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Impacto da Percepção de Risco na Intenção de Adoção de Aplicativos de Mobilidade na Região Metropolitana de São Paulo em Tempos de Pandemia do COVID-19

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Impacto da Percepção de Risco na Intenção de Adoção de Aplicativos de Mobilidade na Região Metropolitana de São Paulo em Tempos de Pandemia do COVID-19

Impact of Risk Perception in the Intention to Adopt Mobility Applications in the Metropolitan Region of São Paulo in Times of COVID-19 Pandemic

Tese apresentada ao programa de Pós-graduação em Administração da Universidade Nove de Julho – UNINOVE, como requisito parcial para obtenção do grau de Doutor em Administração.

Orientador: Prof[a]. Claudia Brito Silva Cirani

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Impacto da Percepção de Risco na Intenção de Adoção de Aplicativos de Mobilidade na Região Metropolitana de São Paulo em Tempos de Pandemia

POR

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Tese apresentada ao Programa de Pós-Graduação em Administração - PPGA da Universidade Nove de Julho – UNINOVE, como requisito parcial para obtenção do título de Doutor em Administração, sendo a banca examinadora formada por:

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São Paulo, 29 de junho de 2020.

DEDICATION

To my parents, José Joaquim (in memoriam) and Aurora Abrunhoza Joaquim (in memoriam), to my beloved wife Lívia, and to my wonderful daughters Daniele e Isabele.

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I initially thank God, Author of Life, for empowering me, guarding me, giving me wisdom and allowing me to get here. All honor, glory and praise to Him.

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RESUMO

Com a eclosão do COVID-19, autoridades governamentais, impuseram medidas de proteção para reduzir a disseminação exponencialmente crescente do vírus. Apesar de todos os esforços do governo, um grande número de pessoas ainda se desloca diariamente usando o já lotado sistema de transporte público de massa. Essas condições de viagem podem ajudar a disseminar infecções contagiosas, apresentando percepções de risco associadas à essa atividade em tempos de pandemia. Numerosos estudos anteriores mostraram que considerar o comportamento dos indivíduos na sociedade em condições de instabilidade social, como a pandemia COVID-19, é essencial tanto econômica quanto sociologicamente. O objetivo desta pesquisa é identificar como o risco percebido em usar o transporte coletivo de massa impacta a Intenção de Comportamento de usar serviços de aplicação de mobilidade em tempos de pandemia de COVID-19 na região metropolitana de São Paulo (RMSP). O modelo utilizado foi a Teoria Decomposta do Comportamento Planejado (DTPB), emprestando construtos da Teoria da Difusão da Inovação (IDT), agregando a Percepção de Risco ao modelo de pesquisa, aplicando questionários e tratamento estatístico dos resultados por Modelagem de Equações Estruturais (SEM). Um questionário online foi distribuído durante o período de 16 de fevereiro. a 5 de março de 2021, com total de 598 respostas válidas. Os resultados da pesquisa demonstram que a Compatibilidade e a Complexidade influenciam positivamente a Atitude. As Normas Subjetivas e Atitude influenciam positivamente a Intenção Comportamental de adotar aplicativos de mobilidade na RMSP em tempos de pandemia. A Percepção de Risco em usar o transporte coletivo de massa influencia positivamente as Normas Subjetivas, a Atitude e a Intenção Comportamental. Este estudo contribuiu para a teoria integrando duas das teorias mais conhecidas (IDT e TPB) e adicionando a Percepção de Risco ao modelo de pesquisa. Os resultados confirmam adequação do modelo DTPB que possui bom poder explicativo (R^2 = 0,658) em predizer a intenção de adoção de aplicações de mobilidade compartilhada em resposta às pandemias para mitigar possível transmissão do COVID-19.

Palavras-chave: mobilidade compartilhada, aplicativos de mobilidade, teoria decomposta do comportamento planejado, teoria da difusão da inovação, percepção de risco, COVID-19.

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ABSTRACT

Upon outbreak of COVID-19, government authorities have imposed protective measures to reduce exponentially increasing virus spread. Despite all government efforts, a large quantity of people still commutes every day using the already crowded mass public transport system. These travelling conditions may help spread contagious infection, thus posing risk perceptions associated to this activity in pandemic times. Numerous previous studies have shown considering behavior of individuals in society under conditions of social instability such as COVID-19 pandemic is essential both economically and sociologically. This research objective is to identify how Risk Perception in taking mass public transportation impacts behavior intention to adopt mobility application services in times of pandemic in the metropolitan region of São Paulo (RMSP). The Decomposed Theory of Planned Behavior model was used, borrowing constructs from Innovation Diffusion Theory, adding Risk Perception to the research model, applying questionnaires and statistical treatment of results by structural equations modeling (SEM). An online questionnaire was distributed from February 16 to March 5, 2021, with a total of 598 valid responses. Survey results demonstrate Compatibility and Complexity positively influence Attitude. Subjective Norms and Attitude positively influences Behavioral Intention to adopt mobility apps in the RMSP in pandemic times. Risk Perception in taking mass public transportation positively influences Subjective Norms, Attitude and Behavioral Intention. This study contributed to the theory integrating two of the most widely known theories (DTPB and IDT) and adding Risk Perception to the research model. Results confirm the appropriateness of DTPB model which has good explanatory power (R^2 = 0.658) in predicting adoption intention of shared mobility applications in response to the pandemics.

Key Words: shared mobility, mobility applications, decomposed theory of planned behavior, innovation diffusion theory, risk perception, COVID-19.

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LIST OF ABBREVIATIONS AND ACRONYMS

AVE	Average Variance Extracted
CAPES	Coordenação de Aperfeiçoamento de Pessoal de Nível Superior
CB-SEM	Co-variance Based - Structural Equations Modeling
CC	Collaborative Consumption
COVID-19	Coronavirus disease-2019
DTPB	Decomposed Theory of Planned Behavior
EVF	Extended Valence Framework
GPS	Global Positioning System
HBM	Health Belief Model
ICT	Information and Communication Technology(ies)
IDT	Innovation Diffusion Theory
OECD	Organization for Economic Cooperation and Development
PLS	Partial Least Square
PMT	Protection Motivation Theory PMT
RMSP	Metropolitan Region of São Paulo (RMSP)
RP	Risk Perception
SARS-COV	Severe Acute Respiratory Syndrome Coronavirus
SE	Shared Economy
SCT	Social Cognitive Theory
SDT	Self-determination Theory (SDT)
TAM	Technology Acceptance Model
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
WHO	World Health Organization
WWW	World Wide Web
VB	Variance-based

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1 INTRODUCTION

The urban transport system exerts great influence on the quality of life of city dwellers, due to traffic congestion, lost productivity associated to hours spent on transit, air pollution, noise pollution, and harmful effects to public physical and mental health. Therefore, society needs to stimulate use of more sustainable means of transport in replacement of private car usage (Klecha & Gianni, 2017). So far, many studies have been conducted to analyze innovative mobility alternatives such as car-sharing or car-pooling (Aguilera-García, Gomez, & Sobrino, 2020).

The introduction of private ride-hailing services such as Lyft and Uber, among others, in 2011 in the U.S. brought significant investment in mobility solutions and services for transportation system in cities (Clewlow, 2019). Uber is an online platform that connects drivers and passengers in exchange for a fee. Uber is a mobility company that has been offering passenger transport services since 2014 in some cities of Brazil, the company’s second largest market, behind the United States. Mobility apps like Uber popularity can be witnessed from the ranking of download applications in both Android and Apple markets. Uber was ranked top 20 in 2017, top 16 in 2018 and top 15 in 2019 (Jones, 2020).

The outbreak of the disease caused by Severe Acute Respiratory Syndrome Coronavirus (Sars-CoV-2 or COVID-19) was declared a pandemic by the World Health Organization (WHO) on March 11, 2020. It has had a detrimental effect on public healthcare systems with effects on every aspect of our lives (WHO, 2020). The treat of spreading COVID-19 pandemic is extremely concerning, especially as alarming levels increase, leaders from many nations declare state of emergency (El Khatib, 2020),

In an attempt to “flatten contagion curve” and reduce transmission speed, government authorities have imposed protective measures to reduce exponentially increasing spread of the virus. Enforcing national border closures, imposing travel restrictions and social distancing, banning congregations and establishing quarantines were adopted in most countries. These measures have also sparked fears of an economic crisis and recession leading to a reduction of workforce across all economic sectors (Nicola et al., 2020). Stated purpose of social distance is to allow time to prepare the health system to prevent it from becoming saturated due to large peak of simultaneous COVID-19 infections (Morato, Bastos, Cajueiro & Normey-Rico, 2020).

Sars-CoV-2 was declared a Public Health Emergency of National Importance, on February 3, 2020, by the Ministry of Health in Brazil. This action had the purpose of favoring administrative measures were taken with greater agility so that the country began to prepare itself to face the pandemic. The first case of COVID-19 infection in Brazil was notified on February 26, in São Paulo. From that moment on, the whole country went on alert. Social distancing, hand hygiene and face mask were then reinforced (Oliveira, Lucas & Iquiapaza, 2020). In Brazil, challenges arising with COVID-19 are even greater, in a context of great social and demographic inequality, with populations living in precarious housing and sanitation conditions, without constant access to water, in a situation of agglomeration and with a high prevalence of chronic diseases (Barreto et al., 2020).

São Paulo is among the most populous metropolitan areas of the world, where a large portion of the population lives in crowded neighborhoods with poor housing and precarious hygiene (Coelho et al., 2020). The metropolitan region of São Paulo (RMSP) currently consists of 39 municipalities, being the largest urban agglomeration in Brazil and third largest in the Americas, with 21.138.247 inhabitants in 2020 (São Paulo, 2020b). Despite drastic measures of horizontal social isolation enforced in a pursuit to limit effects of pandemic, workplace attendance only declined by less than 40% in Brazil, which implies there were still large numbers of people commuting every day (Zhu, Mishra, Han & Santo, 2020).

A partial lockdown enforced by the state of São Paulo government on March 24, closed stores, restaurants, bars, fitness centers, schools, and universities, in an attempt to decrease circulation of people and help increase city's social isolation rate to contain spread of COVID-19. Public transportation started working with reduced hours. Since lockdown was ordered, social isolation achieved an average of 54% (Nakada & Urban, 2020).

Between May 11 and 17, stringent car circulation restrictions were enforced in the city of São Paulo. The measure even removed 1.5 million vehicles a day from city streets. Despite this initiative, general rate of social isolation showed only a small improvement, from 46% on May 8 to 48% on May 15 (São Paulo, 2020).

Public transport in the capital of São Paulo has recorded controversial and troubled decisions and has been target of criticism since beginning of quarantine, especially with greater flexibility in relation to functioning of some sectors in São Paulo. On June 8, city government had advised bus companies that only seated users should be transported to avoid crowding. However, Mayor Bruno Covas gave up the recommendation, after just two weeks of applying the standard due to its unenforceability (Folha de São Paulo, 2020).

This was not the first time the Mayor stepped back in a decision related to transport and traffic to try to slow transmission of the new coronavirus. In early May, city government blocked city streets and avenues in the morning, but the measure lasted only two days. It caused traffic jams in streets and hindered passage of ambulances. The capital's bus fleet had not operated at full capacity, even with various sectors such as commerce, bars, restaurants and shopping malls returning to operation in a process of easing the quarantine promoted by the State government (Folha de São Paulo, 2020).

Regardless of “stay-at-home” message promoted globally, it is uncertain to what extent people change their mobility behaviors in response to pandemics. Perceived risk for spreading infectious diseases, may be dependent to the choice of mobility mode and the proximity of people in closed environments during transportation (Barbieri et al., 2020). Current research provides little understanding of Risk Perception and people’s behavior intentions. Perceiving risks of infectious diseases may provoke behavioral change. Therefore, more research on these topics associated may be helpful (Abdulkareem et al., 2020).

This thesis goal is to understand motivational and inhibitors of behavior intention to participate in mobility application services and their influence of Risk Perception. This understanding may help governments and organizations prioritize their actions to improve transportation service offerings under the impact of current COVID-19 pandemic. Understanding society's response to pandemic phenomena such as COVID-19 is an urgent requirement for researchers and policymakers. The present study wants to answer the following research question: how Risk

Perception in taking mass public transportation (bus, van, subway, train) impact behavior intention to adopt mobility application services in times of pandemic in the RMSP?

This thesis is organized as follows. After this introductory section, Section 2 summarizes literature review covering shared mobility, innovation diffusion theory, research models, Risk Perception, model selection and hypothesis development. Section 3 describes the method used for this research, data collection procedures, sample size determination, research instrument development and structural equation modeling parameters used. Section 4 presents the results and discussion including respondent's demographic profile and mobility habits, preliminary findings and structural equation modeling results. Section 5 presents final considerations and points for further research.

1.1 OBJECTIVES

1.1.1 General Objectives

The general objective of this research is to evaluate how Risk Perception in taking mass public transportation (bus, van, subway, train) impact behavior intention to adopt mobility application services in times of pandemic in the RMSP.

1.1.2 Specific Objectives

1.1.2.1 Identify how Innovation Diffusion Theory determinant factors impact Attitude to adopt mobility application services in the RMSP.

1.1.2.2 Identify how Theory of Planned Behavior determinant factors impact Bahevioral Intention to adopt mobility application services in the RMSP.

1.1.2.3 Identify how Age impacts Risk Perception and Behavioral Intention in taking mass public transportation in times of pandemic in the RMSP to adopt shared mobility applications in response to COVID-19 pandemics.

1.1.2.4 Identify how Risk Perception impacts the behavior intention of the Brazilian mass public transport users residing in the RMSP to adopt shared mobility applications in response to COVID-19 pandemics.

1.2 MANAGERIAL AND ACADEMIC RELEVANCE

Previous studies demonstrated considering the behavior of individuals in society under conditions of social instability such as COVID-19 pandemic is essential both economically and sociologically (El Khatib, 2020). Effects of shared mobility systems on public transport system still remain unexplored (Young & Farber, 2019). According to Hamari et al., (2015), there is a lack of studies on motivational factors that impact consumers' Attitudes and their intentions towards Shared Economy. In terms of managerial relevance, this study can be significant to draw insights into urban mobility market in general. It can also be important for city planners, investors, entrepreneurs and users in order to provide a broad overview to help understand the motivation and barriers for effective deployment of mobility applications, especially in times of social unrest, such as a pandemic.

From the academic point of view, considering the novelty of the topic being studied, there is not much information about shared mobility. According to Min, So & Jeong (2019), few empirical studies integrating IDT & TAM theories were executed from a consumer's perspective. Current existing theory is unable to fully understand the customers' intentions in the sharing economy (Mittendorf, 2017). Also, there is a lack of knowledge understanding the potential impact of COVID-10 transmission on public transport (Gkiotsalitis & Cats, 2020). This study will contribute to developing some of this knowledge, integrating two of the most widely known theories (IDT and TPB) and adding Risk Perception to the research model.

2 THEORETICAL BACKGROUND

2.1 METROPOLITAN TRANSPORT NETWORK

The Greater São Paulo's area of 8,051 km² corresponds to less than one thousandth of the Brazilian surface and less than 4% of the territory of São Paulo. With 39 municipalities, the RMSP has approximately the same dimensions as some nations such as Lebanon (10,452 km²) and Jamaica (10,991 km²). It is the largest metropolitan region in Brazil, with around 21.5 million inhabitants, and one of the ten most populous metropolitan regions in the world. Greater São Paulo is the greatest center of national wealth. In 2011, its Gross Domestic Product (GDP) reached something around R$760 billion (Transportes Metropolitanos, 2021).

It holds the centralization of command of large private capital: here are the Brazilian headquarters of the most important industrial, commercial and mainly financial complexes, which control private economic activities in the country. These phenomena have given rise to a series of sophisticated services in the Metropolitan Region, defined by their intimate dependence on the circulation and transport of information, such as: planning, advertising, marketing, insurance, finance and consulting, among others. The Metropolitan Region of São Paulo (RMSP) was divided into five areas of operation, plus the capital of São Paulo, for the concession of intercity metropolitan services. The respective contracts were signed with concessionaires in four areas of operation, which consolidates the new configuration of the RMSP for system management. The municipality of São Paulo, by exercising a polarizing function, becomes an area common to all concession areas (Transportes Metropolitanos, 2021).

Figure 1 - Metropolitan Region of São Paulo Map

Source: Transportes Metropolitanos (2021). Região Metropolitana de São Paulo. Recovered from: https://www.emtu.sp.gov.br/emtu/institucional/quem-somos/sao-paulo.fss on July 1st, 2021.

The State Secretariat for Metropolitan Transport – STM created by State Law nº 7.450, of July 16, 1991 and organized by State Decree nº 34.184, of November 18, 1991. The Companhia Paulista de Trens Metropolitanos – CPTM, is linked to the STM. the Metropolitan Urban Transport Company - EMTU/SP and the São Paulo Metropolitan Company - METRÔ. Since January 1, 2011, the Campos do Jordão Railroad - EFCJ was integrated into the STM, through State Decree No. 56,635. In addition to the metro-railway system, the Metropolitan Transport Secretariat, through EMTU, is responsible for the metropolitan urban passenger transport infrastructure in the six metropolitan regions of the State of São Paulo: São Paulo (RMSP), Baixada Santista (RMBS), Campinas (RMC), Metropolitan Region of Vale do Paraíba and North Coast (RMVPLN), Metropolitan Region of Sorocaba (RMS) and Metropolitan Region of Ribeirão Preto (RMRP).

The public transport system in the city of São Paulo is made up of buses under the responsibility of the municipal government and complemented by the Metrô, trains from the Companhia Paulista de Trens Urbanos (CPTM) and intercity buses from the Metropolitan Company of Urban

Transport (EMTU) under the responsibility of the government state. The São Paulo fleet comprises 15 thousand buses. There are 1,314 lines, 832 of which run through concessions and 482 operate with permission. This structure transports nearly 3 billion passengers a year.

Figure 2 – Metropolitan Transport Network

The metropolitan tire transport system is managed by EMTU/SP and operated by private companies. Regulated by Decree No. 24,675/86, it offers collective metropolitan passenger transport by bus. The Common Service – composed of sets of lines connecting at least two municipalities that are part of the same metropolitan region. They are served by common urban buses, transporting seated and standing passengers. In the RMSP and Campinas, EMTU also manages the RTO - Operational Technical Reserve system, consisting of intercity lines operated by individual companies that each operate a single small collective vehicle (minibuses and vans up to 20 places).

Also in the São Paulo Metropolitan Region, EMTU/SP controls the operation of the São Mateus – Jabaquara Metropolitan Corridor, with 33 km of exclusive lanes running through five municipalities in the RMSP. The system has nine Transfer Terminals, 111 stops and a fleet of over 200 vehicles. It transports more than 200 thousand passengers daily. Since 1997, it has been the object of a Concession operated by the company Metra – Sistema Metropolitano de Transportes Ltda. Airport Service (Airport Bus Service) – transport between Guarulhos International Airport, provided by two types of service. The common bus, operated by urban buses, connecting the Airport and the Tatuapé Metro Station, and the Especial, connecting that terminal to Congonhas Airport, Praça da República, Tietê Bus Terminal, Hotel Circuit (Av. Paulista Region) and Shopping Eldorado. Ponte Orca Zoo – offering direct transport between Jabaquara Metropolitan Terminal and São Paulo Zoo, operated by ORCA's.

According to Fontoura, Caves & Ribeiro (2019), the MRSP and the city of São Paulo do not have a proper Mobility Plan plan with specific targets for improving urban mobility, despite the plan being required by law.

2.2 SHARED MOBILITY

Since the 1970s, a great number of environmental scientists suggested that greater material efficiency, obtained through use of better materials, reuse and recycling, contribute to economy “dematerialization” (Larson, Ross & Williams, 1986). Dematerialization refers to total or partial reduction in the quantity of materials used coupled with reduction in waste produced in the supply of a unit of economic output (Cleveland & Ruth, 1998). Sharing economy (SE) has potential to contribute to dematerialization, basically because individuals share common resources. To avoid controversies regarding definitions, SE, collaborative consumption and access economy can be considered synonyms (Lee, Chan, Balaji & Chong, 2018).

Information and Communication Technologies (ICT) help SE to mobilize underutilized resources maximizing their output and generating revenue for stakeholders (Rahman & Zafar, 2020). In shared mobility, either public or private, customers shared the use of a vehicle, bicycle or scooter, motorized or not, enabling customers to have short-term access to transportation means according to their needs. Besides being an innovative transportation mode, shared mobility also contributes in many ways to the environment and helps provide alternatives to travelers (Canhestro, 2019).

Hamari, Sjöklint & Ukkonen (2015) investigated people's motivations for participating in SE, based on Self-determination Theory (SDT). Results showed participation in SE is motivated by many factors such as sustainability, hedonic motivation, as well as economic benefits. An interesting detail observed shows sustainability is not directly associated with participation in SE, unless at the same time it is associated with positive Attitudes towards SE. This finding suggests sustainability can be an important factor only for those people for whom ecological consumption is essential. This may mean a positive Attitude does not necessarily translate into actions (Figure 3).

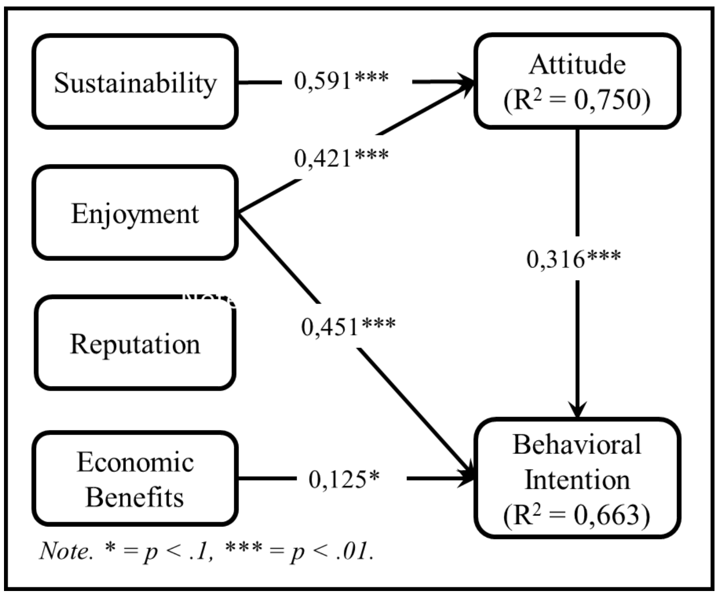

Figure 3 - Self-determination Theory for Shared Economy

Source: Adapted from Hamari, J., Sjöklint, M., & Ukkonen, A. (2015). The sharing economy: Why people participate in collaborative consumption. *Journal of the Association for Information Science and Technology*, *67*(9), 2047-2059.

The evolution of ICT leveraged advancement of collaborative and shared economies, putting service providers and customers in direct contact. Many factors such as economic uncertainty and high private vehicle ownership costs, are fostering drivers to explore alternatives to vehicle ownership (Shaheen & Cohen, 2013). Users of shared mobility options gain benefits of accessing private transportation without the ownership burden (Shaheen, Cohen, Chan & Bansal, 2020). This alternative benefits from the fact that most private cars remain stationary 90% of the day (Hampshire & Graites, 2011).

A study carried out by KPMG (2017) with 953 executives in automotive industry attested to the concern of 83% of them with a possible disruptive change in automotive industry. Changes impact not only the digital ecosystem model involving mobility and its economic efficiency, but also better resources allocation, increased traveled distances and fewer privately owned vehicles produced and marketed. Vehicle sharing can contribute to reduce the total fleet of vehicles in a city. In this way, area and infrastructure required for parking can also be reduced, leading to an increase in area availability and a reduction in total construction costs, in addition to making life more attractive in urban centers (Duncan, 2011). Results of more than 24 studies have shown car sharing is an alternative used in various contexts to increase mobility, reduce dependence on private vehicles, lower vehicle emissions and support a healthier lifestyle by encouraging cycling and walking (Shaheen & Cohen, 2013).

Carsharing has evolved at a multitude of models worldwide: neighborhood residential; business users; government and institutional fleets; university-based; and personal vehicle sharing. Ridesharing services like Uber and Lyft became feasible alternative transportation modes for urban dwellers. Riders have opportunity to spare driving time, converting it into more productive activities like doing business over the phone, e-mailing, texting or reading. Ridesharing services claim to help reduce ownership costs, traffic congestion and pollution emissions. Belief is that ridesharing reduces vehicles on streets, reducing traffic density and simultaneously reducing fuel consumption, therefore decreasing environmental impacts (Shaheen & Cohen, 2013).

Rayle et al., (2014) study indicated ridesharing helps serve unmet demands for convenient, point-to-point urban travel. When compared to taxis, ridesharing wait times are shorter, and fares are more predictable. Ridesharing organizations such as Uber and Lyft, pledge increase point-to-point transportation dependability. These companies practice price surging, adjusting cost of rides to match real time demand, therefore assuring sufficient supply level to meet changing demand (Young & Farber, 2019). Many of these mobility applications provide a rating system enabling passengers and drivers to rate each other after trip completion. Passengers' credit card information can be stored to make future trips payments easier (Rayle, Shaheen, Chan, Dai & Cervero, 2014).

Carranza et al., (2016) attempted to investigate whether Uber is a viable economically and environmentally substitute for car ownership. Evidence demonstrates the most favorable scenario solely using Uber with higher fuel economy and not owning a car, generates lowest CO2 emission. Surprisingly, their study shows lowest total cost for the consumer is for solely using an owned car, considering a fixed annual average of 11,244 miles (18,095 Km) traveled (Carranza, Chow, Pham, Roswell & Sun, 2016).

A survey of 380 San Francisco users indicates ridesharing provides additional mobility alternatives for city dwellers, especially in large, dense metropolitan areas where parking is limited, and mass public transportation is insufficient. 86% of responders claimed the reasons they prefer ridesharing services are due to conveniences such as: ease to request a vehicle, easy of payment and short waiting times. 21% of the users switched to ridesharing claiming they would not drive after drinking and 18% claiming they wanted to avoid the parking hassle (Rayle, Shaheen, Chan, Dai & Cervero, 2014).

A Datafolha research, commissioned by Uber to understand mobility future in the country surveyed 3,271 Brazilians over 16 years old between September 16 and October 7, 2020, in all country regions. No respondents own personal vehicles. Results revealed 38% of Brazilians believe the bicycle is the safest way to get around during the COVID-19 pandemic, followed by mobility applications (35%) and taxi (9%). Mass transportation, on the other hand, reached only 4% of preference in the interviewees' opinion (Boehm, 2020).

When analyzing the RMSP, mobility apps are considered by more than half of the population to be the safest form of transportation (56%). Bicycles with 21% and public transport with 8% come as safer modes for those who do not have their own vehicle. For the Brazilians interviewed, the most important criterion for choosing the transportation means during the pandemic are degree of agglomeration (29%), the security that transport offers (20%) and, tied at 14%, ease of access and the contamination risk. In the RMSP, 30% said the most important aspect for choosing a transportation mode is the degree of agglomeration. The contamination risk (16%) and the security that transport offers (16%) comes next as the most important factors and the ease of access comes in fourth place (13%) as a decision factor (Boehm, 2020).

Regarding the preference for mobility applications, the Datafolha survey shows 61% of Brazilians researched believe this habit will increase, while 10% believe it should stay the same and 29% believe the service should decrease after the COVID-19 pandemic is over. In the RMSP, the numbers reveal an even greater trend towards increasing the habit, with 66%. When asked what degree of actions importance to prevent the contagion of COVID-19 in the use of applications, the use of masks by the driver and user came first, being cited by 79% of respondents. The fact that the car was cleaned by a specialized company was second (74%) and alcohol gel availability for drivers and users in third (71%). In the RMSP, the degree of importance also remained high among these three items (Boehm, 2020).

2.3 INNOVATION DIFFUSION THEORY (IDT)

The Organization for Economic Cooperation and Development (OECD) defines innovation as a new or improved product, process or the combination of both, that is significantly different from the previous products or processes available. Innovation activities include development, financial and marketing activities to generate an innovation for the company. The organization defines two main innovation types: product innovations and business process innovations. A product innovation is a new or improved good or service that differs significantly from the firm’s previous goods or services offered to the customers. A business process innovation is a completely new or improved business process for one or more business functions that differs significantly from the firm’s previous business processes offered to the public (OECD/Eurostat, 2019).

According to Geissinger, Laurell & Sandström (2020), sharing economy can be considered a disruptive innovation that helps increase resource abundance throughout society. Innovation is leveraged by demand for better quality products and services in competitive markets and increasingly sophisticated customers. Sustainable economic growth in the long run is supported by technological innovation. Demanding customers stimulate companies to pursue technology innovations to deliver state-of-the-art products and services (Furman, Porter & Stern, 2002).

Diffusion is the process by which an innovation is communicated, adopted and gains acceptance by members of a certain community or members of a specific social system. The IDT is a tool to understand innovation diffusion in a social system. Four major factors impacting the diffusion process are: 1) the innovation itself, 2) how innovation is communicated, 3) time involved and, 4) the social system where innovation is introduced (Rogers, 2010).

The innovation decision process is the process through which an individual or group evolves toward the decision to adopt or reject an innovation, to implementation the new idea, and confirmation of the decision. Figure 4 depicts this process: (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation. The decision stage leads to innovation adoption or rejection (Rogers, 2010).

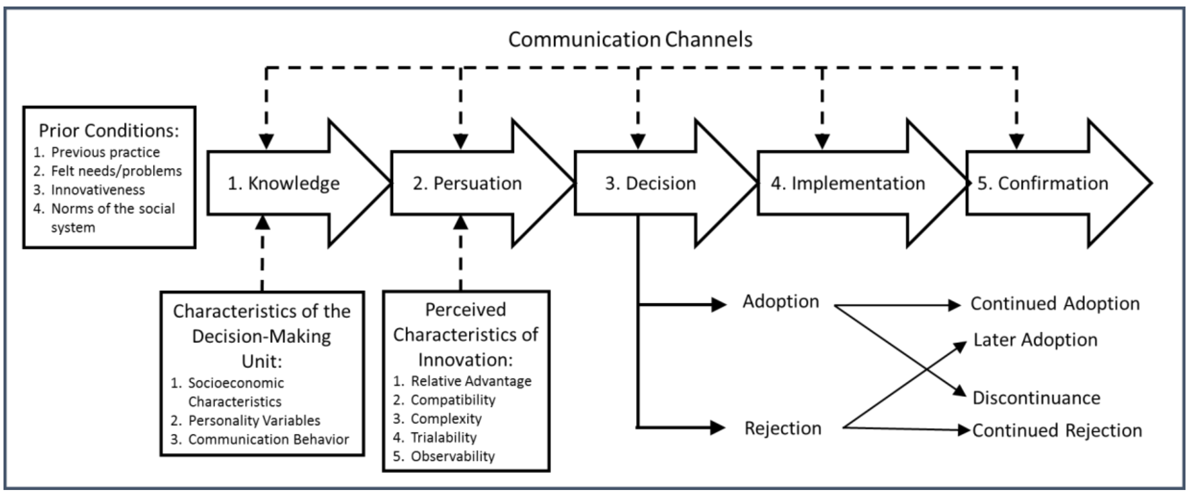

Figure 4 - Five Stages Model for Innovation-decision Process

Source: Rogers, E. M. (2010). *Diffusion of innovations*. Simon and Schuster.

