)	5.71 (2.08)	6.28 (2.20)	6.24***
Value-in-use:				
Informational value	7.22 (1.40)	6.96 (1.70)	7.50 (1.13)	4.52**
Community interactivity	6.32 (1.59)	5.98 (1.81)	6.66 (1.56)	5.95***
Entertainment value	6.57 (1.67)	6.21 (2.11)	6.70 (1.62)	3.33**
Social integrative value	5.18 (2.18)	4.89 (2.63)	5.59 (2.56)	2.73*
Personal integrative value	7.19 (1.35)	7.00 (1.57)	7.05 (1.46)	1.08 (n.s.)

*** $p<0.01$; ** $p<0.05$.

informational value; (2) community interactivity; (3) entertainment value; (4) social integrative value; and (5) personal integrative value.

Finally, the study considers the moderating effect and performs a multigroup structural analysis (website, mobile app, and both platforms). In order to identify a common model for the three analyzed platforms, the study compares pairs of parameters between structural models using a a t-test based on the expression $t = (\beta_i - \beta_j)/\text{square root } (S_i^2 + S_j^2)$, in which β_i and β_j represent the coefficients to be contrasted and S_i and S_j their respective standard errors.

Recently, PLS-SEM application has expanded in marketing research [53]. This study adopts the classic form of divulgation of the measurement and structural results previously used in studies that incorporate this methodology (for example, [51, 54]). However, unlike the PLS-SEM application made by Molinillo et al. [51], which has a different aim, a central objective of this research is to develop the dimensions that constitute users' cocreation value-in-use. Thus, this research incorporates a hierarchical component model and more specifically a reflective-formative construct. The use of PLS is particularly interesting for this aim [55].

4.1. Measurement Model. First, as a preliminary analysis, we tested for common method bias using the post hoc Harman's single-factor test. All construct variables were included in an exploratory factor analysis, and the unrotated factor solution was examined. No single factor accounted for the majority of the variance in the variables [56].

Next, Table 1 presents the descriptive values of the model variables for the whole sample and the differences obtained among the three segments analyzed—use of the website only, the mobile app only, or both platforms.

The variance analysis performed shows statistically significant differences for all model variables except personal integrative value. In general, we observe higher values for value-in-use and cocreation behaviors among users of the mobile app and multiplatform users. Among the dimensions of value-in-use, informational value and personal integrative value stand out, with values close to 7 in the different platform/s considered. Social integrative value, in contrast, shows the lowest values. Among cocreation behaviors, information searching stands out, with values close to 8, followed by feedback and coinnovation. The mean values for the segments analyzed show the greatest differences for the variables of community interactivity and coinnovation, which favor users of the mobile app and multiplatform users over website users.

To evaluate the measurement model (this analysis was replicated using AMOS 23; the model's fit was satisfactory ($\chi 2/\text{d.f.}=2.06$; CFI=0.97; NFI=0.95; IFI=0.97; GFI=0.93; AGFI=0.91; RMSEA=0.04); the scale's reliability and convergent and discriminant validity were also confirmed), it is necessary to confirm the quality of the measurement scales (convergent and discriminant validity). In all cases, the reliability statistics used, the Alpha Cronbach, and composite reliability exceed the minimum value of 0.70 recommended by literature. The variance extracted is greater than or equal to 0.5, and all of the items have good convergent validity, confirmed by the fact that all of the parameters are statistically significant (see Table 2).

Also, two methods are used to check the discriminant validity of PLS: (1) the Fornell-Larcker [57] criterion, which analyzes whether the correlations between the constructs are lower than each construct's square root of AVE and the (2) heterotrait-monotrait (HTMT [58]) ratio of correlations between two constructs, which should be below 0.9. The results in Table 3 indicate acceptable discriminant validity.

To measure the community participants' value-in-use, we verified that value-in-use is a formative multidimensional construct, as indicated by prior studies [4, 34]. First, we must rule out the presence of multicollinearity. As shown in Table 4, multicollinearity was assessed using variance inflation factors (VIF). All VIFs were below the cut-off value of 5 [53]. We also evaluated the validity of the dimensions of the participants' value-in-use through the path coefficients. As observed in Table 5, all coefficients were high and statistically significant, supporting the idea that value-in-use was defined correctly as a formative variable.

TABLE 2: Analysis of reliability and validity of the reflective measurement scales.

Variables	L_i	Reliability		Validity	
		Alpha Cronbach	Composite Reliability (CR)	Average Variance Extracted (AVE)	t-values
Information Searching: When I visit TripAdvisor, before using a specific service:					
(i) I search for information in the comments from other users of the service.	0.79				23.60
(ii) I take into account the comments of other users of the service.	0.82	0.76	0.85	0.66	29.66
(iii) I consult the opinion forum.	0.83				42.15
Feedback: On TripAdvisor, when I have an opinion about a service I have used,					
(i) If I liked it, I say positive things about it.	0.77				32.72
(ii) If I liked it, I recommend it.	0.73				23.60
(iii) If I liked it, I encourage other users to use it.	0.79	0.87	0.90	0.61	32.63
(iv) If I have a good idea about how to improve the service, I include it.	0.82				48.91
(v) When I have a problem with the service, I make it known.	0.80				41.09
(vi) When I have a problem with the service, I give ideas about how to solve it.	0.76				34.75
Co-innovation					
I collaborate with TripAdvisor to improve:					
(i) Its informative content.	0.86				60.02
(ii) Its aesthetics.	0.82	0.92	0.94	0.72	40.95
(iii) Its ease of use.	0.83				44.20
With the service firms, I:					
(i) Propose new modes of service.	0.89				64.85
(ii) Identify new trends.	0.92				69.42
(iii) Propose ideas to identify new users.	0.90				65.55
Informational value: TripAdvisor enables me to know					
(i) The services better.	0.82				32.53
(ii) The firms that provide the services.	0.88	0.81	0.89	0.72	66.13
(iii) The brands that the community evaluates as best.	0.85				38.12
Community interactivity: In TripAdvisor					
(i) Other users respond to my comments.	0.90				98.30
(ii) The companies about which I express opinions respond to my comments on services.	0.89	0.85	0.91	0.77	95.90
(iii) I generally receive responses to the comments I make.	0.84				34.91
Entertainment value: participation in TripAdvisor:					
(i) Entertains me.	0.89				66.04
(ii) Relaxes me.	0.87	0.87	0.92	0.80	68.34
(iii) Is fun.	0.91				117.38
Social integrative value: TripAdvisor enables me to:					
(i) Broaden my social network.	0.96				286.62
(ii) Increase my affinity with the community of users.	0.95	0.95	0.97	0.92	171.47
(iii) Have *more social relationships*.	0.96				217.22

Variables	L_i	Reliability		Validity	
		Alpha Cronbach	Composite Reliability (CR)	Average Variance Extracted (AVE)	t-values
Personal integrative value: On TripAdvisor, I show my level of "expertise" in the use of:					
(i) TripAdvisor and similar platforms.	0.86				32.23
(ii) The services that TripAdvisor provides.	0.93	0.88	0.93	0.81	100.61
(iii) Services about which I post comments.	0.90				78.66

TABLE 3: Fornell-Larcker criterion (HTMT ratio).

	Information searching	Feedback	Co-innovation	Informational value	Community interactivity	Entertainment value	Social integrative value	Personal integrative value
Information searching	0.81							
Feedback	0.43 (0.53)	0.78						
Co-innovation	0.34 (0.39)	0.55 (0.60)	0.85					
Informational value	0.50 (0.61)	0.48 (0.58)	0.45 (0.52)	0.85				
Community interactivity	0.33 (0.39)	0.57 (0.66)	0.61 (0.69)	0.44 (0.52)	0.87			
Entertainment value	0.34 (0.40)	0.52 (0.58)	0.59 (0.66)	0.39 (0.81)	0.54 (0.63)	0.89		
Social integrative value	0.29 (0.32)	0.45 (0.47)	0.65 (0.69)	0.39 (0.45)	0.59 (0.65)	0.67 (0.87)	0.96	
Personal integrative value	0.30 (0.35)	0.38 (0.43)	0.35 (0.39)	0.38 (0.44)	0.31 (0.34)	0.30 (0.68)	0.29 (0.31)	0.90

Note: the square roots of the AVE are in bold on the diagonal of the correlation matrix, and interconstruct correlations are shown off the diagonal.

In the following section, we confirm the predictive validity of community participants' value-in-use through its effect on information searching, feedback, and coinnovation estimated through the relationship model.

4.2. Structural Model.

The hypothesized model (this analysis of the full structural model was replicated using AMOS 23, initially without including the moderator effect; the models' fit was satisfactory (χ2/d.f.=2.09; CFI=0.97; NFI=0.95; IFI=0.97; GFI=0.93; AGFI=0.90; RMSEA=0.04)) fits the data well. First, R^2 values for information searching, feedback, and coinnovation indicate adequate explanatory power (information searching: 0.22; feedback: 0.42; coinnovation: 0.54). All values are above the limit of 0.1, accepted in academic literature [51, 59].

As denoted in Table 5, all paths are significant with at least 0.01 level. In addition, the Stone-Geisser test [60] was estimated (Q^2). The higher Q^2 is, the higher the predictive relevance of the tested model equation is [55]. This model shows medium and large impacts of community participants' value-in-use on information searching (Q^2=0.15), feedback (Q^2=0.23), and coinnovation (Q^2=0.40). This result suggests that the community participants' value-in-use metric showed

good explanatory power, supporting its predictive validity, as indicated in the previous section.

4.3. Moderating Effect of Platforms.

After evaluating the measurement model and structural model, we analyzed the moderating effects of the digital platforms as a form of participation in the virtual community of travelers (website, mobile app, and both platforms) using a multigroup PLS analysis. The results of each of the three models are shown in Figure 2.

The findings show that all dimensions considered contribute significantly to generating participants' value-in-use in the third-managed virtual community through the platform(s) used (website, mobile app, and both). In addition, community participants' value-in-use has a significant positive effect on information searching, feedback, and coinnovation for any platform/s used. This finding suggests that the value-in-use scale has good explanatory power for the three cocreation behaviors considered and for any platform/s.

The significant differences between the parameters in the models are shown in bold in Figure 2 and Table 6. In Table 6, the p values of the differences between path coefficients lower than 0.05 or higher than 0.95 indicate differences

Table 4: Analysis of reliability and validity of the formative scale.

Higher-order factor model	Path coefficients	t-values	VIF
Informational Value⟶Value-in-use	0.23***	21.00	1.39
Community Interactivity⟶Value-in-use	0.28***	23.13	1.74
Entertainment Value⟶Value-in-use	0.29***	26.63	1.97
Social Integrative Value⟶Value-in-use	0.33***	29.02	2.11
Personal Integrative Value⟶Value-in-use	0.20***	10.88	1.22

*** $p<0.01$.
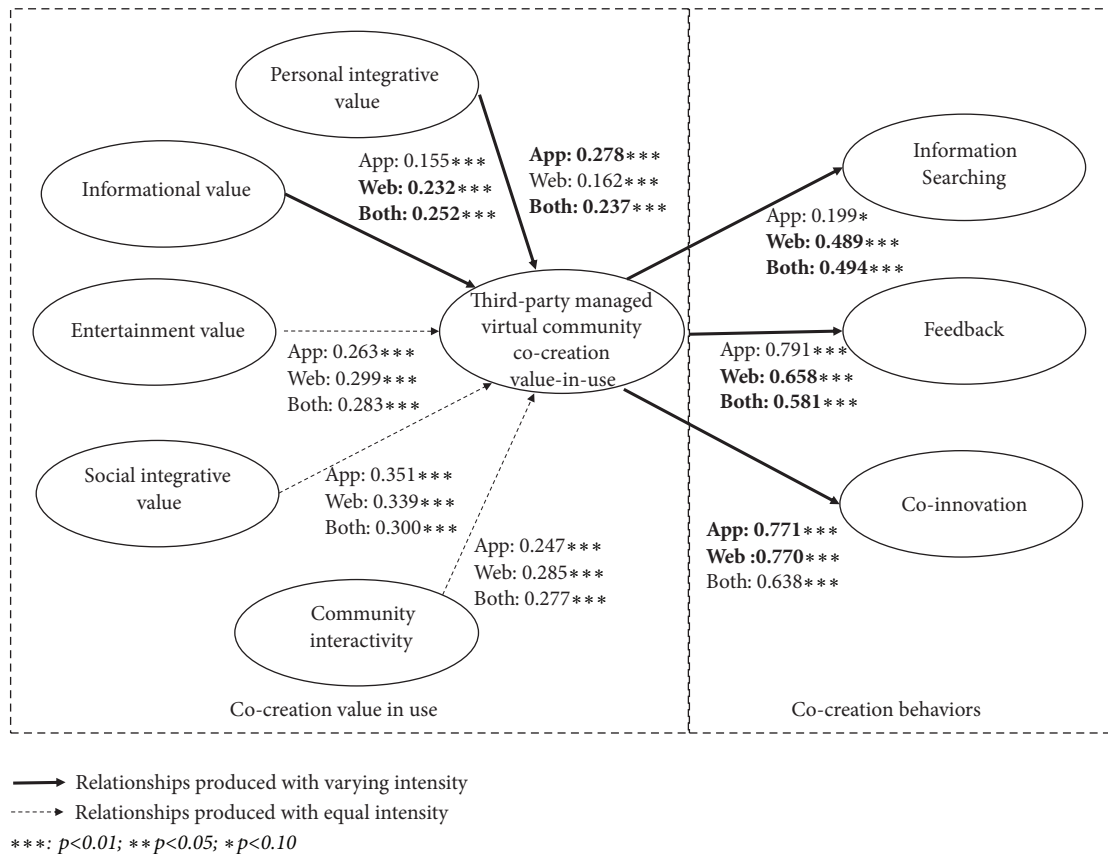
Figure 2: Relationship model.

Table 5: Results of relationship model.

Relationships	Path
Value-in-use⟶ Information searching	0.46***
Value-in-use⟶ Feedback	0.64***
Value-in-use⟶ Co-innovation	0.73***

*** $p<0.01$.

between specific path coefficients across two groups at a 5% significance level [61].

In comparing the website and mobile app models, we find significantly stronger effects on the relationships in the route "informational value-participants' value-in-use-information searching" for the website. This result may be due to the fact that the variables that compose information

searching were measured during a period prior to enjoyment of the service experience, such that participants in the virtual community preferred the website to the mobile app for obtaining information, since the quality and quantity of information on the website are better than those on the app. For example, the website provides suggestions in each section (hotels, restaurants, etc.) and a ranking for each section (hotels, restaurants, etc.) for the current year and for different regions—information not available on the app. The design of information on the website was also more attractive, for example, in terms of image size. Thus, although the app has the characteristic of providing information accessible to the user at any time, at any place, its limitations in quantity and quality of information relative to the website led to better results for the website in the route informational value-participants' value-in-use-information searching.

TABLE 6: Comparison of website model, mobile app model, and both-platforms model.

Relationships	Website vs mobile app.		Website vs both platforms		Mobile app. vs both platforms	
	Path coefficient difference	p-value	Path coefficient difference	p-value	Path coefficient difference	p-value
Value-in-use⟶ Information searching	0.290	**0.008**	0.006	0.461	0.295	**0.008**
Value-in-use⟶ Feedback	0.133	**0.985**	0.077	0.896	0.210	**1.000**
Value-in-use⟶ Co-innovation	0.001	0.505	0.133	**0.998**	0.132	**0.980**
Informational Value⟶Value-in-use	0.077	**0.007**	0.020	0.189	0.097	**0.003**
Community Interactive Value⟶Value-in-use	0.038	0.116	0.008	0.620	0.031	0.180
Entertainment Value⟶Value-in-use	0.036	0.110	0.015	0.755	0.020	0.248
Social Integrative Value⟶Value-in-use	0.012	0.623	0.040	0.914	0.051	0.930
Personal Integrative Value⟶Value-in-use	0.116	**0.998**	0.075	**0.024**	0.041	0.886

Path coefficient differences appear in absolute values.

The weight of personal integrative value on value-in-use, in contrast, is greater in the model for the mobile app, surely because emergence and use of the mobile platform to access the virtual community are more recent, such that users who use it may feel a higher level of expertise in new technologies, etc. Likewise, the effect of participants' value-in use on feedback (recommendations and complaints) is more intense in the case of the mobile app, due surely to the characteristics of this platform itself (accessible to the user at any time, at any place, by merely holding the mobile), encouraging generation and transmission of opinions at the very time of the service experience and immediately after. The results also show a stronger route for personal integrative value-participants' value-in-use-feedback among users of the mobile app than for website users. Mobile app users perceive greater value-in-use as a result of greater expertise and are also the users who cocreate the most through active feedback behavior that includes making recommendations and complaints. These users may think and feel that their recommendations and complaints are more useful for the decision-making of others than do users who obtain value-in-use through other elements.

On the other hand, if we compare the participants who use only one platform (website or mobile app) rather than both (website and mobile app), the weight of use of one technology rather than both is significantly greater in coinnovation. As mentioned above, coinnovation activities require a higher level of involvement from community participants, since contributing ideas about trends in service and users and collaborating to improve the virtual community itself (e.g., providing ideas that improve the usability and attractiveness of the website) require both an effort of reflection and creativity and deeper knowledge of the use platform. Perceived value-in-use strengthened by greater knowledge of a single platform of use increases coinnovation relative to participants who access the community through both platforms.

Finally, we would stress the high proportion of variance explained in the three models for all constructs used except that of information searching in the group that only uses the mobile app. For the group that uses both platforms, we obtain $R^2 = 0.24$ for information searching, $R^2 = 0.34$ for feedback, and $R^2 = 0.41$ for coinnovation. For the model of participants who use only the website, $R^2 = 0.22$ is explained for information searching, $R^2 = 0.42$ for feedback, and $R^2 = 0.54$ for coinnovation. Finally, in the model in which participation in the community occurs through the mobile app only, we obtain $R^2 = 0.04$ for information searching, $R^2 = 0.63$ for feedback, and $R^2 = 0.59$ for coinnovation.

5. Discussion

SDL [2, 3], cocreation literature [4, 34], and uses and gratifications theory provided the theoretical foundation for the conceptual model developed. As prior research has not assessed the conceptualization and dimensions of third-party managed virtual community participants' value-in-use, this study helps to close this knowledge gap by empirically exploring the dimensions of participants' value-in-use for the virtual communities mentioned above. We find

informational value, entertainment value, social integrative value, personal integrative value, and community interactivity to be determinants of virtual community participants' value-in-use.

Further, this study examines the process of cocreation in a virtual community of travelers through a holistic approach and by establishing and measuring the relationships in these communities between participants' value-in-use and cocreation behaviors. This analysis thus extends existing research, which has been limited to arguing the importance of value cocreation in the context of virtual communities. First, the proposed model identifies and integrates three cocreation behaviors that occur in a virtual community of travelers: information searching, feedback, and coinnovation. Identifying these three behaviors enriches knowledge of cocreation behavior in virtual communities of consumers and users, study of which has frequently been tackled from a one-dimensional perspective (i.e., intent to participate in this community). Further, these three behaviors are associated with three levels of cocreation (low, moderate, and high), based on the effort and involvement they require of participants. Dividing cocreation behaviors into levels facilitates study of this variable in the virtual community of travelers.

Further, the study defines coinnovation and how it functions in third-party managed virtual communities. Whereas previous studies show the importance of virtual communities as coinnovation platforms [39], this study demonstrates that coinnovation activities in virtual communities of travelers managed by third parties are expressed through (1) proposals for improvement addressed to the actors housed in the virtual community (proposal of new modes of service, identification of services that are a trend, characterization of new users, etc.), as well as (2) contribution of ideas that encourage ease of use, flexibility, and clarity addressed to the managers of the virtual community to make the virtual community more attractive. Coinnovation activities in both directions benefit relational and business results for all stakeholders involved.

In sum, since prior studies show that each type of virtual community has a different cocreation process, this study enables research to obtain results adapted to third-party managed virtual communities, particularly virtual communities of travelers, by identifying the variables that compose perceived value-in-use for the community's participants and quantifying the effect of this value on the specific cocreation behaviors of this type of community. The analysis stresses the three dimensions weighted relatively higher: social integrative values (0.33), entertainment value (0.29), and community interconnectivity (0.28).

The study contributes to the existing literature on cocreation value by responding to the suggestion by Verleye [20] to introduce as moderating variable the use of multiple platforms to access the virtual community. It examines whether the type of platform used to access the virtual community of travelers (website, mobile app, or both platforms) changes the intensity of the relationship established between the value-in-use perceived by the virtual community's participants and cocreation behaviors. To date, the moderating variables used in studies that relate motivation for participation in the virtual community to specific behavior have been aspects

related either to the type of virtual community [27] or to the community's participants, such as sex [48]. We should not neglect, however, that today's consumers are hyperconnected and can use multiple devices (smartphones, tablets, and PCs) to interact with the environment, conditioning the cocreation process. Our investigation makes an important theoretical contribution in corroborating that the use of different platforms to access the community of travelers has a moderating effect on the proposed model.

The results show that the weight of the dimensions considered in online traveler community participants' value-in-use varies depending on the type of platform access considered, as does the intensity of the effect of participants' value-in-use on cocreation behaviors. Statistically significant differences are obtained in 10 of the 24 relationships estimated, although in no case does the type of platform affect the comparatively greater importance of the dimensions social integrative value, entertainment value, and community interactivity in the composition of value-in-use. On the contrary, the contributions of informational value and personal integrative values to value-in-use differ significantly in the three groups compared according to platform used to access the community of travelers analyzed, as do all effects of value-in-use on cocreation behaviors.

In light of these results, it can be said that, for a specific level of value-in-use, using various platforms to access the virtual community (website and mobile app) does not generate greater synergy of cocreation behaviors relative to access through a single platform (only website or only mobile app). For a given level of value-in-use, using the mobile app only or the website only has a stronger positive influence on higher cocreation levels (coinnovation) than using both platforms. Virtual communities should thus be present through the different platforms, so that their users can employ different platforms based on their preferences, obtaining value-in-use and transforming this value-in-use into higher levels of cocreation, fundamentally into coinnovation activities. It is also worth noting that development of mobile apps is especially interesting to increase the positive influence of value-in-use on the moderate level of cocreation (feedback), due to these apps' great potential in terms of connectivity and ubiquity.

6. Conclusion

The results of this study contribute practical implications in two directions: managers of virtual communities of travelers and those in charge of the companies/brands about which the comments are made. It is very important that both groups understand the factors that contribute to both increasing perception of community users' value-in-use and detecting the levels of participation in the community relative to information searching, generation and transmission of feedback and intent to participate in coinnovation activities. Such understanding will enable managers to establish strategies and action plans that foster these behaviors.

Our research also provides a practical suggestion for firms that manage the virtual communities: exploit the advantages of technology to stimulate users' participation in these communities. As the multigroup analysis shows, the mobile app increases the feedback derived from value-in-use relative to participants who only use the website. Mobile app use also encourages coinnovation activities relative to users who use both the website and the mobile app, since the mobile app facilitates connection to users at any time, at any place. This finding does not, however, reduce the importance of the cocreation behaviors of participants who use only the website. The website is the preferred platform for obtaining informational value and the platform that most fosters the search for information before carrying out the service experience. Participants who use only the website and who perceive positively the value that the virtual community brings them appear more inclined to participate in coinnovation activities than do users who use both platforms. Managers of the virtual community should thus encourage and homogenize the user's experience on both platforms for accessing the virtual community (website and mobile app), since both platforms encourage cocreation behaviors as long as users perceive value-in-use for the community. Both platforms should be attractive for users, since users can then choose one or the other to carry out their cocreation behaviors based on their experience, preferences, and circumstances.

We thus recommend establishing strategic plans based on knowledge of the cocreation behaviors of the different groups of participants, thereby providing users with the tools needed to guarantee continuity in the cocreation behaviors they perform, while also improving cocreation behaviors performed to a lesser extent. For example, for participants who use the mobile app only, managers should increase the influence of value-in-use on information searching by encouraging information searching through this platform during the planning phase of the service. The positive effect of value-in-use on feedback should be improved for participants who use the website only, and this should be done by maximizing the simplicity of the process by which participants write reviews through this platform and by stimulating participants also to use the mobile app (e.g., through promotions only available through that app), since this platform most encourages generation of feedback. Finally, for participants who access the community through both website and mobile app, managers should encourage the positive influence of perceived value-in-use on their coinnovation. For this group, an incentive program could be applied based on participation in coinnovation activities (e.g., prizes).

We can also identify areas for improvement in the variables that compose participants' value-in-use and concentrate resources on developing specific dimensions of this value—for example, improving the average values of social integrative value. To achieve this improvement, visibility of topical forums within the online travel community (e.g., trips with children, pets, etc.) could be increased, as well as forums not directly related to the topics but encouraging exchange of experiences (e.g., forums on gastronomy, leisure, etc.). Such action may be especially beneficial for increasing ties and affinity with other individuals in the group.

Finally, we recommend maximizing interactivity within the community and making participants feel heard, that is, responding to them and making them feel that they

play a very important role in the service firms housed on the virtual community, since these firms benefit most from the feedback and coinnovation that participants generate. Tourist firms that receive comments benefit directly from knowing the suggestions for improvement users propose. Management application of the valuable information that participants provide in codesign activities such as proposing new modes of service, trends, forms of improvement, etc. has direct repercussions for improving business results, as firms can better identify the motivations and behavior of current consumers and thus better satisfy the needs of the target market. Likewise, the managers of virtual communities of travelers benefit from users who propose improvements in informational content, website aesthetics, etc., since making these improvements in the virtual platform helps to improve users' perception of their ease of use and utility, with positive repercussions for attitude (e.g., trust) and loyalty to the virtual community of travelers.

We must note some limitations of this study, which can give rise to future lines of research. First, the cocreation behaviors were obtained through responses by survey respondents based on their perceptions. It is thus advisable to follow up by analyzing respondents' real behavior on the virtual community of travelers. Likewise, since the study was performed with a group of participants representative of the Spanish market, repetition of the study in other geographic contexts would give it greater external validity. In addition, there may be other cocreation behaviors not considered in this model, such as aid to other members of the community or participation in forums, which open a line to future studies. Further, antecedents researched in the cocreation literature could be incorporated to enrich the model proposed (e.g., perceived support given by organizations) by studying these antecedents' influence on value-in-use. Other different consequences of cocreation behaviors could also be incorporated, such as relational results for the firm that manages the virtual community of travelers or the firms housed on the platform (e.g., identification, customer capital, etc.). As the online travel literature indicates [16], it would also be interesting to study the moderating effect of specific variables, such as age, sex, income, education, or level of expertise, on the relationships between participants' value-in-use and cocreation behaviors, as well as to contrast whether the proposed modeling can be applied to other types of virtual communities.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

All authors declare no conflicts of interest.

Acknowledgments

References

[1] A. Patino, D. A. Pitta, and R. Quinones, "Social media's emerging importance in market research," *Journal of Consumer Marketing*, vol. 29, no. 3, pp. 233–237, 2012.

[2] S. L. Vargo and R. F. Lusch, "Institutions and axioms: an extension and update of service-dominant logic," *Journal of the Academy of Marketing Science*, vol. 44, no. 1, pp. 5–23, 2016.

[3] S. L. Vargo and R. F. Lusch, "Evolving to a new dominant logic for marketing," *Journal of Marketing*, vol. 68, no. 1, pp. 1–17, 2004.

[4] M. A. Merz, L. Zarantonello, and S. Grappi, "How valuable are your customers in the brand value co-creation process? The development of a Customer Co-Creation Value (CCCV) scale," *Journal of Business Research*, vol. 82, pp. 79–89, 2018.

[5] E. Claffey and M. Brady, "Examining consumers' motivations to engage in firm-hosted virtual communities," *Psychology & Marketing*, vol. 34, no. 4, pp. 356–375, 2017.

[6] E.-Y. Chou, C.-Y. Lin, and H.-C. Huang, "Fairness and devotion go far: Integrating online justice and value co-creation in virtual communities," *International Journal of Information Management*, vol. 36, no. 1, pp. 60–72, 2016.

[7] B. Xu and D. Li, "An empirical study of the motivations for content contribution and community participation in Wikipedia," *Information Management*, vol. 52, no. 3, pp. 275–286, 2015.

[8] T. Fernandes and P. Remelhe, "How to engage customers in co-creation: customers' motivations for collaborative innovation," *Journal of Strategic Marketing*, vol. 24, no. 3-4, pp. 311–326, 2016.

[9] H. Zhang, Y. Lu, B. Wang, and S. Wu, "The impacts of technological environments and co-creation experiences on customer participation," *Information & Management*, vol. 52, no. 4, pp. 468–482, 2015.

[10] Y.-F. Kuo and L.-H. Feng, "Relationships among community interaction characteristics, perceived benefits, community commitment, and oppositional brand loyalty in online brand communities," *International Journal of Information Management*, vol. 33, no. 6, pp. 948–962, 2013.

[11] Y. Wang, S. F. Chan, and Z. Yang, "Customers' perceived benefits of interacting in a virtual brand community in China," *Journal of Electronic Commerce Research*, vol. 14, no. 1, pp. 49–66, 2013.

[12] L. Tonteri, M. Kosonen, H.-K. Ellonen, and A. Tarkiainen, "Antecedents of an experienced sense of virtual community," *Computers in Human Behavior*, vol. 27, no. 6, pp. 2215–2223, 2011.

[13] P.-L. Hsieh, "Encounters in an Online Brand Community: Development and Validation of a Metric for Value Co-Creation by Customers," *Cyberpsychology, Behavior, and Social Networking*, vol. 18, no. 5, pp. 286–295, 2015.

[14] H. J. Schau, A. M. Muñiz Jr., and E. J. Arnould, "How brand community practices create value," *Journal of Marketing*, vol. 73, no. 5, pp. 30–51, 2009.

[15] M. Zhang, L. Guo, M. Hu, and W. Liu, "Influence of customer engagement with company social networks on stickiness: Mediating effect of customer value creation," *International Journal of Information Management*, vol. 37, no. 3, pp. 229–240, 2017.

[16] G. Agag and A. A. El-Masry, "Understanding consumer intention to participate in online travel community and effects on consumer intention to purchase travel online and WOM: An

integration of innovation diffusion theory and TAM with trust," *Computers in Human Behavior*, vol. 60, pp. 97–111, 2016.

[17] R. J. Brodie, A. Ilic, B. Juric, and L. Hollebeek, "Consumer engagement in a virtual brand community: an exploratory analysis," *Journal of Business Research*, vol. 66, no. 1, pp. 105–114, 2013.

[18] H.-T. Tsai and P. Pai, "Explaining members' proactive participation in virtual communities," *International Journal of Human-Computer Studies*, vol. 71, no. 4, pp. 475–491, 2013.

[19] L. V. Casaló, C. Flavián, and M. Guinalíu, "Redes sociales virtuales desarrolladas por organizaciones empresariales: Antecedentes de la intención de participación del consumidor," *Cuadernos de Economía y Dirección de la Empresa*, vol. 15, no. 1, pp. 42–51, 2012.

[20] K. Verleye, "The co-creation experience from the customer perspective: Its measurement and determinants," *Journal of Service Management*, vol. 26, no. 2, pp. 321–342, 2015.

[21] TripAdvisor, 2017, https://www.tripadvisor.es/Owners.

[22] Hosteltur, 2017, https://static.hosteltur.com/web/uploads/2017/11/Travelport_viajero_digital_2.pdf.

[23] M. Hu, M. Zhang, and N. Luo, "Understanding participation on video sharing communities: The role of self-construal and community interactivity," *Computers in Human Behavior*, vol. 62, pp. 105–115, 2016.

[24] L. Zhao, Y. Lu, B. Wang, P. Y. K. Chau, and L. Zhang, "Cultivating the sense of belonging and motivating user participation in virtual communities: A social capital perspective," *International Journal of Information Management*, vol. 32, no. 6, pp. 574–588, 2012.

[25] T. Kohler, J. Fueller, K. Matzler, D. Stieger, and J. Füller, "CO-creation in virtual worlds: The design of the user experience," *MIS Quarterly: Management Information Systems*, vol. 35, no. 3, pp. 773–788, 2011.

[26] S. Nambisan and R. A. Baron, "Virtual customer environments: Testing a model of voluntary participation in value co-creation activities," *Journal of Product Innovation Management*, vol. 26, no. 4, pp. 388–406, 2009.

[27] U. M. Dholakia, R. P. Bagozzi, and L. K. Pearo, "A social influence model of consumer participation in network- and small-group-based virtual communities," *International Journal of Research in Marketing*, vol. 21, no. 3, pp. 241–263, 2004.

[28] Y. Wang and D. R. Fesenmaier, "Towards understanding members' general participation in and active contribution to an online travel community," *Tourism Management*, vol. 25, no. 6, pp. 709–722, 2004.

[29] L. V. C. Ariño, C. F. Blanco, and M. G. Blasco, "Observación y participación activa en comunidades virtuales comerciales: El caso del sector turismo," *Revista Española de Investigación de Marketing ESIC*, vol. 15, no. 2, pp. 113–134, 2011.

[30] L. J. C. Fiol, J. S. García, M. A. M. Tena, and S. F. Coll, "La importancia de las comunidades virtuales para el análisis del valor de marca: El caso de TripAdvisor en Hong Kong y París," *Papers de Turisme*, vol. 52, no. 2, pp. 89–115, 2012.

[31] L. V. Casaló, C. Flavián, and M. Guinalíu, "Determinants of the intention to participate in firm-hosted online travel communities and effects on consumer behavioral intentions," *Tourism Management*, vol. 31, no. 6, pp. 898–911, 2010.

[32] C. K. Prahalad and V. Ramaswamy, "Co-creation experiences: the next practice in value creation," *Journal of Interactive Marketing*, vol. 18, no. 3, pp. 5–14, 2004.

[33] J. Füller, "Refining virtual co-creation from a consumer perspective," *California Management Review*, vol. 52, no. 2, pp. 98–122, 2010.

[34] K. R. Ranjan and S. Read, "Value co-creation: concept and measurement," *Journal of the Academy of Marketing Science*, vol. 44, no. 3, pp. 290–315, 2016.

[35] C. Tynan and S. McKechnie, "Experience marketing: A review and reassessment," *Journal of Marketing Management*, vol. 25, no. 5-6, pp. 501–517, 2009.

[36] M. Sicilia and M. Palazón, "Brand communities on the internet: A case study of Coca-Cola's Spanish virtual community," *Corporate Communications*, vol. 13, no. 3, pp. 255–270, 2008.

[37] A. Chen, Y. Lu, P. Y. Chau, and S. Gupta, "Classifying, measuring, and predicting users overall active behavior on social networking sites," *Journal of Management Information Systems*, vol. 31, no. 3, pp. 213–253, 2014.

[38] E. Vernette and L. Hamdi-Kidar, "Co-creation with consumers: Who has the competence and wants to cooperate?" *International Journal of Market Research*, vol. 55, no. 4, p. 7, 2013.

[39] H. Bugshan, "Co-innovation: the role of online communities," *Journal of Strategic Marketing*, vol. 23, no. 2, pp. 175–186, 2015.

[40] J. Á. L. Sánchez, C. G. Mieres, and M. L. S. Vijande, "Innovación de servicio y co-creación con los clientes de la empresa: Efectos sobre los resultados," *Revista Española de Investigación en Marketing ESIC*, vol. 17, pp. 79–102, 2013.

[41] U. M. Dholakia, V. Blazevic, C. Wiertz, and R. Algesheimer, "Communal service delivery: How customers benefit from ParticiPation in Firm-hosted virtual P3 communities," *Journal of Service Research*, vol. 12, no. 2, pp. 208–226, 2009.

[42] C. A. Vogt and D. R. Fesenmaier, "Expanding the functional information search model," *Annals of Tourism Research*, vol. 25, no. 3, pp. 551–578, 1998.

[43] H. H. Chang and S. S. Chuang, "Social capital and individual motivations on knowledge sharing: Participant involvement as a moderator," *Information Management*, vol. 48, no. 1, p. 18, 2011.

[44] W. D. Hoyer, R. Chandy, M. Dorotic, M. Krafft, and S. S. Singh, "Consumer cocreation in new product development," *Journal of Service Research*, vol. 13, no. 3, pp. 283–296, 2010.

[45] J. Füller, K. Matzler, K. Hutter, and J. Hautz, "Consumers' Creative Talent: Which Characteristics Qualify Consumers for Open Innovation Projects? An Exploration of Asymmetrical Effects," *Creativity and Innovation Management*, vol. 21, no. 3, pp. 247–262, 2012.

[46] J. Dimmick, "The theory of the niche and spending on mass media: The case of the "video revolution"," *Journal of Media Economics*, vol. 10, no. 3, pp. 33–43, 1997.

[47] J. Dimmick, Y. Chen, and Z. Li, "Competition between the Internet and Traditional News Media: The Gratification-Opportunities Niche Dimension," *Journal of Media Economics*, vol. 17, no. 1, pp. 19–33, 2004.

[48] S. Okazaki, H. Li, and M. Hirose, "Consumer privacy concerns and preference for degree of regulatory control: A study of mobile advertising in Japan," *Journal of Advertising*, vol. 38, no. 4, pp. 63–77, 2009.

[49] E. Parra-López, J. Bulchand-Gidumal, D. Gutiérrez-Taño, and R. Díaz-Armas, "Intentions to use social media in organizing and taking vacation trips," *Computers in Human Behavior*, vol. 27, no. 2, pp. 640–654, 2011.

[50] Y. Yi and T. Gong, "Customer value co-creation behavior: scale development and validation," *Journal of Business Research*, vol. 66, no. 9, pp. 1279–1284, 2013.

[51] S. Molinillo, F. Liébana-Cabanillas, R. Anaya-Sánchez, and D. Buhalis, "DMO online platforms: Image and intention to visit," *Tourism Management*, vol. 65, no. 2, pp. 116–130, 2018.

[52] J. C. Anderson, D. W. Gerbing, and J. E. Hunter, "On the assessment of unidimensional measurement: Internal and external consistency, and overall consistency criteria," *Journal of Marketing Research*, vol. 25, no. 4, pp. 432–437, 1987.

[53] F. J. Hair, M. Sarstedt, L. Hopkins, and G. V. Kuppelwieser, "Partial least squares structural equation modeling (PLS-SEM) An emerging tool in business research," *European Business Review*, vol. 26, no. 2, pp. 106–121, 2014.

[54] M. Tajvidi, M. O. Richard, Y. Wang, and N. Hajli, "Brand co-creation through social commerce information sharing: The role of social media," *Journal of Business Research*, 2018.

[55] W. W. Chin, "Commentary: Issues and opinion on structural equation modeling," *MIS Quarterly*, vol. 22, no. 1, pp. 7–16, 1998.

[56] P. M. Podsakoff, S. B. MacKenzie, J.-Y. Lee, and N. P. Podsakoff, "Common method biases in behavioral research: a critical review of the literature and recommended remedies," *Journal of Applied Psychology*, vol. 88, no. 5, pp. 879–903, 2003.

[57] C. Fornell and D. F. Larcker, "Evaluating structural equation models with unobserved variables and measurement error," *Journal of Marketing Research*, vol. 18, no. 1, pp. 382–388, 1981.

[58] J. Henseler, C. M. Ringle, and M. Sarstedt, "A new criterion for assessing discriminant validity in variance-based structural equation modeling," *Journal of the Academy of Marketing Science*, vol. 43, no. 1, pp. 115–135, 2015.

[59] R. F. Falk and N. B. Miller, *A primer for soft modeling*, University of Akron Press, 1992.

[60] S. Geisser, "The predictive sample reuse method with applications," *Journal of the American Statistical Association*, vol. 70, no. 350, pp. 320–328, 1975.

[61] M. Sarstedt, J. Henseler, and C. M. Ringle, "Multigroup analysis in partial least squares (PLS) path modeling: Alternative methods and empirical results," *Advances in International Marketing*, vol. 22, pp. 195–218, 2011.

Research Article

Relation of Country-of-Origin Effect, Culture, and Type of Product with the Consumer's Shopping Intention: An Analysis for Small- and Medium-Sized Enterprises

Juan Manuel Berbel-Pineda,[1] Beatriz Palacios-Florencio,[1] Luna Santos-Roldán [iD],[2] and José M. Ramírez Hurtado [iD][3]

[1]*Department of Business Organization and Marketing, Faculty of Business Studies, University of Pablo de Olavide, Carretera Utrera, Km.1, 41013 Seville, Spain*
[2]*Department of Business Organization, Faculty of Law and Business, University of Córdoba, Puerta Nueva s.n., 14071 Córdoba, Spain*
[3]*Department of Economics, Quantitative Methods and Economic History, University of Pablo de Olavide, Carretera Utrera, Km.1, 41013 Seville, Spain*

Correspondence should be addressed to Luna Santos-Roldán; td1sarol@uco.es

To obtain information about foreign markets is a very complex task for small- and medium-sized enterprises. This work's aim is to find out how certain variables are related to the consumer's shopping intention. It will help these firms to get a better knowledge of this intention. The work is specifically centred on products related to the gastronomy of a particular place. Through a sample of 154 tourists who visited this destination, we sought to know these products' degree of acceptance. Via structural equation modelling, it has been possible to determine the relevance which the variables of country of origin, gastronomic culture, and type of product have regarding the shopping intention. The work's novelty is to contribute a methodology of gathering information in the destination on the likes and behaviour patterns of foreign consumers without the need of costly research in their countries of origin.

1. Introduction

Thanks to the use of information, communication, and logistic technologies, the development of globalisation in these past years has enabled all firms or activity sectors, whatever the size, to be within reach of goods and services from any part of the planet (e.g., [1, 2]). This globalising phenomenon means that firms beginning their internationalisation seek sustainable competitive advantages via the "made in" or country brand influence (e.g., [3–5]).

The main aim of this research is to find out if a favourable projection of the country of origin and the consumer's positive perception of this projection have a direct relation with consumers' shopping intentions. At the same time, we mean to see the influence of culture and the perception of certain gastronomic products on foreign consumers' shopping intentions.

To carry out the study, we have selected as a target population the tourists visiting the city of Seville, one of Spain's most visited cities [6]. They did a tasting of products belonging to firms participating in the project (related to the local gastronomy). Afterwards, they filled out a questionnaire which provided the information necessary for the study.

We have analysed a series of variables, such as the consumer's behaviour and the "made in" effect (country-of-origin image) (e.g., [7–9]). The study will be centred on this and other variables, for instance, culture (e.g., [10–12]), the respondents' knowledge of the product, their taste for Spanish food, and their perception of Spanish products (e.g., [13, 14]).

It has become fundamental for exporting to foreign markets to find out this perception and the degree of acceptation (as well as the consumption patterns) of these products, whose common link is being part of the local gastronomy and of the Mediterranean diet (so esteemed in the world for its flavour and, especially, for being tremendously healthy). But this knowledge is even more important for small- and medium-sized enterprises which do not have the necessary resources to carry out market research abroad. This results in being very complicated for them to know the tastes and needs concerning shopping and consumption [15–17].

This way of gathering information is going to enable these firms to know, in origin, the tastes of foreign consumers segmented by countries and, therefore, obtain important information in their internationalisation process. This research methodology is very useful for this kind of firms due to the complexity of carrying out market research abroad and the scarcity of resources, allowing them to know the tastes and needs of foreign consumers. The main aim is to find out how the country image ("country-of-origin effect") has an impact on the consumer behaviour regarding the selection of products and how this can help firms in their foreign market selection process. This can lead to a competitive advantage when competing with products from other countries with a lower or even negative country image.

The contribution of this work is eminently practical. It does not add to the theoretical knowledge on the topic but does carry out an application of this theoretical knowledge to the business world. The variables have in general been measured directly, and the questionnaire has been elaborated from measures (of some of these variables) in previous studies. Nonetheless, it has also been worked out from the needs of the participating firms concerning variables which they wished to know about, referring to the shopping behaviour and the consumption behaviour. The way in which the information was collected is also novel, as it was done in origin, whereas this information tends to be collected in the destination country markets. This has therefore become a contribution of the paper.

The work is structured as follows. The first section has a thorough analysis of the extant literature on the research topic. On the other hand, we have centred ourselves on theories of consumer behaviour and country image ("country-of-origin effect") and the relation between the shopping behaviour and the perception of the product or the relation with the culture. In the next section, the methodology details the characteristics of the research carried out. The following section presents the empirical analysis, examining and interpreting the results obtained. The last section specifies the main conclusions, the implications for management, and the work's limitations.

2. Literature Review

2.1. Behaviour of the Consumer.
It is important to know the consumer's behaviour and understand those factors which can influence the decision-making process in the shopping decision for specific products and services [18]. The study of how consumers behave according to the country-of-origin image of the products that they consume begins when they are going to acquire a product or are going to make use of a service to satisfy their needs. This is when the customer faces a series of decisions to be made. These vary from the type of product or the buying situation, and they define this behaviour.

Schiffman et al. [18] determine the behaviour of the consumer as "the behaviour that consumers display in searching for, purchasing, shopping, using, and disposing of products and services which they expect to satisfy their needs," and this encompasses "what they buy, why they buy it, when they buy it, where they buy it, how often they buy it, how often they use it, how they evaluate it after the purchase and the impact of such evaluations on future purchases, and how they dispose of it."

The complexity of the choice will depend, as we have just indicated, on the type of good and the shopping situation. And this will lead to the consumers acting under great uncertainty, due to the quality, the functioning, or the durability of the good acquired not being known at the moment of purchase. They can also face market uncertainty. According to this, the same good is found on sale in different conditions (distinct price or quality), without the consumers knowing which good presents the best conditions (e.g., Leca, 2015 and [19, 20]). In this sense, the "made in" and country brand influence can contribute to decreasing people's uncertainty, with supplementary and relevant information being added when they make their decision [21].

Globalisation and market saturation have intensified the level of competition to such extent that a country's brand image is highly important for firms and their products as this image positively and negatively affects consumers' behaviours [22]. The relevance of the country of origin in the consumers' behaviours towards brands can generate both competitive advantages and disadvantages. Due to personal experiences, information acquired, or stereotyped beliefs about countries, consumers generate their own brand-country images. If the valuations about the country of origin are positive, this will propitiate a favourable perception of the brands of products manufactured in this country [19, 23]. In relation to this, it is worth pointing out that the brands from countries with a better image are better placed to benefit from high prices in contrast to those with a discount that characterise the brands of countries which have a weak or negative image.

It is also worth considering that the family affects the beliefs, attitudes, and motivations of shoppers, that peer groups will modify the person's behaviour patterns, and that culture defines the global behaviour pattern of a complete community, establishing norms, behaviours, values, ideas, beliefs, etc. [18].

2.2. The Country-of-Origin Effect and the Consumer's Behaviour.
The country of origin has attracted the attention of entrepreneurs because research shows that the image associated with a specific country of origin affects the evaluations that consumers make of that country's products, as well as the shopping intentions concerning these products (e.g., [7, 9]).

