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BEYOND USABILITY: INNOVATION IN THE DIGITAL AGE AS AN ANTIDOTE TO SOCIAL ISOLATION

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Abstract

The study's objective: The article aims to evaluate the impact of life satisfaction during the COVID-19 pandemic in Brazil, considering the perception of usability of intelligent personal assistants (IPAs) and investigating possible moderations of consumer innovation dimensions in this relationship.
Methodology/Approach: Field research was carried out with 515 users of intelligent personal assistants (IPAs). The results were analyzed using multiple linear regression, using the SPSS software (Statistical Package for Social Science v.22), with the application of the PROCESS macro.
Originality/Relevance: This study contributes to filling a gap in the literature on the diffusion of innovation and adoption of technological products by investigating aspects of innovative consumption in a pandemic and social isolation scenario.
Main Results: The research results indicate that domain-specific innovativeness (DSI) moderates the relationship between usability (SUS) and life satisfaction (LS). In contrast, innovativeness behavior (IB) moderates this relationship only with DSI maintained at medium and low levels. It was observed that, with greater usability, life satisfaction increases and is moderated by domain-specific innovativeness. For higher IB levels, LS increases more quickly.
Theoretical/Methodological Contributions: Integrating concepts from theories of innovative consumption and diffusion of innovations, the study offers insights into how technology affects well-being in a global crisis. This advanced approach helps understand the mechanisms underlying the impacts of usability and innovation on human behavior.
Social/Managerial Contributions: This study helps understand how IPA users can experience greater life satisfaction and social isolation during a pandemic.

Keywords: innovative consumption, diffusion of innovation, digital platform.

Além da usabilidade: inovação na era digital como antídoto ao isolamento social

Resumo

Objetivo do Estudo: O artigo visa avaliar o impacto da satisfação com a vida no cenário da pandemia de COVID-19 no Brasil, considerando a percepção de usabilidade de assistentes pessoais inteligentes (APIs), e investigar possíveis moderações das dimensões de inovação do consumidor nessa relação.
Metodologia/Abordagem: Foi realizada uma pesquisa de campo com 515 usuários de assistentes pessoais inteligentes (APIs). A análise dos resultados foi conduzida por meio de regressão linear múltipla, utilizando o software SPSS (Statistical Package for Social Science v.22), com a aplicação da macro PROCESS.
Originalidade/Relevância: Este estudo contribui para preencher uma lacuna na literatura sobre a difusão da inovação e adoção de produtos tecnológicos ao investigar aspectos de consumo inovador em um cenário de pandemia e isolamento social.
Principais Resultados: Os resultados da pesquisa indicam que o domínio específico de inovatividade (DSI) modera a relação entre usabilidade (SUS) e satisfação com a vida (LS), enquanto o comportamento inovador (IB) modera essa relação apenas com DSI mantido em níveis

médios e baixos. Observou-se que, com maior usabilidade, a satisfação com a vida aumenta e é moderada por domínio específico de inovatividade. Para níveis mais altos de IB, a LS aumenta mais rapidamente.
Contribuições Teóricas/Metodológicas: Integrando conceitos das teorias de consumo inovativo e da difusão de inovações, o estudo oferece insights sobre como a tecnologia afeta o bem-estar em uma crise global. Essa abordagem avançada ajuda a entender os mecanismos subjacentes aos impactos da usabilidade e da inovação no comportamento humano.
Contribuições Sociais/Gerenciais: Este estudo auxilia na compreensão de como os usuários de APIs podem experimentar maior satisfação com a vida em tempos de pandemia e isolamento social.

Palavras-chave: consumo inovativo, difusão da inovação, plataformas digitais

Más allá de la usabilidad: la innovación en la era digital como antídoto al aislamiento social

Resumen

Objetivo del Estudio: El artículo tiene como objetivo evaluar el impacto de la satisfacción con la vida en el escenario de la pandemia COVID-19 en Brasil, considerando la percepción de usabilidad de los asistentes personales inteligentes (API), e investigar posibles moderaciones de las dimensiones de innovación del consumidor en este relación.
Metodología/Enfoque: La investigación de campo se realizó con 515 usuarios de asistentes personales inteligentes (API). El análisis de los resultados se realizó mediante regresión lineal múltiple, utilizando el software SPSS (Statistical Package for Social Science v.22), con la aplicación de la macro PROCESS.
Originalidad/Relevancia: Este estudio contribuye a llenar un vacío en la literatura sobre la difusión de la innovación y la adopción de productos tecnológicos al investigar aspectos del consumo innovador en un escenario de pandemia y aislamiento social.
Resultados principales: Los resultados de la investigación indican que la innovación en un dominio específico (DSI) modera la relación entre usabilidad (SUS) y satisfacción con la vida (LS), mientras que el comportamiento innovador (IB) modera esta relación solo con DSI mantenida en niveles medios y bajos. Se observó que, con una mayor usabilidad, la satisfacción con la vida aumenta y está moderada por la innovación en un dominio específico. Para niveles de BI más altos, LS aumenta más rápidamente.
Contribuciones Teóricas/Metodológicas: Al integrar conceptos de las teorías del consumo innovador y la difusión de innovaciones, el estudio ofrece información sobre cómo la tecnología afecta el bienestar en una crisis global. Este enfoque avanzado ayuda a comprender los mecanismos subyacentes a los impactos de la usabilidad y la innovación en el comportamiento humano.
Contribuciones sociales/gerenciales: este estudio ayuda a comprender cómo los usuarios de API pueden experimentar una mayor satisfacción con la vida en tiempos de pandemia y aislamiento social.