Certain innovation characteristics, as perceived by members of a social system, establishes its adoption rate. There are five perceived innovations are: (a) Relative Advantage, (b) Compatibility, (c) Complexity, (d) Trialability, and (e) Observability (Figure 5). Relative Advantage is the degree to which an innovation is perceived to be better than the previous or current antecedent or product currently in use. It should consider economic, social and technical benefits. Compatibility refers to the consistency relationship innovation has with an individual's values, needs and potential adopters past experiences. Not only is it related to the difficulties manifested in the use or the perception of these difficulties. Complexity: indicates the degree of difficulty perceived at the time of understanding and using the resources of the innovation in question (Rogers, 2010).

Complexity is also referred to as Easy-of-use (Lopes, Kniess & Ramos, 2015). The more complex the new product, the more difficult it is to gain acceptance. Trialability is the degree to which an innovation can be experienced prior to adoption. Such a property allows the potential buyer to see how a specific innovation would work in a specific situation. Observability relates to how the results of adopting an innovation are visible. The presentation of the results does not only refer to the outputs generated by the new system, but also to the change in the necessary process, such as changes in the time spent to carry out the action (Rogers, 2010).

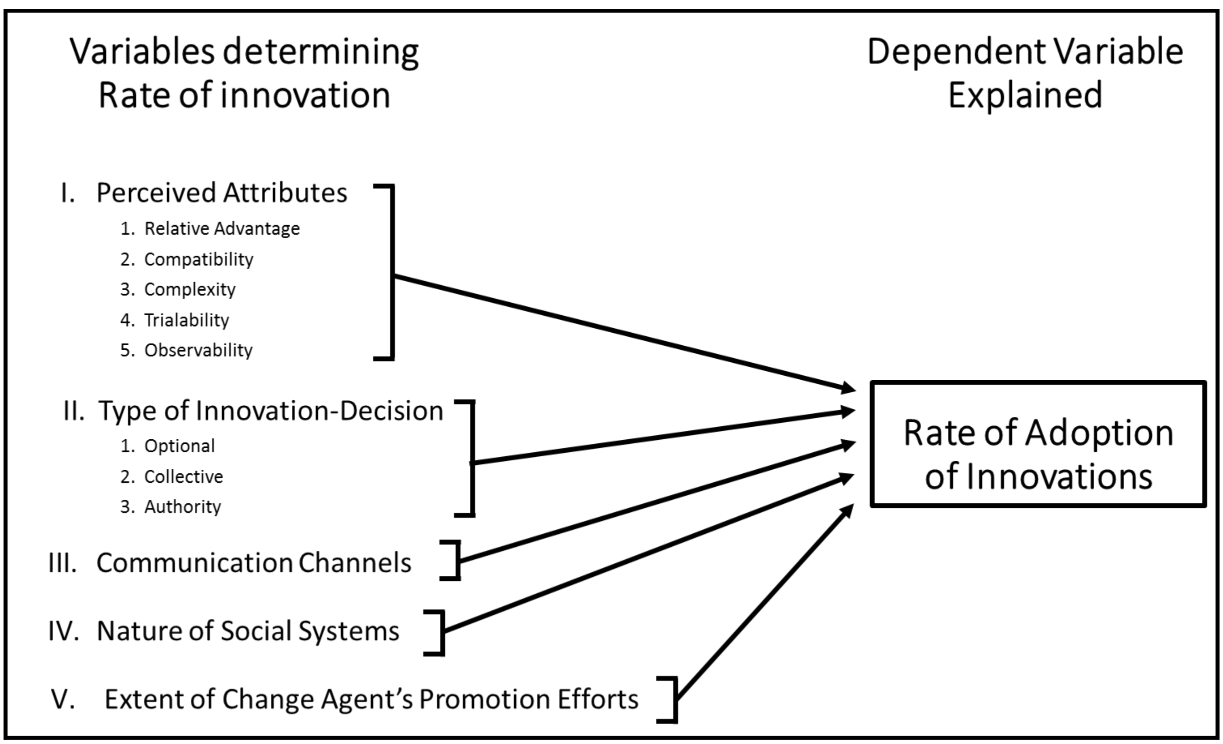

Figure 5 - Variables Determining Rate of Innovation

Source: Rogers, E. M. (2010). *Diffusion of innovations*. Simon and Schuster.

According to Rogers (2010), the continuum of innovativeness shows five main customer categories: a) Innovators - groups of consumers who first adopt the products. They tend to be more adventurous, like to take risks, have an above average education and socialize with other innovators. b) Initial or Earlier adopters - characterized by being opinion makers and role models for others. c) Initial majority - consists of consumers who have a habit of reflecting a lot before buying new products and adopt them just before the average population. d) Late majority - consumers are likely to be careful when evaluating innovations. e) Laggards - skeptical about innovations and exhibit low innovation level among adopters (Figure 6).

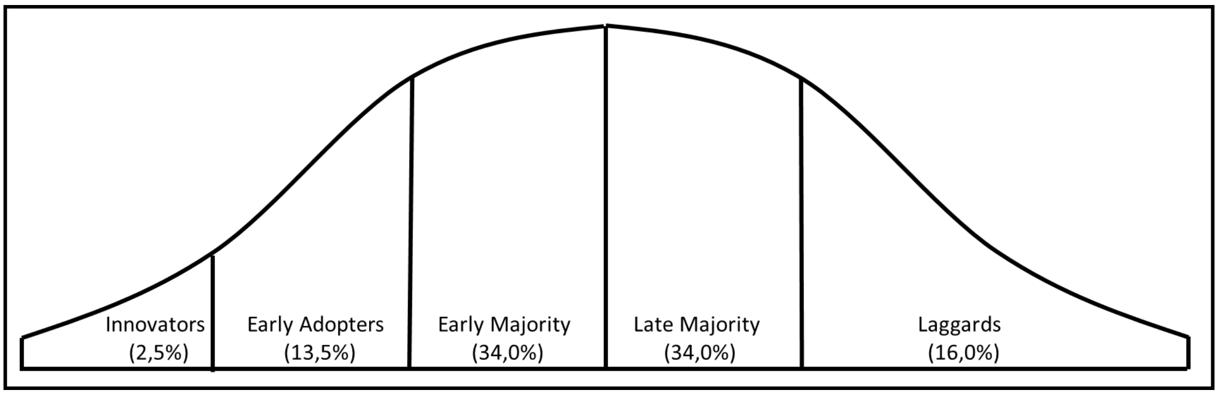

Figure 6 - Adopter categorization Based on Innovativeness

Source: Rogers, E. M. (2010). *Diffusion of innovations*. Simon and Schuster.

2.4 RESEARCH MODELS

2.4.1 Theory of Reasoned Action (TRA).

The Theory of Reasoned Action (TRA) purpose is to explain volitional behaviors (Figure 7). TRA's explanatory breadth disregards spontaneous, impulsive, habitual or mindless behaviors, because their effects might be involuntary or involve unconscious decisions. Behaviors requiring special skills, resources, opportunities or cooperation of other individuals are also excluded by TRA. This theory postulates the most effective predictor of volitional behavior is individual's behavior intention. This is believed to be the result of individual influence, or Attitude, and normative influence, also called subjective norm (Hale, Householder & Greene, 2002). Attitude means the degree to which an individual has a favorable or unfavorable appraisal of the behavior under study. Subjective norm relates to the perceived social pressure to execute or not execute such behavior (Ajzen, 1991).

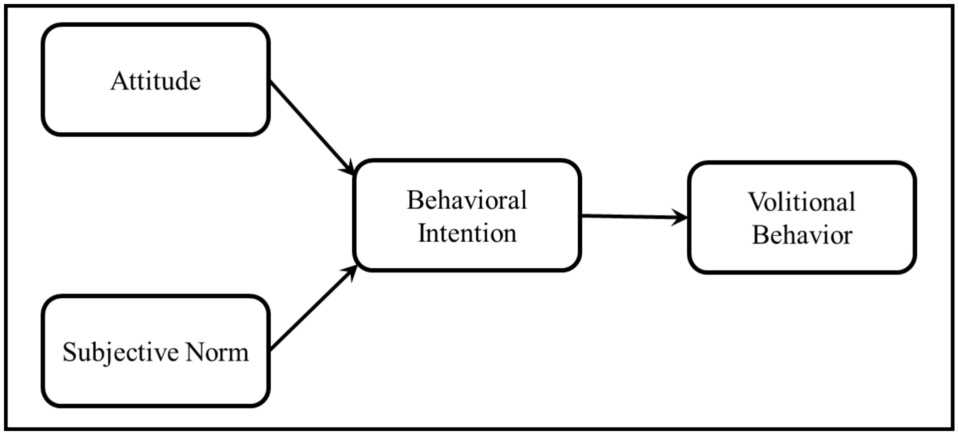

Figure 7 - Theory of Reasoned Action

Source: Adapted from Hale, J. L., Householder, B. J., & Greene, K. L. (2002). The theory of reasoned action. *The persuasion handbook: Developments in theory and practice*, 14, 259-286.

In a survey with 122 respondents to evaluate millennials consumers value perception and behavioral intent, drawing upon the TRA, Hwang & Griffiths (2017) identified a significant moderating effect for consumer innovativeness in using collaborative consumption services. Consumer innovativeness is related to the proneness to be receptive, to experiment and to adopt innovative products and services faster than the average consumer. Evidence supports adopting innovative services and products is heavily influenced by the extent of consumer innovativeness (Hwang & Griffiths, 2017).

2.4.2 Theory of Planned Behavior (TPB)

The theory of planned behavior (TPB) is a model to study individual behavior. The model has been useful for the evaluation of the behavioral intention in the framework of the research in entrepreneurship (Krueger et al., 2000). TCP affirms actions of individuals are preceded by conscious decisions to act in a certain manner. The TPB states intentions are the result of attitudes presented based on individuals' past experiences. According to Ajzen (1991) there are three determinants of intention for a behavior:

1. Attitude of behavior: it is understood how the degree with which an individual has a favorable or unfavorable value of the behavior in question, in this case of carrying out an entrepreneurial action.

2. Subjective norms: it refers to the perceived social influence on a certain conduct. It refers to the degree to which the behavior to be carried out and fulfill the desires of those important individuals in the individual's life.

3. Perceived Behavioral Control: refers to the perceived ease or difficulty of carrying out a given behavior. It is the perception that the individual has of her ability to carry out a specific conduct.

According to Ajzen (1991), the Theory of Planned Behavior (TPB) is an extension of the TRA made necessary due to the TRA’s inability to deal with certain behaviors over which people have no complete volitional control (Figure 8). TPB includes Perceived Behavioral Control (PBC) over engaging in the behavior as a factor influencing intention. PBC refers to the extent of ease or difficulty of performing the behavior. PBC influences both intention and behavior (Rahman & Zafar, 2020). It should also be noted that a large part of the studies in the area of transport have used the TPB to obtain a greater understanding of the choice of transportation mode (Feitosa, 2017).

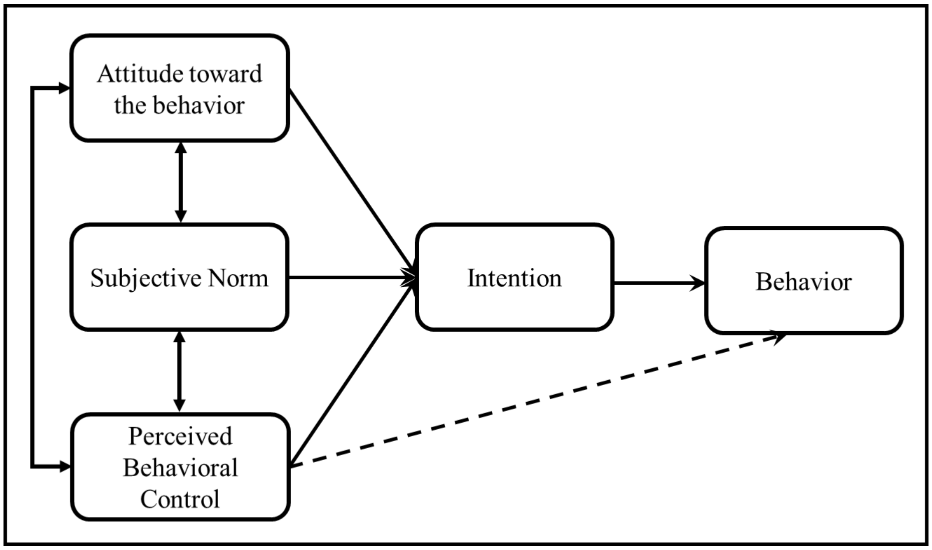

Figure 8 - Theory of Planned Behavior

Source: Adapted from Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes, 50*(2), 179-211.

2.4.3 Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) was initially proposed by Davis, Bagozzi & Warshaw (1989). This model has been widely accepted to study technology adoption in different scenarios (Figure 9). The model has three components, which are perceived ease of use (PEU), perceived usefulness (PU) and Behavioral Intention (BI). PU relates to the prospective user's subjective probability that using a certain technology will improve user's job performance in a professional setting. PEU refers to the extent to which the user expects the technology studied to require less effort. TAM suggests if users find the technology easy-of-use and useful, this will positively affect BI (Davis, Bagozzi & Warshaw, 1989). TAM was originally developed to study technology and information systems acceptance in corporate environments. TAM may not be appropriate to predict customer intention in a voluntary commercial setting (Zhu, So & Hudson, 2017). This model has also been criticized for not reflecting the complex nature of consumer adoption (Min, So & Jeong, 2019).

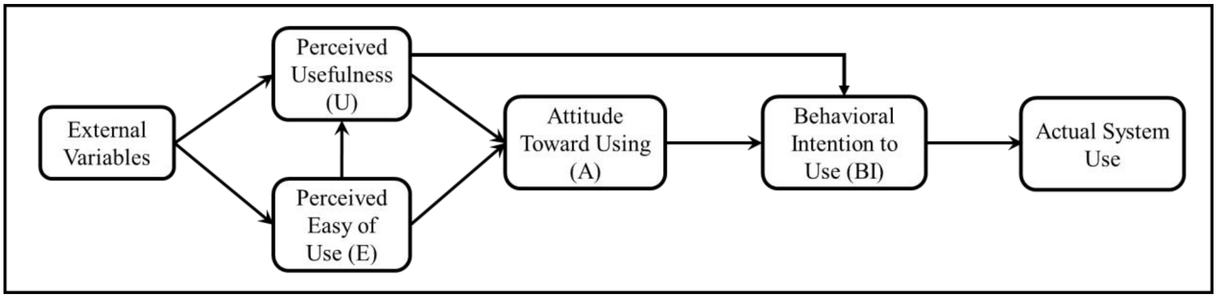

Figure 9 - Technology Acceptance Model

Source: Adapted from Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management science*, *35*(8), 982-1003.

Rahman & Zafar (2020) combined the TPB, TAM and Hofstede's cultural dimensions to investigate the effects of SE and digitalization of services in the consumers intention to adopt Uber within a group of 145 respondents in Bangladesh and Pakistan. Results of the study show "risk" negatively impacts the behavioral intention. Females have more intention to use the Uber service as this is considered more risk-free. It has been suggested, however, that Uber introduces female drivers to serve female customers, specially at dawn, to reduce the Risk Perception. Customers in these countries are willing to pay a higher price for Uber trips because safety is considered a valuable part of the service.

Min, So & Jeong (2019) studied consumer Attitudes and adoption intentions of the Uber mobility application through two theoretical models – IDT and TAM. Not many empirical studies integrating both theories have been performed from a consumer's perspective. The results suggest that all five IDT constructs have a significant influence on both perceived usefulness and perceived ease of use, therefore leading to consumer Attitude and future usage intention. Notably, in their model, trialability was replaced by social influence (Figure 10).

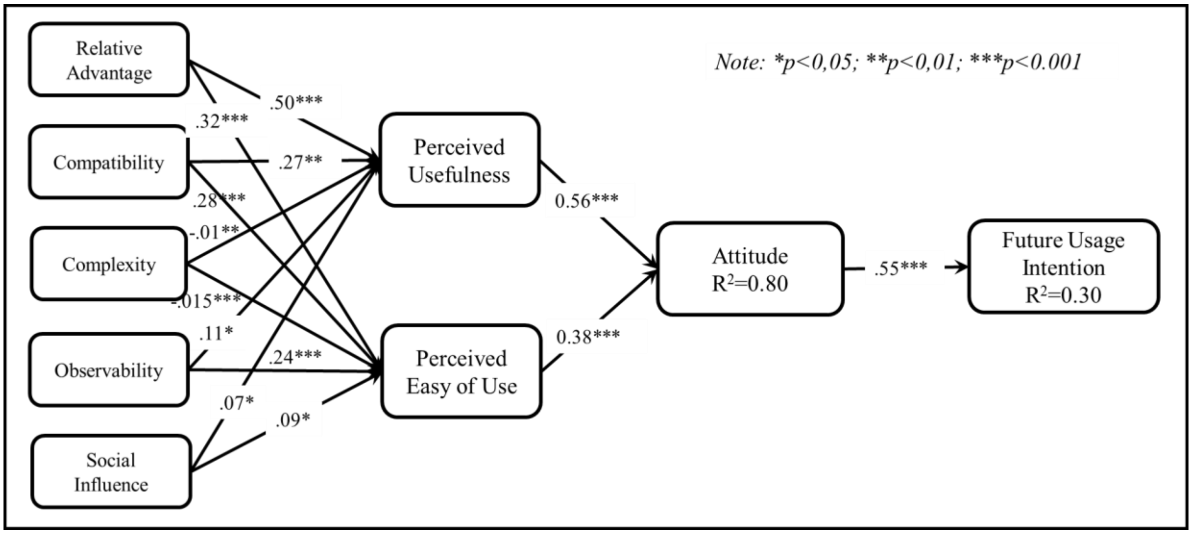

Figure 10 - IDT & TAM for Uber Mobile App

Source: Adapted from Min, S., So, K. K. F., & Jeong, M. (2019). Consumer adoption of the Uber mobile application: Insights from diffusion of innovation theory and technology acceptance model. *Journal of Travel & Tourism Marketing*, *36*(7), 770-783.

Lee, Hsieh & Hsu (2011) combined IDT with TAM to study factors affecting business employees' Behavioral Intention to use the E-Learning in Taiwan. Data from 552 business employees were collected. Results demonstrate that four IDT characteristics (Compatibility, Complexity, Relative Advantage, and Trialability) have a significant influence in employees Behavioral Intention to use E-Learning (Figure 11).

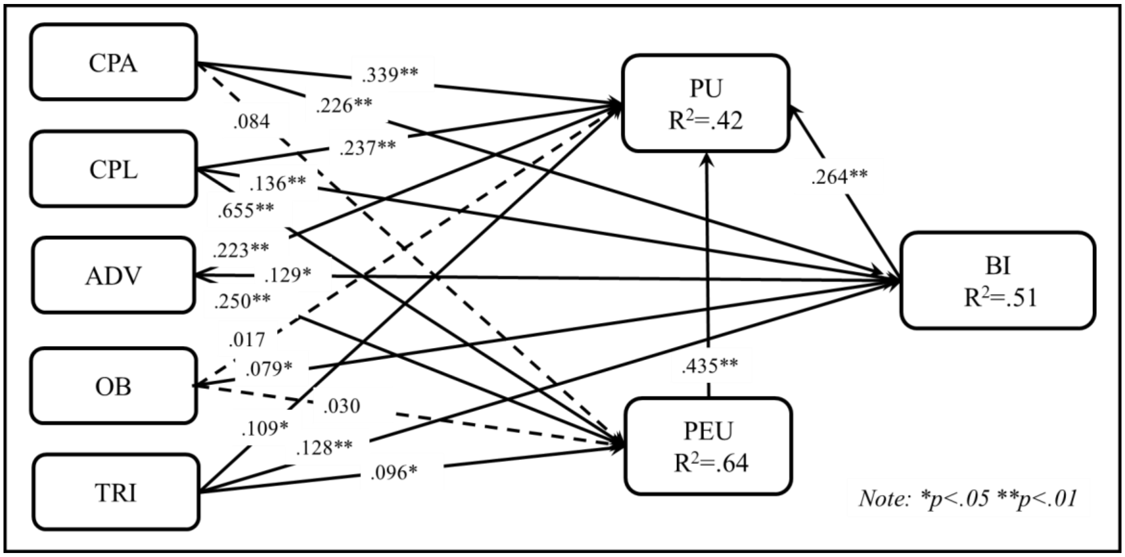

Figure 11 - IDT & TAM for E-Learning Systems

Source: Adapted from Lee, Y. H., Hsieh, Y. C., & Hsu, C. N. (2011). Adding innovation diffusion theory to the technology acceptance model: Supporting employees' intentions to use e-learning systems. *Journal of Educational Technology & Society*, *14*(4), 124-137.

2.4.4 Social Cognitive Theory (SCT)

Zhu, So, & Hudson (2017) investigated consumers intention to adopt mobile applications. The theoretical framework used was the Social Cognitive Theory (SCT). SCT is a model to help understand, predict and change behavior which describes human behavior as a result of the interaction among personal factors, behavior and the environment. This study developed a value adoption model to integrate nine relevant factors that are believed to influence adoption of ridesharing applications: self-efficacy, functional value, emotional value, social value, learning cost, risk cost, perceived value, attitude and intention (Figure 12). Risk costs refer to potential financial risk in the subject online account. A quantitative methodology with a questionnaire that allows the measurement of the constructs contained in the proposed theoretical model was used. Data from a convenience sample of 314 undergraduate students from a large university in Beijing was collected.

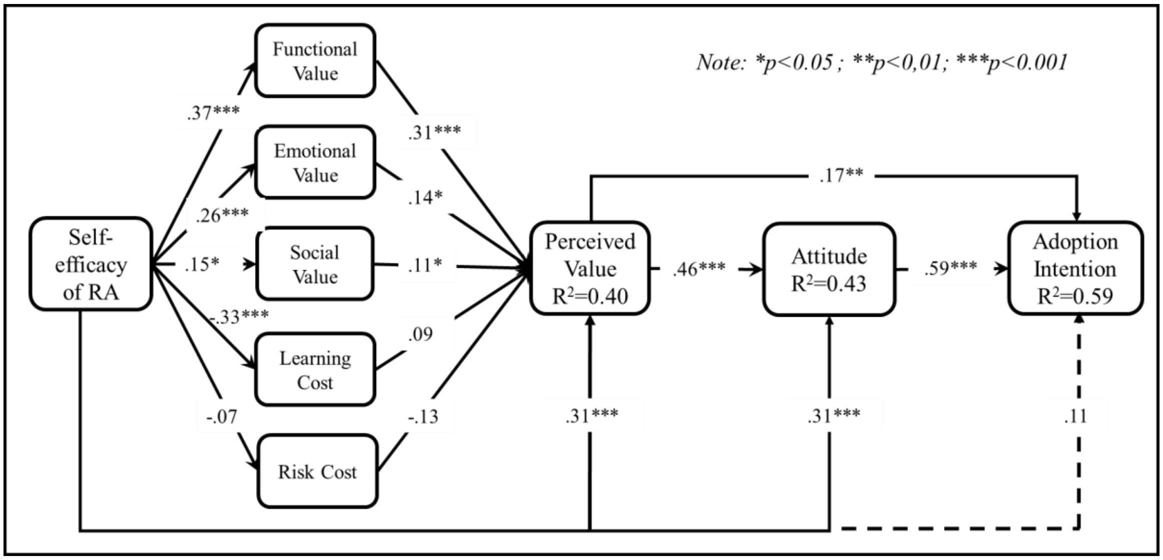

Figure 12 - Social Cognitive Theory in the adoption of mobile apps

Source: Adapted from Zhu, G., So, K. K. F., & Hudson, S. (2017). Inside the sharing economy. Understanding consumer motivations behind the adoption of mobile applications. *International Journal of Contemporary Hospitality Management*.

Previous empirical studies revealed that self-efficacy negatively affects perceived risk in the business-to-customer (B2C) e-commerce and mobile payment settings. The results demonstrate that self-efficacy has a major direct effect on consumers' perceived value and an indirect effect on Behavioral Intentions. The study also demonstrates that functional value, emotional value and social value are fundamental antecedents of mobility applications perceived value. However, the study reveals that learning costs and risk costs are not significant perceived costs for consumers in ridesharing applications adoption intention (Zhu, So & Hudson, 2017).

2.4.5 Decomposed Theory of Planned Behavior (DTPB)

One of the most effective theories for studying innovation adoption processes is the Decomposed Theory of Planned Behavior (DTPB). The DTPB decomposes the three main antecedents of Behavioral Intention of the TPB (Attitude, Subjective Norm and Perceived Behavioral Control) into a set of salient beliefs based on the IDT and the TAM (Taylor & Todd, 1995). In the DTPB, the antecedents of the Attitude towards the behavior are the five characteristics defined by the

IDT: "Relative Advantage", "Compatibility", "Complexity", "Trialability" and "Observability" (Rogers, 2010).

Moons & De Pelsmacker (2015) used an Extended DTPB to investigate electric vehicles adoption process (Figure 13). In their study, four individual constructs were explored attempting to identify early and late adopter groups of environmentally-friend new products: personal values, environmental concern, environmental behavior, and innovativeness. According to the authors, in the DTPB model, Complexity is comparable to PEU, and Relative Advantage is similar to PU in the TAM. One of their study limitations was that Trialability and Observability were not included in the model, due to electric cars unavailability and lack of visibility at the time of the study. Besides Attitudes, perceived Complexity, perceived Relative Advantage and Compatibility have a strong effect on usage intention. Perceived Behavioral Control (ability, constraints and facilitators) and driving habits (emotions) do not substantially affect usage intention.

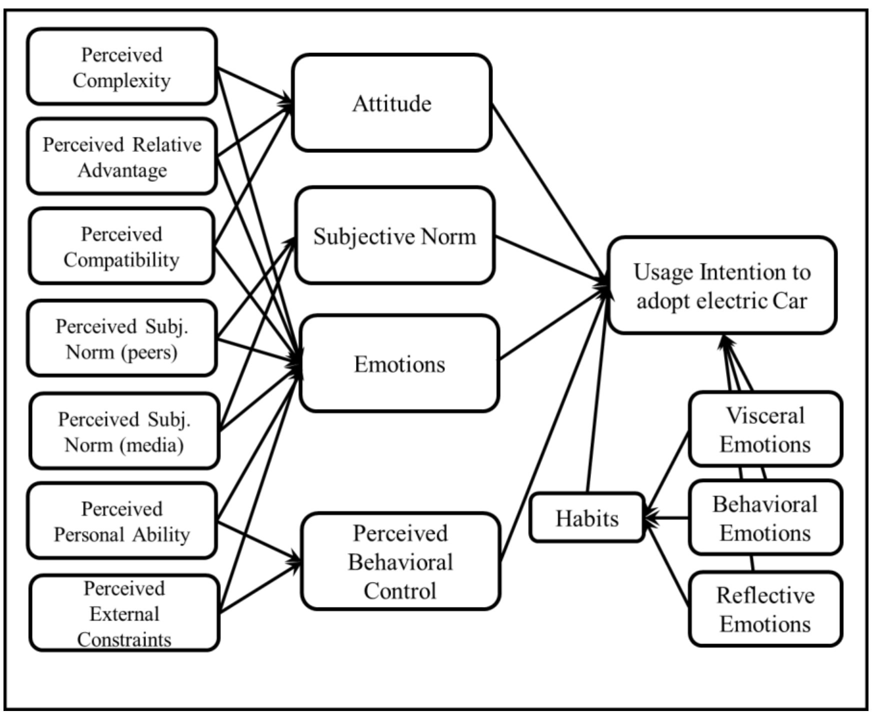

Figure 13 - Extended DTPB Model

Source: Adapted from Moons, I., & De Pelsmacker, P. (2015). An extended decomposed theory of planned behaviour to predict the usage intention of the electric car: A multi-group comparison. Sustainability, 7(5), 6212-6245.

Wani & Ali (2015) used the DTPB to understand smartphones diffusion in the consumer market in India. They modified the model with additional constructs to the existing theory, incorporating "Perceived Enjoyment" and "Perceived Risk" as motivator and inhibitor constructs, respectively. According to the authors, this was done by various other researchers for consumer goods using the TPB.

The study presented by Eccarius & Lu (2020) is the first to investigate the determinant factors that influence the intention of university students of Taiwan to adopt electric scooters. The model used was based on an extension of the TPB including Environmental Values, perceived Compatibility, and Awareness-knowledge (Figure 14). According to the authors, no previous studies investigated how Attitude, Behavioral Control and Subjetive Norms relate to e-scooters usage intention.

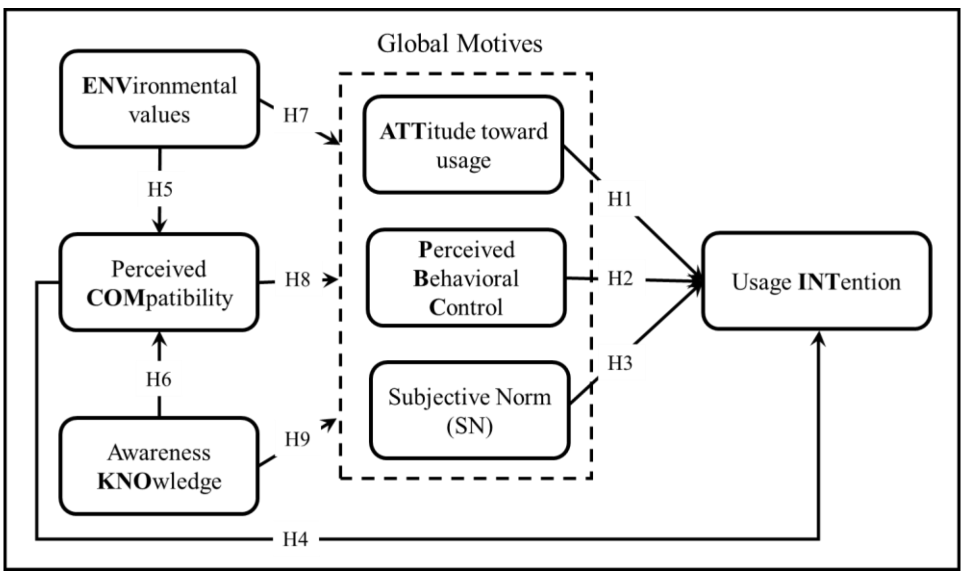

Figure 14 - Behavioral model for Shared E-scooter usage

Source: Adapted from Eccarius, T., & Lu, C. C. (2020). Adoption intentions for micro-mobility–Insights from electric scooter sharing in Taiwan. *Transportation Research Part D: Transport and Environment*, *84*, 102327.

According to Eccarius & Lu (2020), Taiwan already features powered two wheelers highest density in the globe. Approximately 66% of the citizens own one of these vehicles and use it daily. Most of these vehicles (98.2%) have traditional internal combustion engines. Therefore, their study was conducted in a place where vehicle ownership reduction and transition for electric mobility are the main measures to yield environmental benefits, so Environmental Values were considered. Data collected from 471 university student responses in Taiwan was analyzed using factor analysis and SEM. Two thirds of the students reported had never used a shared electric scooter. Results show that Awareness-knowledge and Environmental Values indirectly influence usage intention formation.

2.5 RISK PERCEPTION (RP)

Risk Perception (RP) concerns engagement in activities that may pose threats to a person's mental or physical health (Feijó & Oliveira, 2001). In the search for components to access the perceived risk, Mitchell (1999) presents a general formula: Risk = Negative Consequences Probability X Negative Consequences Importance. By this formula, risk is equal to the possibility of harm and the importance of the negative consequences after the risk. It indicates that when buyers intend to engage in a certain service or to buy a certain product, their behavior will be determined by perceived damage and perceived benefit levels after the transaction (Mitchell, 1999).