The country-of-origin image has been defined in many ways over the years. Generally, the country image has been used to refer to aspects associated with the country itself and with its residents—such as identity, culture, political environment, history, people, and economic and technological development—but not with the country's products [24]. The product's aspect has been defined as the perception of a particular country's "made in" product category, referring to stereotypes concerning the country [25]. Moreover, these macro and micro concepts examine different things. The country's macro image centres on the country's image, but the micro image emphasises more the "made in" image of products of certain countries.

The studies of the country image have also varied considerably. This has meant that some discrepancies have arisen about the issue to be analysed. These discrepancies may be due to prior research having initially centred on the aspect of the country's "made in" or micro image. Through this tendency, it was evaluated if changes in locations from industrialised countries to developing countries reduced the production costs, which affected the products' perceived quality [14]. Consequently, the macro country image was ignored. In the past decades, studies have begun to appear about the macro country image to explain its influence on the preferences of the products acquired by consumers [26, 27].

The country-of-origin image is considered a factor which affects consumers, reducing the complexity of their shopping decisions [28]. When studying the influence of the country of origin, it is necessary to identify if the market is emerging or not. In the case of emerging markets, the country of origin has an influence on the product's image, while the general image of the country affects the consumers' shopping intentions [29].

The country of origin, which can refer to where a brand is based (brand origin) or where a product is manufactured (country of manufacture), is an important sign that consumers consider when they evaluate a product. The products which are offered by binational or multinational brands, the brand origin, and the country of manufacture are often different. This difference is a source of ambiguity. It reduces the evaluations that customers make about the products, which affects the shopping intention [8].

The type of product is also important when studying the influence of the country of origin and the shopping intention [14]. Thus, Berry et al. [30] show that the country of origin has an influence on the shopping intentions of consumers in the case of meat. According to these authors, the country of origin influences the food's safeness, its taste, and its freshness. These factors in turn influence the shopping intention.

So, the brand-country image perceived by the consumers will provide a differentiation of the product whenever the brand image is consistent and recognised by the market as it will provide numerous advantages. Examples of these are the renown and recognition by the market, savings in the investment of advertising and promotion, a greater speed in the launching and distribution of new products, and the entry into new markets [22]. Due to all these, centring on Spain's country image and the perception of our products

abroad, the hypothesis proposed in this research project is as follows:

Hypothesis 1. The country-of-origin image perceived has a direct and positive relation with the consumer's purchasing intention.

2.3. Gastronomic Culture and Consumer Behaviour.
Gastronomy is part of a place's culture [10, 11]. It has also become one of the relevant factors in the consumer's behaviour when choosing tourist destinations, as well as in their behaviour in the destination itself [12]. Consumers often behave influenced by the place where they are, especially regarding gastronomy, given that they prefer to be one more in the destination and behave like a local consumer [31, 32].

Indeed, a place's gastronomy can be encompassed in the context of cultural tourism as the gastronomic experience which each place offers is one of the attractions of the trip. The relation between the consumer's behaviour and food enables analysing one of the most interesting dynamics of the current use of the gastronomic heritage [33].

The local gastronomy therefore becomes a significant tourist resource, being part of the cultural heritage of the geographic areas visited by tourists [34]. Gastronomy is even sought as a reflection of a geographic area's cultural identity [12].

According to Mascarenhas and Gândara [35], food practices are full of meanings. From the choice of what is edible or not to the way of preparing it, serving it, and consuming it, we can appreciate the food characteristics linked with the culture and the society. Tourism is considered one of the elements which use regional food in its activities.

In the Spanish case, its gastronomy is beginning to be recognised at an international level for different attributes, such as its innovative character, its variety, its healthiness, and the quality of its raw materials. Furthermore, the concept of meals through "tapas" (typical of Spain) is increasingly more known and accepted, even being introduced in other countries [36, 37].

To sum up, the behaviour of the consumers as to their shopping or consumption intentions can be seen reflected in the following relation where a link is established between a specific place's gastronomic culture and the behaviour itself. So, this relation can be summarised as follows:

Hypothesis 2. The gastronomic culture of the country of origin has a direct and positive relation with the consumer's purchasing intention.

2.4. Product Perception and Consumer Behaviour.
In the past years, the social dimension of food and its universal interest has been markedly strengthened. As the consumption of food provides the most reliable data of the purchasing behaviour, a rigorously scientific study of this phenomenon requires a detailed approach from various perspectives [38]. A growing segment of the population demands to be able to enjoy in their homes specific dishes of their favourite gastronomy, regardless of whether they coincide or not with their native country.
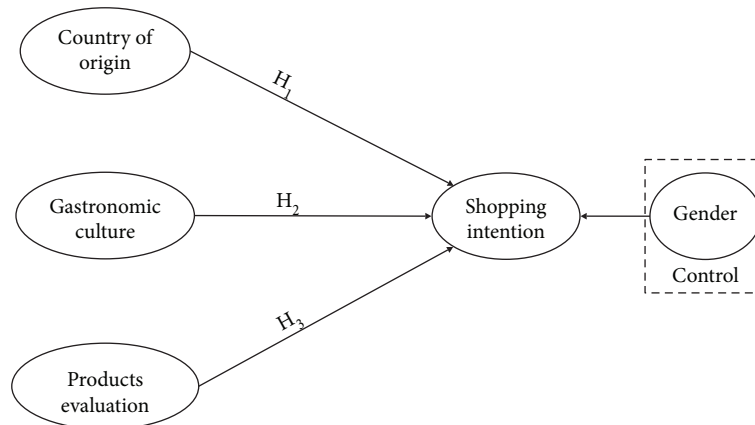
Figure 1: Proposed hypothesis of product evaluation.

The flavours and diversity of food are part of each locality's cultural heritage [39–41]. Mediterranean countries are ubiquitously recognised as those which are enthusiastic about eating, and Spain is no exception. This country has been the protagonist of a radical improvement in its perception by foreigners, a change which is more outstanding if one recalls that, historically, Spanish cuisine was relegated to a lower category by its systematic comparison with the internationally acclaimed French cuisine [42]. Also, coming back to the present, Spanish products have gained in the upward growth of consumption of organic food, being in 2016 among the leading European territories of organic production with 2,018,802 ha [43, 44].

Some works have been done on the product-country image (PCI) with a bilateral direction concerning two specific geographical areas. Gorostidi-Martínez et al. [45] analyse the perception of Spain by Chinese consumers, addressing the country image, the personal image, the product image, personal data, and the general knowledge of Spain. Meanwhile, Gorostidi-Martínez et al. [46] do the study conversely. Other works do not adopt this bilateralism and identify a single country for the study of the perception of a Spanish product. For instance, Aramendia-Muneta and Grande-Esteban [47], also concerning China, state in their conclusions that women, the young and those Chinese citizens who have never visited Spain, have the best valuation of Spanish products; the best valued attributes are their prestige, attractiveness, and quality. From the perspective of hypermarkets, [48] can be consulted. There have also been studies of a single type of product, such as yoghurt [49], boar meat [50], functional food [51], and fruit [13], where according to their results, the French consumers surveyed are willing to pay more for imported Spanish citrus fruits due to their high quality.

Based on the above, this article offers a panoramic view of a transcultural study, receiving the perception of tourists of different nationalities about four products related to the local gastronomy. The identification of key markets is a vital question for the future success of a firm, as the mistakes made in this period can be costly [52]. This leads us to our third hypothesis:

Hypothesis 3. The perception of the products of the country of origin has a direct and positive relation with the consumer's purchasing intention.

The relation of these variables considered with the consumer's behaviour, measured through the shopping intention, is expressed in Figure 1.

3. Methodology

To do this study, we have carried out a commercial investigation in which four Andalusian firms that plan to go international and make their products known abroad have taken part. To be able to get all the data necessary, it was essential to obtain detailed information of the destination country markets, as well as the consumers these firms would be targeting.

This is why we selected tourists from different countries as the target population. They did a tasting of the products of the firms taking part in the project. Afterwards, they filled out a questionnaire. Although the questions which make up the questionnaire were determined from the literature (e.g., [12]), the questionnaire also asked about those aspects that the entrepreneurs who took part in the project needed to know. The questionnaire was tested on experts in a foreign trade.

We thus found out the preferences of the consumers towards some products, their knowledge of these products, their tastes, the perceived quality of the products and their attributes, the purchasing intentions, information of the participants' countries of origin, their opinion of our country, and, likewise, the importance of the "made in" effect in the purchasing decisions. These are some of the variables analysed. They have provided useful information not only for the investigation but also for the collaborating firms. These have been able to find out the image that the participants have of Spain and its influence when acquiring "made in Spain" products and especially how they value the products tasted.

This information is very important not only for our research aim but also for the objective sought by the firms

taking part as it will be of great help for them in their process of entering external markets.

This research was carried out in the most touristic area of Seville over five days. Each firm (through its personnel) gave out their product for testing and provided all the information required by the tourists taking part in the study.

More than a dozen firms showed an interest in this project. For the sake of operability, four firms were chosen. They offered products that were considered suitable for this tasting and which, in some way, complemented each other. The products chosen were ecological olive oil, olives, crackers, and sauces. They belonged to the following firms: *Ecolivum Extra S.L.*, *Valdelacasa*, *Naranjas Carneado*, and *The Tapas Sauces*.

4. Empirical Analysis

Next, Table 1 indicates the main characteristics of the sample via a technical sheet.

A total of 154 tourists took part in this market study: 49 men and 105 women (percentage-wise: 31.4% men and 68.6% women).

The second point to highlight from the sample obtained is the diversification of the countries of origin. The information compiled evidences the broad range of countries present—a total of 22. To facilitate the processing of this information, we grouped together those countries that had a smaller number of participants. Having done this, we had a classification of 8 groups: Latin America (represented by Brazil, Colombia, Costa Rica, Cuba, Ecuador, Haiti, and Peru), Mexico, the United States, Central Europe (Germany and Belgium), geographically close markets (France and Portugal), Italy, Eastern Europe (Slovakia, the Ukraine, the Czech Republic, and Poland), and lastly a section of "others" where we have included those territories that had a lower representation (Finland, Ireland, and the United Kingdom) or were less close (Australia). This grouping is shown in Figure 2.

It can be seen that the Italian market predominates over the rest with 24.7%, almost a quarter of the total respondents. It is followed by the Mexican market (16.66%) and those of countries such as France and Portugal (encompassed in "close markets"— 16.38%). After them come the representatives of markets belonging to "Central Europe" and "Latin America" (having 10.73% and 10.16%, respectively). Next are the respondents from the countries grouped in "Eastern Europe"—8.47% of the sample. In the last position are the USA and the countries in "others": 7.8% and 5.10%, respectively.

4.1. "Made in" Effect on Purchasing Habits. One of the success factors in the commercialisation of a product is having a well-known brand. Consequently, many firms invest vast resources to achieve the positioning of their brand in the consumer's mind. There are also many studies which justify that the brand is not the only important factor to be successful. In the case of internationalisation, a factor which strengthens the brand image and often substitutes it is the image of the country where the product is from,

TABLE 1: Investigation technical sheet.

Sample	154 participants
Gender	49 men (31.4%) and 105 women (68.6%)
Nationalities represented	Germany, Australia, Belgium, Brazil, Colombia, Costa Rica, Cuba, Ecuador, Slovakia, United States, Finland, France, Haiti, Ireland, Italy, Mexico, Peru, Poland, Portugal, United Kingdom, Czech Republic, Ukraine
Firms taking part	*Ecolivum Extra S.L.* (ecological olive oil) *Valdelacasa* (olives) *Naranjas Carneado* (crackers) *The Tapas Sauces* (sauces)

that is, the so-called "made in" effect. This is especially taken into consideration in the internationalisation of food products. As this study is centred on this modality, we believe that studying the image of Spanish products in different countries is an important factor to bear in mind in the internationalisation process.

To do so, we have analysed a series of variables that help us to find out how Spanish products and Spanish food are known and considered in foreign markets. This gives us an idea of the image that Spain has in the food sector at an international level. To do this, we worked with a Likert scale having five possible alternatives (as reflected in Table 2), where the respondents are requested to mark an option from 1 to 5, with 1 being the least valued and 5 being the most valued, according to their perception of Spain and Spanish food.

The results obtained are shown in Figure 3.

We first see in the graphs that the data denote a very positive perception of the "made in" effect regarding Spanish products and food. In general, we determine that they are widely accepted and are highly esteemed by foreign consumers.

81% of the respondents declare liking Spanish food quite a lot or a lot. This data is very significant. No one indicates not liking it, and only 5% declare that they do not like our products very much. These are positive data that strengthen the idea that our gastronomy has a privileged position within the worldwide culinary culture.

Also, a total of 82% of the respondents perceive Spanish products as good (51%) and very good (31%). In contrast, we find that 1 out of every 5 respondents does not have a very positive perception about Spanish products. This is worrying as, percentage-wise, we are talking about a significant 20% of the market. This means that many potential customers are not reached.

Dealing with the importance of the products' country of origin, it is revealed that the consumers take this into account. Indeed, 85% of the respondents pay attention to where the product is from, 60% of them considering this to be quite important or very important.

At the same time, we note that in spite of the good ranking that the Spain brand has, Spanish products are not sold in the world as much as the idea that this perception gives. Only 14% of the respondents declare that they often buy Spanish products, compared to 44%, practically
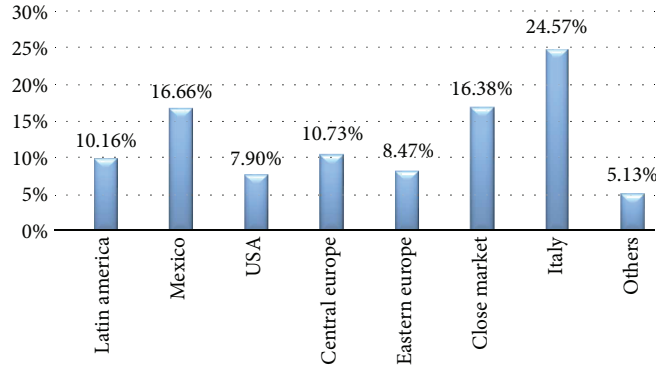
FIGURE 2: Geographic area.

TABLE 2: Questions.

Made in					
The country the product is from is important	Not at all	Not much	A little	Quite a lot	A lot
Tapas culture					
The concept of "tapas" food is known in my city	Not at all	Not much	A little	Quite a lot	A lot
There are Spanish taverns/restaurants in my city	None	Not many	A few	Quite a lot	A lot
Product evaluation					
I like Spanish food	Not at all	Not much	A little	Quite a lot	A lot
Perception of Spanish products	Very bad	Bad	Average	Good	Very good
Shopping intention					
I buy food products from Spain in my country	Never	Not often	Sometimes	Often	Very often

half of the population that indicate that they rarely or never buy Spanish products.

Lastly, it is noted that the concept of tapas and Spanish restaurants in their country of origin are not very common. Only 14% know the tapas culture, and 5% remark that there are Spanish taverns in their country.

To sum up, this introductory block also is aimed at considering the importance that the country of origin can have, analysing variables related to shopping and consumer habits. For this reason, as in any study of this kind, where the aim is to obtain information for a possible commercialisation in different international models, to get to know consumer behaviours regarding consumption and purchasing habits is very relevant.

In this way, we have intended to find out about some aspects, such as liking Spanish food, the image of Spanish products, the perception of them, and the existence of a Spanish gastronomic culture, with a view of examining if these variables influence the participants' shopping intention.

4.2. Analysis of the Proposed Hypothesis. Next, we verify the hypotheses proposed in this work. To do so, we use the PLS-Graph (structural equation technique) programme. The PLS model is analysed and interpreted in two stages [53]: (1) the evaluation of the reliability and the validity of the measurement model and (2) the evaluation of the structural model.

4.2.1. Evaluation of the Measurement Model's Reliability and Validity

(1) Individual Reliability of the Item. To measure the individual reliability, we have to take into account the loadings. In this work, all the reflective indicators have loadings (λ) above 0.707. There are researchers who have the opinion that loadings of 0.5 and 0.6 can be accepted when the scales are applied in different contexts [53]. In this case, we have included loadings less than 0.707.

(2) Reliability of the Construct. The reliability of a construct enables the internal consistency of all the indicators measuring the concept to be checked. That is to say, it evaluates how rigorously manifested variables are measuring the same latent variable [54]. To measure this reliability, the composite reliability is noted [55]. This must be over 0.7. Next, we present the results obtained through the indicators (Table 3). In this model, all the constructs with reflective indicators are reliable.

(3) Convergent Validity. This refers to the degree to which all the items try to measure the same. To do so, all the indicators of the same construct must be highly correlated. The PLS analysis measures this validity through the measurement called "average variance extracted (AVE)" [56]. This provides the quantity of variance that a construct obtains from its indicators in relation to the quantity of variance due to measurement error [57].
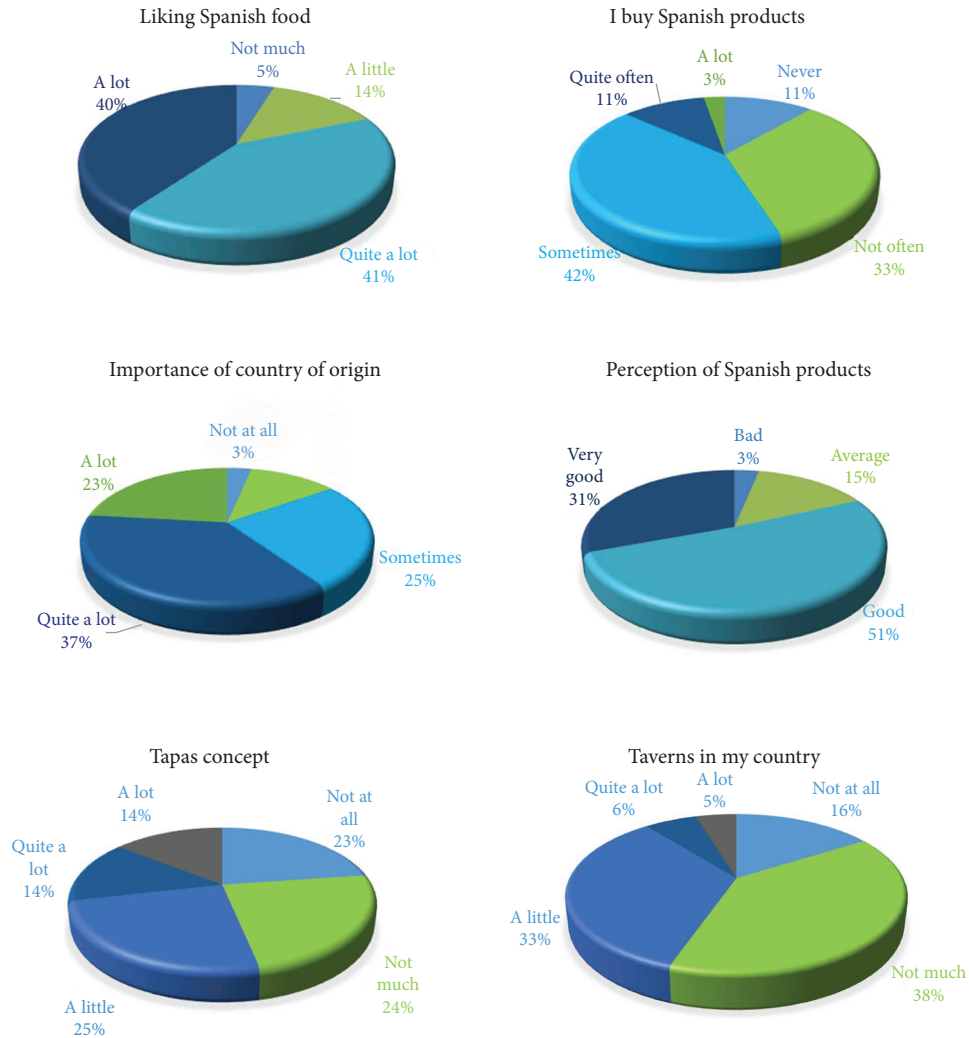
FIGURE 3: Aspects related to Spanish products and food liking/tapas concept/Spanish taverns.

TABLE 3: Measurement model.

| | VIF | Weight | Student's t | Loading | Confidence interval | |
					Lower	Upper
Product evaluation (reflective)						
Spfd				0.907	0.813	0.951
Spprod				0.922	0.866	0.966
Tapas culture (formative)						
Taverns	1.067	0.641**	2.629			
Tapas	1.067	0.624*	2.497			
Made in (reflective)						
Made in				1	1	1
Gender (reflective)						
Gender				1	1	1
Shopping intention (reflective)						
Spbuy				1	1	1

**$p < 0.01$ (based on $t(4999$, two-tailed); *$p < 0.05$ (based on $t(4999$, two-tailed). $t(0.05, 4999) = 1.960$; $t(0.01, 4999) = 2.577$.

TABLE 4: Reliability of the construct, convergent, and discriminant validity.

	Composite reliability	AVE	(1)	(2)	(3)	(4)	(5)
(1) Product evaluation	0.911	0.837	0.915				
(2) Tapas culture	n.a.	n.a.	0.023	0			
(3) Made in	1	1	0.158	−0.014	1		
(4) Gender (control variable)	1	1	0.033	0.007	−0.056	1	
(5) Shopping intention	1	1	0.281	0.282	0.215	−0.223	1

TABLE 5: Effect of the endogenous variable.

	R^2	Q^2	Direct effect	t value	Confidence interval	Variance explained
Shopping intention	23.60%	0.178				
Product evaluation			0.256***	3.478	[0140, 0.381]	7.19%
Tapas culture			0.280***	3.361	[0.148, 0.423]	7.90%
Made in			0.166*	2.141	[0.037, 0.291]	3.57%
Gender (control variable)			−0.244^	3.298	[−0.351, −0.084]	4.99%

***$p < 0.001$ and *$p < 0.05$ (based on $t(4999)$, one-tailed test). $t(0.05, 4999) = 1.645$; $t(0.001, 4999) = 3.092$. ^$p < 0.001$ (based on $t(4999)$, two-tailed test). $t(0.001, 4999) = 3.292$.

Fornell and Larcker [56] recommend that the AVE be over 0.5. This establishes that 50% of the construct's variance is due to its indicators. This is complied with as the AVE measurements of this model's constructs with reflective indicators are over 0.5 (Table 4).

(4) Discriminant Validity. Discriminant validity indicates to what extent a given construct is different from the other constructs. A way of determining this is to demonstrate that the correlations between the constructs are lower than the square root of the AVE.

The diagonal elements of Table 4 correspond to the square root of the construct's AVE, while the rest of the figures represent the correlations between constructs. This model has discriminant validity as the correlations between constructs are lower than the square root of the AVE.

For an appropriate discriminant validity, the elements of the diagonal must be significantly greater than the elements that are in the corresponding rows and columns off the diagonal [53].

Having verified that the measurement model is satisfactory in relation to the preceding criteria (the measurements of the constructs are reliable and valid), we value the structural model.

4.2.2. Evaluation of the Structural Model. From these levels, in the following section, we will obtain the significance of the proposed relation and, therefore, we will accept it or reject it. To do so, we are going to make use of Student's t distribution of 499 degrees of freedom ($n − 1$, where n represents the number of subsamples) to calculate the significance of the path coefficients. We will obtain the values with a significance of 0.001, 0.01, and 0.05 (see Table 5). As we can also note in Table 5, the model explains 23.60% of the shopping intention variable, with the tapas culture being

the construct that most explains it and the "made in" effect being the one which does so least: 7.90% and 3.57%, respectively.

Also, regarding the "gender" control variable, as the path coefficient is negative, the higher the score the less the shopping intention. Thus, it is confirmed that the shopping intention is greater in men than in women.

4.2.3. Verification of Hypothesis. Figure 4 shows the causal relation between the model's constructs, and Table 6 presents the relation to be studied, the effect that this relation actually follows, the path coefficient, the t value, and the idea if the relation has been supported or not.

The result shows that the hypotheses are supported. It is thus confirmed that the "made in" effect influences the perceptions of the consumers towards some products or others in their shopping intentions. Consequently, it can be established that the greater the general valuation of the perceived country image, the greater the commercial success of the products from this country in international markets will be.

5. Discussion

This study contributes additional empirical evidence to recent observations of the positive effect of the "made in" perception, the culture, and the evaluation of the product on the shopping intention.

In general, the valuation of Spain as to the questions related to the "made in" effect is highly positive. Regarding the question of the importance of the country of origin, 85% of the respondents declare that they give some, a lot, or quite a lot of importance to the product's country of origin. This is a very relevant data for the purpose of this work given that, of the 154 participants, 131 showed an interest
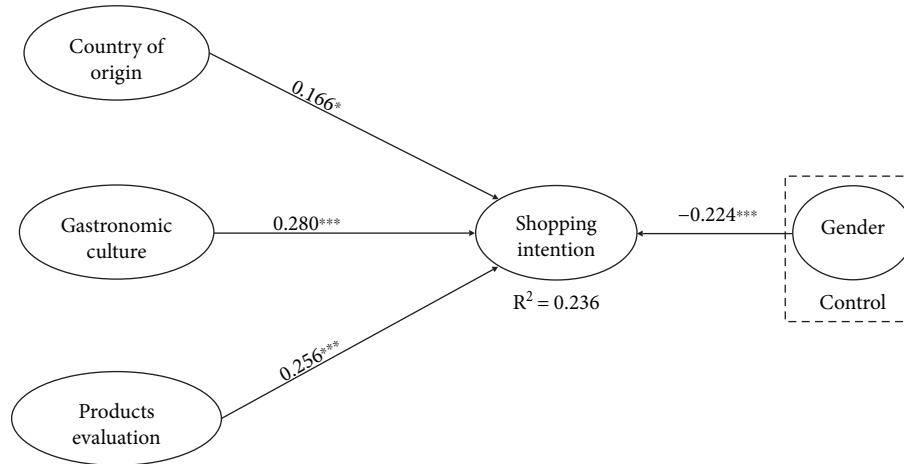
Figure 4: Causal relation of product evaluation.

Table 6: Verification of the hypotheses.

Hypotheses	Effect suggested	Path coefficient (β)	t value (bootstrap)	Supported/not supported
H1: made in → shopping intention	(+)	0.166*	2.141	Supported
H2: tapas culture → shopping intention	(+)	0.280***	3.361	Supported
H3: product evaluation → shopping intention	(+)	0.256***	3.478	Supported

***$p < 0.001$ and *$p < 0.05$ (based on $t(4999)$, one-tailed test). $t(0.05, 4999) = 1.645$; $t(0.001, 4999) = 3.092$.

in where the product that they were buying was from. Hence, it is essential for a country to transmit a positive image and, likewise, for the consumers to perceive this.

Addressing the very surprising percentages as to buying food products from Spain, only 14% declare buying Spanish products in their countries, while 44% point out that they never or very seldom buy them. These data lead us to the following question: what is the reason of this if in general we have checked that their acceptation is good and that they are perceived as having a more than acceptable quality? Perhaps, this result makes sense if we compare it with the study carried out by the Forum of Renowned Spanish Brands (FMRE) and the Spanish Federation of Food and Beverage Industries (FIAB). This is expressed in the conceptual framework in which the foreign tourists surveyed show an interest in continuing to consume Spanish products in their countries of residence, but almost half (a similar data to that of our study) say that they cannot do so due to their scant accessibility. Also, international consumers do not recognise a good part of our products as Spanish. This possibly makes sense of the valuation received in this question.

According to the data obtained in the project's questionnaire, we can answer the initial question through the evaluations carried out in the PLS-Graph programme: the proposed hypothesis is supported. This confirms the role played by the "made in Spain" effect (H$_1$) in the internationalisation of firms belonging to the agri-food sector. We have also found out the valuation of this effect in the perception of the Spain brand in the consumer's shopping behaviour (H$_3$), as well as

the influence of the gastronomic culture in the purchasing of Spanish products (H$_2$). These findings are in line with the studies of Cerviño et al. [19], Jiménez and San Martín [58], Ganguly et al. [59], and Li et al., [9], among others. The tapas culture represents the best predictor of the shopping intention in the research model, explaining 7.90% of its variance. The least significant variable is the "made in" effect, which explains 3.57%. This degree of significance is also found in the research carried out by Cerviño et al. [19], where the "made in" effect on the product's success is the lowest of all the study variables. This finding suggests that the consumer does not give so much importance to where the product is from, but rather to the existence of a culture such as eating tapas. Thus, Ahmed and d'Astous [25] corroborated this, stating that though the consumers may have a general unfavourable perception of a country, if they consider that it has good-quality products, they consume them. Our study's results demonstrate as well that the perception of the product variable also affects the shopping intention, having a variance explained of 7.19%. This result is consistent with other studies, such as that of Khalid and Nawawi [60].

It should be pointed out that the PLS methodology is aimed at specifying predictability through the values of the variance explained (R2) and the redundancy (Q2) in the model in which it is tested, as well as the decomposition of the variance explained. This contributes useful information about the practice, and theoretical conclusions can be drawn. The model tested in this study attained moderate values for the variance explained [57]. Furthermore, the

squared validated redundancy measures (Q2) show that the structural model has a satisfactory predictive relevance for the shopping intention (Q2 > 0). Therefore, the results indicate that a positive "made in" effect, the existence of Spanish gastronomic culture in the destination country, and the perception of the product can foster a shopping intention.

6. Conclusions, Implications for Management, and Limitations

The aim of this study has been to find out if the "made in" effect, a favourable perception of the country of origin, and the gastronomic culture have a direct relation with the consumer's shopping intention. To do so, it was very important to compile an appropriate sample to obtain the necessary data to respond to the proposed hypotheses.

It is worth highlighting the variety of countries where the participants who answered the questionnaire were from. This enriches the data and, consequently, the analysis and the conclusions which we draw from the research.

The results of this study come from a sample whose respondents have quite varied nationalities. As a result, it has been possible to find out the image of the Spanish products in the study in a diversity of markets. Accordingly, to know the perceptions about our country and our products is valuable to configure Spain's reputation at the international level.

Based on the studies carried out and the results obtained, we establish the following:

(i) The country image influences both the consumers' perceptions about a product's quality and their shopping behaviour

(ii) A favourable projection of the "made in Spain" effect, as well as a positive perception of it by the consumer, will significantly affect the commercial success of Spanish firms in their international expansion

(iii) Consumers show an interest in where a product that they buy is from, so it is crucial to transmit a positive image since the consumers perceive this

(iv) To achieve an increase in the valuation and the international positioning of the "Spain brand," it is necessary to carry out an appropriate communication policy made up of the image projected and the image perceived

(v) Firms should centre themselves on the variables which make up the gastronomic culture construct as it is the one which best explains the shopping intention. This implies that a greater knowledge of the gastronomic culture of Spain in the country of origin brings about a greater shopping intention regarding its products. It would hence be recommendable to create more Spanish restaurants and introduce the tapas concept in these countries

(vi) In general, our gastronomy has a great acceptation and our products are highly esteemed by foreign consumers.

With this study, we have meant to contribute information which helps firms of the agri-food sector wishing to expand to international markets to achieve sustainable competitive advantages through the country image projected abroad.

Carrying out a commercial investigation at a very low cost leads small firms or those with scant financial resources to be able to find out the tastes and preferences of foreign consumers. It is to bear in mind that this part of the information process (knowledge of foreign markets) is undoubtedly the most important but, in turn, it is the one which costs most.

We finish these prior considerations noting that we must not forget that this study is a pilot study which will give us no more than an approach to those factors that we are going to analyse, given that the sample can in no case be understood as a representative sample. This is a significant limitation for the work. Nevertheless, it is going to mean, for the firms taking part, an access to the tastes, habits, customs and opinions that consumers of different markets have, on the one hand, about Spanish food and products and, on the other hand, about the products tested in this study.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

[1] A. Maurer and C. Degain, "Globalization and trade flows: what you see is not what you get!," *Journal of International Commerce, Economics and Policy*, vol. 3, no. 3, article 1250019, 2012.

[2] G. Svensson, "Beyond global marketing and the globalization of marketing activities," *Management Decision*, vol. 40, no. 6, pp. 574–583, 2002.

[3] J. Brookfield, "Globalization and competitive advantage," *Strategy & Leadership*, vol. 31, no. 3, 2003.

[4] M. J. EnrightN. Hood and S. Young, "The globalization of competition and the localization of competitive advantage: policies towards regional clustering," in *The globalization of multinational enterprise activity and economic development*, pp. 303–331, Palgrave Macmillan, London, 2000.

[5] R. R. Park-Barjot, "Mondialisation et avantage concurrentiel," *Revue Économique*, vol. 58, no. 1, pp. 231–258, 2007.

[6] Enterat, "Las 50 ciudades más visitadas de España 2018 (ranking)," 2018, http://www.enterat.com/ocio/ciudades-mas-visitadas-espana.php.

[7] A. Insch and M. Florek, "Prevalence of country of origin associations on the supermarket shelf," *International Journal of Retail & Distribution Management*, vol. 37, no. 5, pp. 453–471, 2009.

[8] Z. S. Johnson, Y. Tian, and S. Lee, "Country-of-origin fit: when does a discrepancy between brand origin and country of manufacture reduce consumers' product evaluations?," *Journal of Brand Management*, vol. 23, no. 4, pp. 403–418, 2016.

[9] J. Li, D. Mizerski, A. Lee, and F. Liu, "The relationship between attitude and behavior: an empirical study in China," *Asia Pacific Journal of Marketing and Logistics*, vol. 21, no. 2, pp. 232–242, 2009.

[10] M. Bogers and J. D. Jensen, "Open for business? An integrative framework and empirical assessment for business model innovation in the gastronomic sector," *British Food Journal*, vol. 119, no. 11, pp. 2325–2339, 2017.

[11] V. Gordin, J. Trabskaya, and E. Zelenskaya, "The role of hotel restaurants in gastronomic place branding," *International Journal of Culture, Tourism and Hospitality Research*, vol. 10, no. 1, pp. 81–90, 2016.

[12] T. López-Guzmán, C. P. Uribe Lotero, J. C. Pérez Gálvez, and I. Ríos Rivera, "Gastronomic festivals: attitude, motivation and satisfaction of the tourist," *British Food Journal*, vol. 119, no. 2, pp. 267–283, 2017.

[13] Z. Gao, S. Sing Wong, L. A. House, and T. H. Spreen, "French consumer perception, preference of, and willingness to pay for fresh fruit based on country of origin," *British Food Journal*, vol. 116, no. 5, pp. 805–820, 2014.

[14] K. Vijaranakorn and R. Shannon, "The influence of country image on luxury value perception and purchase intention," *Journal of Asia Business Studies*, vol. 11, no. 1, pp. 88–110, 2017.

[15] K. Al-Hyari, G. Al-Weshah, and M. Alnsour, "Barriers to internationalisation in SMEs: evidence from Jordan," *Marketing Intelligence & Planning*, vol. 30, no. 2, pp. 188–211, 2012.

[16] J. O. Okpara, "Strategic export orientation and internationalization barriers: evidence from SMEs in a developing economy," *Journal of International Business and Cultural Studies*, vol. 1, no. 1, pp. 15–27, 2009.

[17] J. O. Okpara and N. J. Koumbiadis, "Strategic export orientation and internationalization barriers: evidence from SMEs in a developing economy," *Journal of International Business and Cultural Studies*, vol. 4, no. 1, pp. 35–51, 2011.

[18] L. G. Schiffman, L. L. Kanuk, and J. Wisenblit, *Comportamiento del consumidor*, Pearson, Mexico, 2010.

[19] J. Cerviño Fernández, J. Sánchez Herrera, and J. M. Cubillo Pinilla, "Influencia de posicionamiento competitivo de las empresas en el efecto made in Spain y éxito empresarial," *Información Comercial Española, ICE: Revista De Economía*, vol. 827, pp. 261–276, 2005.

[20] J. Noya, *La imagen de España en el exterior*, Real Instituto Elcano de Estudios Internacionales y Estratégicos, 2002.

[21] B. Dubois and A. Rovira, *Comportamiento del consumidor: Comprendiendo al consumidor*, Prentice Hall, Madrid, 1998.

[22] M. Alonso and E. F. Blasco, "La imagen de los productos españoles en los mercados internacionales," 2006, Available at: https://halshs.archives-ouvertes.fr/halshs-00119377.

[23] R. Lee and L. Lockshin, "Reverse country-of-origin effects of product perceptions on destination image," *Journal of Travel Research*, vol. 51, no. 4, pp. 502–511, 2012.

[24] L. Hamzaoui and D. Merunka, "The impact of country of design and country of manufacture on consumer perceptions of bi-national products' quality: an empirical model based on the concept of fit," *Journal of Consumer Marketing*, vol. 23, no. 3, pp. 145–155, 2006.

[25] S. A. Ahmed and A. d'Astous, "Perceptions of countries as producers of consumer goods: A T-shirt study in China," *Journal of Fashion Marketing and Management: An International Journal*, vol. 8, no. 2, pp. 187–200, 2004.

[26] K. P. Roth and A. Diamantopoulos, "Advancing the country image construct," *Journal of Business Research*, vol. 62, no. 7, pp. 726–740, 2009.

[27] J. C. Usunier, "Relevance in business research: the case of country-of-origin research in marketing," *European Management Review*, vol. 3, no. 1, pp. 60–73, 2006.

[28] N. Papadopoulos and L. Heslop, "Country equity and country branding: problems and prospects," *Journal of Brand Management*, vol. 9, no. 4, pp. 294–314, 2002.

[29] N. Souiden, F. Pons, and M. E. Mayrand, "Marketing high-tech products in emerging markets: the differential impacts of country image and country-of-origin's image," *The Journal of Product and Brand Management*, vol. 20, no. 5, pp. 356–367, 2011.

[30] C. Berry, A. Mukherjee, S. Burton, and E. Howlett, "A COOL effect: the direct and indirect impact of country-of-origin disclosures on purchase intentions for retail food products," *Journal of Retailing*, vol. 91, no. 3, pp. 533–542, 2015.

[31] G. Akdag, O. Guler, A. Dalgic, S. Benli, and A. C. Cakici, "Do tourists' gastronomic experiences differ within the same geographical region? A comparative study of two Mediterranean destinations: Turkey and Spain," *British Food Journal*, vol. 120, no. 1, pp. 158–171, 2018.

[32] K. Suet Leng and N. Badarulzaman, "Branding George Town world heritage site as city of gastronomy: prospects of creative cities strategy in Penang," *International Journal of Culture, Tourism and Hospitality Research*, vol. 8, no. 3, pp. 322–332, 2014.

[33] L. P. D. Morais and M. H. S. Gimenes, *Tradição e inovação nas culinárias regionais–tópicos para reflexão. Saber e Sabor I*, Colóquio de História e Cultura da Alimentação, Curitiba, 2007.

[34] P. Björk and H. Kauppinen-Räisänen, "Local food: a source for destination attraction," *International Journal of Contemporary Hospitality Management*, vol. 28, no. 1, pp. 177–194, 2016.

[35] R. G. Mascarenhas and J. M. Gândara, "Producción y transformación territorial: la gastronomía como atractivo turístico," *Estudios y Perspectivas en Turismo*, vol. 19, no. 5, pp. 776–791, 2010.

[36] J. C. Pérez Gálvez, M. Torres-Naranjo, T. Lopez-Guzman, and M. Carvache Franco, "Tourism demand of a WHS destination: an analysis from the viewpoint of gastronomy," *International Journal of Tourism Cities*, vol. 3, no. 1, pp. 1–16, 2017.

[37] S. Sanchez-Cañizares and A. M. Castillo-Canalejo, "A comparative study of tourist attitudes towards culinary tourism in Spain and Slovenia," *British Food Journal*, vol. 117, no. 9, pp. 2387–2411, 2015.

[38] E. P. Köster, "Diversity in the determinants of food choice: a psychological perspective," *Food Quality and Preference*, vol. 20, no. 2, pp. 70–82, 2009.

[39] R. Lee, L. Lockshin, and L. Greenacre, "A memory-theory perspective of country-image formation," *Journal of International Marketing*, vol. 24, no. 2, pp. 62–79, 2016.

[40] J. C. Nevot and E. E. Bernat, *Comensales, Consumidores y Ciudadanos, Una Perspectiva Sobre Los Múltiples Significados de la Alimentación en el Siglo XXI*, Limpergraf, Barcelona, 2010.

[41] N. M. Sussman, "The dynamic nature of cultural identity throughout cultural transitions: why home is not so sweet," *Personality and Social Psychology Review*, vol. 4, no. 4, pp. 355–373, 2000.

[42] R. Núñez-Florencio, "La comida española y la mirada extranjera," *Ars Medica. Revista de Humanidades*, vol. 1, pp. 20–35, 2007.

[43] Eurostat, 2017, http://ec.europa.eu/eurostat/statistics-exploained/index.php/Organic_farming.

[44] M. von Meyer-Höfer, S. Nitzko, and A. Spiller, "Is there an expectation gap? Consumers' expectations towards organic: an exploratory survey in mature and emerging European organic food markets," *British Food Journal*, vol. 117, no. 5, pp. 1527–1546, 2015.

[45] H. Gorostidi-Martinez, W. Xu, and X. Zhao, "A study of the Chinese consumers' product-country image of Spain," *Asia Pacific Journal of Marketing and Logistics*, vol. 29, no. 5, pp. 947–977, 2017.

[46] H. Gorostidi-Martinez, W. Xu, and X. Zhao, "A review of Spanish consumers' product-country image of China," *Asia Pacific Journal of Marketing and Logistics*, vol. 29, no. 3, pp. 589–615, 2017.

[47] M. E. Aramendia-Muneta and I. Grande-Esteban, "Spaniards and Spanish product image among the Chinese: implications for marketing strategies," *Journal of China Marketing*, vol. 6, no. 1, pp. 79–95, 2016.

[48] G. Kan, G. Cliquet, and M. Puelles Gallo, "The effect of country image on hypermarket patronage intention," *International Journal of Retail & Distribution Management*, vol. 42, no. 2, pp. 106–130, 2014.

[49] F. Messina, A. Saba, A. Turrini, M. Raats, M. Lumbers, and Food in Later Life Team, "Older people's perceptions towards conventional and functional yoghurts through the repertory grid method: a cross-country study," *British Food Journal*, vol. 110, no. 8, pp. 790–804, 2008.

[50] U. Weiler, M. Font i Furnols, K. Fischer et al., "Influence of differences in sensitivity of Spanish and German consumers to perceive androstenone on the acceptance of boar meat differing in skatole and androstenone concentrations," *Meat Science*, vol. 54, no. 3, pp. 297–304, 2000.

[51] I. Siró, E. Kápolna, B. Kápolna, and A. Lugasi, "Functional food. Product development, marketing and consumer acceptance – a review," *Appetite*, vol. 51, no. 3, pp. 456–467, 2008.

[52] W. Viviers, L. Cuyvers, E. Steenkamp, S. Grater, M. Matthee, and W. Krugell, "Identifying new product and service export opportunities for South Africa using a decision support model," *International Business & Economics Research Journal (IBER)*, vol. 13, no. 6, pp. 1403–1417, 2014.

[53] D. Barclay, C. Higgins, and R. Thompson, "The partial least squares (PLS) approach to causal modelling: personal computer adoption and use as an illustration," *Technology Studies, Special Issue on Research Methodology*, vol. 2, no. 2, pp. 285–309, 1995.

[54] J. L. Roldán, "Sistemas de Información Ejecutivos (EIS): Génesis, Implantación y Repercusiones Organizativas," Doctoral Thesis. Universidad de Sevilla, 2000.

[55] C. E. Werts, R. L. Linn, and K. G. Jöreskog, "Intraclass reliability estimates: testing structural assumptions," *Educational and Psychological Measurement*, vol. 34, no. 1, pp. 25–33, 1974.

[56] C. Fornell and D. F. Larcker, "Evaluating structural equation models with unobservable variables and measurement error," *Journal of Marketing Research*, vol. 18, no. 1, pp. 39–50, 1981.

[57] W. W. Chin, "Issues and opinion on structural equation modelling," *MIS Quarterly*, vol. 22, pp. 7–14, 1998.

[58] N. Jiménez and S. San Martín, *El efecto del país de origen en la compra de Automóviles importados*, Pecunia, Monográfico, 2010.

[59] B. Ganguly, S. B. Dash, D. Cyr, and M. Head, "The effects of website design on purchase intention in online shopping: the mediating role of trust and the moderating role of culture," *International Journal of Electronic Business*, vol. 8, no. 4/5, pp. 302–330, 2010.

[60] Khalid and Nawawi, "Consumers perception, purchase intention and actual purchase behavior of organic food products," *Review of Integrative Business and Economics Research*, vol. 3, no. 2, pp. 378–397, 2014.

Research Article

Key Factors for In-Store Smartphone Use in an Omnichannel Experience: Millennials vs. Nonmillennials

Ana Mosquera ⓘD, **Emma Juaneda-Ayensa** ⓘD, **Cristina Olarte-Pascual** ⓘD, **and Jorge Pelegrín-Borondo** ⓘD

Universidad de La Rioja, Departamento de Economía y Empresa, C/La Cigüeña, 60 Logroño, Spain

Correspondence should be addressed to Ana Mosquera; ana-maria.mosquera@unirioja.es

The in-store use of smartphones is revolutionizing the customer journey and has the potential to become an important driver in the omnichannel context. This paper aims at identifying the key factors that influence customers' intentions to use smartphones in-store and their actual behavior and to test the moderating effect of age, differentiating between millennials and nonmillennials, as millennials are considered digital natives and early adopters of new technologies. We applied the UTAUT2 model to a sample of 1043 Spanish customers, tested it using structural equations, and performed a multigroup analysis to compare the results between the two groups. The results show that the model explains both the behavioral intention to use a smartphone in a brick-and-mortar store and use behavior. The UTAUT2 predictors found to be most important were habit, performance expectancy, and hedonic motivation. However, the study shows that the only difference between millennials and nonmillennials with regard to the use of smartphones in-store is the effects of behavioral intention and habit on use behavior. The study adds to the existing knowledge by providing evidence in support of the validity of UTAUT2 as an appropriate theoretical basis to explain effectively behavioral intention, specifically the in-store use of smartphones.

1. Introduction

Omnichannel retailing has dramatically changed the way customers shop. Nowadays, consumers increasingly simultaneously use multiple channels and touchpoints during their customer journey and demand that they should be connected and integrated to enjoy a holistic and seamless shopping experience [1]. In this new scenario, the smartphone has become a powerful tool. Customers are mobile dependent and prefer to consult their phones rather than salespersons to carry out different tasks in-store, such as searching for product information and prices, checking product ratings, comparing products, and paying; they also use them to consult family and friends for advice [2–4]. Moreover, they have the potential to become important drivers in the omnichannel context due to their importance as initiators for conversion to other touchpoints or channels.

As Marriott et al. [5] highlight, business managers stress the importance of understanding customer behavior. This is crucial for the successful management and development of m-shopping in the retail industry [6].

M-shopping is defined by many authors as a subsidiary of m-commerce: the online purchase of products or services using a smartphone [7–13]. However, for the purpose of this research, we use a wider definition of m-shopping, which includes browsing, searching, purchasing, and comparing products using smartphones [5, 14–16]. M-shopping is a critical part of m-marketing as it empowers shoppers by allowing them to research product characteristics from multiple sources and carry out tasks such as checking product availability and prices, compare different brands and offers, and read user opinions and reviews [17–19]. In addition, m-shopping encompasses the use of smartphones in prepurchasing activities such as finding directions to the store and checking opening hours [20].

