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Periodical Part

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Journal of electronic commerce in organizations

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http://hdl.handle.net/11159/709523

Mobile Payment Innovations in Ambiguously Enforced Use Contexts:
A Study Amid the COVID-19 Pandemic in Brazil

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ABSTRACT

In this study, the authors discuss whether the innovation characteristics of mobile payment (m-payment) explain user attitudes and intentions in a psychologically conflictual context regarding the locus of control of use decisions. The authors present the development of an instrument that fully integrates innovation diffusion theory with the technology acceptance model and analyze data collected with it from Brazilian m-payment users during the COVID-19 pandemic. With path analysis, the authors found that the innovation factors of perceived observability and perceived relative advantage respectively explain the attitudes and the intentions toward m-payment. None of the other innovation factors had explanatory power. Moreover, two expected relationships in voluntary use settings for the formation of attitudes were not supported, leading the authors to conclude that the locus of control in use decisions was ambiguous to the user. The findings contribute to research on innovation diffusion, technology acceptance, consumer studies, usage patterns, behavioral change, and on the debate about the voluntariness or mandatoriness of technology use.

KEYWORDS

Mobile Services, Consumer Behavior, Innovation Adoption, Locus of Control, Technology Use, Behavioral Change, Structural Equation Modeling

INTRODUCTION

The adoption and use of digital technologies remain topics of much interest and contemporaneity in academia (e.g., Abdelfattah et al., 2023; Alkhwaldi, 2023; Bravo & Ostos, 2023; Changchit et al., 2023; Nguyen, 2023; Qiu, 2023; Sabani et al., 2023). Mobile services—those relying on internet

technologies and mobile devices to provide individuals and businesses with new communication channels and commercial opportunities—are among the technology-mediated services deserving attention in this regard, particularly since new features emerge continuously and users from different regions of the world hold different cultural and attitudinal archetypes (Changchit et al., 2023).

In the early 2000s, m-payment services, i.e., buyer–seller transactions of goods and services effected through mobile devices (Thakur & Srivastava, 2014; Mantri & Feng, 2011), emerged as a topic in the business and the academic communities, and multiple m-payment applications were soon made available in the global market (Dahlberg et al., 2008). M-payment was particularly revolutionary in Brazil, Russia, India, China, and South Africa (BRICS countries), which brings together the most important developing nations in terms of political and economic power (BBC, 2024). In China, for instance, m-payment progressed rapidly and ended up accounting for an increase in 42.3% of revenues in 2018 as compared to the previous year (Lu & Lu, 2020). India and Brazil have witnessed similar trends (The Economist, 2023; Kearns & Mathew, 2022). Not surprisingly, companies operating in the m-payment sector thus enjoy great prestige all over the world. One evidence comes from The South Summit (the self-defined "best global showcase for the world's leading companies, startups, investors, and institutions that want to accelerate innovation, build lasting relationships, identify opportunities, and generate business"), in which two m-payment companies (Payflow and Uelz) won the 2022 and 2023 competitions for the best start-up business plans (The South Summit, 2022, 2023).

In the present study, m-payment is framed as a technological innovation, since it involves new modalities of payment that make it easier and more convenient for consumers and vendors to perform their financial transactions (Kaur et al., 2020). M-payment indeed conveys unique opportunities to trade goods and services regardless of place, time, and distance in a way that offers flexibility, familiarity, and convenience (Phonthanukitithaworn et al., 2016) by relying on a pool of technologies such as smartphones, near-field communication, and QR codes (Dahlberg et al., 2008). However, m-payment still faces adoption and use issues (Kaur et al., 2020). Innovation adoption takes place gradually, since several aspects need time and understanding to mature, including the very nature of the innovation, the characteristics of the potential adopters, and the process of communication, as described in Rogers' (2003) innovation diffusion theory (IDT). Moreover, in the case of m-payment, its value depends on the number of consumers using it (Wang & Lai, 2020) and whether dealers/merchants accept it (Możdżyński & Cellary, 2022) and appropriate it (P. H., 2023).

Opportunities for scholarly research thus exist about the adoption of m-payment, particularly in regard to its stakeholders (P. H., 2023) and in developing countries (Changchit et al., 2023). Regarding the stakeholders of m-payment, we decided to study the relationship of consumers with the technological features (Dahlberg et al., 2008); regarding the regional context, we performed the study in the giant market base of the developing Brazilian economy during the COVID-19 pandemic. In Brazil, the *Fintech Report* (Distrito, 2023) revealed that the growth in the number of fintech startups contributed to the m-payment technological landscape (e.g., open banking, open finance, the PIX platform for banking transactions, and non-fungible tokens) that was revolutionary for the Brazilian economy since the COVID-19 pandemic. During the pandemic, increased levels of anxiety were reported due to fears of virus transmission through traditional commercial transactions, pushing people to adopt m-payment as part of the strategies for social distancing (Capgemini Research Institute, 2020; Alam et al., 2021). Research has indeed shown that the COVID-19 pandemic significantly impacted not only people's physical health (Del Rio et al., 2020) and mental health (Serafini et al., 2020), but also their patterns of technology adoption (Soares et al., 2023).

The pandemic, therefore, represented an unparalleled opportunity to study m-payment services, as those services conveyed instrumental resources for the global community to fulfill safer social and commercial operations (Hijazi & Abudaabes, 2023). Considering that the pandemic has accelerated and changed forever the digital economy (UNCTAD, 2021; McKinsey & Company, 2020) and that people tend to preserve their routines (Kanter, 2012), we should expect that attitudes and behaviors

developed during the pandemic will remain active in post-pandemic times and are thus worth revealing and discussing.

Finally, given that the dominant models of technology adoption are strongly based on discretionary processes (Koh et al., 2010; Brown et al., 2002; Moore & Benbasat, 1991), the pandemic also conveyed the opportunity to discuss those models in an institutional context that imposed—to some degree—the use of m-payment tools due to social distancing. It is difficult to accurately conclude if the use of mobile devices and services was volitional or not in that period, i.e., whether the locus of control was internal or external to the individual user (Solomon et al., 1979; Rotter, 1990), which makes the context of our study interesting and at the same time challenging for theory development.

For the reasons stated above, we devised the following research question: how do the innovation characteristics of m-payment as perceived by users/consumers impact their attitudes and intentions toward m-payment adoption in an ambiguously voluntary context of technology use decisions? To answer it, we developed a model that fully integrates IDT with Davis's (1989) technology acceptance model (TAM) and studied it during the pandemic in Brazil, which is a globally relevant market and idiosyncratic society. While many other proposals for integrating IDT and TAM exist, we innovatively offer a full integration of those two models, with two pairs of overlapping constructs. Our study thus adds to IDT and TAM research as well as to m-payment and consumer research by discussing the antecedents of adoption of m-payment in the unique context of the pandemic's social-distancing period in Brazil. The study also directly contributes to the long-lived tension in the literature on the voluntary and mandatory contexts of technology diffusion, adoption, and use.

The article is organized as follows. We begin with the dominant models of technological innovation and adoption to subsequently build an integrated conceptual model that addresses the perceived innovation characteristics of m-payment as well as the attitude of consumers toward it. Next, we present the methodological approach to test the hypotheses of our model, and we give special attention to some challenging data resulting from those tests. In the methods section, we also provide discussions on the real-world nature of the collected data to put in context the validity of studies like ours—the type of discussion we think is lacking in numerous studies on the adoption of technology. And finally, we provide a view on how this study contributes to the literature, its known limitations, and perspectives for future research.