Public mass transportation system composed mostly by buses, vans, subways and trains uses generally poorly ventilated vehicles with passengers in close proximity, especially during rush hours. These travelling conditions may help spread contagious infections via direct or indirect contact, thus posing Risk Perceptions associated to this activity in pandemic times. Public transportation systems, used daily by millions of passengers, might help contribute to spread of infectious. Keep regular business continuity and provide transportation needs in such conditions pose a challenge to government authorities (Troko et al., 2011).

TPB allows variable addition in case they can contribute to improve model predictiveness. Risk Perception (RP) or susceptibility are known to be missing in the original TPB model (Norman, Conner & Bell, 1999). Risk Perception concerns engagement in activities that may pose threats to a person's mental or physical health (Feijó & Oliveira, 2001). RP refers to the extent to which individuals perceive factors related to potentially dangerous technologies or activities that impact people's risk judgments (Oltedal, Moen, Klempe & Rundmo, 2004). RP is also referred to as risk awareness, perceived susceptibility or threat (Champion & Skinner, 2008). There are many studies recognizing the impact of RP on life behavior, including consumer behavior (El Khatib, 2020).

Schmiege, Bryan & Klein (2009) attempted to integrate Worry and RP into the TPB across two realms of behavior: health and non-health. Worry and RP are constructs that refer to reactions to or beliefs about potential negative consequences to actions. Evidence supports both constructs may be moderately correlated, suggesting that they may function in a similar way in predicting outcomes (Schmiege, Bryan & Klein, 2009).

Norman, Conner & Bell (1999) added Perceived Susceptibility as an additional intention predictor to quit smoking in the TPB. The inclusion increased the predictive utility of the TPB model in the survey of 84 smokers attending health clinics programs. Other health behavior models, such as the Health Belief Model (HBM) and Protection Motivation Theory (PMT), have better RP considerations than TAM. Meta-analyses of the HBM and PMT report significant, but weak, positive correlations between RP and concurrent protective behavior (Champion & Skinner, 2008).

Lee, Chan, Balaji & Chong (2018) conducted a self-reported online survey in Hong Kong among Uber users to investigate thrust effects, RP and Perceived Benefit on Intention to participate in the SE (Figure 15). Privacy and security Risk Perceptions have been found remarkable deterrents to the use of different online services, such as online shopping, social networking and financial services. To join the shared mobile system, users are required to provide personal, financial and location information that may be used for non-intended business activities. There have also been reported rape and robbery cases in the use of different shared services such as Uber. In this study, RP refers to the potential damage that a given situation may cause to people, such as physical injury. The study used the Extended Valence Framework (EVF) incorporating perceived platform qualities into the research model. A total of 295 valid responses were collected and the research model was tested using SEM technique. The results implicate that RP, Trust in Uber, Perceived Benefits and Perceived Uber Qualities were significant predictors of users' Intention to join the platform services.

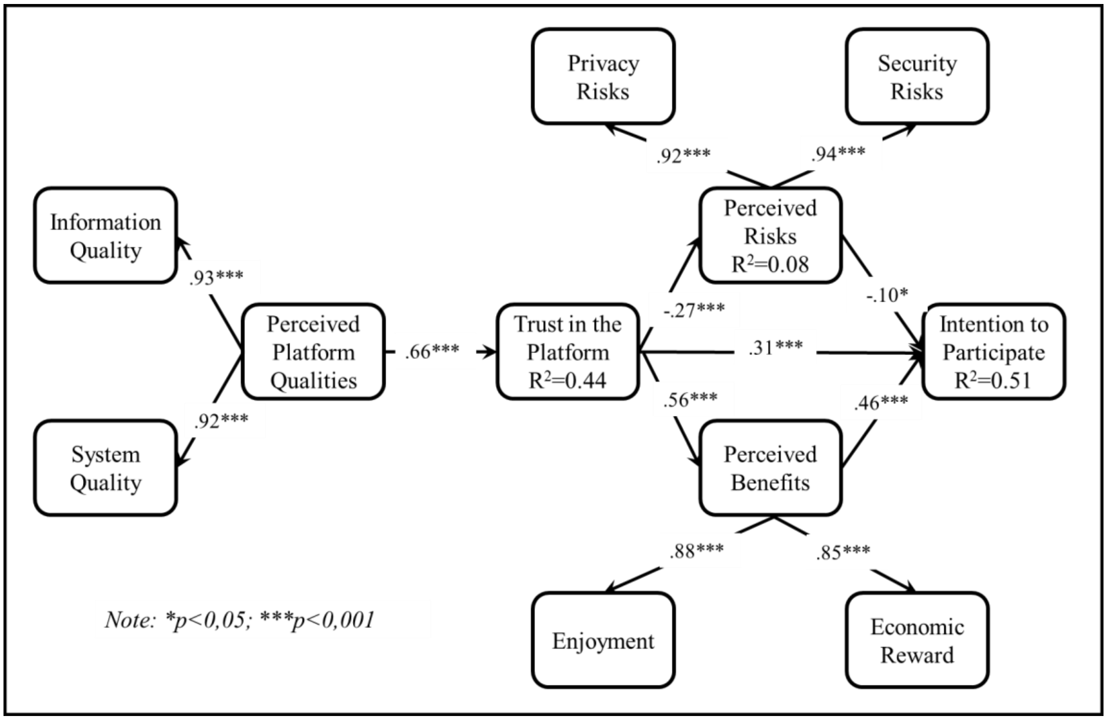

Figure 15 - Extended Valence Framework in the investigation of Uber

Source: Adapted from Lee, Z. W., Chan, T. K., Balaji, M. S., & Chong, A. Y. L. (2018). Why people participate in the sharing economy: an empirical investigation of Uber. *Internet Research*.

El Khatib (2020) used the TPB model in combination with the consumer RP theory to understand the factors that affect people's eating behavior during the COVID-19 pandemic (Figure 16). The survey results show COVID-19 pandemic Risk Perception positively affected consumers Attitudes towards the intention to maintain food storage, which subsequently affected the consumers' intention to store food. There are previous studies where the variable RP has always negatively affected Attitude, perceived behavior and purchase intention. In this study, however, the higher the RP, the stronger the Attitude of storing reserve goods. This demonstrates that a high RP, in the case of COVID-19 pandemic or other civil unrest, will cause the intention to buy goods that no longer follow common sense. Study participants were selected using a convenience sampling technique, which resulted in the participation of 155 respondents between April 10 and May 19, 2020 in the city of São Paulo, Brazil.

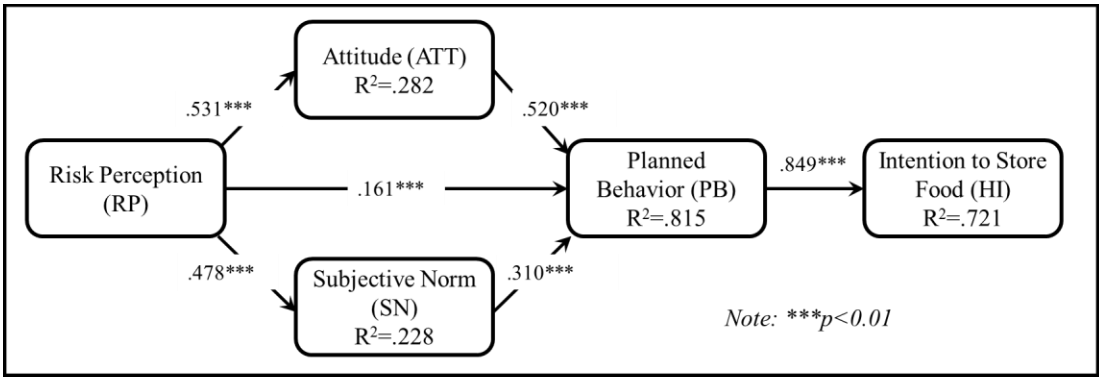

Figure 16 - Research Model for food storage during COVID-19

Source: Adapted from El Khatib, A. S. (2020, October). Acúmulo de Alimentos durante a Pandemia da COVID-19: Uma Análise à luz da Teoria do Comportamento Planejado (TCP). In CLAV 2020.

Based on the TPB, the article by Zhang, Yang, Cheng & Luqman (2019) studies the impact of H7N9 pandemic on poultry meat consumption in China. A sample of 710 respondents participated in the study after avian influenza outbreak in 2017. The results of SEM indicate that Perceived Behavioral Control, Subjetive Norm and consumers' Attitude mediate the relationship between H7N9 Risk Perception and poultry consumption Intention. The results confirm the suitability of the extended TPB model and its high explanatory power in predicting consumers' intention to consume poultry during a pandemic (Figure 17).

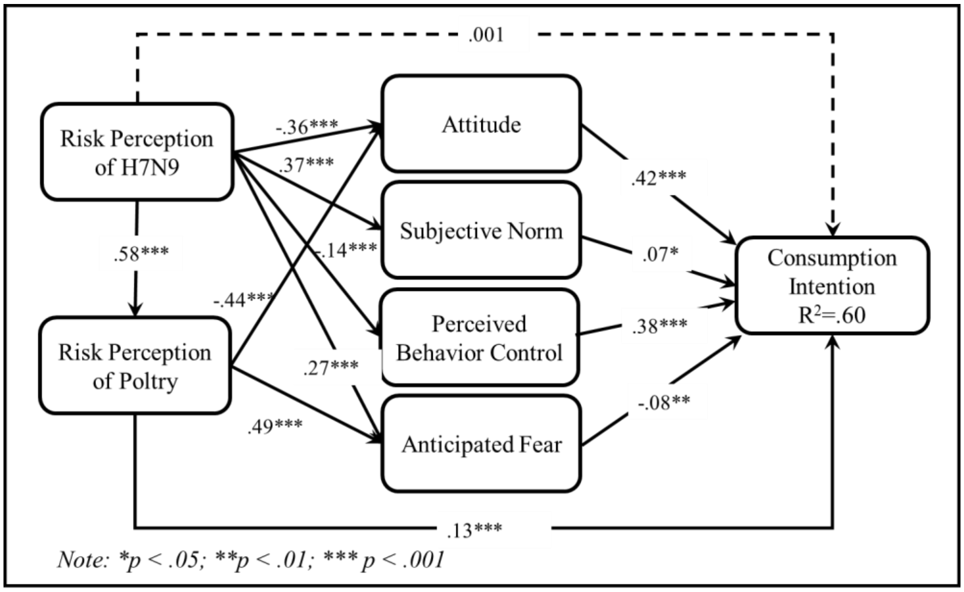

Figure 17 - Research Model for RP of H7N9 and poultry consumption intention

Source: Adapted from Zhang, Y., Yang, H., Cheng, P., & Luqman, A. (2019). Predicting consumers' intention to consume poultry during an H7N9 emergency: an extension of the theory of planned behavior model. *Human and Ecological Risk Assessment: An International Journal*.

Mittendorf (2017) proposed a modified research model to study the implications of "trust in Uber" and "trust in driver" in customers' intentions from a potential passenger's perspective (Figure 18). Mittendorf also incorporated "disposition to trust" and "familiarity with Uber" as antecedents of trust. Uber is notably interesting in the context of SE as this mobility app connects people completely strange to each other on a temporary business to consumer relationship that imply certain risk and Complexity levels. The study employed survey data with 221 respondents and SEM. Former research conceptualizes trust as a major construct to successfully establish a collaborative environment in the SE. The results demonstrate empirical evidence that "trust in Uber" influences customers' intentions to request a ride. However, the influence of "Trust in drivers" is insignificant.

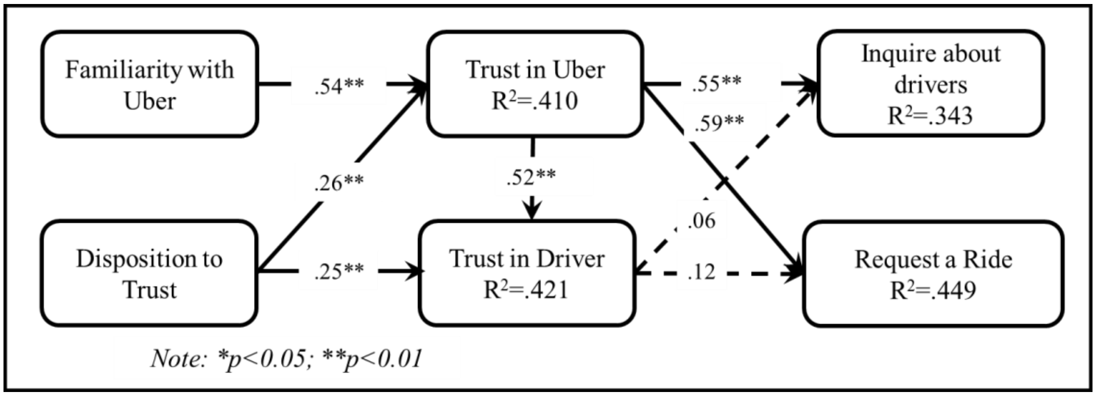

Figure 18 - Research Model for The Implications of Trust in the SE

Source: Adapted from Mittendorf, C. (2017, January). The implications of trust in the sharing economy – An empirical analysis of Uber. In *Proceedings of the 50th Hawaii International Conference on System Sciences*.

2.6 MODEL AND HYPOTHESES DEVELOPMENT

To close the formulated research gap, we selected the constructs and the research model that allows us to analyze Risk Perception impact on customers' intentions to engage in mobility application services. During the COVID-19 pandemic, travelers might perceive the risk of getting infected in mass public transportation, so their Risk Perception (RP) may be in the same direction as the Attitude (ATT), the Subjetive Norm (SN) and Perceived Behavioral Control (PBC) in the Behavioral Intention (INT) to adopt mobility apps in the RMSP in pandemic period. The proposed model and hypothesis are presented in Figure 19.

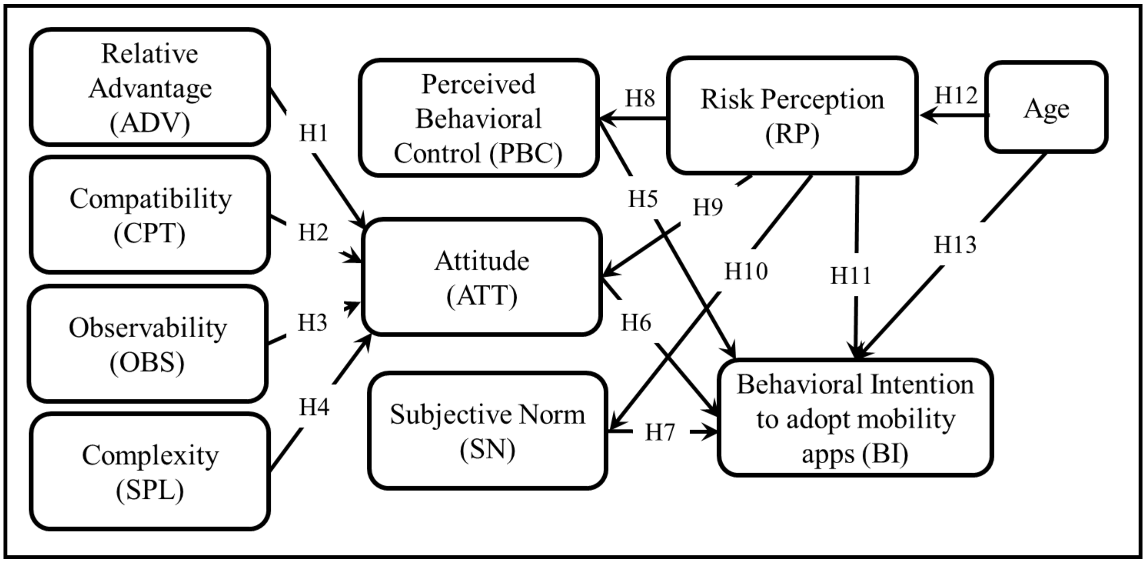

Figure 19 - Proposed Model and Hypotheses

Source: Developed by the author.

Four antecedents of Attitude (ATT) were be considered: Relative Advantage (ADV), Compatibility (CPT), Observability (OBS) and Complexity (SPL). Relative Advantage (ADV) refers to the degree to which the system is perceived to be better than the previous or current antecedent or product currently in use. Compatibility (CPT) refers to the consistency relationship that innovation has with an individual's values, needs and past experiences of potential adopters. Observability (OBS) relates to how the results of adopting an innovation are visible, and Complexity (SPL) refers to the degree of difficulty perceived at the time of understanding and using the resources of the innovation in question (Rogers, 2010).

Similarly to the decision of Moons & De Pelsmacker (2015), Trialability was not considered in our proposed model. Trialability, which refers to the degree to which an innovation can be experienced prior to adoption, is irrelevant in our setting, since engaging in shared mobility applications do not imply in long-term contracts or switching costs. Mobility app download is free of charge and require no subscriptions.

Lopes, Kniess & Ramos (2015) used the IDT to study the adoption, the implementation and utilization processes of the Balanced Scorecard in a major Brazilian agro-industrial cooperative. A qualitative approach was used for the research. The results demonstrated that three of the IDT attributes (Relative Advantage, Compatibility and Easy-of-Use or Complexity) positively influence the decision process of BSC adoption.

Hamari, Sjöklint & Ukkonen (2015) study demonstrates the Relative Advantage of economic benefits are associated with positive Attitudes towards the Shared Economy. They also hypothesized that extrinsic rewards, such as saving time when participating in SE, positively influences Attitudes. Rahman & Zafar (2020) study show customers in Bangladesh and Pakistan are willing to pay a higher price for Uber trips because safety is considered a valuable part of the service, presenting a Relative Advantage. The study of Min, So & Jeong (2019) suggest that all five IDT constructs (Compatibility, Complexity, Relative Advantage, Observability and Trialability) have a significant influence on both perceived usefulness and perceived ease of use, therefore leading to consumer Attitude and future usage intention.

In the DTPB, the antecedents of the Attitude towards the behavior are the five characteristics defined by the IDT: “Relative Advantage”, “Compatibility”, “Complexity”, “Trialability” and “Observability” (Rogers, 2010). Moons & De Pelsmacker (2015) defined Compatibility, Relative Advantage and Complexity as cognitive belief antecedents of Attitude and should affect it positively. Lee, Hsieh & Hsu (2011) study demonstrates that the five IDT characteristics (Compatibility, Complexity, Relative Advantage, Observability and Trialability) have a significant influence in employees Behavioral Intention to use E-Learning. Given that, we built the first four research hypothesis:

H1: Relative Advantage (ADV) has a positive relationship with Attitude (ATT) to adopt mobility apps in the RMSP.

H2: Compatibility (CPT) has a positive relationship with Attitude (ATT) to adopt mobility apps in the RMSP.

H3: Observability (OBS) has a positive relationship with Attitude (ATT) to adopt mobility apps in the RMSP.

H4: Complexity (SPL) has a positive relationship with Attitude (ATT) to adopt mobility apps in the RMSP.

Perceived Behavioral Control (PBC) refers to the conditions and control you have or not to perform the behavior. PBC influences both intention and behavior (Rahman & Zafar, 2020). According to Zhang, Yang, Cheng & Luqman (2019) PBC is significantly and positively related to consumption intention. According to Ajzen (1991), the greater the Perceived Behavioral Control, the stronger is an individual Behavior Intention to perform the behavior under study. With this comes the fifth hypotheses:

H5: Perceived Behavioral Control (PBC) has a positive relationship with Behavioral Intent (BI) to adopt mobility apps in the RMSP.

Attitude (ATT). Refers to the feelings of favourableness or unfavourableness towards performing a behavior (Ajzen, 1991). According to the same study, the more favorable the Attitude, the stronger is the Behavioral Intention to engage in such behavior. According to Hamari et al., (2015), Attitude towards Collaborative Consumption positively influences Behavioral Intention. Based on Min, So, & Jeong (2019), users Attitude is positively related to Behavior Intention to use mobile app. Zhang et al., (2019) defend a positive relationship between Attitude and Behavioral Intention exists in emergency situations such as H7N9. With this comes the sixth hypothesis:

H6: Attitude (ATT) has a positive relationship with Behavioral Intent (BI) to adopt mobility apps in the RMSP in Pandemic Period.

Subjetive Norm (SN) relates to the perceived social pressure to execute or not execute such behavior (Ajzen, 1991). According to the same author, the more favorable the Subjetive Norm with respect to a certain behavior, the greater is the perceived Behavioral Intention to execute the behavior under consideration. According to Moons, & De Pelsmacker (2015), Subjetive Norm has a positive effect on the Behavioral Intent to use the electric car. According to Zhang, Yang, Cheng & Luqman (2019), Subjective Norm toward poultry consumption during H7N9 positively affects Behavioral Intention to consume poultry. With this comes the seventh hypothesis:

H7: Subjetive Norm (SN) has a positive relationship with Behavioral Intention (BI) to adopt mobility apps in the RMSP in Pandemic Period.

In his study, El Khatib (2020), demonstrates that a high Perception Risk, in the case of COVID-19 pandemic or other civil unrest, will cause the intention to engage in Behavioral Intentions that no longer follow common sense. Risk Perception of avian influenza A (H7N9) influence Attitude, Subjetive Norm, Perceived Behavioral Control and Behavioral Intention in predicting consumers' intention to consume poultry during an emergency (Zhang, Yang, Cheng & Luqman, 2019). Results of Rahman & Zafar (2020) study show females have Behavioral Intention to use the Uber service as this is considered more risk-free. According to (Gu et al., 2019), decision makers' Behavior Intention is related to the degree of Risk Perception. Many studies conclude that Risk Perception influences customers' intention to use e-banking (Siraye, 2014). According to Schmiege et al., (2009), Risk Perception influences TPB constructs. With this, comes the eighth to eleventh hypotheses:

H8: Risk Perception (RP) to get infected in mass transportation has a positive relationship with Perceived Behavioral Control (PBC) to adopt mobility apps in the RMSP in Pandemic Period.

H9: Risk Perception (RP) to get infected in mass transportation has a positive relationship with Attitude (ATT) to adopt mobility apps in the RMSP in Pandemic Period.

H10: Risk Perception (RP) to get infected in mass transportation has a positive relationship with Subjetive Norm (SN) to adopt mobility apps in the RMSP in Pandemic Period.

H11: Risk Perception (RP) to get infected in mass transportation has a positive relationship with Behavioral Intention (BI) to adopt mobility apps in the RMSP in Pandemic Period. Martins, Oliveira & Popovič (2014), developed a model combining Unified Theory of Acceptance and Use of Technology (UTAUT) with Risk Perception to understand behavior intention to use Internet banking. The results support risk perception as a strong factor to predict behavioral intention to use Internet banking.

According to the World Health Organization (WHO), COVID-19 is riskier for older people infected with the coronavirus (Bastos & Cajueiro, 2020). COVID-19 infection and mortality have significant differences across age-groups, increasing rapidly in the elderly (Singh & Adhikari, 2020). A study based on data from 26 countries by Demombynes (2020) reveals people 70 years and older constitute 51% of deaths due to COVID-19 in Brazil. Caramelo, Ferreira & Oliveiros

(2020) study reveals age is the factor that presents higher risk fatality associated with COVID-19. A survey demonstrated older adults are especially vulnerable to COVID-19 infection (Bonanad et al., 2020). Age impacting both Risk Perception and Behavioral Intention was considered. Therefore, come the last two hypotheses:

H12: Age has a has a positive relationship with Risk Perception (RP) to get infected in mass transportation during COVID-19.

H13: Age has a positive relationship with Behavioral Intention (BI) to adopt mobility apps in the RMSP in Pandemic Period.

To meet the objective of this research, we seek to relate the general objective, specific objectives (research questions), hypotheses, theories and main references. To collect data, online questionaries were utilized. Structural Equation Modelling was used to analyze data. Figure 20 provides a summary of the information.

General Objective	Specific Objectives	Hypoteses	References
How Risk Perception in taking mass public transportation impact behavior intention to adopt mobility application services in times of pandemic in the RMSP to mitigate possible COVID-19 transmission?	How IDT determinant factors impact Attitude to adopt mobility application services in the RMSP?	H1: Relative Advantage has a significant relationship and positively affects Attitude to adopt mobility apps in the RMSP. H2: Compatibility has a significant relationship and positively affects Attitude to adopt... H3: Observability has a significant relationship and positively affects Attitude to adopt... H4: Complexity has a significant relationship and positively affects Attitude to adopt...	**Innovation Diffusion Theory -** Lopes, Kniess & Ramos (2015); Hamari, Sjöklint & Ukkonen (2015); Lee, Hsieh & Hsu (2011)
	How TPB determinant factors impact behavior intention to adopt mobility application services in times of pandemic in the RMSP to mitigate possible COVID-19 transmission?	H5: Perceived Behavioral Control has a significant relationship and positively affects Behavioral Intent to adopt mobility apps... H6: Attitude has a significant relationship and positively affects Behavioral Intent to adopt mobility apps... H7: Subjetive Norm has a significant relationship and positively affects Behavioral Intention to adopt...	**Theory of Planned Behavior -** Ajzen (1991); Eccarius & Lu (2020) Moons & De Pelsmacker (2015)
	How Risk Perception in taking mass public transportation impact TPB determinant factors in adoption of mobility application services in times of pandemic in the RMSP to mitigate possible COVID-19 transmission?	H8: Risk Perception (RP) to get infected in mass transportation has a significant relationship and positively affects Perceived Behavioral Control (PBC) to adopt... H9: Risk Perception (RP) to get infected in mass transportation has a significant relationship and positively affects Attitude (ATT) to adopt... H10: Risk Perception (RP) to get infected in mass transportation has a significant relationship and positively affects Subjetive Norm (SN) to adopt... H11: Risk Perception (RP) to get infected in mass transportation has a significant relationship and positively affects Behavioral Intention (BI) to adopt...	**Risk Perception -** El Khatib (2020); Zhang, Yang, Cheng & Luqman (2019);
	How Age impacts Risk Perception and Behavioral Intention in taking mass public transportation in times of pandemic in the RMSP to mitigate possible COVID-19 transmission?	H12: Age has a significant relationship and positively affects Risk Perception (RP) to get infected in mass transportation during COVID-19. H13: Age has a significant relationship and positively affects Behavioral Intention (BI) to adopt mobility apps in the RMSP in Pandemic Period.	**Age -** Bastos & Cajueiro (2020): Singh & Adhikari (2020): Demombynes (2020); Caramelo et al., (2020); Bonanad et al., (2020)

Figure 20 - Hypotheses Deployment Summary

Source: Developed by the author.

3 METHOD

This study is characterized as a quantitative approach, in the positivist paradigm (Figure 21). The model used was the Decomposed Theory of Planned Behavior, borrowing constructs from the Innovation Diffusion Theory, adding Risk Perception to the research model, applying questionnaires and statistical treatment of the results.

Synthesis of Research Methods and Procedures	
Nature of the Research	Quantitative
Methodological Approach	Descriptive
Paradigm	Positivism
Unit of Analysis	Users or Mass transport system in the RMSP
Data collection procedures	Questionnaire application
Data collection instrument	Online questionaries (Google Forms)
Data Analysis	Confirmatory Factor Analysis (SPSS) & Structural Equation Modelling (Smart PLS 3.0)

Figure 21 - Synthesis of Research Methods and Procedures

Source: Developed by the author.

3.1 STRUCTURAL EQUATION MODELING

Structural Equations Modeling (SEM) was used for statistical treatment of the using the software Smart PLS 3.3.3. The software uses the Partial Least Squares method, recommended in the absence of variable symmetric distribution and more complex formative models with many constructs and many variables observed. SEM was used based on correlation by the partial least square method (Hair, Sarstedt, Hopkins & Kuppelwieser, 2014; Ringle, Silva & Bido, 2014).

Since the purpose of this study is to understand which motivational and inhibitors of behavior intention to participate in mobility application services and the influence of Risk Perception to in times of COVID-19 pandemic in the RMSP, rather than confirming a theory, SEM was performed. PLS- SEM has higher statistical power compared to the covariance-based SEM alternative in the case of complex structural models (Amirkiaee & Evangelopoulos, 2018). The model requires that steps be followed to verify that convergent validity (consistency between measured variables and the latent construct) and discriminant validity (if there is sufficient difference between the constructs) have been achieved to arrive at the structural model and path coefficients (Ringle, Silva & Bido, 2014).

3.2 RESEARCH PROTOCOL

The objective of this thesis was to analyze factors that predict the Behavior Intention of using shared mobility apps based on the DTPB and how influence of Risk Perception justify the Behavior Intention of the Brazilian mass public transport users residing in the RMSP to adopt shared mobility applications in response to COVID-19 pandemics. The continuity of the quarantine due to the Coronavirus pandemic in the RMSP, made it difficult to investigate and analyze actual consumer mobility app behavior, therefore, our research focused on consumer intentions. The research protocol is described below:

- Model Selection – DTPD, incorporating TPB and IDT,
- Variables Selection: Relative Advantage, Compatibility, Observability, Complexity, Perceived Behavioral Control, Attitude, Social Norm, Behavioral Intention, Risk Perception and Age
- Hypotheses Development,
- Research Instrument Development,
- Sample Size Determination,
- Proceed to Data Collection and selection of data, assuring compliance to requirements (residents in the RMSP and users of mass transport system, at least once a month)
- Analyze Data using Confirmatory factor Analysis,
- Analyze Model using Structural Equations Modelling,
- Presentation of Results, including Respondent Demographic Profile, Respondent Mobility Habits, Results Qualitative Approach, and SEM Results,

- Discussions, and
- Final Considerations, including Practical Implications and Limitations

3.3 RESEARCH INSTRUMENT

The research instrument was adapted from established existing scales. The questions used by Moore & Benbasat (1991); Min, So & Jeong (2019); Rayle et al., (2014); Eccarius & Lu (2020); Shih & Fang (2004); Moons & De Pelsmacker (2015); Zhang et al., (2019) were translated to Portuguese, partially following the procedure suggested by Borsa, Damasio & Bandeira (2012) with translation, adaptation to fit the research object and pandemic context, evaluation by experts, evaluation by target audience and final adjustments. Discussions with original instrument authors was not performed due to the diverse nature of the research objects (personal workstations, ridesharing, internet banking, electric cars and poultry consumption), due to the time lapse, since some researchers developed their scales as long as 30 years ago, and due to the specific pandemic context, besides time constraints.

The questions were adapted in a way to enable respondents to answer them easily and accurately, without ambiguity, making sure a regular citizen had enough knowledge for that. Whenever necessary, questions were adapted from a professional to everyday life focus (easier to my job / easier for everyday life). Questions were also kept at a minimum to improve responsiveness and reduce time necessary to respond the survey. To reduce confusion, reverse questions were avoided, and the most conventional terms were used (Kitchenham & Pfleeger, 2002). Two-edged questions (contains two different ideas) with possible contradictory answers were rephrased to avoid confusion (Kitchenham & Pfleeger, 2002). Example: “Internet Banking use is easy to learn and it is important to me” (Shih & Fang, 2004). Questions were also rewritten to reinforce differentiation. Example: “using Internet Banking would be a wise idea / using Internet Banking would be a good idea (Shih & Fang, 2004). Whenever necessary, a time frame (in times of pandemic) was provided to make answers more precise (Kitchenham & Pfleeger, 2002). The 9 constructs, 36 original items, references, translation, adaptation, evaluations by experts, evaluations by target audience and final adjustments are presented in Appendix 1.