Previous research has shown that consumers' intention to use smartphones in-store positively affects purchase intention, especially when they are used to compare prices and

obtain discount coupons [21]. However, there is a lack of research into the motivations for in-store smartphone use. Thus, following the suggestion of Venkatesh et al. [22], this study seeks to bridge that gap by examining the applicability of the UTAUT2 model to explain consumer use of smartphones in a physical store. Additionally, previous literature has discussed the moderating effect of age, demonstrating that young people are more innovative and more likely to accept new technologies than older people (e.g., [12, 16, 23, 24]). Due to m-shopping and omnichannel retailing literature being in its infancy, practical and theoretical understanding remains limited. For this reason, this study's aim is twofold: first, to identify the key factors influencing customers' intentions to use smartphones in-store to gain an accurate understanding of customer m-shopping acceptance behavior and their actual behavior in an omnichannel context, and, second, to test the moderating effect of age, differentiating between millennials and nonmillennials.

The paper is organized into four sections. The first offers an overview of the literature describing the conceptual foundation for the acceptance and in-store use of smartphones. The second describes the sample and the methodology employed. The third reports the results. Finally, the main conclusions and implications are discussed in the context of future research.

2. Theory of Acceptance and In-Store Use of Smartphones: Model and Hypotheses

Our research framework is based on the unified theory of acceptance and use of the technology (UTAUT2) model [22], which is an extension of the original UTAUT model [25]. We select the UTAUT2 model because it provides an explanation for information and communication technology (ICT) acceptance and use by consumers and can be applied to different technologies and contexts [22]. Moreover, Marriott et al. [5] gave us three more reasons to use the UTAUT2 model. First, "UTAUT2 was created in relation to mobile utilization." Second, "UTAUT2 incorporates the cost-benefit factors of *performance expectancy* and *effort expectancy*." Third, "UTAUT2 accounts for voluntary situations and allows for time factors to be considered." Under this model, a customer's intention to accept and use a new technology is affected by seven factors: *performance expectancy* (PE), *effort expectancy* (EE), *social influence* (SI), *facilitating conditions* (FC), *hedonic motivation* (HM), *price value* (P), and *habit* (HA).

Although the model has been used previously to explain customer behavior in the context of mobile commerce (e.g., [26, 27]), to our knowledge, little attention has been paid to the in-store omnichannel shopping context [28]. Thus, this study examines the applicability of the UTAUT2 model specifically to explain consumers' use of smartphones, while in a physical store, in an omnichannel context. In the following paragraphs, we describe the main constructs of the research model.

Performance expectancy is defined as the degree to which using a technology will provide benefits to the consumer in performing certain activities [22]. Performance expectancy adapted to omnichannel stores considers how consumers perceive the benefits they receive by using smartphones while in a physical store. This variable has been shown to be one of the strongest predictors of behavioral intention to adopt m-commerce and an influence on omnichannel shopping behavior (e.g., [7, 17, 28]). Thus, the following hypothesis is proposed:

> H1. Performance expectancy positively affects behavioral intention to use a smartphone in-store.

Effort expectancy is described as the degree of ease/effort associated with the consumers' use of technology [22]. Perceived ease of use has been demonstrated to be a significant influence on the intention to use mobile commerce (e.g., [5, 7, 12, 17, 27]). In addition, this factor is a key determinant of purchase intention in an omnichannel context [28]. In keeping with these previous works, we propose the following:

> H2. Effort expectancy positively affects behavioral intention to use a smartphone in-store.

Social influence is defined as how "consumers perceive that important others (e.g., family and friends) believe that they should use a particular technology" ([29], p. 73). In the case of m-shopping, previous literature suggests that social influence encourages m-shopping acceptance behavior [12, 16, 24, 30]. Moreover, younger consumers are more susceptible to technology adoption due to social media [23]. Adapting social influence to omnichannel shopping, we hypothesize that behavioral intention to use devices in-store is likely to be influenced by friends, family, role models, and celebrities. Therefore, the following hypothesis is proposed:

> H3. Social influence positively affects behavioral intention to use a smartphone in-store.

Facilitating conditions are the consumers' perceptions of the resources and support available to perform a behavior [25, 31]. Previous studies demonstrate that a favorable set of facilitating conditions results in greater intention to use shopping apps [5, 27]. We hypothesize that when the consumer has a favorable perception of the facilitating conditions, it will lead to smartphone use in-store during either, or both, the prepurchase and purchase stages. Thus, we have the following:

> H4a. Facilitating conditions positively affect behavioral intention to use a smartphone in-store.
>
> H4b. Facilitating conditions positively affect the use behavior of smartphones in-store.

Hedonic motivation is defined as the pleasure or enjoyment derived from using a technology [22]. Previous literature has shown the influence of hedonic motivation on the intention to use m-shopping (e.g., [7, 8, 16, 17]).

However, Juaneda-Ayensa et al. [28] did not find that hedonic motivation-influenced purchase intention in the omnichannel context. As there are different results with respect to this variable, we hypothesize that the higher the consumers' perceived enjoyment is when they use their smartphones in-store, the higher will be their behavioral intention to use them. Thus, we put forward the following hypothesis:

H5. Hedonic motivation positively affects behavioral intention to use a smartphone in-store.

Habit is described as the extent to which people tend to perform behaviors automatically because of learning [32]. This concept, which is a new construct in the UTAUT2 model, has been considered a predictor of behavioral intention to use mobile apps [16, 27]. In addition, Kim [33] demonstrated that habit influenced the actual use of mobile apps and data services. However, Juaneda-Ayensa et al. [28] did not find that habit-influenced purchase intention in the omnichannel context. Taking into account the different results recorded in the literature and that the use of mobile devices is a part of the daily lives of shoppers, we hypothesize the following:

H6a. Habit positively affects behavioral intention to use smartphones in-store.

H6b. Habit positively affects use behavior of smartphones in-store.

The price value is defined as the consumers' cognitive tradeoff between the perceived benefits of the use of internet data and the monetary cost of using them [22]. Thus, we hypothesize that if the perception of the price value when accessing data on the internet using smartphones in-store has greater benefits than the perceived monetary cost (e.g., data cost and other types of service charges), consumers are more likely to access them. Therefore, the following hypothesis is proposed:

H7. Price value positively affects behavioral intention to use a smartphone in-store.

Behavioral intention is the main antecedent of use behavior, and it has a direct effect on individuals' actual use of a given technology [34]. Several studies in different contexts confirm the relationship between intention to perform a behavior and actual behavior [17, 35–37]. Thus, the following hypothesis is proposed:

H8. Behavioral intention positively affects the use behavior of smartphones in-store.

3. The Moderating Role of Age: Millennials vs. Nonmillennials

Previous literature has demonstrated that shopping behavior and the use of new technologies during the customer journey are influenced by sociodemographic variables such as gender,

age, and education (e.g., [22, 38, 39]). Regarding age, previous studies have shown behavioral differences between "millennials" and "nonmillennials" [40–42]. Millennials are the generation born between the early 1980s and the early 2000s [43]. They are considered the first high-tech generation because they are early adopters of technological devices and expert Internet users. They are known as digital natives, as opposed to the members of the previous generation, who are called digital immigrants [44].

Previous research has noted that young people integrate smartphones into their daily lives, while older people generally use them for basic functions [45]. Some studies identify a relationship between the age of consumers and the probability that they will use smartphones and mobile technologies during their shopping journeys [45–50]. Although many works have studied this influence, there is no consensus on the relationship between the age of consumers and the probability that they will use new technology in their shopping journeys [49]. The study of how age can influence the way in which a consumer accepts and uses new technology is included in the UTAUT2 [22] as a moderating effect of the influence of facilitating conditions, hedonic motivation, habit, and price value on behavioral intention; however, the authors did not include the influence of age on performance expectancy, effort expectancy, and social influence. Although no works have studied the influence of age using the UTAUT2 model, we have found some works studying the influence of age using the UTAUT model. Regarding the influence of age as a moderator variable in technology acceptance, effort expectancy is stronger for older consumers [25, 50]. Lian and Yen, [48], in their study into online shopping drivers and barriers for older adults, concluded that the major online shopping driving forces are performance expectancy and social influence. Due to the lack of consensus regarding this moderating effect and the lack of works specifically regarding the use of smartphone in the omnichannel context, we would like to develop further debate in this area. For this reason, we studied the moderating role of age by differentiating the two groups, millennials and nonmillennials. Specifically, regarding m-shopping, some studies have shown that younger consumers are more likely to accept m-shopping than older consumers [16, 23, 24] and that the intention to use smartphones in-store positively affects the use behavior more in young people [51]. Due to the limited papers that discuss this moderating effect in the omnichannel shopping process, we incorporate it through the following hypotheses:

H9. Age ("millennials" vs "nonmillennials") plays a moderating role in the relationship between the seven exogenous variables and intention to use smartphones in-store.

This hypothesis is divided into the following:

H9a. Age plays a moderating role in the relationship between performance expectancy and intention to use smartphones in-store.
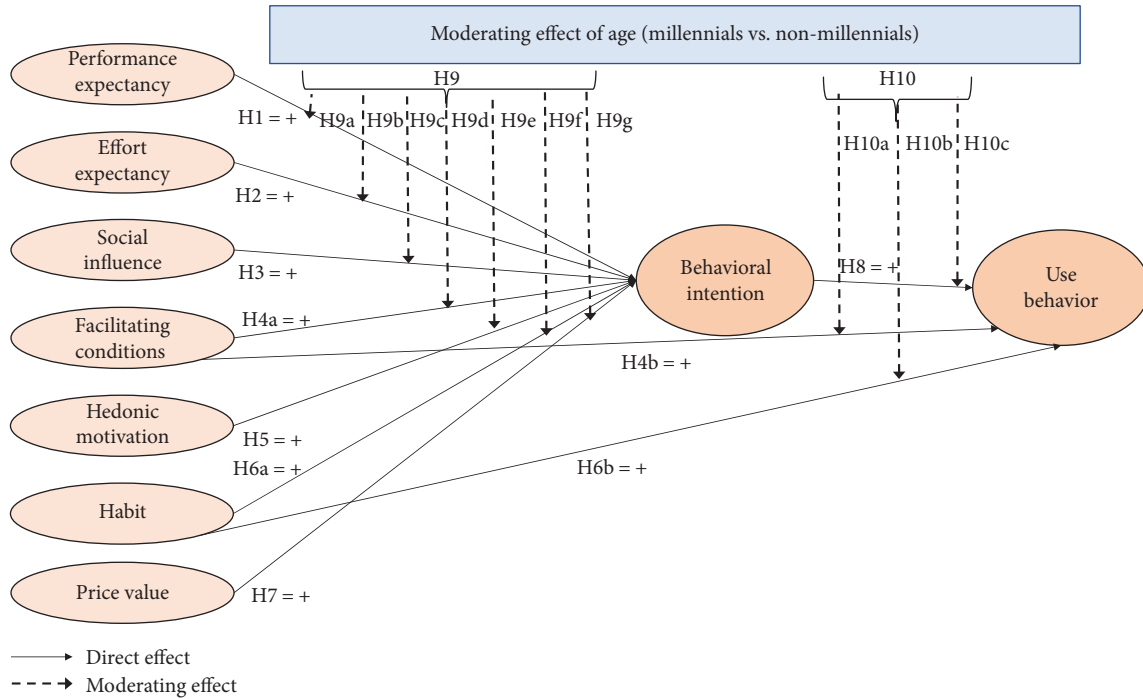
Figure 1: Research model.

H9b. Age plays a moderating role in the relationship between effort expectancy and intention to use smartphones in-store.

H9c. Age plays a moderating role in the relationship between social influence and intention to use smartphones in-store.

H9d. Age plays a moderating role in the relationship between facilitating conditions and intention to use smartphones in-store.

H9e. Age plays a moderating role in the relationship between hedonic motivations and intention to use smartphones in-store.

H9f. Age plays a moderating role in the relationship between habit and intention to use smartphones in-store.

H9g. Age plays a moderating role in the relationship between price value and intention to use smartphones in-store.

H10. Age ("millennials" vs "nonmillennials") plays a moderating role in the relationship between the three antecedents of the use behavior of smartphones in-store.

H10a. Age plays a moderating role in the relationship between facilitating conditions and the real behavior of using smartphones in-store.

H10b. Age plays a moderating role in the relationship between habit and the real behavior of using smartphones in-store.

H10c. Age plays a moderating role in the relationship between behavioral intention and the real behavior of using smartphones in-store.

To determine the impact of the different constructs on the behavioral intention to use a smartphone and use behavior, we developed a model with nine hypotheses related to the effect of age on customers' in-store use of their smartphones in an omnichannel context (Figure 1).

4. Research Method

4.1. Data Collection Procedure. Data were collected using a personal survey focusing on Spanish customers who use smartphones in physical stores. The measurement scale was adopted from Venkatesh et al. [22], and we developed the items related to use behavior from the results of previous reports [52, 53]. The performance expectancy, effort expectancy, facilitating conditions, and habit constructs are each composed of four items. Social influence, hedonic motivation, price value, and behavioral intention are each comprised of three items. Questions were answered on an eleven-point Likert scale, with 0 referring to totally disagree and 10 referring to totally agree. The instrument was pretested on four university marketing professors, and as a result, modifications were made to improve the content and make it more understandable and consistent. Thereafter, we conducted a pilot study with two groups (millennials and nonmillennials), using a paper version. The data were collected in November 2017. The sample consisted of 1043 individuals. Of the surveys collected, 40.7% were millennials (between 18 and 35 years) and 59.3% were nonmillennials

TABLE 1: Profile of respondents.

Characteristics	Frequency		Percentage (%)	
	Millennials	Nonmillennials	Millennials	Nonmillennials
Gender				
Male	219	309	51.5	50.0
Female	206	309	48.5	50.0
Level of education				
Primary education	54	160	12.7	25.9
Secondary education	261	214	61.4	34.6
University studies	110	244	25.9	39.5
Mobile data plans				
Yes	418	539	98.4	87.8
No	7	79	1.6	12.8

(older than 36 years). Table 1 summarizes the profile of the respondents.

4.2. Data Analysis Process. To test the hypotheses about the significance of the relationships in the model and the multigroup analysis, we used PLS-SEM (partial least square-structural equation modeling) [54]. Our objectives were to predict the intention to use mobile technology in a store in an omnichannel environment and identify the key drivers that explain use and use behavior. Hair et al. ([55], p. 144) recommend using PLS-SEM "if the goal is predicting key target constructs or identifying key 'driver' constructs," as in our case. Similarly, other authors suggest that PLS-SEM is appropriate when the research has a predictive purpose [56–59] and an explanatory purpose [60], as is the case with our study.

In this study, age is a categorical variable that integrates two groups: millennials and nonmillennials. The moderating influence of age has been analyzed through a multigroup analysis [61].

5. Results

5.1. Measurement Model. The reliability and validity of the measurement model were analyzed. We tested the measurement model in the general model to be able later to maintain the structure when executing the two models for the millennials and nonmillennials.

Subsequently, the structural model was analyzed and the effects of the exogenous variables on the endogenous variables were checked. Finally, a multisample analysis was carried out.

In the analysis of the measurement model, reliability and convergent and discriminant validity were verified. Regarding the reliability of the indicators, most factor loadings were >0.70 and had *t* values > 1.96, but two did not [62]. These two exceptions could be considered for removal based on composite reliability (CR) and convergent validity (AVE). Regarding the reliability of the scales used to measure the factors, the CR coefficient should, to establish internal consistency, be higher than 0.7 [63]. As to convergent validity, the AVE must be >0.5 [63]. The results in Table 2 show that all

the constructs fit these criteria. Given that the requirements of reliability and convergent validity have been met, we decided to maintain the indicators with loadings in the range of 0.4–0.7 [54]. Discriminant validity was measured by two methods. First, it was measured by comparing the correlation among constructs and the square root of the AVEs [64]. Secondly, we used the heterotrait-monotrait (HTMT) ratio, which has been established as a superior criterion [65]. The present study uses the more conservative level of 0.85 to assess discriminant validity. In Table 3, it can be seen that in all the cases the square root of the AVEs is greater than their corresponding intercorrelations and that all results are below the critical value of 0.85. Accordingly, both criteria for achieving discriminant validity are satisfied. These results allow us to confirm that the measuring instrument is reliable and valid.

5.2. Assessment of the Structural Model. First, we assessed the structural model for collinearity between items using the variance inflation factor (VIF) values (Table 4) [63]. The VIF values of this analysis are lower than 3.3 in all cases (complete model and millennial and nonmillennial models), so there are no problems of multicollinearity [66].

We now discuss the effects of the exogenous variables on behavioral intention and real behavior. Regarding the structural model, we analyzed (i) the R^2 (coefficient of determination), (ii) the Q^2 (predictive relevance of the model), and (iii) the algebraic sign, magnitude, and significance of the path coefficients [67]. The results show that the model has the capacity to explain both behavioral intention and use behavior. Overall, for the millennials, the variables performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, habit, and price value explain 71.8% of the variation in behavioral intention ($R^2 = 0.718$). For the nonmillennials, the R^2 is 0.685. Chin [68] argues that R^2 values of 0.67, 0.33, and 0.19 can be considered substantial, moderate, and weak, respectively. Thus, following this prescription, our research model "substantially" explains variations in behavioral intention to use smartphones in-store. The R^2 for use behavior was 0.498 for millennials and 0.546 for nonmillennials. In this case,

TABLE 2: Assessment results of the measurement model.

Construct/associated items	Loading	CR > 0.7	Cronbach's alpha	AVE > 0.5
Performance expectancy (PE)		0.951	0.890	0.830
PE1	0.902			
PE2	0.929			
PE3	0.896			
PE4	0.917			
Effort expectancy (EE)		0.958	0.941	0.851
EE1	0.902			
EE2	0.943			
EE3	0.949			
EE4	0.895			
Social influence (SI)		0.959	0.935	0.886
SI1	0.930			
SI2	0.956			
SI3	0.938			
Facilitating conditions (FC)		0.879	0.816	0.647
FC1	0.835			
FC2	0.846			
FC3	0.815			
FC4	0.714			
Hedonic motivation (HM)		0.969	0.951	0.911
HM1	0.949			
HM2	0.967			
HM3	0.948			
Price value (P)		0.943	0.910	0.847
P1	0.921			
P2	0.943			
P3	0.897			
Habit (HA)		0.947	0.926	0.818
HA1	0.919			
HA2	0.912			
HA3	0.857			
HA4	0.928			
Behavioral intention (BI)		0.981	0.972	0.946
BI1	0.973			
BI2	0.974			
BI3	0.971			
Use behavior (UB)		0.916	0.890	0.613
UB1	0.866			
UB2	0.701			
UB3	0.891			
UB4	0.896			
UB5	0.642			
UB6	0.823			
UB7	0.604			

the research model "moderately" explains the variations. Thus, the study demonstrates that UTAUT2 is appropriate to explain the in-store use of smartphones in an omnichannel context and explains variations in behavioral intention and use behavior [65]. Regarding the predictive power of the model, we used the Q^2 provided by PLS predict. Our results gave us 0.689 for the millennials and 0.651 for the nonmillennials for behavioral intention. For use behavior, it was 0.416

TABLE 3: Discriminant validity.

	PE	EE	SI	FC	HM	HA	P	BI	UB
PE	**0.911**	0.596	0.593	0.560	0.720	0.691	0.385	0.757	0.742
EE	0.559	**0.922**	0.359	0.811	0.621	0.531	0.410	0.545	0.567
SI	0.554	0.337	**0.941**	0.404	0.585	0.573	0.294	0.573	0.559
FC	0.492	0.710	0.355	**0.804**	0.599	0.448	0.487	0.532	0.485
HM	0.679	0.558	0.552	0.531	**0.955**	0.770	0.405	0.743	0.689
HA	0.644	0.499	0.534	0.394	0.726	**0.904**	0.319	0.829	0.774
P	0.354	0.380	0.272	0.420	0.376	0.294	**0.920**	0.383	0.364
BI	0.721	0.521	0.546	0.477	0.714	0.789	0.360	**0.973**	0.735
UB	0.682	0.521	0.511	0.417	0635	0.707	0.323	*0.686*	**0.783**

Note: values on the main diagonal are the square roots of the AVEs. Below the diagonal: correlations between the factors. Above the diagonal: ratio HTMT.85 criterion.

TABLE 4: Full collinearity VIFs.

	Total	Millennials	Nonmillennials
VIF behavioral intention			
PE	2.332	2.149	2.221
EE	2.449	1.946	2.290
SI	1.641	1.722	1.655
FC	2.229	1.869	2.177
HM	2.910	2.201	3.206
HA	2.422	2.118	2.495
P	1.280	1.215	1.253
VIF use behavior			
FC	1.296	1.219	1.258
HA	2.648	2.719	2.346
BI	2.893	2.928	2.560

for millennials and 0.501 for nonmillennials. Table 5 also shows the explained variance of each factor for each group. It can be seen that the direct effects of effort expectancy (−0.045) and price value (−0.002) are negative for millennials. They are negative also for nonmillennials for price value (−0.002). According to Falk and Miller [69], "when the original relationship between the two variables is so close to zero, the difference in the signs simply reflects random variation around zero." In summary, the results support seven of the hypotheses for the millennial group: H1 (regarding the influence of performance expectancy), H3 (social influence), H4a (facilitating conditions), H5 (hedonic motivation), H6a (regarding habit), H8 (behavioral intention), and H7 (regarding the influence of habit on use behavior). H2 (effort expectancy), H7 (price value), and H4b (regarding the influence of facilitation conditions on use behavior) were rejected, as the relationships were not significant. With regard to the nonmillennials, support was found for seven hypotheses, H1, H5, H6a, H7, H8, H4b, and H6b, while no significant differences were found for H2, H3, and H4a (Table 5).

5.3. Multigroup Analysis. We carried out a multigroup analysis to verify the moderating effect of age on intention to use smartphones in-store and real behavior. For this purpose, the sample was split into two groups, millennials and nonmillennials. We

followed a three-step procedure to analyze the measurement invariance of composite models (MICOM). Following the proposals of Henseler et al. [70], we first checked configural invariance, then compositional invariance, and finally, we assessed the equal means and variances.

As Table 6 illustrates, partial measurement invariance for both groups was achieved for all model variables, thereby allowing multigroup comparison between groups.

We next performed two nonparametric tests, Henseler's test [70] and the permutation test. These were used as both are nonparametric tests, and they fit well with the nonparametric character of PLS-SEM [71].

Table 7 shows the p values of Henseler's tests in the P_H column. The last column of the table shows the p values of the permutation test. In this test, the differences are only significant at the 5% level if the p value is less than 0.05. We used 5000 permutations and 5000 bootstrap resamples. Henseler's test shows significant differences between millennials and nonmillennials only in the effect of price value on behavioral intention and habit on use behavior. The permutation test, which is considered the best technique [72], confirms the lack of significance of the differences shown in the results, except in the case of the relationship between behavioral intention (H10c) and habit (H10b) on use behavior of smartphones in-store in an omnichannel context.

5.4. Assessment of Predictive Validity Using PLSpredict. With the objective of producing valid predictions of behavioral intention and use behavior, we used PLSpredict for the general model and the millennial and nonmillennial models. We carried out the new PLSpredict technique using SmartPLS software version 3.2.7.

In general, for the simple models with minimal theoretical constraints, PLSpredict allows predictions very close to those obtained by using LM [59]. This study follows this approach and Felipe et al.'s [73] to assess the predictive performance of the PLS path model for the indicators and constructs. We obtain the mean absolute error (MAE), the root mean squared error (RMSE), and the Q^2 for indicators. Moreover, we also obtained the Q^2 for the constructs behavioral intention and use behavior.

In order to assess predictive performance, we carried out the benchmark procedures developed by the SmartPLS team

TABLE 5: Effect of endogenous variables, p values, and support for the hypotheses.

	R^2	Q^2	Direct effects	Correlations	Explained variance	p value	Confidence intervals	Support for hypotheses
				Millennials				
Behavioral intention	0.718	0.689						
H1: PE ≥ BI			0.254	0.697	17.70%	0.000	[0.173, 0.337]	H1: supported
H2: EE ≥ BI			−0.045	0.439	−1.98%	0.241	[−0.120, 0.030]	H2: nonsupported
H3: SI ≥ BI			0.075	0.569	4.27%	0.039	[0.003, 0.146]	H3: supported
H4a: FC ≥ BI			0.087	0.424	3.69%	0.014	[0.016, 0.155]	H4a: supported
H5: HM ≥ BI			0.114	0.648	7.39%	0.030	[0.015, 0.220]	H5: supported
H6a: HA ≥ BI			0.514	0.795	40.86%	0.000	[0.428, 0.594]	H6a: supported
H7: P ≥ BI			−0.002	0.232	−0.05%	0.941	[−0.061, 0.054]	H7: nonsupported
Use behavior	0.498	0.416						
H8: BI ≥ UB			0.442	0.683	30.19%	0.000	[0.314, 0.560]	H8: supported
H4b: FC ≥ UB			0.052	0.334	1.74%	0.134	[−0.017, 0.119]	H4b: nonsupported
H6b: HA ≥ UB			0.276	0.645	17.80%	0.000	[0.144, 0.406]	H6b: supported
				Nonmillennials				
Behavioral intention	0.685	0.651						
H1: PE ≥ BI			0.275	0.704	19.36%	0.000	[0.185, 0.364]	H1: supported
H2: EE ≥ BI			−0.002	0.492	−0.10%	0.960	[−0.075, 0.070]	H2: nonsupported
H3: SI ≥ BI			0.036	0.527	1.90%	0.341	[−0.038, 0.112]	H3: nonsupported
H4a: FC ≥ BI			0.064	0.452	2.89%	0.083	[−0.006, 0.137]	H4a: nonsupported
H5: HM ≥ BI			0.132	0.718	9.48%	0.015	[0.025, 0.236]	H5: supported
H6a: HA ≥ BI			0.426	0.757	32.25%	0.000	[0.331, 0.516]	H6a: supported
H7: P ≥ BI			0.074	0.372	2.75%	0.005	[0.022, 0.126]	H7: supported
Use behavior	0.546	0.501						
H8: BI ≥ UB			0.196	0.644	12.62%	0.000	[0.102, 0.302]	H8: supported
H4b: FC ≥ UB			0.112	0.391	4.38%	0.000	[0.064, 0.164]	H4b: supported
H6b: HA ≥ UB			0.526	0.715	37.61%	0.000	[0.412, 0.622]	H6b: supported

[74]: "The Q^2 value, which compares the prediction errors of the PLS path model against simple mean predictions. If the Q^2 value is positive, the prediction error of the PLS-SEM results is smaller than the prediction error of simply using the mean values. Accordingly, the PLS-SEM model offers an appropriate predictive performance." As Table 8 shows, this is true both at construct and at indicator levels for the general model and for the millennial and nonmillennial models.

In addition, if we compare the results of PLS with LM, the differences between PLS and PLS-LM are very small (these differences are shown in the PLS-LM column of Table 8). The Q^2 differences are less than 0.06, which is an indicator of a good predictive capacity; and the differences between RMSE and MAE are around 0.1.

6. Discussion and Conclusions

Technology is changing the way customers shop in the omnichannel era. Smartphones have become essential tools in daily life and are increasingly gaining importance for shopping in brick and mortar stores. More and more people use them to look for information and make purchases. This research explains how customers behave with regard to the in-store use of smartphones. Specifically, this study aims at analyzing the key factors that influence both customers' intention to use their devices in physical stores and their actual use of those devices. It also seeks to deepen this understanding by assessing the differences between the millennial and nonmillennial generations. To this end, the UTAUT2 model [22] was adapted, and its specific applicability to the consumer context was confirmed by applying it to a new technology (in-store use of smartphones). Our research has theoretical implications since the results reveal that the UTAUT2 model holds good predictive power and is able to explain well the behavioral intention and use behavior of smartphones in-store for both groups, millennials and nonmillennials. Although previous researchers have examined m-shopping in general, a few studies have focused on the in-store use of smartphones. Specifically, this research advances the understanding of the antecedents of the use of smartphones in-store in the new omnichannel retailing context, where customers use different channels simultaneously.

The results indicate that habit, performance expectancy, and hedonic motivation are the strongest predictors of in-store smartphone use for both groups (millennials and nonmillennials). This is consistent with the findings of previous studies in other contexts (e.g., [12, 17, 22,

Table 6: Results of the measurement invariance of composite models (MICOM) procedure.

Construct	Step 1	Step 2		Step 3a				Step 3b				Measurement invariance?
	Configural invariance	Compositional invariance		Equal variances				Equal means				
		Original correlation	5%	Partial measurement invariance established	Variance-original difference	2.5%	97.5%	Equal	Mean-original difference	2.5%	97.5%	Equal	
PE	Yes	1.000	1.000	Yes	0.573	−0.130	0.121	No	−0.171	−0.112	0.111	No	Partial
EE	Yes	1.000	1.000	Yes	0.850	−0.123	0.121	No	−0.526	−0.121	0.124	No	Partial
SI	Yes	1.000	1.000	Yes	0.185	−0.128	0.120	No	−0.024	−0.133	0.133	Yes	Partial
FC	Yes	0.999	0.997	Yes	0.563	−0.127	0.117	No	−0.577	−0.173	0.168	No	Partial
HM	Yes	1.000	1.000	Yes	0.637	−0.132	0.124	No	−0.079	−0.129	0.128	Yes	Partial
HA	Yes	1.000	1.000	Yes	0.563	−0.128	0.122	No	0.319	−0.192	0.171	No	Partial
P	Yes	1.000	0.999	Yes	0.459	−0.121	0.126	No	−0.424	−0.185	0.171	No	Partial
BI	Yes	1.000	1.000	Yes	0.539	−0.126	0.119	No	0.044	−0.135	0.114	Yes	Partial
UB	Yes	1.000	0.999	Yes	0.599	−0.132	0.123	No	0.106	−0.176	0.148	Yes	Partial

TABLE 7: Multigroup comparison for the intention to use a smartphone in-store: millennials vs. nonmillennials.

Relationships	Nonmillennials	Millennials	Path coefficient differences	P_H	p value permutation test
H9a: PE ≥ BI	0.275	0.254	0.021	0.635	0.748
H9b: EE ≥ BI	−0.002	−0.045	0.043	0.792	0.477
H9c: SI ≥ BI	0.036	0.075	0.039	0.230	0.457
H9d: FC ≥ BI	0.064	0.087	0.023	0.328	0.678
H9e: HM ≥ BI	0.132	0.114	0.088	0.594	0.837
H9f: HA ≥ BI	0.426	0.514	0.088	0.085	0.186
H9g: P ≥ BI	0.074	−0.002	0.076	0.026	0.055
H10a: FC ≥ UB	0.112	0.052	0.060	0.087	0.135
H10b: HA ≥ UB	0.526	0.276	0.250	0.002	0.003
H10c: BI ≥ UB	0.196	0.442	0.246	0.002	0.006

Notes: P_H = p value Henseler's test.

29, 32, 35]). On the other hand, we did not find significant differences between the groups regarding the effect of effort expectancy on the intention to use smartphones in-store. This result differs from previous studies; this has always been considered one of the variables that most explains the intention to use a new technology. This lack of empirical evidence may be due to the absence of incremental effort perception, on the part of consumers, of in-store mobile use. Both millennials and nonmillennials use mobile phones in their daily lives; therefore, it should not be an additional effort to use them in the purchasing process.

Analyzing the results by group, first focusing on the millennial generation, it can be seen that price value does not influence the intention to use smartphones. This may be because young people do not take into account the price of internet data, as the cost has fallen since Venkatesh's 2012 study. As can be seen in the sample, 98.4% of them access mobile data, which they assume is normal. Another explanation for this result is that the Internet is now widely available due to the introduction of Wi-Fi open access points in cities and in physical stores and more and more of these offer free Wi-Fi. In addition, no significant differences were found regarding the effect of facilitating conditions on use behavior of smartphones in-store. This result is in line with the studies of Baptista and Oliveira [26] and Chopdar et al. [34], but contrary to the findings of Venkatesh et al. [22]. The explanation for this may be that the millennial generation is accustomed to new technologies and devices and they believe that they have enough skills to use their mobile phones and do not give importance to supporting factors.

For the nonmillennial group, social influence did not play a significant role in affecting behavioral intention to use smartphones in-store during the shopping process. The insignificant impact of this construct on behavioral intention suggests that older consumers are not influenced by other people. The explanation for this may be that the use of smartphones is perceived as a private activity. This result is consistent with the studies of Hew et al. [27] and Chopdar et al. [34]. In addition, facilitating conditions have an insignificant impact on intention to use smartphones in-store. A possible explanation for this result may be that today people habitually use mobiles in their daily lives and, therefore, they

consider themselves self-sufficient in their use, including in the shopping context.

The results also confirm the influence of behavioral intention on use behavior. In other words, the greater a customer's perceived intention to use a smartphone in-store is, the more likely he or she is to actually use it. This result is in line with the recent studies of Chopdar et al. [34], Escobar-Rodríguez and Carvajal-Trujillo [29], and Venkatesh et al. [22]. Specifically, the proposed model explains 71.8% of the intention to use smartphones in-store by millennials and 68.5% for the nonmillennial group. In addition, the R^2 for use behavior was 49.8% for millennials and 54.6% for nonmillennials. The R^2 results we obtained were "weakly" lower than the variance values obtained by previous studies. For example, Chopdar et al. [34] obtained an R^2 value for BI 0.70 and an R^2 for UB 0.59 for the adoption of mobile shopping apps in the USA and an R^2 for BI 0.63 and an R^2 for UB 0.58 for India; Escobar-Rodríguez and Carvajal-Trujillo [29] obtained values of R^2 on BI 0.60 and R^2 on UB 0.6 for purchasing tickets online; and Venkatesh et al. [22] obtained values of R^2 on BI 0.74 and R^2 on UB 0.52 in the context of mobile technology.

Moreover, the model shows predictive power for the sample used in the research. This means that the model provides more information than noise, and the seven drivers predict accurately the behavioral intention to use smartphones in-store and real behavior.

Regarding the moderating role of age, our results indicate that, although millennials are considered digital natives and early adopters of technological devices, there are no differences between them and nonmillennials in terms of intention to use a smartphone in-store. This result is inconsistent with the findings of Bigne et al. [23] and Yang and Forney, [24]. The only differences found between the groups are in terms of the relationship between the behavioral intention and habit constructs on use behavior of smartphones in-store in an omnichannel context.

With regard to managerial implications, clothing retailers should develop user-friendly, useful, effective, and enjoyable apps and/or responsive websites to provide customers with a complete and seamless shopping experience when using their smartphones, as this research shows that consumers

TABLE 8: PLS predict assessment.

Construct prediction summary

	Q^2		
	Complete model	Millennials	Nonmillennials
BI	0.654	0.689	0.651
UB	0.503	0.416	0.501

Indicator prediction summary

Complete model

	PLS			LM			PLS-LM		
	RMSE	MAE	Q^2	RMSE	MAE	Q^2	RMSE	MAE	Q^2
BI1	1801	1368	0.682	1801	1337	0.682	0.000	0.031	0.000
BI2	1894	1469	0.659	1878	1420	0.665	0.016	0.049	−0.006
BI3	1851	1402	0.679	1859	1383	0.677	−0.008	0.019	0.002
UB1	2111	1640	0.466	2013	1515	0.515	0.098	0.125	−0.049
UB2	2192	1631	0.423	2123	1573	0.458	0.069	0.058	−0.035
UB3	2227	1673	0.396	2179	1618	0.423	0.048	0.055	−0.027
UB4	2296	1667	0.337	2278	1647	0.347	0.018	0.020	−0.010
UB5	2761	2349	0.292	2679	2193	0.334	0.082	0.156	−0.042
UB6	2575	1997	0.253	2581	2001	0.250	−0.006	−0.004	0.003
UB7	2233	1485	0.186	2243	1510	0.180	−0.010	−0.025	0.006

Millennials

	RMSE	MAE	Q^2	RMSE	MAE	Q^2	RMSE	MAE	Q^2
BI1	1808	1394	0.673	1832	1375	0.665	−0.024	0.019	0.008
BI2	1873	1473	0.641	1897	1445	0.632	−0.024	0.028	0.009
BI3	1866	1435	0.67	1926	1438	0.649	−0.060	−0.003	0.021
UB1	2288	1861	0.396	2259	1760	0.411	0.029	0.101	−0.015
UB2	2345	1892	0.372	2316	1836	0.387	0.029	0.056	−0.015
UB3	2409	1937	0.325	2421	1905	0.318	−0.012	0.032	0.007
UB4	2586	2012	0.288	2627	2027	0.266	−0.041	−0.015	0.022
UB5	2964	2532	0.156	2942	2412	0.168	0.022	0.120	−0.012
UB6	2750	2296	0.19	2829	2332	0.142	−0.079	−0.036	0.048
UB7	2540	1879	0.143	2624	1958	0.086	−0.084	−0.079	0.057

Nonmillennials

	RMSE	MAE	Q^2	RMSE	MAE	Q^2	RMSE	MAE	Q^2
BI1	1809	1358	0.642	1839	1350	0.63	−0.030	0.008	0.012
BI2	1921	1471	0.623	1940	1441	0.616	−0.019	0.030	0.007
BI3	1860	1398	0.647	1881	1396	0.639	−0.021	0.002	0.008
UB1	1965	1453	0.453	1900	1384	0.489	0.065	0.069	−0.036
UB2	2076	1427	0.41	2056	1432	0.422	0.020	−0.005	−0.012
UB3	2089	1475	0.408	2075	1472	0.416	0.014	0.003	−0.008
UB4	2068	1405	0.346	2095	1430	0.329	−0.027	−0.025	0.017
UB5	2447	2039	0.313	2466	1987	0.302	−0.019	0.052	0.011
UB6	2436	1761	0.253	2476	1778	0.228	−0.040	−0.017	0.025
UB7	2006	1210	0.196	2024	1259	0.181	−0.018	−0.049	0.015

Notes: BI: behavioral intention. US: use behavior RMSE: root mean squared error. MAE: mean absolute error. PLS: partial least pquares math model. LM: linear model.

perceive both the utilitarian and the hedonic benefits of using their smartphones in-store. Consumers are becoming more and more accustomed to using their mobile phones in their daily lives, and therefore, retailers and managers should facilitate the use of smartphones and integrate them in their physical stores. In this way, when customers are in a store they can get all the information they need about products, inventories, and the possibility of buying online to avoid queues. If all of this information is available in the retailer's app, then this will be registered and the retailers can use this huge amount of data to offer suggestions for future purchases and the personalization of products and offers. Moreover, smartphones increasingly offer the possibility of paying without using a credit card. Therefore, managers are

recommended to facilitate this by providing checkouts that integrate this technology. In addition, the management of fashion retail stores with a target market over 35 years of age should bear in mind that these nonmillennials are not influenced by the opinions of others (friends, family, and celebrities), and we recommend that they rethink the use of the resources that they dedicate to hire influencers to publicize their products.

This paper has some limitations. Specifically, the study focuses on clothing retailers and the sample is limited to Spain. Although the sample is very complete in terms of gender, age, and educational level, it would be interesting, to generalize the results, to replicate the study in other sectors and countries with different levels of penetration of smartphone use in-store during the shopping process. In addition, we consider it necessary to rethink the price-value construct, because the reduction in the cost of accessing mobile data has diminished the importance of this cost. Additionally, future papers should analyze the influence of other constructs, such as security and trust, to test whether the inclusion of these variables would improve the predictive value of both behavioral intention and actual in-store smartphone use. It would also be interesting to analyze the influence of other moderating variables, such as gender and personal innovativeness.

Although the mobile phone is revolutionizing the purchasing process, the physical store is still the preferred channel to make purchases. It is important for retailers to think of the physical store not only in terms of sales generation but also as a means of enriching the user's engagement with the consumer experience and the services that can only be offered in the physical channel. Consumers are ahead of retailers: their digitization, in all respects, occurred before the retailers. They enter physical stores, often having researched information online, with more knowledge and demands than ever before. And they expect a brand experience, ahead of the channel. As omnichannel shopping and, more specifically, m-shopping research, remain in their infancy, there are several research gaps, so further work to examine consumer acceptance models is needed.

Data Availability

The database used to support the findings of this study is available from the corresponding author upon request.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

Acknowledgments

References

[1] A. Mosquera, C. Olarte Pascual, and E. Juaneda Ayensa, "Understanding the customer experience in the age of omnichannel shopping," *ICONO 14*, vol. 15, no. 2, pp. 92–114, 2017.

[2] C. B. Rippé, S. Weisfeld-Spolter, Y. Yurova, A. J. Dubinsky, and D. Hale, "Under the sway of a mobile device during an in-store shopping experience," *Psychology & Marketing*, vol. 34, no. 7, pp. 733–752, 2017.

[3] V. Shankar, "Shopper marketing 2.0: opportunities and challenges," in *Shopper Marketing and the Role of In-Store Marketing (Volume 11)*, pp. 189–208, Emerald Group Publishing Ltd, 2014.

[4] E. Voropanova, "Conceptualizing smart shopping with a smartphone: implications of the use of mobile devices for shopping productivity and value," *The International Review of Retail, Distribution and Consumer Research*, vol. 25, no. 5, pp. 529–550, 2015.

[5] H. R. Marriott, M. D. Williams, and Y. K. Dwivedi, "What do we know about consumer m-shopping behaviour?," *International Journal of Retail & Distribution Management*, vol. 45, no. 6, pp. 568–586, 2017.

[6] M.-C. Hung, S.-T. Yang, and T.-C. Hsieh, "An examination of the determinants of mobile shopping continuance," *International Journal of Electronic Business Management*, vol. 10, no. 1, pp. 29–37, 2012.

[7] S. Agrebi and J. Jallais, "Explain the intention to use smartphones for mobile shopping," *Journal of Retailing and Consumer Services*, vol. 22, pp. 16–23, 2015.

[8] E. Ko, E. Y. Kim, and E. K. Lee, "Modeling consumer adoption of mobile shopping for fashion products in Korea," *Psychology and Marketing*, vol. 26, no. 7, pp. 669–687, 2009.

[9] A. A. Ozok and J. Wei, "An empirical comparison of consumer usability preferences in online shopping using stationary and mobile devices: results from a college student population," *Electronic Commerce Research*, vol. 10, no. 2, pp. 111–137, 2010.

[10] S. San-Martín, B. López-Catalán, and M. A. Ramón-Jerónimo, "Mobile shoppers: types, drivers, and impediments," *Journal of Organizational Computing and Electronic Commerce*, vol. 23, no. 4, pp. 350–371, 2013.

[11] J. H. Wu and Y. M. Wang, "Development of a tool for selecting mobile shopping site: a customer perspective," *Electronic Commerce Research and Applications*, vol. 5, no. 3, pp. 192–200, 2006.

[12] K. Yang, "Determinants of US consumer mobile shopping services adoption: implications for designing mobile shopping services," *Journal of Consumer Marketing*, vol. 27, no. 3, pp. 262–270, 2010.

[13] S. Yang, "Role of transfer-based and performance-based cues on initial trust in mobile shopping services: a cross-environment perspective," *Information Systems and e-Business Management*, vol. 14, no. 1, pp. 47–70, 2016.

[14] L. Y. Chen, "Antecedents of customer satisfaction and purchase intention with mobile shopping system use," *International Journal of Services and Operations Management*, vol. 15, no. 3, pp. 259–274, 2013.

[15] M. Groß, "Exploring the acceptance of technology for mobile shopping: an empirical investigation among smartphone users," *The International Review of Retail, Distribution and Consumer Research*, vol. 25, no. 3, pp. 215–235, 2014.

[16] K. Yang and H.-Y. Kim, "Mobile shopping motivation: an application of multiple discriminant analysis," *International Journal of Retail & Distribution Management*, vol. 40, no. 10, pp. 778–789, 2012.

[17] M. Groß, "Mobile shopping: a classification framework and literature review," *International Journal of Retail & Distribution Management*, vol. 43, no. 3, pp. 221–241, 2015.

[18] A. Holmes, A. Byrne, and J. Rowley, "Mobile shopping behaviour: insights into attitudes, shopping process involvement and location," *International Journal of Retail & Distribution Management*, vol. 42, no. 1, pp. 25–39, 2013.

[19] I. K. W. Lai and D. C. F. Lai, "User acceptance of mobile commerce: an empirical study in Macau," *International Journal of Systems Science*, vol. 45, no. 6, pp. 1321–1331, 2013.

[20] R. J.-H. Wang, E. C. Malthouse, and L. Krishnamurthi, "On the go: how mobile shopping affects customer purchase behavior," *Journal of Retailing*, vol. 91, no. 2, pp. 217–234, 2015.

[21] A. Mosquera, C. Olarte-Pascual, E. Juaneda Ayensa, and Y. Sierra Murillo, "The role of technology in an omnichannel physical store: assessing the moderating effect of gender," *Spanish Journal of Marketing–ESIC*, vol. 22, no. 1, pp. 63–82, 2018.

[22] V. Venkatesh, J. Y. L. Thong, and X. Xu, "Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology," *MIS Quarterly*, vol. 36, no. 1, pp. 157–178, 2012.

[23] E. Bigne, C. Ruiz, and S. Sanz, "The impact of internet user shopping patterns and demographics on consumer mobile buying behaviour," *Journal of Electronic Commerce Research*, vol. 6, no. 3, pp. 193–209, 2005.

[24] K. Yang and J. C. Forney, "The moderating role of consumer technology anxiety in mobile shopping adoption: differential effects of facilitating conditions and social influences," *Journal of Electronic Commerce Research*, vol. 14, pp. 334–347, 2013.

[25] V. Venkatesh, M. Morris, G. Davis, and F. Davis, "User acceptance of information technology: toward a unified view," *MIS Quarterly*, vol. 27, no. 3, pp. 425–478, 2003.

[26] G. Baptista and T. Oliveira, "Understanding mobile banking: the unified theory of acceptance and use of technology combined with cultural moderators," *Computers in Human Behavior*, vol. 50, pp. 418–430, 2015.

[27] J. Hew, V. Lee, K. Ooi, and J. Wei, "What catalyses mobile apps usage intention: an empirical analysis," *Industrial Management & Data Systems*, vol. 115, no. 7, pp. 1269–1291, 2015.

[28] E. Juaneda-Ayensa, A. Mosquera, and Y. Sierra Murillo, "Omnichannel customer behavior: key drivers of technology acceptance and use and their effects on purchase intention," *Frontiers in Psychology*, vol. 7, 2016.

[29] T. Escobar-Rodriguez and E. Carvajal-Trujillo, "Online purchasing tickets for low cost carriers: an application of the unified theory of acceptance and use of technology (UTAUT) model," *Tourism Management*, vol. 43, pp. 70–88, 2014.

[30] T. Tsu Wei, G. Marthandan, A. Yee-Loong Chong, K. B. Ooi, and S. Arumugam, "What drives Malaysian m-commerce adoption? An empirical analysis," *Industrial Management & Data Systems*, vol. 109, no. 3, pp. 370–388, 2009.