Palabras clave: consumo innovador, difusión de la innovación, plataforma digital.

1 Introduction

Discussions related to innovative consumption are essential to research on the diffusion of innovation. Ideologically, according to Rogers (2003), when they are invented, disseminated, adopted, or even rejected, innovations can generate changes in the function or even in the structure of a social system because of the new ideas they propagate. In this sense, diffusion "is the process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 2003, p. 11).

The COVID-19 pandemic drastically altered daily life, driving increased reliance on digital tools for communication, information, and entertainment. This study investigates how the use of Intelligent Personal Assistants (IPAs) during this period, moderated by consumer innovation dimensions, impacts individual well-being.

Successfully launching new products requires high precision skills in understanding the entire innovation ecosystem – from the firm's capabilities to understanding the markets. If not correctly managed, innovations can cause unexpected failures, as indicated by numerous surveys, indicating that approximately 40% of industrial and consumer-oriented innovations, and 60% of those related to technological products, fail (Boulding *et al.,* 1997; Golderberg *et al.,* 2001; Hultink *et al.,* 2000).

Specifically, in the area of technological products and/or services, in the last 30 years, many studies have focused on identifying factors that influence the acceptance of technology, with emphasis on the Technology Acceptance Model (TAM) (Davis, 1989). This line of research and its ramifications do not aim to understand the degree of innovativeness of the consumer and their experience in using digital innovations, being restricted to the operational aspects of technology adoption and acceptance.

More progress must be made in understanding cognitive and motivational factors and more abstract personality traits in consumer behavior. Still, in this field of research, Venkatesh *et al*. (2003) presented, also derived from the TAM, the Unified Model for the Use and Acceptance of Technology (UTAUT) (Unified Theory of Acceptance and Use of Technology). Later, it evolved into an updated version called UTAUT2 (Venkatesh *et al*., 2012), in which consumer behavioral dimensions, such as hedonic motivation attributes, and social influence, began to be considered.

Both models were pioneers and managed to remain, until today, contemporary and influential within the studies of diffusion of innovation (Dendrinos & Spais, 2023).

The focus on understanding the perception of the novelty of a product/service by the innovative consumer, later defined as innovative consumption, in the view of Roehrich (2004), was delineated as the consumption of novelties. Then, gained different conceptualizations and divided into two main streams of research, which consider (1) unobservable consumer aspects, more related to personality traits (Chung & Cho, 2018; Leavitt & Walton, 1975; Midgley & Dowling, 1978) and (2) observable consumer aspects, more focused on behavioral factors (Goldsmith & Hofacker, 1991; Hirschman, 1980; Im *et al.,* 2003; Jeong *et al.,* 2017; Summers, 1971).

Limited research has examined how technological products usage and adoption affect people's satisfaction with their lives (Attas & Sweis, 2010; Brooks, 2017; Chan, 2015; Coyne, 2014; Longstreet & McDaniel, 2017). In this context, systems based on the use of artificial intelligence (AI) emerge with emphasis on four aspects (Andre *et al.,* 2017; Jordan, 2019; Mehr, 2017; Patachunka, 2018; Wang *et al.,* 2018; Paesano, 2023)

- AI as a recommendation and expert advice - for example, Netflix movie recommendations;
- AI such as access to databases and complex programs - for example, bank credit recommendation;
- Cognitive AI - for example, intelligent human-machine interaction interfaces such as personal assistants, Alexa from Amazon, Siri from Apple, and Google Assistant from Google;
- Autonomous AI - for example, systems that make independent decisions, such as telecommunications network management systems.

According to Roth and Thorndyke (1985, p.231), cognitive skills and understanding human behavior will progress this research. In times of social isolation caused by the COVID-19 pandemic, companies and consumers have had to adapt their habits and attitudes (Brough & Martin, 2020).