In the invitation, people resident in the metropolitan region of São Paulo and users of the public transport system were asked to complete the research on urban mobility. Besides questions regarding the respondent's profile such as gender, age, household income, city of residence and car ownership, a self-reported frequency of transportation mode usage was used, measured with a 6-point scale: 1) never/rarely; 2) at least once a month; 3) at least twice a month; 4) at least once a week; 5) 2 to 3 times a week; and 6) more than 3 times a week. The following transport modes were surveyed: 1) bus/van/subway/train (mass transportation); 2) bicycle/scooter (motorized or not); 3) motorcycle; 4) car (owned, borrowed or rented); 5) mobility applications (Uber, 99, Cabify or other); and 6) regular taxi.

3.4 SAMPLE SIZE

The acceptable sample size was defined using G * Power 3.1.9.2 (http://www.gpower.hhu.de/en.html), as recommended by Ringle, Silva & Bido (2014). The following parameters were used to calculate the minimum sample size, as recommended by Hair, Sarstedt, Hopkins & Kuppelwieser (2014): power > 0.80 and effect size (f^2) = 0.15. For the model proposed, 8 predictors were considered. Figure 22 shows test results performed with these parameters. Thus, the minimum sample calculated for the example should be 109 responses. As a suggestion to have a more consistent model it is interesting to use double or triple that value. Once the minimum sample requirements were met, we proceeded to the data analysis.

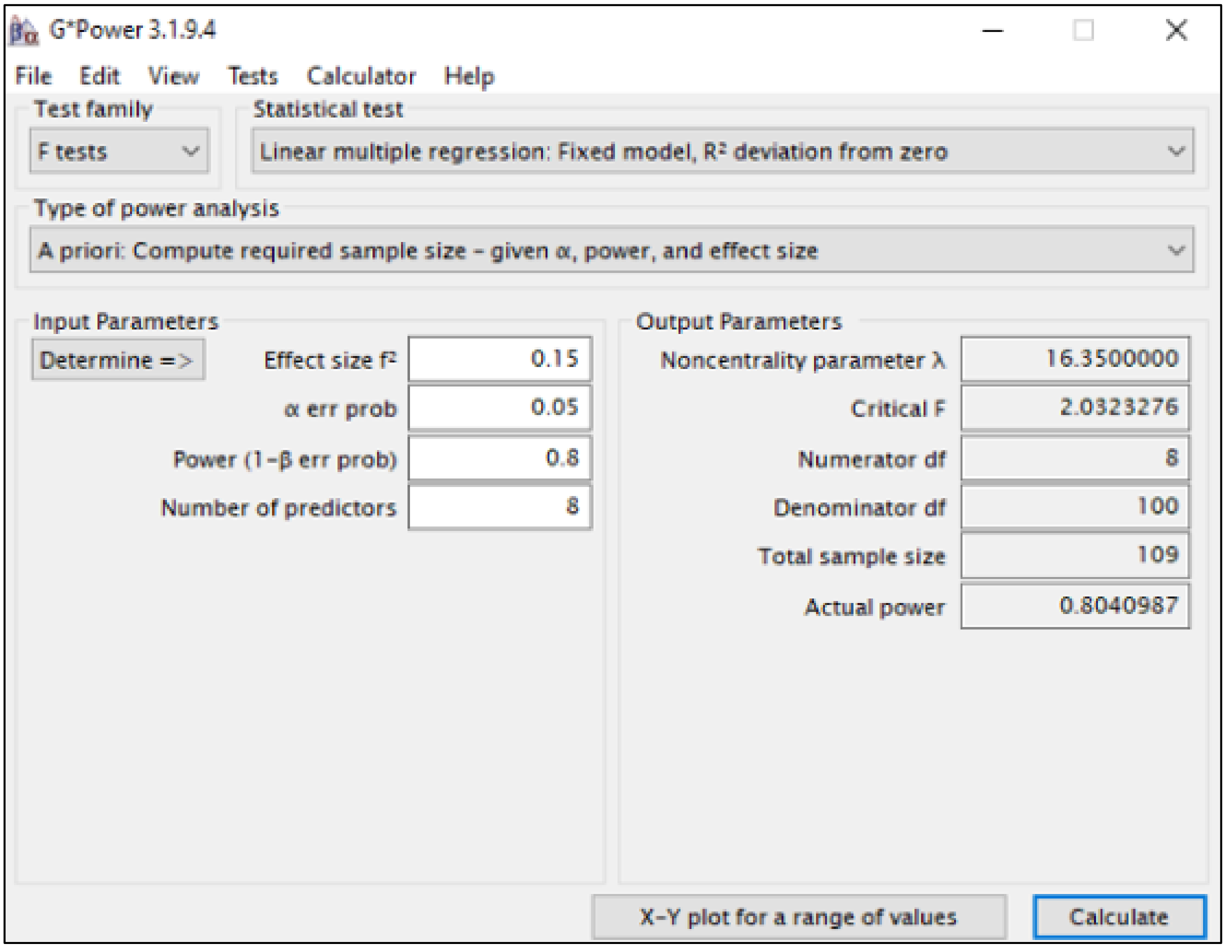

Figure 22 - Calculation of the Minimum Survey Sample with 08 Predictors

Source: Extracted from G*POWER 3.1.9.4 software with the calculation of the minimum sample

3.5 DATA COLLECTION

An online Google Forms questionnaire (https://docs.google.com) was chosen, which allows data collection from a large quantity of participants in a short period, allows remote response and facilitates data charting, with no significant costs associated. The "mandatory questions" feature was used to avoid questionnaires with blank answers (missing values). The feature that allows a random mix of questions to avoid bias was also used. The assertions were evaluated using a 7-point Likert scale, ranging from 1 meaning “totally disagree” to 7 meaning “totally agree”. The respondents were selected up from e-mail lists from researchers and social networks (LinkedIn, Facebook, Whatsapp) by means of “snowball” disclosure and capture (one potential respondent indicates another), starting from the researchers’ own contact network.

4 RESULTS AND DISCUSSIONS

In this study, responses were collected from February 16 to March 5. A total of 805 survey forms were received. A group of 17 respondents that reside in cities outside the RMSP was excluded. Another group of 190 respondents that reported “never or rarely” to public transportation system use frequency (bus/van/subway/train) was rejected because they were not exposed to the perceived risks posed by this type of transportation mode, subject of this research. This resulted in a final sample of 598 valid responses.

4.1 RESPONDENT DEMOGRAPHIC PROFILE

Figure 23 presents this study respondent demographic profile. Female respondents correspond to 62.7%. Average age was 24,3 years, with standard deviation of 9,2 years. The two groups with ages from 16 to 18 and from 19 to 20 account for 45.6% of the respondents. 63.4% of the respondents have a household income equal or inferior to 03 minimum wages (R$3,306). A group of 68.1% claim not owning a vehicle. For graphical representation, see APPENDIX 2 – Results 6.1 Respondent Demographic Profile.

	N	%		N	%
Gender			Household Income		
Female	375	62,7%	Up to 03 minimum wages (R$3.306)	379	63,4%
Male	223	37,3%	Up to 06 minimum wages (R$6.612)	106	17,7%
Total	598	100,0%	Up to 09 minimum wages (R$9.918)	42	7,0%
Age (years)			Up to 12 minimum wages (R$13.223)	25	4,2%
16 to 18	88	14,7%	Up to 15 minimum wages (R$16.529)	12	2,0%
19 to 20	185	30,9%	Above 15 minimum wages(R$16.529)	34	5,7%
21 to 22	114	19,1%			
23 to 27	96	16,1%		N	%
28 to 33	49	8,2%	Own a vehicle?		
34 to 44	36	6,0%	Yes	191	31,9%
45 or older	30	5,0%	No	407	68,1%

Figure 23 - Respondents Demographic Profile (n=598)

4.2 RESPONDENT MOBILITY HABITS

Figure 24 presents this study respondent mobility habits. This group is represented by respondents that reported to use public transportation systems at least once a month, with 59.9% using this transportation mode more than 3 times a week. Bicycle / scooters, (motorized or not) are never or rarely used by 85.5% of the respondents. Likewise, motorcycles are never or rarely used by 88.3% of the respondents. Only a small group of 9.5% of the respondents reported “never or rarely” to the frequency of use of mobility applications, whereas 92.6% of the respondents reported “never or rarely” to the frequency of use of regular taxis, demonstrating a shift in preference of mobility applications at the expense of taxi usage).

Frequency of use	Public Transp.		Bycicle		Motorcycle		Car		Mobility App.		Regular Taxi	
	N	%	N	%	N	%	N	%	N	%	N	%
Never or rarely	0	0,0%	511	85,5%	528	88,3%	207	34,6%	57	9,5%	554	92,6%
Up to once a month	69	11,5%	37	6,2%	23	3,8%	45	7,5%	155	25,9%	22	3,7%
Up to twice a month	40	6,7%	8	1,3%	7	1,2%	42	7,0%	102	17,1%	5	0,8%
Up to once a week	71	11,9%	17	2,8%	11	1,8%	62	10,4%	117	19,6%	7	1,2%
Up to 3 times a week	60	10,0%	13	2,2%	11	1,8%	88	14,7%	109	18,2%	5	0,8%
More than 3 times a week	358	59,9%	12	2,0%	18	3,0%	154	25,8%	58	9,7%	5	0,8%

Figure 24 - Respondent Mobility Habits Percentages (n=598)

4.3 RESULTS QUALITATIVE APPROACH

Results for the survey exploring behavior intention to use shared mobility services in times of COVID-19 pandemic in the RMSP are commented below. Before demonstrating the structural equation modelling results, raw survey responses with respect to different constructs were analyzed. It must be reinforced that, only respondents in the sample who use the public transportation system were considered. Then, although 805 valid responses were collected in the survey, the analysis is built based on a sample of 598 responses.

For this preliminary analysis of survey responses, the following criteria was developed, similarly to the ones used by Canhestro (2019) and Eccarius & Lu (2020). Construct and question Averages were classified in three equally divided groups in a likert scale of 1 to 7. Averages ranging from 1 to 3 (included) were classified as “Disagree”. Averages ranging from above 3 to 5 (included) were classified as “Neutral”. Averages ranging from above 5 to 7 were classified as “Agree”.

In general, respondents positively perceive the Relative Advantage of the mobility apps when compared to the mass transportation system (Relative Advantage average of 5.38). Using mobility apps allows respondents to get things done faster (ADV1 average of 6.10); using mobility apps makes their lives easier (ADV2 average of 5.95); mobility applications have more advantages than disadvantages (ADV4 average of 5.79), and, when compared to taxis, waiting times for mobility applications are shorter and fares are more predictable (ADV6 average of 6.21). However, respondents were neutral regarding the help of mobility apps to improve their performance at work or everyday activities (ADV 3 average of 4.85) and to help them save money (ADV5 average of 3.35). (Figure 25).

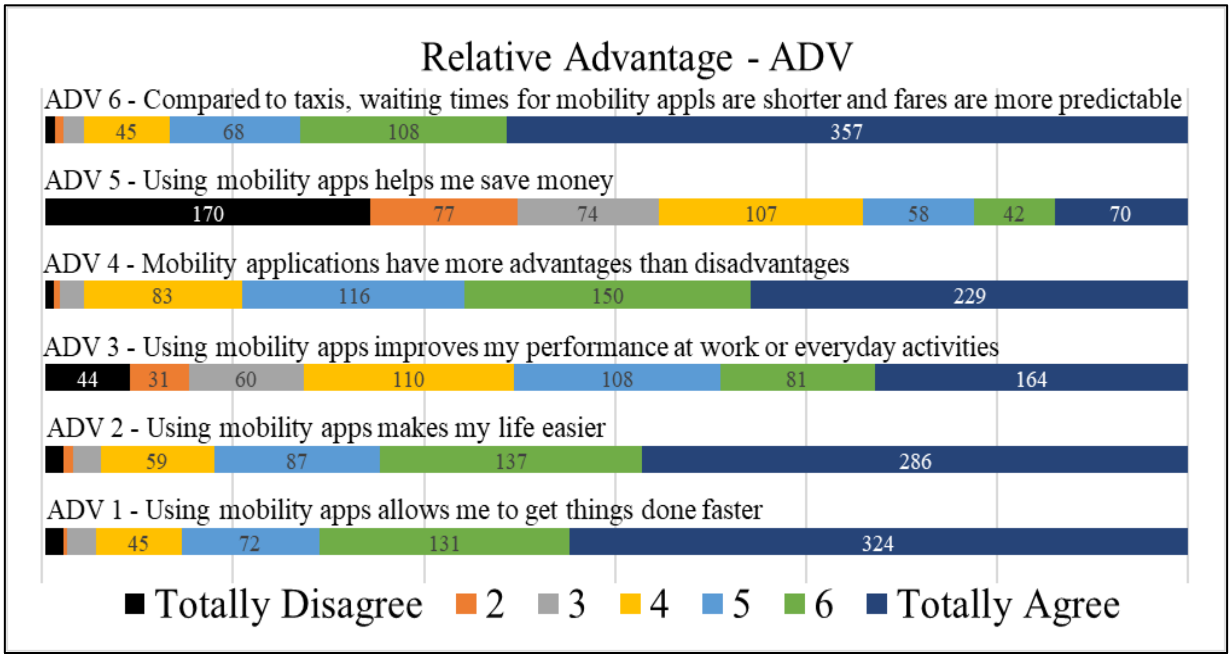

Figure 25 - Survey Results – Relative Advantage

Respondents positively perceive the mobility apps Compatibility (Compatibility average of 5.25). Mobility applications serve respondents urban transport needs well (CPT3 average of 5.81); mobility applications can be used in combination with mass transport systems (CPT4 average of 5.28). Respondents are neutral regarding the Compatibility of mobility apps with all aspects of their activities (CPT1 average of 4.94) and Compatibility with the use of mobility apps to their lifestyles (CPT 2 average of 4.98) (Figure 25).

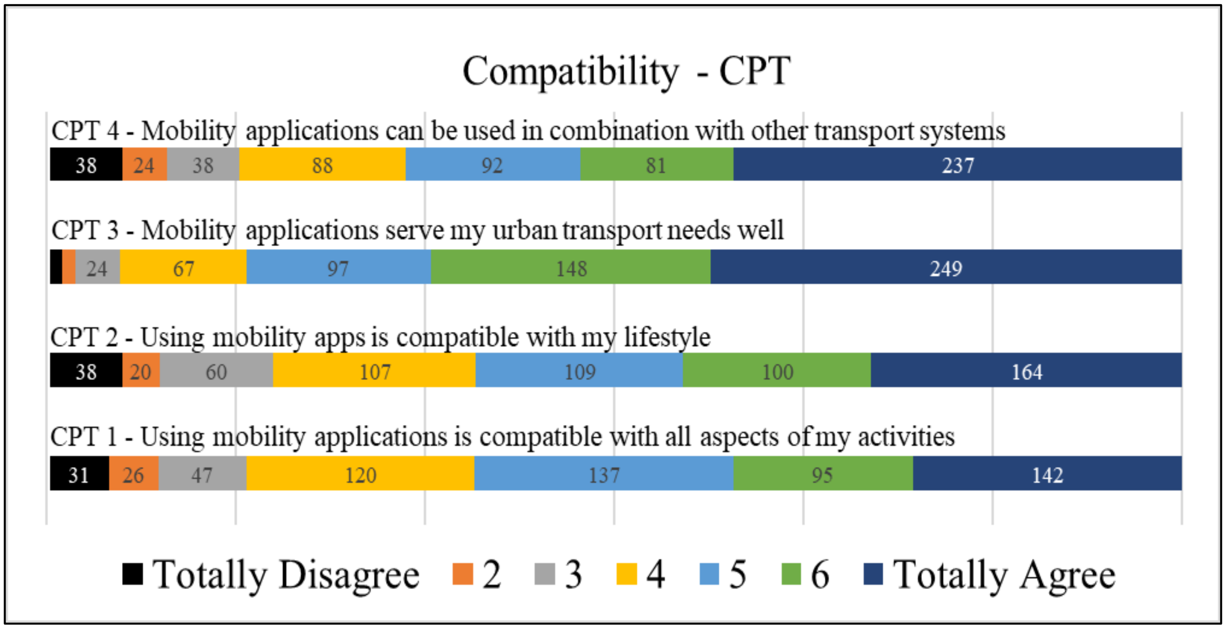

Figure 26 - Survey Results – Compatibility

Respondents positively perceive mobility apps Observability (Observability average of 6.32). Respondents can see many people using mobility applications (OBS1 average of 6.21); respondents hear many people say that they use mobility applications (OBS2 average of 6.31); and respondents know many people who use mobility applications, (OBS3 average of 6.45 (Figure 27).

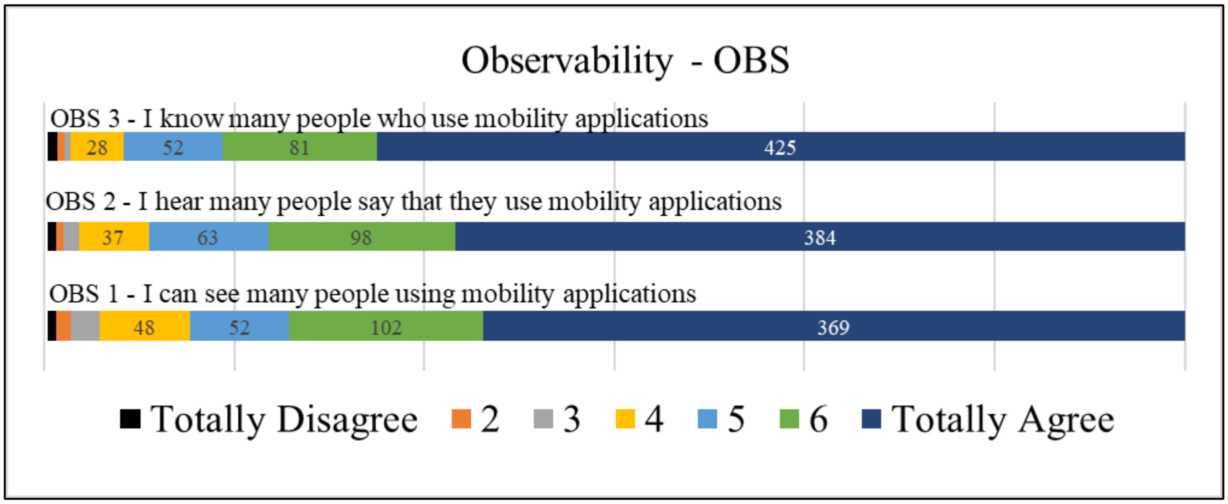

Figure 27 - Survey Results – Observability

Respondents positively perceive mobility apps Complexity (SPL average of 6.29). Respondents agree the use of mobility applications is easy to learn (SPL1 average of 6.40); mobility applications are simple to operate (SPL2 average of 6.24); it is easy to request a trip through the mobility applications (SPL3 average of 6.45) and mobility apps make it easy to pay for a trip, SPL4 average of 6.10) (Figure 28).

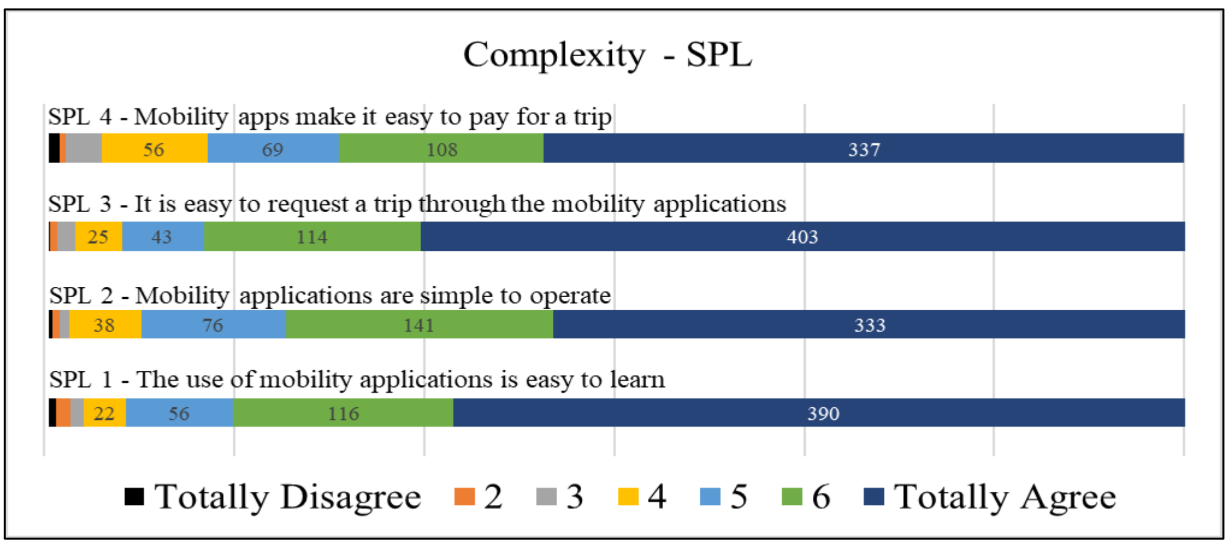

Figure 28 - Survey Results – Complexity

Respondents have a positive Attitude regarding the use of mobility apps (Attitude average of 5.79). They consider using mobility apps during the pandemic a safe Attitude (ATT1 average of 5.32); using mobility apps in times of pandemics is a good idea (ATT2 average of 5.72); they like to use mobility apps (ATT3 average of 6.11); and using mobility applications during COVID-19 is convenient to avoid crowding (ATT4 average of 6.03) (Figure 29).

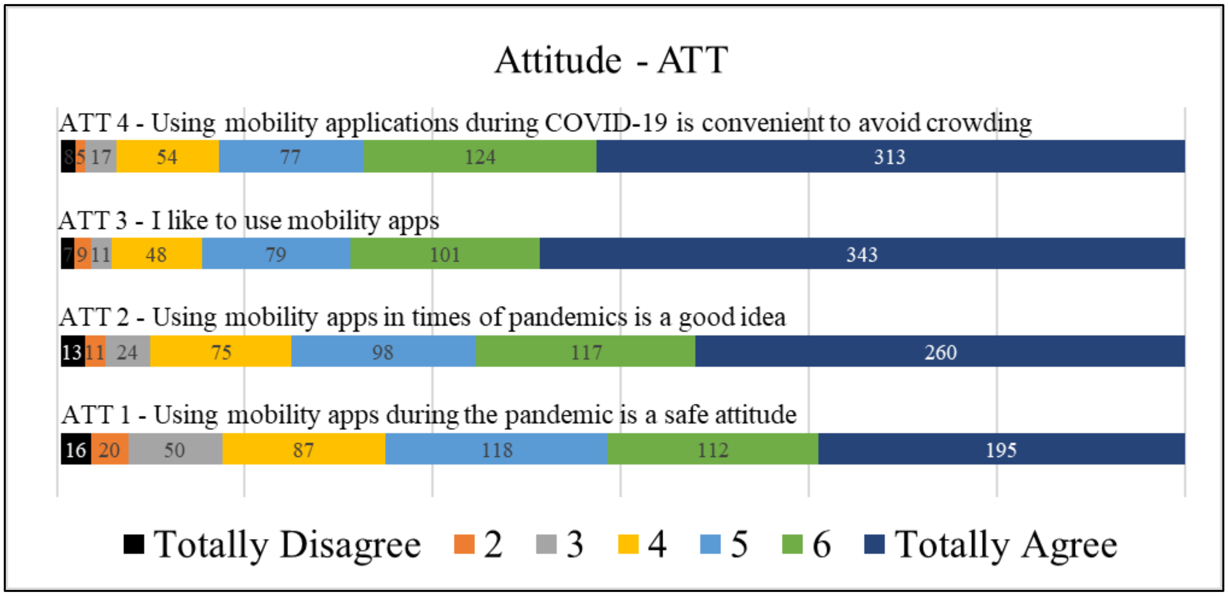

Figure 29 - Survey Results – Attitude

Subjetive Norm relates to the perceived social pressure to execute or not execute a certain behavior. Respondents positively perceived the Subjetive Norm to use mobility apps in times of pandemic (Subjetive Norm average of 5.16). People important to the respondents think that using mobility apps would be a safe Attitude during COVID-19 (SN1 average of 5.38); and people whose opinion the respondents value think that they should use mobility apps to avoid crowds (SN3 average of 5.33). However, respondents are neutral about their families' opinion whether they should use mobility apps in times of a pandemic (SN2 average of 4.76) (Figure 30).

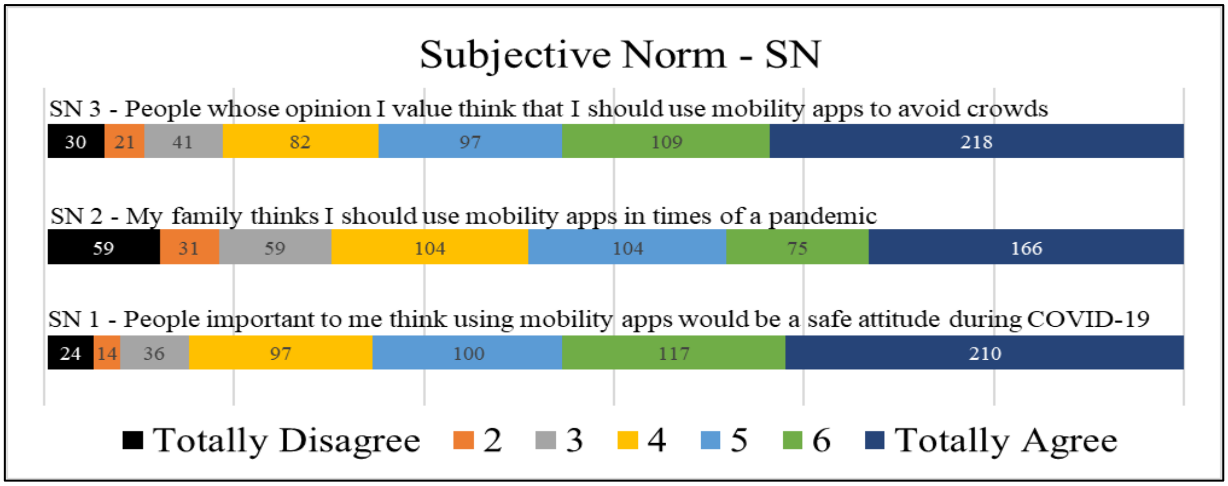

Figure 30 - - Survey Results – Subjective Norm

Respondents positively respond to the Perceived Behavioral Control they have over the use of mobility apps (Perceived Behavioral Control average of 6.03). Respondents think they are able to operate mobility applications (PBC1 average of 5.93); they have the resources (cash, credit / debit card, smartphone) to use mobility applications (PBC2 average of 5.96); they feel comfortable using mobility apps (PBC3 average of 5.72); and they perceive mobility apps are easily available on their smartphones (PBC 4 average of 6.53) (Figure 31).

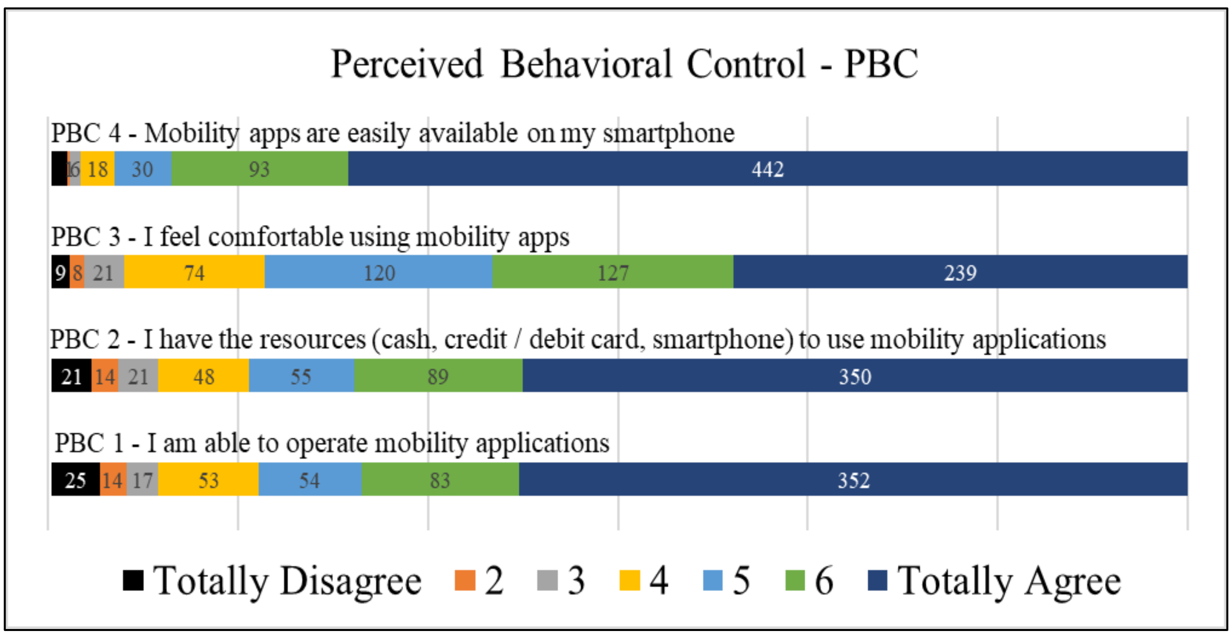

Figure 31 - Survey Results – Perceived Behavioral Control

Respondents demonstrated positive Behavioral Intention to use mobility apps in times of pandemic (Behavioral Intention average of 5,35). Respondents intend to use mobility applications during the COVID-19 pandemic (BI1 average of 5,25); they hope to use mobility applications to avoid contagion from COVID-19, (BI2 Average of 5.19); the- I can recommend the use of mobility applications to others to reduce transmission of COVID-19 (BI3 average of 5.52); and they intend to use mobility applications whenever possible so as not to expose themselves to agglomerations (BI4 average of 5.44) (Figure 32).

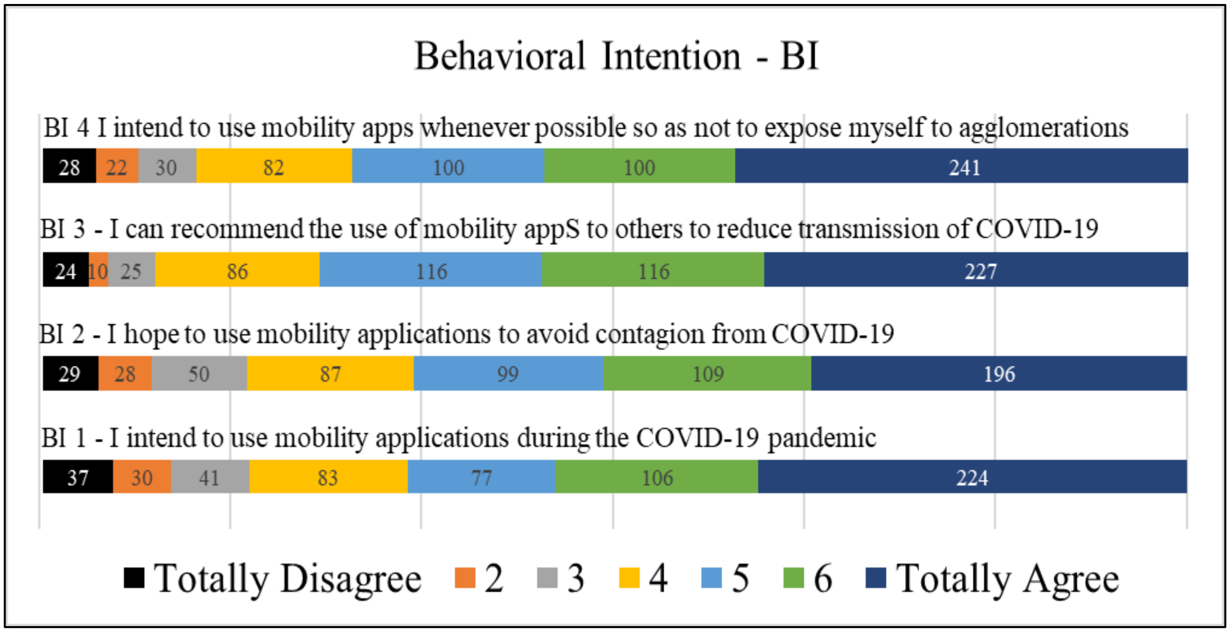

Figure 32 - Survey Results – Behavioral Intention

Respondents have high Risk Perception of using mass transportation systems in times of pandemic (Risk Perception average of 6.22). Respondents think that using public transportation is risky during COVID-19 (RP1 average of 6.28); they think that the use of public transportation can cause health problems during COVID-19 (RP2 average of 6,11); they think the use of public transportation can infect them with COVID-19 (RP3 average of 6.14); and respondents think they are exposed to many risks when using public transportation during COVID-19 (RP4 average of Avg 6.35) (Figure 33).

