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CONSUMER BEHAVIOR TOWARDS TECHNOLOGICAL INNOVATIONS: A SYSTEMATIC REVIEW

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ABSTRACT

One of the biggest challenges facing technology innovation companies is how to jump from a small group of enthusiasts and achieve mass sales. For this, many theories are extended trying to explain the different behavioral profiles. Therefore, the objective of this article is to analyze the studies on consumer behavior of technological innovations, synthesize the main concepts on this theme, and outline an overview of how this field is configured. To this end, a systematic review, first in the research front and then in intellectual base was performed. The results indicate a dynamic of articles with more than one model or hybrids that seems to be a trend towards complementing the already consolidated factor theoretical models. This fact implies that these theories are failing to accurately explain the factors that influence a technology to push visionary customers to mass demand.

Keyword: Technology Acceptance Model, Innovation Adoption, Innovation Diffusion, Research Front, Intellectual Base.

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INTRODUCTION

One of the most substantial challenges facing technology companies concerns what Moore (2010) has called crossing the chasm, stressing that the greatest growth challenge for any innovation is how to make the jump from a small group of enthusiasts to the mainstream market, create volume and achieve mass sales, which requires understanding the difference between behavioral profiles. In turn, with the increasing sophistication of technological products and services, the consumer has also found it increasingly difficult to understand and deal with these innovations, making the decision about whether to include them in their daily lives more complex (Parasuraman, 2000).

That said, understanding the factors that drive consumers to adopt new technologies is interesting for both companies and consumer behavior research. The answer to this question can contribute to the development of better designs and to the evaluation and prediction of user responses to new technologies (Taherdoost, 2018). In general, the managers responsible for decision-making need to understand the issues that influence users to use a specific system so that they can be considered during the development phase.

The particular characteristics that permeate consumers' relationship with high-tech products and services demand an approach focused on the topic, dedicated specifically to understanding how consumers perceive and relate to these types of innovations (Parasuraman & Colby, 2001).

Many researchers have focused on explaining how the technology adoption process takes place. There are a number of technology adoption models, all rooted in different theories, from fields such as sociology, social psychology and human behavior (Venkatesh *et al.* 2003; Davis, 1989; Mick & Fournier, 1998; Lu & Yu-Jen, 2009). All have proven their effectiveness for predicting and explaining a range of human behaviors in different contexts or in adoption decisions in which organizational characteristics, rather than the individual, play a key role (Taherdoost, 2018). However, what are the main models and in which theories they stand?

Given this paradox, the present work intends to answer the following research question: what is the current state of the research field in which researchers strive to understand consumer behavior towards technological innovations? Methodologically, the decision was made to conduct a systematic literature review, as it offers opportunities to identify gaps and possibilities for further research, first aiming to understand what are the main hybrid models (mapped in the research front) and further, which theory they stand (searching in the intellectual basis). To this end, the objective of this article is to analyze studies on consumer behavior towards technological innovations and summarize the key concepts for this subject as well as provide an overview of the field of study concerning consumer behavior in light of these innovations.

THEORETICAL FRAMEWORK

The objective of this section is to identify the articles that used bibliographic research to reflect on consumer behavior towards technological innovations. The reviews most representative of the field will be described.

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According to the Web of Science (WoS), the most cited review is the article titled On-line market research by Miller and Dickson (2001), which reviews online research technologies and methods, indicating different methodological and ethical issues. The authors argue that online consumer behavior and e-commerce are new areas of academic study in marketing. Most of the early work in these areas was carried out by professionals, as illustrated by research reports and case studies presented at professional conferences. Online research is evaluated from two perspectives: orthodox thinking about the validity of research and out-of-the-box thinking about how online research can increase the impact of market research and develop the competitive capabilities of companies.

Another important review is published in Technovation Journal; the first author is Brent Zenobia, a researcher in the Department of Engineering and Technology Management, State University of Portland. Zenobia et al. (2009) indicate that artificial markets are an emerging form of agent-based social simulation in which agents represent consumers, companies or industries interacting under simulated market conditions. The authors review the models used and analyze their strengths, weaknesses, opportunities and threats, with a special focus on consumers. Zenobia et al. (2009) note that computer simulation has been used in management research and has been useful for demonstrating how complex behavioral patterns can emerge from simple underlying mechanisms but that its low accuracy has limited its applicability to real markets or organizations. Computer simulations are too limited to characterize phenomena for research on technological innovations, such as social interactions between heterogeneous populations, clearly reinforcing the need for more accurate tools, particularly for emerging technologies. As a research implication, the authors cite the importance of using qualitative techniques.

The third prominent review was carried out by Chen et al. (2008), who propose a theoretical framework as a foundation to better understand and subsequently analyze the adoption of online news services (ONS), conducting a literature review in conjunction with a series of in-depth interviews with some of the industry's leading experts. Chen and Corkindale (2008) analyze three paradigms (namely, innovation diffusion theory (IDT), the technological acceptance model (TAM) and uses and gratifications theory). As results, these researchers identify six factors as potential key factors in ONS adoption. These are based on the results of the literature review and the in-depth interviews with industry experts. The six constructs are perceived usefulness (PU), perceived core service quality (PCSQ), perceived supplementary service quality (PSSQ), trust, networking, interface and subjective norms.