This phenomenon can be assessed from the point of view of both digital natives and non-digital natives. Intelligent personal assistants (IPA), activated by voice command, use the concept

of cognitive AI, its adoption and use, as well as other technology products that are related to the perception of ease of use or its usability of the products (Bogers *et al.,* 2019; Lopez *et al.,* 2017). Usability has been discussed as a factor that can contribute to the success or failure of digital services (Schwaiger et al., 2021). Studies of this type require new methods and approaches involving other usability-related factors, for example, design principles for task-oriented, innovativeness and others (Oesterreich et al., 2023; Paesano, 2023; Park & Jun, 2003). There are three types: cognition (such as affective and socio-cognitive factors); interaction with artifacts (which define the users' pleasure, such as the aesthetic experience, the desire to repeat the use, the favorable decision to use a digital artifact); and improved mental models (Bargas-Avila & Hornbeak, 2011; Law and Van Schaik, 2010; Hsieh & Lee, 2021).

Innovative consumers have a greater or lesser degree of innovativeness (Rogers, 2003). The domain-specific innovativeness scale (DSI) is one way to measure innovativeness. The scale's objective is to measure how people learn and adopt new products in a specific domain of interest (Goldsmith & Hofacker, 1991). Another dimension refers to innovativeness behavior (IB). One way to measure IB is through the transversal method (Foxall, 1998; Foxall, 1995; Rogers, 2003). The transversal method measures the degree of innovativeness over time of acceptance concerning a set of new products and services (Im *et al.,* 2007; Mansori *et al.,* 2015).

This study uniquely combines the concepts of innovative consumption and well-being within the context of the COVID-19 pandemic, focusing specifically on the use of Intelligent Personal Assistants (IPAs). While prior research has explored the impact of technology on well-being and the adoption of innovative products, few have investigated this relationship through the lens of domain-specific innovativeness and innovativeness behavior in the context of a global crisis like the pandemic. This study contributes novel insights by examining how the usability of IPAs, moderated by these innovation dimensions, influences life satisfaction during a period of heightened social isolation. This approach provides a deeper understanding of how technology can impact individual well-being during challenging times, offering valuable implications for innovative companies seeking to create products and services that enhance user satisfaction in the face of unprecedented events.

Understanding the improvement in life satisfaction can shed light on new innovativeness behaviors habits, and attitudes related to using technological products (Brandt, Hansen, & Christensen, 2020; Li *et al.*, 2019), such as cognitive AI. After all, it is influenced by the perceived

ease of use of IPA - moderated by the dimensions of innovativeness - amid social isolation caused by the COVID-19 pandemic.

This study seeks to show the moderation of innovativeness (DSI and IB) and the relationship between usability and life satisfaction in a social isolation scenario generated by the COVID-19 pandemic.

2 Theoretical Foundation

2.1 IPA usability

The term IPA is used interchangeably in the literature, with terms such as conversational agents, virtual personal assistants, personal digital assistants, voice-enabled assistants, or voice-enabled personal assistants. IPA combines speech recognition, language comprehension, dialogue management, language generation, and speech synthesis to respond to user queries and requests (Cowan *et al.,* 2017; Clark *et al.,* 2019; Oesterreich *et al.*, 2023). López *et al*. (2017) advocate that, in the Human-Computer Interaction (HCI) domain, Natural Use Interfaces (IUN), based on speech, are systems that users operate through intuitive actions related to natural human behavior with voice instructions. There are many names for these IUNs, including voice-activated intelligent personal assistants implanted in smartphones or smart speakers, which can be present in e-commerce and educational establishments, medicine, individual and collective law, finance, health, and welfare, and tourism (Han & Yang, 2018; Knight, 2017).

Usability refers to the ease of use that specific human-machine interfaces demonstrate. It also refers to dimensioning ease of use in prototyping and defining product or service design (Dourado & Canedo, 2018). Nielsen (2005, p.1-2) defines the ten general principles for user interface design, namely: system status visibility, system correspondence and the real world, user control and freedom, consistency, and standards, prevention of errors, recognition instead of a recall, flexibility, and efficiency of use, aesthetic and minimalist design, helps users to recognize, diagnose, and recover errors and help and documentation. These ten definitions broadened the discussions related to usability.

On the other hand, Brooke (1996) developed a scale to measure how users perceived their computer systems' usability. This scale became known as the System Usability Scale (SUS) and is widely used in studies (Drew *et al.,* 2018; Lewis, 2018; Martin *et al.,* 2018).

In Soscia, Arbone and Hofacker (2011) research, product testing positively impacts the perceived ease of use, not the perceived usefulness. The perception of ease of use influences the intention to adopt the new technology.

Venkatesh *et al.* (2003, p.447) developed a unified model to analyze the phenomenon of individual technology acceptance, called the Unified Theory of Acceptance and Use of Technology (UTAUT), which brought together several constructs from previous research on the subject. The model suggests the following four parameters that explain its intention to use: expected performance or performance, the expectation of effort, social influence, and enabling conditions that influence the behavioral intention to use technology and/or its use. The following discussion concerns the constructs of the consumer innovation dimensions.