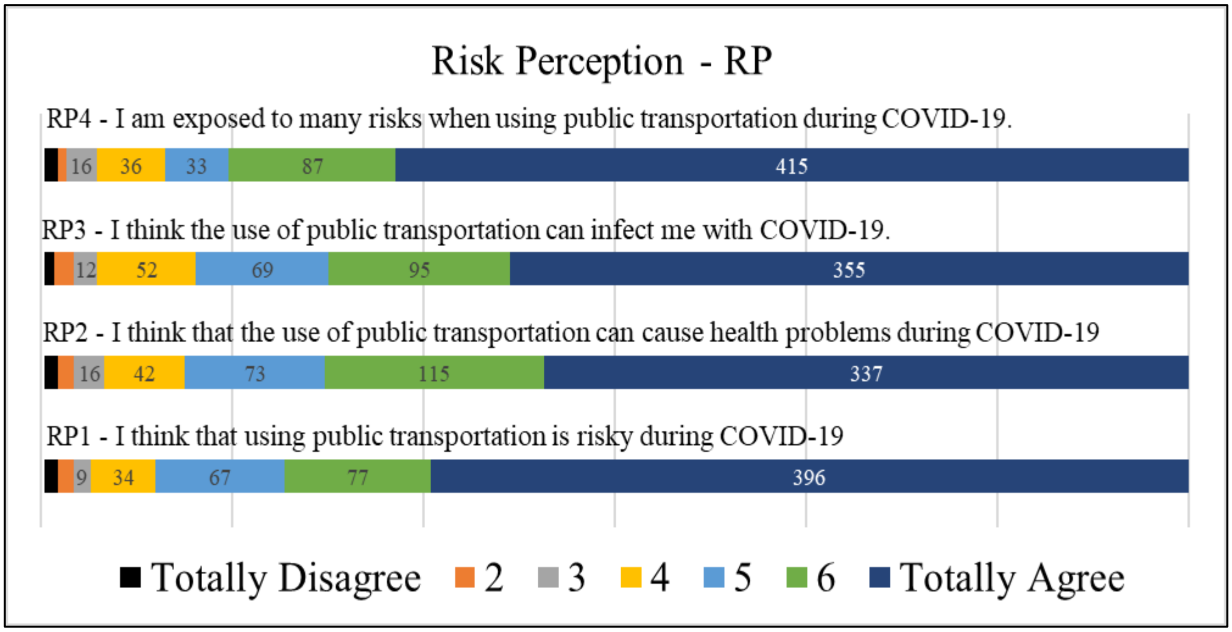

Figure 33 - Survey Results – Risk Perception

4.4 STRUCTURAL EQUATION MODELING RESULTS

The Smart PLS Algorithm default settings maintained. The path weighting selection was used because it is the recommended approach, providing the highest R^2 value for endogenous latent variables and is generally applicable. The 300 maximum iterations option was maintained. The Stop criterium was kept at 10^{-7}.

First, the measuring model was evaluated. The results of the initial measurement model showed that four items with paths under 0,5 (ADV5, ADV6, CPT4 and PBC1) were problematic due to their low factor loadings, therefore were eliminated for the necessary adjustments. After these adjustments, Relative Advantage (CA = 0,687 and AVE = 0,401), and Perceived Behavioral Control (CA = 0,530 and AVE = 0,419) were removed from the model for not reaching Cronbach's Alfa (CA) and Average Variance Extracted (AVE) criteria limits (CA > 0,7 and AVE > 0,5). AVEs greater than 0.50 show the model converges with a satisfactory result. CA and CR values above 0.70 are considered satisfactory. Also, discriminant validity was confirmed. The Outer Loading indicators have higher factorial loads in their respective construct than in others (Appendix 3). Also, the square roots of the AVE values of each construct were greater than the correlations between the constructs according to the criteria of Fornell & Larcker (1981). The

Variance Inflation Factor (VIF) values for all items below 3.3 indicates that there is no multicollinearity (Appendix 3). The adjusted model has confirmed its reliability, being the sample free of biases (Figure 34).

	CA	CR	AVE	AGE	ATT	BI	CPT	OBS	RP	SN	SPL
AGE	1.000	1.000	1.000	**1.000**							
ATT	0.794	0.880	0.709	0.035	**0.842**						
BI	0.842	0.894	0.678	0.051	0.698	**0.823**					
CPT	0.711	0.837	0.632	0.076	0.336	0.555	**0.795**				
OBS	0.761	0.863	0.677	-0.037	0.291	0.300	0.384	**0.823**			
RP	0.814	0.877	0.641	0.030	0.212	0.290	0.191	0.306	**0.800**		
SN	0.825	0.896	0.741	0.005	0.630	0.753	0.498	0.334	0.240	**0.861**	
SPL	0.758	0.859	0.671	-0.031	0.298	0.272	0.367	0.498	0.239	0.266	**0.819**
(CA) Cronbach's Alpha			(CR) Composite Reliability				(AVE) Average Variance Extracted				

Figure 34 - CA, CR, AVE & Discriminant Validity

After the measuring model was adjusted and validated, the path model was evaluated. The first evaluation performed was the Pearson's coefficients (R^2). It evaluates the portion of the variance of the endogenous variables explained by the structural model. R^2 indicates the quality of the adjusted model. Cohen (1988) suggests that R^2 = 2% as classified as having a small effect, R^2 = 13% as a medium effect, and R^2 = 26% as having a large effect, for the field of the social and behavioral sciences. The results show that Behavioral Intention has a large effect (66%), Attitude has a medium effect (17%), Subjective Norm has a small effect (5,6%) and Risk Perception has no effect (0,01%) (Figure 35).

Next, two other indicators of the quality of the model adjustment are evaluated: Predictive Validity (Q^2) and Effect Size or Cohen's Indicator (f^2). F^2 values of 0.02, 0.15 and 0.35 are considered small, medium, and large respectively (Hair et al., 2014). To test Predictive Validity (Q^2), the Blindfolding module was used. Basic Settings were used: Omission Distance - Default: 7.

Q^2 evaluates the model prediction quality (or accuracy of the adjusted model) and is obtained by reading the general redundancy of the model. Values greater than zero should be obtained (Hair et al., 2014). A perfect model would have $Q^2 = 1$. All Q^2 values are above zero, indicating the results provide strong evidence signifying the predictive ability of the hypothesized theoretical model (Figure 35).

The Effect Size or Cohen's Indicator (f^2) is obtained by the individual inclusion and exclusion of model constructs. F^2 evaluates how useful the individual construct is for the adjustment model. Values of 0.02, 0.15 and 0.35 are considered small, medium, and large respectively (Hair et al., 2014). The results demonstrate that Risk Perception has a small effect (f^2 = 0,023) on Behavioral Intention, Attitude has a medium effect (f^2 = 0,0226), and Subjective Norm has a large effect (f^2 = 0,438) (Figure 35).

	R^2	Effect	Q^2	f^2	Effect
ATT	0.169	medium	0.408	0.226	medium
BI	0.658	large	0.457	--	--
RP	0.001	--	0.399	0.023	small
SN	0.057	small	0.463	0.438	large

Figure 35 - Pearson's coefficients (R^2), Predictive Validity (Q^2) and Effect (f^2)

To test the significance of the constructs relations, the Bootstrapping module was used. The default setup used for Bootstrapping was: 500 subsamples; do parallel processing; Basic Bootstrapping; Confidence Interval Method: Bias-Corrected and Accelerated (BCa) Bootstrap; Test Type: two tailed; and Significance Level: 0,05. Figure 36 shows a summary of the hypothesis testing results.

HYPOTHESIS		(O)	(M)	(STDEV)	(|O/STDEV|)	P Values	(HTR)
H1	ADV => ATT						Not supported
H2	CPT => ATT	0.226	0.228	0.046	4.942	0.000	Supported
H3	OBS => ATT	0.102	0.099	0.058	1.779	0.076	Not supported
H4	SPL => ATT	0.140	0.141	0.052	2.710	0.007	Supported
H5	PBC => BI						Not supported
H6	ATT => BI	0.360	0.361	0.042	8.519	0.000	Supported
H7	SN => BI	0.503	0.503	0.041	12.172	0.000	Supported
H8	RP => PBC						Not supported
H9	RP => ATT	0.104	0.108	0.046	2.250	0.025	Supported
H10	RP => SN	0.240	0.243	0.044	5.486	0.000	Supported
H11	RP => BI	0.092	0.093	0.029	3.230	0.001	Supported
H12	AGE => RP	0.030	0.032	0.038	0.769	0.442	Not supported
H13	AGE => BI	0.033	0.032	0.022	1.459	0.145	Not supported
(O) Original Sample or β			(M) Sample Mean		(STDEV) Standard Deviation		
(|O/STDEV|) T Statistics				(HTR) Hypothesis Testing Results			

Figure 36 - Hypothesis Testing Results

The survey results demonstrate that Compatibility ($\beta = 0,226$; t = 4,942; p = 0,000), and Complexity ($\beta = 0,140$; t = 2,710; p = 0,007) positively influence Attitude, supporting Hypothesis H2 and H4. Attitude ($\beta = 0,360$; t = 8,590; p = 0,000), and Subjective Norms ($\beta = 0,503$; t = 12,172; p = 0,000) positively influence Behavioral Intention to adopt mobility apps in the RMSP in pandemic times, supporting hypothesis H6 and H7. Risk Perception in taking mass public transportation positively influences Attitude ($\beta = 0,104$; t = 2,250; p = 0,025), Subjective Norms ($\beta = 0,240$; t = 5,486; p = 0,000) and Behavioral Intention ($\beta = 0,092$; t = 3,230; p = 0,001), supporting hypothesis H9, H10 and H11.

The result of Hypothesis 6 is consistent with the study about consumer adoption of the Uber mobile application by Min et al., (2019): users' Attitude is positively related to their future usage intention the Uber mobile application ($\beta = 0,550$; t = 8,702; p = 0,000).

The influence of Age in Risk Perception ($\beta = 0,030$; t = 0,769; p = 0,442) and in Behavior Intention ($\beta = 0,033 = 1,459$; p = 0,145) was not significant, not supporting H12 and H13. Results confirm the appropriateness of DTPB model which has large explanatory power for Behavioral Intention ($R^2 = 0.658$) in predicting the adoption of shared mobility applications in response to the COVID-19 pandemics. The model has medium effect (R^2 = 0.169) in predicting Attitude and a small effect (R^2 = 0.057) in predicting Subjective Norms. Figure 37 shows the model with total effects and R^2.

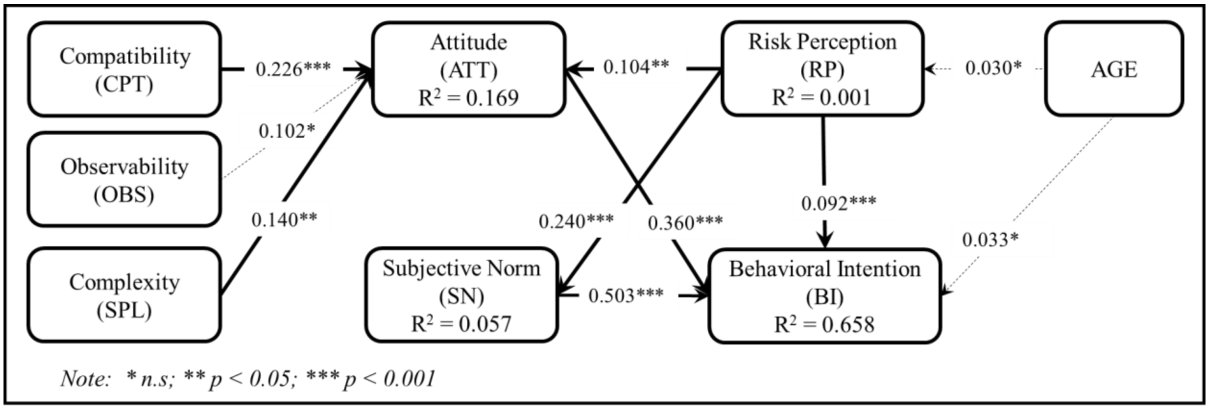

Figure 37 - Model with Total Effects and R^2

Source: Extracted from Smart PLS 3.0 software

Attitude and Subjective Norms mediate the Risk Perception to get infected in mass transportation significantly and positively affecting the Behavioral Intention to adopt mobility apps in the RMSP in Pandemic Period (Figure 38). Zhang et al., (2019) study results also indicate that Subjetive Norm and consumers' Attitude mediate the relationship between H7N9 Risk Perception and poultry consumption Intention.

MEDIATION	(O)	(M)	(STDEV)	(|O/STDEV|)	P Values	RESULT
RP => ATT => BI	0.037	0.039	0.017	2.169	0.031	supported
RP => SN => BI	0.121	0.123	0.023	5.338	0.000	Supported

Figure 38 - Mediation test Results

4.5 DISCUSSIONS

The model used in our study was the Decomposed Theory of Planned Behavior, borrowing constructs from the Innovation Diffusion Theory, adding Risk Perception to the research model. This Risk Perception is a real concern, especially for people in the RMSP where, a large quantity of passengers uses crowded mass public transport systems, especially during rush hours. These travelling conditions may help spread contagious infections via direct or indirect contact.

Ellaway et al., (2003) study showed that respondents who had access to a private vehicle believed that it provided more protection when compared to public transportation. Gatersleben (2007) conducted an analysis to understand the main reasons have for using a private vehicle. One of the reasons was personal space concern. Hiscock et al., (2002) suggest that private vehicles are believed to provide more psycho-social benefits than public transport in terms of undesirable social contact and personal space. The findings of Troko et al., (2011) suggest that use of public transportation is a significant individual risk factor for the acquisition of respiratory infections.

Our results demonstrated that Risk Perception in taking mass public transportation has a significant relationship and positively affects Attitude, Subjective Norms and Behavioral Intention to adopt mobility apps in the RMSP (Hypotheses 9, 10 and 11). In his study, El Khatib (2020) demonstrated that the greater the perception of risk that consumers have, stronger is the Attitude of buying reserve food during COVID-19. Both studies demonstrate that the Risk Perception, in cases of pandemics like the COVID-19, will cause the intention to engage in behaviors that try to preserve one's own health and well-being. The main reason for this Behavioral Intention to adopt mobility apps in the RMSP in pandemic times is the belief that social distancing will not be achieved in mass transportation services. Respondents think that using public transportation in times of pandemic is risky and fear that they may get infected with COVID-19 when using the mass transport system.

Although H1- Relative Advantage (ADV) has a significant relationship and positively affects Attitude (ATT) to adopt mobility apps in the RMSP - was not supported, respondents positively perceive the Relative Advantage of the mobility apps when compared to the mass transportation system. This perception was confirmed by Rayle et al., (2014) study where respondents claimed they prefer ridesharing services due to Relative Advantages such as easiness to request a vehicle, easy of payment, short waiting times, no need to drive after drinking and avoiding the hassle of parking. Our result contrast with Min, So & Jeong (2019). Their results suggest that Relative Advantage has a significant influence on both perceived usefulness and perceived ease of use, therefore leading to consumer Attitude and future usage intention.

Using mobility apps allows respondents to get things done faster; using mobility apps makes their lives easier; mobility applications have more advantages than disadvantages, and, when compared to taxis, waiting times for mobility applications are shorter and fares are more predictable. However, respondents were neutral regarding the help of mobility apps to improve their performance at work or everyday activities and the ability of the app to help respondents save money. Relative Advantage was removed from the model for not reaching criteria limits.

Hypothesis 2 - Compatibility has a significant relationship and positively affects Attitude to adopt mobility apps in the RMSP in Pandemic Period - was supported. Our conclusion is in accordance with Moons & De Pelsmacker (2015) results that state Compatibility has a strong effect on electric vehicles adoption usage intention. Lee, Hsieh & Hsu (2011) demonstrate that Compatibility has a significant influence in employees Behavioral Intention to use E-Learning. In the DTPB, Compatibility is one of the antecedents of the Attitude towards the behavior (Rogers, 2010).

In the study of electric shared scooters adoption, Eccarius & Lu (2020) confirm Compatibility of ESS with transport needs and personal values has the largest effect on usage intention. The results of Lopes, Kniess & Ramos (2015) study demonstrates Compatibility positively influence the decision process of Balanced Scorecard adoption. Our respondents positively perceive the mobility apps Compatibility. Mobility applications serve respondents urban transport needs well; mobility applications can be used in combination with mass transport systems. Respondents are neutral regarding the Compatibility of mobility apps with all aspects of their activities and Compatibility with the use of mobility apps to their lifestyles.

Mobility apps Observability scored the highest average (6.32 on a scale of 1 to 7) of all the constructs. Respondents can see many people using mobility applications, respondents hear many people say that they use mobility applications, and respondents know many people who use mobility applications. However, Observability demonstrated a non-significant association with Attitude, suggesting that Observability is a weak predictor of Attitude to adopt mobility apps in the RMSP in Pandemic Period (Hypothesis 3), not confirming Rogers (2010), that proposed Observability as one of the antecedents of the Attitude towards the behavior.

H4 - Complexity (SPL) has a significant relationship and positively affects Attitude (ATT) to adopt mobility apps in the RMSP in Pandemic Period - was supported. In the DTPB, Complexity is one of the antecedents of the Attitude towards the behavior (Rogers, 2010). Respondents positively perceive mobility apps Complexity. Respondents agree the use of mobility applications is easy to learn; mobility applications are simple to operate; it is easy to request a trip through the mobility applications and mobility apps make it easy to pay for a trip.

Lee, Hsieh & Hsu (2011) demonstrate Complexity has a significant influence in employees Behavioral Intention to use E-Learning. Lopes, Kniess & Ramos (2015) study results demonstrated Easy-of-use or Complexity positively influence the decision process of BSC adoption. Of the four constructs borrowed from IDT (Relative Advantage, Compatibility, Observability and Complexity), only Compatibility and Complexity could be demonstrated to have a significant relationship and to positively influence Attitude with medium effect.

Although respondents positively respond to the Perceived Behavioral Control they have over the use of mobility apps, H5 - Perceived Behavioral Control has a significant relationship and positively affects Behavioral Intent to adopt mobility apps in the RMSP - was not supported. Respondents still think they are able to operate mobility applications; they have the resources (cash, credit / debit card, smartphone) to use mobility applications; they feel comfortable using mobility apps; and they perceive mobility apps are easily available on their smartphones.

Our results are in accordance with Moons & De Pelsmacker (2015) study to investigate electric vehicles adoption process. Perceived Behavioral Control (ability, constraints and facilitators) do not substantially affect usage intention. Perceived Behavioral Control was also removed from our model for not reaching criteria limits, dismissing H8 - The Risk Perception (RP) to get infected in mass transportation has a significant relationship and positively affects Perceived Behavioral Control (PBC).

H6 - Attitude (ATT) has a significant relationship and positively affects Behavioral Intention (BI) to adopt mobility apps in the RMSP in pandemic period - was supported. According to Hamari et al., (2015), Attitude towards Collaborative Consumption positively influences Behavioral Intention. Zhu, So & Hudson (2017) results indicate that Attitude has a strong effect on ridesharing apps adoption intention. Based on Min, So, & Jeong (2019), users Attitude is positively related to Behavior Intention to use mobile app. Zhang et al., (2019) defend a positive relationship between Attitude and Behavioral Intention exists in emergency situations such as H7N9.

Our respondents have a positive Attitude regarding the use of mobility apps. They consider using mobility apps during the pandemic a safe Attitude; using mobility apps in times of pandemics is a good idea; they like to use mobility apps; and using mobility applications during COVID-19 is convenient to avoid crowding. Attitude mediates the Risk Perception to get infected in mass transportation significantly and positively affecting the Behavioral Intention.

H7 - Subjective Norm (SN) has a significant relationship and positively affects Behavioral Intention (BI) to adopt mobility apps in the RMSP in Pandemic Period - was supported. Our study result is in accordance with Ajzen (1991), Moons & De Pelsmacker (2015) and Zhang et al., (2019). Subjective Norm positively affects Behavioral Intention.

Respondents positively perceived the Subjective Norm to use mobility apps in times of pandemic. People important to the respondents think that using mobility apps would be a safe Attitude during COVID-19; and people whose opinion the respondents value think that they should use mobility apps to avoid crowds. However, respondents are neutral about their families' opinion whether they should use mobility apps in times of a pandemic. Subjective Norms mediates the Risk Perception to get infected in mass transportation significantly and positively affecting the Behavioral Intention.

In our study, the influence of Age in Risk Perception and in Behavior Intention could not be proven to be significant (Hypotheses 12 and 13). This may be explained by the relatively low respondents age average of the sample (24,3 years) combined with the small size of the elderly group (45 years or older) with just 5% of the respondents. A group of 198 respondents who answered "never or rarely" to the frequency of use of public transport averaged 35,3 years of age was eliminated from the sample.

5 FINAL CONSIDERATIONS

The novel nature of COVID-19 pandemic and uncertainty about it makes the formulation of pandemic transport policies difficult (Gkiotsalitis & Cats, 2020; El Khatib, 2020; Young & Farber, 2019; Troko et al., 2011). The mass public transport system in the RMSP has recorded controversial and troubled decisions since the beginning of the pandemic, being target of criticism. Blocking streets for private car circulation and reducing the bus fleet, for example, are measures that increase the perceived risk for spreading infectious diseases during transportation. Whether these interventions were effective to reduce spread of the disease is still unclear (Lai, Shih, Ko, Tang & Hsueh, 2020).

Understanding factors that impact behavior intention to select transportation services may help governments and organizations prioritize their actions during pandemics like COVID-19. This pandemic has also made evident the need to be better prepared for future disruptions. Results from this study have the potential to provide practical, theoretical and methodological contributions.

5.1 PRACTICAL IMPLICATIONS

To close the identified research gap, the DTPB research model and constructs were selected to analyze Risk Perception impact on customers’ intentions to engage in mobility application services in the RMSP in times of COVID-19 pandemics. Starting from two well-established theories, the TPB and IDT, we develop a DTPB model by specifying key factors that are influential in the formation of Behavioral Intention, and the influence of Risk Perception and Age. Our study incorporated the key elements of IDT to better understand the adoption of mobility apps in times of social unrest.

A final sample of 598 valid responses were collected from February 16 to March 5. Our respondents have high Risk Perception of using mass transportation systems in times of pandemic. Results confirm the appropriateness of DTPB model which has good explanatory power (R^2 = 0.658) in predicting Behavioral Intention. Results demonstrate Compatibility and

Complexity positively influence Attitude. Subjective Norms and Attitude positively influences Behavioral Intention to adopt mobility apps in the RMSP in pandemic times.

Risk Perception in taking mass public transportation significantly and positively influences Subjective Norms, Attitude and Behavioral Intention. Attitude and Subjective Norms mediate the Risk Perception to get infected in mass transportation significantly and positively affecting the Behavioral Intention. The results of the survey can be important transport practitioners and policy makers to provide insights to help understand the motivation and barriers for effective deployment of mobility applications, especially in times of social unrest, such as a pandemic (Barbieri et al., 2020).

The development of ICT has disrupted many fields of human endeavor, transforming the way we request a vehicle and experience travel. The Shared Economy has challenged the way we consider ownership. Understand consumer motivations behind technology adoption for businesses is needed.

According to (Boehm, 2020), mobility app companies took immediate measures in the RMSP to improve protection for passengers and drivers: use of masks by the driver; cars cleaned by a specialized company; protective shields were installed and alcohol gel made available. 56% of the population consider mobility apps to be the safest form of transportation during the pandemic (Boehm, 2020).

By limiting the use of the rear seat only, each trip with the Uber app will have one less passenger seat available. Uber trips can have a maximum of 3 users. At the end of the trip, drivers and users will be evaluated in terms of hygiene. Drivers are able to cancel trips, with no impact on the cancellation rate, if they feel unsafe at the time of boarding, like in the case the user is not wearing a mask. The user can also cancel without any kind of fee if the driver is not wearing a mask (UBER, 2020).

Mobility app companies should promote the benefits of their service to make it even more attractive (Min, So & Jeong, 2019). Convenience and cost-effectiveness should therefore be emphasized. These companies should reinforce mobility apps help users improve performance at work or everyday activities by allowing them to get things done faster. Mobility apps should emphasize their users have the opportunity to spare driving time, converting it into more productive activities. Mobility apps also help users save money by reducing vehicle ownership costs.

The use of mobility apps to help the environment by reducing traffic congestion and pollution emissions should be communicated (Shaheen & Cohen, 2013). Mobility apps are compatible with other transport means and when compared to taxis, waiting times for mobility applications are shorter and fares are more predictable.

Important to mention is the fact that only a small percentage of respondents (9.5%) reported “never or rarely” to the frequency of use of mobility applications, whereas 92.6% of the respondents reported “never or rarely” to the frequency of use of regular taxis. The Datafolha survey showing 66% of RMSP residents believe preference for mobility applications will increase, is extremely concerning for the regular taxi business (Boehm, 2020). This shows a shift in the preference of mobility apps at the expense of taxi usage.

Traditional taxi owners may be encouraged to improve their own services in response to the new competition. Actions to reinvent the regular taxi business to adapt to customer changing requirements and expectations are required. Taxi owners should, for example, make sure their cars are clean, run air conditioner at comfortable temperatures, avoid talking on the cellphone while driving and ensuring credit card readers are operable. Otherwise, this business will be doomed to extinction.

Respondents in the RMSP in pandemic times believe social distancing will not be achieved in mass transportation services. They fear that they may get infected with COVID-19 when using the mass transport system (Hendrickson & Rilett, 2020). Mobility app companies and regular taxis can benefit from Risk Perceptions of getting infected in mass transport systems, providing transportation needs during pandemics like COVID-19 in this urban setting.

5.2 THEORETICAL & METHODOLOGICAL CONTRIBUTIONS

According to Gkiotsalitis & Cats (2020), there is a lack of knowledge understanding challenges posed by pandemic transmission on public transport operations. Risk Perception is known to be missing in the original TPB model (Norman, Conner & Bell, 1999, Abdulkareem et al., 2020). Current existing theory is unable to fully understand the customers' intentions in the sharing economy (Mittendorf, 2017).

This study contributes to developing some of this knowledge, integrating two of the most widely known theories (IDT and TPB) and adding Risk Perception to the research model. Results confirm the appropriateness of DTPB model which has good explanatory power in predicting adoption intention of shared mobility applications in response to the COVID-19 pandemics.

This study presents a research instrument adapted from established existing scales. The questions used by Moore & Benbasat (1991); Min, So & Jeong (2019); Rayle et al., (2014); Eccarius & Lu (2020); Shih & Fang (2004); Moons & De Pelsmacker (2015); Zhang et al., (2019) were translated to Portuguese. Whenever necessary, questions were adapted from a professional to a everyday life focus (easier to my job / easier for everyday life).

The questions were adapted in a way to enable respondents to answer them easily and accurately, without ambiguity, making sure a regular citizen had enough knowledge for that. Questions were also kept at a minimum to improve responsiveness and reduce time necessary to respond the survey. Two-edged questions (contains two different ideas) with possible contradictory answers were rephrased to avoid confusion (Kitchenham & Pfleeger, 2002). Whenever necessary, the time period was especified to make answers more precise (Kitchenham & Pfleeger, 2002).

5.3 LIMITATIONS AND FUTURE STUDIES

The continuity of the quarantine due to the Coronavirus pandemic in the RMSP, made it difficult to investigate and analyze consumer mobility app actual behavior. Therefore, our research focused on consumer intentions. Future studies could include Actual mobility app usage.

Time constraints limited the possibility of this study to add measures to the study to locate respondents in the continuum of innovativeness scale (innovators, earlier adopters, initial majority, and laggards). That would be helpful to study user innovation readiness Behavioral Intention to adopt mobility apps in times of social unrest like a pandemic. Another relevant factor to be studied may be users technological background (Zhu, So & Hudson, 2017).

Due to the relatively low respondents age average of the sample (24,3 years), influence of Age in Risk Perception and in Behavior Intention could not be proven to be significant in our study. This may have limited the quality of the conclusions. Since age is a factor contributing to higher risk fatality related with COVID-19 (Bastos & Cajueiro, 2020; Singh & Adhikari, 2020; Demombynes, 2020; Caramelo, Ferreira & Oliveiros, 2020; and Bonanad et al., 2020), future studies could try to balance different age groups and retest the hypothesis 12 and 13.

Data collection procedure via online questionnaire is also in itself a limitation. It restricts the sample mostly to the researcher's network. To increase diversification of respondents, future surveys could include physical questionaries to be distributed and filled, or other data collection methods.