LITERATURE REVIEW

In this section, we frame m-payment as an innovation and we present the dominant models of technology diffusion, adoption, and use in order to develop the study's hypotheses and research model.

Mobile Payment as Innovation

Innovation is a new practice or product that facilitates or improves the daily routine of people (Gupta et al., 2011), with most innovations today being based on information technology (IT) developments (Rogers, 2003). One of the cases we have been witnessing in this regard involves the high rates of penetration of mobile IT devices and internet services that grant users multiple methods for performing commercial transactions, notably in BRICS countries such as India (P. H., 2023; Dwivedi et al., 2022; Thakur & Srivastava, 2014), China (Lu et al., 2011), and Brazil (Caldeira et al., 2021; Braido et al., 2021). In this realm, mobile payment services and tools (m-payment) are conceived as a green innovation (Hijazi & Abudaabes, 2023) that fosters innovative business models in that they leverage the capacities of mobile applications related to payment and bank transfers at the same time as they offer practicality, convenience, and other benefits to the consumer (Kaur et al., 2020; Pham & Ho, 2015). The financial transfer services through digital communication devices thus facilitate direct connections between multiple commercial agents (Leong et al., 2013), provided that merchants devise benefits stemming from the type of consumers who are likely to adopt a particular tool (Wang & Lai, 2020) and provided that consumers adopt the needed behaviors (Mallat, 2007).

Diffusion, Adoption, and Use of M-Payment

For Asiaei and Rahim (2019), innovation diffusion and adoption are not as simple as we might infer from the successful cases that easily come to mind. The diffusion of a technological innovation refers to the process in which the innovation is distributed through a channel over time and across a social system (Rogers, 2003). Rogers' (2003) IDT is the dominant theory on the adoption of technology innovations (Mallat, 2007), describing how an innovation finds its way into the environment as well as the elements that influence innovation-related human behavior. IDT includes the following five perception-based antecedents of adoption: relative advantage, complexity, compatibility, trialability, and observability. The diffusion process also relies on adoption processes, which take time and involve a series of events (Chatman, 1986).

According to Bessant and Tidd (2015), the ultimate decision to adopt an innovation is individual (when a person is the decision agent), collective (when a group is the decision agent), or authoritative (when external pressure or formal requirements push the decision process). Here, we frame the adoption of m-payment as an individual-centered innovation in which consumers are usually granted the decision to use it or not. Accordingly, IDT has been used in m-payment research to analyze the diffusion process of m-payment in terms of adoption and use (Chen, 2008). Related studies identified enablers and inhibitors concerning technical and attitudinal issues such as perceived cost and perceived trust (Phonthanukitithaworn et al., 2016; Lu et al., 2011), innovation characteristics (Lu & Lu, 2020; Johnson et al., 2018; Eze et al., 2008), social influence (Lu & Lu, 2020), security and privacy (Chen, 2008), and a wide range of alternative payment methods familiar to the consumer, such as credit cards, paychecks, and cash payment systems (Johnson et al., 2018). A study by Kaur et al. (2020) also addressed the importance of developing new technological features with an attention to people's usage patterns.

In the IT field, Davis (1989) and Davis et al. (1989) championed the discussion of technology adoption and use with their seminal works on TAM. TAM is at the origin of an outstanding tradition of scholarly research due to its highly parsimonious explanatory mechanism that includes only two characteristics imputed to a technology: how its users perceive the technology's usefulness and ease of use. Nevertheless, TAM is often criticized for disregarding other possibly important factors and for its main constructs behaving like "black boxes" (Benbasat & Barki, 2007; Gefen & Straub, 2000; Goodhue, 2007). To overcome the limitations of TAM, researchers have modified the model in numerous ways (e.g., Venkatesh & Davis, 2000; see two important early reviews in Brown et al., 2002 and in Koh et al., 2010) and ultimately formulated a unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al., 2003, 2016). Today, TAM- and UTAUT-based models dominate IT adoption research, including m-payment research (e.g., Changchit et al., 2023; P. H., 2023; Caldeira et al., 2021; Thakur & Srivastava, 2014).

However, UTAUT does not solve all the issues raised against TAM (Dwivedi et al., 2019). UTAUT is far more complex than TAM due to its numerous components and relationships, but it is still limited in how it frames the antecedents of technology use (as pure perceptions), the context of use decisions (as strictly voluntary), and the type of use (not specified). In fact, the antecedents of both TAM and UTAUT include only a technology user's perceptions (Moore & Benbasat, 1991) about the technology's features, about his or her own technological competencies or computer self-efficacy (Compeau & Higgins, 1995; Marakas et al., 1998), and about the technology use environment. In other words, the models' antecedents do not include the individual user's characteristics (Dwivedi et al., 2019), such as his or her actual abilities or skills to operate the technology (Mota & Porto-Bellini, 2017). Moreover, the two models are clearly restricted to voluntary use decisions (Koh et al., 2010; Brown et al., 2002; Moore & Benbasat, 1991). Last, the two models are vague on the boundary conditions of technology use (Porto-Bellini & Serpa, 2018), whereas if use and the use context are not precisely defined in a study, anything goes—including the misuses.

While we acknowledge such critiques, our study is strictly focused on the measurement of perceptions in a cross-sectional design; thus, the dominant perception-based models are helpful to

inform the development of our research model. Moreover, as we focus on the antecedents of adoption and use, we borrow from IDT and TAM to keep our model more parsimonious than UTAUT. Per Brown et al.'s (2002) study, attitude is of prime importance for the adoption of a technology in mandatory use situations. Due to the pandemic, m-payment use has become tacitly mandatory despite not being explicitly enforced by the Brazilian government. This fact gave us a unique opportunity to reflect on the antecedents of technology adoption and use. We further elaborate on this point in the next sections.

It is important to note that there is another dominant model in this stream of the literature that is concerned with the so-called success of an information system. DeLone and McLean's (1992, 2003) information system success model has been influential in studies at both the individual and the organizational levels for including user satisfaction among the explanatory factors, which is important to explain continued use by individual users and by groups of users with shared goals. That model is also based on perceptions—on the quality of the system, the information, and the mediated services—and applicable to voluntary use contexts. Its authors posit that their model also applies to certain mandatory use situations, such as when an organizational manager has the power to decide whether to continue or to interrupt the use of a technology. However, besides our skepticism on that being a sufficient argument, such a scenario as well as the organizational level of analysis are out of the scope of our study. Therefore, we did not consider the information systems success model as a candidate for inclusion in our conceptual modeling.

In summary, there are evident limitations germane to the dominant models of technology adoption and use; thus, we endeavored to find a parsimonious combination of their features that presumably works well for the individual adoption of technological innovations. It also dovetails with recent research done in Brazil (e.g., Caldeira et al., 2021) examining TAM variables in the context of technology readiness. Technology readiness is a reflective construct consisting of multiple subconstructs. Besides not conveying parsimony, it focuses on an individual's perceptions of optimism, innovativeness, insecurity, and discomfort, thus focusing on user traits. Our study, in its turn, examines users' perceptions of a technology's characteristics. UTAUT application to m-payment adoption (Bailey et al., 2022) also presents us with the same issues, including lack of parsimony, as we are not studying adoption by an individual in an organization where the social context and the facilitating conditions can play a role. In our case, the pandemic background provides relatively natural controls on context and conditions, thus allowing us to focus on user perceptions largely based on the technology (i.e., m-payments) itself. To do so, the logical step was to integrate TAM and IDT, as we discuss next.