[31] S. A. Brown and V. Venkatesh, "Model of adoption of technology in households: a baseline model test and extension incorporating household life cycle," *MIS Quarterly*, vol. 29, no. 3, pp. 399–436, 2005.

[32] M. Limayem, S. G. Hirt, and C. M. K. Cheung, "How habit limits the predictive power of intention: the case of information systems continuance," *MIS Quarterly*, vol. 31, no. 4, pp. 705–737, 2007.

[33] B. Kim, "The diffusion of mobile data services and applications: exploring the role of habit and Its antecedents," *Telecommunications Policy*, vol. 36, no. 1, pp. 69–81, 2012.

[34] P. K. Chopdar, N. Korfiatis, V. J. Sivakumar, and M. D. Lytras, "Mobile shopping apps adoption and perceived risks: a cross-country perspective utilizing the unified theory of acceptance and use of technology," *Computers in Human Behavior*, vol. 86, pp. 109–128, 2018.

[35] J. Aldás-Manzano, C. Ruiz-Mafé, and S. Sanz-Blas, "Exploring individual personality factors as drivers of M-shopping acceptance," *Industrial Management & Data Systems*, vol. 109, no. 6, pp. 739–757, 2009.

[36] P. A. Dabholkar and R. P. Bagozzi, "An attitudinal model of technology-based self-service: moderating effects of consumer traits and situational factors," *Journal of the Academy of Marketing Science*, vol. 30, no. 3, pp. 184–201, 2002.

[37] P. A. Dabholkar, L. Michelle Bobbitt, and E.-J. Lee, "Understanding consumer motivation and behavior related to self-scanning in retailing," *International Journal of Service Industry Management*, vol. 14, no. 1, pp. 59–95, 2003.

[38] E. W. Baker, S. S. Al-Gahtani, and G. S. Hubona, "The effects of gender and age on new technology implementation in a developing country: testing the theory of planned behavior (TPB)," *Information Technology & People*, vol. 20, no. 4, pp. 352–375, 2007.

[39] B. Hernández, J. Jiménez, and M. José Martín, "Age, gender and income: do they really moderate online shopping behaviour?," *Online Information Review*, vol. 35, no. 1, pp. 113–133, 2009.

[40] A. Hall and N. Towers, "Understanding how millennial shoppers decide what to buy: digitally connected unseen journeys," *International Journal of Retail and Distribution Management*, vol. 45, no. 5, pp. 498–517, 2017.

[41] M. J. Haught, R. Wei, Y. Xuerui, and J. Zhang, "Understanding the psychology of mobile phone use and mobile shopping of the 1990s cohort in China: a lifestyle approach," *International Journal of Online Marketing*, vol. 4, no. 3, pp. 68–84, 2014.

[42] A. Siva Kumar and A. Gunasekaran, "An empirical study on the factors affecting online shopping behavior of millennial consumers," *Journal of Internet Commerce*, vol. 16, no. 3, pp. 219–230, 2017.

[43] W. Strauss and N. Howe, *Generations: The History of America's Future, 1584 to 2069*, William Morrow & Company, New York, NY, USA, 1991.

[44] J. Palfrey and U. Gasser, "Born digital: understanding the first generation of digital natives," *Hedgehog Review*, vol. 198, p. 288, 2008.

[45] T. Natarajan, S. A. Balasubramanian, and D. L. Kasilingam, "The moderating role of device type and age of users on the intention to use mobile shopping applications," *Technology in Society*, vol. 53, pp. 79–90, 2018.

[46] P. Acheampong, L. Zhiwen, F. Boateng, A. B. Boadu, and A. A. Acheampong, "Determinants of behavioral intentions of 'Generation - Y' adoption and use of computer-mediated communication tools in Ghana," *British Journal of Interdisciplinary Research*, vol. 8, no. 1, 2017.

[47] S. Ha and L. Stoel, "Consumer e-shopping acceptance: ante-cedents in a technology acceptance model," *Journal of Business Research*, vol. 62, no. 5, pp. 565–571, 2009.

[48] J.-W. Lian and D. C. Yen, "Online shopping drivers and barriers for older adults: age and gender differences," *Computers in Human Behavior*, vol. 37, pp. 133–143, 2014.

[49] F. Liébana-Cabanillas, J. Sánchez-Fernández, and F. Muñoz-Leiva, "Antecedents of the adoption of the new mobile payment systems: the moderating effect of age," *Computers in Human Behavior*, vol. 35, pp. 464–478, 2014.

[50] C.-S. Yu, "Factors affecting individuals to adopt mobile banking: empirical evidence from the UTAUT model," *Journal of Electronic Commerce Research*, vol. 13, pp. 104–121, 2012.

[51] D. Grewal, C. P. Ahlbom, L. Beitelspacher, S. M. Noble, and J. Nordfält, "In-store mobile phone use and customer shopping behavior: evidence from the field," *Journal of Marketing*, vol. 82, no. 4, pp. 102–126, 2018.

[52] Gfk, *Consumers' Activities with Mobile Phones in Stores (Vol. 6)*, Springer India, 2015.

[53] Smartme Analytics, *Mobile Millenials 25-34: Entiende Cómo Conectar con ellos en su Móvil*, Smartme Analytics, 2017.

[54] S. M. Rasoolimanesh, C. M. Ringle, M. Jaafar, and T. Ramayah, "Urban vs. rural destinations: residents' perceptions, community participation and support for tourism development," *Tourism Management*, vol. 60, pp. 147–158, 2017.

[55] J. F. Hair, C. M. Ringle, and M. Sarstedt, "PLS-SEM: indeed a silver bullet," *Journal of Marketing Theory and Practice*, vol. 19, no. 2, pp. 139–152, 2011.

[56] G. Cepeda Carrión, J. Henseler, C. M. Ringle, and J. L. Roldán, "Prediction-oriented modeling in business research by means of PLS path modeling: introduction to a JBR special section," *Journal of Business Research*, vol. 69, no. 10, pp. 4545–4551, 2016.

[57] G. Shmueli, "To explain or to predict?," *Statistical Science*, vol. 25, no. 3, pp. 289–310, 2010.

[58] G. Shmueli and O. R. Koppius, "Predictive analytics in information systems research," *MIS Quarterly*, vol. 35, no. 3, pp. 553–572, 2011.

[59] G. Shmueli, S. Ray, J. M. Velasquez Estrada, and S. B. Chatla, "The elephant in the room: predictive performance of PLS models," *Journal of Business Research*, vol. 69, no. 10, pp. 4552–4564, 2016.

[60] J. Henseler, "Partial least squares path modeling: quo vadis?," *Quality and Quantity*, vol. 52, no. 1, pp. 1–8, 2018.

[61] J. Henseler and G. Fassott, "Testing moderating effects in PLS path models: an illustration of available procedures," in *Hanbook of Partial Least Squares*, pp. 713–735, Springer Berlin Heidelberg, Heidelberg, 2010.

[62] J. F. Hair Jr., C. M. Ringle, and M. Sarstedt, "Partial least squares structural equation modeling: rigorous applications, better results and higher acceptance," *Long Range Planning*, vol. 46, no. 1-2, pp. 1–12, 2013.

[63] J. F. Hair, G. T. M. Hult, C. M. Ringle, and M. Sarstedt, *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*, SAGE Publications, Los Angeles, 2nd edition, 2017.

[64] J. L. Roldán and M. J. Sánchez-Franco, "Variance-based structural equation modeling: guidelines for using partial least squares in information systems research," in *Research Methodologies, Innovations and Philosophies in Software Systems Engineering and Information Systems*, pp. 193–221, IGI Global, 2012.

[65] J. Henseler, C. M. Ringle, and M. Sarstedt, "A new criterion for assessing discriminant validity in variance-based structural equation modeling," *Journal of the Academy of Marketing Science*, vol. 43, no. 1, pp. 115–135, 2015.

[66] S. Petter, D. Straub, and A. Rai, "Specifying formative constructs in information systems research," *MIS Quarterly*, vol. 31, no. 4, pp. 623–656, 2007.

[67] J. F. Hair, M. Sarstedt, C. M. Ringle, and J. A. Mena, "An assessment of the use of partial least squares structural equation modeling in marketing research," *Journal of the Academy of Marketing Science*, vol. 40, no. 3, pp. 414–433, 2012.

[68] W. Chin, "The partial least squares approach to structural equation modeling," in *Methodology for Business and Management. Modern Methods for Business Research*, G. A. Marcoulides, Ed., pp. 295–336, Lawrence Erlbaum Associates Publishers, Mahwah, NJ, USA, 1998.

[69] R. F. Falk and N. B. Miller, *A Primer for Soft Modeling*, University of Akron Press, 1992.

[70] J. Henseler, C. M. Ringle, and M. Sarstedt, "Testing measurement invariance of composites using partial least squares," *International Marketing Review*, vol. 33, no. 3, pp. 405–431, 2016.

[71] M. Sarstedt, J. Henseler, and C. M. Ringle, "Multigroup analysis in partial least squares (PLS) path modeling: alternative methods and empirical results," in *Measurement and Research Methods in International Marketing*, pp. 195–218, Emerald Group Publishing Limited, 2011.

[72] W. W. Chin and J. Dibbern, "An introduction to a permutation based procedure for multi-group PLS analysis: results of tests of differences on simulated data and a cross cultural analysis of the sourcing of information system services between Germany and the USA," in *Handbook of Partial Least Squares. Springer Handbooks of Computational Statistics*, V. Esposito Vinzi, W. Chin, J. Henseler, and H. Wang, Eds., Springer, Berlin, Heidelberg, 2010.

[73] C. M. Felipe, J. L. Roldán, and A. L. Leal-Rodríguez, "Impact of organizational culture values on organizational agility," *Sustainability*, vol. 9, no. 12, article 2354, 2017.

[74] C. M. Ringle, S. Wende, and J. M. Becker, *Smart PLS 3*, Smart PLS Gmb H, Boenningstedt, 2015.

Research Article

Predicting Thalasso Tourist Delight: A Hybrid SEM—Artificial Intelligence Analysis

Agustín J. Sánchez-Medina ⓘ,[1] **Ylenia I. Naranjo-Barrera** ⓘ,[2] **Jesús B. Alonso** ⓘ,[3] **and Julio Francisco Rufo Torres** ⓘ[3]

[1]*Instituto Universitario de Ciencias y Tecnologías Cibernéticas (IUCTC), University of Las Palmas de Gran Canaria, Despacho C-2.21, Ed. de Económicas y Empresariales, Campus de Tafira, 35017 Las Palmas de Gran Canaria, Spain*
[2]*Instituto Universitario de Ciencias y Tecnologías Cibernéticas (IUCTC), University of Las Palmas de Gran Canaria, Campus de Tafira, 35017 Las Palmas de Gran Canaria, Spain*
[3]*Instituto para el Desarrollo Tecnológico y la Innovación en Comunicaciones (IDeTIC), University of Las Palmas de Gran Canaria, Campus de Tafira, 35017 Las Palmas de Gran Canaria, Spain*

Correspondence should be addressed to Agustín J. Sánchez-Medina; agustin.sanchez@ulpgc.es
and Ylenia I. Naranjo-Barrera; ynaranjobarrera@gmail.com

This study focuses on the influence of the quality of services received by thalassotherapy customers on their global satisfaction and the relationship between this and the word of mouth. This study uses a hybrid SEM—classification tree analysis. The empirical findings reveal a significant relationship between the quality of each offered service and global satisfaction. This study contributes to identify tourist's satisfaction or delight on received thalasso services through a proposed methodology. The main contribution of this work consists of the proposal of a methodology to identify objectively through the opinion of tourists if they were satisfied or had reached delight. This work demonstrates, confirming what has been found in previous literature, that global satisfaction is related to the different experiences provided by the service. Thus, all hypotheses are accepted, supporting the hypotheses that relate the pool, the staff, the treatments, and the environment to satisfaction. In addition, the hypotheses that link satisfaction with the word of mouth are also supported. This theoretical implication has important practical implications for managers of the type of facilities such as those studied in this paper, since it shows that it is not enough to do well in one of the services provided if the environment or the interaction with the staff is not right.

1. Introduction

The concept of well-being has its origin in the work of Halbert Dunn in 1959, in which he discusses a particular state that incorporates a general sense of well-being that is formed by the body, mind, spirit, and surrounding environment [1, 2]. Since old times, health has been known as a motivation to travel. We can mention examples like the Roman terms, the Turkish baths, the Japanese *onsens*, or nowadays the Alpine healing resorts [3]. However, in recent years, health tourism has reinvented itself and grown in popularity, becoming a tourist phenomenon worldwide with an upward trend that seems to be maintained [4]. Scholars like

Goodarzi et al. [5] believe that this trend is due to the growing awareness of the importance of health in the middle and upper middle classes.

According to Dimitrovski and Todoroviic [6], definitions of health and wellness tourisms are inconsistent and vary significantly, which means that the concept can be understood in different ways. Moreover, this inconsistency is even found in the term itself, and according to the authors, "health tourism," "thermal tourism," and "wellness tourism" are used interchangeably.

Other authors like Mueller and Kaufmann [2] establish different categories for this type of tourism, dividing it into illness spa/convalescence tourism and prevention tourism,

the latter being divided into specific illness prevention and wellness tourism. However, on many occasions, wellness centers offer all these services together, and thus, making distinctions between them is not easy.

Therefore, health and wellness tourisms include all the relationships and phenomena that result from a trip with a stay of at least one night, and in which the main motivation is to preserve or promote health and well-being [2, 5, 7].

Bennett et al. [8] believe that any type of tourism aimed at reducing stress can be considered as a type of health or wellness tourism. If we consider Wray et al. [9], we must note that they emphasize that this traditional way of contemplating health tourism has recently expanded itself to include other types such as yoga, spiritual pilgrimages, or holistic tourism. In this sense, [10] defines it as "the trip of at least one night in a facility that is specifically designed for physical, psychological, spiritual, and/or social welfare enhancement."

This research focuses on the study of tourist's satisfaction and delights in a particular wellness service: thalassotherapy. Etymologically, thalassotherapy comes from the Greek terms "thalassa" and "terapia," these mean sea and therapy [11]. According to the Spanish Society of Thalassotherapy, this is a method of therapy that has been used since ancient times for therapeutic purposes. The most important aspects are the properties that have the chemical elements of sea water, seaweed, mud, and other elements extracted from the sea for health and physical appearance.

Ortiz [11] defines thalassotherapy as "a treatment technique that combines seawater baths (hydrotherapy), marine climate (atherapy), and solar radiation (heliotherapy) bringing benefits to healthy and sick individuals." Since the Greek-Roman period, there is knowledge of these types of treatments. During the Middle Ages, their use decay, but from the eighteenth century onwards, they recover their interest. We find the first traces of thalassotherapy in the tourism sector in the 19th century with the development of large health villas [12].

On one hand, consumer satisfaction is a matter of interest for academic research [13]. The study of the satisfaction of tourists has gained great relevance and topicality in the last years. In this sense, according to Google Scholar, of the 841 researches that have been published with the topic "tourist satisfaction" in the title, 90% of them have been put forth in the last decade (data obtained the first week of July 2016). If we carry out the same operation in Web of Science, the results are quite similar. It is important to highlight the fact that of the total of 151 investigations that appear in the search, 92% have been written in the last ten years. Scholars like Choi and Chu [13] confirmed that research on customer satisfaction in the service industry had increased significantly in recent years. On the other hand, if we focus on *wellness* and *tourism*, the results obtained show that their study has lately grown. However, the number of documents is considerably lower, 151 researches in Google Scholar (88% published in the last decade) and 32 studies in Web of Science (96% published in the last decade).

The importance of this research is based on the different topics we mention below. It is framed in tourism, an economic sector that has developed a great importance in the last decades. It is focused on a specific touristic service, the wellness area. This field has not been studied in depth. Studies about thalassotherapy centers do not abound, so the literature about it is limited.

Therefore, this document has as main purpose to determine how the services offered in thalassotherapy, its personnel, and its facilities influence the satisfaction of the client and how the satisfaction is related to the *word of mouth* (wom) recommendation. Another important aspect of this work is how to predict the delight through artificial intelligence starting from the variables that influenced satisfaction. It was assumed that there was happiness when people gave the highest score to each item on the overall satisfaction scale, and in addition, they also did it on all of the *word of mouth* scale.

The results obtained in this study have helped to develop an objective methodology which identifies and evaluates tourist's conditions after receiving thalassotherapy treatments. This way, we have a tool to know if they have felt satisfaction or if they have reached delight. This last status is related by scholars with the highest rate of repetition and with the *word of mouth*.

The present essay is divided in four chapters. In the first chapter, we make a presentation of the state of the art and of the hypothesis of this research. In the second chapter, the development of the methodology applied during the essay is dealt with. In the third chapter, obtained results are shown, and a short discussion is presented. Finally, in the last chapter, the main conclusions of the research are offered.

2. Theoretical Background

In large service industries, customer satisfaction is seen as a key element [14, 15]. Thus, customer satisfaction or the lack of it could serve as a control mechanism for companies to identify which attributes should improve to achieve this satisfaction [15]. Rajaguru and Hassanli [16] affirm that the quality of the service is considered an important predictor of success in the tourism industry. In addition, it must be considered that, in order to have good results, continuous customer feedback must be made on this variable [17, 18].

Although quality of service and satisfaction are related concepts [16, 19, 20], they are different. Thus, Parasuraman et al. [21] define the quality of services as a judgment related to the superiority of the service. Ryan [22] asserts that quality in the tourism industry is the features and characteristics of services and products that meet the needs of tourists, whether they are declared or implied. Finally, Prayag [23] adds that the quality of the service is an enduring construct that encompasses quality performance in all activities carried out by management and employees.

Satisfaction can be defined as the general assessment that the client makes of the service once it has been consumed [15], being a consequence of the quality of the service [24]. On the other hand, Anderson et al. [25] assert that satisfaction is the result of the general evaluation that derives from the total experience of consumption with a good or service. Cong [26] and Ramamoorthy et al. [27] affirm that this concept is related to the difference between the expectations that

were held before the consumption of the service and the perceived performance once it was consumed. Thus, in the tourism sector, if the expectations are exceeded, the tourist will be satisfied [24]. In addition, it must be taken into account that the relationships between companies and customers have changed and they must strive to achieve customer satisfaction. To do so, companies must compete in order to provide higher quality services that lead them to achieve the tourist satisfaction [27].

Satisfaction is a very important aspect in the tourism area [28], and it is also a matter of interest for scholars [13, 29]. Thus, in a changing and dynamic environment, providing quality services to their customers becomes an important tool for suppliers to maintain the competitive advantage [30]. In this way, increasing satisfaction allows to improve the retention and, with that, to increase the profits, to generate a word of mouth, and to expend less in marketing [31]. Thus, it has been related, among other positive aspects, with the fidelity and intention to repeat of the tourist [32–35], with the word of mouth [30, 36, 37] or with paying *premium prices* [33, 38].

For Ifie et al. [39], one of the most important sources of new customers for companies is the recommendations of current customers. This form of promotion is interesting, for companies, because of the low cost it has. In this way, wom is an effective way to promote products and services [40, 41]. Thus, marketing professionals have not been oblivious to this issue and the implications it has on the results of the company [42]. For Sivadas and Jindal [15], the wom can be defined as the transmission of experiences from person to person that does not originate commercially with respect to a brand or service, being perceived as more credible than advertising; for its part, Saleem et al. [43] state that the wom refers to communications between clients, talking about their experiences and evaluating a service.

Determining what causes a positive wom is of great interest and has been analyzed from different perspectives [39, 44]. In the tourism industry, due to its fragmented structure, it is of special interest since the acquisition of new clients depends on the references of existing satisfied consumers, generated in the form of a positive wom [15]. According to Ifie et al. [39] or Sivadas and Jindal [15], some of these antecedents of the wom have been issues such as the characteristics of the product and the organization, the relations with the client, the brand image, or the quality of the service which is the most analyzed in the literature [15].

3. Research Hypothesis

Satisfaction can be defined as the positive reaction of customers to a specific experience with a product or service [45]. Other authors go further by asserting that it is the reaction to a set of experiences and not just a single one [33, 35]. As expressed by McDougall and Levesque [31], customer satisfaction has to do with a global evaluation of the service provider. Besides, Hu et al. [30] consider it as the affective reaction that occurs as a result of one or several services received, which would cover the two previous points of view. In this sense, the overall satisfaction of the tourist in the

thalassotherapy centers can come from the satisfaction with the main activities: water treatments in the swimming pools, the personal treatments (body or facial treatments), the environment, and the interaction with the staff. For this reason, the following four hypotheses are formulated:

H1: Satisfaction with swimming pool treatments is positively related to overall satisfaction with the thalassotherapy center

H2: Satisfaction with body treatments is positively related to overall satisfaction with the thalassotherapy center

H3: Satisfaction with the thalassotherapy environment is positively related to overall satisfaction with the thalassotherapy center

H4: Satisfaction with thalassotherapy staff is positively related to overall satisfaction with the thalassotherapy center

According to Saleem et al. [43], the intentions of wom list several factors, among which is the quality of service as one of the most important [39]. In this way, in the tourism industry, there is a link between customer satisfaction and their tendency to share their experiences with positive recommendations [15, 16, 34, 35, 46–50]. So, according to Lai and Hitchcock [51], the relationship between quality of service and the wom is well confirmed in previous studies. In the same line, Meng and Han [24] assert that wom is a direct result of satisfaction and that this relationship is well supported in the literature. First of all, we propose that the satisfied customers can contribute positively to a positive word of mouth (wom) promotion.

Therefore, the fifth hypothesis of this work is formulated.

H5: Overall satisfaction with the thalassotherapy center is positively related to a favourable word of mouth (wom)

According to Liu and Keh [29], in the last decades, the interest in the emotional states of the consumers has increased. Among these emotional states, delight stands out [29, 52, 53]. It is important to note that delight and satisfaction are not the same [54, 55]. Thus, mere customer satisfaction is not enough to achieve their delight [56]. Following Finn [57], satisfaction and delight do not have exactly the same effects on behavioral intentions, and he suggests that existing research on satisfaction cannot be applied in full to delight. Thus, it can be considered that there are three levels along the continuum of satisfaction: the area of no satisfaction, mere satisfaction, and delight [29]. There must be high satisfaction and an emotional response for delight to exist [58]. Liu and Keh [29] believe that delight is defined by managers in a pragmatic way as what goes beyond satisfaction. However, academics define it as a pleasant surprise. Following this argumentation, Chandler [59] states that it occurs when the customer experiences an unexpected level of value or satisfaction. Likewise, Berman [60] considers that delight requires an extraordinary service or performance of

the product. Arnold et al. [61] and Rust and Oliver [62] argue that it is a positive emotional state resulting from the positive improvement of the consumer's expectations and the existence of a degree of surprise. Delight can be defined as a positive effect with a high level of activation in which there is a combination of satisfaction with excitement and pleasure [63, 64]. Thus, delight is generated by a combination of positive disconfirmation and surprise to some previous expectations [55]. It means that it happens when the expectations are positively exceeded with a degree of surprise, so consumers do not expect the product or service to be so good [65].

As believed by Liu and Keh [29] and Berman [60], moving consumers from the satisfaction zone to the delight area is very positive for the company in terms of getting better results in customer retention and sales, word of mouth, and market share. In addition, it increases the value of the brand and the ability to resist the entry of new bidders [60].

To sum up, it should be noted that the tourism sector has not been excluded from research on delights, as has been studied, for example, in hotels [66], restaurants [67], or theme parks [55, 68]. In the second part of this paper, a proposal is to study the importance of satisfaction with the environment of the establishment, the interaction with the staff, and the main offered activities. Thus, a methodology will be provided that, through classification trees, allows to identify and evaluate objectively the importance that the aforementioned variables have to achieve.

4. Methodology

In the elaboration of the present research, both primary and secondary sources of information were used. Secondary ones were used to elaborate the theoretical framework and formulate the hypotheses. The primaries, to validate the hypotheses mentioned above.

4.1. Sample. The sample used to carry out this study was tourists using a well-known Thalasso Hotel located in the south of Gran Canaria, one of the main tourist areas of the Canary Islands, Spain. This 4-star hotel has one of the largest thalassotherapy centers in Europe. It has an area of approximately $7000 \, \text{m}^2$ focused on health with sea water. The thalassotherapy center offers health and wellness treatments, including massage techniques, body treatments (peeling and wrapping), facials, wellness cures, and hydrotherapy [69].

Questionnaires were used to collect information from the Thalasso visitors. Tourists were informed of the purpose of this work. Data was collected as tourists had just finished their treatment. Surveys were conducted in June 2016.

In total and after eliminating several of them because they were poorly completed, 246 valid questionnaires were obtained. The description of the main characteristics of this sample is reflected in Table 1. Thus, the majority of the respondents, more than 75%, were Spanish, British, or German nationalities which are the main visitors of the hotel. As for sex, approximately 60% were men, and the remaining 40% were women. Finally, it should be mentioned that the majority of respondents were less than 50 years old.

TABLE 1: Demographic profile of the respondents.

Variables	Frequency	Percentage
Age		
≤30	78	31.7%
31–40	67	27.2%
41–50	30	12.2%
51–60	56	22.8%
≥61	15	6.1%
Gender		
Male	149	60.6%
Female	97	39.4%
Nationality		
German	35	14.2%
Argentinian	4	1.6%
Austrian	2	0.8%
Brazilian	4	1.6%
British	48	19.5%
Czech	4	1.6%
Spanish	104	42.3%
French	15	6.1%
Hungarian	2	0.8%
Irish	5	2.0%
Mexican	2	0.8%
Portuguese	2	0.8%
Russian	7	2.8%
Swedish	4	1.6%
Swiss	4	1.6%
Indian	2	0.8%
Polish	2	0.8%
Total	246	

4.2. Measurements. In the present study, the method used to obtain the necessary information to cover the objectives was the survey, in which the basic observation instrument is the questionnaire [70]. Except for age, sex, nationality, level of education, and place of residence, all items in this study are scored on a 7-point Likert scale ranging from (1) "strongly disagree" to (7) "totally agree." The survey questions were written in Spanish, English, and German.

Besides, the scales to evaluate the services offered by the Thalasso, i.e., the hydrotherapy circuit, the individual treatments (body or face), and the general environment, in addition to the satisfaction with the staff and global satisfaction were elaborated based on the proposal by Huang et al. [71]. To this, we have to add that the word of mouth scale was elaborated based on the work of Riquelme et al. [72].

4.3. Data Analysis. Data analysis has been divided into two parts. The first part has been used to test the hypotheses that related the quality of the services with global satisfaction. For this purpose, structural equations based on covariance were used. This is done using the lavaan R package [73]. Once the proposed model was validated, a methodology was

TABLE 2: Reliability, convergent validity, and discriminant validity: correlation coefficients and chi-square difference test.

Cronbach's alpha	Composite reliability	AVE	Construct	Body treatment	Human resources	Pool treatment	Environment	Satisfaction	wom
0.915	0.916	0.785	Treatment	**0.886**					
0.868	0.871	0.693	Staff	0.222*** (9.831**) #0.220#	**0.833**				
0.944	0.944	0.809	Pool	0.698*** (153.53***) #0.702#	0.259*** (13.913***) #0.268#	**0.900**			
0.950	0.950	0.825	Environment	0.615*** (99.324***) #0.614#	0.352*** (26.953***) #0.338#	0.749*** (174.52***) #0.750#	**0.908**		
0.955	0.954	0.874	Satisfaction	0.760*** (166.61***) #0.756#	0.396*** (31.651***) #0.376#	0.762*** (173.62***) #0.754#	0.793*** (204.76***) #0.778#	**0.935**	
0.963	0.963	0.897	wom	0.601*** (126.75***) #0.668#	0.313*** (43.728***) #0.434#	0.602*** (158.66***) #0.722#	0.627*** (137.08***) #0.671#	0.791*** (194.38***) #0.774#	**0.947**

Note: $n = 246$; ***$p \leq 0.001$; **$p \leq 0.01$; square root of AVE (in bold) is shown on the diagonal; off-diagonal elements are the correlation coefficients; values in brackets show the chi-square difference statistics with $df = 1$; values in # show the ratio of heterotrait–monotrait correlations.

developed to objectively identify and evaluate whether the clients were satisfied or had reached delight (second part). To do this, we used as input data the opinion of the tourists about the different services, the environment of the facilities, and the interaction with the staff. It should be mentioned that there was delight when people gave the highest score to each item on the overall satisfaction scale and, in addition, they also did it on all of the word of mouth scale. All this was implemented with the assembly of classification trees, specifically using the techniques of bagging and boosting. For this purpose, adabag software was used [74].

5. Results

5.1. Contrast of Hypotheses. As it can be seen in Table 2, there is no occurrence of multicollinearity [75, 76] because all the correlation coefficients are below 0.8 and also the largest variance inflation factor (VIF) is 3.366 (<10). As recommended by Hair et al. [77], Leong et al. [78], and Wang et al. [79], a two-step technique was used to examine the causal relationship between the constructs. First, an exploratory factorial analysis, which was useful for filtering and defining the dimensional character of the scale [80], was used. The second stage was a confirmatory factor analysis to evaluate the validity of constructs [81, 82].

To evaluate the convergent validity, the estimated load of each indicator in its construct was examined. For such validity, the load must be high, and the values of t statistically must be significant [83]. In the planned model, the above is confirmed with an acceptable convergent validity. Thus, the AFC results indicate that the relationship between each item and its respective construct is statistically significant with loads that exceed 0.790 (all p value ≤ 0.001). With these results, the existence of convergent validity is assumed (see Table 3). It is also necessary to determine the convergent validity of the constructs. According to Hair et al. [84] and

Roldán and Sánchez-Franco [85], this validity must be evaluated by analyzing *Cronbach's alpha*, the composite reliability index by Fornell and Larcker [86], and the average extracted variance (AVE). The reference point, for the first two cases, is 0.7 and for the third case is 0.5 [84, 85]. In the model we considered and as shown in Table 2, all these criteria are well met. Thus, the minimum *Cronbach's alpha* value obtained is 0.868, the composite reliability is 0.871, and the AVE, 0.693. Therefore, it can be concluded that the reflective constructs are consistent.

To obtain the discriminant validity, the square root of the AVE (located on the diagonal of the matrix in Table 2) is compared to the correlations between the constructs (the elements located outside the diagonal) [85, 87]. On average, it can be observed that each construct is stronger related to its own means than to the other constructs. Also, the chi-square difference test [88] is also achieved, and the result shows that all constructs are different. In addition, it was used on the evaluation of the heterotrait–monotrait ratio (HTMT) [89]. This criterion is more demanding than the previous criteria. This measure establishes the ratio of heterotrait–monotrait correlations, with discriminant validity confirmed when the values are less than 0.90 [90]. The highest value obtained in our sample is 0.778. Consequently, there are no discriminant validity problems even though the correlations between the constructs are high.

5.2. Test of Hypotheses. The structural model was verified with some measures of goodness. To adjust the measurement model, robust maximum likelihood estimators were used [91, 92]. As it can be seen in Table 4, all of them exceeded the recommended thresholds (CFI = 0.940, TLI = 0.929, RMSEA = 0.056, and SRMR = 0.044). Hence, the structural model fits with the collected data.

In the path analysis, the significance of a path is determined based on its p value. The results implied that 77.5%

TABLE 3: Confirmatory analyses.

Construct/indicator	Standardized loading	Z value	p value
Body treatments			
The Thalasso has an adequate number of body care treatments	0.906		
The Thalasso offers a wide variety of body care treatments	0.890	23.324	≤0.001
I am satisfied with the body care treatments provided by the Thalasso	0.858	21.036	≤0.001
Pool treatments			
The "Get in Shape" pool treatments are adequate	0.911		
I am satisfied with the "Get in Shape" pool treatments	0.914	23.949	≤0.001
The pool programmes are satisfactory	0.911	20.579	≤0.001
I am satisfied with the guidance that I was given for the "Get in Shape" pool services	0.866	16.329	≤0.001
Human resources			
The staff gives an adequate service to the clients	0.866		
The staff gives personal attention to the clients	0.836	13.514	≤0.001
The staff is polite to the clients	0.790	8.764	≤0.001
Environment			
I think the Thalasso has a comfortable atmosphere	0.863		
I am satisfied with the cleanness of the facilities of the Thalasso	0.887	23.028	≤0.001
I am satisfied with the decoration, conditions, and style of the Thalasso	0.955	24.839	≤0.001
I am satisfied with the security conditions of the Thalasso	0.925	26.676	≤0.001
Satisfaction			
The Thalasso has met my expectations	0.930		
I am willing to return to the Thalasso	0.936	41.619	≤0.001
In general, I am satisfied with the service given at the Thalasso	0.940	24.767	≤0.001
Word of mouth			
I would be willing to recommend the Thalasso to someone who sought my advice	0.944		
I would be willing to encourage friends and family to use Thalasso	0.960	29.624	≤0.001
I would have no problem in saying positive things about the Thalasso	0.936	25.543	≤0.001

TABLE 4: Measures of the model fit.

Number of observations: 246		
Estimator	Maximum likelihood	Robust
Minimum function test statistic	301.741	279.968
Degrees of freedom	159	159
p value (chi-square)	≤0.001	≤0.001
Scaling correction factor or the Satorra-Bentler correction		1.081
Model test baseline model		
Minimum function test statistic	5648.416	2212.795
Degrees of freedom	190	190
p value	≤0.001	≤0.001
	Maximum likelihood	Robust
User model versus baseline model		
Comparative fit index (CFI)[a]	0.974	0.940
Tucker-Lewis index (TLI)[b]	0.969	0.929
RMSEA[c]	0.061	0.056
SRMR[d]	0.044	0.044

[a]Recommended value ≥ 0.90 [77]. [b]Recommended value ≥ 0.90 [77]. [c]Recommended value ≤ 0.08 [78]. [d]Recommended value ≤ 0.1 [78].

Table 5: Results of path analysis.

Hypothesis	Path	Estimate	Std. error	Z value	p value	Remarks
H1	Pool→satisfaction	0.186**	0.071	2.624	0.009	Supported
H2	Staff→satisfaction	0.132*	0.078	2.448	0.014	Supported
H3	Treatment→satisfaction	0.366***	0.067	5.739	≤0.001	Supported
H4	Environment→satisfaction	0.383***	0.075	5.093	≤0.001	Supported
H5	Satisfaction→wom	0.791***	0.086	13.745	≤0.001	Supported

Significance level: $^{***}p \leq 0.001$; $^{**}p \leq 0.01$; $^{*}p \leq 0.05$; ^{ns} not significant

$^{***}p < 0,001$; $^{**}p < 0,01$; $^{*}p < 0,01$; ^{ns} not significant
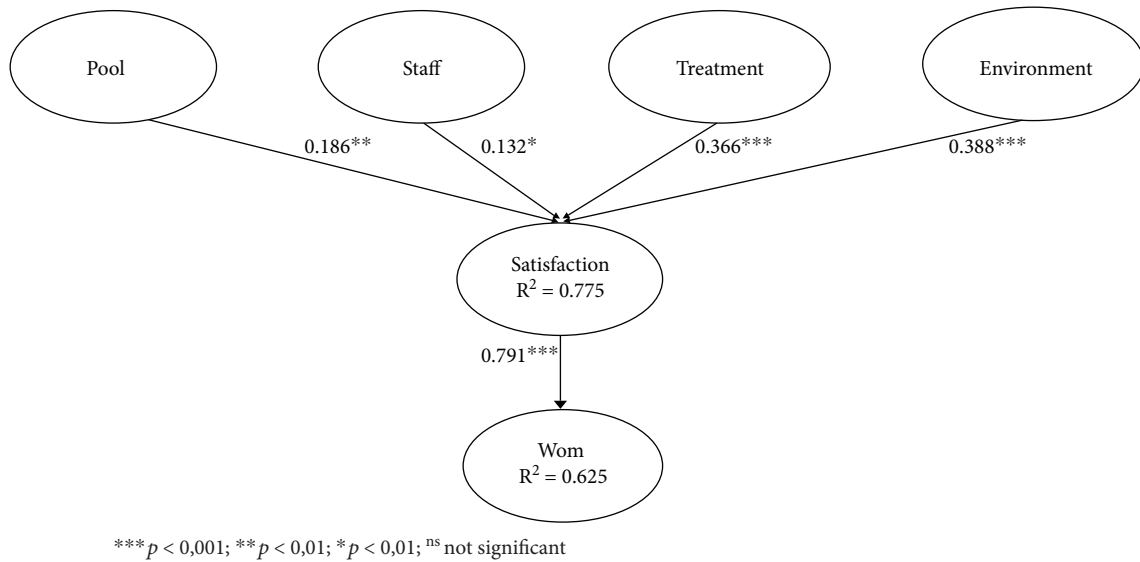
Figure 1: Structural model.

of the variance in satisfaction is explained by the model variables while satisfaction is able to explain 62.5% of the variance in wom.

As shown in Table 5, the findings further reveal that pool treatments ($\beta = 0.186^{**}$), human resources ($\beta = 0.132^{*}$), body treatments ($\beta = 0.366^{***}$), and environment ($\beta = 0.383^{***}$) have significant and positive impacts on satisfaction while satisfaction ($\beta = 0.791^{***}$) positively impacted on wom. Therefore, all hypotheses were supported (see Figure 1 and Table 5).

5.3. Proposal of a Model to Establish the Importance of the Determinants of Delight in the Services of Thalassotherapy. Based on the previous results, it was decided to include as input variables of the delight classifier the four variables that were significant in the previous model, that is to say, the environment, the service of body treatments, the service of the swimming pool, and the interaction with the staff.

To analyze the data, an artificial intelligence method was used, classification trees were assembled with boosting and bagging [93–96]. Bagging and boosting [74] can generate a diverse set of classifiers through the manipulation of training data with a learning algorithm [97]. The bagging method produces multiple versions of a predictor so that an aggregate predictor can be obtained. These multiple versions are generated by making bootstrap replicates of the learning set [98].
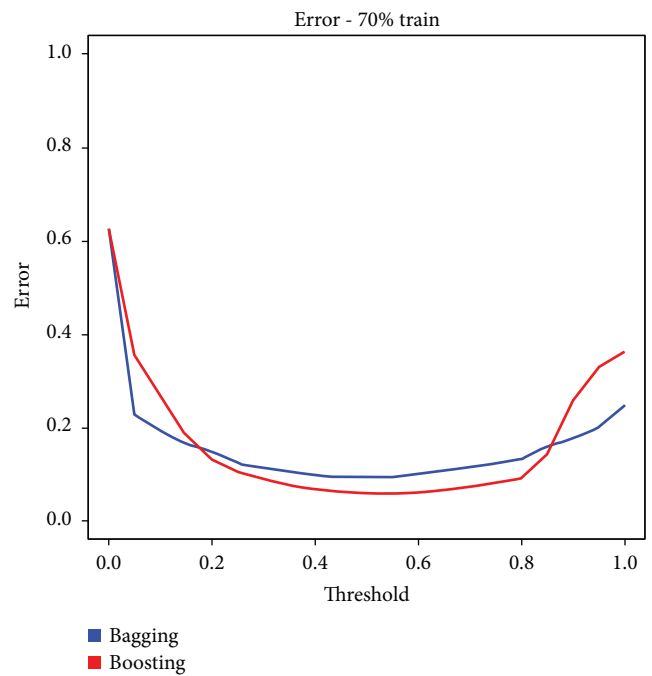

Figure 2: Total error of the models used.

TABLE 6: Total error of the models used.

Threshold	0.000	0.050	0.100	0.150	0.200	0.250	0.300	0.350	0.400	0.450
Bagging	0.627	0.228	0.191	0.166	0.148	0.122	0.113	0.105	0.099	0.093
Boosting	0.627	0.356	0.270	0.182	0.131	0.106	0.088	0.076	0.069	0.063
Threshold	0.500	0.550	0.600	0.650	0.700	0.750	0.800	0.850	0.900	0.950
Bagging	0.093	0.094	0.101	0.106	0.114	0.122	0.132	0.160	0.176	0.201
Boosting	0.060	0.060	0.062	0.065	0.071	0.079	0.092	0.144	0.260	0.329
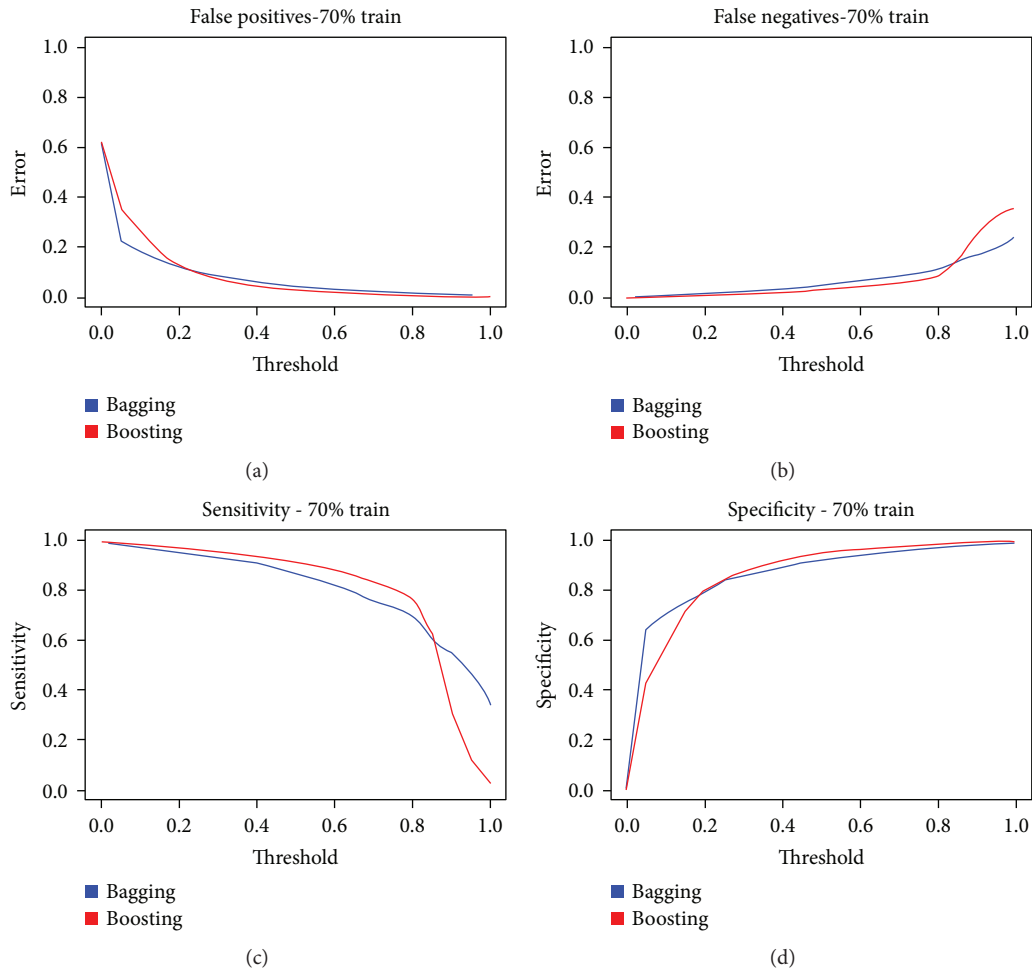
FIGURE 3: False positives, false negatives, specificity, and sensitivity.

Thus, starting from a training set with m cases, other sets are created (with replacements) [97]. A series of classifiers can be obtained with the boosting technique. The training set for each member of the series is chosen according to the performance of the previous classifier. Thus, the cases are extracted with replacement with probability proportional to their weights [97].

Classification and regression trees are, compared to other learning techniques, one of the most intuitive and transparent classification algorithms [99], representing a powerful alternative to the more traditional statistical models [98]. According to Homaie-Shandizi et al. [100], they were presented during the '60s by Morgan and Sonquist [101], and two decades later, Breiman et al. [102] develop the first exhaustive and modern algorithm. In the tree structure, the leaves represent the classifications and the branches the conjunctions of characteristics that lead to the mentioned categories [98, 103]. Its purpose is to perform a recursive partition of the training data into homogeneous subsets so that each new partition will minimize the number of members [104]. The technique of the decision trees is attractive for a lot of business applications [99] since a minimum of parameters and no domain knowledge is required. They have the advantage, too, of being able to detect nonlinear relationships and to show a good performance when there is qualitative information [98].

As already mentioned in Methodology, the adabag package of R, which allows the use of bagging and boosting for the assembly of classification trees, was used. For its application, 70% of the sample for training and the remaining 30% for testing was established. It is worth mentioning that different thresholds for classification were implemented. Thus, values ranging from 0 to 1 were used for this threshold with increments of 0.05. In all, 1000 iterations were performed. In each one of them, which elements of the database would be in the training group and which were in the test group were chosen in a random way. For each of these training and test groups, bagging and boosting were applied, obtaining the results that will be shown below. Once all the results were available, the average value and the standard deviation obtained with the aforementioned 1000 iterations were calculated, for each level of threshold. The t value was also calculated to compare it with a two-tailed Student's t with 998 degrees of freedom.

The results obtained from applying the cited methods will be presented below. The "rough data" produced by a classification system are the counts of the correct and incorrect classifications of each class. A matrix of confusion, which is a contingency table form that shows the differences between the actual and predicted classes for a set of labeled examples [105], is used to analyze the obtained information. Referring to the total error obtained, it can be observed that the smaller errors, which are around 9% with bagging and 6% with boosting, occur in both methods with thresholds close to 0.5 (see Figure 2). Table 6 show that the minimum error is obtained using bagging. Errors occurring with the first method are always lower when the threshold is less than 0.20 or higher than 0.85, that is, in extreme cases.

In addition, Figure 3 shows that for the false positives, that is, cases classified as "delight" that in reality were not "delight," both methods behave similarly. As for specificity, it is worth mentioning that for very low thresholds, the bagging behaves better, occurring otherwise when it exceeds the heat of 0.1. As far as sensitivity is concerned, boosting for all thresholds below 0.85 behaves better. Moreover, an analysis is presented of sensitivity, "the proportion of true positives correctly identified by the test," and specificity, "the proportion of true negatives correctly identified by the test" [106]. (Sensitivity = true positive/(true positive + false negative); specificity = true negative/(true negative + false positive)). In relation to sensitivity, boosting always behaves slightly better except when the thresholds are very high; in that case, the bagging provides a better performance. For thresholds higher than 0.15, boosting presents a better specificity.

In order to show the performance of both methods, the ROC curves obtained for both are presented below. These curves are a good way to visualize the performance of the classifiers [105]. Figure 4 shows that the area under the curve when using boosting is greater than when using bagging.