RESEARCH PROCEDURES

First, to give greater transparency to the construction of this review, the decision was made to adapt a framework proposed by Prado et al. (2016), which establishes steps to be followed by researchers for designing the study, searching for data and selecting, organizing and analyzing the material that will constitute the research corpus (Table 1).

The steps in Table 1 will be presented in greater detail in the following subsections.

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Table 1. Framework for organizing the study.

Phases	Procedures Description		
Database	(1) Field study	1.1	Choice of scientific basis or journals
		1.2	Delimitation of Terms Representing Field
		1.3	Operationalization of search and filtering of articles
	(2) Data selection and organization	2.1	Download references in spreadsheet format
		2.2	Download references for use in CiteSpace
		2.3	Spreadsheet Analysis Matrix Organization
		2.4	Data Import into Other Analysis Software
Discussion	(3) Research front	3.1	Volume and temporal analysis
		3.2	Analysis of the most cited articles
		3.3	Analysis of the central themes
		3.4	Description, study of relationships and trends
	(4) Intellectual basis	4.1	Analysis of *journal co-citation network*
		4.2	Analysis of *reference co-citation network*

Source: Adapted from Prado *et al*. (2016).

Database

Following the framework for bibliometric analysis, the first step concerns the (1) field under study, with the (1.1) selection of the scientific database(s) or journals; (1.2) delineation of the terms representing the field and (1.3) operationalization of the search and filtering the articles. In (1.2), an attempt was made to identify the terms that could represent the field of study. To this end, the following terms from previous publications were considered: field (consumer behavior and intention to buy) and topic (innovation technology and disruptive technology). Next, searches were carried out with the expression in quotation marks in the "topic" field of WoS, i.e., the term must appear in the title, abstract or keywords of the article, signifying that the topic is central to the article's development.

Only papers in the format of a scientific article were considered, for all the years available in the database: 1997 to 2019. The following areas of study were defined as the research scope: management and business (Table 2).

Table 2. Summary of the search criteria.

Search systematization	Filters
Document Type	Article
Categories of Web of Science	All categories
Allotted time	1997-2019
Research Date	August 2, 2019

Source: The authors.

At the end of the filtering process, 346 empirical articles were found. The search was followed by step (2): data selection and organization. First, the references (2.1) were downloaded and managed in software (2.2), and the references were downloaded for use in the software CiteSpace (2.3). Following these procedures, the references were organized in Excel (2.4), the analysis matrix was organized in the electronic spreadsheet (2.5), and the data were imported into other analysis software.

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Data analysis

To present the data, the decision was made to adopt the procedures described by Chen (2006) regarding the use of CiteSpace to visualize intellectual turning points and to generally understand emerging trends and transient patterns. According to Chen (2006, p. 362), the research front is emerging thematic trends and surges of new topics, and the intellectual base is represented in CiteSpace by the co-citation networks.

Given that scientific literature can be analyzed through its patterns, which to a certain extent reveal a "map" of scientific fields, Chen (2006) demonstrates that we can discover the research trends, research front and intellectual base of the field through citations and co-citations. This makes it possible for researchers to visualize the relationships that exist in their research field, identifying the works that are most cited by the sample under study.

In this article, in the (3) research front, the intention was to analyze the volume and temporal trends, the most cited articles and the keywords. (4) Intellectual base was defined by analyzing the reference co-citation network and describing and studying the relationships and trends, comparing them with studies in the research front. Figure 1 ilustrates this dynamic.

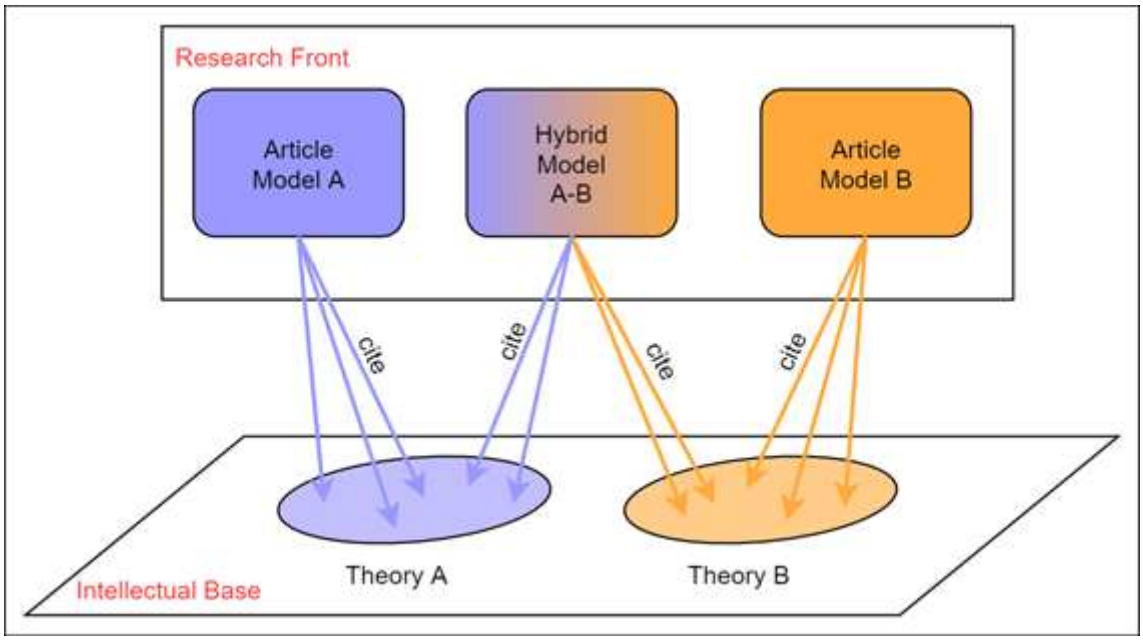

Figure 1. Research front and Intellectual base
Source: Adapted from Chen (2006)