Research Model

Research on m-payment adoption and use has been intense in recent years. For instance, Hijazi and Abudaabes (2023) used protection motivation theory to study the factors of influence on the continued use of m-payment, and Ashour et al. (2023) used the theory of planned behavior to study the adoption of electronic payment services. Our study contributes to such recent interests by merging IDT and TAM to identify the characteristics of m-payment that contribute to form consumer attitudes and intentions toward the use of m-payment, particularly in a context of recommended social distancing. In the model, the characteristics of the technology are interpreted through IDT's five perception-based attitudinal antecedents, since one expects those constructs to explain the likelihood of assimilation of an innovation (Gallivan, 2001). In fact, when an individual becomes aware of an innovation, he or she develops an attitude toward it, and that attitude helps to determine whether the individual will eventually use the innovation in practice or not (Hubbard et al., 2003). IDT thus supports our understanding about IT adoption and use, as it is concerned with how the attitudes are formed, how the attitudes influence the adoption decision, and the role of the characteristics of a technological innovation in that process (Karahanna et al., 1999).

As we explain later, IDT and TAM have a significant overlap that allows for their integration in a single model for use in certain situations. While the joint application of IDT and TAM is not new in the literature, our study innovates by providing a full integration of the two models and a superimposition

of two pairs of constructs. In fact, to the best of our knowledge, all previous IDT-TAM studies differ from ours as they borrow only a few measures from IDT (e.g., Agag & El-Masry, 2016; Chen, 2008; Tung et al., 2008), they test the joint application of TAM and IDT with no overlaps (e.g., Alhasan et al., 2022; Al-Rahmi et al., 2021, 2019; Karahoca et al., 2018; Jongchul & Sung-Joon, 2014; Giovanis et al., 2012; Gumussoy & Calisir, 2009; Zhang et al., 2008), or they integrate IDT and TAM with additional models (e.g., Rana et al., 2013).

We found five TAM- or UTAUT-based m-payment studies worth mentioning: Chen (2008), who collected data from 299 potential m-payment users from three different organizations in the United States; Caldeira et al. (2021), who collected data from 402 m-payment consumers in Brazil; Soares et al. (2023), who collected data from 1,052 online consumers in Brazil; P. H. (2023), who collected data from 349 students and staff members of a university in India; and Changchit et al. (2023), who collected data from 372 m-payment users in Vietnam. Unlike our study, they included either perceived risk (Chen, 2008; Changchit et al., 2023), perceived trust (Caldeira et al., 2021; P. H., 2023), or perceived quality (Caldeira et al., 2021) among the antecedents of m-payment use intention, and one of them (Soares et al., 2023) used a pure TAM model to study online shopping. As for the pure application of an extant model, we had not considered it as an option due to the lack of modeling contribution. And as for the inclusion of exogenous variables in the model, we also had not considered it, for two reasons: first, we did not want to add or exclude any construct besides those already available in IDT and TAM, given that IDT and TAM have extensive research traditions in virtually all IT usage domains; and second, numerous factors are said to explain technology adoption and use in specific contexts and for specific users (see a review in P. H., 2023). Thus, instead of including each and every measure already reported in the literature, we decided to rely on the two dominant, parsimonious models for the purposes of our research—IDT and TAM. It is important to remember that instead of proposing modifications to the two models, we innovate by fully merging them in a single model with two overlapping points. Nevertheless, we can anticipate that trust and risk are currently the best candidates to extend our model in future studies.

In building connections between IDT and TAM, we modeled the constructs much like we did in a pilot study on the adoption and use of innovative e-learning technologies by instructors (Machado et al., 2012). That pilot study developed the constructs and the hypotheses based on merging two pairs of constructs of both TAM and IDT to explain the formation of one's attitudes and intentions toward technology adoption and use. Such an interaction of the two models has been long believed to exist (Moore & Benbasat, 1991; Karahanna et al., 1999). Our model worked well in the pilot study; thus, we adopted it in full to discuss its application and validity across contexts—i.e., it was first studied with e-learning technologies, and now we study it with m-payment services.

The integrated IDT-TAM model included all constructs from the original models as well as the direct and indirect effects predicted in TAM to connect perceptions, attitudes, and intentions (see Fig. 1). We defined the constructs as follows: perceived relative advantage (PRA) (and its TAM pair, perceived usefulness) is the degree to which consumers perceive m-payment as better than the traditional payment tools; perceived complexity (PCX) (the opposite of its TAM pair, perceived ease of use) is the degree to which consumers perceive m-payment as difficult to understand and use; perceived compatibility (PCM) is the degree to which consumers perceive m-payment as consistent with their values, needs, and experiences; perceived trialability (PTR) is the degree to which consumers perceive that m-payment can be tested before actual adoption to minimize uncertainty fears; and perceived observability (POB) is the degree to which consumers perceive that the outcomes of m-payment are visible to others so as to meet shared perspectives and social norms. In the original formulation of IDT, all constructs except PCX have a positive effect on the adoption of innovations (Rogers, 2003).

For the development of the research hypotheses, we followed the original nomological networks of both IDT and TAM and reinforced their propositions with findings from the m-payment literature. First, in m-payment adoption studies, a significant relationship between PRA and consumer attitudes is acknowledged in Agag and El-Masry (2016). Moreover, when IDT's PRA is articulated with TAM's

Figure 1. The integrated model
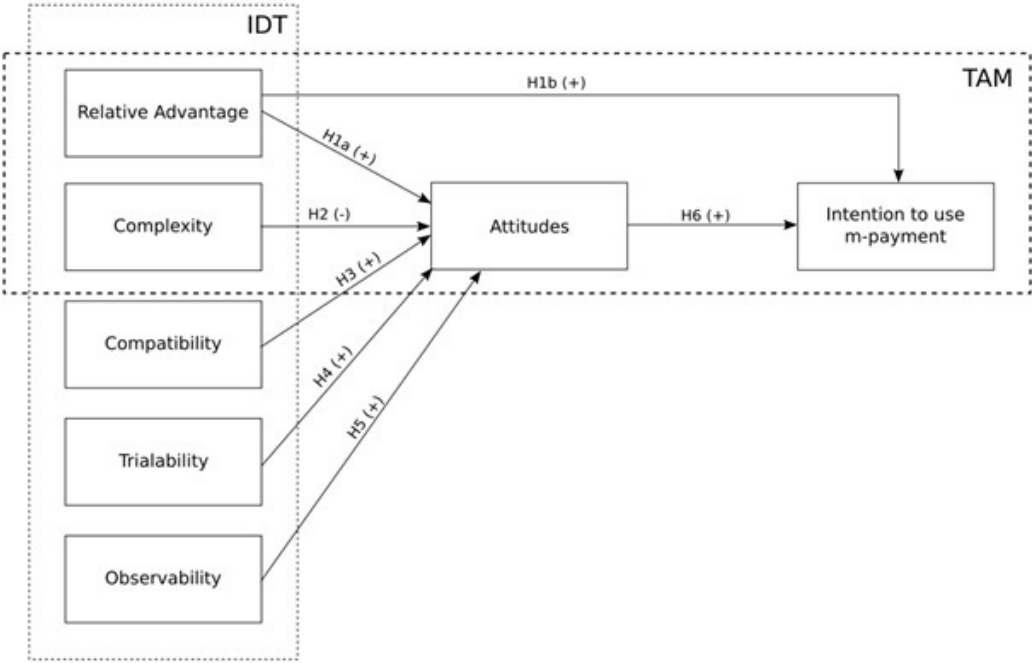
Note: The five IDT antecedents are modeled as perceptions. IDT's perceived relative advantage is assumed to also represent TAM's perceived usefulness, and IDT's complexity is assumed to also represent TAM's ease of use (in reverse). The presence of both attitudes and intentions in the model as well as the influences they suffer from the IDT antecedents are based on TAM's rationale for volitional technology use.