Regarding the importance given by bagging and boosting to the variables used to classify the companies in the categories "delight" and "nondelight" (see Figure 5), the bootstrapping technique (1000 subsamples) was used to generate the Student t statistics and the standard errors. Thus, the statistical significance of the mean values for importance was obtained. In both methods, it considered as the least
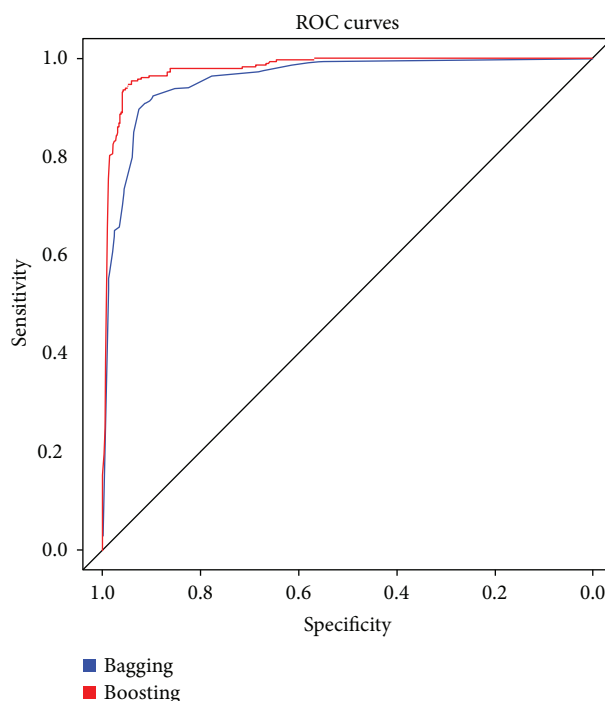

Figure 4: ROC curves.

important variable the pool treatments and as the most important the staff. However, there is a slight difference in the situation of those in the second and third positions. Thus, in the boosting, the second in relevance is that of treatment followed by environment, whereas in the bagging, these positions are interchanged (see Table 7).

5.4. Discussion. According to the results, the presented hypotheses are confirmed. The overall satisfaction of the tourist in the thalassotherapy centers comes from the satisfaction with the main activities: water treatments in the swimming pools, the personal treatments (body or facial treatments), the environment, and the interaction with the staff. The results tell us, as well, that the satisfied customers can contribute positively to the word of mouth promotion. This theoretical implication has important practical implications for managers of facilities, such as those studied in this work, since it shows that it is not enough to do well in one of the services provided if the environment or the interaction with the staff is not right. In this case, all the thalasso facilities and the staff interaction must be taken into account by managers to increase the tourist delight. Today's business is characterized by tough competition; consequently, the delivery of a quality service becomes a fundamental element to attract and retain customers [27].

It is a contribution of the present work the proposal of a methodology to identify and evaluate objectively and through the opinion about the different services offered by thalassotherapy if the tourists' status was of satisfaction or had arrived at delight. This is a matter of great importance if we take into account that, as it has been indicated throughout this work, when a customer moves from satisfaction to delight, he
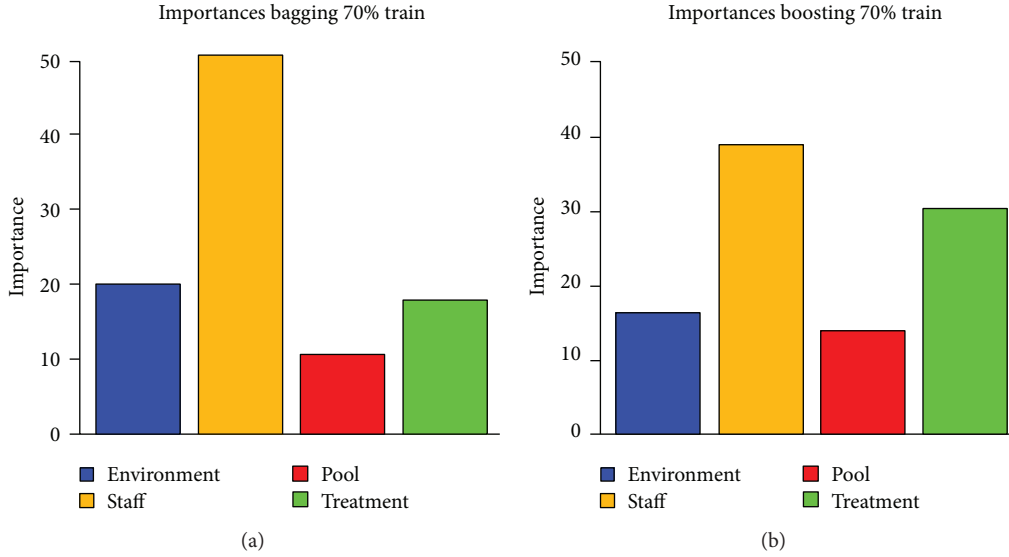
Figure 5: Importance of each of the variables studied for classification.

Table 7: Means of the importance, standard deviations, and Student t for bagging and boosting.

	Bagging			
	Environment	Staff	Pool	Treatment
Mean importances	20.272**	50.865***	10.778*	18.085**
SD importances	7.765	9.501	4.207	6.504
t	2.611	5.354	2.562	2.780
	Boosting			
Boosting	Environment	Staff	Pool	Treatment
Mean importances	16.499***	39.071***	14.129***	30.302***
SD importances	3.360	4.513	2.732	4.467
t	4.910	8.657	5.172	6.783

Bootstrap-t (based on $t(998)$ two-tailed test); $t(0.001;998) = 3.300$; $t(0.01;998) = 2.581$; $t(0.05;998) = 1.962$; ***$p < 0.001$; **$p < 0.01$; *$p < 0.05$; [ns] nonsignificant.

contributes to greater profitability to the company, increases its fidelity, and improves its word of mouth [53, 60].

The methodology developed is based on the use of assembled classification trees, specifically with the methods of bagging and boosting. Also, from the comparison of the results obtained with both methods, it was observed that the assembly with boosting provided better results. The great use of machine learning is in situations where the variables are related in a highly nonlinear way. Besides, it is also an academic contribution of this work that the proposed model, if it is frequently fed, can maintain the classifications updated with the tastes of the clients and the conditions of the service provided. So, this kind of artificial intelligence (AI) can make continuous evaluations as we mentioned in the theoretical background of this paper.

Regarding the main weaknesses of the present study, it is worth mentioning that a cross-sectional methodology was used, thus increasing the probability of the study being biased due to the use of a single method/data source. Another limitation is determined by the technique used, structural equations, which assumes a linearity of the relationships between latent variables [77].

6. Conclusions

This work demonstrates, confirming what has been found in previous literature [55, 59, 68], that global satisfaction is related to the different experiences provided by the service. Thus, all hypotheses are accepted, supporting the hypotheses that relate the pool, the staff, the treatments, and the environment to satisfaction. In addition, the hypotheses that link satisfaction with the wom are also supported. This theoretical implication has important practical implications for managers of the type of facilities such as those studied in this paper, since it shows that it is not enough to do well in one of the services provided if the environment or the interaction with the staff is not right. In this way, managers could have a tool that could inform them about which aspects of the business are contributing to a better satisfaction and delight of the clients. In this sense, they can establish corrective actions to improve these variables. In addition, the system can be fed with new data so that managers could always have up-to-date information on which of the services provided contributes more, at each moment, to the satisfaction of customers. This is in line with the constant feedback that authors like Lu

et al. [17] and Mohsin and Lockyer [18] consider necessary in business nowadays. This issue is relevant because in this type of business, the pleasures of customers can change quickly for various issues such as the emergence of new treatments both in the cabin and in the pool or the appearance of new competitors with modern facilities. The conditions in which the service is provided may change, due to deterioration of the facilities, personnel changes or behavior, etc. All this is of great importance since the service companies have become increasingly clear that they must focus on the client side and that the quality of the service is a differentiator on the road to success [27]. In this way, Sivadas and Jindal [15] state that those responsible for marketing in the tourism sector must understand better the factors that drive the intention of wom if they wish to develop effective marketing strategies. Moreover, this is even more important taking into account that the growth of the power of wom comes from the increasing use of social networks [107].

Finally, as far as possible future lines of research are concerned, it has been considered that it would be interesting to go deeper into the search for a shorter scale to measure satisfaction with the different services provided by the hotel, as well as to study if there are cultural differences between the various nationalities in order to reach delight for the service received.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

[1] K. H. Chen, F. H. Chang, and F. Y. Liu, "Wellness tourism among seniors in Taiwan: previous experience, service encounter expectations, organizational characteristics, employee characteristics, and customer satisfaction," *Sustainability*, vol. 7, no. 8, pp. 10576–10601, 2015.

[2] H. Mueller and E. L. Kaufmann, "Wellness tourism: market analysis of a special health tourism segment and implications for the hotel industry," *Journal of Vacation Marketing*, vol. 7, no. 1, pp. 5–17, 2001.

[3] L. Puczkó and M. Bachvarov, "Spa, bath, thermae: what's behind the labels?," *Tourism Recreation Research*, vol. 31, no. 1, pp. 83–91, 2006.

[4] E. Alén, P. De Carlos, and T. Domínguez, "An analysis of differentiation strategies for Galician thermal centres," *Current Issues in Tourism*, vol. 17, no. 6, pp. 499–517, 2014.

[5] M. Goodarzi, N. Haghtalab, and E. Shamshiry, "Wellness tourism in Sareyn, Iran: resources, planning and development," *Current Issues in Tourism*, vol. 19, no. 11, pp. 1071–1076, 2016.

[6] D. Dimitrovski and A. Todorović, "Clustering wellness tourists in spa environment," *Tourism Management Perspectives*, vol. 16, pp. 259–265, 2015.

[7] P. Erfurt-Cooper and M. Cooper, *Health and Wellness Tourism*, Channel View Publications, Bristol, 2009.

[8] M. Bennett, B. King, and L. Milner, "The health resort sector in Australia: a positioning study," *Journal of Vacation Marketing*, vol. 10, no. 2, pp. 122–137, 2004.

[9] M. Wray, J. Laing, and C. Voigt, "Byron Bay: an alternate health and wellness destination," *Journal of Hospitality and Tourism Management*, vol. 17, no. 1, pp. 158–166, 2010.

[10] N. A. Valentine, "Wellness tourism: using tourists' preferences to evaluate the wellness tourism market in Jamaica," *Review of Social Sciences*, vol. 1, no. 3, 2016.

[11] M. R. Ortiz, "Orígenes y fundamentos de la talasoterapia," *Revista de La Facultad de Ciencias*, vol. 2, p. 12, 2004, http://www.uax.es/publicacion/origenes-y-fundamentos-de-la-talasoterapia.pdf.

[12] Abalnearios, "Abalnearios," 2016, July 2016, http://www.abalnearios.com/talasoterapia/.

[13] T. Y. Choi and R. Chu, "Determinants of hotel guests' satisfaction and repeat patronage in the Hong Kong hotel industry," *International Journal of Hospitality Management*, vol. 20, no. 3, pp. 277–297, 2001.

[14] Z. Zhang, M. Jiang, and X. Li, "Refining the relationship between attribute performance and customer satisfaction in the Chinese hospitality industry," *Total Quality Management and Business Excellence*, vol. 24, no. 11-12, pp. 1364–1375, 2013.

[15] E. Sivadas and R. P. Jindal, "Alternative measures of satisfaction and word of mouth," *Journal of Services Marketing*, vol. 31, no. 2, pp. 119–130, 2017.

[16] R. Rajaguru and N. Hassanli, "The role of trip purpose and hotel star rating on guests' satisfaction and WOM," *International Journal of Contemporary Hospitality Management*, vol. 30, no. 5, pp. 2268–2286, 2018.

[17] C. Lu, C. Berchoux, M. W. Marek, and B. Chen, "Service quality and customer satisfaction: qualitative research implications for luxury hotels," *International Journal of Culture, Tourism, and Hospitality Research*, vol. 9, no. 2, pp. 168–182, 2015.

[18] A. Mohsin and T. Lockyer, "Customer perceptions of service quality in luxury hotels in New Delhi, India: an exploratory study," *International Journal of Contemporary Hospitality Management*, vol. 22, no. 2, pp. 160–173, 2010.

[19] E. N. Torres, "Deconstructing service quality and customer satisfaction: challenges and directions for future research," *Journal of Hospitality Marketing and Management*, vol. 23, no. 6, pp. 652–677, 2014.

[20] R. Hallak, G. Assaker, and R. El-Haddad, "Re-examining the relationships among perceived quality, value, satisfaction, and destination loyalty: a higher-order structural model," *Journal of Vacation Marketing*, vol. 24, no. 2, pp. 118–135, 2018.

[21] A. Parasuraman, V. Zeithaml, and L. Berry, "SERVQUAL—a multiple-item scale for measuring consumer perceptions of service quality," *Journal of Retailing*, vol. 64, no. 1, pp. 12–37, 1988.

[22] C. Ryan, "Seeking quality in Pacific tourism," in *Tourism in the Pacific: Issues and Cases*, C. M. Hall and S. J. Page, Eds., pp. 146–160, International Thomson Business Press, London, England, 1996.

[23] G. Prayag, "Tourists' evaluations of destination image, satisfaction, and future behavioral intentions—the case of

Mauritius," *Journal of Travel & Tourism Marketing*, vol. 26, no. 8, pp. 836–853, 2009.

[24] B. Meng and H. Han, "Working-holiday tourism attributes and satisfaction in forming word-of-mouth and revisit intentions: impact of quantity and quality of intergroup contact," *Journal of Destination Marketing & Management*, vol. 9, pp. 347–357, 2018.

[25] E. W. Anderson, C. Fornell, and D. R. Lehmann, "Customer satisfaction, market share, and profitability: findings from Sweden," *Journal of Marketing*, vol. 58, no. 3, p. 53, 1994.

[26] L. C. Cong, "A formative model of the relationship between destination quality, tourist satisfaction and intentional loyalty: an empirical test in Vietnam," *Journal of Hospitality and Tourism Management*, vol. 26, pp. 50–62, 2016.

[27] R. Ramamoorthy, A. Gunasekaran, M. Roy, B. K. Rai, and S. A. Senthilkumar, "Service quality and its impact on customers' behavioural intentions and satisfaction: an empirical study of the Indian life insurance sector," *Total Quality Management & Business Excellence*, vol. 29, no. 7-8, pp. 834–847, 2016.

[28] E. F. Mathis, H. L. Kim, M. Uysal, J. M. Sirgy, and N. K. Prebensen, "The effect of co-creation experience on outcome variable," *Annals of Tourism Research*, vol. 57, pp. 62–75, 2016.

[29] M. W. Liu and H. T. Keh, "Consumer delight and outrage: scale development and validation," *Journal of Service Theory and Practice*, vol. 25, no. 6, pp. 680–699, 2015.

[30] H.-H. S. Hu, J. Kandampully, and T. D. Juwaheer, "Relationships and impacts of service quality, perceived value, customer satisfaction, and image: an empirical study," *The Service Industries Journal*, vol. 29, no. 2, pp. 111–125, 2009.

[31] G. H. G. McDougall and T. Levesque, "Customer satisfaction with services: putting perceived value into the equation," *Journal of Services Marketing*, vol. 14, no. 5, pp. 392–410, 2000.

[32] J. Alegre and J. Garau, "Tourist satisfaction and dissatisfaction," *Annals of Tourism Research*, vol. 37, no. 1, pp. 52–73, 2010.

[33] F. Ali, "Service quality as a determinant of customer satisfaction and resulting behavioural intentions: a SEM approach towards Malaysian resort hotels," *Tourism*, vol. 63, no. 1, pp. 37–52, 2015.

[34] Y. Kim and J. Lee, "Relationship between corporate image and customer loyalty in mobile communications service markets," *Africa Journal of Business Management*, vol. 4, no. 18, pp. 4035–4041, 2010.

[35] K. Ryu, H.-R. Lee, and W. G. Kim, "The influence of the quality of the physical environment, food, and service on restaurant image, customer perceived value, customer satisfaction, and behavioral intentions," *International Journal of Contemporary Hospitality Management*, vol. 24, no. 2, pp. 200–223, 2012.

[36] I. R. del Bosque and H. San Martín, "Tourist satisfaction a cognitive-affective model," *Annals of Tourism Research*, vol. 35, no. 2, pp. 551–573, 2008.

[37] Y. Yoon and M. Uysal, "An examination of the effects of motivation and satisfaction on destination loyalty: a structural model," *Tourism Management*, vol. 26, no. 1, pp. 45–56, 2005.

[38] R. A. Ganiyu, I. I. Uche, and A. O. Elizabeth, "Is customer satisfaction an indicator of customer loyalty?," *Australian Journal of Business and Management Research*, vol. 2, no. 7, pp. 14–20, 2012.

[39] K. Ifie, A. C. Simintiras, Y. Dwivedi, and V. Mavridou, "How service quality and outcome confidence drive pre-outcome word-of-mouth," *Journal of Retailing and Consumer Services*, vol. 44, pp. 214–221, 2018.

[40] M. Hultman, D. Skarmeas, P. Oghazi, and H. M. Beheshti, "Achieving tourist loyalty through destination personality, satisfaction, and identification," *Journal of Business Research*, vol. 68, no. 11, pp. 2227–2231, 2015.

[41] Y. Wardi, A. Abror, and O. Trinanda, "Halal tourism: antecedent of tourist's satisfaction and word of mouth (WOM)," *Asia Pacific Journal of Tourism Research*, vol. 23, no. 5, pp. 463–472, 2018.

[42] A. Marchand, T. Hennig-Thurau, and C. Wiertz, "Not all digital word of mouth is created equal: understanding the respective impact of consumer reviews and microblogs on new product success," *International Journal of Research in Marketing*, vol. 34, no. 2, pp. 336–354, 2017.

[43] M. A. Saleem, A. Yaseen, and A. Wasaya, "Drivers of customer loyalty and word of mouth intentions: moderating role of interactional justice," *Journal of Hospitality Marketing and Management*, vol. 27, no. 8, pp. 877–904, 2018.

[44] A. M. Baker, N. Donthu, and V. Kumar, "Investigating how word-of-mouth conversations about brands influence purchase and retransmission intentions," *Journal of Marketing Research*, vol. 53, no. 2, pp. 225–239, 2016.

[45] R. Oliver, "Measurement and evaluation of satisfaction processes in retail settings," *Journal of Retailing*, vol. 57, no. 3, pp. 25–48, 1981.

[46] A. Pizam, V. Shapoval, and T. Ellis, "Customer satisfaction and its measurement in hospitality enterprises: a revisit and update," *International Journal of Contemporary Hospitality Management*, vol. 28, no. 1, pp. 2–35, 2017.

[47] S. R. Swanson and M. K. Hsu, "The effect of recovery locus attributions and service failure severity on word-of-mouth and repurchase behaviors in the hospitality industry," *Journal of Hospitality & Tourism Research*, vol. 35, no. 4, pp. 511–529, 2011.

[48] G. Tripathi, "Customer satisfaction and word of mouth intentions: testing the mediating effect of customer loyalty," *Journal of Services Research*, vol. 17, no. 2, pp. 1–16, 2018.

[49] M. Amin, Z. Yahya, W. F. A. Ismayatim, S. Z. Nasharuddin, and E. Kassim, "Service quality dimension and customer satisfaction: an empirical study in the Malaysian hotel industry," *Services Marketing Quarterly*, vol. 34, no. 2, pp. 115–125, 2013.

[50] G. Dominici and R. Guzzo, "Customer satisfaction in the hotel industry: a case study from Sicily," *International Journal of Marketing Studies*, vol. 2, no. 2, pp. 3–12, 2010.

[51] I. K. W. Lai and M. Hitchcock, "Local reactions to mass tourism and community tourism development in Macau," *Journal of Sustainable Tourism*, vol. 25, no. 4, pp. 451–470, 2016.

[52] E. N. Torres, X. Fu, and X. Lehto, "Are there gender differences in what drives customer delight?," *Tourism Review*, vol. 69, no. 4, pp. 297–309, 2014.

[53] E. N. Torres and S. Kline, "From customer satisfaction to customer delight: creating a new standard of service for the hotel industry," *International Journal of Contemporary Hospitality Management*, vol. 25, no. 5, pp. 642–659, 2013.

[54] J. C. Crotts and V. P. Magnini, "Is Surprise Essential?," *Annals of Tourism Research*, vol. 38, no. 2, pp. 719–722, 2011.

[55] J. Ma, J. Gao, N. Scott, and P. Ding, "Customer delight from theme park experiences," *Annals of Tourism Research*, vol. 42, pp. 359–381, 2013.

[56] S. M. C. Loureiro, F. J. Miranda, and M. Breazeale, "Who needs delight?," *Journal of Service Management*, vol. 25, no. 1, pp. 101–124, 2014.

[57] A. Finn, "Customer delight: distinct construct or zone of non-linear response to customer satisfaction?," *Journal of Service Research*, vol. 15, no. 1, pp. 99–110, 2012.

[58] J. Füller and K. Matzler, "Customer delight and market segmentation: an application of the three-factor theory of customer satisfaction on life style groups," *Tourism Management*, vol. 29, no. 1, pp. 116–126, 2008.

[59] C. H. Chandler, "Quality: beyond customer satisfaction," *Quality Progress*, vol. 22, no. 30–32, 1989.

[60] B. Berman, "How to delight your customers," *California Management Review*, vol. 48, no. 1, pp. 129–151, 2005.

[61] M. J. Arnold, K. E. Reynolds, N. Ponder, and J. E. Lueg, "Customer delight in a retail context: investigating delightful and terrible shopping experiences," *Journal of Business Research*, vol. 58, no. 8, pp. 1132–1145, 2005.

[62] R. T. Rust and R. L. Oliver, "Should we delight the customer?," *Journal of the Academy of Marketing Science*, vol. 28, no. 1, pp. 86–94, 2000.

[63] M. W. Alexander, "Customer delight: a review," *Academy of Marketing Studies Journal*, vol. 50, no. 5, pp. 535–545, 2010.

[64] S. Denning, "The essential metric of customer capitalism is customer outcomes," *Strategy & Leadership*, vol. 39, no. 4, pp. 12–18, 2011.

[65] R. Oliver and W. S. DeSarbo, "Processing of the satisfaction response in consumption: a suggested framework and research propositions," *Journal of Consumer Satisfaction, Dissatisfaction and Complaining Behavior*, vol. 2, no. 1, pp. 1–16, 1989.

[66] E. N. Torres and S. Kline, "From satisfaction to delight: a model for the hotel industry," *International Journal of Contemporary Hospitality Management*, vol. 18, no. 4, pp. 290–301, 2006.

[67] J. L. H. Bowden and T. S. Dagger, "To delight or not to delight? An investigation of loyalty formation in the restaurant industry," *Journal of Hospitality Marketing & Management*, vol. 20, no. 5, pp. 501–524, 2011.

[68] F. Ali, W. G. Kim, J. Li, and H.-M. Jeon, "Make it delightful: customers' experience, satisfaction and loyalty in Malaysian theme parks," *Journal of Destination Marketing & Management*, vol. 7, pp. 1–11, 2018.

[69] Gloria Thalasso & Hotels, *Thalasso Gloria—San Agustín*, 2016, July 2016, http://www.gloriapalaceth.com/hoteles/gloria-palace-san-agustin-thalasso-hotel/thalasso/.

[70] R. Sierra Bravo, *Técnicas de investigación social. Teoría y ejercicios*, Paraninfo, Madrid, 1991.

[71] HuangSongshan (Sam), A. Afsharifar, and R. van der Veen, "Examining the moderating role of prior knowledge in the relationship between destination experiences and tourist satisfaction," *Journal of Vacation Marketing*, vol. 22, no. 4, pp. 320–334, 2016.

[72] I. P. Riquelme, S. Román, and D. Iacobucci, "Consumers' perceptions of online and offline retailer deception: a moderated mediation analysis," *Journal of Interactive Marketing*, vol. 35, pp. 16–26, 2016.

[73] Y. Rosseel, "Lavaan: an R package for structural equation modeling," *Journal of Statistical Software*, vol. 48, no. 2, pp. 1–36, 2012.

[74] E. Alfaro, M. Gamez, and N. García, "Adabag: an R package for classification with boosting and bagging," *Journal of Statistical Software*, vol. 54, no. 2, pp. 1–35, 2013.

[75] L. Y. Leong, T. S. Hew, V. H. Lee, and K. B. Ooi, "An SEM-artificial-neural-network analysis of the relationships between SERVPERF, customer satisfaction and loyalty among low-cost and full-service airline," *Expert Systems with Applications*, vol. 42, no. 19, pp. 6620–6634, 2015.

[76] A.-C. Teo, G. W.-H. Tan, K.-B. Ooi, T.-S. Hew, and K.-T. Yew, "The effects of convenience and speed in m-payment," *Industrial Management & Data Systems*, vol. 115, no. 2, pp. 311–331, 2015.

[77] J. F. Hair, W. Black, and B. Balbin, *Multivariate Data Analysis: A Global Perspective*, Prentice Hall, Upper Saddle River, NJ, USA, 7th ed. edition, 2010.

[78] L. Y. Leong, T. S. Hew, G. W. H. Tan, and K. B. Ooi, "Predicting the determinants of the NFC-enabled mobile credit card acceptance: a neural networks approach," *Expert Systems with Applications*, vol. 40, no. 14, pp. 5604–5620, 2013.

[79] C.-J. Wang, H.-T. Tsai, and M.-T. Tsai, "Linking transformational leadership and employee creativity in the hospitality industry: the influences of creative role identity, creative self-efficacy, and job complexity," *Tourism Management*, vol. 40, pp. 79–89, 2014.

[80] M. K. Cabrera-Suárez, M. D. L. C. Déniz-Déniz, and J. D. Martín-Santana, "The setting of non-financial goals in the family firm: the influence of family climate and identification," *Journal of Family Business Strategy*, vol. 5, no. 3, pp. 289–299, 2014.

[81] F. T. S. Chan and A. Y. L. Chong, "A SEM-neural network approach for understanding determinants of interorganizational system standard adoption and performances," *Decision Support Systems*, vol. 54, no. 1, pp. 621–630, 2012.

[82] K. K. F. So, C. King, B. A. Sparks, and Y. Wang, "The role of customer engagement in building consumer loyalty to tourism brands," *Journal of Travel Research*, vol. 55, no. 1, pp. 64–78, 2015.

[83] J. C. Anderson and D. W. Gerbing, "Structural equation modeling in practice: a review and recommended two-step approach," *Psychological Bulletin*, vol. 103, no. 3, pp. 411–423, 1988.

[84] J. F. Hair, G. T. Hult, C. M. Ringle, and M. Sarstedt, *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*, SAGE, Thousand Oaks CA, USA, 2014.

[85] J. L. Roldán and M. J. Sánchez-Franco, "Variance-based structural equation modeling: guidelines for using partial least squares in information systems research," in *Research Methodologies, Innovations and Philosophies in Software Systems Engineering and Information Systems*, M. Mora, A. Steenkamp, L. Johnston, and J. Gamon, Eds., pp. 193–221, Information Science Reference, Hershey, PA, USA, 2012.

[86] C. Fornell and D. F. Larcker, "Evaluating structural equation models with unobservable variables and measurement error," *Journal of Marketing Research*, vol. 18, no. 1, pp. 39–50, 1981.

[87] W. W. Chin, "Issues and opinion on structural equation modeling," *MIS Quarterly*, vol. 22, no. 1, pp. 7–16, 1998.

[88] P. Bertea and A. Zait, "Methods for testing discriminant validity," *Management & Marketing Journal*, vol. 9, no. 2, pp. 217–224, 2011.

[89] J. Henseler, C. M. Ringle, and M. Sarstedt, "A new criterion for assessing discriminant validity in variance-based structural equation modeling," *Journal of the Academy of Marketing Science*, vol. 43, no. 1, pp. 115–135, 2015.

[90] J. F. Hair, G. T. M. Hult, C. Ringle, and M. Sarstedt, *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*, SAGE Publications, Thousand Oaks, CA, USA, 2016.

[91] A. Satorra, "Power of χ^2 goodness-of-fit test in structural equation models: the case of non-normal data," in *New Developments of Psychometrics*, H. Yanai, A. Okada, K. Shigemasu, Y. Kano, and J. Meulman, Eds., pp. 57–68, Springer, Tokyo, 2003.

[92] A. Satorra and P. M. Bentler, "A scaled difference chi-square test statistic for moment structure analysis," *Psychometrika*, vol. 66, no. 4, pp. 507–514, 2001.

[93] E. Bauer and R. Kohavi, "An empirical comparison of voting classification algorithms: bagging, boosting, and variants," *Machine Learning*, vol. 36, no. 1/2, pp. 105–139, 1999.

[94] T. G. Dietterich, "Ensemble methods in machine learning," in *Multiple Classifier Systems*, pp. 1–15, Springer, Berlin, Heidelberg, 2000.

[95] M. Galar, A. Fernandez, E. Barrenechea, H. Bustince, and F. Herrera, "A review on ensembles for the class imbalance problem: bagging-, boosting-, and hybrid-based approaches," *IEEE Transactions on Systems, Man, and Cybernetics, Part C (Applications and Reviews)*, vol. 42, no. 4, pp. 463–484, 2012.

[96] S. B. Kotsiantis, "Supervised machine learning: a review of classification techniques," *Informatica*, vol. 31, pp. 249–268, 2007.

[97] T. G. Dietterich, "An experimental comparison of three methods for constructing ensembles of decision trees," *Machine Learning*, vol. 40, no. 2, pp. 139–157, 2000.

[98] M. Chrzanowska, E. Alfaro, and D. Witkowska, "The individual borrowers recognition: single and ensemble trees," *Expert Systems with Applications*, vol. 36, no. 3, pp. 6409–6414, 2009.

[99] M. A. King, A. S. Abrahams, and C. T. Ragsdale, "Ensemble learning methods for pay-per-click campaign management," *Expert Systems with Applications*, vol. 42, no. 10, pp. 4818–4829, 2015.

[100] A.-H. Homaie-Shandizi, V. P. Nia, M. Gamache, and B. Agard, "Flight deck crew reserve: from data to forecasting," *Engineering Applications of Artificial Intelligence*, vol. 50, pp. 106–114, 2016.

[101] J. N. Morgan and J. A. Sonquist, "Problems in the analysis of survey data, and a proposal," *Journal of the American Statistical Association*, vol. 58, no. 302, pp. 415–434, 1963.

[102] L. Breiman, J. Friedman, R. Olshen, and C. Stone, *Classification and Regression Trees*, Wadsworth & Brooks, Wadsworth International Group, Monterey, CA, USA, 1984.

[103] C. F. Tsai and Y. J. Chiou, "Earnings management prediction: a pilot study of combining neural networks and decision trees," *Expert Systems with Applications*, vol. 36, no. 3, pp. 7183–7191, 2009.

[104] G. Shmueli, N. Patel, and P. Bruce, *Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner*, Wiley, Hoboken, N.J, USA, 2010.

[105] A. P. Bradley, "The use of the area under the ROC curve in the evaluation of machine learning algorithms," *Pattern Recognition*, vol. 30, no. 7, pp. 1145–1159, 1997.

[106] D. G. Altman and J. M. Bland, "Statistics notes: diagnostic tests 1: sensitivity and specificity," *BMJ*, vol. 308, no. 6943, article 1552, 1994.

[107] S. Gopinath, P. K. Chintagunta, and S. Venkataraman, "Blogs, advertising, and local-market movie box office performance," *Management Science*, vol. 59, no. 12, pp. 2635–2654, 2013.

Research Article

Complexity in the Acceptance of Sustainable Search Engines on the Internet: An Analysis of Unobserved Heterogeneity with FIMIX-PLS

Pedro Palos-Sanchez,[1] Felix Martin-Velicia [ID],[1] and Jose Ramon Saura [ID][2]

[1]Department of Business Administration and Marketing, University of Seville, Spain
[2]Department of Business Economics, Rey Juan Carlos University, Spain

Correspondence should be addressed to Jose Ramon Saura; joseramon.saura@urjc.es

This paper analyses the complexity of user behaviour when facing the challenge of using sustainable applications, such as Internet search engines. This paper analyses an acceptance model using extended TAM (Technology Acceptance Model) with Trust as an added external variable. It was suggested that Trust indirectly influences the final Intention to Use with the perceptions of Utility and Ease of Use. To test the proposed model, a survey was carried out with users from different geographical areas of Spain ($n = 445$). The second aim of this study was to understand the complexity of marketing segmentation by separating the application users into different user groups. Users were grouped by their preference of favorite Internet search engine. Unobserved heterogeneity was studied using FIMIX-PLS, and three different user behaviours with search engines were identified. These corresponded to the number of inhabitants who live in the user area. In this way, the impact that the environment has on user choice, acceptance, and use of this type of sustainable applications was shown. The results were checked using PLS-SEM and showed that the model for the adoption of sustainable search engines is explanatory and predictive because confidence and acceptance for this TAM were validated. The conclusions are interesting for developers of environmentally sustainable and responsible applications which want to coincide with current trends to ensure that users prefer them.

1. Introduction

Many companies have had to adapt their business organizations to new technological developments in the Internet [1]. In a world that is increasingly global and interconnected, finding information that can enrich a company and allow it to obtain a competitive advantage is becoming increasingly important [2]. In addition, these technological changes have also affected users and have significantly changed consumers' lives.

In this global context, the increasing complexity of business environments has led to the introduction of new business models, an improvement in global contacts and relationships, with easier access to information. Businesses need to know how to take advantage of these new opportunities. One way

to do this is for companies to use Internet search engines to find information about different products, services, activities, or any information that is required. The use of these technological advances has changed users' habits and ways of accessing information as well as increasing creativity when solving strategic marketing problems [3, 4].

Companies have realized that they need to develop effective marketing strategies in order to take advantage of new trends in consumer behaviour. One of the tools that can be used to do this is the search engine. Search engines are websites that index information on the Internet and organize it according to its quality for a user's search criteria. Today, the most widely used search engines worldwide are Google with 78.78% of the total market share, Bing with 7.65%, Baidu with 7.33%, and Yahoo with 4.70% [5]. Each of these

TABLE 1: Related works.

Authors	Descriptions
Chao et al. [21]	Present an investigation of the participating agents when users search for information with search engines, especially studying the beliefs and risks that are taken in their searches
Palos-Sanchez and Saura [5]	Analyse the Ecosia sustainable search engine using the Unified Theory of Acceptance and Use of Technology (UTAUT) and then analysing the results with PLS-SEM (Partial Least Squares-Structural Equation Modelling)
Rangaswamy et al. [22]	Research the different strategic perspectives of search engines from the point of view of sustainability and sustainable development
Keirstead [23]	Investigates the searches made with sustainable search engines and the user behaviour
Liaw et al. [24]	Use the TAM with PLS to find what the users feel about the information found with different search engines
Kamis and Stohr [25]	Develop a PLS model to determine the importance of search engines when an online purchase is made, using factors such as purchase decision, trust or perceived utility, and the behaviour of different users

search engines has different features that can be used to analyse and improve marketing strategies.

As well as considering global developments when creating new business models, companies are also trying to use the planet's resources more sustainably and use niche-marketing strategies. The complexity of these marketing strategies must be analysed in order to understand the new consumer [6, 7]. Research has been done on various sustainable search engine initiatives called Green Search Engines in some studies, which are a strategic micro niche within the sector [5, 8, 9].

Many energy-consuming computing resources are needed for a search engine to be able to find information from anywhere in the world. These resources generate high temperatures that can be mitigated with air conditioning that also consumes electricity. In fact, Google says that each query requires around 1 kJ or 0.0003 kWh of energy [10].

Sustainable search engine is the name given to a search engine that gives part or all of its profits to sustainable social and environment projects. A search engine's profits usually come from advertising in the search results [5, 11].

With the amount of information that exists on the Internet, new sustainable business models have been developed for search engines in recent years [12]. It is important to note that the well-known techniques of SEO, Search Engine Optimization, and SEM, Search Engine Marketing, are widely used. The first technique optimizes the information given in the results of any search request, and the second technique is used to produce economic benefits. These economic benefits are earned from sponsored search results (paid search) that are financed by advertisers using CPC (cost per click) or CPM (cost per thousand impressions) or any other type of payment method [13, 14]. This type of advertising also allows effective marketing strategies to be used, since it collects usage and navigation data about new consumer trends, which can be used to modify marketing.

As a general rule, SEM-sponsored search results finance and sustain different types of sustainable projects [15]. Some sustainable search engines are described below. Ecosia allocates 80% of SEM advertising revenue to tree reforestation projects around the world. Solydar helps sustainable development projects as well as sectors of the socially disadvantaged population. Goodsearch encourages users of their search engine to accumulate $5 units of credit that they can later donate to sustainable development projects. Lilo is a search engine that donates drops of water that are accumulated by users every time they search using this search engine. Benefind makes a donation of 0.5 cents each time someone searches using their search engine. Forestle donates 90% of its profits to sustainable and social development agencies or projects such as Treeho, which is similar to the Ecosia model of planting trees as a result of using the search engine [5, 16, 17].

The purpose of this study is to use the TAM with Trust as an external variable to identify different groups of sustainable search engine users. A FIMIX-PLS analysis and a post hoc analysis are carried out in order to identify different behaviour when users adopt a sustainable search engine and to detect new trends in consumer behaviour. In this way, a large amount of information can be used to comment on how marketing can face future technological challenges as users take advantage of environmentally sustainable technologies.

2. Theoretical Background

Over the last decade, researchers have followed various lines of research in the areas of search engine acceptance, users' feelings about different search engines, and the different options available in the market (see Table 1 [18]).

Sánchez et al. [19] investigated the evolution of search, the number of searches made, and the consistency of any expected result when using different sustainable search engines. Likewise, Martínez-Sanahuja and Sánchez [20] carried out research on search engine sustainability to discover how sustainable programs affect the users' opinion and also review the main initiatives of sustainable search engine since 1994.

In the research by Hahnel et al. [26], both traditional and sustainable search engines were studied to find the factors which influence users' choice of search engines. Liaw and Huang [27] suggested a model to investigate the methods used to find information with search engines and identify how these searches can be made more efficient.

Fortunati and O'Sullivan [28] showed the importance of new media and new technologies that are provided by digital alternatives. Sustainable social development was studied with special importance placed on how users behave with these new digital alternatives in order to find ways to improve them

[29]. Jaca et al. [30] showed the importance for businesses of considering society and users' respect for the environment. They pointed out that sustainable development can be understood by analysing user behaviour for sustainable organizations [23].

In addition, Hirsu [29] investigated the cultural factors that influence the choice of search engine for different searches made by users. The behaviour of different types of users of search engines was investigated in order to determine behaviour patterns and consequently predict them [28].

3. Research Model and Hypotheses Development

After analysing different models and theories of technological acceptance, the TAM with Trust as an added external variable was chosen for this investigation. TAM was chosen because it has been shown to be a reliable model for measuring the acceptance and use of technologies as well as for the behaviour of users. The main constructs in the model explain users' attitudes towards using technology, and the TAM has been used to investigate users' attitudes towards alternative technologies. Reviewing different research that used the TAM, with added external variables, to accept theories helped in the choice of this model. In the next section, there is an explanation of each of the variables and relationships used in the model to analyse the hypotheses.

4. Technology Acceptance Model (TAM) Variables

The TAM establishes casual relationships between perceived usefulness (PU), perceived ease of use (PEOU), attitude toward using (ATU), and intention to use (USE) [31]. Following the research of Davis [32], in which the model was proposed for the first time, perceived usefulness (PU) and perceived ease of use (PEOU), that are not implicitly included in TAM, are expected to influence attitude toward using (ATU) and behavioural intention to use [33]. In this study, the external variable Trust was also included. Trust is defined as the confidence that users have in technology and links the reliability of their implicit actions with technology when they use it [5]. ATU refers to a user's positive or negative feelings toward the use of any given technology, while BUSE is the amount of prior use given to the technology [34]. PU is defined as how much an individual believes that using a particular system will improve their performance [32]. It is a measure of the subjective likelihood that a potential user will increase their work performance in an organization when using the technology [35]. The PEOU variable measures how much an individual believes that using a particular system is effort-free. Different authors have also previously used the external variable, Trust, in the TAM [36]. Trust is an external variable to the model and has been defined by previous research in a variety of ways, both theoretically and operationally.

Palanisamy [37] demonstrated and developed a model for the acceptance of different search engines and linked the influence of PU with USE. Liaw and Huang [27] studied the influence of PU on ATU to understand users' attitudes towards using search engines and the perceived utility of the different search engines. Using the studies above, we propose the following hypothesis.

H1 Perceived usefulness (PU) influences intention to use (USE) sustainable search engines on the Internet.

Lim and Ting [38] developed a technology acceptance model for search engines that are used in e-commerce web pages. A clear relationship was found between PU and ATU when using the search engine. Koufaris [39] studied user behaviour when making queries with these search engines and investigated the relationship between PU and ATU when accessing a web page as a result of using a search engine. Using these studies, we propose the following hypothesis.

H2 Perceived usefulness (PU) influences attitude towards using (ATU) for sustainable search engines on the Internet.

Morosan and Jeong [40] used the TAM to study the adoption of search engines for booking hotels and restaurants and researched the influence of the PEOU and PU variables when using these search engines to achieve travellers' goals. Yang and Kang [41] showed the influence of USE and PU variables for search engines in Thailand and used them in the UTAUT (Unified Theory of Acceptance and Use of Technology) model. Using this literature, we propose the following hypothesis.

H3 Perceived ease of use (PEOU) influences perceived usefulness (PU) of sustainable search engines on the Internet.

Hsu and Walter [42] investigated the relationship of the ease of use and the perceived usefulness of search engines when looking for content on web pages. They proposed a relationship between PEOU and ATU using the technology acceptance model. Chi-Yueh et al. [43] explored the intention of users to use search engines to find audio and video content on the Internet and analysed the influence of PEOU on ATU. Using these investigations, we propose the following hypothesis.

H4 Perceived ease of use (PEOU) influences attitude toward using (ATU) sustainable search engines on the Internet.

Moon and Kim [44] and Gefen et al. [45] used the TAM to study search engines and online stores on the Internet. In this research, the influence of attitude toward using (ATU) on intention to use (USE) Internet search engines was studied. Following these investigations, in which the TAM was adapted for search engines, we propose the following hypothesis.

H5 Attitude toward using (ATU) influences intention to use (USE) sustainable search engines on the Internet.

Hsu and Walter [42] adapted the TAM for search engine use by adding the Trust variable and then linking this to PU. To do this, the influence that attitude has on use, when a user trusts the search engine, was measured [44]. Palanisamy [37] also included the Trust variable in the model, in order to find the reliability of search engines and their technological acceptance. Using this research on search engines, we propose the following hypothesis.

H6 Trust influences perceived usefulness (PU) of sustainable search engines on the Internet.

Lim and Ting [38], Palanisamy [37], and Hsu and Walter [42] also analysed the influence that Trust, as an external variable, has on PEOU in acceptance models and revealed the influence of both variables for search engines [5, 45]. Therefore, the following hypothesis was proposed.

H7 Trust influences perceived ease of use (PEOU) for sustainable search engines on the Internet.

5. Heterogeneity and Segmentation

In Social Sciences, it is difficult to guarantee that the whole sample fits the same probabilistic distribution. However, with PLS, segmentation can be used with the structural model, which means that different parameters are used to separate the sample into groups [46].

Heterogeneity in the data may or may not be observed. Heterogeneity is observed when the differences between two or more groups of data are caused by observable characteristics, such as sex, age, or country of origin. On the other hand, unobserved heterogeneity arises when the differences between two or more data groups do not depend on any observable characteristic or combinations of characteristics. However, there can still be significant differences in the relationships between data groups in the model, when the origins of these differences cannot be attributed to any observable variable such as age, gender, educational level, or any other type [47].

In our study, these observable characteristics were used to divide the data into separate groups for investigation and then analysed with a group-specific PLS-SEM method. To do this, the variables used for the grouping of the sample had to be found. Once these were identified, the relationships between these groupings could be established and analysed.

There are established techniques for this process, but previous research has shown that traditional grouping techniques do not work very well for the identification of grouping differences [48]. Methodological research with PLS-SEM has resulted in a multitude of different techniques, commonly referred to as latent class techniques, to identify and treat unobserved heterogeneity. These techniques have proved to be very useful for identifying unobserved heterogeneity and grouping the data accordingly [47].

TAM was used for this investigation into the adoption of sustainable search engines on the Internet, and the number of segments was established so that it was small enough to guarantee parsimony and large enough to guarantee strategic relevance [49].

The technique chosen to study unobserved heterogeneity was FIMIX-PLS [50], extended by Sarstedt et al. [51]. FIMIX-PLS is the most used latent class approach for PLS-SEM [52] and is an exploratory tool that results in the appropriate number of segments into which the sample should be divided. The FIMIX-PLS technique allowed decisions to be made about the number of segments using pragmatic reasoning and practical issues identified in current research [53].

FIMIX-PLS is the most widely used technique and has been used in various areas of research, such as environmental positioning of businesses [46], Internet usage by SMEs [54, 55], tourism management [56], strategic marketing management [57], corporate reputation [48, 58], mobile shopping [59], and learning systems [60].

FIMIX proposes an estimated path model using the PLS-PM algorithm. The resulting latent variable values are used in the FIMIX-PLS algorithm to find any unobserved heterogeneity in the estimated parameters of the internal model (relationships between latent variables).

6. Data and Methodology

Table 2 shows the demographic characteristics of the sample ($n = 445$). It can be seen that most of the sample are young people aged 19–30 (81.3%) who are students (75.3%) at university (73.0%) and use search engines with smartphones (91.2%). The percentages of men (41.6%) and women (56.8%), as well as the habitats, were more equally proportioned.

The data collection technique chosen for this study was the survey, which is a quantitative technique. In this case, it allowed us to identify the users' attitudes and behaviour when using sustainable and unsustainable search engines on the Internet. A 15-item questionnaire about attitudes and behaviour and 5 classification questions were used. The classification questions were about gender, age, job, habitat, education level, and the device used for Internet access. The questionnaire was divided into 3 sections.

The first section dealt with the questions for the TAM [32] about Internet search engine technology and the users' feelings, attitudes, and behaviour for the adoption and use of sustainable search engines. This section was composed of 12 questions about PU (3), PEOU (3), ATU (3), and USE (3). The TAM variables were measured using adapted item scales [32].

The second section consisted of a block of questions on different aspects of Trust and sustainable search engines. These questions were grouped into the 3 items in the Trust construct. The behavioural items about sustainable search engines on the Internet were adapted from previous research on Trust, in which the Trust variable refers to how much a user believes in the safety, reliability, efficiency, competence, and validity of a sustainable search engine [5]. The behavioural items for sustainable search engines refer to the moment when a user finds a service to be unreliable and interacts less with the search engine, content, or information.

TABLE 2: Demographic characteristics of the sample ($n = 445$).

Classification variable		Frequency	Percentage
Gender	Female	253	56.8%
	Male	185	41.6%
	Others	7	1.6%
Age	18–30	362	81.3%
	31–45	49	11.0%
	46–55	27	6.1%
	56–65	6	1.4%
	>65	1	0.2%
Job	Unemployed worker	13	2.9%
	Self-employed worker	24	5.4%
	Contracted worker	58	13.7%
	Student	335	75.3%
	Housewife	8	1.8%
	Retired	4	0.9%
Habitat	Town with more than 100,000 inhabitants	142	31.9%
	From 20,000 to 100,000 habitants	153	34.4%
	Less than 20,000 habitants	149	33.7%
Education level	Basic studies (O-levels)	77	17.3%
	Professional training/A-levels	40	8.7%
	University degree	325	73.0%
Access to Internet from	Smartphone	406	91.2%
	Tablet or iPad	117	26.3%
	Laptop	270	60.7%
	Personal computer	47	10.6%

In the study of the behavioural intention to use a search engine, Trust is defined as the general belief that these searches will be made [37, 38, 42, 44, 45].