2.2 Dimensions of consumer innovation

The study of consumer innovation focuses on understanding the characteristics related to the speed and greed of adopting innovations. Therefore, it is related to understanding the traits and concepts responsible for explaining which factors lead specific consumers to adopt new products or their propensity to adopt them.

Innovativeness is a valid predictor for adopting new products (Hauser *et al.,* 2006). Hirschman (1980, p.283) proposed that “few concepts in the behavioral sciences have as much immediate relevance to consumer behavior as innovativeness". Research related to consumer innovation determines a dimension defined as Domain-Specific Innovativeness (DSI). Individuals who master specific categories of innovative products tend to learn and adopt such products (Goldsmith & Hofaker, 2001; Hirshman, 1980; Jeong, 2017). The domain-specific dimension captures an individual’s predisposition toward a product class and reflects their interest in information-seeking and adoption. People who dominate certain products can better identify innovations when released (Goldsmith & Hofacker, 1991; Roehrich, 2004).

Thus, the domain-specific construct of innovativeness studies aspects of human behavior associated with innovation from the point of view of its importance and the attention given to it by an individual (Midgley & Dowling, 1993). According to this construct, there is a predisposition to acquire new brands or products, which is established in the individual, removing him from the possibility of maintaining old patterns (Steenkamp *et al.,* 1999). However, Goldsmith *et al.* (1995)

argue that innovative consumers can adopt innovativeness behavior in a particular consumption context, being conservative in others.

Another dimension accepted and discussed in studies related to consumer innovation is innovativeness behavior that can lead to adoption behavior (Goldsmith, 2012; Hauser *et al.,* 2006; Kaushik & Rahman, 2014; Lui *et al*., 2022). Some researchers relate these new behaviors to unobservable cognitive aspects (Chakrabarti & Baisya, 2009; Hussain & Rashidi, 2017; McMahan *et al.,* 2009), which reflect a person's inherent and innovative personality. This composition includes essential situational characteristics, learning history, and a consumption compound "influencing consumer behavior in situations of consumption of innovative products" (Neckel & Boeing, 2017, p. 65).

The studies discussed in the theory of diffusion of innovation (Rogers, 2003) are primarily associated with adoption behavior and consumption behavior. One of the approaches to the diffusion of innovation (Rogers, 2003) evaluates that it is possible to identify adopters' categories based on the degree of innovation (Kim *et al.,* 2017). However, few studies associate innovativeness behavior and usability with life satisfaction (Ali, 2017; Kujala & Miron-Shatz, 2013). Next, we will discuss life satisfaction in a pandemic scenario.

2.3 Life Satisfaction in the pandemic caused by the COVID-19 virus

Due to the COVID-19 pandemic, a new world social order was established, often based on the need for social isolation with substantial impacts on countless social vectors. The research was initiated in the medical field, but in social sciences, engineering, economics, and other areas of knowledge considering the pandemic. The approach to the effects of illness related to life satisfaction considers the fear of disease, depression, anxiety and stress, health, anguish, psychological consequences, work, study, well-being, and many other approaches (Li *et al.,* 2020; Satici *et al.,* 2020; Zhanh & Tower, 2020; Zhang *et al.,* 2020).

This new social order has accelerated the digital transformation with a visible increase in digital tools. This change is partly explained by the growth of e-commerce, social networks, search for information, mobile applications, video calls, work in the home office, virtual classes, home banking, and other daily activities, places the individual consumer at the epicenter of strategic

corporate innovation decisions (Agostino *et al.,* 2020; Kim, 2020; Goyal *et al*., 2021; Alkhwaldi et al, 2022; Riedl *et al*., 2023).

However, the literature needs more discussions about how the usability of digital tools, especially those involving IPA and the degree of innovativeness, affect life satisfaction in the pandemic scenario. Later, we will discuss the hypotheses related to the proposed theoretical model.

3 Theoretical Model And Hypotheses

Usability and life satisfaction

Some studies relate improving life satisfaction to using technology and its usability (Lotrea *et al.,* 2019; Li *et al.,* 2019). Palacio *et al.* (2017, p.104) highlight the relationship between the role of technology and increased life satisfaction. Kujala and Miron-Shatz (2013) analyzed how emotional aspects can affect product evaluation and started a relationship between negative emotions and low usability. Peters *et al.* (2018) analyzed how well-being and motivation can be affected by autonomy, competence, and belonging from self-determination theory. The Technology Acceptance Model (TAM) model determines which consumers of technological products will adopt and use these new ideas if they are convinced that this use will generate positive results in terms of the constructs “perceived utility” and “ease of use” (Davis, 1985).

The use and interaction with IPA during the COVID-19 pandemic became more required in obtaining information about the disease (Miner *et al.,* 2020). We hypothesize that the usability of IPA positively influences life satisfaction in a pandemic situation.

H1: The usability of IPA positively influences life satisfaction in a pandemic situation.