RESULTS

Emergence of Publications and Publication Trends

Interest from researchers in understanding the factors that lead consumers to adopt new technologies appears to be growing, alongside the particular characteristics that permeate the consumer's relationship with high-tech products and services. Analyzing the temporality (Figure 2) of the publications, the sample under study shows an increasing number of works on the topic in question.

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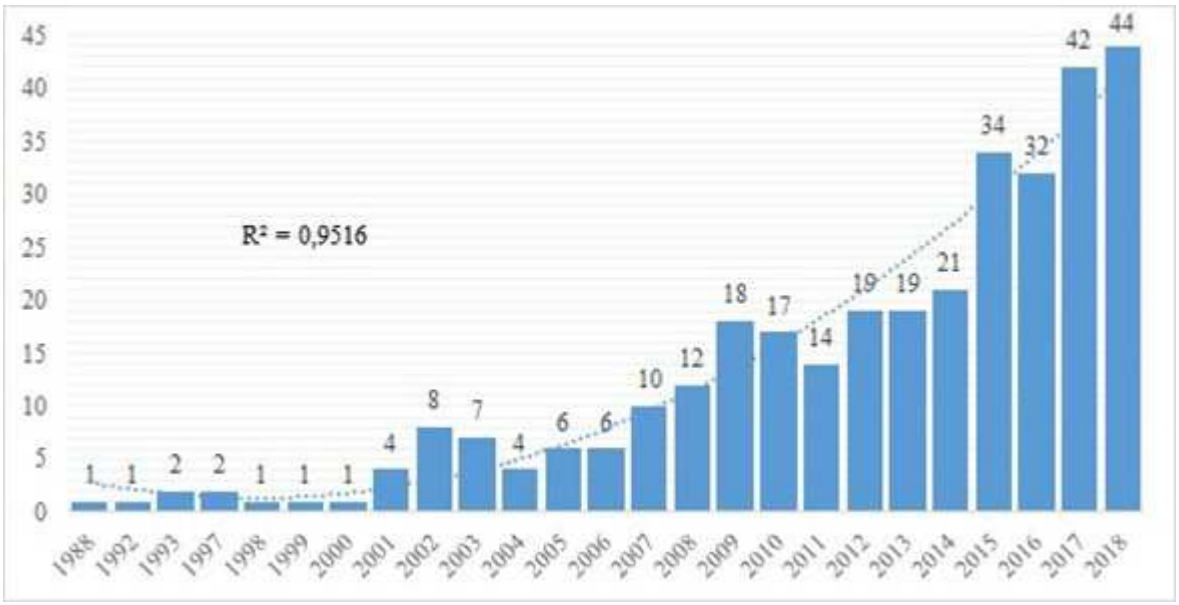

Figure 2. Number of articles per year.
Source: Research data.

The growth of online commerce and internet services, such as "internet banking," in mid-2005/2006, was accompanied by an explosion in the number of publications in the field. Notably, beginning in 2008, the number of studies that use e-commerce or internet services as a study object intensified. In a bibliographic review, there were arguments relating the growth in the number of publications with the growth of online services and sales (Chen & Corkindale, 2008; Cho & Chang, 2008).

Relevant Literature in the Research Front

This section will present the studies that received the highest number of citations. The decision was made to discuss the ten most relevant studies, according to the WoS database. Table 3 presents these key works, with a description of the title, the authors who conducted the study and the main theory adopted, as well as the method used in the study.

Table 3 also shows that among the works that compose this study's sample, the article by Wu and Wang (2005) is particularly noteworthy, as it is ranked first regarding the number of citations (474). These authors present an extension of the TAM, integrating IDT, perceived risk and perceived cost into the TAM in order to investigate which factors determine user mobile commerce acceptance. This work's contributions include the fact that Perceived Ease of Use (PEoU) does not affect the "behavioral intention to use" but that this is indirectly affected by "perceived usefulness" (Wu & Wang, 2005).

The second most cited work (334) also extends the TAM by adding IDT in order to examine consumer behavior in the context of online stores. Gillenson et al. (2002) report that this article was driven by the realization that in order for an online store to compete effectively with physical stores and other online retailers, there is an urgent need to understand the factors leading consumers to use it.