There were 20 items in the research questionnaire (see Table 3). All the items, except for the classificatory questions, were measured using a Likert 5-point scale that ranged from total disagreement [61] to total agreement [62].

Overall, 445 questionnaires were collected from the users. Google Forms was used because the questionnaire could be produced online and then distributed on social networks. Nonprobabilistic and convenience sampling was used, and a pilot survey was carried out to check the validity and reliability of the scales. In this way, the questions could be refined and additional comments on the content and structure of the questionnaire were obtained. All the participants in the survey were asked to watch the video that accompanied the questionnaire.

The PLS-SEM method was used for the analysis. This is a statistical analysis technique based on the Structural Equation Model, which is a recommended method for exploratory research as it allows the modelling of latent constructs with indicators [63] to analyse the collected data. PLS is

appropriate for the analysis and prediction of relatively new phenomena [64]. For this study, we used the SmartPLS 3 software [65]. The results were handled with the statistical package SPSS 24, which was used to calculate frequency tables, CHAID tree, ANOVA, and sample statistics.

To find the minimum sample size for PLS modelling, Hair et al. [66] recommend using the Cohen tables [67]. These tables were used with the G*Power software package [68] to find the dependent constructs, which are those that have the highest number of predictors. In this case, they were PU, ATU, and USE. The following parameters were used for the calculation: the test power (power = $1 - \beta$ error prob. II) and the size of the effect (f^2). Cohen [69] and Hair et al. [70] recommend a power of 0.80 and an average size of the effect $f^2 = 0.15$. In our case, there were 2 predictors, which were the constructs that have causal relationships with USE (see Figure 1). Therefore, from PLS, the USE construct established the minimum sample size as 107 for a power = 0.95 and critical F = 3.08. Therefore, the sample used is adequate because it is more than four times the recommended minimum for obtaining valid and reliable results with the established parameters.

7. Analysis of Results

7.1. Measurement Model Evaluation. Before the PLS analysis was carried out, the validity and reliability of the measurement model were calculated with the following tests: individual reliability of each item, internal consistency (or reliability) of each scale (or construct), convergent validity, and discriminant validity.

7.1.1. The Individual Reliability of the Items: Construct Loads (λ). In this phase of the investigation, the indicators' loads (λ) were calculated, with the minimum acceptance level for part of the construct $\lambda \geq 0.707$ [71]. Therefore, a value $\lambda \geq 0.707$ indicates that each measurement represents at least 50% ($0.707^2 = 0.5$) of the variance of the underlying construct [72]. The indicators that did not reach the minimum level were disregarded [73].

The magnitude and importance of the relationships between latent variables were calculated using the standardized path coefficient. The rule established by Chin [74] states that this value must be at least 0.2 (see Figure 1).

Cronbach's alpha and the composite reliability (CR, composite reliability) were then calculated to find the reliability of each construct. This evaluation measures the consistency of a construct based on its indicators [75], that is, the rigor with which these items are measuring the same latent variable. The lower limit for the acceptance of the construct reliability using Cronbach's alpha is usually between 0.6 and 0.7 [76]. Causality is found from the loads of the indicators and the composite reliability (CR) [77] which must have a minimum level of 0.7 [62, 78, 79].

Table 4 shows the results for all the reliability coefficients. As can be seen, all the coefficients had much higher values than the necessary minimum limits, which confirms the high internal consistency of all the latent variables.

TABLE 3: Items and scale.

Construct	Items
Attitude toward using (ATU)	(ATU1) My favorite search engine provides access to most data.
	(ATU2) My favorite search engine is better than previous search engines.
	(ATU3) My favorite search engine provides accurate information.
	(ATU4) My favorite search engine provides integrated, up-to-date, and reliable information.
Perceived ease of use (PEOU)	(PEOU1) Interaction with my favorite search engine services is clear and easily understood.
	(PEOU2) Working with my favorite search engine does not require much mental effort.
	(PEOU3) My favorite search engine services are easy to use.
	(PEOU4) I can easily find what I want in my favorite search engine.
Perceived usefulness (PU)	(PU1) Using my favorite search engine allows tasks to be completed more quickly.
	(PU2) Using my favorite search engine improves work performance.
	(PU3) Using my favorite search engine increases work productivity.
	(PU4) Using my favorite search engine improves work effectiveness.
Intention to use (IU)	(IU1) I am going to use my favorite search engine.
	(IU2) I expect the information provided by my favorite search engine to be useful.
Trust (T)	(T1) My Internet search engine is trustworthy.
	(T2) My Internet search engine takes its users' ideas into account.
	(T3) My Internet search engine has good intentions.
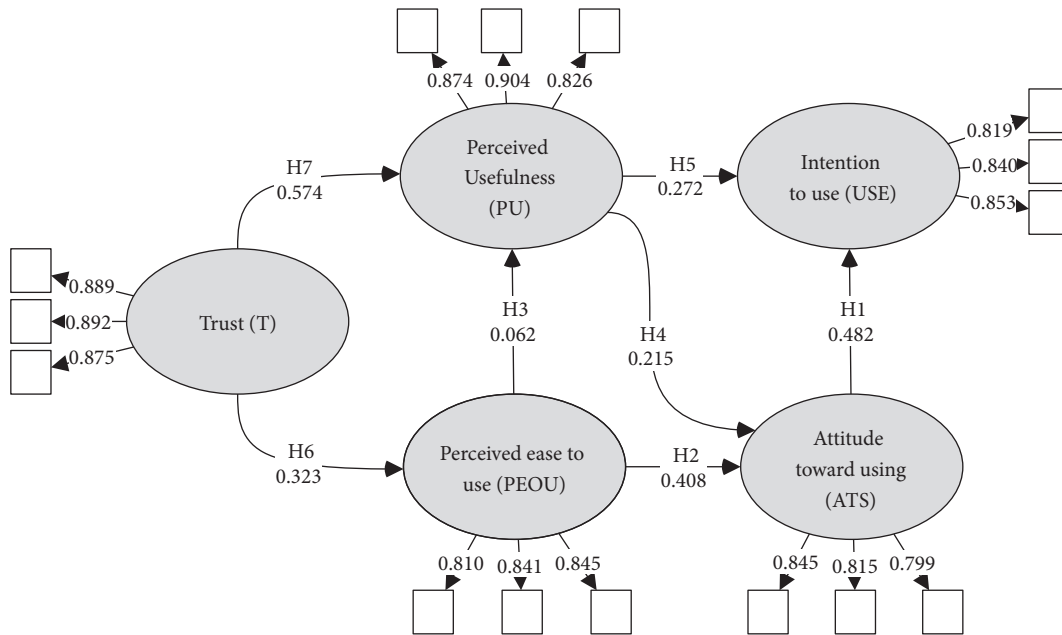
FIGURE 1: Proposed research model and PLS results.

TABLE 4: Measurement model.

Reliability of each construct					Fornell & Larcker criterion				
Constructs	Cronbach's alpha	rho_A	CR	AVE	ATS	USE	PEOU	PU	TRUST
ATS	0.756	0.757	0.860	0.672	0.820				
USE	0.830	0.833	0.898	0.746	0.572	0.864			
PEOU	0.703	0.700	0.828	0.616	0.535	0.461	0.785		
PU	0.756	0.756	0.860	0.673	0.383	0.496	0.325	0.820	
TRUST	0.862	0.862	0.916	0.784	0.386	0.423	0.364	0.637	0.885

7.1.2. Discriminant and Convergent Validity. AVE (average variance extracted) is defined as the mean extracted variance and measures how much variance the indicators of a construct have compared to the amount of variance due to the measurement error [80]. The recommendation of these authors is that AVE is ≥0.50. The rho_A coefficient [81] shows that in all constructs it is ≥0.7.

The discriminant validity shows how much one construct is different from another. A high value indicates weak correlations between constructs. For this test, the Fornell & Larcker [80] criterion is used, which verifies if the square root of the average variance extracted (AVE) for a construct is greater than that of the relationship between the construct and the rest of the model's constructs. This condition was met as can be seen on the right side of Table 2.

Table 5 shows the results that were obtained, where it can be seen that all the HTMT relationships for each pair of factors are <0.90 [82, 83]. The fulfilment of all these criteria and measurements means that the validity and reliability of the model are confirmed.

7.2. Assessment of the Structural Model. The following analyses were used to study the structural model, the explained variance of the endogenous constructs (R^2), the predictive capacity Q^2, the path coefficients (β), and the selection of critical values for the distribution of Student's t-value [84].

Henseler et al. [72] consider the explanatory power of R^2 values of 0.67, 0.33, and 0.19 to be substantial, moderate, and weak, respectively. In Table 4, we can see that PU ($R^2 = 0.416$), ATS ($R^2 = 0.335$), and USE ($R^2 = 0.417$) have a moderate explanatory power, while PEOU has a weak explanatory power ($R^2 = 0.133$).

7.3. Model and Hypothesis Testing. The model was then analysed using the bootstrapping technique. Using this technique, the standard deviation of the parameters and the Student t-values are found. From these, the simple regression coefficients for the components are calculated, and the results for the relationships between the latent variables of the hypotheses are found.

At this stage, the hypotheses were tested to see if the relationships established in the proposed model were confirmed [84]. Firstly, all the relationships between constructs had a significant impact on the behavioural intention to use the search engine (see Table 6). Therefore, the proposed TAM was supported together with the external Trust variable. All the hypotheses were supported with a 99.9% confidence level, except H3. The relationship between PEOU → PU was the least significant with a 95% confidence level ($\beta = 0.107$, $t = 2.628$).

The relationships that stood out most strongly were, in order, H7: TRUST → PU ($\beta = 0.598$; $t = 14.622$) and H2: PEOU → ATS ($\beta = 0.459$; $t = 10.675$).

7.4. Results for FIMIX-PLS: Study of Unobserved Heterogeneity. FIMIX-PLS calculates the probability of belonging to any given segment in which each observation is adjusted to the predetermined number of segments by estimating separate linear regression functions, which gives a

Table 5: HTMT and explanatory and predictive capacity of the model.

Constructs	ATS	USE	PEOU	PU	R^2 (with effect level)	Q^2
ATS					0.335 (moderate)	0.211
USE	0.716				0.417 (moderate)	0.293
PEOU	0.574	0.528			0.133 (weak)	0.070
PU	0.393	0.509	0.292		0.416 (moderate)	0.266
TRUST	0.479	0.570	0.378	0.692	—	—

Table 6: Statistical hypothesis test.

Hypotheses	Path	β path coefficients (t-values)	p value	Supported
H1	ATS USE	0.448 (8.877)***	0.001	Yes
H2	PEOU ATS	0.459 (10.675)***	0.001	Yes
H3	PEOU PU	0.107 (2.180)*	0.029	Yes
H4	PU ATS	0.234 (5.395)***	0.001	Yes
H5	PU USE	0.324 (6.851)***	0.001	Yes
H6	TRUST PEOU	0.364 (8.704)***	0.001	Yes
H7	TRUST PU	0.598 (14.622)***	0.001	Yes

Note: Bootstrapping with 5000 samples based on the Student t-distribution (499) in single queue: $^*p < 0.05$ ($t(0.05; 499) = 1.64791345$); $^{**}p < 0.01$ ($t(0.01; 499) = 2.333843952$); $^{***}p < 0.001$ ($t(0.001; 499) = 3.106644601$).

group of possible segments. Each case is assigned to the segment with the greatest probability.

The test is done in four stages: firstly, the number of optimal segments is calculated with FIMIX. Then, the latent variables that justify these segments are found, in order to finally estimate the model and its segments.

FIMIX was used to divide the sample into different segments. The first problem encountered was the selection of the appropriate number of segments. It is typical to repeat the FIMIX-PLS procedure with consecutive numbers of latent classes. In our case, given the sample size $n = 445$, we calculated for $k = 5$, $k = 4$, $k = 3$, and $k = 2$. The results obtained were compared using different information criteria provided by the FIT indices. The following were compared, Akaike (AIC), the controlled AIC (CAIC), the Bayesian information criterion (BIC), and the standardized entropy statistic (EN). The results obtained for the FIT indices are shown in Table 7.

Firstly, the FIMIX test was used to find the number of segments into which the sample can be divided. The algorithm was configured for the size of the sample so that PLS-SEM could be applied with 10 repetitions. This configuration was done using the expectation maximization algorithm (EM). The EM algorithm alternates between performing an expectation step (E) and a maximization step (M) [47]. Step E evaluates and uses the current estimation of the parameters. Step M calculates the parameters maximizing the logarithmic registration probability found in step E. Steps E and M are applied successively until the results are

TABLE 7: Indices FIT. Criteria for model choice.

FIT indices	$k = 2$	$k = 3$	$k = 4$	$k = 5$
AIC (Akaike information criterion)	3984.504	3891.831	3689.352	3683.153
AIC3 (AIC modified with factor 3)	4007.504	3926.831	**3736.352**	3742.153
AIC4 (AIC modified with factor 4)	4030.504	3961.831	**3783.352**	3801.153
BIC (Bayesian information criterion)	4078.760	4035.264	**3881.961**	3924.940
CAIC (AIC controlled)	4101.760	4070.264	**3928.961**	3983.940
LnL (LogLikelihood)	−1969.252	−1910.916	−1797.676	−1782.577
MDL5 (minimum description length with factor 5)	**4639.783**	4888.994	5028.399	5364.085
EN (standardized entropy statistics)	**0.998**	0.819	0.787	0.766

stabilized. Stabilization is achieved when there is no substantial improvement in the values obtained.

Table 7 shows the results after running FIMIX with different numbers of k partitions. Since the number of segments was unknown a priori, the different segment numbers were compared in terms of suitability and statistical interpretation [85, 86].

A purely data-based approach was taken, which only provided an approximate guide to the number of segments that should be selected. Heuristics, such as the information criteria and the EN, are fallible because they are sensitive to the data and the characteristics of the model [47].

The different criteria obtained were then evaluated. Sarstedt et al. [51] evaluated the effectiveness of different information criteria in FIMIX-PLS for a wide range of data constellations and models. Their results showed that researchers should consider AIC 3 and CAIC. As long as these two criteria indicate the same number of segments, the results probably point to the appropriate number of segments. In Table 6, it can be seen that in our analysis these results do not point to the same number of segments. Therefore, AIC was used with factor 4 (AIC 4, [87]) and BIC. These indices usually work well and, in our case (see Table 6), they indicated the same number of segments, which was $k = 4$. Other criteria showed this as a pronounced overestimation, although MDL5 indicated the minimum number of segments $k + 1$, which in this case would indicate 3 [47].

Measurements of entropy, such as the standardized entropy statistic (EN), were also considered [88]. EN uses the probability that an observation belongs to a segment to indicate whether the partition is reliable or not. The higher the probability of belonging to a segment is for a measurement, the clearer segment affiliation is. The EN index oscillates between 0 and 1. The highest values indicate a better quality partition. Previous research provided evidence that EN values above 0.50 allow a clear classification of the data into the predetermined number of segments [89, 90]. In Table 6, it can be seen that all the partitions have values of EN > 0.50, although the highest value is reached in $k = 2$ with EN = 0.998; for $k = 3$ EN = 0.819, and EN = 0.717 for $k = 4$.

Therefore, from the proposed solutions, the number of optimal segments was between $k = 3$ and $k = 4$. $k = 3$ was taken as the number of segments indicated by FIMIX-PLS, given that the smallest size of the partitions in this case was 12.1%.

TABLE 8: Relative segment sizes.

k	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5
2	0.637	0.363			
3	**0.582**	**0.296**	**0.121**		
4	0.561	0.285	0.105	0.049	
5	0.374	0.286	0.202	0.089	0.049

As can be seen in Table 8, for the $k = 3$ solution and a sample $n = 445$, the partitioning of the segments was 58.2% (259), 29.6% (131), and 12.1% [91, 92]. The segment sizes are not small despite the percentages. Therefore, the sample sizes are sufficient to use PLS. The sample size can be considerably smaller in PLS than in SEM due to covariance [47]. There can even be more variables than observations, and there may be a small amount of data that is completely missing [46, 93]. Different authors have shown that in PLS the sample can be very small [94] and that the minimum can even be 20 [64].

The segmentation structure of the obtained data is prepared in the third step of FIMIX. To do this, an ex post analysis was performed [50], which means, firstly, assigning each observation to a segment from the highest result for the probability of belonging to that segment. Secondly, the data are divided by means of an explanatory variable or a combination of several explanatory variables, resulting in data grouping that corresponds to that produced by FIMIX-PLS.

A post hoc analysis was carried out to determine the explanatory variables that justify this segmentation. Using the recommendations of several authors, CHAID decision or classification and regression trees were used to do this [48, 95].

A CHAID decision tree [96] is a graphical and analytical way of representing all the events that may arise from a decision. These trees allow the examination of the results and visually determine how the model flows. The visual results help to find specific subgroups and relationships that might not be found with more traditional statistics [97]. In this investigation, this method was used to make the "best" decision from a probabilistic point of view on a range of possible decisions. As seen in Figure 2, the obtained results show that the HABITAT variable is sufficiently explanatory for the choice of 4 segments.

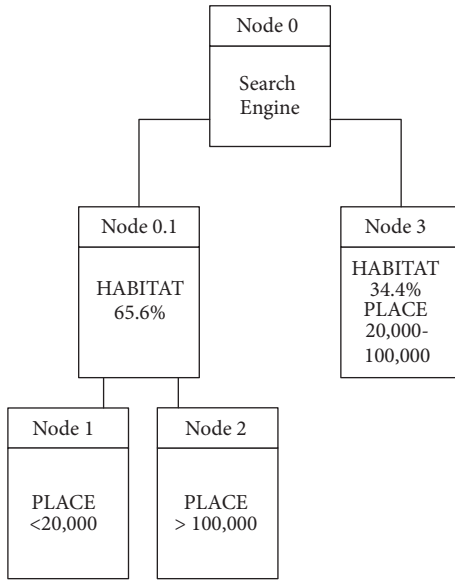Another technique that could be used in the post hoc analysis was to compare the classificatory explanatory

FIGURE 2: CHAID decision tree.

TABLE 9: ANOVA results.

ANOVA	F	Sig.
What is your genre?	1.091	0.337
Where is your current house?	3.858	0.022
What is your current situation?	1.558	0.212
What is your education level?	1.649	0.193
How old are you?	3.211	0.041
What is your favorite search engine?	5.415	0.005

variables using the Analysis of Variance (ANOVA) for a factor applied to the segment assigned to each observation.

In this way, the CHAID tree was constructed, and the characteristics of the segments were found using FIMIX-PLS. The results obtained for the Analysis of Variance (ANOVA) defined the category variables with explanatory capacity. Table 9 shows that not only the HABITAT variable has explanatory capacity but also AGE and FAVORITE SEARCH ENGINE.

In a more detailed analysis in Table 10, AGE was not found to be significant when studying the differences of means for the 3 segments. However, HABITAT and FAVORITE SEARCH ENGINE were significant.

Table 10 indicates the differences in segments 1 and 2 between towns of <20,000 inhabitants, from 20,000 to 100,000 inhabitants, and >100,000 inhabitants. There are significant differences between Google and https://www.ecosia.org/ search engines in these same segments.

The last step of the FIMIX analysis was to estimate segment-specific models. Once the HABITAT and FAVORITE SEARCH ENGINE variables were found to be the main explanatory variables that justify the FIMIX-PLS partitions, only the final step remained. In this step, the specific models for the indicated segments were found.

In order to do this, a multigroup analysis was carried out for HABITAT, as the results of the CHAID decision tree suggested. The 3 groups corresponding to living in a place <20,000 inhabitants, 20,000–100,000 inhabitants, and >100,000 inhabitants were used. An analysis of variance found significant differences for HABITAT between segments 1 and 2 and also for the FAVORITE SEARCH ENGINE: Google or Ecosia. After applying bootstrapping again, the results in Table 11 were found.

These analyses complete the basic steps of the FIMIX-PLS method. However, other research suggests testing whether the numerical differences between the specific path coefficients of the segment are also significantly different

using multigroup analysis. Document research found several approaches for multigroup analysis, which Sarstedt et al. [98] and Hair et al. [47] discuss in more detail. Hair et al. [47] recommend using the permutation approach (Chin & Dibbern, 2010; Dibbern & Chin, 2005), which has also been implemented in the SmartPLS 3 software.

However, before interpreting the results of a multigroup analysis, the researchers must make sure that the measurement models are invariable in all the groups. Once the measurement invariance (MICOM) described by Henseler et al. [99] had been checked, an analysis was carried out to find if there were any significant differences between the segments using multigroup analysis (MGA). The results can be seen in the three columns on the right of Table 12.

As can be verified from the results obtained by the nonparametric testing, the multigroup PLS-MGA analysis confirmed the parametric tests and also found significant differences between segments 2 and 3.

There are differences between the first and second segments but only $k = 2$ and $k = 3$ in H1 ATS $\rightarrow$ USE ($\beta = 0.642^{***}$) and $k = 1$ and $k = 3$ in H1 ($\beta = 0.521^{***}$) and H7 ($\beta = 0.316^{***}$) show a significant difference.

The validity of the segment measurement model and its explanatory capacity using R^2 is shown in Table 11 with the main results classified by segment. It can be seen that $k = 2$ has values for CR and AVE below the limits ($k = 2$, CR PU $= 0.293$, AVE PU $= 0.497$). The explanatory capacity of each segment (R^2) was shown to improve in the general model in all the partitions with the main dependent variable USE.

7.4.1. Assessment of the Predictive Validity. PLS can be used for both explanatory and predictive research as it can predict both existing and future observations [100] Predictive validity indicates that a given set of measurements for any construct can predict a dependent construct [101], as is, in our case, intention to use (IU).

Predictive validity (prediction outside the sample) was evaluated by cross-validation with retained samples. The approach suggested by Shmueli et al. (2016) was used in this investigation.

Using the research by other authors [102, 103], the current PLS Predict algorithm in the SmartPLS software version 3.2.7 was used [65]. This software gave results for the k-fold cross prediction errors and the summaries of prediction errors, such as the root mean square error (RMSE) and the mean absolute error (MAE). The predictive performance

TABLE 10: ANOVA differences of means for segments.

Dependent variable	(I) segment	(J) segment	Differences of means (I − J)	Sig.
	1	2	−0.246*	**0.016**
		3	−0.082	0.830
Where is your current house?	2	1	0.246*	**0.016**
		3	0.164	0.527
	3	1	0.082	0.830
		2	−0.164	0.527
	1	2	0.160	0.068
		3	−0.090	0.709
How old are you?	2	1	−0.160	0.068
		3	−0.250	0.107
	3	1	0.090	0.709
		2	0.250	0.107
	1	2	−2.511*	**0.005**
		3	0.447	0.934
What is your favorite search engine?	2	1	2.511*	**0.005**
		3	2.957	0.079
	3	1	−0.447	0.934
		2	−2.957	0.079

TABLE 11: Disaggregate results for direct effects between latent variables.

Hypotheses	Global model	FIMIX segmentation					
		k = 1 \n n = 292	k = 2 \n n = 116	k = 3 \n n = 37	MGAk1 vs k2	MGAk1 vs k3	MGAk2 vs k3
ATS → USE	0.448***	0.516**	0.637***	0.005 n.s.	0.121 n.s.	0.521***	0.642***
PEOU → ATS	0.459***	0.501***	0.166 n.s.	0.597***	0.335**	0.096 n.s.	0.431 n.s.
PEOU → PU	0.107*	0.089*	0.008 n.s.	0.068 n.s.	0.097 n.s.	0.157 n.s.	0.060 n.s.
PU → ATS	0.234***	0.294***	0.340*	0.115 n.s.	0.634*	0.178 n.s.	0.455 n.s.
PU → USE	0.324***	0.309***	0.196*	0.690***	0.505**	0.382 n.s.	0.887 n.s.
TRUST → PEOU	0.364***	0.393***	0.408***	0.336 n.s.	0.015 n.s.	0.057 n.s.	0.071 n.s.
TRUST → PU	0.598***	0.834***	0.300*	0.518**	1.134***	0.316*** n.s.	0.818 n.s.

Note: n.s. (not supported); *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

TABLE 12: Reliability measurements for the general model and for the three segments.

	Global model			k = 1 (58.2%)			k = 2 (29.6%)			k = 3 (12.1%)		
	CR	AVE	R^2	CR	AVE	R^2	CR	AVE	R^2	CR	AVE	R^2
ATS	0.860	0.672	0.335	0.849	0.651	0.456	0.861	0.674	0.158	0.858	0.679	0.385
USE	0.898	0.746	0.417	0.878	0.705	0.519	0.828	0.618	0.535	0.919	0.791	0.475
PEOU	0.828	0.616	0.133	0.837	0.632	0.151	0.766	0.525	0.166	0.812	0.592	0.113
PU	0.860	0.673	0.413	0.912	0.776	—	0.293	0.497	0.092	0.828	0.616	0.249
TRUST	0.916	0.784	—	0.933	0.824	0.761	0.878	0.708	—	0.885	0.721	—

of the PLS route model for indicators and constructs could then be evaluated. The following benchmarks given by the SmartPLS team were used to evaluate the predictive performance of the model [102–104]:

(1) The Q^2 value in PLS predict: the prediction errors of the PLS model were compared with the simple mean predictions. If the value of Q^2 is positive, the prediction error of the PLS-SEM results is less

than the prediction error of simply using the mean values. Consequently, the PLS-SEM model offered appropriate predictive performance. This is the case here in the two subsamples of segments 1 and 3 (see Table 13) in the dependent construct IU (Table 14). This indicates that we obtained good prediction results

(2) The linear regression model (LM) approach: a regression of all the exogenous indicators in each endogenous indicator was made. When this comparison is made, an estimate is obtained of where better prediction errors could be obtained. This is shown when the value of RMSE and MAE are lower than those of the LM model. If this is found, predictions can be made. This technique can only be applied for indicators. As can be seen in Table 14, the values of RMSE and MAE were mostly negative, which indicated good predictive power

Following Felipe et al. [102], the predictions within the sample and outside the sample were compared to the real composite scores. In order to do this, the research by [105] was used:

Using this procedure, the following metrics were found for the IU construct: RMSE for the complete sample (see Table 8) was 0.374 and had a higher value in segment 1 (0.485, difference = 0.111) and lower values in segment 2 (0.205, difference = −0.169) and segment 3 (0.337, difference = −0.037). As the composite values are normalized and have a mean of 0 and variance 1, RMSE can be considered as a measure of standard deviation. The difference between RMSE within the sample and outside the sample had a maximum of 0.205, which is less than 25% of standard deviation [102]. Since the difference in RMSE is not substantial, excess capacity is not a problem for this study.

The density diagrams of the residues within the sample and outside the sample are provided in Figure 3.

As a result of the different analyses, this research found sufficient evidence to support the predictive validity (out-of-sample prediction) of our research model, in order to predict values for new cases of IU. Therefore, the model can predict the intention to use in additional samples that are different from the data set which was used to test the theoretical research model [106].

The predictive validity gives additional support for the research model tested in this paper.

7.5. Considerations for the Management of Internet Search Engines (IPMA). In line with research that studied data heterogeneity [59], the IPMA-PLS technique was used to find more precise recommendations for the marketing of search engines on the Internet. IPMA is a grid analysis using matrices that allows combining the total effects of the PLS-SEM estimation "importance" with the average value score for "performance" [59, 107]. The results are presented in an importance-performance graph of four fields. In this way, marketing actions can be prioritized by taking into account

Table 13: Summary of dependent variable prediction.

Construct IU	RMSE	MAE	Q^2
Complete sample	0.374	0.286	−0.101
Segment 1	0.485	0.376	0.131
Segment 2	0.205	0.161	−0.311
Segment 3	0.337	0.235	0.291

the average lines of importance and performance for each latent construct [108].

The results for the different types of search engine users on the Internet are displayed in Figure 4. As proposed by other authors with different applications, four different recommendations can be made for more efficient search engine marketing actions on the Internet ([109] [59, 110, 111]).

For Groß [59], the interpretation of the four quadrants into which the graph is divided is as follows:

Quadrant I shows attributes of acceptance that are highly valued for performance and importance, competitive stress, and factors which gain or maintain the acceptance of search engines on the Internet at a high level. Therefore, companies that are developing search engines should take these attributes into account.

Quadrant II shows acceptance attributes of great importance but low performance, which need to be improved. In this case, Internet search engine developers should focus on these factors first.

Quadrant III shows acceptance attributes that are low in importance and performance. Due to their low priority, it is not advisable to focus the efforts of additional improvements in search engines on these attributes, as long as the strength of their influence does not change.

Quadrant IV shows acceptance attributes with little objective importance but a high performance index. This possible excess of positive acceptance of search engines must be taken into account so that resources and efforts can be assigned to other attributes that are not in this quadrant.

The results obtained give unequal results for each segment. For users belonging to $k = 1$, all constructs are important and offer reasonable performance and show lower importance and performance of PU but with similar results to those obtained for Trust and to a lesser extent to PEOU, which is more important.

Therefore, the individual results for the types of Internet search engine users can be interpreted in four different recommendations for carrying out more efficient marketing actions for search engines on the Internet.

For users belonging to $k = 2$, the results are the same for ATS but with slightly less performance in PEOU and TRUST. These show a very low PU performance, so developers should focus on marketing campaigns that show the enormous utility of the product in daily life, without highlighting the importance but rather the results that can be achieved with product use.

Finally, the results obtained for $k = 3$ show a different situation. These users valued importance >40 and <70, stating that PU is the least valued and obtained a score of 0.85. Therefore, in this segment, improvements should be made

Table 14: PLS predict assessment.

Items	PLS			LM			PLS-LM		
	RMSE	MAE	Q^2	RMSE	MAE	Q^2	RMSE	MAE	Q^2
Complete sample model									
IU1	0.877	0.665	0.114	0.88	0.665	0.107	−0.003	0	0.007
IU2	0.933	0.745	0.158	0.934	0.742	0.156	−0.001	0.003	0.002
IU3	0.861	0.661	0.107	0.863	0.659	0.102	−0.002	0.002	0.005
Segment 1									
IU1	0.68	0.534	0.178	0.682	0.535	0.173	−0.002	−0.001	0.005
IU2	0.772	0.625	0.264	0.777	0.621	0.255	−0.005	0.004	0.009
IU3	0.659	0.534	0.135	0.665	0.546	0.118	−0.006	−0.012	0.017
Segment 2									
IU1	0.857	0.688	0.031	0.886	0.682	−0.036	−0.029	0.006	0.067
IU2	0.908	0.724	0.025	0.936	0.745	−0.036	−0.028	−0.021	0.061
IU3	0.821	0.674	0.047	0.823	0.657	0.041	−0.002	0.017	0.006
Segment 3									
IU1	1.355	1.108	0.117	1.501	1.178	−0.083	−0.146	−0.07	0.2
IU2	1.201	0.952	0.193	1.146	0.928	0.265	0.055	0.024	−0.072
IU3	1.301	1.066	0.137	1.352	1.098	0.068	−0.051	−0.032	0.069
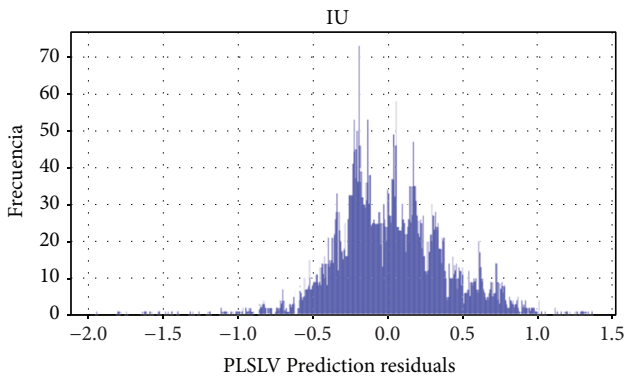
Figure 3: Residue density within the sample and outside the sample.

in the performance of PEOU and ATS, improving the users' perception of search engines. Most marketing actions should be taken in this segment, emphasising the ease of use, and working on actions that improve attitudes to Internet search engines.

8. Discussion

Firstly, a discussion is made of the results of an extended theoretical TAM with the external variable Trust, which analyses the intention to use socially and environmentally responsible search engines. The PLS method was used to analyse the measurement models and test the hypothesis. The results showed that the scales used were valid and reliable in all models. The result also indicated that all the variables were supported and even Trust influenced PU and PEOU. Other authors also confirmed this statement [37, 42, 44].

The FIMIX-PLS analysis divided the sample into three groups. The analysis of the FIT indices, the size of the segments, and the values of R^2 recommended segmentation into three sample groups. The multigroup analysis found significant differences for the relationships in different groups.

The post hoc analysis was made using a decision or classification CHAID tree [96] which resulted in the best classification variables for the sample groups. The results indicated that the HABITAT variable was the best variable for group classification. This meant that the three segments should be made with the size of the locality where the users of the search engines live. That is, users living in places with <20,000 inhabitants, between 20,000–100,000 inhabitants, and >100,000 inhabitants. FAVORITE SEARCH ENGINE (Google vs. https://www.ecosia.org/) is an additional classification variable.

The result of the bootstrapping analysis showed that some relationships were not valid in some of the segments, even though they were valid for the complete sample. All the hypotheses were supported in the largest segment (58.2%), which means that this group had the standard Google search engine user profile.

Google is a world leader in the search engine market, leading the ranking in all countries except China. In Spain, it has 95.79% of the market share, followed by Bing (2.61%) and Yahoo (1.34%) according to data from May 2018 [112]. Therefore, this segment represents the majority of users in Spain where it is the favorite search engine. It is clear that computers are not the only devices on which search engines are used, and many searches are also made with mobile devices. Taking into account that in Spain Android has 90% of the market share and that the search engine comes preinstalled in Google's mobile operating system, it is not surprising that the Google search engine usage statistics are so favorable.

However, this majority behaviour was not evident in the second segment (29.6%), where PEOU did not have significant relationships with PU and ATS. Of these two
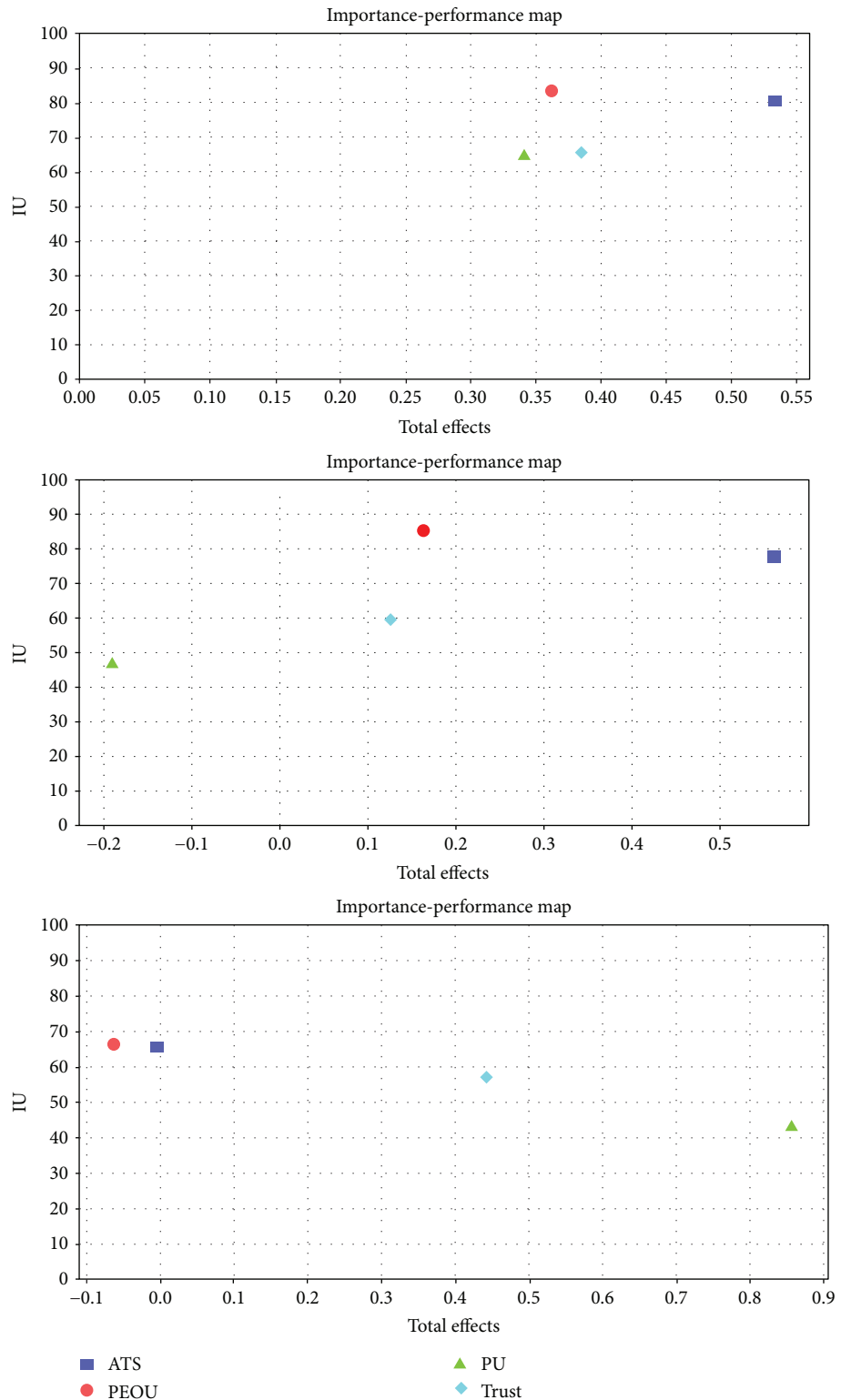
Figure 4: Importance-performance maps for $k = 1$, $k = 2$, and $k = 3$.

relationships, the multigroup analysis showed significant differences (confidence level = 99.9%) in PEOU → ATS in the first two segments. Therefore, it seems that the users in the second segment do not take into consideration that

the search engines are easy to use, and this fact does not influence their attitude towards them.

Similarly, segment 2 showed a decrease in the path coefficients and the significance of the relationships. As

k = 1
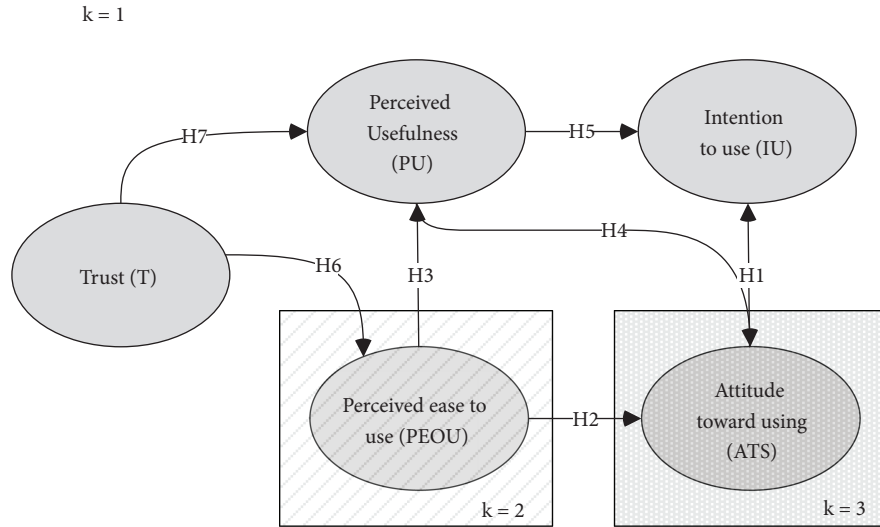
FIGURE 5: Segmentation results.

can be seen in Figure 5, the relationships that changed in this segment were PU → ATS and TRUST → PU. Other relationships increased, such as TRUST → PEOU and ATS → USE. These users are the ones for whom learning how to use the search engine is not a problem and who do not take into account its ease of use. The decision to use a search engine is taken based on the perceptions of its utility and the confidence generated. This user could therefore be a potential user of socially and environmentally sustainable search engines.

For segment 3 (12.1%), it can be seen that the four hypotheses were not confirmed (ATS → USE, PEOU → PU, PU → ATS, TRUST → PEOU), so users in this segment prefer simple search engines and only consider their usefulness. However, PU is not influenced by PEOU, which means that useful search engines are only influenced by trust. This type of user prefers alternative search engines that contribute socially and environmentally and that have additional search engine utilities, such as being sustainable. This group, therefore, consists of possible users of sustainable search engine.

The explanatory capacity of the segments was higher in the three analysed partitions (moderate) than in the general model, with segment 2 having a moderately higher value.

8.1. Segmentation Using Habitat and Favorite Search Engine. Like other recent studies [60], this study found that segmentation using PLS is a valid and adequate technique for studying unobserved heterogeneity and can help to improve understanding of marketing in complex systems. In our case, the place where the user lives (Habitat) and the user's favorite search engine (Favorite Search Engine) provided the sample segmentation and also moderate the relationships in the accepted model.

Existing scientific literature recognizes the importance of the moderating effects in relationships and most studies consider this influence in classic TAM [32], TRA (Theory of Reasoned Action) [61], UTAUT (Unified Theory of Acceptance and Use of Technology) [113], and in derived adaptations.

However, literature that uses Habitat as a segmentation variable or that moderates technology adoption is quite scarce. Recent studies confirm that adoption of Internet standards are moderated by national culture [114], and therefore, the place where one lives conditions perception of the Internet.

Some authors [5] point out that the second proposed segmentation variable, favorite search engine preference, conditions the relationships in the adoption model.

In contrast with other studies into the influence of habitat, a priori variables were not used. This study used unobserved segmentation to divide the sample into groups so that the heterogeneity could be found and homogenous groups created in the population. Later, CHAID analysis showed that the habitat variable was the best predictive variable for segmentation of the available information. Later, the unobserved heterogeneity was used as observed heterogeneity for a later analysis with ANOVA.

These results show that the habitat variable has a moderating effect on the intention to use certain search engines. In the group analysis, the MGA test found differences in the PEOU → ATS relationship in the k1 and k2 segments. At the same time, the ATS → USE relationship was not supported in the third segment, and significant differences were detected with respect to k1 and k2. The rest of the differences are in the intensity of the relationship. In the first segment, Trust → PU has greater significance than in the second segment, which implies that the search engine effectiveness is more important than other aspects. This confirms that segment 2 contains potential users of sustainable search engines.

9. Conclusion

9.1. Implications for Business Management. In the current market, technology companies have to deal with complex problems. Two of the most important are the increasing variety of products and the changes in consumer demands. These have forced market research to stop recommending

undifferentiated marketing strategies and to adopt processes using segmentation based on causal relationships.

The use of technological products which are designed to be environmentally friendly and therefore sustainable from a social point of view is a recent area of interest in the IT sector. There is still little research in this area, and only a few companies consider the results of these attributes for their products. However, users are increasingly interested in these attributes. This research studied Internet search engines, where there are still only a few which are socially and environmentally sustainable. In order for a search engine to work all over the world, many computer resources that consume electricity are needed. Search engine use generates high temperatures that are mitigated with air conditioned rooms, and these also consume electricity. In fact, Google states that each query which is made requires around 1 kJ or 0.0003 kWh of energy [10]. A small part of this energy is generated by renewable energies, 16.5% in the case of Spain (Eurostat, 2016). This means that the company must compensate for all the pollution generated by the production of energy for the servers, network devices, and storage units needed for search engines to work, by improving the search engine sustainability and environmental awareness. This study found the best relationship model for the variables that condition the users' preference and acceptance of search engines as well as the profile of sustainable search engine users.

This research makes two important contributions to the scientific literature. The first contribution is methodological, with the use of nonparametric heterogeneous unobserved segmentation as a technique that helps to understand complex systems. As was seen in the literature review, this methodology has been used by authors for business, marketing, and management, but it has not been applied to technological products in the IT sector. Consequently, the behaviour of different Internet search engine user groups was explored, with special consideration given to environmental sustainability attributes.

All the constructs of the proposed hypotheses in the general model were accepted. Trust was an important consideration in the acceptance of search engines on the Internet [5, 37, 38, 42, 44, 45], as it indirectly influences PU and PEOU.

The following actions were proposed after studying the segmentation variables and user behaviour in each group. Users in towns with less than 20,000 inhabitants showed a utilitarian behaviour, so strategies aimed at increasing performance, productivity, and efficiency are suggested along with highlighting the advantages of using the search engine.

For users belonging to the second segment, the results are the same for ATS but with slightly less importance of PEOU and TRUST. These users give importance to PU, so the search engine companies should have marketing campaigns that show the enormous utility of their product in daily life, and the results that can be achieved by using it.

Finally, the results obtained for the users in the third segment reflect a different scenario. These users state that PU is the least important variable for them. Therefore, in this case, PEOU and ATS should be considered by improving the users' perception of the search engine. The most important

marketing actions should be taken in this area, promoting the attributes of ease of use and actions that improve the users' attitude towards using Internet search engines. Sustainability and respect for the environment are important aspects which should be included in marketing actions.

9.2. Limitations and Future Lines of Research. The research that was carried out has limitations because it is an exploratory study in the very recent area of research into sustainable IT products. In the future, larger population sizes should be used to compare and contrast the results found in this study. Also, marketing is a complex system where cause and effect can only be seen in retrospect. The complexity of these systems must be understood and strategies developed to face these challenges. Another important point is that the speed of innovation development is often not the same as that of market research. In addition, users were still not very familiar with the use of these applications and needed to watch a video and interact with the sustainable search engine to see how it worked, but perhaps, more time should be spent on this for a complete understanding of the application and its wider ranging effects.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

[1] T. M. Harrison and B. Barthel, "Wielding new media in Web 2.0: exploring the history of engagement with the collaborative construction of media products," *New Media & Society*, vol. 11, no. 1-2, pp. 155–178, 2009.

[2] A.-R. Ramos-Rodríguez and J. Ruíz-Navarro, "Changes in the intellectual structure of strategic management research: a bibliometric study of the *Strategic Management Journal*, 1980-2000," *Strategic Management Journal*, vol. 25, no. 10, pp. 981–1004, 2004.

[3] J. Hung, "Economic essentials of online publishing with associated trends and patterns," *Publishing Research Quarterly*, vol. 26, no. 2, pp. 79–95, 2010.

[4] J. R. Saura, P. Palos-Sánchez, and L. M. Cerdá Suárez, "Understanding the digital marketing environment with KPIs and web analytics," *Future Internet*, vol. 9, no. 4, p. 76, 2017.

[5] P. Palos-Sanchez and J. Saura, "The effect of internet searches on afforestation: the case of a green search engine," *Forests*, vol. 9, no. 2, p. 51, 2018.

[6] M. A. Gbededo, K. Liyanage, and J. A. Garza-Reyes, "Towards a life cycle sustainability analysis: a systematic review of approaches to sustainable manufacturing," *Journal of Cleaner Production*, vol. 184, pp. 1002–1015, 2018.