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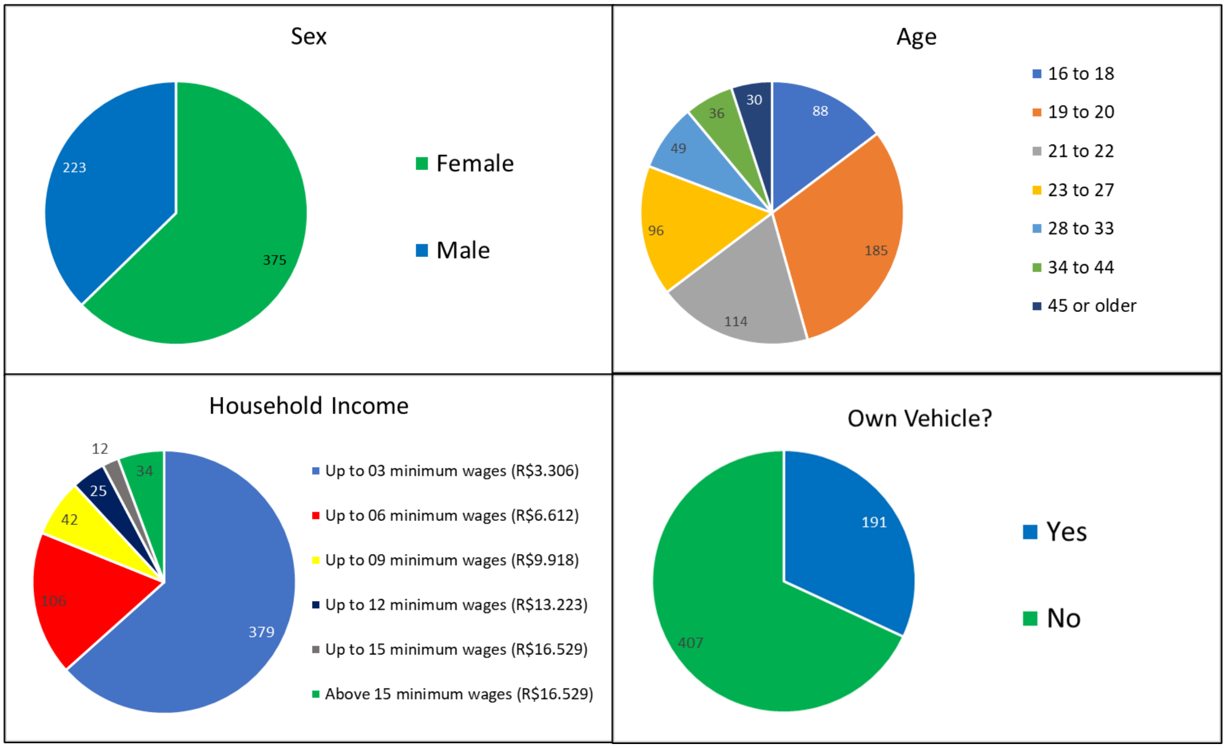
APPENDIX 1 – CONSTRUCTS, ORIGINAL ITEMS, EVALUATIONS AND ADJUSTMENTS

Construct		Original Item	Reference	Translation, adaptation to fit the research object and pandemic context	Evaluation by experts, evaluation by target audience and final adjustments
ADV	1	Using a Personal Work Station (PWS) enables me to accomplish tasks more quickly	Moore & Benbasat (1991)	Usar aplicativos de mobilidade (Uber, 99, Cabify ou outros) me habilita a realizar tarefas mais rapidamente	Usar aplicativos de mobilidade me permite realizar tarefas mais rapidamente
	2	Using a PWS makes it easier to do my job		Usar aplicativos de mobilidade (Uber, 99, Cabify ou outros) facilita realizar meu trabalho.	Usar aplicativos de mobilidade torna minha vida mais fácil.
	3	Using a PWS improves my job performance.		Usar aplicativos de mobilidade (Uber, 99, Cabify ou outros) melhora meu desempenho no trabalho.	Usar aplicativos de mobilidade melhora meu desempenho no trabalho ou atividades cotidianas.
	4	The disadvantages of my using a PWS far outweigh the advantages (rev).		As desvantagens de utilizar aplicativos de mobilidade (Uber, 99, Cabify ou outros) superam em muito as vantagens (rev).	Os aplicativos de mobilidade possuem mais vantagens do que desvantagens.
	5	Uber mobile application saves me money compared to taking a regular taxi.	Min, So & Jeong, 2019	Usar aplicativos de mobilidade (Uber, 99, Cabify ou outros) me ajuda a economizar dinheiro quando comparado a pegar um taxi regular.	Usar aplicativos de mobilidade me ajuda a economizar dinheiro.
	6	When compared to taxis, ridesharing wait times are shorter, and fares are more predictable	Rayle *et al* (2014)	Quando comparados aos táxis, aplicativos de mobilidade (Uber, 99, Cabify ou outros) possuem tempos de espera menores e tarifas mais previsíveis	Quando comparados aos táxis, os tempos de espera dos aplicativos de mobilidade são menores e as tarifas são mais previsíveis
CPT	7	Using a PWS is compatible with all aspects of my work.	Moore & Benbasat (1991)	Usar aplicativos de mobilidade (Uber, 99, Cabify ou outros) é compatível com todos os aspectos do meu trabalho.	Usar aplicativos de mobilidade é compatível com todos os aspectos de minhas atividades.
	8	Using a PWS fits into my work style.		Os aplicativos de mobilidade (Uber, 99, Cabify ou outros) se ajustam bem à maneira de trabalhar.	Usar aplicativos de mobilidade é compatível com meu estilo de vida.
	9	Using EMS fits my transportation needs.	Eccarius & Lu (2020)	Os aplicativos de mobilidade (Uber, 99, Cabify ou outros) atendem minhas necessidades de transportes.	Os aplicativos de mobilidade atendem bem minhas necessidades de transporte urbano.
	10	Uber mobile application fits with my service needs.	Min, So & Jeong, 2019	Os aplicativos de mobilidade (Uber, 99, Cabify ou outros) atendem minhas necessidades de serviços.	Os aplicativos de mobilidade podem ser usados em conjunto com outros sistemas de transporte (ônibus, vans, metrô ou trens).
OBS	11	I have seen others using Uber mobile application	Min, So & Jeong, 2019	Tenho visto outros utilizando aplicativos de mobilidade (Uber, 99, Cabify ou outros).	Posso ver muitas pessoas usando aplicativos de mobilidade.
	12	It is easy for me to observe others using Uber mobile application in my social group.		É fácil para mim observar outros utilizando aplicativos de mobilidade (Uber, 99, Cabify ou outros) em meu grupo socal.	Ouço muitas pessoas dizer que usam os aplicativos de mobilidade.
	13	In my social group, I see Uber mobile application on many people's smartphones.		Em meu grupo social, vejo a utilização de aplicativos de mobilidade (Uber, 99, Cabify ou outros) nos smartphones de muitas pessoas.	Conheço muitas pessoas que utilizam aplicativos de mobilidade.
SPL	14	Internet Banking (IB) use is easy to learn and it is important to me	Shih & Fang (2004)	O uso dos aplicativos de mobilidade (Uber, 99, Cabify ou outros) é fácil de aprender e importante para mim.	O uso dos aplicativos de mobilidade é fácil de aprender.
	15	IB is easy to operate and it is important to me		Os aplicativos de mobilidade (Uber, 99, Cabify ou outros) são simples de operar e são importantes para mim.	Os aplicativos de mobilidade são simples de operar.
	16	I believe that a PWS is cumbersome to use (rev).	Moore & Benbasat (1991)	O uso dos aplicativos de mobilidade é (Uber, 99, Cabify ou outros) complicado (rev).	É fácil solicitar uma viagem pelos aplicativos de mobilidade.
	17	Compared to taking a regular taxi, Uber mobile application enables me to make a payment in a more convenient way.	Min, So & Jeong, 2019	Comparado a pegar um taxi convencional. os aplicativos de mobilidade (Uber, 99, Cabify ou outros) me habilitam pagar de uma maneira mais conveniente.	Os aplicativos de mobilidade facilitam o pagamento de uma viagem.

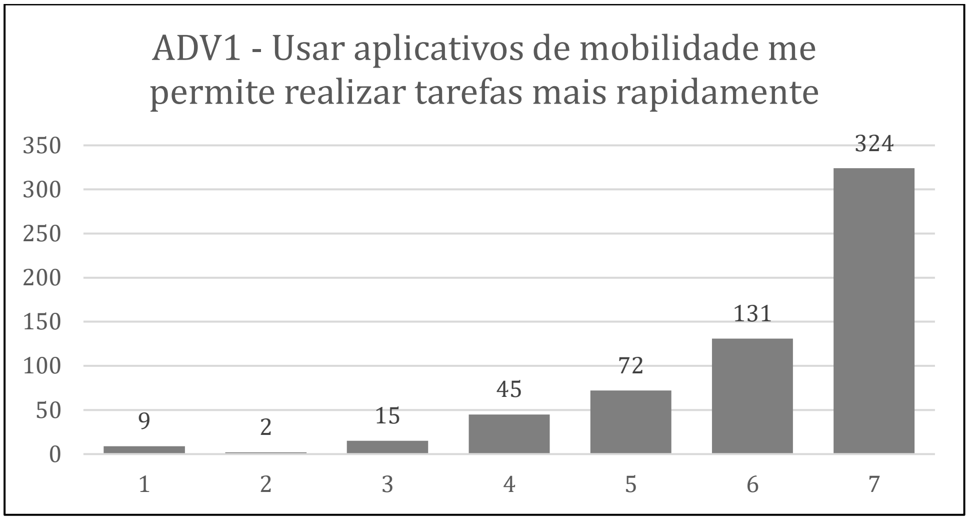
Construct		Original Item	Reference	Translation, adaptation to fit the research object and pandemic context	Evaluation by experts, evaluation by target audience and final adjustments
ATT	18	Using Internet Banking would be a wise idea	Shih & Fang (2004)	Usar aplicativos de mobilidade (Uber, 99, Cabify ou outros) durante a pandemia é uma ideia inteligente.	Usar aplicativos de mobilidade durante a pandemia é uma atitude segura.
	19	Using Internet Banking is a good idea		Usar aplicativos de mobilidade (Uber, 99, Cabify ou outros) durante a pandemia é uma boa ideia.	Usar os aplicativos de mobilidade em tempo de pandemia é uma boa ideia.
	20	I like to use Internet Banking		Eu gosto de usar aplicativos de mobilidade (Uber, 99, Cabify ou outros).	Eu gosto de usar aplicativos de mobilidade.
	21	Using Internet Banking is dangerous (Rev)		Usar aplicativos de mobilidade (Uber, 99, Cabify ou outros) é perigoso (rev).	Usar aplicativos de mobilidade é conveniente para evitar alomerações.
SN	22	People important to me would think that using Internet Banking would be a wise idea	Shih & Fang (2004)	Pessoas importantes para mim acham que usar aplicativos de mobilidade (Uber, 99, Cabify ou outros) seria uma ideia inteligente.	Pessoas importantes para mim acham que usar aplicativos de mobilidade seria uma atitude segura.
	23	My family important to me would think I should use Internet Banking		Minha família importante para mim acha que eu deveria usar aplicativos de mobilidade (Uber, 99, Cabify ou outros) durante a pandemia.	Minha família acha que eu deveria usar aplicativos de mobilidade em tempos de pandemia
	24	People whose opinion I value think I should use Internet Banking		Pessoas cuja opinião eu valorizo acham que eu deveria usar aplicativos de mobilidade (Uber, 99, Cabify ou outros).	Pessoas cuja opinião eu valorizo acham que eu deveria usar aplicativos de mobilidade para evitar alomerações.
PBC	25	I would be able to operate Internet Banking	Shih & Fang (2004)	Eu seria capaz de operar aplicativos de mobilidade (Uber, 99, Cabify ou outros).	Eu sou capaz de operar aplicativos de mobilidade.
	26	I have the resources to use Internet Banking		Tenho os recursos para operar aplicativos de mobilidade (Uber, 99, Cabify ou outros).	Tenho os recursos (dinheiro, cartão de crédito / débito, smartphone) para utilizar aplicativos de mobilidade.
	27	I would feel comfortable using Internet Banking and it is important to me		Eu me sentiria confortável usando aplicativos de mobilidade (Uber, 99, Cabify ou outros).	Eu me sinto confortável usando aplicativos de mobilidade.
	28	The Internet Banking system is available for me		Os sistemas de aplicativos de mobilidade (Uber, 99, Cabify ou outros) estão disponíveis para mim.	Aplicativos de mobilidade estão facilmente disponível no meu smartphone.
INT	29	I have the intention to drive an electric car in the near future	Moons & De Pelsmacker, 2015	Tenho a intenção de usar aplicativos de mobilidade (Uber, 99, Cabify ou outros) em um futuro próximo.	Tenho a intenção de usar aplicativos de mobilidade durante a pandemia do COVID-19.
	30	I expect that I will be driving an electric car in the near future		Espero usar aplicativos de mobilidade (Uber, 99, Cabify ou outros) em um futuro próximo.	Espero usar aplicativos de mobilidade para evitar contágio da COVID-19.
	31	I will recommend the use of the electric car to other people		Eu vou recomendar o uso dos aplicativos de mobilidade (Uber, 99, Cabify ou outros) a outras pessoas.	Posso recomendar o uso dos aplicativos de mobilidade a outras pessoas para reduzir transmissão de COVID-19.
	32	I will drive na electric car whenever possible		Eu utilizo aplicativos de mobilidade (Uber, 99, Cabify ou outros) sempre que possível.	Pretendo usar aplicativos de mobilidade sempre que possível para não me expor a aglomerações.
RP	33	I think eating poultry is risky during H7N9	Zhang, Y., Yang, H., Cheng, P., & Luqman, A. (2019)	Acho que usar transporte coletivo (ônibus, vans, metrô ou trens) é arriscado durante o COVID-19.	Acho que usar transporte coletivo (ônibus, vans, metrô ou trens) é arriscado durante o COVID-19.
	34	I think eating poultry may cause health problems from H7N9		Acho que o uso de transporte coletivo (ônibus, vans, metrô ou trens) pode causar problemas de saúde durante o COVID-19.	Acho que o uso de transporte coletivo (ônibus, vans, metrô ou trens) pode causar problemas de saúde durante o COVID-19.
	35	I think eating poultry may cause me infected by H7N9		Eu acho que o uso de transporte coletivo(ônibus, vans, metrô ou trens) pode me infectar por COVID-19.	Eu acho que o uso de transporte coletivo (ônibus, vans, metrô ou trens)pode me infectar por COVID-19.
	36	I am exposed to much risk when I eating poultry during H7N9		Estou exposto a muitos riscos ao usar o transporte coletivo (ônibus, vans, metrô ou trens) durante o COVID-19.	Estou exposto a muitos riscos ao usar o transporte coletivo (ônibus, vans, metrô ou trens) durante o COVID-19.

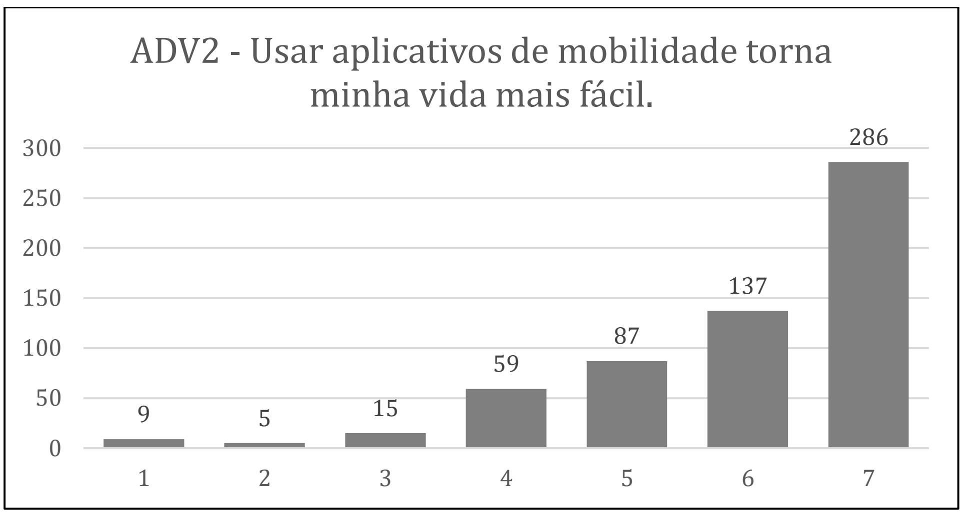
APPENDIX 2 – RESULTS

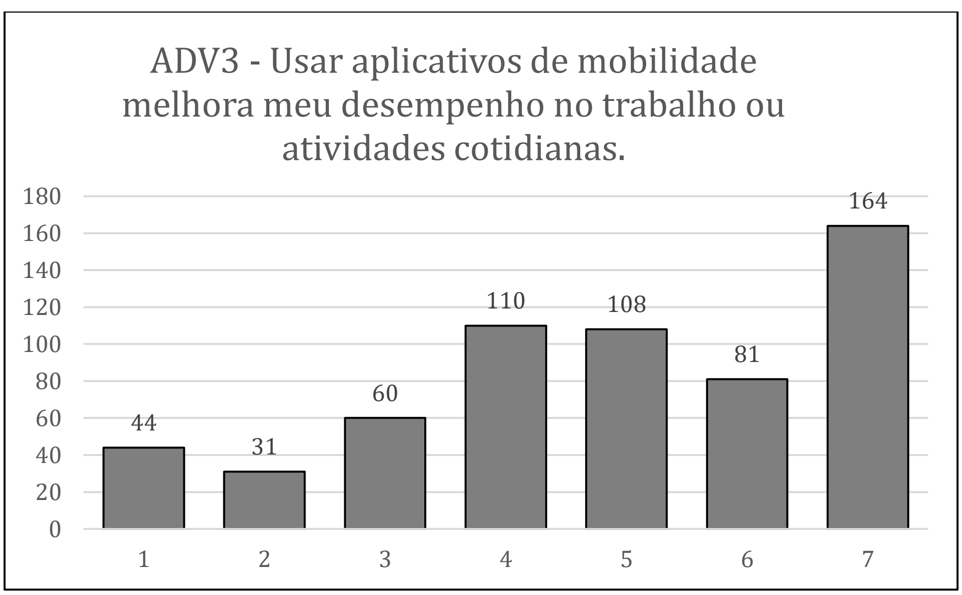
6.1 RESPONDENT DEMOGRAPHIC PROFILE

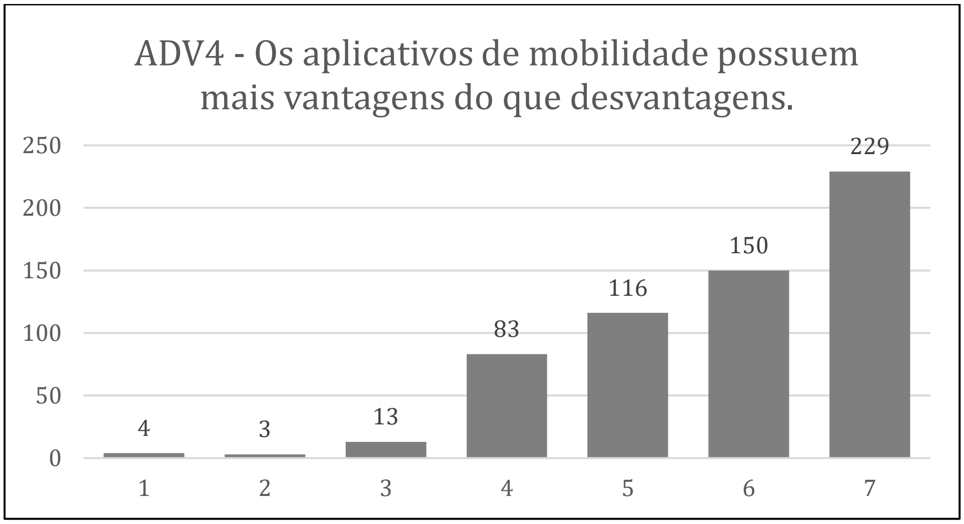


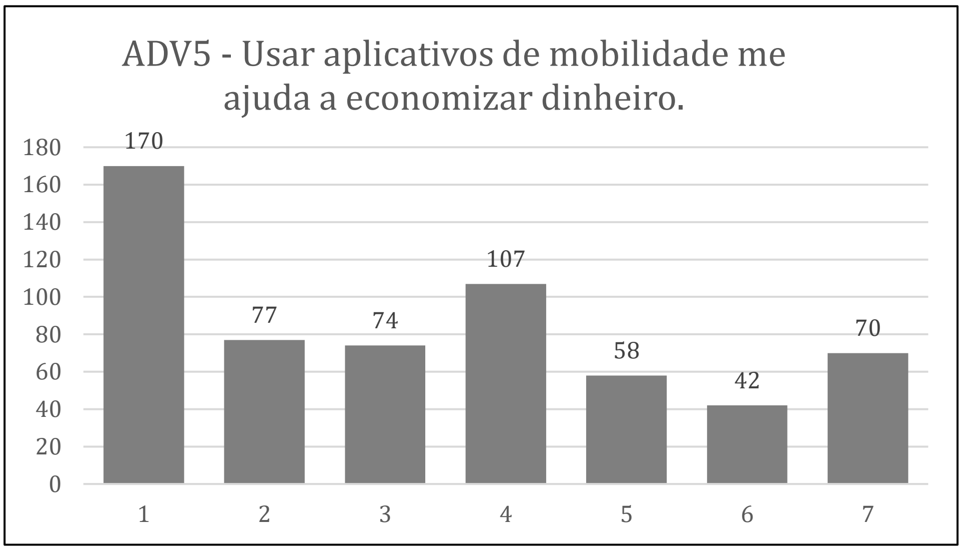
6.2 MOBILITY APPLICATIONS ACCEPTANCE

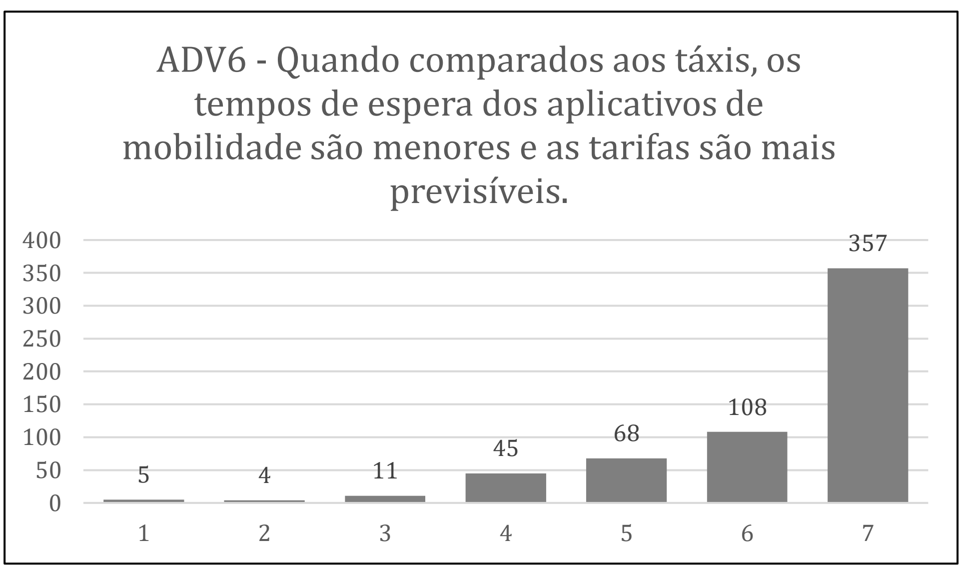


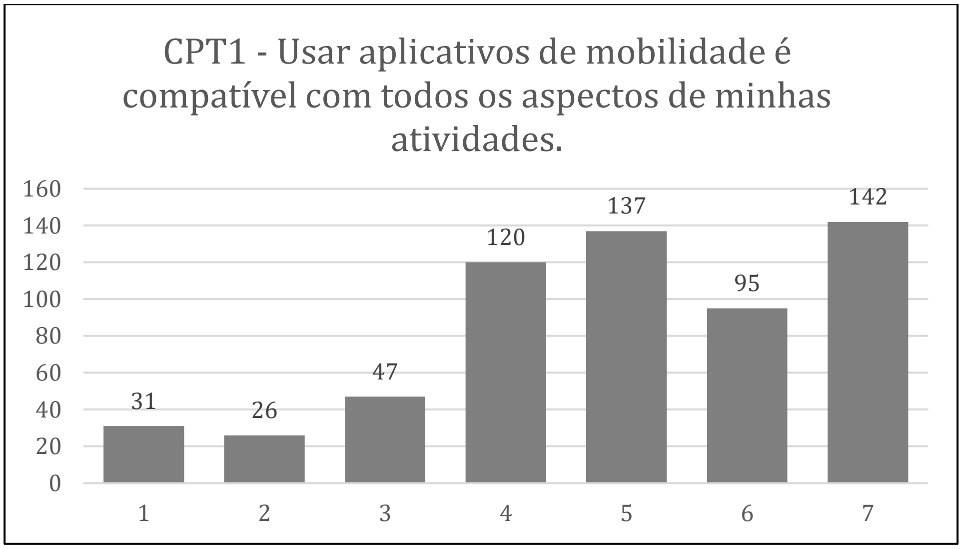


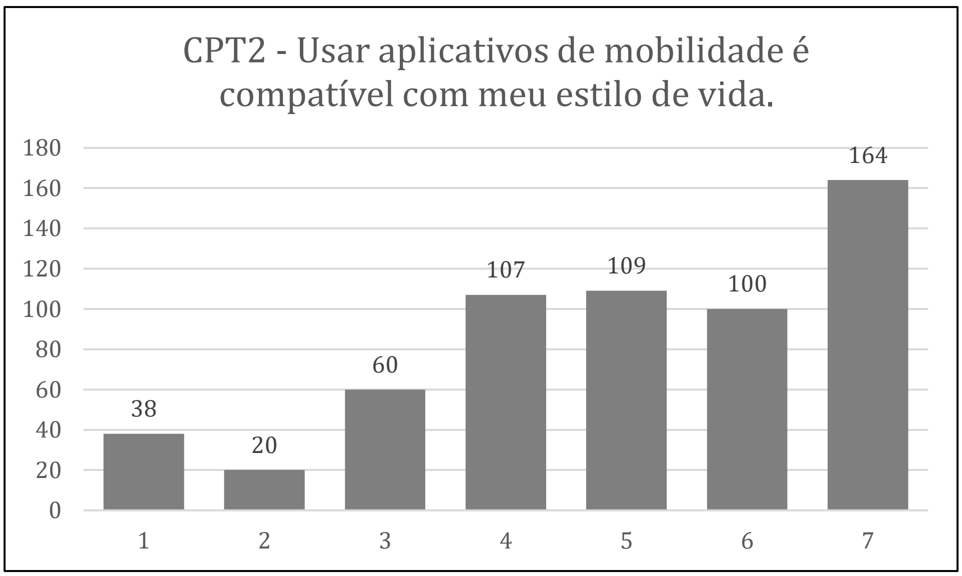


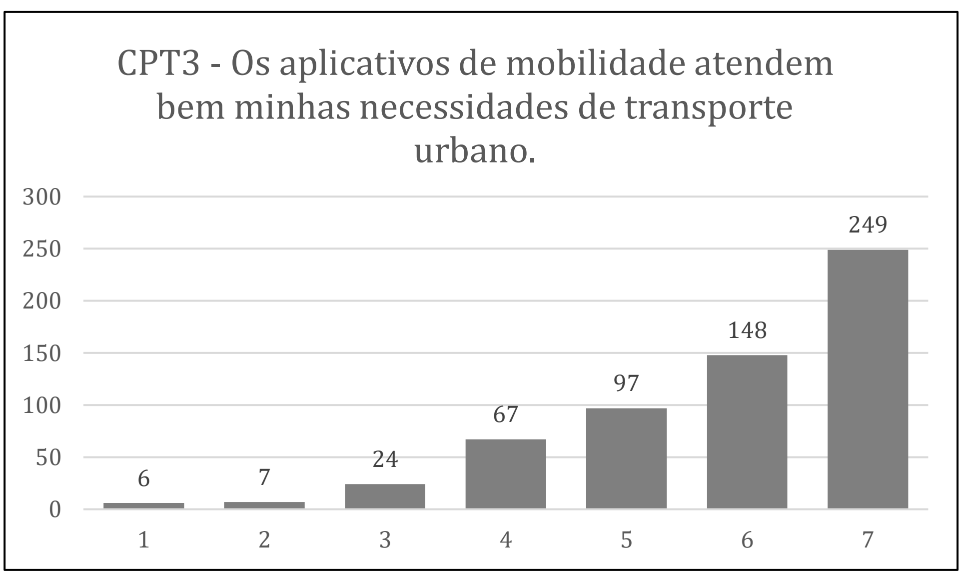

ADV4 - Os aplicativos de mobilidade possuem mais vantagens do que desvantagens.
250
200
150
100
50
0
4
3
13
83
116
150
229
1
2
3
4
5
6
7

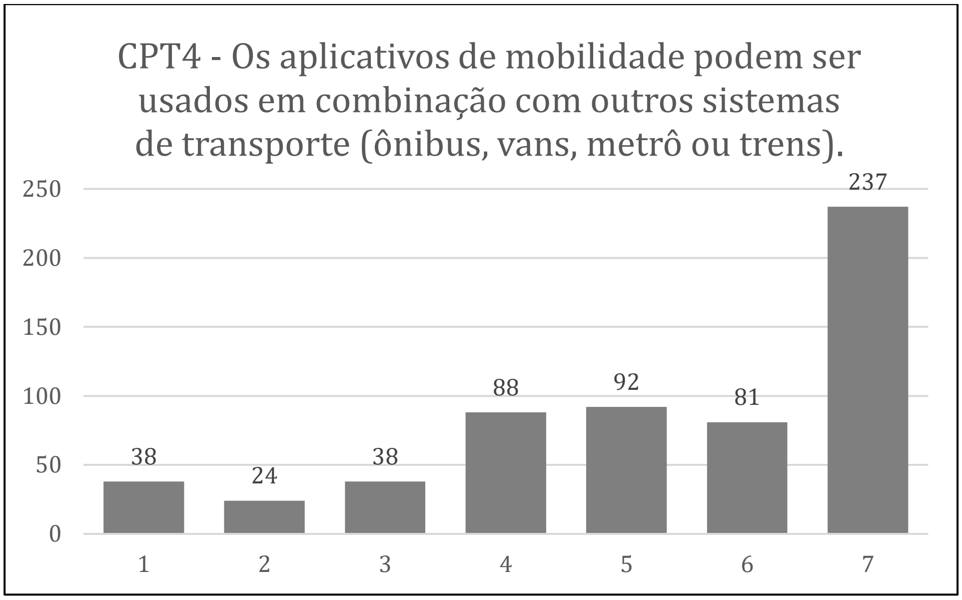

ADV5 - Usar aplicativos de mobilidade me ajuda a economizar dinheiro.
180
160
140
120
100
80
60
40
20
0
170
77
74
107
58
42
70
1
2
3
4
5
6
7

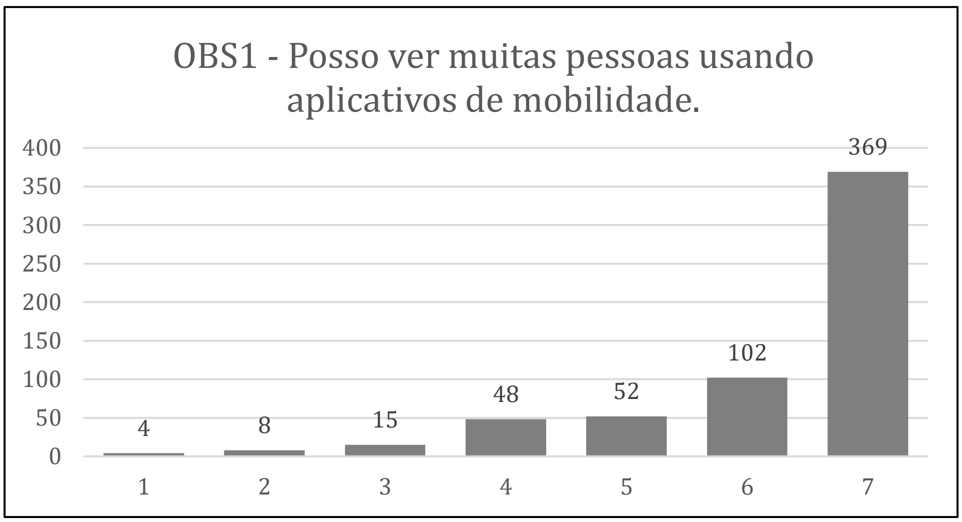

ADV6 - Quando comparados aos táxis, os tempos de espera dos aplicativos de mobilidade são menores e as tarifas são mais previsíveis.
400
350
300
250
200
150
100
50
0
5
4
11
45
68
108
357
1
2
3
4
5
6
7