DSI moderation between usability and life satisfaction

Positive and negative emotions are affected by personal satisfaction with various aspects of life. An individual’s perceptions of life regarding psychological and social functions can reflect on his or her well-being, which refers to one’s level of personal satisfaction with various aspects of life (Diener *et al.,* 1999). The predisposition to purchase and use new products that deviate from

previous purchasing patterns results from interaction and a strong interest in a particular category of products (Goldsmith *et al.*, 1996; Roerich, 2004).

Ladeira *et al.* (2016, p.74) argue that DSI is a strong predictor of well-being and life satisfaction, presenting an R^2 of 69 and 70 percent, respectively.

So, we hypothesize that DSI moderates the relationship between usability and life satisfaction.

H2: DSI moderates the relationship between usability and life satisfaction.

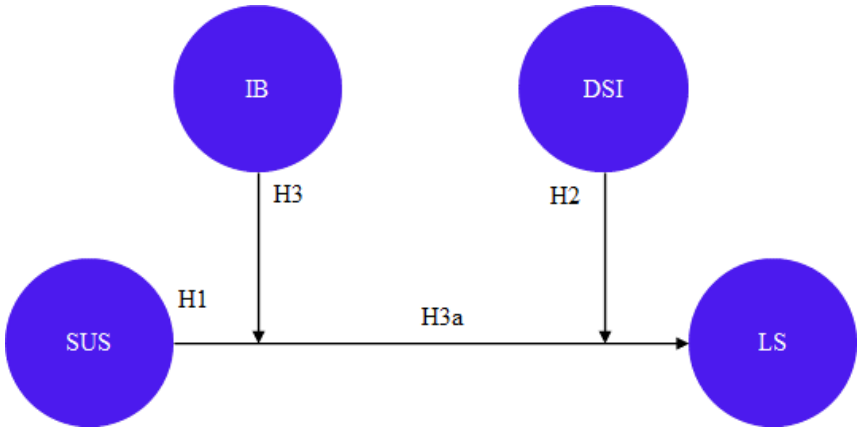
IB moderation between usability and life satisfaction

A significant and essential stream of studies on innovativeness behavior related to the adoption and natural acquisition of new information, ideas, and products were developed using the behavioral perspective or adoption of new products (Rogers, 1983; Hirschman, 1980; Midgley; Dowling, 1978). The data for the studies above were collected through various indirect measures that include many products owned (Rogers, 1983; Goldsmith & Foxall, 2003), having a particular product (Dickerson & Gentry, 2002), purchase intention (Holak & Lehmann, 2002) and relative time of adoption of a given product (Midgley & Dowling, 1993). One of the definitions of usability satisfaction is user comfort and positive attitudes toward using the system. In this sense, three usability variables were found: efficiency, effectiveness, and satisfaction, which are considered independent aspects (Frokjaer *et al.,* 2000). Honkaniemi *et al*. (2015) indicate a strong relationship between innovation and perception of one's well-being. Ali's (2019, pp. 44-45) research demonstrated a strong association between personality traits and individual innovativeness and life satisfaction and a strong association of innovation with the satisfaction of perceptions of life. We hypothesize that innovativeness behavior moderates the relationship between usability and life satisfaction.

H3: IB moderates the relationship between usability and life satisfaction.

H3a: DSI and IB together moderate the relationship between usability and life satisfaction

Figure 1



Theoretical model

Source: Authors

Next, we will discuss the methodology used in the research.

4 Methodology

This research highlights innovativeness (DSI and IB) moderation in the relationship between usability and life satisfaction in a social isolation scenario caused by the COVID-19 pandemic in Brazil. It is worth highlighting the devastating impact of the disease in the country, where more than 20 million people were infected, and more than 600 thousand people died from the virus.

To answer the research question through the presented hypotheses, we used a questionnaire with problems of the domain-specific innovativeness scales - DSI (Goldsmith & Hofacker, 1991), usability - SUS (Brooke, 1996), life satisfaction - LS (Diener *et al.,* 1985). To measure innovativeness behavior - IB, we use the equation RTA (Relative Time of Acceptance); it is a method that measures the degree of innovativeness by the time of acceptance relative to a set of new products and services. In other words, the method calculates the degree of innovativeness by the time of acceptance relative to a set of new products and services (Im *et al.,* 2007). All the scales used have already been extensively tested and validated in several other studies. The questionnaire was made available electronically through the Google Forms platform to participants in the pandemic due to the COVID-19 virus (April 20 to May 20). (IM *et al.,* 2007).

This study used multiple linear regression as a statistical technique to analyze the relationships between the independent variables and the dependent variable (Hair *et al.,* 2009).

Thus, we used the SPSS (Statistical Package for the Social Sciences v.22) software and PROCESS macro for SPSS for moderation analyses (Hayes, 2013). PROCESS is a free, multifaceted modeling tool compatible with SPSS and SAS, which brings together in a single platform several functionalities of popular and established statistical software, especially for moderation analysis and its integrated aspects (Hayes, 2012). Our model contains moderating variables DSI (domain-specific innovativeness) and IB (innovativeness behavior), independent variable SUS (usability), and dependent variable LS (life satisfaction).