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Table 3. Most cited articles in the Web of Science

Authors	Theoretical Support	Method	Citation
Wu & Wang (2005)	(i) Perceived risk; (ii) Innovation diffusion theory; (iii) Technology acceptance model;	SEM	474
Chen, Gillenson & Sherrell (2002)	(i) Technology Acceptance Model; (ii) Innovation Diffusion Theory	CFA e SEM	334
Mick and Fournier (1998)	(i) Innovation Diffusion; (ii) Human Coping; (iii) Innovativeness Behavior.	Focus Group	315
Chang, Cheung & Lai (2005)	(i) Technology adoption	Systematic review	106
Lu & Su (2009)	(i) Technology Acceptance Model; (ii) Theory Planned Behavior	SEM	68
Wang & Cheung (2004)	(i) Innovation Adoption	CFA	55
Poon (2008)	(i) Innovation Adoption	CFA	41
Ploetz, Schneider, Globisch & Duetschke (2014)	(i) Innovation Adoption	Experiment design	33
Bartels & Reinders (2011)	(i) Innovative behavior	Systematic review	31
Lee, Lee & Schumann (2002)	(i) Diffusion of Innovations Theory; (ii) Communication Modality	Multinomial Logit Analysis	30

Source: Research data.

This article validated classical theories about technology acceptance and innovation diffusion/ adoption to explain and predict user behaviors in the context of e-commerce. Consumer acceptance and use of online stores can be explained by attitudes towards the use of online stores (Gillenson et al., 2002). The authors also report that compatibility; PU and PEoU are the main determinants of consumer attitudes towards the use of online stores.

The article by Mick and Fournier (1998) is the third most cited study (315). The authors investigate the perspectives, meanings and experiences of consumers regarding different technology products, interviewing 29 families, with individuals who had purchased a certain technology for the first time included in the group of respondents. This article uses concepts ranging from the technology paradox and postmodernism to clinical and social psychology. According to the results presented by the authors, technology paradoxes elicit strong, often negative, emotions that trigger a range of behavioral strategies to not use technology.

The study by Chang and Cheung (2005) was the fourth most cited work (106). The article sought to identify areas that would assist in developing a better understanding of the decision-making process for online shopping. Specifically, the authors identify the key factors that contribute to understanding the online shopping process. To achieve this objective, the authors conduct a review of empirical studies on the history of shopping, identifying a total of 45 relevant articles. The authors report that the TAM, the theory of planned behavior and the Triandis model can be used to structure

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new investigations into the use and acceptance of new technologies and note that trust is a factor that merits further study; given the researchers' confusion about its definition, this explanation can also be applied to perceived risk (Chang & Cheung, 2005).

The fifth most cited work was published by Le and Yu-Jen (2009). The objective was to explore a conceptual model for analyzing customer perceptions of using mobile commerce services for online shopping. As results, the authors find that anxiety is an important negative predictor of customer intentions. They also show that enjoyment strongly affects consumer intent, i.e., a customer's interaction with technology involves intrinsic motivation (enjoyment) rather than extrinsic motivation (usefulness); the authors report that individuals are in a playful state, finding the interaction intrinsically interesting: they are engaged in the activity for pleasure. The second relevant finding in this study concerns consumer anxiety, which is revealed to be a negative influencer of behavioral intention. In other words, individuals who feel less anxiety about the system also feel more comfortable using it.

The sixth most cited work was published by Wang and Cheung (2004). The study focuses on the travel industry, as it has become perhaps the largest online sales market in recent years. According to these authors, technology adoption is affected by internal and external factors. The study shows that decisions in favor of technology adoption are not entirely based on considerations about technological compatibility. The results also suggest that technological superiority is not the only force driving innovation adoption.

The study by Wai-Ching Poon is the seventh most cited. The author tested ten attributes – namely, ease of use, accessibility, features availability, bank management and image, security, privacy, design, content, speed, and fees and charges – to explore the factors that determine the adoption of a technology: e-banking. In Poon's (2008) results, privacy and security are the primary sources of dissatisfaction and may create insecurity in adopters.

The eighth most cited work was published by Plötz, Schneider, Globisch and Dütschke. These researchers report that politicians and car manufacturers are interested in understanding the first large group of electric vehicles (EV) users, often called early adopters; however, there are only a few empirical results available for this important group. They analyze and discuss different empirical data sets from Germany, categorizing groups of users by who is willing to buy an EV and who should buy one. The researchers show that the most likely group of private EV purchasers in Germany are middle-aged men in technical professions living in the suburbs or rural areas with their families. This type of consumer usually owns a vehicle and is more likely to profit from the economic benefits of EVs due to the annual mileage traveled. In contrast, city dwellers are less likely to buy EVs, as they compose a small group of car owners compared to the general population, the mileage is too low for EVs to be economically beneficial and they claim less interest and less willingness to pay for these vehicles (Plötz et al., 2014).

The ninth most cited work was published by Bartels and Reinders (2010), who present the results of a systematic literature review on consumer innovativeness. Based on a literature review, this study developed a conceptual model of the consumer innovativeness construct, presenting three types of consumer innovativeness: i) innate innovativeness, ii) domain-specific innovativeness and, iii) innovativeness as actualized behavior, or innovative behavior. The main contributions of this study lie in the perception that innate innovativeness has a stronger effect on behavioral intention than on the actual adoption behavior.