[7] J. Robinson, "Squaring the circle? Some thoughts on the idea of sustainable development," *Ecological Economics*, vol. 48, no. 4, pp. 369–384, 2004.

[8] K. Burns, "New technology briefing: ten golden rules to search advertising," *Interactive Marketing*, vol. 6, no. 3, pp. 248–252, 2005.

[9] R. F. Wilson and J. B. Pettijohn, "Search engine optimisation: a primer on keyword strategies," *Journal of Direct, Data and Digital Marketing Practice*, vol. 8, no. 2, pp. 121–133, 2006.

[10] Google, "Blogspot.com, powering a Google search. Consultado el 30 de abril de 2018," 2009, https://googleblog.blogspot.com.es/2009/01/powering-google-search.html.

[11] A. Gupta, B. Saha, and U. K. Sarkar, "Emergent heterogeneity in keyword valuation in sponsored search markets: a closer-to-practice perspective," *Computational Economics*, vol. 50, no. 4, pp. 687–710, 2017.

[12] H. Haans, N. Raassens, and R. van Hout, "Search engine advertisements: the impact of advertising statements on click-through and conversion rates," *Marketing Letters*, vol. 24, no. 2, pp. 151–163, 2013.

[13] J. Bagnall, "New technology briefing: search engine marketing," *Interactive Marketing*, vol. 4, no. 4, pp. 388–394, 2003.

[14] N. Yalçın and U. Köse, "What is search engine optimization: SEO?," *Procedia-Social and Behavioral Sciences*, vol. 9, pp. 487–493, 2010.

[15] K. Jerath, L. Ma, and Y. H. Park, "Consumer click behavior at a search engine: the role of keyword popularity," *Journal of Marketing Research*, vol. 51, no. 4, pp. 480–486, 2014.

[16] M. Grehan and J. B. Pettijohn, "Search marketing yesterday, today, and tomorrow: promoting the conversation," *Journal of Direct, Data and Digital Marketing Practice*, vol. 11, no. 2, pp. 100–113, 2009.

[17] A. V. Zakharov, "Methods of web marketing and search optimization for libraries that receive a profit from the use of their sites within the framework of the "reader-library" system," *Scientific and Technical Information Processing*, vol. 41, no. 2, pp. 140–144, 2014.

[18] D. Tjondronegoro and A. Spink, "Web search engine multimedia functionality," *Information Processing & Management*, vol. 44, no. 1, pp. 340–357, 2008.

[19] D. Sánchez, L. Martínez-Sanahuja, and M. Batet, "Survey and evaluation of web search engine hit counts as research tools in computational linguistics," *Information Systems*, vol. 73, pp. 50–60, 2018.

[20] L. Martínez-Sanahuja and D. Sánchez, "Evaluating the suitability of web search engines as proxies for knowledge discovery from the web," *Procedia Computer Science*, vol. 96, pp. 169–178, 2016.

[21] C.-Y. Chao, T.-C. Chang, H.-C. Wu, Y.-S. Lin, and P.-C. Chen, "The interrelationship between intelligent agents' characteristics and users' intention in a search engine by making beliefs and perceived risks mediators," *Computers in Human Behavior*, vol. 64, pp. 117–125, 2016.

[22] A. Rangaswamy, C. L. Giles, and S. Seres, "A strategic perspective on search engines: thought candies for practitioners and researchers," *Journal of Interactive Marketing*, vol. 23, no. 1, pp. 49–60, 2009.

[23] J. Keirstead, "Feeling lucky? Using search engines to assess perceptions of urban sustainability," *Environmental Impact Assessment Review*, vol. 29, no. 2, pp. 87–95, 2009.

[24] S.-S. Liaw, W.-C. Chang, W.-H. Hung, and H.-M. Huang, "Attitudes toward search engines as a learning assisted tool: approach of Liaw and Huang's research model," *Computers in Human Behavior*, vol. 22, no. 2, pp. 177–190, 2006.

[25] A. A. Kamis and E. A. Stohr, "Parametric search engines: what makes them effective when shopping online for differentiated products?," *Information & Management*, vol. 43, no. 7, pp. 904–918, 2006.

[26] C. Hahnel, F. Goldhammer, U. Kröhne, and J. Naumann, "The role of reading skills in the evaluation of online information gathered from search engine environments," *Computers in Human Behavior*, vol. 78, pp. 223–234, 2018.

[27] S.-S. Liaw and H.-M. Huang, "An investigation of user attitudes toward search engines as an information retrieval tool," *Computers in Human Behavior*, vol. 19, no. 6, pp. 751–765, 2003.

[28] P. Palos-Sanches, J. M. Hernandez-Mogollon, and A. M. Campon-Cerro, "The behavioral response to location based services: an examination of the influence of social and environmental benefits, and privacy," *Sustainability*, vol. 9, no. 11, p. 1988, 2017.

[29] L. Hirsu, "Tag writing, search engines, and cultural scripts," *Computers and Composition*, vol. 35, pp. 30–40, 2015.

[30] C. Jaca, V. Prieto-Sandoval, E. L. Psomas, and M. Ormazabal, "What should consumer organizations do to drive environmental sustainability?," *Journal of Cleaner Production*, vol. 181, pp. 201–208, 2018.

[31] V. Venkatesh and F. D. Davis, "A theoretical extension of the technology acceptance model: four longitudinal field studies," *Management Science*, vol. 46, no. 2, pp. 186–204, 2000.

[32] F. D. Davis, "Perceived usefulness, perceived ease of use, and user acceptance of information technology," *MIS Quarterly*, vol. 13, no. 3, p. 319, 1989.

[33] F. D. Davis, R. P. Bagozzi, and P. R. Warshaw, "User acceptance of computer technology: a comparison of two theoretical models," *Management Science*, vol. 35, no. 8, pp. 982–1003, 1989.

[34] R. J. Budd, "Response bias and the theory of reasoned action," *Social Cognition*, vol. 5, no. 2, pp. 95–107, 1987.

[35] J. R. Saura, P. Palos-Sanchez, and M. A. Rios Martin, "Attitudes to environmental factors in the tourism sector expressed in online comments: an exploratory study," *International Journal of Environmental Research and Public Health*, vol. 15, no. 3, p. 533, 2018.

[36] R. Bagozzi, "The legacy of the technology acceptance model and a proposal for a paradigm shift," *Journal of the Association for Information Systems*, vol. 8, no. 4, pp. 244–254, 2007.

[37] R. Palanisamy, "Evaluation of search engines: a conceptual model and research issues," *International Journal of Business and Management*, vol. 8, no. 6, 2013.

[38] W. M. Lim and D. H. Ting, "E-shopping: an analysis of the technology acceptance model," *Modern Applied Science*, vol. 6, no. 4, 2012.

[39] M. Koufaris, "Applying the technology acceptance model and flow theory to online consumer behavior," *Information Systems Research*, vol. 13, no. 2, pp. 205–223, 2002.

[40] C. Morosan and M. Jeong, "Understanding travelers' adoption of hotel reservation web sites," in *Information and Communication Technologies in Tourism 2006*, pp. 394–405, Springer, Vienna, 2006.

[41] K. C. C. Yang and Y. Kang, "Exploring factors influencing Internet users' adoption of Internet television in Taiwan," *First Monday*, vol. 11, no. 3, 2006.

[42] L. Hsu and Z. Walter, "Search engine or content website? A local information seeking classification model based on

consumer characteristics and website perceptions," *International Journal of Human-Computer Interaction*, vol. 31, no. 4, pp. 263–276, 2015.

[43] H. Chi-Yueh, H. Ci-Jhan, and C. Hsiu-Hui, "Using technology acceptance model to explore the intetion of internet users to use the audio and video fitness teaching," *Journal of Engineering and Applied Sciences*, vol. 12, no. 18, pp. 4740–4744, 2017.

[44] J.-W. Moon and Y.-G. Kim, "Extending the TAM for a World-Wide-Web context," *Information & Management*, vol. 38, no. 4, pp. 217–230, 2001.

[45] D. Gefen, E. Karhanna, and D. W. Straub, "Trust and TAM in online shopping: an integrated model," *MIS Quarterly*, vol. 27, no. 1, p. 51, 2003.

[46] J. Mondéjar-Jiménez, M. Segarra-Oña, Á. Peiró-Signes, A. M. Payá-Martínez, and F. J. Sáez-Martínez, "Segmentation of the Spanish automotive industry with respect to the environmental orientation of firms: towards an ad-hoc vertical policy to promote eco-innovation," *Journal of Cleaner Production*, vol. 86, pp. 238–244, 2015.

[47] J. F. Hair, M. Sarstedt, L. Matthews, and C. M. Ringle, "Identifying and treating unobserved heterogeneity with FIMIX-PLS: part I-method," *European Business Review*, vol. 28, no. 1, pp. 63–76, 2016.

[48] M. Sarstedt and C. M. Ringle, "Treating unobserved heterogeneity in PLS path modeling: a comparison of FIMIX-PLS with different data analysis strategies," *Journal of Applied Statistics*, vol. 37, no. 8, pp. 1299–1318, 2010.

[49] M. Sarstedt and E. Mooi, "Cluster analysis," in *A concise guide to market research*, pp. 273–324, Springer, Berlin, Heidelberg, 2014.

[50] C. Hahn, M. D. Johnson, A. Herrmann, and F. Huber, "Capturing customer heterogeneity using a finite mixture PLS approach," *Schmalenbach Business Review*, vol. 54, no. 3, pp. 243–269, 2002.

[51] M. Sarstedt, J.-M. Becker, C. M. Ringle, and M. Schwaiger, "Uncovering and treating unobserved heterogeneity with FIMIX-PLS: which model selection criterion provides an appropriate number of segments?," *Schmalenbach Business Review*, vol. 63, no. 1, pp. 34–62, 2011.

[52] M. Sarstedt, "A review of recent approaches for capturing heterogeneity in partial least squares path modelling," *Journal of Modelling in Management*, vol. 3, no. 2, pp. 140–161, 2008.

[53] M. Sarstedt, M. Schwaiger, and C. M. Ringle, "Do we fully understand the critical success factors of customer satisfaction with industrial goods?- extending Festge and Schwaiger's model to account for unobserved heterogeneity," *Journal of Business Market Management*, vol. 3, no. 3, pp. 185–206, 2009.

[54] M. C. J. Caniëls, H. K. L. Lenaerts, and C. J. Gelderman, "Explaining the internet usage of SMEs: the impact of market orientation, behavioural norms, motivation and technology acceptance," *Internet Research*, vol. 25, no. 3, pp. 358–377, 2015.

[55] M. C. J. Caniëls, H. K. L. Lenaerts, and C. J. Gelderman, "Explaining the internet usage of SMEs," *Internet Research*, vol. 25, no. 3, pp. 358–377, 2015.

[56] C. Marques and E. Reis, "How to deal with heterogeneity among tourism constructs?," *Annals of Tourism Research*, vol. 52, pp. 172–174, 2015.

[57] A. Navarro, F. J. Acedo, F. Losada, and E. Ruzo, "Integrated model of export activity: analysis of heterogeneity in managers' orientations and perceptions on strategic marketing management in foreign markets," *Journal of Marketing Theory and Practice*, vol. 19, no. 2, pp. 187–204, 2011.

[58] L. M. Matthews, M. Sarstedt, J. F. Hair, and C. M. Ringle, "Identifying and treating unobserved heterogeneity with FIMIX-PLS: part II–a case study," *European Business Review*, vol. 28, no. 2, pp. 208–224, 2016.

[59] M. Groß, "Heterogeneity in consumers' mobile shopping acceptance: a finite mixture partial least squares modelling approach for exploring and characterising different shopper segments," *Journal of Retailing and Consumer Services*, vol. 40, pp. 8–18, 2018.

[60] J. Arenas-Gaitán, F. J. Rondán-Cataluña, and P. E. Ramírez-Correa, "Modelling the success of learning management systems: application of latent class segmentation using FIMIX-PLS," *Interactive Learning Environments*, vol. 60, pp. 1–13, 2018.

[61] I. Ajzen and M. Fishbein, *Understanding Attitudes and Predicting Social Behavior*, Prentice-Hall, Englewood Cliffs, NJ, 1980.

[62] R. P. Bagozzi and Y. Yi, "On the evaluation of structural equation models," *Journal of the Academy of Marketing Science*, vol. 16, no. 1, pp. 74–94, 1988.

[63] J. Y. Son and I. Benbasat, "Organizational buyers' adoption and use of B2B electronic marketplaces: efficiency-and legitimacy-oriented perspectives," *Journal of Management Information Systems*, vol. 24, no. 1, pp. 55–99, 2007.

[64] W. Ching and P. Newsted, "Chapter 12. Structural Equation modeling. Analysis with small samples using partial least squares," in *Statisticas strategies for smart sample researchs*, E. R. H. Hoyle, Ed., Sage Publications, Thousand Oaks, CA, USA, 1999.

[65] C. M. Ringle, S. Wende, and J. M. Becker, *Smart PLS 3*, Smart PLS Gmb H, Boenningstedt, 2015, https://www.smartpls.com/.

[66] J. F. Hair, G. T. M. Hult, C. M. Ringle, and M. Sarstedt, *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*, Sage, Thousand Oaks, CA, USA, 2014.

[67] J. Cohen, *Statistical Power Analysis for the Behavioral Sciences*, Eribaum, Hillsdale, NJ, 2nd edition, 1988.

[68] F. Faul, E. Erdfelder, A. Buchner, and A. G. Lang, "Statistical power analyses using G* Power 3.1: tests for correlation and regression analyses," *Behavior Research Methods*, vol. 41, no. 4, pp. 1149–1160, 2009.

[69] J. Cohen, "A power primer," *Psychological Bulletin*, vol. 112, no. 1, pp. 155–159, 1992.

[70] J. F. Hair Jr, M. Sarstedt, L. Hopkins, and V. G. Kuppelwieser, "Partial least squares structural equation modeling (PLS-SEM): an emerging tool in business research," *European Business Review*, vol. 26, no. 2, pp. 106–121, 2014.

[71] E. G. Carmines and R. Zeller, *Reliability and Validity Assessment*, Sage Publications, Newbury Park, CA, 1979.

[72] J. Henseler, C. M. Ringle, and R. R. Sinkovics, "The use of partial least squares path modeling in international marketing," *Advances in International Marketing*, vol. 20, pp. 277–320, 2009.

[73] D. Barclay, C. Higgins, and R. Thompson, "The partial least squares (PLS) approach to causal modelling: personal computer adoption and use as an illustration, technology studies, special issue on research methodology," *Technology and Investment*, vol. 2, no. 2, pp. 285–309, 1995.

[74] W. W. Chin, "The partial least squares approach to structural equation modelling," *Modern Methods for Business Research*, vol. 295, no. 2, pp. 295–336, 1998.

[75] O. Götz, K. Liehr-Gobbers, and M. Krafft, "Evaluation of structural equation models using the partial least squares (PLS) a roach," in *Handbook of Partial Least Squares*, E. W. W. V. Esposito Vinzi, Ed., pp. 691–711, Springer Berlin Heidelberg, Berlin, Germany, 2010.

[76] J. Hair, W. Black, B. Babin, R. Anderson, and W. C. Black, *Multivariate Data Analysis*, Cengage, UK, 8th edition, 2018.

[77] C. E. Werts, R. L. Linn, and K. G. Jöreskog, "Intraclass reliability estimates: testing structural assumptions," *Educational and Psychological Measurement*, vol. 34, no. 1, pp. 25–33, 1974.

[78] J. F. Hair, C. M. Ringle, and M. Sarstedt, "PLS-SEM: indeed a silver bullet," *Journal of Marketing Theory and Practice*, vol. 19, no. 2, pp. 139–152, 2011.

[79] J. Nunnally, *Psychometric Theory*, McGraw-Hill, New York, 1978.

[80] C. Fornell and D. F. Larcker, "Evaluating structural equation models with unobservable variables and measurement error," *Journal of Marketing Research*, vol. 18, no. 1, pp. 39–50, 1981.

[81] T. K. Dijkstra and J. Henseler, "Consistent and asymptotically normal PLS estimators for linear structural equations," *Computational Statistics and Data Analysis*, vol. 81, pp. 10–23, 2015.

[82] D. Bennett, D. P. B. Yábar, and J. R. Saura, "University Incubators May Be Socially Valuable, but How Effective Are They? A Case Study on Business Incubators at Universities," in *Entrepreneurial Universities. Innovation, Technology, and Knowledge Management*, M. Peris-Ortiz, J. Gómez, J. Merigó-Lindahl, and C. Rueda-Armengot, Eds., Springer, Cham, Switzerland, 2017.

[83] J. Henseler, "Bridging design and behavioral research with variance-based structural equation modeling," *Journal of Advertising*, vol. 46, no. 1, pp. 178–192, 2017.

[84] R. F. Falk and N. B. Miller, *A Primer for Soft Modeling*, University of Akron Press, 1992.

[85] J. Henseler, C. M. Ringle, and M. Sarstedt, "A new criterion for assessing discriminant validity in variance-based structural equation modeling," *Journal of the Academy of Marketing Science*, vol. 43, no. 1, pp. 115–135, 2015.

[86] M. Sarstedt, C. M. Ringle, D. Smith, R. Reams, and J. F. Hair Jr, "Partial least squares structural equation modeling (PLS-SEM): a useful tool for family business researchers," *Journal of Family Business Strategy*, vol. 5, no. 1, pp. 105–115, 2014.

[87] H. Bozdogan, "Mixture-model cluster analysis using model selection criteria in a new information measure of complexity," in *Proceedings of the First US/Japan Conference on the Frontiers of Statistical Modeling: An Informational Approach*, H. Bozdogan, Ed., pp. 69–113, Kluwer Academic Publishers, Dordrecht, Boston, London, 1994.

[88] V. Ramaswamy, W. S. Desarbo, D. J. Reibstein, and W. T. Robinson, "An empirical pooling approach for estimating marketing mix elasticities with PIMS data," *Marketing Science*, vol. 12, no. 1, pp. 103–124, 1993.

[89] C. M. Ringle, S. Wende, and A. Will, "Customer segmentation with FIMIX-PLS," in *Proceedings of PLS-05 International Symposium*, T. Aluja, J. Casanovas, V. Esposito Vinzi, A. Morineau, and M. Tenenhaus, Eds., pp. 507–514, PAD Test&go, Paris, Paris, 2005.

[90] C. M. Ringle, S. Wende, and A. Will, "Finite mixture partial least squares analysis: methodology and numerical examples," in *Handbook of partial least squares*, Springer handbooks of computational statistics series, Vol. 2, V. Esposito Vinzi, W. W. Chin, J. Henseler, and H. Wang, Eds., pp. 195–218, Springer, Heidelberg, Dordrecht, London, NY, 2010.

[91] L. T. Hu and P. M. Bentler, "Fit indices in covariance structure modeling: sensitivity to underparameterized model misspecification," *Psychological Methods*, vol. 3, no. 4, pp. 424–453, 1998.

[92] L. T. Hu and P. M. Bentler, "Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives," *Structural Equation Modeling: A Multidisciplinary Journal*, vol. 6, no. 1, pp. 1–55, 1999.

[93] M. Tenenhaus, V. E. Vinzi, Y. M. Chatelin, and C. Lauro, "PLS path modeling," *Computational Statistics and Data Analysis*, vol. 48, no. 1, pp. 159–205, 2005.

[94] H. O. Wold, "Introduction to the second generation of multivariate analysis," in *Theoretical Empiricism: A General Rationale for Scientific Model-Building*, H. O. Wold, Ed., p. VIIIeXL, Paragon House, New York, NY, 1989.

[95] C. M. Ringle, M. Sarstedt, and E. A. Mooi, "Response-based segmentation using finite mixture partial least squares: theoretical foundations and an application to American customer satisfaction index data," *Data Mining*, vol. 8 of Annals of Information Systems, pp. 19–49, 2010.

[96] G. V. Kass, "An exploratory technique for investigating large quantities of categorical data," *Journal of Applied Statistics*, vol. 29, no. 2, pp. 119–127, 1980.

[97] V. Berlanga-Silvente, M. J. Rubio-Hurtado, and R. V. Baños, "Com aplicar arbres de decisió en SPSS," *REIRE Revista d'Innovació i Recerca en Educació*, vol. 6, no. 1, pp. 65–79, 2013.

[98] M. Sarstedt, J. Henseler, and C. M. Ringle, "Multigroup analysis in partial least squares (PLS) path modeling: alternative methods and empirical results," in *Measurement and research methods in international marketing, pp. 195-218, Vol.37 (8)*, pp. 1299–1318, Emerald Group Publishing Limited, Statistics, 2011.

[99] J. Henseler, G. Hubona, and P. A. Ray, "Using PLS path modeling in new technology research: updated guidelines," *Industrial Management & Data Systems*, vol. 116, no. 1, pp. 2–20, 2016.

[100] G. Shmueli and O. Koppius, "Predictive analytics in information systems research," *MIS Quarterly*, vol. 35, no. 3, pp. 553–572, 2011.

[101] D. Straub, M. C. Boudreau, and D. Gefen, "Validation guidelines for IS positivist research," *Communications of the Association for Information Systems*, vol. 13, pp. 380–427, 2004.

[102] C. Felipe, J. L. Roldán, and A. L. Leal-Rodríguez, "Impact of organizational culture values on organizational agility," *Sustainability*, vol. 9, no. 12, p. 2354, 2017.

[103] M. Sarstedt, C. M. Ringle, G. Schmueli, J. H. Cheah, and H. Ting, *Predictive Model Assessment in PLS-SEM: Guidelines for Using PLSpredict*, Working Paper, 2018.

[104] Smart PLS, *PLS Predict Smart PLS*, 2018, July 2018, https://www.smartpls.com/documentation/algorithms-and-techniques/predict.

[105] N. Danks, S. Ray, and G. Shmueli, "Evaluating the predictive performance of constructs in PLS path modeling (Working

Paper October 18, 2017),” 2018, July 2018, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3055222.

[106] A. G. Woodside, “Moving beyond multiple regression analysis to algorithms: calling for adoption of a paradigm shift from symmetric to asymmetric thinking in data analysis and crafting theory,” *Journal of Business Research*, vol. 66, no. 4, pp. 463–472, 2013.

[107] E. E. Rigdon, C. M. Ringle, M. Sarstedt, and S. P. Gudergan, “Assessing heterogeneity in customer satisfaction studies: across industry similarities and within industry differences,” *Advances in International Marketing*, vol. 22, pp. 169–194, 2011.

[108] J. A. Martilla and J. C. James, “Importance-performance-analysis,” *Journal of Marketing*, vol. 41, no. 1, pp. 77–79, 1977.

[109] K. Matzler, F. Bailom, H. H. Hinterhuber, B. Renzl, and J. Pichler, “The asymmetric relationship between attribute-level performance and overall customer satisfaction: a reconsideration of the importance-performance analysis,” *Industrial Marketing Management*, vol. 33, no. 4, pp. 271–277, 2004.

[110] M. Feng, J. Mangan, C. Wong, M. Xu, and C. Lalwani, “Investigating the different approaches to importance–performance analysis,” *Service Industries Journal*, vol. 34, no. 12, pp. 1021–1041, 2014.

[111] A. Riviezzo, A. de Nisco, and M. Rosaria Napolitano, “Importance-performance analysis as a tool in evaluating town centre management effectiveness,” *International Journal of Retail & Distribution Management*, vol. 37, no. 9, pp. 748–764, 2009.

[112] Statista, *Accedidoen Mayo 2018*, 2018, https://es.statista.com/estadisticas/670092/cuota-de-mercado-de-los-motores-de-busqueda-por-buscador-espana/.

[113] V. Venkatesh, M. G. Morris, G. B. Davis, and F. D. Davis, “User acceptance of information technology: toward a unified view,” *MIS Quarterly*, vol. 27, no. 3, pp. 425–478, 2003.

[114] X. Wang and S. Zander, “Extending the model of internet standards adoption: a cross-country comparison of IPv6 adoption,” *Information & Management*, vol. 55, no. 4, pp. 450–460, 2018.

Research Article

Research on Supply Chain Stability Driven by Consumer's Channel Preference Based on Complexity Theory

Yi Tian, Junhai Ma [ID], and Wandong Lou [ID]

College of Management and Economics, Tianjin University, Tianjin 300072, China

Correspondence should be addressed to Junhai Ma; mjhtju@aliyun.com and Wandong Lou; wdl160211@126.com

At present, most of the manufacturers are increasingly laying emphasis on dual-channel selling. The level of consumer's preference is diverse with different channels. This study discusses a supply chain where one common manufacturer uses two different channels to sell product. The bounded rationality expectation has been applied to explore the decision-making mechanism in finalizing the wholesale prices and sales commissions for the manufacturer and retailers. In addition, the dynamic features of the system are simulated by 2D bifurcation diagram, the largest Lyapunov exponent, attractor variation, and time series. The simulation results suggest that if the adjustment speeds of the wholesale prices and sales commissions change drastically, the system would fall into a chaotic state. If the consumers prefer the online channel, the wholesale prices and sales commissions may be raised and vice versa. However, too strong preference of each channel will make the system appear to have a considerably periodic fluctuation, even chaos. In the meantime, the parameter adjustment method can help make the periodic or chaotic system go back to stability. Therefore, the significance of this study is with a practical meaning to make better pricing strategy for players in dual-channel selling supply chain system.

1. Introduction

The rapid development of Internet technology and social economy promoted a huge amount of manufacturers who had been transferred from traditional retailing to the combination of traditional and electronic retailing. For instance, according to the data provided by the China Academy of Information and Communications Technology (CAICT), sales of smart phone in China records nearly 390 million at year-end of 2016. Huawei took a 16.4 percent market share in China, while Apple, 9.6 percent. Smart phone manufacturers always distribute their products through both traditional and online channels. In this research, a pricing problem in supply chain with one manufacturer (Huawei) who supplies an identical product (Mate 9) to two retailers (China Resources Vanguard Co. Ltd. and JD.com) is brought to discussion. CR Vanguard is one of the world's top five hundred enterprises, and it is China's largest supermarket chains by a number of stores for years. JD.com is a typical Chinese e-commerce company which is one of the biggest e-malls in China with self-support storage and logistics system. CR Vanguard and JD.com are the typical representatives of traditional and online channels for smartphone sales, respectively. Different consumers will choose their own preferred buying channels. Therefore, the supply chain driven by the consumer's channel preference is necessary to be studied.

Two-echelon supply chain has been widely paid attention to and discussed in academia. Ma, Ma and Bao [1, 2] investigated the bullwhip effect in a two-echelon supply chain. This study discusses a supply chain which consists of one common manufacturer and two retailers from traditional and online sales channels, respectively. The manufacturer determines the wholesale prices and the two retailers decide their own sales prices.

In the current studies [3–7], the consumer preference is frequently considered as one of the chief factors that influence the marketing. Especially, consumer's channel preference is a hot topic in supply chain research. Khouja et al. [8] analyzed the manufacturer's channel selection and pricing problem. They considered consumer's preferences under different distribution strategies. Gao and Su [9]

investigated a stylized model where a retailer operated the dual-channel. Customers strategically make channel choices that included both online and offline. Ke and Liu [10] discussed a dual-channel supply chain competition with channel preference under an uncertain environment. Their results indicated that the customer's direct-channel preference had the opposite effect on the profit of supplier and retailer. Gan et al. [11] presented pricing decisions and profits of supply chain members in a closed-loop supply chain and considered the parameter of customer's direct channel preference as a key factor.

Different from the above mentioned literatures, this paper discusses the decision-making of wholesale prices and sales commissions for manufacturer and retailers based on the bounded rationality expectation by employing complexity theory to explore the effect of the adjustment speed of the above variables on the system stability. More and more researchers used bounded rational theory to analyze the economic model. Ma and Wang [12] applied two noncooperative game models to study the bounded rationality expectation. Song and Zhao [13] pointed out a decision-making problem of newsvendor system with strategic customers of bounded rationality. Ma and Si [14] established a continuous Bertrand duopoly game model with two-stage delay to investigate the influence of delay and weight on the complex dynamic characteristics of the system. Ma and Xie [15] analyzed the comparison and complexity on a dual-channel supply chain under the different channel power structures and uncertain demand. Ma and Xie [16] discussed the impact of loss sensitivity on a mobile phone supply chain system stability based on the chaos theory. In conclusion, it has received a considerable amount of attention to apply bounded rationality and complexity theory to study the management problems in the supply chain.

In reality, the exploration of the supply chain driven by consumer's channel preference based on chaos theory has a great significance. In this paper, besides the adjusted basic parameters such as the wholesale prices and sales commissions, the consumer's channel preference is also discussed. The results indicated that the preference plays an important role in status transformation from stability to chaos. In this analysis, a supply chain model which depicts one common manufacturer using two different channels to sell its product is built in the first place. Then, the bounded rationality expectation is applied to study the complex dynamics of the system. Furthermore, the dynamic characteristics of the system are discussed by 2D bifurcation diagram, the largest Lyapunov exponent, attractor variation, and time series. The results indicate that not only the drastic adjustment of traditional parameters such as the wholesale prices and sales commissions can make the system go chaotic but also the consumer's channel preference can also lead to system considerably periodic fluctuation, even to chaos, which is the primary finding in this article. Finally, the parameter adjustment control method is performed on the system to return the periodic or the chaotic state to stability. The conclusions of this paper can give constructive suggestions for managers of both manufacturers and retailers.

The structure of this paper is as follows. In Section 2, the basic model considering the influence of consumer's channel preference is established. In this part, the optimal decision of the complex dynamic system is analyzed. Following Section 2, this study further applies numerical simulation to investigate the stability aspect and the dynamical behaviors. 2D bifurcation diagram, the largest Lyapunov exponent, attractor, and time series have been utilized to study the influence on the supply chain. In Section 4, we introduce the method to control the chaos system. Finally, the conclusion of this research is provided.

2. Demand Model

A supply chain system consists of one manufacturer and two retailers, one of which is a traditional retailer (retailer 1) and the other is an online retailer (retailer 2), which has been restricted in this study. The manufacturer provides an identical product at a constant unit cost (c) and wholesale prices (w_i) to retailer 1 and retailer 2. Then, the retailers distribute the product to consumers in a common market by traditional and online channels, respectively. The retailers decide their unit sales commissions $k_i, i = 1, 2$. Retailer 1 and retailer 2 have a competitive relationship between each other as shown in Figure 1.

Hence, the sales prices of this supply chain can be described as $p_i = w_i + k_i, i = 1, 2$. The demand function is simplified as the following linear form:

$$q_i = d_i - (\delta + \gamma)p_i + \gamma p_{3-i}, \quad i = 1, 2. \tag{1}$$

This simplified linear demand function has been used by Anderson and Bao [17], Wu et al. [18], Yang and Zhou [19], and Choi [20]. Here, d_i is the market base of channel i, p_i is the sales price of retailer i, δ is the price sensitivity of the product, and γ denotes the substitutability of the retailers. In order to discuss the influence of consumer's channel preference and pricing strategies on the performance of the supply chain members without loss of generality, the method proposed by Mcguire and Staelin [21] has been applied to rescale the demand functions in (1). The scaled model can conduct some analytical comparisons instead of numerical experiments reported in Xiao et al. [22]. Let $\mu = \gamma/(\gamma + \delta)$; the above linear function will be changed as

$$q_i' = d_i' - \frac{\delta}{(1 - \mu)}p_i' + \frac{\delta\mu}{(1 - \mu)}p_{3-i}', \quad i = 1, 2. \tag{2}$$

The substitutability of the two retailers in terms of changes in prices has been denoted as parameter μ. Let $\phi_1 = d_1' - \delta c' \equiv \phi$, $\phi_2 = d_2' - \delta c'$ and $d_1' \leq d_2'$, and define $\eta = (d_2' - \delta c')/(d_1' - \delta c')$. The parameter $\eta(\eta \geq 1)$ depicts the consumer's channel preference.

$\mu = 0$ represents the scenario in which the submarket is monopolized by one retailer. $\mu = 1$ represents the scenario in which there exist two completely substitutable retailers, Then, the prices can be standardized as $k_i = (\delta/(\phi(1 - \mu)))k_i'$, $w_i = (\delta/(\phi(1 - \mu)))(w_i' - c')$, and $p_i = (\delta/(\phi(1 - \mu)))(w_i' + k_i' - c')$.
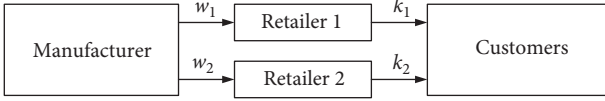
FIGURE 1: The model of supply chain.

The demand function q_1' can be formulated as follows:

$$q_1' = d_1' - \frac{\delta}{(1-\mu)}p_1' + \frac{\delta}{(1-\mu)}p = \phi(1 - p_1 + \mu p_2). \quad (3)$$

q_2' can be obtained by using the same method:

$$q_2' = d_2' - \frac{\delta}{(1-\mu)}p_2' + \frac{\delta\mu}{(1-\mu)}p_1' = \phi(\eta - p_2 + \mu p_1). \quad (4)$$

So we can get the demands as below:

$$q_1 = \frac{q_1'}{\phi} = 1 - p_1 + \mu p_2, \quad q_2 = \frac{q_2'}{\phi} = \eta - p_2 + \mu p_1. \quad (5)$$

But in reality, the market requirements are often influenced by some other factors; here, ε_i is used to represent these disturbance factors in research.

$$q_1 = \frac{q_1'}{\phi} = 1 - p_1 + \mu p_2 + \varepsilon_1,$$

$$q_2 = \frac{q_2'}{\phi} = \eta - p_2 + \mu p_1 + \varepsilon_2. \quad (6)$$

$\varepsilon_i (i = 1, 2)$ follows a normal distribution such that $E(\varepsilon_i) = 0$, var $(\varepsilon_i) = \sigma^2$. The expected profit decision models of the manufacturer and two retailers are shown as

$$E(\pi_{r1}) = k_1(1 - (k_1 + w_1) + \mu(k_2 + w_2)),$$

$$E(\pi_{r2}) = k_2(\eta - (k_2 + w_2) + \mu(k_1 + w_1)),$$

$$E(\pi_m) = w_1(1 - (k_1 + w_1) + \mu(k_2 + w_2)) \\ + w_1(\eta - (k_2 + w_2) + \mu(k_1 + w_1)). \quad (7)$$

In order to deduce the marginal profits of the manufacturer and two retailers, the first-order partial derivative of (7) can be calculated as follows:

$$\frac{\partial E(\pi_{r1})}{\partial k_1} = 1 - 2k_1 - w_1 + (k_2 + w_2)\mu,$$

$$\frac{\partial E(\pi_{r2})}{\partial k_2} = -2k_2 - w_2 + \eta + (k_1 + w_1)\mu,$$

$$\frac{\partial E(\pi_m)}{\partial w_1} = 1 - k_1 - 2w_1 + w_2\mu + (k_2 + w_2)\mu,$$

$$\frac{\partial E(\pi_m)}{\partial w_2} = -k_2 - 2w_2 + \eta + w_1\mu + (k_1 + w_1)\mu. \quad (8)$$

2.1. Optimal Decision.
In the market, the optimal decisions of the retailers and manufacturer are influenced by each other. Therefore, this study assumes that they share overlapping information. In this research, when the marginal profits reduce

to zero, the optimal decision for retailers and manufacturer can be obtained. The wholesale prices and sales commissions are the decision variables. The research calculates the first-order derivative of the retailers' and manufacturer's profit. When the marginal profit equals to zero, the optimal wholesale prices and sales commissions can be derived. The detailed process is as follows:

$$\frac{\partial E(\pi_{r1})}{\partial k_1} = 0,$$

$$\frac{\partial E(\pi_{r1})}{\partial k_2} = 0,$$

$$\frac{\partial E(\pi_m)}{\partial w_1} = 0,$$

$$\frac{\partial E(\pi_m)}{\partial w_2} = 0. \quad (9)$$

The optimal solution of the system will be solved.

$$k_1^* = -\frac{3 + \eta\mu}{-9 + \mu^2},$$

$$k_2^* = -\frac{3\eta + \mu}{-9 + \mu^2},$$

$$w_1^* = -\frac{-3 - 4\eta\mu - \mu^2}{(-9 + \mu^2)(-1 + \mu^2)},$$

$$w_2^* = -\frac{-3\eta - 4\mu - \eta\mu^2}{(-9 + \mu^2)(-1 + \mu^2)}. \quad (10)$$

2.2. The Complex Dynamics of the System.
The real market is a changeable and complex system. The manufacturer and retailers cannot know the complete market information, and predict other decision-makers' information accurately. Hence, the bounded rationality expectations have been universally adopted by market decision-makers. The decision of $t + 1$ period is as follows:

$$k_1(t+1) = k_1(t) + g_1 k_1(t) \frac{\partial E(\pi_{r1}(t))}{\partial k_1(t)},$$

$$k_2(t+1) = k_2(t) + g_2 k_2(t) \frac{\partial E(\pi_{r2}(t))}{\partial k_2(t)},$$

$$w_1(t+1) = w_1(t) + g_3 w_1(t) \frac{\partial E(\pi_m(t))}{\partial w_1(t)},$$

$$w_2(t+1) = w_2(t) + g_4 w_2(t) \frac{\partial E(\pi_m(t))}{\partial w_2(t)}. \quad (11)$$

In the paper, the price adjustment speeds consist of two wholesale prices and sales commissions. Here, $g_i > 0$ ($i = 1, 2, 3, 4$); g_1 and g_2 are the adjustment speed of the sales commissions with retailer 1 and retailer 2, respectively. g_3 and g_4 represent the adjustment speed of the wholesale prices with the manufacturer. Based on the above equation, the four-dimensional discrete dynamic system can be acquired and expressed in (12). The wholesale prices and the sales commissions in the next period depend on the estimation of these

period marginal profits. Base on that, the adjustment of bounded rationality is completed. If the entity's current marginal profit is positive, the price will increase during the next period for higher profits. If the entity's current marginal profit is negative, the price should be reduced during the next period. The dynamic adjustment processes are as follows:

$$k_1(t+1) = k_1(t) + g_1 k_1(t)(1 - 2k_1 - w_1 + (k_2 + w_2)\mu),$$
$$k_2(t+1) = k_2(t) + g_2 k_2(t)(-2k_2 - w_2 + \eta + (k_1 + w_1)\mu),$$
$$w_1(t+1) = w_1(t) + g_3 w_1(t)(1 - k_1 - 2w_1 + w_2\mu + (k_2 + w_2)\mu),$$
$$w_2(t+1) = w_2(t) + g_4 w_2(t)(-k_2 - 2w_2 + \eta + w_1\mu + (k_1 + w_1)\mu).$$
$$(12)$$

After a long period of operation, when $k_i(t+1) = k_i(t)$ and $w_i(t+1) = w_i(t)$, the system will become steady. Under the equilibrium state, all parties in the game cannot increase profits for themselves by changing the decision variables. Therefore, when the decision variables take the values of the equilibrium state, every player in the game can obtain the maximized profit. There are sixteen equilibriums of system (12):

$$E_1(0,0,0,0),$$
$$E_2\left(0,0,0,\frac{\eta}{2}\right),$$
$$E_3\left(0,0,-\frac{1+\eta\mu}{2(-1+\mu^2)},-\frac{\eta+\mu}{2(-1+\mu^2)}\right),$$
$$E_4\left(0,0,\frac{1}{2},0\right),$$
$$E_5\left(0,\frac{\eta}{3},-\frac{1+\eta\mu}{2(-1+\mu^2)},-\frac{2\eta+3\theta+\eta\mu^2}{6(-1+\mu^2)}\right),$$
$$E_6\left(0,\frac{\eta}{3},0,\frac{\eta}{3}\right),$$
$$E_7\left(0,\frac{\eta}{2},0,0\right),$$
$$E_8\left(0,-\frac{2\eta+\mu}{-4+\mu^2},-\frac{2+\eta\mu}{-4+\mu^2},0\right),$$
$$E_9^*\left(-\frac{3+\eta\mu}{-9+\mu^2},-\frac{3\eta+\mu}{-9+\mu^2},-\frac{-3-4\eta\mu-\mu^2}{(-9+\mu^2)(-1+\mu^2)},\right.$$
$$\left.-\frac{-3\eta-4\mu-\eta\mu^2}{(-9+\mu^2)(-1+\mu^2)}\right),$$
$$E_{10}\left(\frac{1}{3},0,-\frac{2+3\eta\mu+\mu^2}{6(-1+\mu^2)},-\frac{\eta+\mu}{2(-1+\mu^2)}\right),$$
$$E_{11}\left(-\frac{2+\eta\mu}{-4+\mu^2},0,0,-\frac{2\eta+\mu}{-4+\mu^2}\right),$$
$$E_{12}\left(\frac{1}{2},0,0,0\right),$$
$$E_{13}\left(\frac{1}{3},0,\frac{1}{3},0\right),$$

$$E_{14}\left(-\frac{3+2\eta\mu}{2(-3+\mu^2)},-\frac{2\eta+\mu}{2(-3+\mu^2)},0,-\frac{2\eta+\mu}{2(-3+\mu^2)}\right),$$
$$E_{15}\left(-\frac{2+\eta\mu}{-4+\mu^2},-\frac{2\eta+\mu}{-4+\mu^2},0,0\right),$$
$$E_{16}\left(-\frac{2+\eta\mu}{2(-3+\mu^2)},-\frac{3\eta+2\mu}{2(-3+\mu^2)},-\frac{2+\eta\mu}{2(-3+\mu^2)},0\right).$$
$$(13)$$

For these above equilibriums, it can be found that E_9^* is the only point which is completely nonzero. The others are boundary points. E_9^* is the unique Nash equilibrium point. The Jacobian matrix of system (12) can be calculated as follows:

$$\mathbf{J}(E) = \begin{pmatrix} 1-2g_1k_1 & g_1k_1\mu & -g_1k_1 & g_1k_1\mu \\ g_2k_2\mu & 1-2g_2k_2 & g_2k_2\mu & -g_2k_2 \\ -g_3w_1 & g_3w_1\mu & 1-2g_3w_1 & 2g_3w_1\mu \\ g_4w_2\mu & -g_4w_2 & 2g_4w_2\mu & 1-2g_4w_2 \end{pmatrix}.$$
$$(14)$$

The Jacobian matrix and Jury criterion have been applied to discuss the local stability of the Nash equilibrium in this paper.

The characteristic polynomial of the Jacobian matrix is as follows:

$$F(\lambda) = \lambda^4 + \zeta_3\lambda^3 + \zeta_2\lambda^2 + \zeta_1\lambda + \zeta_0.$$
$$(15)$$

In order to guarantee the local stability of the Nash equilibrium, $F(\lambda)$ must satisfy the following conditions:

$$1 + \zeta_3 + \zeta_2 + \zeta_1 + \zeta_0 > 0,$$
$$1 - \zeta_3 + \zeta_2 - \zeta_1 + \zeta_0 > 0,$$
$$|\zeta_0| < 1,$$
$$|\beta_0| < |\beta_3|,$$
$$|\sigma_0| < |\sigma_2|.$$
$$(16)$$

The details of $\zeta_1, \zeta_2, \zeta_3, \zeta_4, \beta_0, \beta_3, \sigma_0$, and σ_2 are as below:

$$\beta_3 = 1 - \zeta_0^2,$$
$$\beta_2 = \zeta_3 - \zeta_1\zeta_0,$$
$$\beta_1 = \zeta_3 - \zeta_2\zeta_0,$$
$$\beta_0 = \zeta_1 - \zeta_3\zeta_0,$$
$$\sigma_2 = \beta_3^2 - \beta_0^2,$$
$$\sigma_1 = \beta_3\beta_2 - \beta_1\beta_0,$$
$$\sigma_0 = \beta_3\beta_1 - \beta_2\beta_0$$

$$\begin{aligned}
\zeta_0 = {} & 1 - 2g_1k_1 - 2g_2k_2 + 4g_1k_1g_2k_2 - 2g_3w_1 + 3g_1k_1g_3w_1 \\
& + 4g_2k_2g_3w_1 - 6g_1k_1g_2k_2g_3w_1 - 2g_4w_2 + 4g_1k_1g_4w_2 \\
& + 3g_2k_2g_4w_2 - 6g_1k_1g_2k_2g_4w_2 + 4g_3w_1g_4w_2 \\
& - 6g_1k_1g_3w_1g_4w_2 - 6g_2k_2g_3w_1g_4w_2 \\
& + 9g_1k_1g_2k_2g_3w_1g_4w_2 - g_1k_1g_2k_2\mu^2 - g_2k_2g_3w_1\mu^2 \\
& + 2g_1k_1g_2k_2g_3w_1\mu^2 - g_1k_1g_4w_2\mu^2 + 2g_1k_1g_2k_2g_4w_2\mu^2 \\
& - 4g_3w_1g_4w_2\mu^2 + 6g_1k_1g_3w_1g_4w_2\mu^2 \\
& + 6g_2k_2g_3w_1g_4w_2\mu^2 - 10g_1k_1g_2k_2g_3w_1g_4w_2\mu^2 \\
& + g_1k_1g_2k_2g_3w_1g_4w_2\mu^2,
\end{aligned}$$

$$\begin{aligned}
\zeta_1 = {} & -4 + 6g_1k_1 + 6g_2k_2 - 8g_1k_1g_2k_2 + 6g_3w_1 \\
& - 6g_1k_1g_3w_1 - 8g_2k_2g_3w_1 \\
& + 6g_1k_1g_2k_2g_3w_1 + 6g_4w_2 - 8g_1k_1g_4w_2 - 6g_2k_2g_4w_2 \\
& + 6g_1k_1g_2k_2g_4w_2 - 8g_3w_1g_4w_2 + 6g_1k_1g_3w_1g_4w_2 \\
& + 6g_2k_2g_3w_1g_4w_2 + 2g_1k_1g_2k_2\mu^2 + 2g_2k_2g_3w_1\mu^2 \\
& - 2g_1k_1g_2k_2g_3w_1\mu^2 + 2g_1k_1g_4w_2\mu^2 \\
& - 2g_1k_1g_2k_2g_4w_2\mu^2 + 8g_3w_1g_4w_2\mu^2 \\
& - 6g_1k_1g_3w_1g_4w_2\mu^2 - 6g_2k_2g_3w_1g_4w_2\mu^2,
\end{aligned}$$

$$\begin{aligned}
\zeta_2 = {} & 6 - 6g_1k_1 - 6g_2k_2 \\
& + 4g_1k_1g_2k_2 - 6g_3w_1 + 3g_1k_1g_3w_1 + 4g_2k_2g_3w_1 \\
& - 6g_4w_2 + 4g_1k_1g_4w_2 + 3g_2k_2g_4w_2 + 4g_3w_1g_4w_2 \\
& - g_1k_1g_2k_2\mu^2 - g_2k_2g_3w_1\mu^2 - g_1k_1g_4w_2\mu^2 \\
& - 4g_3w_1g_4w_2\mu^2,
\end{aligned}$$

$$\begin{aligned}
\zeta_3 = {} & -4 + 2g_1k_1 + 2g_2k_2 + 2g_3w_1 \\
& + 2g_4w_2.
\end{aligned}$$

$$\tag{17}$$

Because the conditions are very complex, the process to solve (12) is a tedious task. If the Nash equilibrium satisfies (12), it can be considered as locally stable. In the next section, we will utilize numerical simulation to further analyze the dynamic characteristic on the system.