perceived usefulness (Chen & Adams, 2005), they jointly have a direct and positive effect on the formation of attitudes (Lu & Lu, 2020). P. H. (2023) additionally found a positive influence of TAM's perceived usefulness (which is here TAM's equivalent of IDT's PRA) on m-payment's adoption readiness, which in turn was found to be the single most important attitude toward the development of m-payment intentions. Finally, in both voluntary and mandatory use settings, perceived usefulness is a key antecedent of the formation of attitudes (Brown et al., 2002). Therefore, we developed the following hypothesis:

H1a: PRA of using m-payment positively affects a consumer's attitude toward using m-payment.

Johnson et al. (2018) and Lu et al. (2011) identified a positive effect between PRA and a consumer's intention to use m-payment services. Also, the study by Chen (2008) used TAM's perceived usefulness (as previously stated, it is TAM's equivalent of IDT's PRA) to explain m-payment intentions, finding a positive relationship as well. However, Agag and El-Masry (2016) did not identify a significant relationship between PRA and a consumer's intention to purchase travel tickets in online platforms or to engage in word-of-mouth. By the same token—and contrary to what happens in volitional decisions of technology adoption and use—perceived usefulness is not significant to explain adoption and use intentions in mandatory use situations (Brown et al., 2002). More recently, though, Alam et al. (2021) used part of TAM's rationale to study the adoption of m-payment services by international students in China during the COVID-19 pandemic, and they found that both perceived usefulness and social

distancing behavior explained to a good degree the adoption of m-payment services. However, they did not make any explicit claim on the voluntary or mandatory aspects of m-payment adoption in the pandemic context, and, since we also do not know whether m-payment was interpreted as mandatory or not by the participants of our study, we developed the following more conservative hypothesis:

H1b: PRA of using m-payment positively affects a consumer's intention toward m-payment adoption and use.

When an innovation is sophisticated and complex, it is reasonable to expect that individuals should possess certain abilities and skills to use it. However, Chen and Adams (2005) argue that m-payment is not complex once it provides simple and convenient payment functionalities. Therefore, complexity would possibly have a negative relationship on one's attitudes toward m-payment. In fact, Chen (2008) later found that consumers are more likely to adopt m-payment if they believe it is easy to use. Finally, from the long TAM tradition on the volitional decisions of technology adoption and use, perceived ease of use (the opposite of PCX) is one of the key positive antecedents in the formation of attitudes toward technology adoption and use. Therefore, we developed the following hypothesis:

H2: PCX of using m-payment negatively affects a consumer's attitudes toward m-payment adoption and use.

Chen (2008) found that m-payment adoption is also determined by PCM, since that study's respondents reported m-payment as consistent with their lifestyle and the way they performed shopping activities. Compatibility in fact plays a crucial role in that it refers to alternative products or services that require little effort for one to learn how to deploy them or require only a few behavioral changes (Chen & Adams, 2005). It may thus explain the positive influence that has been found of PCM on the attitudes toward m-payment (Agag & El-Masry, 2016; Lu & Lu, 2020). Therefore, we developed the following hypothesis:

H3: PCM of using m-payment positively affects a consumer's attitudes toward m-payment adoption and use.

Johnson et al. (2018) have found an indirect effect of PTR on m-payment use intentions as mediated by perceived security. In our model, we predict an indirect effect of PTR on m-payment use intention as mediated by attitude, since Chen and Adams (2005) previously advocated a positive effect of PTR on the attitudes toward m-payment usage. Therefore, we developed the following hypothesis:

H4: PTR of using m-payment positively affects a consumer's attitudes toward m-payment adoption and use.

Observability shares characteristics with Ajzen's (1991) subjective norms, in that one is knowledgeable of how others conceive the use of certain technologies. Chen and Adams (2005) have posited that POB has an impact on one's attitudes toward m-payment usage, and He et al. (2006) reinforced that the more visible the outcomes of an electronic payment innovation, the faster its adoption and incorporation into one's habits. In TAM-based research, the related concept of subjective norms is sometimes considered in the discussion of contexts of technology adoption and use, with such norms explaining a technology user's intentions in mandatory contexts (Brown et al., 2002). Since we did not know whether m-payment would be interpreted as mandatory or volitional by the participants of our study, we developed the following conservative hypothesis that predicts a positive but indirect effect of POB on intentions by means of the attitudes:

Table 1. Definition of constructs

Construct	Definition	References
PRA	Degree to which a consumer perceives m-payment as better than the traditional payment tools.	Rogers (2003)
PCX	Degree to which a consumer perceives m-payment as difficult to understand and use.	
PCM	Degree to which a consumer perceives m-payment as being consistent with his or her values, needs, and experiences.	
POB	Degree to which a consumer perceives the outcomes of m-payment as visible to others.	
PTR	Degree to which a consumer perceives that m-payment can be tried before actual adoption.	
ATT	A consumer's positive or negative perspective on m-payment usage.	Venkatesh et al. (2003); Fishbein & Ajzen (1974)
INT	A consumer's favorable or unfavorable inclination toward using m-payment.	Ajzen et al. (2004)

H5: POB of using m-payment positively affects a consumer's attitudes toward m-payment adoption and use.

The relationship between attitudes and intentions is predicted in the m-payment literature (Wong, 2018; Liébana-Cabanillas et al., 2014). This means that if individuals hold positive perceptions toward m-payment, they are likely to adopt it. In TAM-based research, attitudes will be associated with intentions only in voluntary contexts (Brown et al., 2002). Since we did not know if m-payment would be interpreted as mandatory or volitional by the participants of our study, we developed the following conservative hypothesis:

H6: Attitudes toward using m-payment positively affect a consumer's intentions toward m-payment adoption and use.

METHOD

The theoretical domain of the constructs (Table 1) was based on previous literature, as discussed before. Next, we developed the measures by adapting items from other studies (Hosseinikhah Choshaly, 2018; Moore & Benbasat, 1991; Wang et al., 2018; Higgins et al., 2007; Agag & El-Masry, 2016; Khaksar et al., 2019; Van Ittersum et al., 2006; Rogers, 2003; Tan & Teo, 2000; Taylor & Todd, 1995; Wang & Jeong, 2018). It is important to note that we have not restricted the type of m-payment to be measured so that we could develop the broadest view possible on m-payment in Brazil (for a review on m-payment tools and methods, see Changchit et al., 2023).