In the tenth most cited work, the authors investigate the effects of communication channel and mode on the adoption of electronic banking innovations within the theoretical framework of

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innovation diffusion. They argue that communication factors are, in fact, significant predictors of the consumer adoption of innovations, reinforcing the importance of word of mouth and more credible media for publicizing and advertising the product, using not only advertising campaigns but also advertising in a journalistic format in order to reinforce the credibility of the technology to be adopted (Lee, Lee & Schumann, 2002).

Intellectual Base of the Research Field

This section will discuss the works and studies that are most cited by the sample collected. It is important to note that the second and third most cited works are different editions of the same book. Table 4 shows the ten most cited works, with the title, author(s), predominant theoretical support and number of times it was cited (QC).

Table 4. Works most cited by the sample.

Authors	Theoretical Support	Citation
Davis, Bagozzi & Warshow (1989)	(i) Technology Acceptance Model; (ii) Theory of Reasoned Action	24
Rogers (1995)	Innovation of Diffusion	18
Rogers (2003)	Innovation of Diffusion	17
Davis (1989)	Technology Acceptance Model	16
Venkatesh, Morris, Davis & Davis (2003)	Multiple Theories	15
Ajzen (1991)	Planned Behavior	13
Agarwal and Prasad (1998)	(i) Innovation Adoption; (ii) Technology Acceptance Model	12
Fornell and Larcker (1981)	Structural Equation Modeling	12
Midgley e Dowling (1978)	Innovativeness Behavior	11
Venkatesh & Davis (2000)	(i) Diffusion of Innovations Theory; (ii) Theory of Reasoned Action; (iii) Technology Acceptance Model; (iv) Planned Behavior	11

Source: Research data.

As seen in Table 4, the work most cited by the sample was published by Fred Davis in 1989. In this study, the author developed and validated measurement scales for PU and PEoU, two variables that determine computer use. One of the main contributions is the relative strength of usefulness compared to "ease of use," where "usefulness" was more strongly linked to "use" than "ease." For

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example, users are generally willing to deal with some level of difficulty when they are using a system that provides a necessary functionality.

The second and third most cited references are the 4th and 5th editions of Everett Roger's book Diffusion of Innovation. In this book, the author emphasizes the process of innovation diffusion, stating that it is a process in which participants create and share information with one another in order to achieve a mutual understanding that is moving towards some social change. This change takes places when new ideas are invented, disseminated and adopted or rejected, leading to certain consequences that influence the status quo (Roger, 2003). Notably, Rogers was a communication theorist and sociologist as well as a professor in the Department of Communication and Journalism at the University of New Mexico; influenced by communication studies, this book reinforces the importance of communication channels for influencing and encouraging behavioral changes in the social system.

The article by Davis, Bagozzi and Warshaw is the fourth most cited. Davis et al. (1989) address the ability to predict the acceptance of computer systems through intentions in terms of attitudes, subjective norms, PU, PEoU, and related variables. PU strongly influenced people's intentions, explaining more than half of the variation in intentions after 14 weeks of research. PEoU had a small but significant effect on intentions as well, although this effect diminished over time.

The fifth most cited reference was published by Venkatesh, Morris, Davis, and Davis in 2003. The authors worked with eight information technology (IT) acceptance models, each with different sets of acceptance determinants. Venkatesh et al. (2003) carried out the following research procedures: i) literature review of user acceptance and discussion of the eight most prominent models; ii) empirical comparison of the eight models and their extensions; (3) formulation of a unified model that integrates elements from the eight models; and (4) empirical validation of the unified model. The eight models analyzed were the rational action theory, the TAM, the motivational model, the theory of planned behavior, a model combining the TAM and the theory of planned behavior, the model of PC utilization, the IDT, and the social cognitive theory. Using data from four organizations over a six-month period with three measurement points, the model explained between 17% and 53% of the variation in user intentions to use IT. This study resulted in a unified model called the unified theory of acceptance and use of technology (UTAUT), with four key determinants of intention and usage and four moderators of key relationships. The UTAUT was then tested using the original data and found to outperform the eight models.

The theory of planned behavior by Icek Ajzen is the sixth most cited work. In this article, the author reviews his previous work on the theory of planned behavior (Ajzen, 1985) and discusses some unresolved issues. Broadly speaking, Ajzen (1991) reports that the exact nature of the relationships between attitudes, behavior, subjective norms, and perceived behavioral control is still uncertain, as are perceived value formulations. As a means of addressing the limitations of expectancy and value measures, Ajzen (1991) includes 'past behavior' in the prediction equation as a way to test the theory's sufficiency; however, according to the results presented, the issue remains unresolved.

The article A Conceptual and Operational Definition of Personal Innovativeness in the Domain of Information Technology, by Agarwal and Prasad, is the seventh most mentioned work within this topic. The authors report that different models have been developed in the literature to facilitate an understanding of the process by which new information technologies are adopted.

The article by Claes Fornell and David F. Larcker, published in the Journal of Marketing Research, is the eighth most cited reference. Titled Evaluating Structural Equation Models with Unobservable

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Variables and Measurement Error, this paper examines the statistical tests used to analyze structural equation models (SEMs) with unobservable variables and measurement error. The authors argue that one disadvantage of the commonly applied chi-square test, in addition to the known issues related to sample size and power, is that it may indicate an increasing correspondence between the hypothesized model and the observed data as measurement properties and the relationship between the constructs decrease. Furthermore, and contrary to the common assertion, the risk of making a type II error can be substantial even when the sample size is large; additionally, they report that present testing methods are unable to evaluate the explanatory power of a model. To overcome these problems, the authors develop and apply a testing system based on measures of shared variance within the structural model, measurement model and overall model. The significance of this article for this topic may be associated with the fact that a significant number of the works analyzed test models using SEM as a proposed methodology.