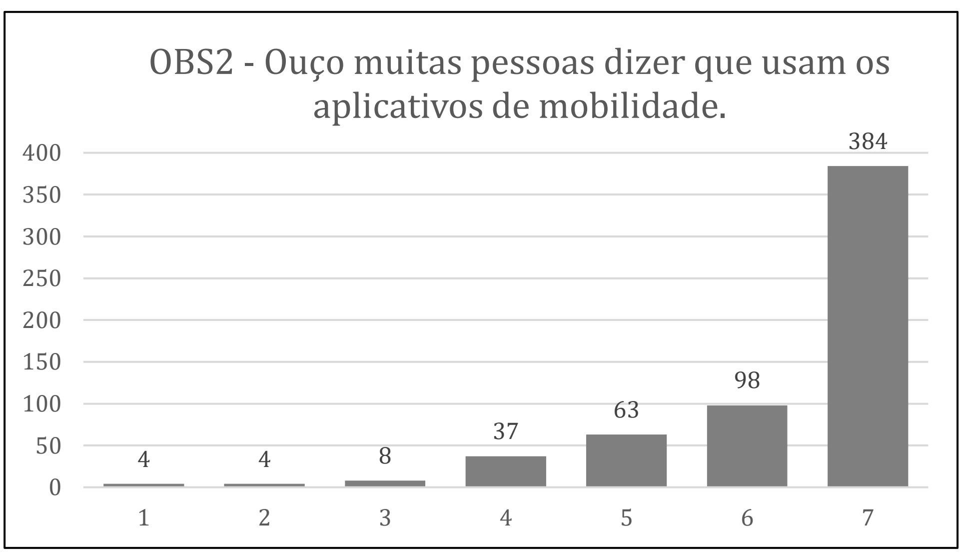

CPT1 - Usar aplicativos de mobilidade é compatível com todos os aspectos de minhas atividades.
160
140
120
100
80
60
40
20
0
31
26
47
120
137
95
142
1
2
3
4
5
6
7

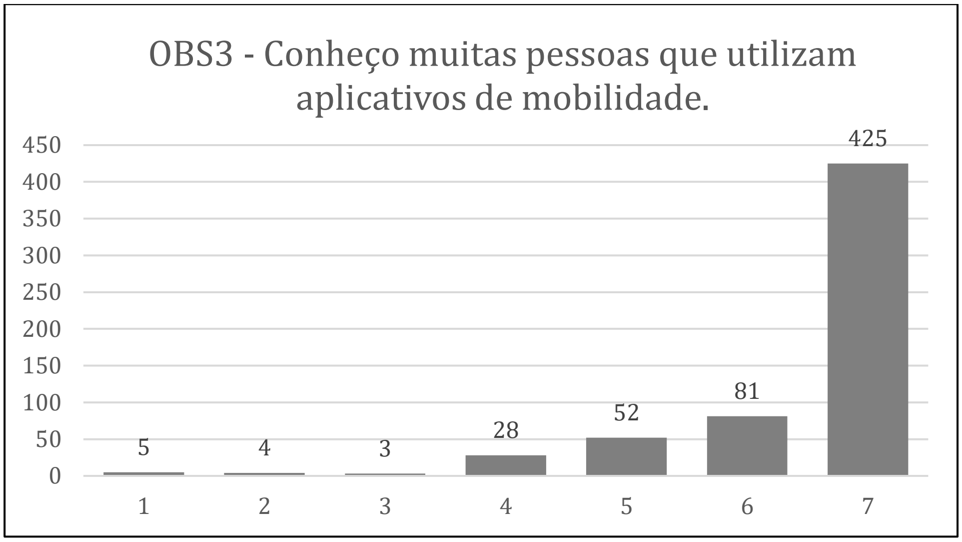

CPT2 - Usar aplicativos de mobilidade é compatível com meu estilo de vida.
180
160
140
120
100
80
60
40
20
0
38
20
60
107
109
100
164
1
2
3
4
5
6
7

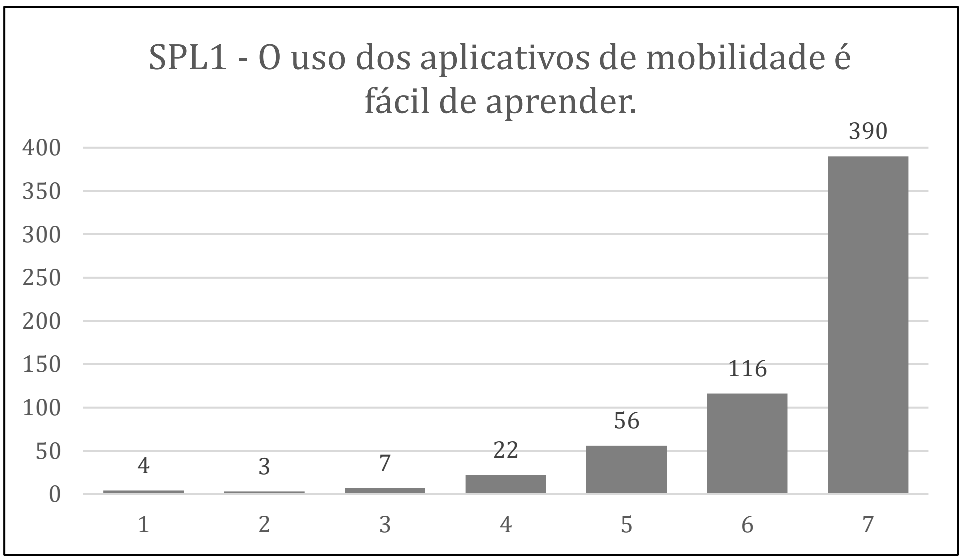

CPT3 - Os aplicativos de mobilidade atendem bem minhas necessidades de transporte urbano.
300
250
200
150
100
50
0
6
7
24
67
97
148
249
1
2
3
4
5
6
7

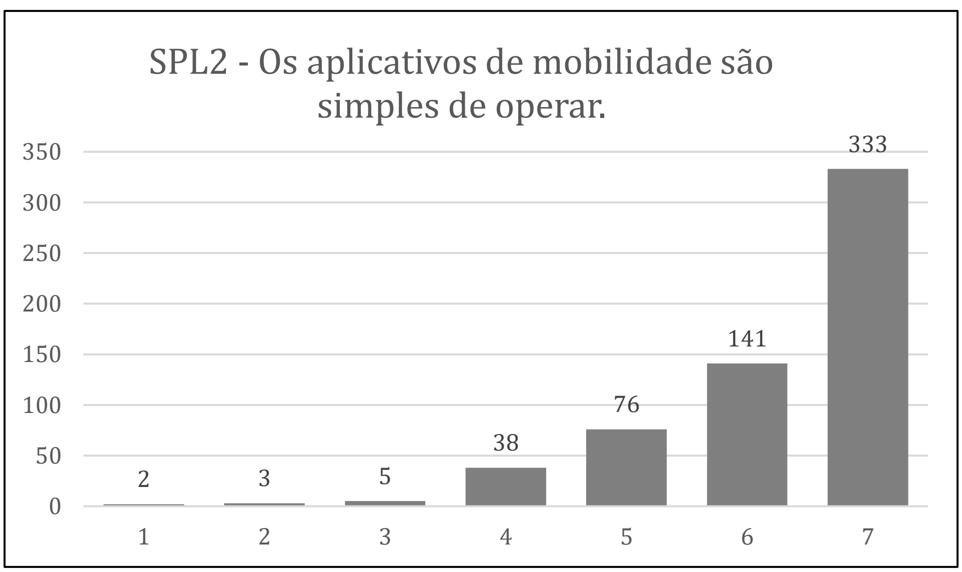

CPT4 - Os aplicativos de mobilidade podem ser usados em combinação com outros sistemas de transporte (ônibus, vans, metrô ou trens).
250
200
150
100
50
0
38
24
38
88
92
81
237
1
2
3
4
5
6
7

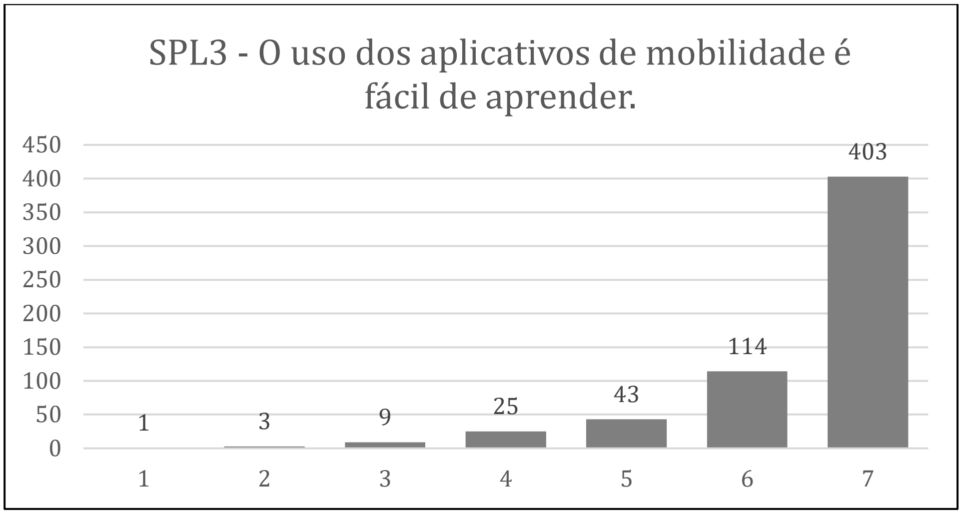

OBS1 - Posso ver muitas pessoas usando aplicativos de mobilidade.
400
350
300
250
200
150
100
50
0
4
8
15
48
52
102
369
1
2
3
4
5
6
7


OBS2 - Ouço muitas pessoas dizer que usam os aplicativos de mobilidade.
400
350
300
250
200
150
100
50
0
4
4
8
37
63
98
384
1
2
3
4
5
6
7

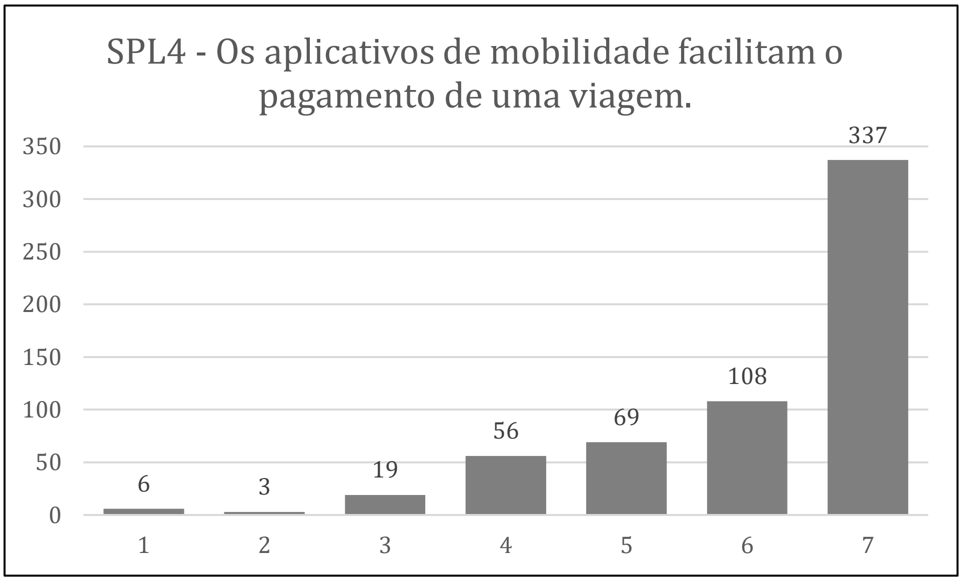

OBS3 - Conheço muitas pessoas que utilizam aplicativos de mobilidade.
450
400
350
300
250
200
150
100
50
0
5
4
3
28
52
81
425
1
2
3
4
5
6
7


SPL1 - O uso dos aplicativos de mobilidade é fácil de aprender.
400
350
300
250
200
150
100
50
0
4
3
7
22
56
116
390
1
2
3
4
5
6
7

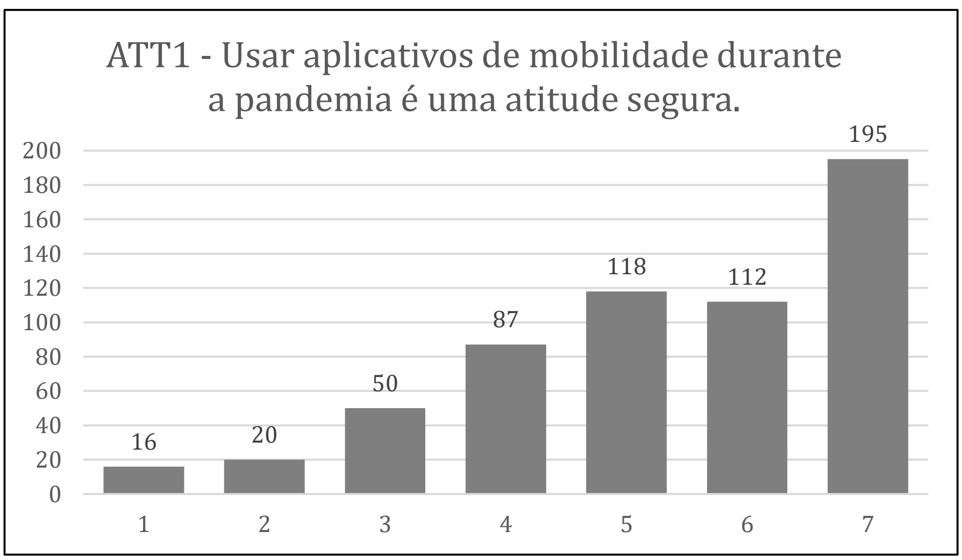

SPL2 - Os aplicativos de mobilidade são simples de operar.
350
300
250
200
150
100
50
0
2
3
5
38
76
141
333
1
2
3
4
5
6
7



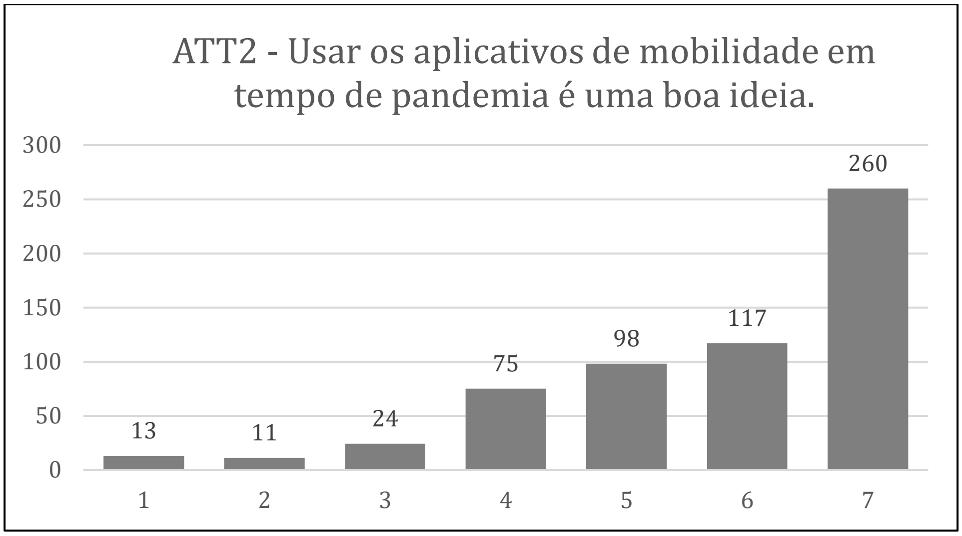
SPL3 - O uso dos aplicativos de mobilidade é fácil de aprender.
450
400
350
300
250
200
150
100
50
0
1
3
9
25
43
114
403
1
2
3
4
5
6
7

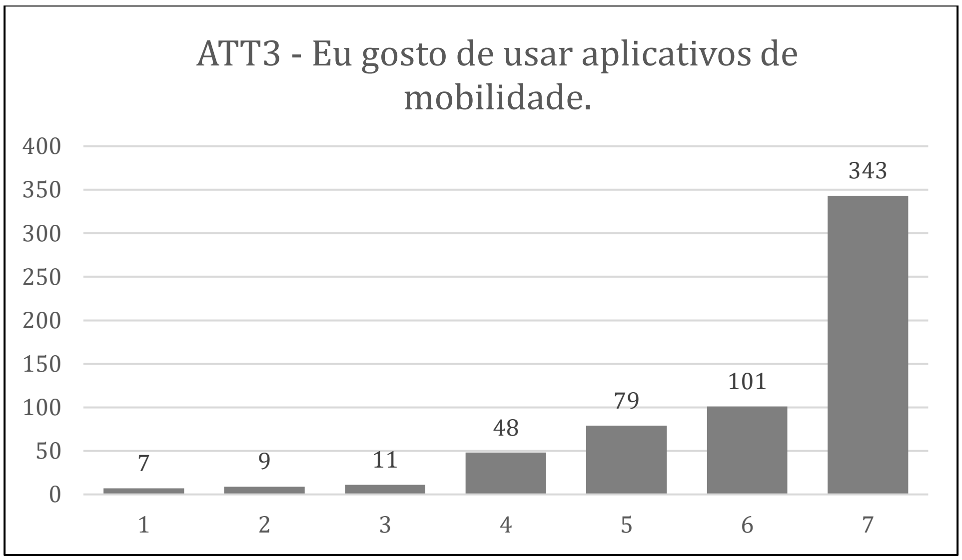


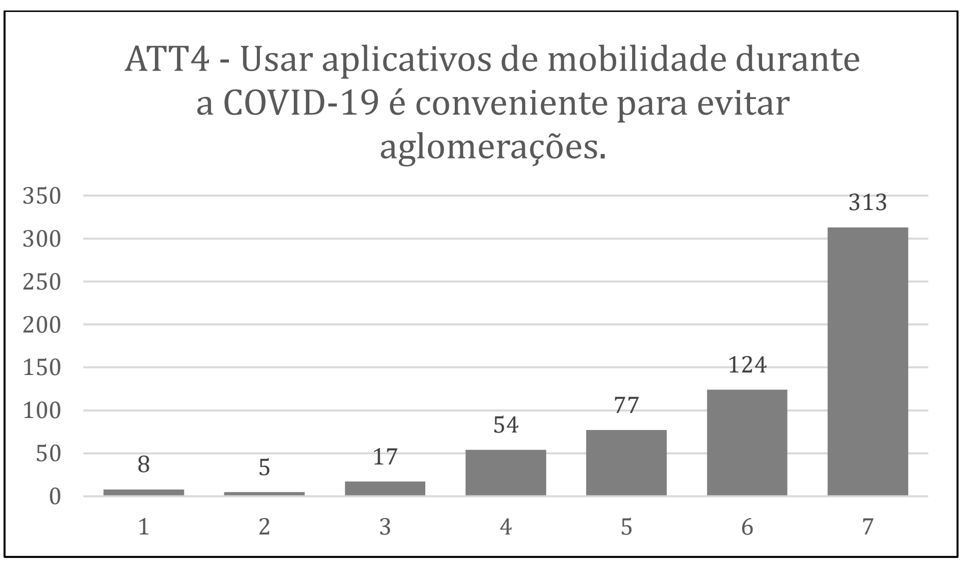
SPL4 - Os aplicativos de mobilidade facilitam o pagamento de uma viagem.
350
300
250
200
150
100
50
0
6
3
19
56
69
108
337
1
2
3
4
5
6
7

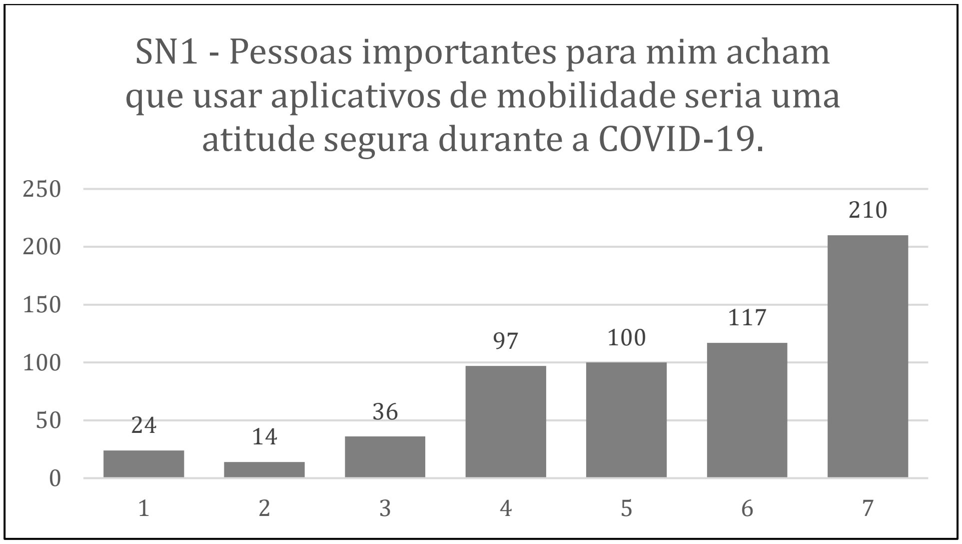


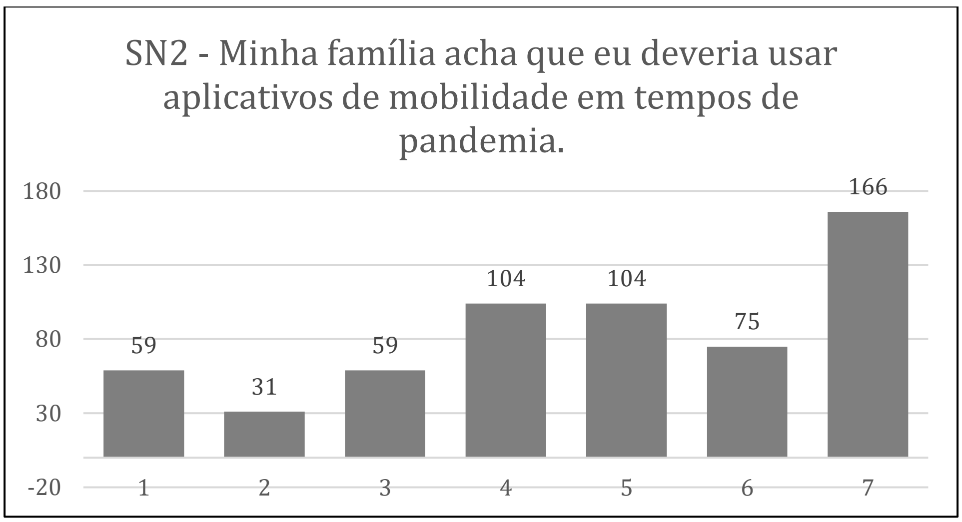
ATT1 - Usar aplicativos de mobilidade durante a pandemia é uma atitude segura.
200
180
160
140
120
100
80
60
40
20
0
16
20
50
87
118
112
195
1
2
3
4
5
6
7

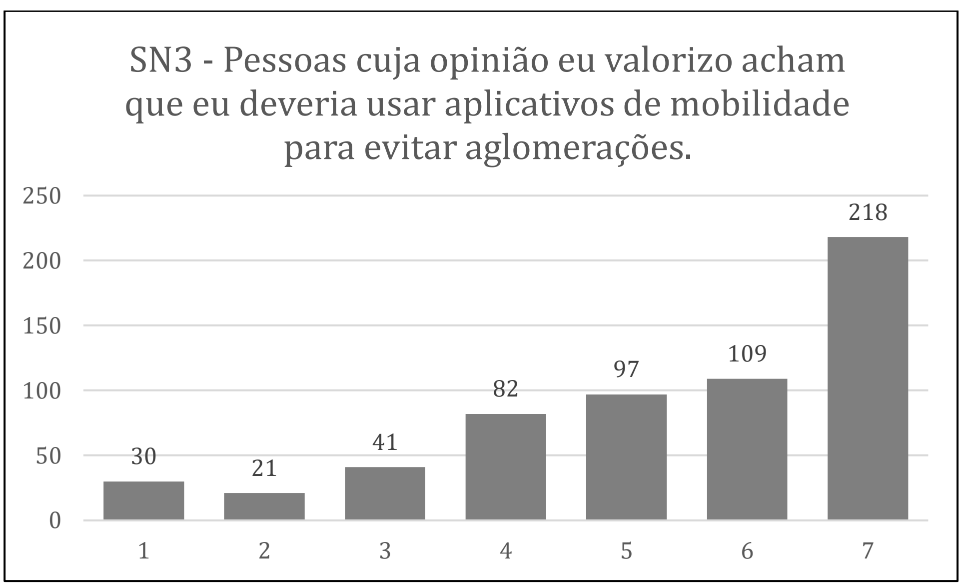

ATT2 - Usar os aplicativos de mobilidade em tempo de pandemia é uma boa ideia.
300
250
200
150
100
50
0
13
11
24
75
98
117
260
1
2
3
4
5
6
7

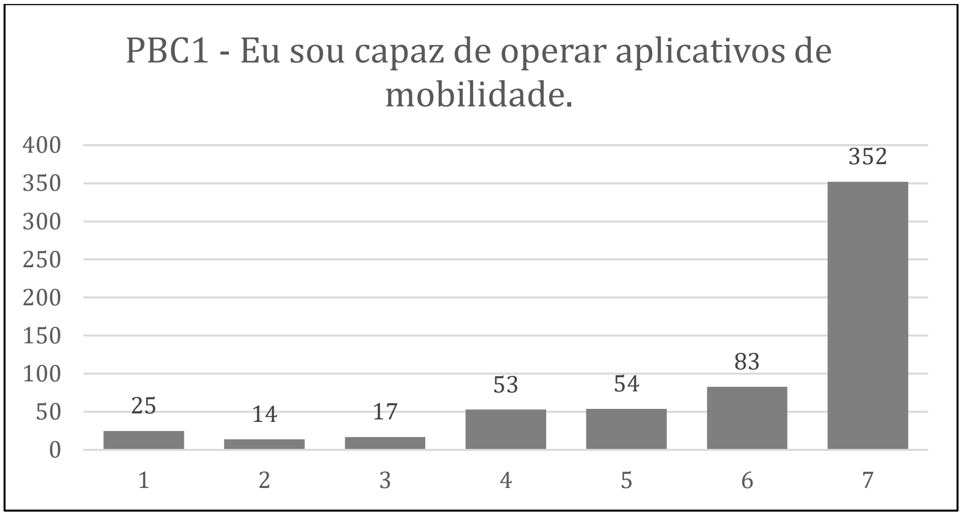

ATT3 - Eu gosto de usar aplicativos de mobilidade.
400
350
300
250
200
150
100
50
0
7
9
11
48
79
101
343
1
2
3
4
5
6
7

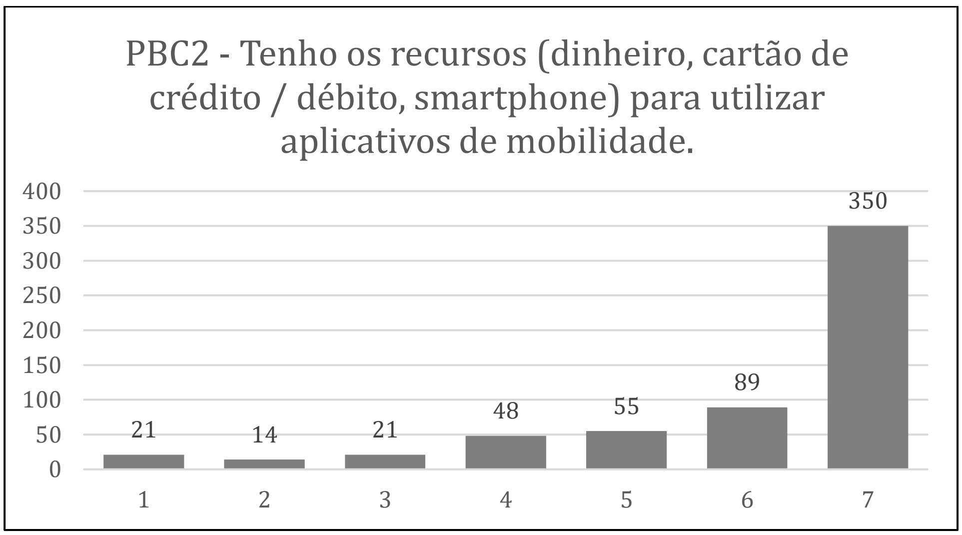

ATT4 - Usar aplicativos de mobilidade durante a COVID-19 é conveniente para evitar aglomerações.
350
300
250
200
150
100
50
0
8
5
17
54
77
124
313
1
2
3
4
5
6
7

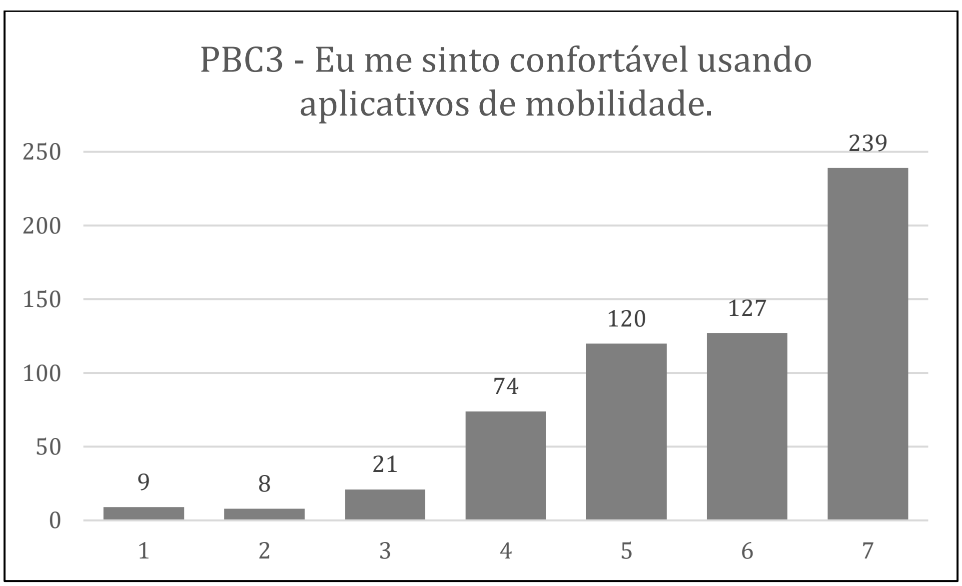

SN1 - Pessoas importantes para mim acham que usar aplicativos de mobilidade seria uma atitude segura durante a COVID-19.
250
200
150
100
50
0
24
14
36
97
100
117
210
1
2
3
4
5
6
7