The next step was to perform content validation on the data-collection instrument. This procedure was partially based on the previous literature from which we adapted the items, but we performed additional validations with the help of four researchers who manifested their views about the representativeness and the clarity of each item. The researchers received an original instrument consisting of 53 items. In the validation process, we extracted the average score for each item to define the inclusion and exclusion criteria as well as to assess the views of the researchers. The resulting instrument consisted of 51 items measured with a six-point Likert scale ranging from *strongly disagree*

to *strongly agree* measures, with no neutral point so that the respondents should manifest their views toward the extremes of the scale.

Data collection was then performed continuously in two months during the COVID-19 pandemic (July–August 2020) using the Google Docs platform. In those specific months, there were no relevant policy changes regarding the pandemic, and people were already familiarized with using m-payment for their financial needs. Familiarity was indeed confirmed later with the collected data, when participants reported positive assessments of all aspects of m-payment, including ease of use, usefulness, and compatibility with one's lifestyle, among other issues. It is important to note that the pandemic in Brazil was declared on March 16, 2020 (Villela et al., 2021). Therefore, early and late responses are assumed to contain no time-impacted data. We received responses from 351 m-payment users, but the measure purification process led to the exclusion of 16 cases considered outliers. The final sample thus consisted of 335 valid cases, a number that is just about the same as in related studies conducted in the United States (Chen, 2008), India (P. H., 2023), Vietnam (Changchit et al., 2023), and Brazil (Caldeira et al., 2021).

For the data analysis, we performed descriptive statistics to characterize the sample, descriptive statistics for an overview of the results, factor analysis to group the items in the conceptually developed constructs, and structural equation modeling to test the causal hypotheses. We used RStudio Version 1.2.5 in such procedures, which are discussed next.

Sample

A final sample of 335 Brazilian consumers participated in the study. Brazil is a unique context for internet studies in many senses, particularly regarding the challenges of providing quality service in its giant land size, the high rates of internet penetration that make Brazil the fifth largest internet population while also facing increasing issues regarding internet freedom (Bianchi, 2024; Petrosyan, 2023a, 2023b), and the positive attitudes of Brazilians toward innovative market channels and technology-based services (Mintel, 2021). The pandemic period also represented a unique research opportunity, as people were in a situation where the use of m-payment services was not completely voluntary due to the restrictions on mobility and on personal interactions to perform commercial transactions; but it was also not completely mandatory since most electronic commerce tools and operations were not imposed by the public agents but were rather an option made available by the technological and business infrastructure. Therefore, we had contact with data that allowed us to measure perceptions, attitudes, and intentions in an ambiguous context of voluntary and mandatory use of m-payment tools, while the dominant models in the literature were designed for strictly voluntary technology adoption and use situations. The reason for the models' assumptions on volitional use decisions is that it does not make sense to ask an individual whether he or she will decide to use a technology if technology use is mandatory. Therefore, our study had unique access to data from institutionally voluntary technology uses in a psychologically mandatory technology use context due to the social restrictions of the pandemic period.

The respondents in our sample were selected from three organizations, including one university. The reason for such a convenience sample was to increase the likelihood that we would get an acceptable number of answers in a short period and from "real" respondents. For these and other reasons, convenience samples are common in this type of research (e.g., Yoshikuni et al., 2023; Almeida et al., 2022), whereas the generalization of findings is always a risk. However, we were not aware of any solid statistic about m-payment user demographics in Brazil to guide a probabilistic sampling design. Respondents in those organizations were contacted via electronic mail, WhatsApp, and Instagram by a company that offers contact services for researchers. After the exclusion of statistical outliers, a total of 335 responses were available for analysis. Table 2 shows the demographic data related to m-payment usage, gender, age, marital status, education, and income. Respondents had mostly used m-payment for six months by the time of the survey. Most of them were female (58%),

Table 2. Demographic profile of respondents (n = 335)

M-payment usage	Frequency	Rate (%)	Cumulative rate (%)
Never used	15	4	4
Used for up to 6 months	114	34	38
Used for up to 1 year	65	20	58
Used for up to 2 years	70	21	79
Used for up to 3 years	47	14	93
Used for over 3 years	24	7	100
Gender			
Female	195	58	58
Male	140	42	100
Age			
15–19	32	9.5	9.5
20–24	112	33.4	42.9
25–29	97	29	71.9
30–34	70	21	92.9
35–39	14	4	96.9
40–44	4	1.3	98.2
45–49	5	1.5	99.7
50–54	1	0.3	100
Marital status			
Single	241	72	72
Married	66	19.7	91.7
Divorced	8	2.3	94
Stable relationship	19	5.6	99.6
Widow/widower	1	0.4	100
Education			
High-school diploma	39	11.6	11.6
Undergraduate degree	239	71.3	82.9
Postgraduate degree	57	17.1	100
Income (monthly salary in US$)			
≤ 280.00	177	53	53
280.01–560.00	93	27.7	80.7
560.01–800.00	42	12.5	93.2
800.01–1,400.00	13	3.9	97.1
1,400.01–2,000.00	7	2	99.1
>2,000.00	3	0.9	100

aged 20–24 years (33.4%), and single (72%), held an undergraduate degree (71.3%), and earned less than R$1,400 (US$280) per month (53%).

Measurement Model

Normality analysis of the 51-item data-collection instrument led to the exclusion of eight items due to skewness and kurtosis. To further validate the instrument with the remaining 43 items, we analyzed convergent validity on the factor loadings of each item (Table 3). After we excluded seven items with lower loadings than desirable, the remaining 36 items presented satisfactory loadings. Cronbach's alpha was also satisfactory for the constructs, and average variance extracted (AVE) results were above the threshold except for PTR (AVE = .340). Nevertheless, its alpha and composite reliability (CR) were high, which suggests acceptable reliability. Finally, CR levels were all above the threshold, thus suggesting good reliability and convergent validity of the full instrument.

We carried out variance inflation factor (VIF) analysis to verify multicollinearity between predictor variables of the structural model (Hair et al., 2021). To do so, we assessed multicollinearity between five first-order constructs, examining the regression model for each set of constructs separately to generate the adjusted R^2 and calculate the VIF for each variable using the following equation: $VIF_i = 1/(1 - R_i^2)$. VIF values ranged between 1.1 and 3.25 (Table 4), i.e., all below the threshold (<5), thus suggesting low multicollinearity between predictors and no substantial effect on the structural model estimates (Hair et al., 2021).

We also conducted factor analysis to examine the discriminant validity of the constructs (Table 5). In most cases, the diagonal values (square root of the AVE for each construct) were slightly higher than the cross-correlations among constructs, thus the instrument achieved moderate discriminant validity (Chin, 1998). We understand that the source of ambiguity in certain correlations did not rest on the theoretical model, since the model integrates in full the nomological networks of both IDT and TAM. Instead, some items in our instrument might not have been sufficiently informative to the respondents. However, this possibility is also intriguing, since we adapted known scales from the literature (thus having a conceptually sound instrument) and carefully screened the collected data toward building a statistically solid dataset (thus having no garbage-like data to process). As a matter of fact, the analysis within each construct proved successful. Therefore, to our best reasoning efforts, we can only think of a puzzling limitation of our study stemming from the data in Table 5, which might have impacted to some degree the subsequent test of hypotheses and the discussion of findings. Nevertheless, we stand by the validity of the model's rationale and the items that form each construct, which is a contribution per se of this study.