The ninth most cited article was published by Midgley and Dowling in the Journal of Consumer Research. The authors explore the nature of innovation and its relationship to adoption, arguing that the communication processes that exist between the adoption of a new technology and its meanings should be observed in order to understand the behavior of the individuals being analyzed.

The article A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies, developed by Venkatesh and Davis, was the tenth most cited work, in which the authors develop and test a theoretical extension of the TAM that explains perceived usefulness and usage intentions in terms of social influence and cognitive instrumental processes. The extended model, called TAM2, was tested using longitudinal data collected from four different systems at four organizations: two involving voluntary usage and two involving mandatory usage. As results, these scientists found that both social influence processes (subjective norm, voluntariness and image) and cognitive instrumental processes (job relevance, product quality, result demonstrability, and ease of use) significantly influence user acceptance.

Central Themes of the Studies on Technology Consumption

Through the network of keywords generated by CiteSpace, it is possible to identify the main theories and models that are used to explain and measure the factors that determine consumer behavior towards new technologies. It is important to clarify that the keywords used to search the WoS were removed from the network to make it look cleaner; this action is not expected to affect the results presented, as they were part of the study and it is only natural that they would appear in a prominent position.

The most recurrent topics were technology acceptance model, user acceptance, internet, model, diffusion, adoption, determinants and intentions. Figure 3 illustrates the relationship between these words and the publication years; the colors dark blue, light blue, green, yellow and brown symbolize the publication year, which can also be identified by the color of the arrow. The year shown at the bottom of the figure indicates the period when the keyword became more recurrent in the academic context.

It can thus be observed that the most prominent keyword was technology acceptance model (cited 13 times), the model used by Wu and Wang (2005), in which the authors propose to extend the factors and constructs that are part of the original model presented by Davis (1989). Poon (2008) also uses the model to explain the acceptance of online banking services.

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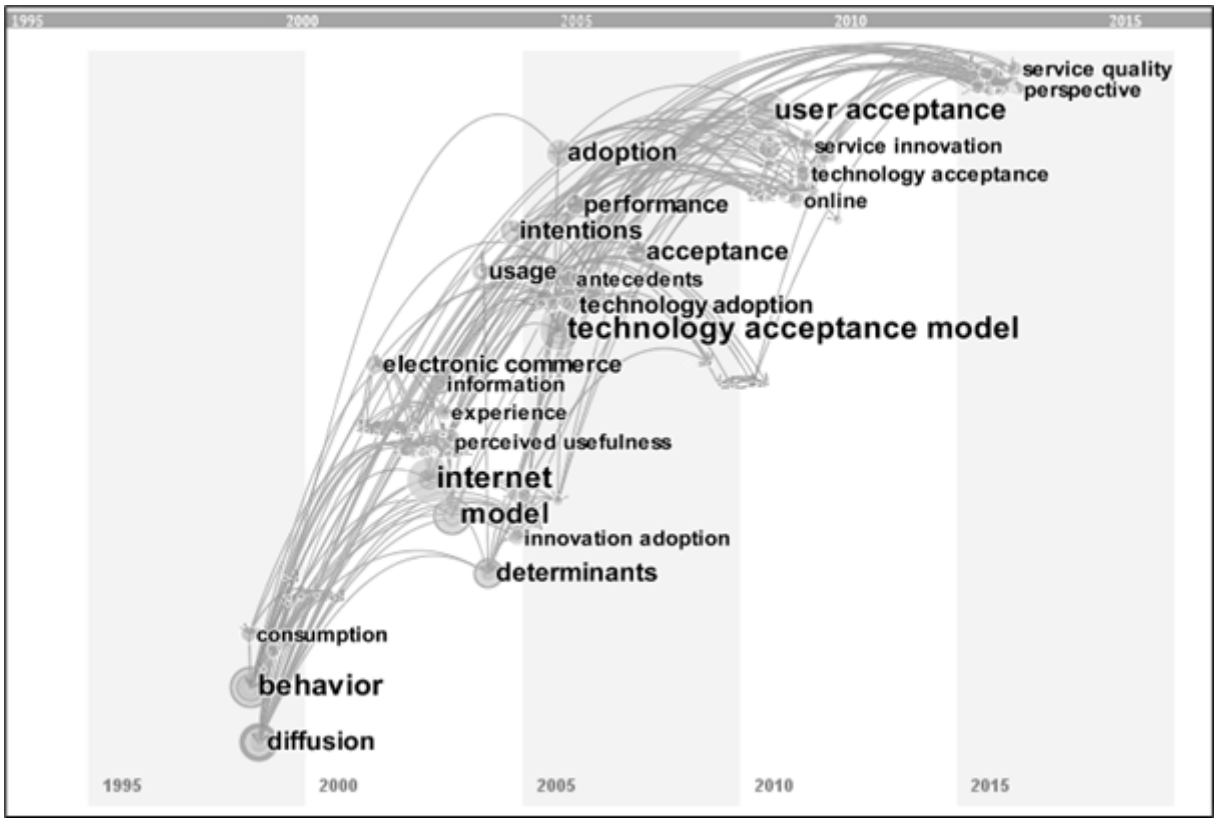

Figure 3. Network of the most recurrent keywords in the sample.
Source: Research data.