4.1 Sample and Collection

The unit of analysis was individuals using IPA in the pandemic period. The survey respondents were asked about their agreement on the questionnaire's questions on a metric scale (Hair *et al*., 2009), with a Likert between 1 and 7, 1 for more significant disagreement, and 7 for greater agreement. The back-translation process was used in the translation of the scales.

The sample comprised individuals in social isolation using IPA, totaling 795 respondents. After debugging data related to filling errors, duplication, and lack of information, the survey received 597 respondents. Of these, the sample was reduced to 515 observations, considering the participants who answered the verification question; such question was elaborated as follows: "The question below only serves to check your attention and seriousness in answering the questionnaire. You need to dial the number 3."

4.2 Measurement of constructs

The independent Usability construct (SUS) was based on the Brooke scale (1996) to measure the perception of IPA use during the pandemic, with Cronbach Alpha: 0.762.

The independent construct and moderator of domain-specific innovativeness (DSI) was based on the Goldsmith and Hofacker scale (1991) to measure the aspects of human behavior associated with innovation within the specific interest of adopting the IPA in a pandemic time With Cronbach Alpha: 0.703.

The independent construct and moderator of innovativeness behavior IB was based on the transversal method, which measures the degree of innovativeness by accepting acceptance related to a set of new products and services (Im *et al.,* 2007).

The life satisfaction dependent construct (LS) was based on the Diener *et al.* (1985) scale with a Cronbach Alpha of 0.858.

5 Results

Of the respondents for the study, demographic information revealed that school education consisted of 45% being without a college degree, 28% having a college degree, and 27% having a graduate degree. Regarding age, 42% ranged in age up to 25 years old, 31% were classified as being 25 to 40 years old, and 27% were found to be over 40 years old. When we count which IPA the individuals in the sample use, we observe 37% for Siri from Apple, 51% for Google Assistant from Google, 1% for Cortana from Microsoft, and 12% for others. 25% of the sample uses IPA to work, 75% for personal use, 38% use voice as an IPA trigger, and 62% use typing. Regarding the frequency of use, 62% answered that they use a lot, 31% moderately, and 7% stated that they use little.

A moderation analysis investigated how domain-specific innovativeness levels and innovativeness behavior moderated the relationship between usability and life satisfaction in the pandemic scenario and the social isolation caused by COVID-19.

As seen in Table 1, the interaction between usability and life satisfaction showed a statistically significant effect, indicating the presence of moderation. The moderating variables were divided into three parts to understand the effect better, adopting the cutoff points: 16% lower, 64% average, and 16% upper (Hayes, 2018). The first interaction (SUS*IB) proved not to be significant (β= -0.0018 e p=0.34), and the second interaction (SUS*DSI) demonstrated to have a significant effect on the relationship between usability and life satisfaction (β= -0.2738 e p=0.0002).

Table 1

Effects of the Moderation Model

	Coefficient (b)	***Standard error***	***t***	***p***
Constant	-3.1484	1.4812	-2.1256	0.0340
Usability (SUS)	1.7953	0.3731	4.8117	0.0000
Innovativeness behavior (IB)	0.0126	0.0071	1.7686	0.0776
SUS * IB	-0.0018	0.0018	-1.0255	0.3056
Domain-specific innovativeness (DSI)	1.1421	0.2960	3.8586	0.0001
SUS * DSI	-0.2738	0.0733	-3.7375	0.0002

Source: Survey data

Domain-specific innovativeness moderates the relationship between usability and life satisfaction (R^2 *chng*=2.37%, F=13.9688 e p<0.0002), innovativeness behavior does not moderate the relationship (R^2 *chng*=0.18%, F=1.0516 e p<0.3056), but double moderation is significant in the relationship (R^2 *chng*=2.46%, F= 7.2658 e p<0.0008), as shown in table 2.

Table 2

Test of highest-order unconditional interaction

	R^2***chng***	***F***	***df1***	***df2***	***p***
SUS*IB	0.0018	1.0516	1.0000	509.0000	0.3056
SUS*DSI	0.0237	13.9688	1.0000	509.0000	0.0002
Double moderation	0.0246	7.2658	2.0000	509.0000	0.0008

Source: Survey data

Double moderation occurs when domain-specific innovativeness and innovativeness behavior levels are low and medium (low DSI=2.8333; medium DSI= 4.0000 and low IB=64.2936; medium IB=114.4727) with p <0.05. The double moderation for the high DSI value (high DSI=5.1667) did not significantly affect the model.