Structural Model

We performed adjustment tests to the model and path analysis as part of a confirmatory factor analysis using R's lavaan package. The adjustment measures are shown in Table 6. Based on three adjustment models, we concluded that the adjustment measures have met the recommended thresholds in Hair et al. (1998). Our statistics are very similar to those in P. H. (2023).

Table 7 and Fig. 2 show the results for the structural model. Only three of the seven expected relationships were statistically significant.

DISCUSSION

The first important result concerns the context of technology adoption and use. As discussed in the literature review, the original proposition of the dominant models of adoption and use of technology (including the technological innovations) applies exclusively to volitional use situations. In mandatory contexts, those models should be modified in many senses, such as by adding or dropping constructs, reorganizing their relationships, or reinterpreting the causal paths (Koh et al., 2010; Brown et al., 2002). Four of our seven hypotheses were previously studied in voluntary versus mandatory use contexts; thus, we compared previous knowledge with our data in order to determine the type of context of m-payment use during the pandemic period. Of those four hypotheses, the

Table 3. The 36-item instrument

IDT Construct	Item	Loading	Cronbach's Alpha (>.7)	AVE (>.5)	CR (>.7)
PRA	PRA1. I see m-payment as satisfying me more than other payment methods (such as the credit card).	.79	.82	.53	.71
	PRA2. I see m-payment as just as useful as a credit card.	.69			
	PRA4. I see m-payment as granting me more control over my finances.	.70			
	PRA9. I see m-payment as more convenient than any other payment method.	.72			
PCM	PCM1. I see m-payment as fitting well to the way I like to manage my finances.	.74	.90	.66	.91
	PCM2. I see m-payment as appropriate for my work style.	.70			
	PCM4. I see m-payment as fitting well to the way I use it.	.88			
	PCM5. I see m-payment as consistent with my values, beliefs, and needs.	.86			
	PCM6. I see m-payment as consistent with my personal goals.	.87			
PCX	PCX1. I see the use of m-payment as complex for one to learn.	.78	.85	.54	.85
	PCX2. I see the use of m-payment as difficult.	.72			
	PCX5. I see that the fast changes and technological advances in mobile devices complicate the use of m-payment.	.69			
	PCX6. I see shopping with m-payment as complex and time consuming.	.72			
	PCX7. I would need a long time to learn how to shop with m-payment.	.75			
PTR	PTR2. I had the opportunity to test m-payment before adoption.	.60	.71	.34	.71
	PTR3. I know how to satisfactorily explore m-payment's features.	.69			
	PTR4. I can try m-payment, since it is widely available.	.66			
	PTR6. I do not worry about the time involved to explore m-payment.	.55			

Table 3. Continued

IDT Construct	Item	Loading	Cronbach's Alpha (>.7)	AVE (>.5)	CR (>.7)
POB	POB2. I see m-payment as trustworthy and I will likely recommend it to other people.	.85	.91	.64	.91
	POB3. I see m-payment as interesting due to its coverage of online payments.	.83			
	POB4. I see m-payment as pleasant due to its efficiency (it saves resources).	.79			
	POB5. I see m-payment as requiring learning time and effort, while also being beneficial due to its applications.	.73			
	POB6. I prefer to use m-payment to buy products and services.	.79			
	POB7. I see m-payment as highly reliable and valuable for paying for products.	.77			
ATT	ATT1. I see m-payment as not only pleasant but also a good idea.	.85	.93	.71	.94
	ATT2. I like to use m-payment.	.88			
	ATT3. I see m-payment as a better payment option as compared to the traditional options.	.77			
	ATT4. I see the use of m-payment as pleasant.	.90			
	ATT5. I see m-payment functionalities as impressive.	.79			
	ATT6. I see the use of m-payment as interesting.	.84			
INT	INT1. I prefer to use m-payment over other payment methods.	.84	.94	.74	.94
	INT2. I will likely choose m-payment in my next payment.	.87			
	INT3. I will likely recommend m-payment to other people.	.84			
	INT4. I will likely use m-payment whenever possible.	.91			
	INT5. I will likely use m-payment for online purchases.	.81			
	INT6. I will likely try to use m-payment whenever possible.	.87			

Table 4. Multicollinearity between predictor variables

Regression Coefficient and Multicollinearity Test	Predictors				
	PRA	PCM	PCX	PTR	POB
R^{2*}	0.50001	0.572	0.09064	0.4339	0.6922
VIF values (<5)	2.00	2.34	1.10	1.77	3.25

*Adjusted R-squared when regressing each predictor variable against the remaining ones.

results for two of them (H1b and H6) suggest that the context of m-payment adoption and use in the pandemic period was voluntary in nature, and the results for other two hypotheses (H1a and H2) were inconclusive, as follows:

- Contrary to what happens in voluntary contexts of technology adoption and use, IDT's PRA, which is a proxy for TAM's perceived usefulness, would not have an impact on use intentions in

Table 5. Correlation of the latent variables and discriminant validity

Construct	PRA	PCM	PCX	PTR	POB	ATT	INT
PRA	.73						
PCM	.64	.81					
PCX	-.13	-.25	.73				
PTR	.41	.57	-.12	.58			
POB	.67	.75	-.29	.62	.85		
ATT	.65	.68	-.29	.54	.85	.84	
INT	.70	.71	-.21	.56	.83	.83	.86

Table 6. Results of the measurement model

| Index	Indicator	Initial Model	Calibrated Model	Final Model	Reference Value[1]
Absolute adjustment	Normed chi-square (X^2/df)	2.905	2.913	2.818	Between 1 and 3
	Goodness-of-fit index (GFI)[2]	.765	.772	.789	$\geq.9$
	Root mean square residual	.092	.091	.080	$\leq.05$
	Standardized root mean residual	.053	.052	.048	Smallest value (modulus)
	Root mean square error of approximation	.075	.076	.074	$<.1$
Incremental adjustment	Normed fit index	.813	.824	.841	Biggest value
	Comparative fit index	.868	.877	.891	$\geq.9$
	Tucker-Lewis index	.858	.866	.880	Biggest value
Parsimonious adjustment	Adjusted GFI[3]	.733	.739	.757	$\geq.9$
	Parsimony normed fit index	.754	.760	.770	Biggest value

[1]Hair et al. (1998).

[2]GFI is sensitive to sample size. Thus, considering the relatively small size of our sample, such an index did not show an excellent fit. Besides, GFI is dependent on model complexity, once it increases as the number of parameters/variables increases; therefore, it tends to favor models with a larger number of variables (MacCallum & Hong, 1997).

[3]Adjusted GFI is problematic in simple models; thus, in such cases it is recommended to take root mean square error of approximation for power analysis and model evaluation (MacCallum & Hong, 1997).