3. Dynamic Characteristics of the System

Recently, the numerical simulation method has been widely applied to represent complex dynamic system in literatures. In this study, $g_i(i = 1, 2)$ is the sales commissions' adjustment speed of retailer i. $g_i(i = 3, 4)$ represents the adjustment speed of the wholesale prices (w_1, w_2) of the manufacturer. The values of the system parameters are defined as $k_1 = 0.1$, $k_2 = 0.1$, $w_1 = 0.31$, $w_2 = 0.4$, $g_1 = 0.4$, $g_2 = 0.13$, $g_3 = 0.12$, $g_4 = 0.15$, $\mu = 0.5$, and $\eta = 1.1$. The stable region, bifurcation, and chaos will be studied as follows.

3.1. The Stable Region. The decision variables of the system are wholesale prices and sales commissions. The system will change to be either stable or unstable, if the wholesale prices and sales commissions obtain different values. The stability region of the deterministic system is shown as the blue and green part in Figures 2 and 3, respectively. The white areas
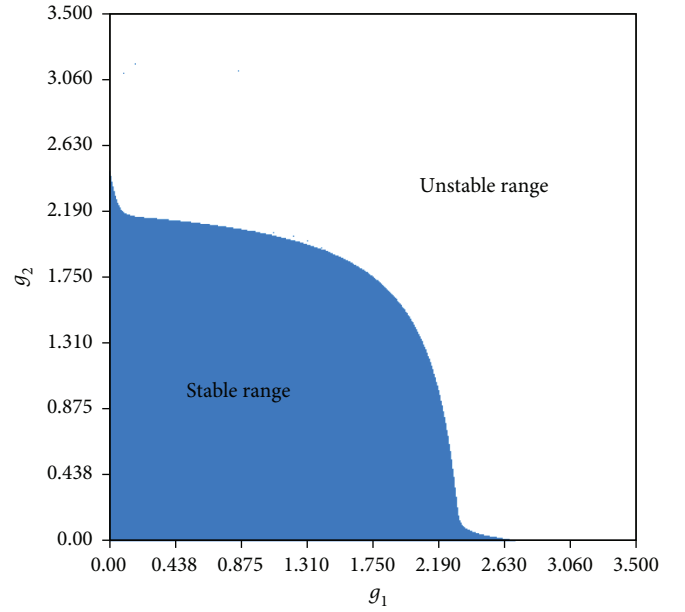
FIGURE 2: The 2D stable region of g_1 and g_2.

are the unstable range. If the applied values come from the blue and green region of Figures 2 and 3, after the iteration of period by period, the system will tend to reach the equilibrium state. If the values landed in the white areas, the system will exhibit unstable phenomena.

In Figure 2, when g_1 increases, the tendency of g_2 should be reduced. In the stable region, it has the opposite effect on g_1 and g_2, so does Figure 3. Through Figures 2 and 3, we found that the stable range of g_1 and g_2 is almost twice as much as g_3 and g_4, when the value of g_1 is larger than others' price adjustment parameters. Period doubling and chaos should be avoided. The supply chain system should be kept in the stable state as long as possible.

3.2. The Bifurcation and Chaos Behavior. The parameter basin has been used to describe 2D bifurcation effect. The results are shown in Figures 4 and 5. Different colors represent different cycles. Blue represents the stable region in Figure 4, and green represents the stable region in Figure 5. Orange, pink, purple, indigo, brown, yellow, and black regions represent the stable cycles of the periods from 2 to 8, respectively. The gray region is non-convergence, and the white region is divergence in both Figures 4 and 5. The system can remain stable, when the adjustment parameter g_i is relatively small. As g_1 and g_2 increase, the system will go into the stable cycles of period 2. If g_1 and g_2 continue to increase, the system will go into the stable cycles of period 4, which is shown in Figure 4. However, the system continually changes to the stable cycles of periods 2, 4, 8, and so on. If g_3 and g_4 keep on increasing, the system will go into chaos state. This process is depicted in Figure 5. In this situation, the market will become chaotic and the market participants cannot make good decisions to reach the best profits.

When the adjustment parameter changes in a small range from 0, the variables will be stable. However, if the decision
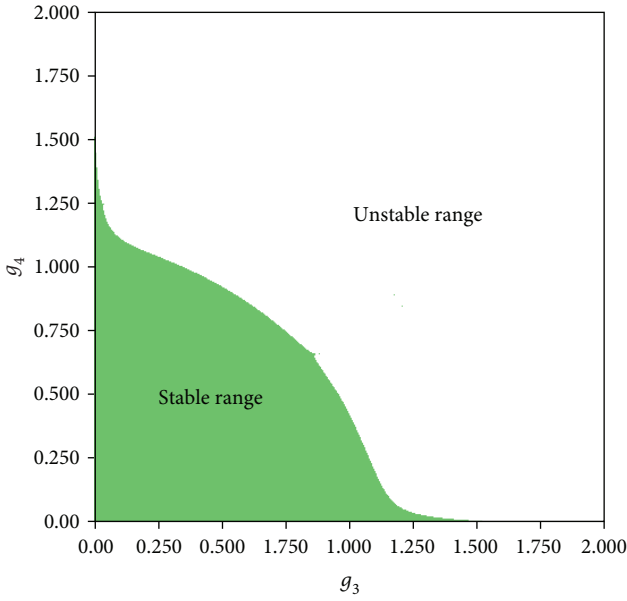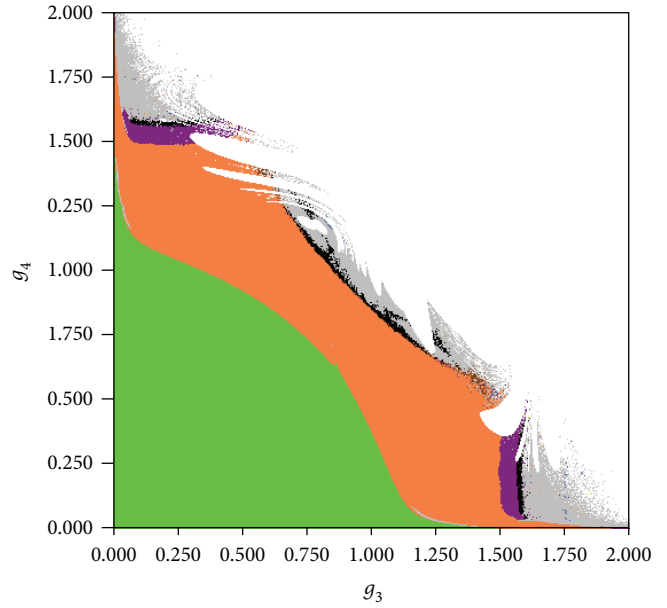
Figure 3: The 2D stable region of g_3 and g_4.

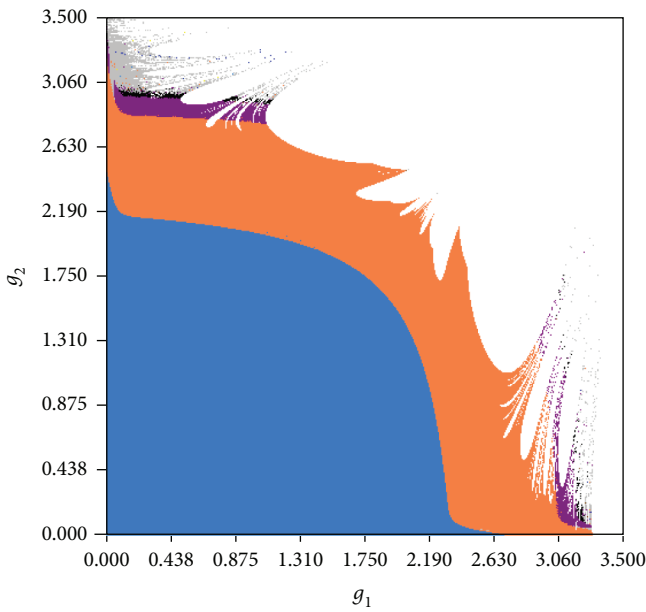Figure 5: 2D bifurcation diagram of g_3 and g_4.

Figure 4: 2D bifurcation diagram of g_1 and g_2.

variables adjust sharply, the variables will be unstable. Especially, in chaotic state, the system will become sensitive and unpredictable. In economic terms, when the adjustment parameter exceeds a certain limit, the intense competition and price drastic fluctuation will occur.

The bifurcation diagram is an intuitive way to show the dynamic characteristics of the system. One of the parameters is fixed and the other changed within a certain range. In the following bifurcation diagrams, the blue line represents k_1 and the red line k_2. The green line represents w_1 and the purple line w_2.

The largest Lyapunov exponent (LLE) is another efficient way to make clear the complex dynamic characteristics of the system, which also is corresponding to the variation of the bifurcation diagram when discussing the same parameter. The dramatic variation of LLE is accompanied by the decision variables changing. If the LLE < 0, it means the system is in a stable state. When the LLE = 0 for the first time, the system stays at a critical point and usually the bifurcation appears. If the LLE > 0, it indicates that the system runs into the unstable state. The manufacturer and retailers should be cautious to prevent system chaos.

The following part gives the bifurcation diagram and LLE diagram with respect to the parameters g_1, g_2, g_3, and g_4. The bifurcation diagrams of k_1, k_2, w_1, and w_2, with respect to the adjustment speeds of the sales commissions, are shown in Figures 6 and 7. In the same condition, Figures 8 and 9 depict the variation of LLE with respect to g_1 and g_2.

When $g_1 \in [1.5, 3.10]$ and with the other parameters settled down, the conditions of k_1, k_2, w_1, and w_2 are shown in Figure 6. Because the dots of w_1 and w_2 gather together, we further enlarge critical parts in sub-windows in order to describe the bifurcation conditions of w_1 and w_2. The upper small picture is the blowup of the bifurcation diagram for w_1 and w_2, and the other one is the blowup of the bifurcation diagram for k_2. When $g_1 \in [0, 2.338]$, k_1, k_2, w_1, and w_2 are all in the stable state. When g_1 grows to 2.339, k_1, k_2, w_1, and w_2 bifurcate at the first time and enter into the stable cycles of period 2. If g_1 continues to increase, the system will enter into the stable cycles of period 4.

Figure 8 reveals the variation of LLE along with g_1 increasing, which expresses the pattern of the complex dynamic behavior caused by the growth of the price adjustment speed. Figure 8 explores the LLE of the system with respect to $g_1 \in [1.5, 3.10]$. When $g_1 \in [0, 2.338]$, the LLE is below zero, which indicates that the system is stable. When
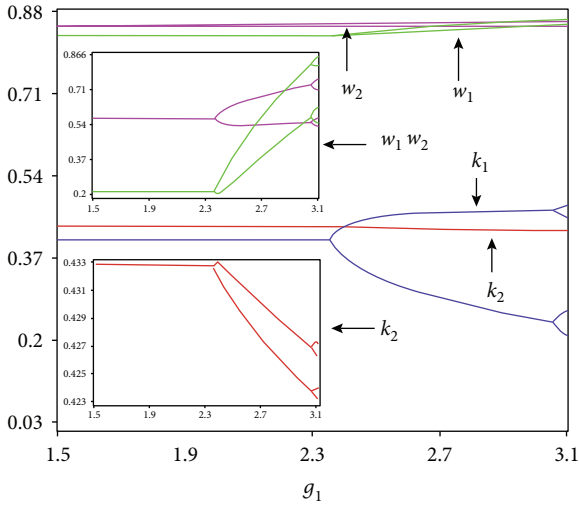
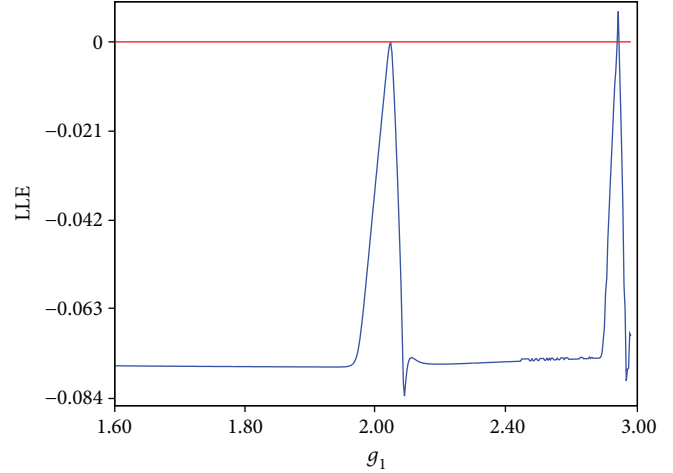FIGURE 6: Bifurcation diagram of k_1, k_2, w_1, w_2 when $g_1 \in [1.5, 3.10]$.

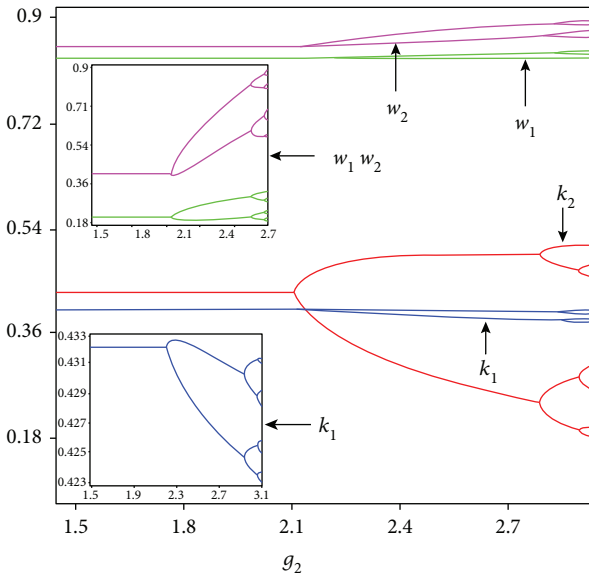FIGURE 8: The largest Lyapunov exponent of the system with respect to $g_1 \in [1.5, 3.10]$.

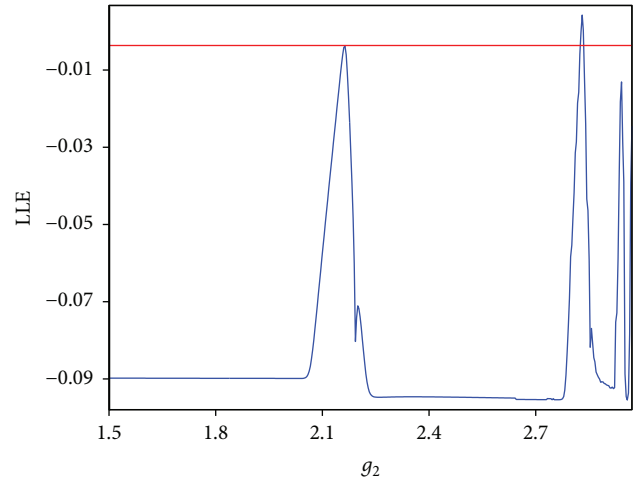FIGURE 7: Bifurcation diagram of k_1, k_2, w_1, w_2 when $g_2 \in [1.5, 2.98]$.

FIGURE 9: The largest Lyapunov exponent of the system with respect to $g_2 \in [1.5, 2.98]$.

g_1 increases to 2.339, the LLE is equal to zero and the bifurcation occurs in the system. The bifurcation point in Figure 8 is the same as that in Figure 6.

Figures 7 and 9 also have the same bifurcation point. k_1, k_2, w_1, and w_2 bifurcate at 2.156 as g_2 varies from 0 to 2.98. If g_2 continues increasing, the system runs into the cycles of period 4. In order to describe the changing processes of the system from the stable state to the chaotic region more clearly, g_1 and g_2 start from 1.5 in Figures 6–9.

The bifurcation diagrams of k_1, k_2, w_1, and w_2, with respect to the adjustment speeds of the wholesale prices, are shown in Figures 10 and 11. In the same condition, Figures 12 and 13 depict the variation of LLE with respect to g_3 and g_4.

k_1, k_2, w_1, and w_2 bifurcate at 1.096 as g_3 varies from 0 to 1.70. k_1, k_2, w_1, and w_2 bifurcate at 1.107 as g_4 varies from 0 to 1.73. If g_3 and g_4 continue increasing, the system runs into

cycles of periods 4, 8, and so on. Next, the system will fall into chaos gradually. In this part, g_3 and g_4 start from 0.7 in Figures 10–13.

Above all, Figures 10–13 sufficiently indicate that if the wholesale prices of the manufacturer are adjusted drastically, the system will fall into chaos. On the other side, as shown in Figures 6–9, if the sales commissions of the retailers are adjusted radically, the bifurcation will appear but the chaos will not occur. From an economic point of view, if the adjustment parameter rapidly changes, the market will fall into the chaotic state. Therefore, the manufacturer and retailers should keep the price adjustments within a reasonable range.

The substitutability of the retailers will be discussed in the following part. $\mu = 0$ represents the demands which are absolutely independent. Each retailer is a monopolist in its own area. $\mu = 1$ represents the two retailers who are totally substitutable. When $\mu \in [0, 0.89]$ and the other parameters are kept constant, the situations of k_1, k_2, w_1, and w_2 are shown in Figure 14. When μ grows to 0.872, the system begins the first
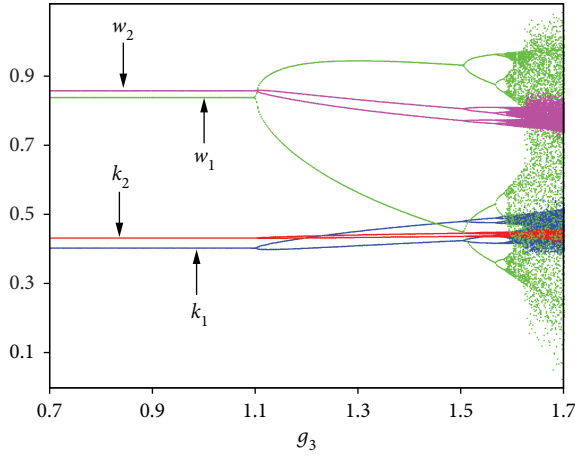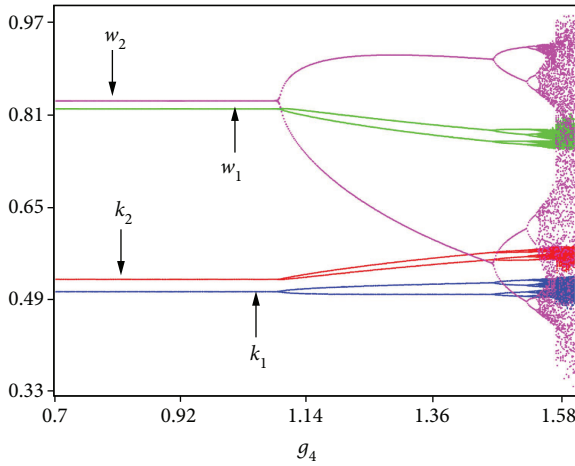
FIGURE 10: Bifurcation diagram of k_1, k_2, w_1, w_2 when $g_3 \in [0.7, 1.70]$.

FIGURE 11: Bifurcation diagram of k_1, k_2, w_1, w_2 when $g_4 \in [0.7, 1.73]$.
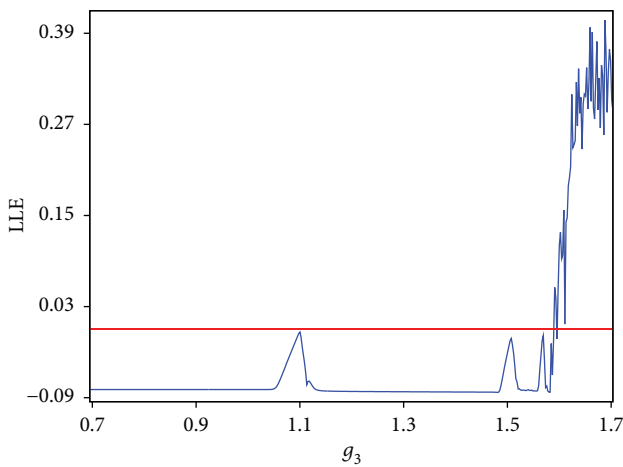

FIGURE 12: The largest Lyapunov exponent of the system with respect to $g_3 \in [0.7, 1.70]$.
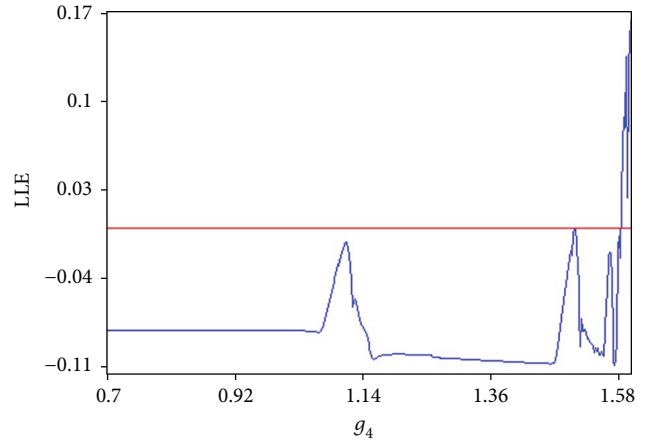

FIGURE 13: The largest Lyapunov exponent of the system with respect to $g_4 \in [0.7, 1.73]$.

bifurcation which is the stable cycles of period 2. If μ continues to increase, the system runs into the stable cycles of periods 4, 8, and so on. Then, the system will fall into chaos gradually. The small picture in Figure 14 is the blowup of the bifurcation region for k_1, k_2, w_1, and w_2, when $\mu \in [0.8, 0.89]$.

Figure 15 explores the LLE of the system with respect to $\mu \in [0, 0.89]$. When $\mu \in [0, 0.871]$, the LLE is less than zero, and the system is in a stable state. While μ grows to 0.872, LLE changes into zero for the first time, and the system falls into the bifurcation state, the completely same bifurcation points in Figures 15 and 14.

In Figure 14, the manufacturer is more sensitive to the substitutability of the retailer, which leads to a rise in the wholesale price. However, the retailer's profits are robust to the changes in the retailer's substitutability. Under this condition, fierce competition may lead to the dominance of the manufacturer. Nevertheless, bifurcation and chaos will still occur in the market after the fierce competition, once a certain extent of substitutability remains among the retailers of different channels.

The impacts of consumer's channel preference on the dynamic system will be discussed in the following part. When $\eta \in [0, 3.80]$, $\eta = 3.80$, $g_1 = 0.4$, $g_2 = 0.4$, $g_3 = 0.4$, and $g_4 = 0.4$, the situations of k_1, k_2, w_1, and w_2 are shown in Figure 16. The lines in the bifurcation diagram indicate that other parameters are stabilized separately, when η is changing in the range of [0, 3.80]. When η grows to 2.558, the system begins the first bifurcation which is the stable cycles of period 2. If η continues to increase, the system runs into the stable cycles of periods 4, 8, and so on. After that, the system will fall into chaos gradually. Figure 17 proves the same conclusion as Figure 16 does.

The curves of the traditional retailers and online retailers are shown in Figure 16. When $\eta > 1$, it can be found that the channel preference of consumers will convert from one channel to another. If one channel has more consumer preference, its wholesale prices and sales commission will rise; $w_2 > w_1$ and $k_2 > k_1$ are displayed in Figure 16. However, if the channel preference obviously comes to one channel, it is possible that bifurcation and chaos appear in the system.
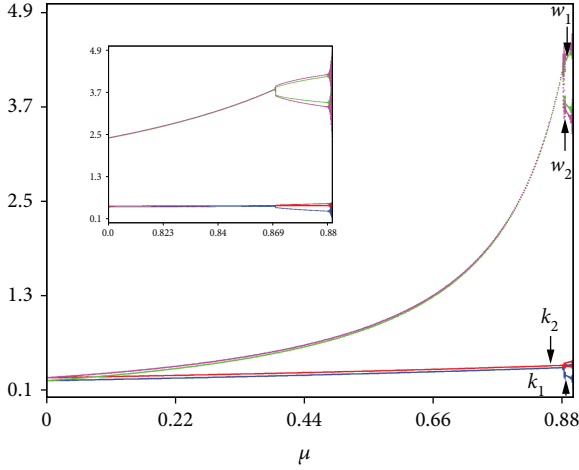
FIGURE 14: Bifurcation diagram of k_1, k_2, w_1, w_2 when $\mu \in [0, 0.89]$.
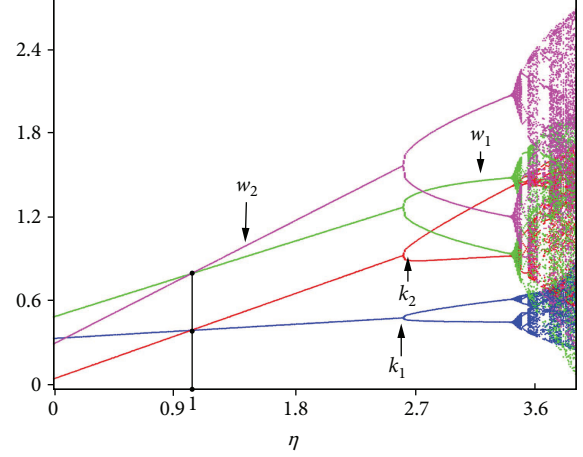
FIGURE 16: Bifurcation diagram of k_1, k_2, w_1, w_2 when $\eta \in [0, 3.80]$.
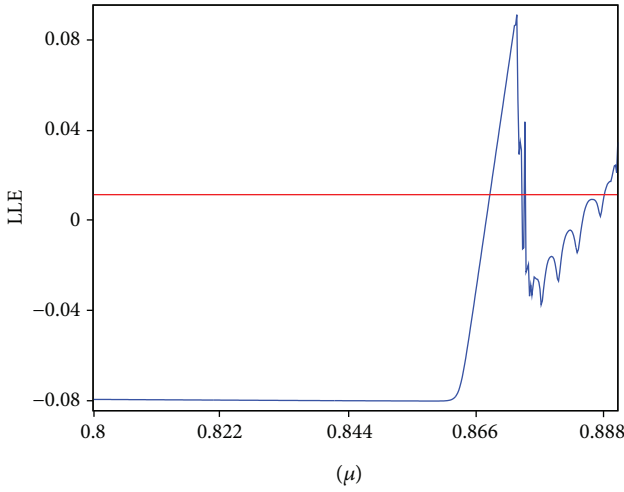
FIGURE 15: The largest Lyapunov exponent of the system with respect to $\mu \in [0.8, 0.89]$.
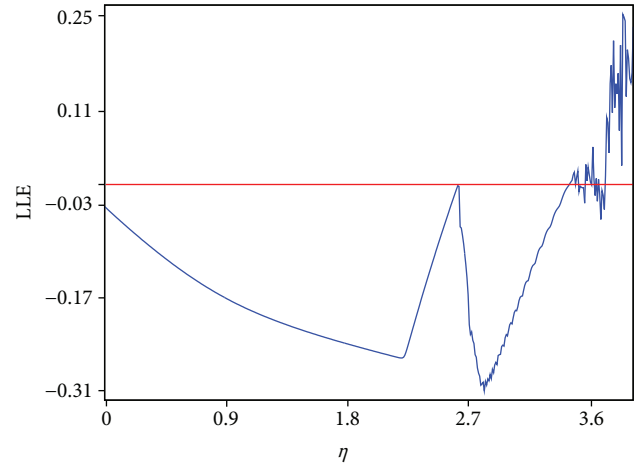
FIGURE 17: The largest Lyapunov exponent of the system with respect to $\eta \in [0, 3.80]$.

In this paper, the chaos attractor has been investigated to the dynamic characteristics of the system. Strange attractor is a set of numbers of indefinite points. The larger the space of the strange attractor is, the more complex the structure will be. No matter how instable the system is, the points are always attracted along a certain trajectory.

Figure 18 shows the chaotic attractor of w_1 and w_2, when $k_1 = 0.31$, $k_2 = 0.1$, $w_1 = 0.31$, $w_2 = 0.4$, $g_1 = 0.4$, $g_2 = 0.13$, $g_3 = 1.65$, $g_4 = 0.15$, $\mu = 0.5$, and $\eta = 1.1$, the system becomes complex and even moves into chaotic state. The dynamic characteristics of the system are obvious. Based on parameter studies, w_1 changes in a larger range than w_2 when the adjustment speeds of wholesale price g_3 change more intensively than g_4.

The time series of different decision variables are shown in Figures 19 and 20. In the chaotic state, the system is more sensitive to the initial value. The phenomenon can be called as the initial value sensitivity. In Figure 19, to better show the character of the chaotic system, we assume the retailer 1 to make decisions under the condition that

$\eta = 3.75$ and show the time series of k_1 after 100 iterations. The blue line represents the initial value with $k_1 = 0.1$, and the red line represents the initial value with $k_1 = 0.101$, when the dynamic system state is in a chaotic state. We also set the other parameters' values as follows: $k_2 = 0.1$, $w_1 = 0.31$, $w_2 = 0.4$, $g_1 = 0.4$, $g_2 = 0.4$, $g_3 = 0.4$, $g_4 = 0.4$, and $\mu = 0.5$. As shown in Figure 19, although the initial value of sales commissions only changes from 0.1 to 0.101, after 100 iterations, a large gap between the two tracks will occur.

Figure 20 shows the time series of k_1, k_2, w_1, and w_2 in a stable state. We set the initial values of the wholesale prices and sales commissions as $k_1 = 0.3$, $k_2 = 0.6$, $w_1 = 1$, and $w_2 = 0.5$ in Figure 20. We set the initial value of k_1 and w_2 from a low value, while we set the initial value of k_2 and w_1 from a high value. We set the same initial values of k_1, k_2, w_1, and w_2 with those above. k_1, k_2, w_1, and w_2 would gradually flatten after 12 iterations shown in Figure 20.

In short, Figures 19 and 20 have different meanings. The adjustment speeds of the wholesale prices and sales commissions depend on the price fluctuation levels. As
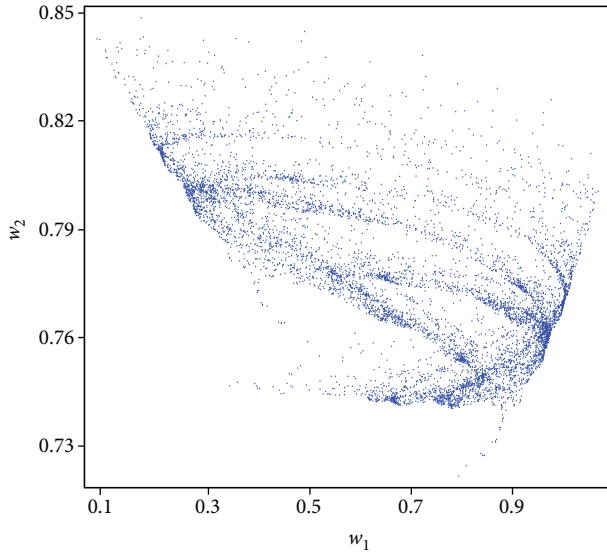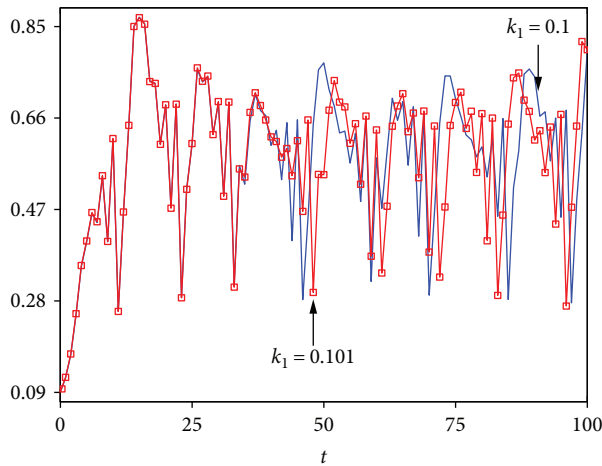
FIGURE 18: The chaotic attractor of w_1 and w_2.

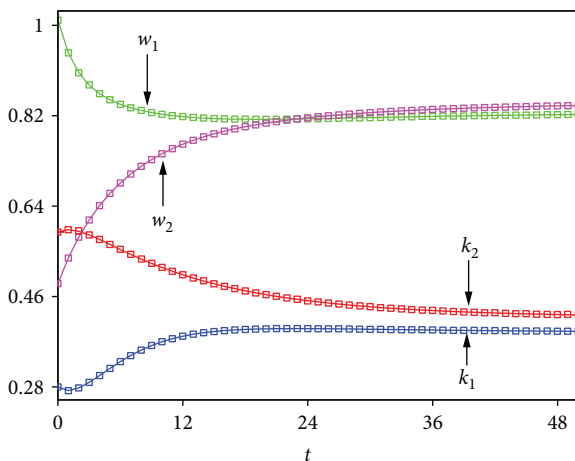FIGURE 19: Time series of k_1 in a chaotic state.

FIGURE 20: Time series of k_1, k_2, w_1, w_2 in a stable state.

such, the manufacturer and retailers should keep price adjustment in reasonable ranges.

4. Chaos Control

The excessive competition will cause the chaotic phenomenon of a market, which poises negative effect on all competitive subjects in the market and impedes the economic operation. Therefore, some chaos control methods have been made use of to propel the system to return to stable equilibrium. There are a lot of chaos control methods such as continuous feedback control, self-adaptation control, and OGY. In this research, parameter adjustment control method has been used. The manager can control the chaotic behavior through introducing the control parameter v. Huang [23] conducted the chaos control with setting the control parameter as $v = 0.6$. The values of the other parameters have been set in the sections above. The stable range and the bifurcation diagram will be given to account for the state of the system. Under the parameter adjustment control, the system can be expressed as follows:

$$
\begin{aligned}
k_1(t+1) &= (1-v)(k_1(t) + g_1 k_1(1\text{-}2k_1 - w_1 + (k_2 + w_2)\mu)) \\
&\quad + v k_1(t), \\
k_2(t+1) &= (1-v)(k_2(t) + g_2 k_2(-2k_2 - w_2 + \eta \\
&\quad + (k_1 + w_1)\mu)) + v k_2(t), \\
w_1(t+1) &= (1-v)(w_1(t) + g_3 w_1(1 - k_1 - 2w_1 \\
&\quad + w_2\mu + (k_2 + w_2)\mu)) + v w_1(t), \\
w_2(t+1) &= (1-v)(w_2(t) + g_4 w_2(-k_2 - 2w_2 + \eta + w_1\mu \\
&\quad + (k_1 + w_1)\mu)) + v w_2(t).
\end{aligned}
$$

(18)

Under the process of chaos control, three parameters, including wholesale price, consumer's channel preference, and the substitutability of retailers, will be discussed in this part. If g_3 equals 1.65, the system will be chaotic. When the control parameter v varies from 0 to 0.7, the changes of the system are shown in Figure 21. Besides, if μ equals 0.892, the system will be chaotic. When the control parameter v varies from 0 to 0.3, the changes of the system are shown in Figure 22. Finally, if we set $\eta = 3.8$, $g_1 = 0.4$, $g_2 = 0.4$, $g_3 = 0.4$, and $g_4 = 0.4$, the system will be chaotic. When the control parameter v varies from 0 to 0.4, the changes of system are shown in Figure 23.

The above figures indicate that the chaos of the system has been controlled when introducing the controlling parameter v. With v increasing, the system changes from the chaotic region to the bifurcation region. When v is big enough, the system will fall into the steady state. For the manufacturer and retailer, they should try their best to control the system into the stable state and maximize their profits.
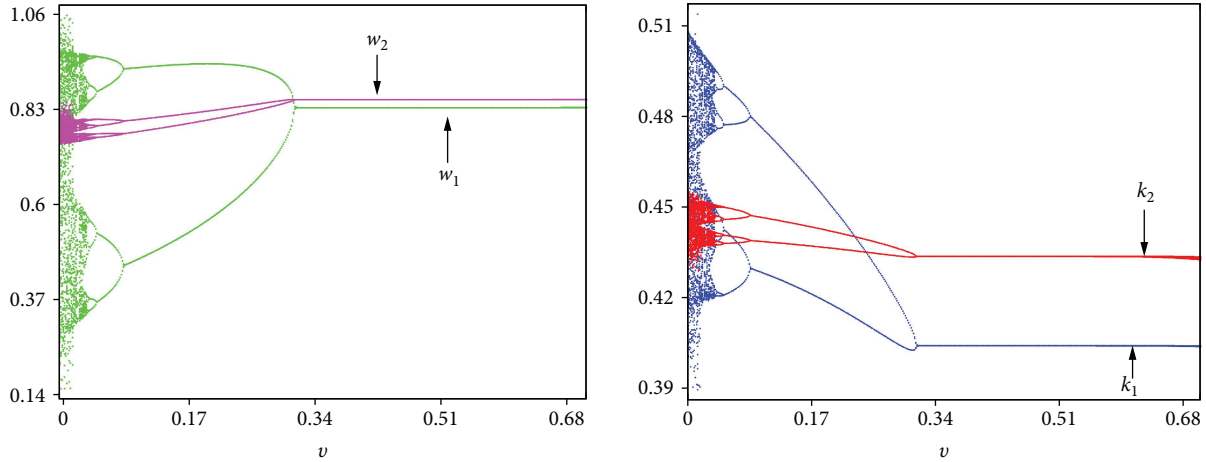
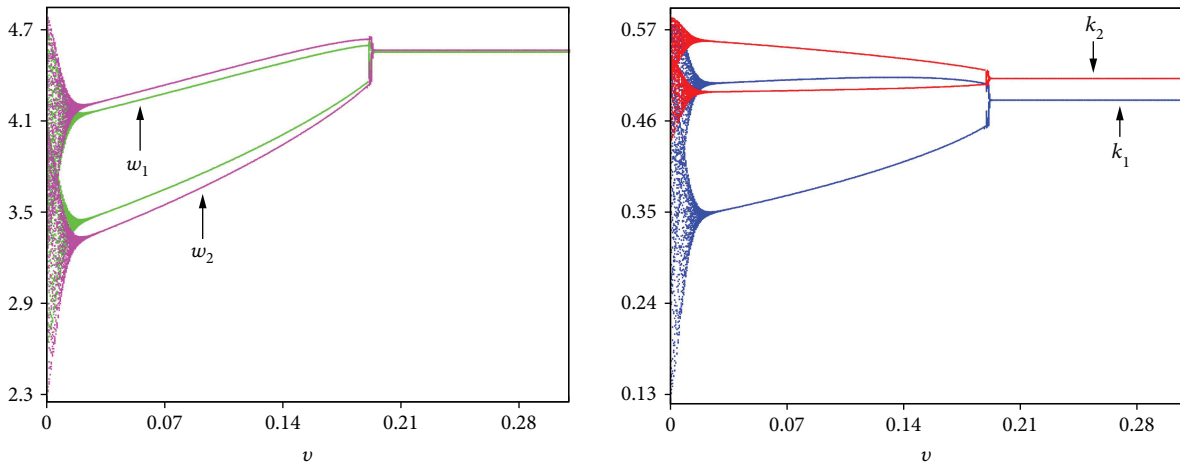FIGURE 21: Bifurcation diagram when v varies from 0 to 0.7 and $g_3 = 1.65$.

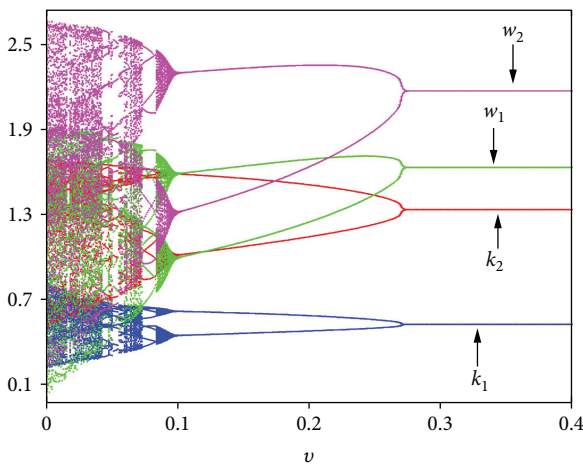FIGURE 22: Bifurcation diagram when v varies from 0 to 0.3 and $\mu = 0.892$.

FIGURE 23: Bifurcation diagram when v varies from 0 to 0.4 and $\eta = 3.8$.

5. Conclusion

A supply chain system consisted of one manufacturer and two retailers have been discussed in this study. One is a traditional retailer and the other an online retailer. The complex dynamics of the system is studied by numerical simulation. The dynamic characteristics are investigated through 2D bifurcation diagram, the largest Lyapunov exponent, chaotic attractor, and time series. Finally, parameter adjustment control method is used to control the chaos.

In this paper, a pricing problem in the supply chain with one manufacturer who supplies an identical product to two retailers has been researched. For example, Huawei supplies Mate 9 to China Resources Vanguard Co. Ltd. and JD.com. CR Vanguard and JD.com are the typical representatives of traditional and online channels, respectively. These research results indicate that if the retailers compete with each other, the substitutability between the two sales channels will be generated. The competitions between retailers are helpful for the manufacturers. However, when the competition is

fierce, the traditional and online channel can be replaced by each other, and the system will be reduced into a chaotic state. This article has demonstrated that consumer's channel preference can affect the wholesale prices and sales commissions. If the consumers prefer any channel of the two, its wholesale prices and sales commissions may be raised. When the preference is too intense, the system will be unstable and even lead to chaotic phenomena. The parameter adjustment control method is performed on the parameters of wholesale price; the substitution of retailers and consumer's channel preference make the system stable by adjusting the parameter v. For all these works, the achievements of this study have both theoretical and practical significances for the manufacturer and retailers.

The conclusions of this paper can be helpful to the managers; however, there still exist some limitations. On the one hand, it considered a model of two-stage and dual-channel supply chain, which might be simple in practice. On the other hand, we only did the numerical simulation but did not make an empirical analysis of influence factors as an example. Hence, in the future, research based on large amounts of real data is significant. We may do further study in multi-stage and multi-channel supply chains in a practical market.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare no conflict of interest regarding the publication of this paper.

Acknowledgments

References

[1] J. Ma and X. Ma, "Measure of the bullwhip effect considering the market competition between two retailers," *International Journal of Production Research*, vol. 55, no. 2, pp. 313–326, 2016.

[2] J. Ma and B. Bao, "Research on bullwhip effect in energy-efficient air conditioning supply chain," *Journal of Cleaner Production*, vol. 143, no. 2, pp. 854–865, 2017.

[3] T. Shu, H. Liao, S. Chen, S. Wang, K. K. Lai, and L. Gan, "Analysing remanufacturing decisions of supply chain members in uncertainty of consumer preferences," *Applied Economics*, vol. 48, no. 34, pp. 3208–3227, 2016.

[4] L. Feng, K. Govindan, and C. Li, "Strategic planning: design and coordination for dual-recycling channel reverse supply chain considering consumer behavior," *European Journal of Operational Research*, vol. 260, no. 2, pp. 601–612, 2017.

[5] S. Du, J. Zhu, H. Jiao, and W. Ye, "Game-theoretical analysis for supply chain with consumer preference to low carbon,"

[6] R. T. Frambach, H. C. A. Roest, and T. V. Krishnan, "The impact of consumer internet experience on channel preference and usage intentions across the different stages of the buying process," *Journal of Interactive Marketing*, vol. 21, no. 2, pp. 26–41, 2007.

[7] M. Okimoto, "International price competition among food industries: the role of income, population and biased consumer preference," *Economic Modelling*, vol. 47, pp. 327–339, 2015.

[8] M. Khouja, S. Park, and G. Cai, "Channel selection and pricing in the presence of retail-captive consumers," *International Journal of Production Economics*, vol. 125, no. 1, pp. 84–95, 2010.

[9] F. Gao and X. Su, "Omnichannel retail operations with buy-online-and-pick-up-in-store," *Management Science*, vol. 63, no. 8, pp. 2478–2492, 2017.

[10] H. Ke and J. Liu, "Dual-channel supply chain competition with channel preference and sales effort under uncertain environment," *Journal of Ambient Intelligence and Humanized Computing*, vol. 8, no. 5, pp. 781–795, 2017.

[11] S. S. Gan, I. N. Pujawan, Suparno, and B. Widodo, "Pricing decision for new and remanufactured product in a closed-loop supply chain with separate sales-channel," *International Journal of Production Economics*, vol. 190, pp. 120–132, 2017.

[12] J. Ma and H. Wang, "Complexity analysis of dynamic non-cooperative game models for closed-loop supply chain with product recovery," *Applied Mathematical Modelling*, vol. 38, no. 23, pp. 5562–5572, 2014.

[13] Y. Song and X. Zhao, "A newsvendor problem with boundedly rational strategic customers," *International Journal of Production Research*, vol. 55, no. 1, pp. 228–243, 2016.

[14] J. Ma and F. Si, "Complex dynamics of a continuous Bertrand duopoly game model with two-stage delay," *Entropy*, vol. 18, no. 7, p. 266, 2016.

[15] J. Ma and L. Xie, "The comparison and complex analysis on dual-channel supply chain under different channel power structures and uncertain demand," *Nonlinear Dynamics*, vol. 83, no. 3, pp. 1379–1393, 2016.

[16] J. Ma and L. Xie, "The impact of loss sensitivity on a mobile phone supply chain system stability based on the chaos theory," *Communications in Nonlinear Science and Numerical Simulation*, vol. 55, pp. 194–205, 2018.

[17] E. J. Anderson and Y. Bao, "Price competition with integrated and decentralized supply chains," *European Journal of Operational Research*, vol. 200, no. 1, pp. 227–234, 2010.

[18] C. H. Wu, C. W. Chen, and C. C. Hsieh, "Competitive pricing decisions in a two-echelon supply chain with horizontal and vertical competition," *International Journal of Production Economics*, vol. 135, no. 1, pp. 265–274, 2012.

[19] S. L. Yang and Y. W. Zhou, "Two-echelon supply chain models: considering duopolistic retailers different competitive behaviors," *International Journal of Production Economics*, vol. 103, no. 1, pp. 104–116, 2006.

[20] S. C. Choi, "Price competition in a channel structure with a common retailer," *Marketing Science*, vol. 10, no. 4, pp. 271–296, 1991.

[21] T. W. Mcguire and R. Staelin, "An industry equilibrium analysis of downstream vertical integration," *Marketing Science*, vol. 2, no. 2, pp. 161–191, 1983.

International Journal of Production Research, vol. 53, no. 12, pp. 3753–3768, 2014.

[22] T. Xiao, T. M. Choi, and T. C. E. Cheng, "Product variety and channel structure strategy for a retailer-Stackelberg supply chain," *European Journal of Operational Research*, vol. 233, no. 1, pp. 114–124, 2014.

[23] W. Huang, "Stabilizing nonlinear dynamical systems by an adaptive adjustment mechanism," *Physical Review E*, vol. 61, no. 2, pp. R1012–R1015, 2000.