Table 3

Conditional effects (IB e DSI)

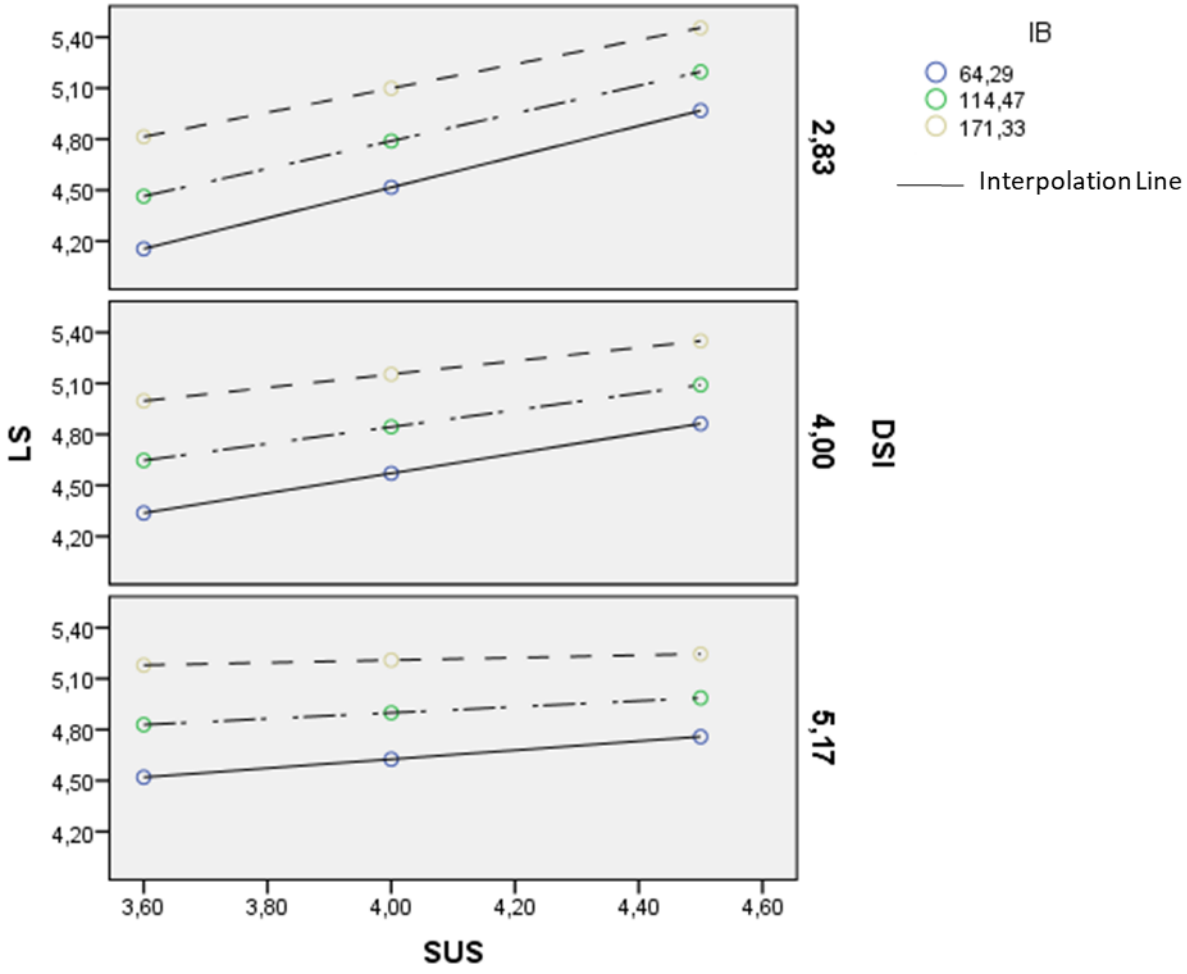
IB	*DSI*	*Coefficient (b)*	*Standard error*	*t*	*p*
64.2936	2.8333	0.9040	0.1610	5.6140	0.0000
64.2936	4.000	0.5846	0.1417	4.1255	0.0000
64.2936	5.1667	0.2652	0.1698	1.5617	0.1190
114.4727	2.8333	0.8139	0.1282	6.3503	0.0000
114.4727	4.000	0.4944	0.1081	4.5729	0.0000
114.4727	5.1667	0.1750	0.1468	1.1919	0.2338
171.3262	2.8333	0.7117	0.1560	4.5611	0.0000
171.3262	4.000	0.3923	0.1445	2.7149	0.0069
171.3262	5.1667	0.0729	0.1789	0.4072	0.6841

Source: Survey data

The results of the moderations can be seen in the following graph:

Graph 1

Analysis of moderations



Source: Survey data

The results indicate that the interaction between domain-specific innovativeness (DSI) and usability was significant when DSI was at medium and low levels ($p < 0.05$). However, the relationship between IB and usability was only moderated by DSI when it was maintained at medium and low levels, indicating that DSI plays a crucial role in moderating the impact of usability on life satisfaction during the pandemic.