Table 7. Summary of the path analysis

Structural Path	Path Coefficient	p-Value	Result	Conclusion About the Adoption/Use Context
H1a: PRA → ATT	-.002	.993	Not supported	None
H1b: PRA → INT	.780	.000	Supported	Voluntary
H2: PCX → ATT	-.001	.989	Not supported	None
H3: PCM → ATT	.010	.957	Not supported	Not applicable
H4: PTR → ATT	-.294	.272	Not supported	Not applicable
H5: POB → ATT	2.842	.000	Supported	Not applicable
H6: ATT → INT	.666	.000	Supported	Voluntary

Figure 2. The structural model
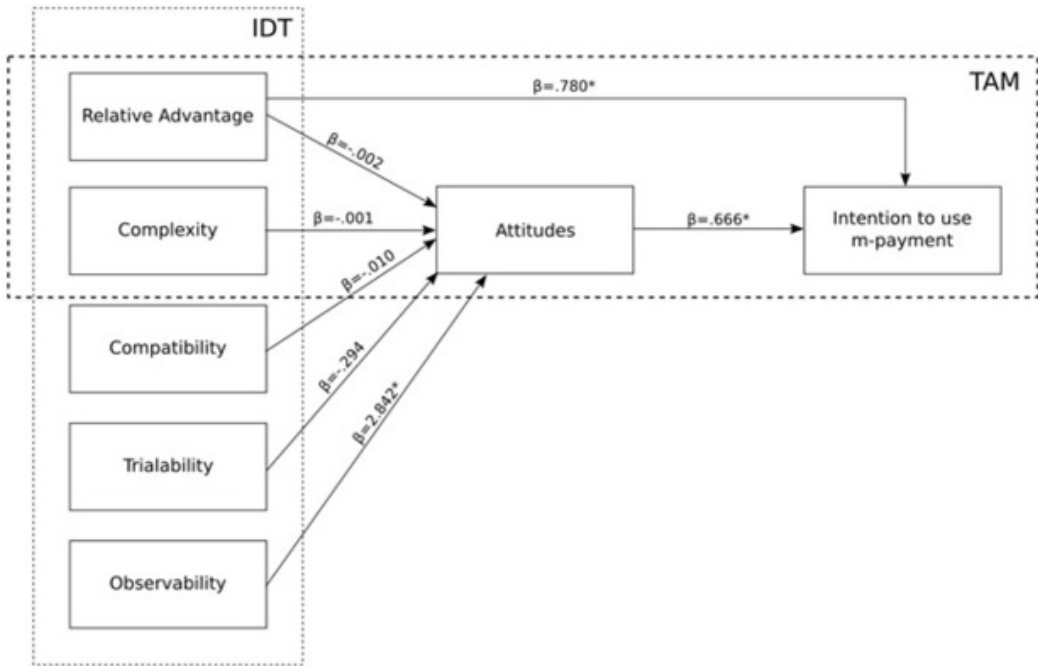
*Note: * significant at 5%. The five IDT antecedents were modeled as perceptions.*

mandatory contexts (Koh et al., 2010; Brown et al., 2002). Therefore, since H1b (PRA→INT) was supported, our respondents are likely to have interpreted the technology use decisions as voluntary, i.e., dependent on the users' individual discretion.

- Also contrary to what happens in voluntary contexts of technology adoption and use, one's attitudes toward using a technology would not have an impact on the corresponding intentions in mandatory contexts (Koh et al., 2010; Brown et al., 2002). Therefore, since H6 (ATT→INT) was supported, our respondents are likely to have interpreted the technology use decisions as voluntary, i.e., dependent on the users' individual discretion.
- With H1a and H2, we tested whether the formation of attitudes would be impacted by both IDT's PRA (which is a proxy for TAM's perceived usefulness) and IDT's PCX (which is a reverse proxy for TAM's perceived ease of use). Such impacts are expected in voluntary contexts, but the hypotheses were not supported. Therefore, we cannot affirm that the use context of m-payment during the pandemic period was fully consistent with volitional uses.
- The other three hypotheses (H3, H4, and H5) do not convey implications for mandatory versus voluntary use contexts.

From such results, we conclude that the context of technology adoption and use in our study—i.e., how the consumers conceived using m-payment tools and services during the COVID-19 pandemic period—was relatively ambiguous in terms of volitional or mandated uses in that the consumers were assumed to be free to choose whether to use m-payment or not, but in practice they may have seen m-payment as a partially mandatory method to perform the commercial transactions. Situations such as this one are possibly more common than imagined. As Koh et al. (2010) and Dwivedi et al. (2019) recall, voluntariness in technology adoption and use is more like a continuum and a matter

of perspective, whereas extant studies usually frame the use setting as either strictly voluntary or mandatory or do not describe it at all.

As per the results for m-payment and innovation adoption research, we begin with the three supported hypotheses. First, IDT's PRA had a significant, positive effect on the intentions to use m-payment (H1b: $\beta_{PRA \rightarrow INT}$ = .780, $p \leq .5$). As PRA mean values ranged from 4.59 to 4.89, we see that the respondents are satisfied with using m-payment, as it is seen as easier and more convenient than the traditional payment methods. Also, individuals believe they have more control over their financial transactions with m-payment.

Second, POB had a significant, positive effect on the attitudes toward m-payment (H5: $\beta_{POB \rightarrow ATT}$ = 2.842, $p < .5$). As POB mean values ranged from 4.45 to 4.99, we see that respondents tend to use m-payment and spread the word about it to other people. The reason is that m-payment is considered interesting, pleasant, trustworthy, and worth spending time on, and it is a favorite tool for those who want to perform financial transactions. Respondents thus believe that using m-payment is valuable in buying opportunities. All POB items were considered significant in the decision to use or abandon m-payment in the future.

Third, the attitudes toward using m-payment had a significant, positive effect on the corresponding intentions (H6: $\beta_{ATT \rightarrow INT}$ = .666, $p < .5$). We infer that our respondents had a positive evaluation of m-payment and that such an evaluation impacted their "intentions" toward using m-payment in the future. As ATT mean values ranged from 4.9 to 5.02, we see that the respondents were positive regarding the use of m-payment, as they consider it exciting, pleasant, and a good idea when compared to the more traditional payment methods. Respondents also reported positive intentions (INT mean values ranged from 4.34 to 4.96) to recommend and use m-payment in the future.

As per descriptive statistics of IDT's constructs whose expected relationships with attitudes were not supported, PRA measures were already commented on previously. Next, the results for PCX (PCX mean values ranged from 1.95 to 2.18) show that the respondents did not perceive m-payment as complex despite the high rates of change in technology innovations. Therefore, using m-payment does not require strenuous mental effort nor represent a waste of time for those learning how to use it. Also, respondents perceived m-payment as compatible (PCM mean values ranged from 4.31 to 4.66) with the way they manage their financial routines, work, and lifestyle as well as with their beliefs, values, needs, and goals. Regarding PTR (PTR mean values ranged from 3.13 to 4.25), respondents realized that they had not tested the tool enough before deciding to adopt it, whereas they know how to use it satisfactorily. This fact may be related to the perception of ease of use and usefulness of m-payment. In addition, the availability of the tool to be tested is positively perceived by the consumers.