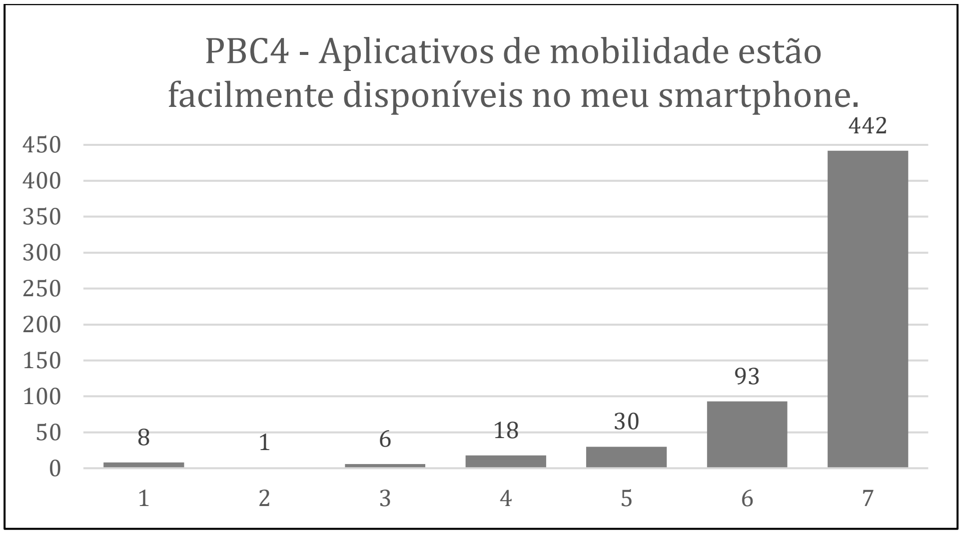

SN2 - Minha família acha que eu deveria usar aplicativos de mobilidade em tempos de pandemia.
180
130
80
30
-20
59
31
59
104
104
75
166
1
2
3
4
5
6
7

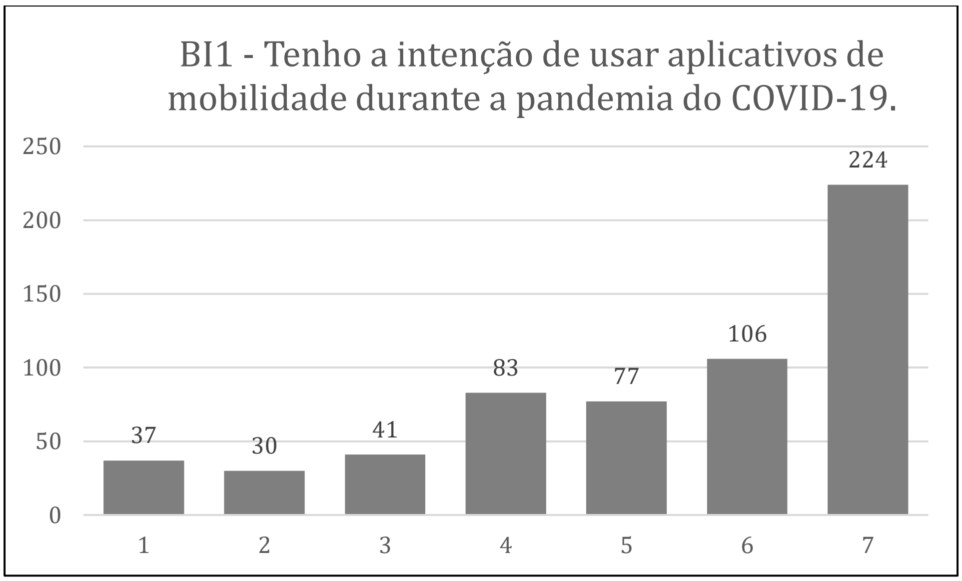

SN3 - Pessoas cuja opinião eu valorizo acham que eu deveria usar aplicativos de mobilidade para evitar aglomerações.
250
200
150
100
50
0
30
21
41
82
97
109
218
1
2
3
4
5
6
7

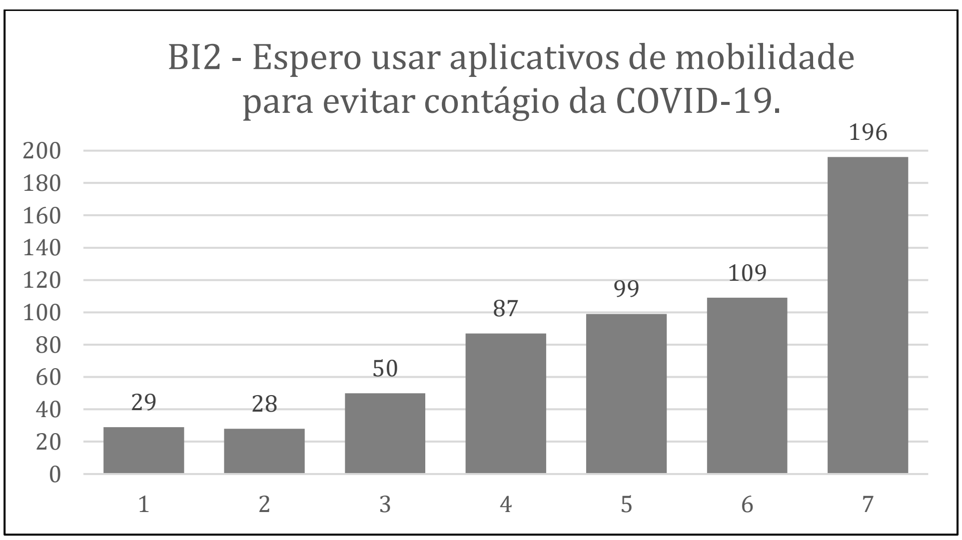

PBC1 - Eu sou capaz de operar aplicativos de mobilidade.
400
350
300
250
200
150
100
50
0
25
14
17
53
54
83
352
1
2
3
4
5
6
7

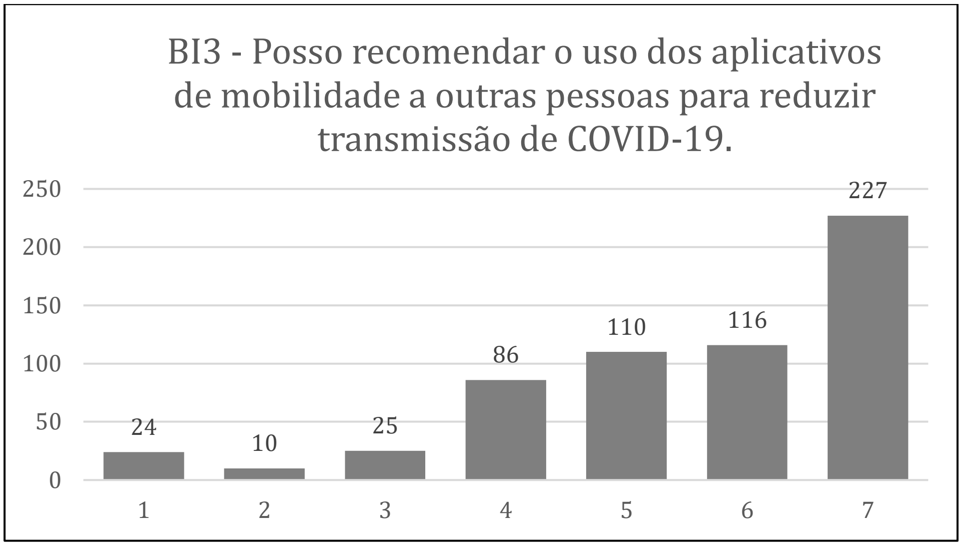

PBC2 - Tenho os recursos (dinheiro, cartão de crédito / débito, smartphone) para utilizar aplicativos de mobilidade.
400
350
300
250
200
150
100
50
0
21
14
21
48
55
89
350
1
2
3
4
5
6
7

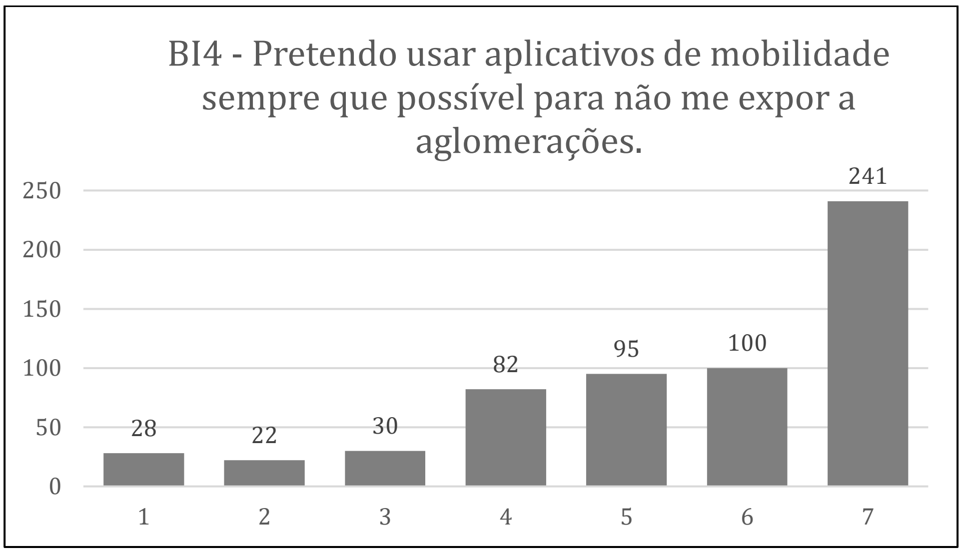

PBC3 - Eu me sinto confortável usando aplicativos de mobilidade.
250
200
150
100
50
0
9
8
21
74
120
127
239
1
2
3
4
5
6
7

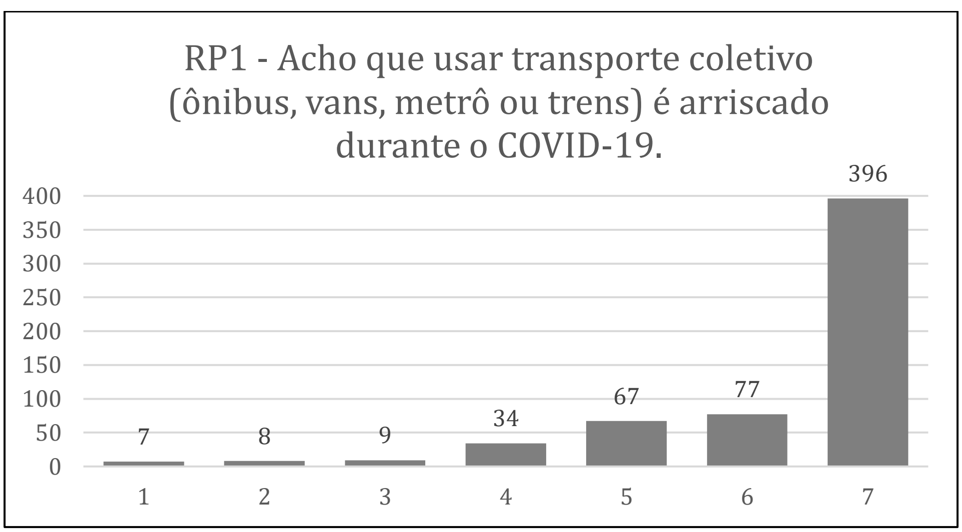

PBC4 - Aplicativos de mobilidade estão facilmente disponíveis no meu smartphone.
450
400
350
300
250
200
150
100
50
0
8
1
6
18
30
93
442
1
2
3
4
5
6
7

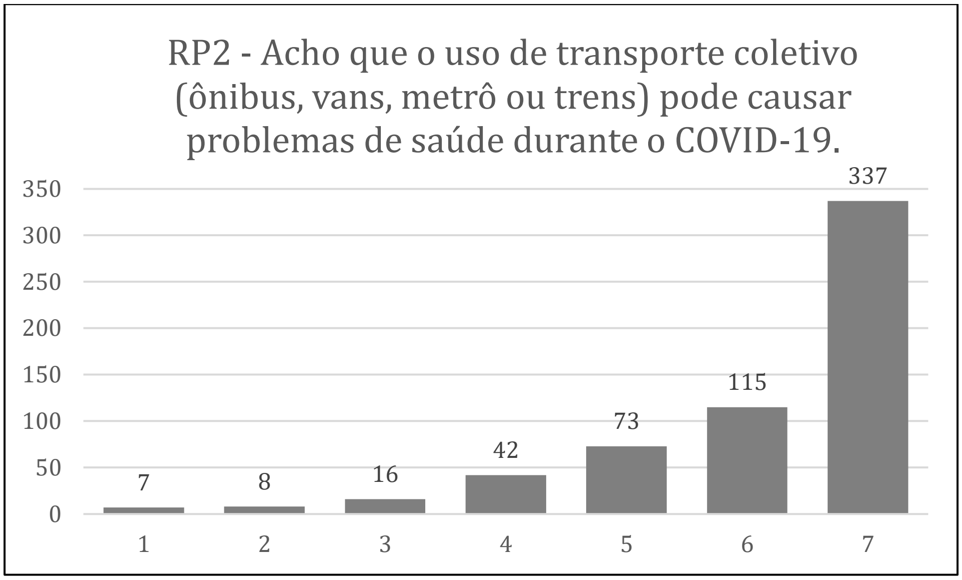

BI1 - Tenho a intenção de usar aplicativos de mobilidade durante a pandemia do COVID-19.
250
200
150
100
50
0
37
30
41
83
77
106
224
1
2
3
4
5
6
7

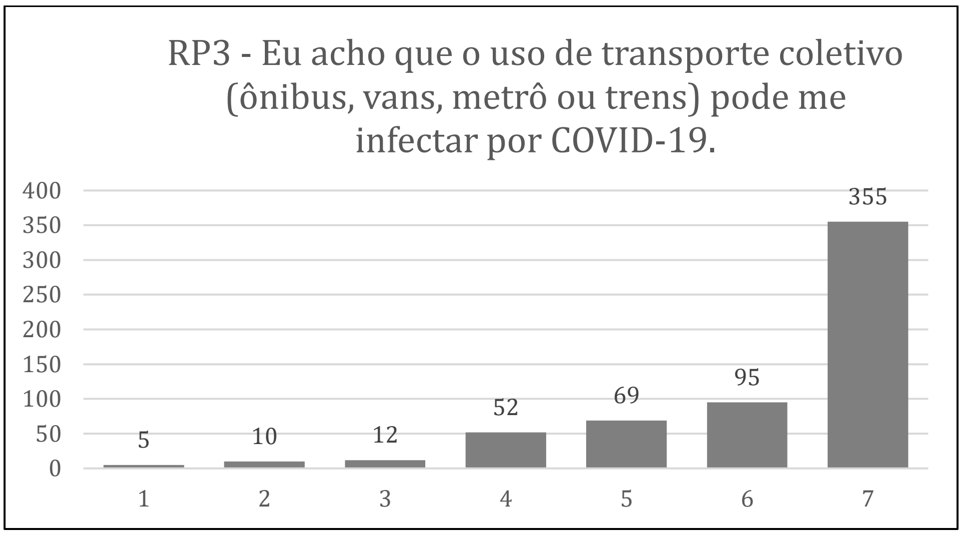

BI2 - Espero usar aplicativos de mobilidade para evitar contágio da COVID-19.
200
180
160
140
120
100
80
60
40
20
0
29
28
50
87
99
109
196
1
2
3
4
5
6
7

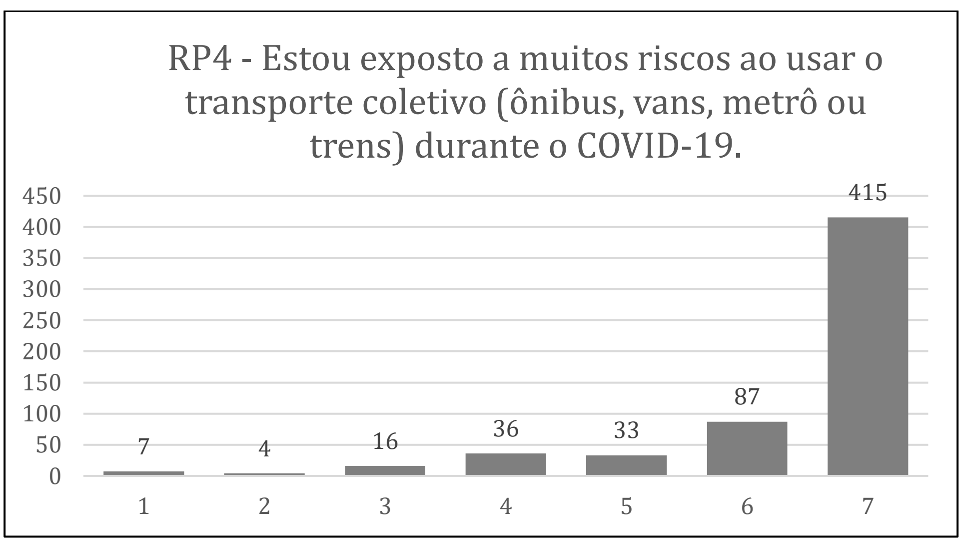

BI3 - Posso recomendar o uso dos aplicativos de mobilidade a outras pessoas para reduzir transmissão de COVID-19.
0
50
100
150
200
250
24
10
25
86
110
116
227
1
2
3
4
5
6
7


BI4 - Pretendo usar aplicativos de mobilidade sempre que possível para não me expor a aglomerações.
0
50
100
150
200
250
28
22
30
82
95
100
241
1
2
3
4
5
6
7

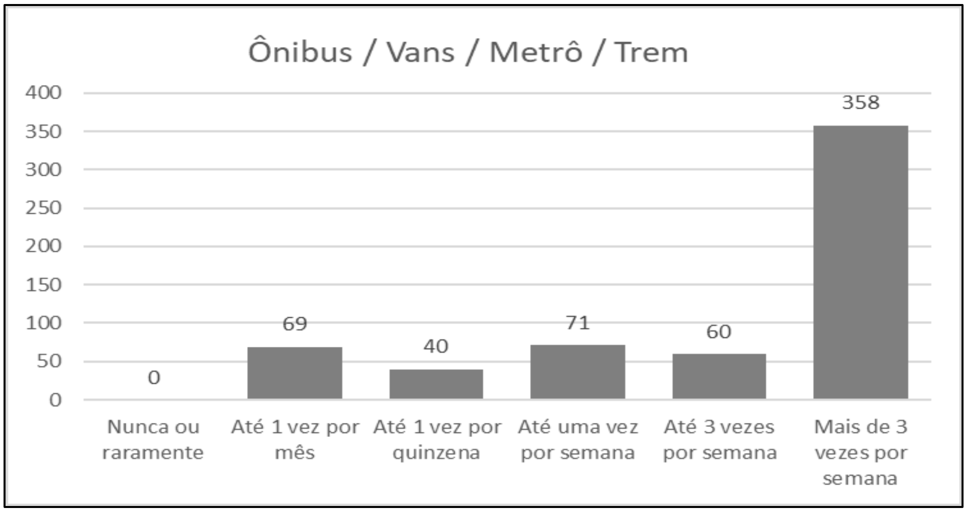

RP1 - Acho que usar transporte coletivo (ônibus, vans, metrô ou trens) é arriscado durante o COVID-19.
0
50
100
150
200
250
300
350
400
7
8
9
34
67
77
396
1
2
3
4
5
6
7

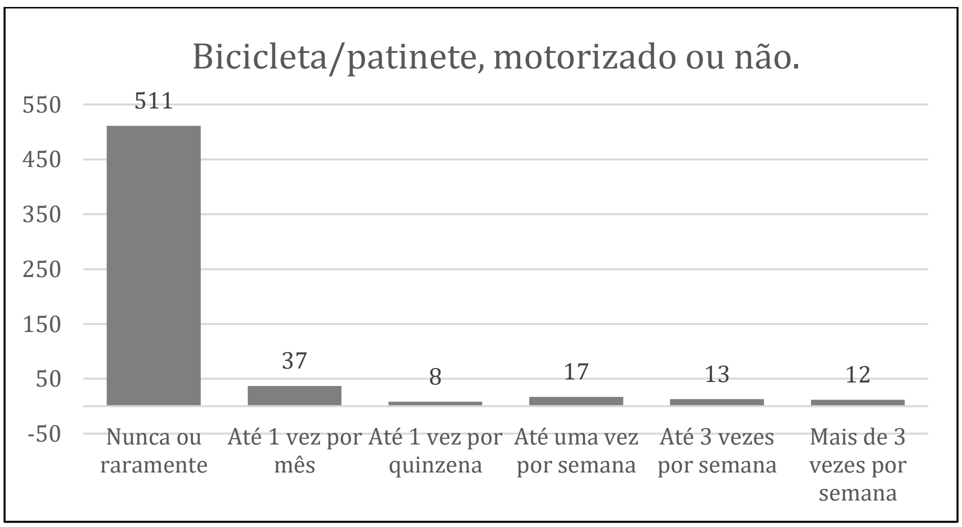

RP2 - Acho que o uso de transporte coletivo (ônibus, vans, metrô ou trens) pode causar problemas de saúde durante o COVID-19.
350
300
250
200
150
100
50
0
7
8
16
42
73
115
337
1
2
3
4
5
6
7

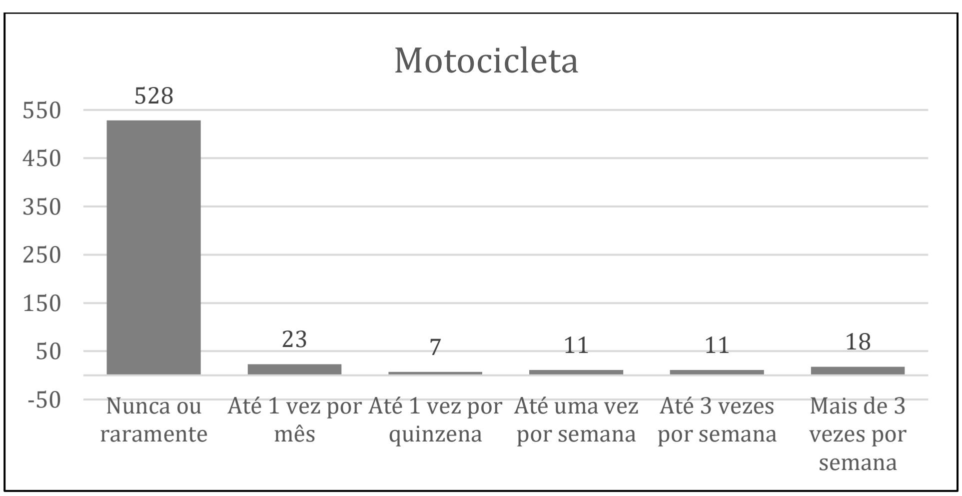

RP3 - Eu acho que o uso de transporte coletivo (ônibus, vans, metrô ou trens) pode me infectar por COVID-19.
400
350
300
250
200
150
100
50
0
5
10
12
52
69
95
355
1
2
3
4
5
6
7

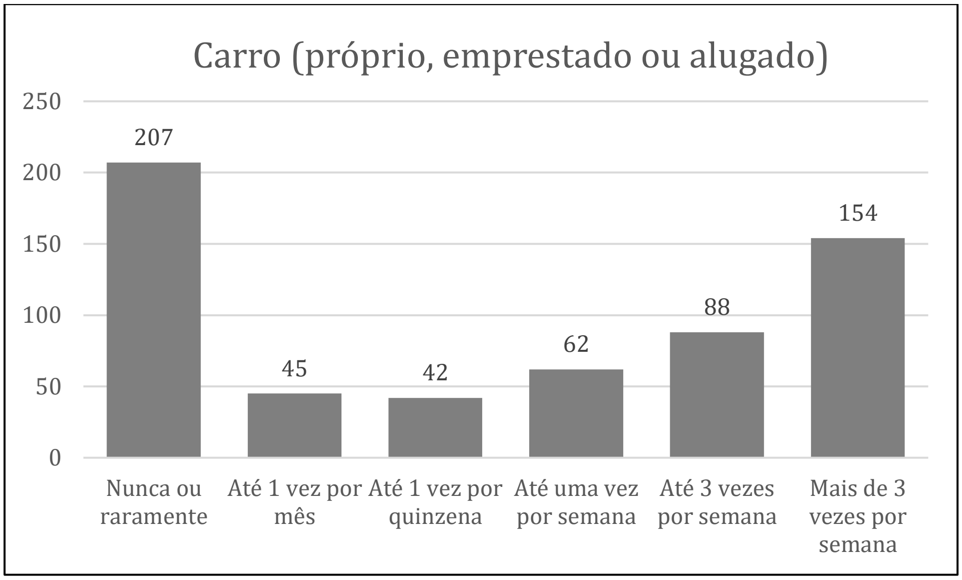

RP4 - Estou exposto a muitos riscos ao usar o transporte coletivo (ônibus, vans, metrô ou trens) durante o COVID-19.
450
400
350
300
250
200
150
100
50
0
7
4
16
36
33
87
415
1
2
3
4
5
6
7

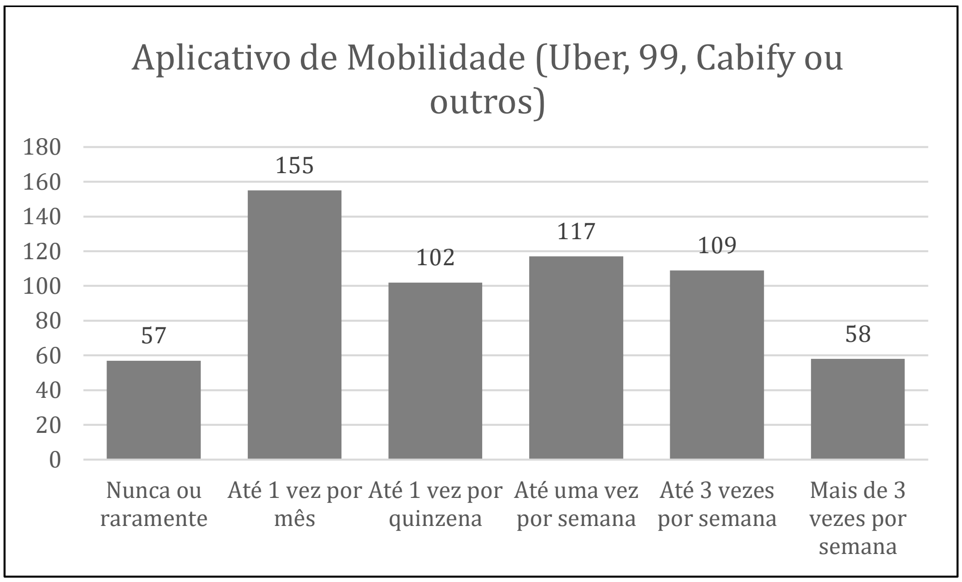
6.3 RESPONDENT MOBILITY HABITS

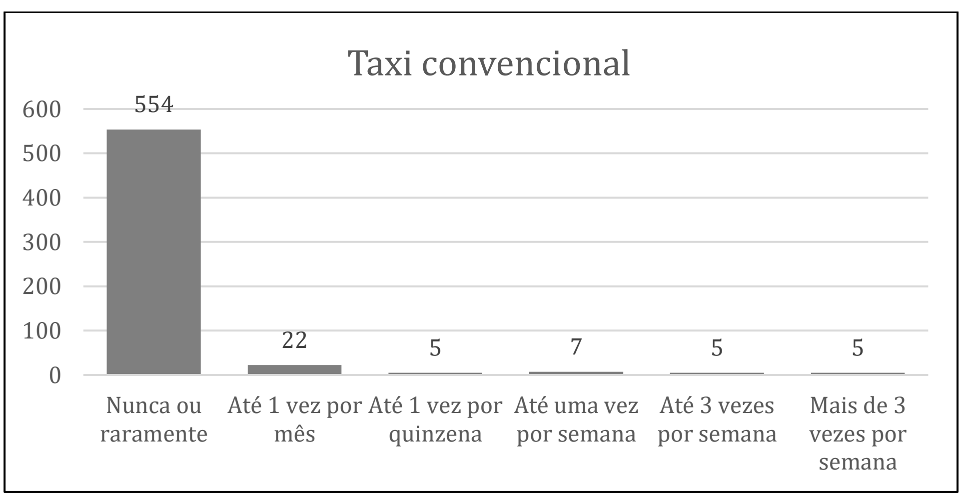







Carro (próprio, emprestado ou alugado)
250
200
150
100
50
0
207
45
42
62
88
154
Nunca ou raramente
Até 1 vez por mês
Até 1 vez por quinzena
Até uma vez por semana
Até 3 vezes por semana
Mais de 3 vezes por semana


Aplicativo de Mobilidade (Uber, 99, Cabify ou outros)
180
160
140
120
100
80
60
40
20
0
57
155
102
117
109
58
Nunca ou raramente
Até 1 vez por mês
Até 1 vez por quinzena
Até uma vez por semana
Até 3 vezes por semana
Mais de 3 vezes por semana


Taxi convencional
600
500
400
300
200
100
0
554
22
5
7
5
5
Nunca ou raramente
Até 1 vez por mês
Até 1 vez por quinzena
Até uma vez por semana
Até 3 vezes por semana
Mais de 3 vezes por semana

APPENDIX 3 – PROPERTY OF THE MEASURES

Property of the Measures: Outer Loadings, VIF, Original Sample, Mean, Standard Deviation, T Statistics, P Values and Q^2																
	AGE	ATT	BI	CPT	OBS	RP	SN	SPL	VIF	(O)	(M)	(STDEV)	(|O/STDEV|)	P Values	ICR	ICC
AGE	1.000								1.000	1.000	1.000	0.000				1.000
ATT1		0.860							1.864	0.394	0.394	0.015	25.588	0.000	0.092	0.452
ATT2		0.872							1.856	0.429	0.431	0.018	23.481	0.000	0.134	0.447
ATT4		0.792							1.497	0.362	0.361	0.016	22.117	0.000	0.111	0.326
BI1			0.808						1.817	0.290	0.290	0.010	29.587	0.000	0.404	0.435
BI2			0.864						2.133	0.329	0.329	0.010	33.906	0.000	0.514	0.527
BI3			0.794						1.677	0.306	0.307	0.011	28.684	0.000	0.445	0.387
BI4			0.827						1.968	0.288	0.288	0.009	30.799	0.000	0.396	0.480
CPT1				0.851					1.556	0.479	0.474	0.038	12.558	0.000		0.334
CPT2				0.767					1.478	0.344	0.345	0.040	8.601	0.000		0.297
CPT3				0.764					1.269	0.430	0.432	0.046	9.256	0.000		0.188
OBS1					0.798				1.372	0.431	0.429	0.061	7.021	0.000		0.262
OBS2					0.845				1.734	0.410	0.409	0.042	9.861	0.000		0.401
OBS3					0.824				1.696	0.376	0.376	0.044	8.583	0.000		0.385
RP1						0.823			1.675	0.359	0.360	0.040	8.947	0.000	-0.001	0.399
RP2						0.754			1.615	0.249	0.247	0.036	6.951	0.000	0.000	0.364
RP3						0.823			1.860	0.302	0.302	0.034	8.833	0.000	-0.003	0.461
RP4						0.799			1.616	0.335	0.334	0.044	7.552	0.000	0.002	0.373
SN1							0.859		1.838	0.392	0.392	0.012	31.580	0.000	0.039	0.453
SN2							0.872		1.978	0.388	0.388	0.011	34.852	0.000	0.038	0.492
SN3							0.851		1.807	0.381	0.381	0.014	27.712	0.000	0.046	0.443
SPL1								0.830	1.585	0.403	0.401	0.048	8.423	0.000		0.366
SPL2								0.885	1.667	0.505	0.505	0.043	11.718	0.000		0.401
SPL3								0.735	1.417	0.298	0.297	0.054	5.543	0.000		0.287

(VIF) Collinearity Statistics
(O) Original Sample
(M) Sample Mean
(STDEV) Standard Deviation
(|O/STDEV|) T Statistics
(ICR) Indicator Crossvalidated Redundancy - Q^2 (=1-SSE/SSO)
(ICC) Indicator Crossvalidated Communality - Q^2 (=1-SSE/SSO)

Figure 39 - Property of the Measures