The results of the PROCESS macro also demonstrate that the effect of IB moderation is significant ($p < 0.05$) for medium and low values (64.2936 and 114.4727) since the DSI values also remain medium and low (2.8333 and 4.0000). We will now move on to general discussions.

6 Discussion of Results

This study aimed to show the moderation of innovativeness (DSI and IB) in the relationship between usability and life satisfaction in a social isolation scenario caused by the COVID-19 pandemic. The main contribution of the research was to reveal that, in a scenario of social isolation, life satisfaction increases due to IPA usability and that innovativeness behavior and domain-specific innovativeness moderate this relationship. We can infer that usability added value to the most understandable, friendly, and pleasant user experience. As highlighted in this work, usability is a fundamental part of the user experience and customer experience. Hoffmann (2003) pointed out that the customer experience comprises four independent elements: brand, functionality, content, and usability.

We observed that domain-specific innovativeness and innovativeness behavior moderated the relationship between usability and life satisfaction when both have low and medium levels. We can infer that this phenomenon happens because, in the quarantine, people started to use more technology, in this case, IPA, and the more they learn to use it, the greater their well-being. These findings suggest that users who are more innovative within a specific domain are more likely to experience higher life satisfaction as a result of greater usability, particularly when the level of innovativeness behavior is moderate or low.

The study also reveals that domain-specific innovativeness (DSI) is a significant predictor of life satisfaction during the pandemic (R^2 chng=2.37%, F=13.9688 e p<0,0002), suggesting that users who are more innovative within a specific domain tend to have greater life satisfaction. This finding aligns with previous research indicating that domain-specific innovativeness plays a vital role in driving consumer behavior (Goldsmith & Hofacker, 1991), specifically in adopting new products and services. This emphasizes the importance of tailoring products and services to meet the specific needs and preferences of innovative consumers within their respective domains, potentially leading to higher life satisfaction levels. This understanding can be valuable for businesses aiming to develop products and services that cater to the specific needs and preferences of innovative consumers, thereby maximizing their potential for achieving higher life satisfaction.

The research showed that mastery over such technology increases life satisfaction if the consumer learns to use it. On the other hand, when there are many specific domains, even if innovativeness behavior is high, it does not affect life satisfaction, even if usability improves. Thus,

we can infer this happens, as there is no novelty or learning cognitive skills with IPA (Vandecasteele & Geuens, 2010).

The hypothesis was confirmed regarding the proposed hypotheses in the DSI moderating the relationship between SUS and LS. This fact occurs because usability may be related to an individual's predisposition to a specific product class, reflecting their trend within one particular domain of interest (Goldsmith, 1991). Therefore, IPA's use becomes more constant during a pandemic, generating greater consumer interest. When the individual has a more significant specific domain of a particular technology, his self-esteem likely improves, promoting a sense of well-being. We propose that life satisfaction is related to usability, confirmed by hypothesis H1.

The moderation of IB between SUS and LS was not confirmed. We believe this happened because we use the transversal measurement model, often criticized as a temporal measure, often without an isomorphic relationship with the construct (Hurt *et al.,* 1977; Midgley & Dowling, 1978).

However, as noted in the study, there is a moderating effect of IB between SUS and LS, provided that the moderation is in conjunction with DSI and only for low and medium levels of domain-specific innovativeness.

This study's main empirical contribution is understanding how IPA users can be more satisfied with life during a global crisis such as a pandemic. For example, the results suggest that DSI plays a crucial role in moderating the impact of usability on life satisfaction during the pandemic. This information is useful for understanding how to design and market products and services in a way that appeals to innovative consumers.

Regarding theoretical contribution, only some studies exist within the diffusion of innovation and studies that analyze the concept of the use and adoption of technological products. This research has a unique outlook on this area of research by evaluating innovative consumption aspects during a pandemic. We suggest that other tasks be carried out using other forms of IB measurement. We plan to generate ideas for future research experimentation using the application model with other technological products.

7 Final Considerations

As the main limitation of this study, we can point out its application in a single type of digital service - Intelligent Personal Assistants based on artificial intelligence. It can be extended to a larger universe of users, such as specific groups related to using specific digital services.

Another limitation is that the sample was not probabilistic but for convenience (although participation was voluntary), which prevented a better distribution of respondents, for example, by states of the Federation.

This research also demonstrates the effort to understand the management of innovation in emerging economies in a scenario of digital transformation. Therefore, another limitation of the research was that it was applied only in the national territory, being expanded, for example, to countries also participating in the bloc of emerging economies and also expanded to countries with advanced economies for comparison purposes.

We suggest other research that addresses innovative consumption, which expands the analysis to other technological products and other areas of knowledge. We note, for example, in the literature review that there is much interest in themes involving usability and life satisfaction in the health area with technological products for people with physical limitations or poor health. We believed that they could improve their quality of life using technological products.

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