Another keyword that stood out for its frequency of use was user acceptance. A relevant work that uses this keyword is the study by Thakur and Srivastava (2014), in which the authors "[integrate] eight theories of user acceptance of technology derived from the existing information systems literature – the TAM, innovation diffusion theory (IDT), the motivational model, the TRA, the theory of planned behavior (TPB), a model combining the TAM and TPB, the model of PC utilization and social cognitive theory" (Thakur & Srivastava, 2014, p. 369). Another relevant study that contains this keyword is that by Mahatanankoon (2014), which examines the use of mobile phones; the research data show that personal innovation and a playful personality can predict complex patterns of mobile phone use.

Another prominent keyword is diffusion, a concept presented by Roger (1989), in which the author discusses the influence of social groups and mass media on the diffusion of technological innovations, among other things. One important work using this keyword is by Xu, Venkatesh, Tam, and Hong (2015), in which the authors develop a model of consumer migration and use of platforms. The authors propose three categories of factors that influence migration intention to a consumer platform: technological insights, external influences, and complementarities.

Based on the representations of the most fruitful words and how they are used by researchers in the field, the central theories underlying scholarly discussions become clear. The section that follows was developed to present a summary of the most significant relationships in the field, based on the use of the central research theories and topics.

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Thematic Directions of the Intellectual Base and Research Front

This section identifies and reflects on the theories underlying the studies on technology consumption. To this end, a superficial reading was carried out of the ten most relevant works in the research front (10 most cited in the WoS) as well as the ten most relevant works in the intellectual base (10 most cited by the sample under study), which allowed us to identify the theories used by those works. This resulted in Figure 4, which summarizes the theoretical contribution and traces the relationships between the research front and the intellectual base.

The Figure 4 first shows that the three theories emphasized in the network – IDT, TAM and Innovation Adoption – are central to the field. Cited in works in both the research front and the intellectual base, the strength of their relationships makes it possible to infer that they are part of the most established studies in the academic context. The most cited theory in the network – Innovation Diffusion – seeks to explain how, why, and the speed at which new ideas and technology spread. Rogers (2003), a communications professor, argues that diffusion is the process by which an innovation is communicated over time among participants in a social system.

Another theory with a strong emphasis is the TAM, an information systems theory that models how users begin to accept and use a technology. The model suggests that when users are introduced to a new technology, different factors influence their decision about how and when they will use it, and the following are used as constructs: PU, "the degree to which a person believes that using a particular system would enhance his or her job performance"; and PEoU, "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989).