Despite the aforementioned positive evaluations, PCX ($\beta_{PCX \rightarrow ATT}$ = -.001, $p > .5$), PCM ($\beta C_{PCM \rightarrow ATT}$ = .010, $p > .5$), and PTR ($\beta_{PTR \rightarrow ATT}$ = -.294, $p > .5$) had no significant effect on the attitudes toward using m-payment. Such results are contrary to known literature. Also, as mentioned before, PRA had a positive effect on the formation of intentions, but not on the formation of attitudes ($\beta_{PRA \rightarrow ATT}$ = -.002, $p > .5$). This means that, even if respondents perceive m-payment as advantageous, this is not a reason for them to develop strong feelings about it. This makes us think of the commoditization of IT, in that the value of IT "lies less in the specifics of design than in the ingenuity of its use" (DeSanctis, 2003, p. 367). That is, the characteristics of IT, including its cutting-edge features, are useless if the user does not develop personal interests in it. In fact, at least in India, recent data suggest that numerous people see m-payment as lacking a strong value proposition (P. H., 2023). A second explanation is that reported attitudes and intentions do not necessarily correspond to actual actions. Evidence of such a viable explanation is found in the actual use of m-payment during the pandemic period, which has increased significantly since its first year (Shearman, 2020). For instance, in the country of our study, the m-payment PIX technology created in 2020 by the Central Bank of Brazil was an option during the pandemic that ensured availability, celerity, and consistency for financial transactions at no cost. For such reasons, PIX represented a financial inclusion revolution in Brazil and became the preferred money transfer method in the country since the COVID-19 pandemic (Distrito, 2023).

IMPLICATIONS, LIMITATIONS, AND FUTURE STUDIES

The social context has an influence over the development of consumer attitudes and in the availability of payment services (Dahlberg et al., 2008). M-payment is among the available options and was boosted by the need for social distancing during the COVID-19 pandemic. Our study on the adoption of m-payment during the pandemic offers six main contributions.

First, the study contributes directly to consumer behavior and m-payment research by framing m-payment as a technological innovation and by updating scholarly knowledge on the antecedents of m-payment with data from a globally relevant market and idiosyncratic society (Brazil). Second, we develop a research model integrating IDT and TAM attitudinal antecedents. Interestingly, the two pairs of overlapping constructs across those two models (IDT's PRA and PCX and TAM's perceived usefulness and ease of use) did not have a significant role in the formation of m-payment attitudes here. For TAM-based research, the implications are notable, since TAM relies exclusively on those two direct antecedents for the development of a user's attitudes and intentions toward the adoption of an IT tool. A possible reason for such a lack of explanatory power is the ambiguous context of technology use decisions in our study, whereas TAM is known to work in strictly voluntary use situations. As such, perceptions of nonvolitional use situations that have accounted for the mixed findings in numerous TAM-based studies (Koh et al., 2010) may have occurred in ours too. Changchit et al. (2023) found a similar phenomenon for their UTAUT-based m-payment study, where most UTAUT antecedents had not influenced the users' intention to use m-payment, but those authors did not raise any possible explanation for that result. Besides, since they also do not disclose when their data were collected, we cannot make any further comment on their findings.

Third, our study reinforces the need to accurately define the technology's use purposes to represent the dependent variable in the structural models of technology adoption and use, as advocated in the relatively sparse research tradition on technology use effectiveness (Burton-Jones & Grange, 2012; Porto-Bellini, 2018). We make such an inference based on the fact that four of our seven hypotheses were not supported vis-à-vis previous research, which is possibly due to the different technologies used across studies and to the different use purposes arbitrarily defined therein. A fourth contribution of this study is that it informs innovation designers about the requirements they have to capture from potential technology adopters to enhance the features of m-payment. In this regard, the findings suggest that designers could focus on features such as usefulness, convenience, consistency, and availability when, for example, integrating payment systems of the BRICS or other economic blocks to ensure the growth and continued usage of decentralized, multicurrency, international payment systems.

As a fifth contribution, we add to the long-lived debate on whether to use IDT- and TAM-based models in unclearly voluntary technology use situations, like in the psychologically conflictual context of technology use decisions that epitomized the pandemic times. Accordingly, a sixth contribution of this study refers to its social implications, the pandemic being at the origin of long-standing psychological, physical, behavioral, and business impacts. In this sense, our study may have captured emerging behavioral patterns of people toward technology and services, which is another viable conjecture on why explanatory ambiguity was found regarding the study's hypotheses.

As for the limitations of this study, the first one is that we did not screen the respondents as per their levels of individual discretion to decide to use m-payment or not. Second, we did not measure their effective behavior of technology adoption and use; rather, we measured perceptions, attitudes, and intentions toward m-payment use situations. However, Koh et al. (2010) warn that when technology use possibly includes a mandatory component, the attitudes—instead of actual behaviors—should be the preferred construct to study. Third, trade-offs exist when one endeavors to collect statistically relevant data at the expense of not collecting additionally useful data. That was the case here, since we collected data on the general use of m-payment methods during the pandemic rather than on specific use situations. Fourth, some respondents might have provided their views under the influence of social pressure to adopt internet technologies whenever possible in daily routines. Fifth, while our

instrument was developed from adapting two dominant models in the literature and extant scales, the instrument did not show desirable discriminant validity. Even if we have employed solid conceptual reasoning and statistical procedures to ensure that our data were valid, we will never know how our respondents interpreted the questionnaire's items.

As for suggestions for future studies, a straightforward one is to study our model in other contexts and with other technologies in order to contribute to IT replication research (Brendel et al., 2023). A second idea, as mentioned in the literature review, is to integrate m-payment trust and perceived risk to the research model, so that we can test whether those constructs add significant explanatory power. A third suggestion is to consider an integration of our model—which is based on voluntary uses of technology—with Koh et al.'s (2010) model for mandatory use of software technologies when studying ambiguous contexts of use decisions such as the one involved in our study. A fourth suggestion is to study technology-related behavioral change, which seems to us a largely ignored topic but one that may explain myriads of ambiguous or frustrating results found in the literature on the attitudes and intentions toward IT and its effective uses.

CONCLUSIONS

This study discussed the influence of perceived characteristics of m-payment on consumers' attitudes and intentions toward using m-payment during the COVID-19 pandemic in Brazil. To do so, we developed a research model based on a full integration of IDT and TAM with a superimposition of two pairs of constructs, and we tested the model in a context of ambiguous locus of control regarding the use of technological innovations. The findings show that m-payment is perceived by consumers as advantageous, useful, easy to use, and compatible with many aspects of their lives, such as the way they manage their financial activities, work, and lifestyle, as well as with their beliefs, values, needs, and goals. The demands and restrictions of the pandemic period regarding the social dynamics are presumably related to such positive perceptions. Moreover, despite the participants in our study not having had the opportunity to test m-payment before the adoption decision, they perceived it as viable and satisfactory to use. Last, the consumers were confident in using m-payment and spreading the word about it to other people.

Our findings also showed that two factors are critical for the formation of m-payment attitudes and intentions: POB and PRA. POB was found to impact the attitudes toward m-payment usage in that when the outcomes of m-payment are visible to others, consumers are likely to adopt it. PRA was found to affect the intentions of consumers to use m-payment in the future. To our surprise, however, even if PRA, PCX, PCM, and PTR were seen as positive features of m-payment, those four characteristics were not relevant for the formation of consumer attitudes toward m-payment usage. We raise but a few possible explanations for such a lack of effect, particularly the unclear degree of individual volition in the studied context of IT use, the commoditization of IT, the emergence of new behavioral patterns toward technology in post-COVID-19 times, and the fact that reported attitudes and intentions do not necessarily correspond to actual behaviors of technology use.

CONFLICTS OF INTEREST

The authors report no conflict of interest.

FUNDING STATEMENT

PROCESS DATES

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