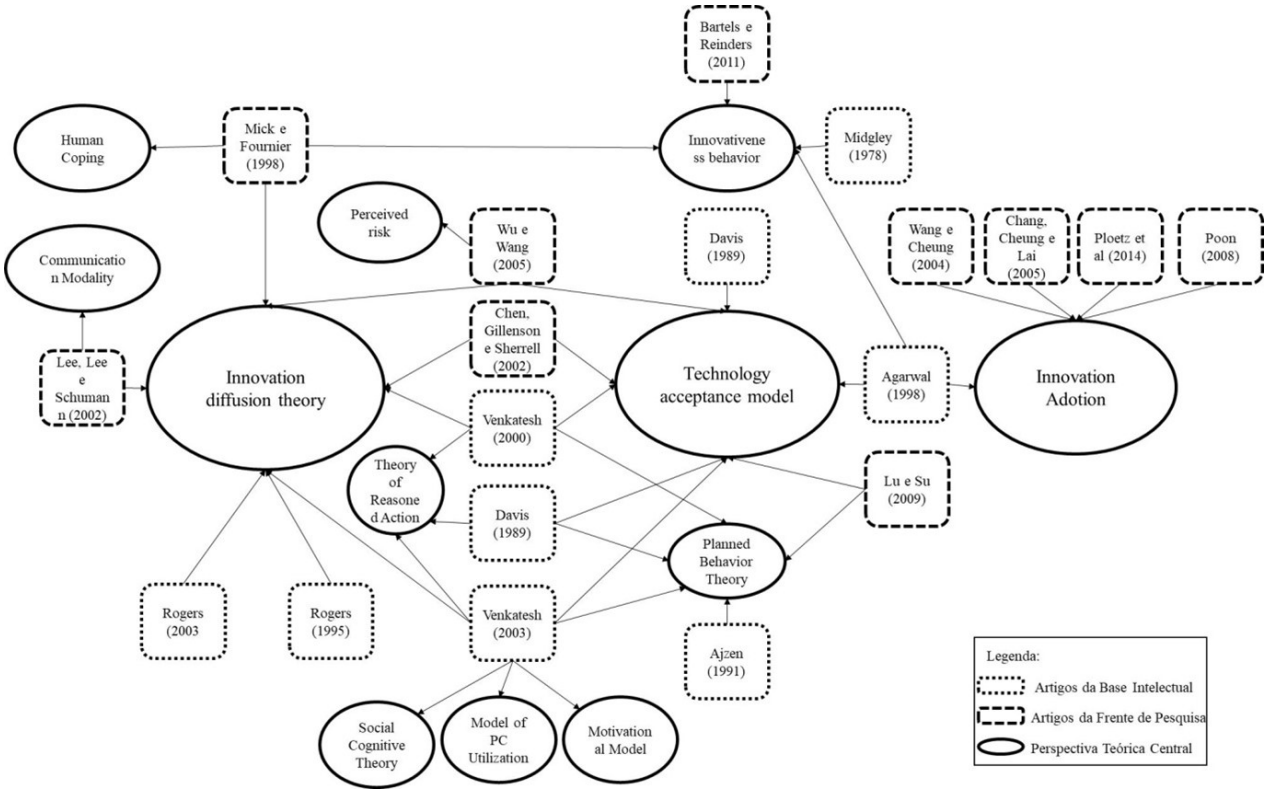

Figure 4. Most representative relationships in the field.
Source: The authors.

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The Innovation Adoption is the study of consumer behavior focused on the business-to-business (B2B) market, involving changes in business processes and significant financial investments in areas such as computing, network infrastructure and human resource management. Broadly speaking, innovation adoption seeks to understand how innovation adoption works in organizations as well as when adoption works, under what circumstances, and how and why the mechanisms identified encourage adoption.

It is important to emphasize that these theories are not mutually exclusive, given that they are discussed by authors in a single paper, as seen in the network, either contextually or in contrast. The innovation adoption theory – applied to the B2B market – was also used with another theory, along the same lines as Argawal (1998), who combined TAM constructs to provide a conceptual and operational definition of a construct that can shed more light on how individuals adopt new information technologies in the workplace. The author contributed by identifying a construct that can be used to identify early adopters, who can serve as change agents or be specifically targeted for adoption when organizational resources are limited.

In turn, it is important to mention that some theories are used and cited in only a few works and are thus considered peripheral theories, for example social cognitive theory, the motivational model, human coping, the communication model; although they are used in only one or two studies, they deserve attention, as they compose the theoretical framework of extremely relevant research in the field. In all the citations, they are used to complement or extend the consolidated theoretical models, which make it possible to infer that these great overarching theories are unable to accurately explain the factors that influence a technology to make the leap from visionary customers to achieving true mass demand.

With regard to the authors in the study's intellectual base, it is important to mention the renowned article by Venkatesh et al. (2003), in which the researchers use and discuss eight theories in order to develop and validate a model that explains the factors driving the adoption and diffusion of a new technology. The authors take four organizations as their study object and work on data collection for six months, with the objective of identifying characteristics of technology acceptance in the organizational context.

FINAL CONSIDERATIONS

The key findings of the study make it possible to conclude that beginning in the 1990s, the emphasis shifted to studies based on technology acceptance and diffusion, focusing on assumptions from the field of psychology. There was clearly a large increase in the number of publications in the field. However, an analysis of the influence of groups and means of communication on the diffusion of innovations continues to be used, particularly in studies that use innovation diffusion and technology acceptance models to complement one another. This is why Venkatesh (2003), Roger (2003) and Davis (1998) are frequently cited authors, particularly Roger, who was the first to propose using an analysis of the society to which the individual belongs and the media's influence in encouraging diffusion. Articles with more than one model or with hybrid models seem to be a trend, with a particular emphasis on the studies by Venkatesh (1998 and 2003), Lu and Su (2009) and Wu and Wang (2009).

Another important result identified is the fact that the most relevant works in the research front treat the adoption of "online shopping" as an innovation, i.e., key studies have been carried out in the services sector. However, in the intellectual base, i.e., the articles most used by the research front,

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the most prominent studies use innovative products as an object of study, which makes it possible to infer that for the researchers, the same principles found in the services sector can also be linked to products; what happens in one may therefore also be valid for the other.

There was also a visible emergence of more advanced models, which use assumptions from psychology and have complex analytical structure, such as Mick and Fournier (1998) and as seen in the review by Bartels and Reinders (2011). However, among the works analyzed, it was evident that they considered measures of "behavioral intention to use," as there were few studies that used objective measures of actual usage, and when they did, the sample size was relatively small. It is therefore recommended that, where possible, researchers use objective measures for "usage," such as, the number of times a server is accessed or an application is used. This may explain the phenomenon studied by Keung et al. (2004), in which the authors found that a particular TAM predicted that a technology would likely be adopted. However, one year later, the researchers found that the technology was not being used.

Another important finding was the increase in publications in 2008, as highlighted by authors found in the review (Bartels & Reinders, 2011), around when internet commerce gains momentum. Future studies should identify whether the upward trend driven by this growth will continue or whether another economic, social or political phenomenon will influence this field.

As an agenda for future research, new forms of reviews are suggested, such as meta-analyses. Because the vast majority of studies use robust statistical techniques, a review aimed at analyzing the quantitative information generated in these studies could contribute to understanding how a technology is accepted and adopted by consumers. Another suggestion that may contribute to improvements in empirical studies is the inclusion of more objective measures in relation to 'usage' itself, moving beyond the indicators used to measure behavioral intention.

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