

**Smart City Technologies implemented in public transport in a post-  
COVID-19 pandemic scenario**

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## ABSTRACT

With the global pandemic of COVID-19 completing one year, this paper intends to analyse the perceptions of public transport users about the implementation of smart city technologies. Two aspects were analysed, namely: the perception of safety regarding the use of surveillance technologies in the containment of the virus; and the perception of safety of the same technologies regarding data protection and privacy. After the identification and choice of initiatives in smart cities to be addressed, a questionnaire was prepared and made available online, in which 414 replies were considered for the final analysis, respecting the proportionality of the percentage of replies in each region to the respective population percentage. In general, technologies provide a great sense of security regarding the use of public transportation. However, they cause concern regarding data protection and privacy. From this result and with analyses in relation to the regulation of personal data, international experiences and the Brazilian reality were contrasted.

**KEYWORDS:** Smart City, COVID-19, Public Transport.

## 1. INTRODUCTION

SARS-CoV-2 shocked the world in 2019 and stopped it in 2020. The global pandemic, turned 1 year old on March 11, 2021, the day the World Health Organization raised the status from epidemic to pandemic (WHO, 2020). After an unprecedented effort for the development and production of vaccines, personal protective equipment (PPE) for health professionals, respirators and masks for a global consumption of the population, it is necessary to think about a post-pandemic scenario, where social distancing and safety measures against the spread of the virus will still need to be maintained.

In this context, during the pandemic, technological measures were adopted to contain the spread and enable the rapid containment of the virus (SÖDERSTRÖM, 2020), as well as narratives began to be developed regarding smart cities in a post-pandemic scenario (KUNZMANN, 2020). As Deleuze (2013) states "the socio-technical study of control mechanisms, apprehended in their dawn, should be categorical and describe what is already in the process of being deployed". It is to incite such studies that this research was built, because the technologies addressed are not materially present in the Brazilian reality, but represent a global trend of surveillance technologies, both algorithmic and imperative and universal modulators (DELEUZE, 2013; SABARIEGO, AMARAL & SALLES, 2020).

Technology is, by nature, an instrument and a mean of modulating sociocultural behaviours, from hygienistic architecture to new forms of social interactions (WINNER, 1980). The widespread "datafication" of various aspects of social action, transforms aspects of private life, economy, politics, society and culture (DOWBOR, 2020). The binomial of democracy, freedom and security, is at the heart of this question, for who owns the citizens' data, what protections exist to prevent the misuse of these personal and collective data flows? How comfortable are citizens, with the use of new surveillance technologies for the active and passive modulation of urban life? After all, it is in cities where there is the greatest entanglement between the material and the virtual (LEVY, 2010).

The paradigm of smart cities, according to the literature, goes through two basic axes as a development strategy: (i) investment in a physical capital, with the incentive in the application of Information and Communication Technologies (ICTs) and Internet of Things (IoT), in favour of the improvement of urban infrastructure, aiming at greater efficiency of cities and higher overall quality of life; (ii) investment in human and social capital, prioritizing a high degree

of education and training of individuals (ZANELLA et al., 2014; SHAPIRO, 2006). However, the literature recognises that "smart" strategies are not limited to these aspects, they instigate creativity and diversity in problem solving, advocate universal sustainability of urban systems and prize a greater integration between city and citizen (SHAFERS, 2012; BIBRI & KROGSTIE, 2017).

An important aspect is often overlooked, both the physical capital and the human and social capital, in the context of a smart city generate and talk with a third type of capital, the virtual or digital capital (ANTUNES, 2020). This capital has as its basic commodity, the data or information. The discussions about a growing "datafication" and the information society have much to add in the analysis of smart city technologies (DOWBOR, 2020; SABARIEGO, AMARAL & SALLES, 2020). It is limiting and incomplete any analysis that does not consider this aspect of digital capital.

According to the aforementioned context, this article focuses only on the first point, the physical capital, specifically in public transport. The choice of analysing public transportation is because of its nature, which makes social distancing difficult, being imperative the respect and attention to other measures, such as passenger reduction, fleet increase and vehicles sanitisation (DE VOS, 2020; MUSSELWHITE et al., 2020).

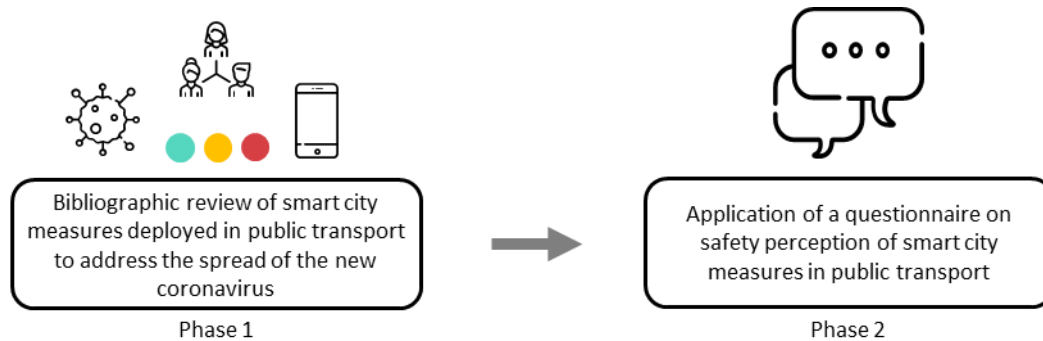
## **2. OBJECTIVES**

This study aims to analyse the perception of the population of Brazilian capital cities regarding the adoption of smart city initiatives in public transport to contain the COVID-19 pandemic, and the paradigm of protection and use of personal data arising from the use of these technologies.

## **3. METHODOLOGY**

The methodology of this work is composed of two stages. The first comprised a review of smart city initiatives adopted to face the spread of the new coronavirus, admitted only those contained in published academic articles. In the second stage, a questionnaire was applied on smart city technologies integrated to public transport as one way to contain COVID-19. The participants were asked to give their opinion regarding the safety that the use of these technologies conveys to them, in relation to the containment of the pandemic and the privacy of their data. Figure 1 presents a scheme of the methodology used.

Figure 1 - Proposed methodology for analysing the perception of public transport in relation to the pandemic of COVID-19



Source: Authors, 2021.

The questionnaire was composed of two sections: i) socioeconomic data; and ii) perception of safety in relation to COVID-19 contamination and personal data protection, if certain security measures were adopted in public transport in Brazilian capitals. The survey was elaborated in online format and its dissemination occurred through social networks in thematic groups in each capital and with local universities. For the post-pandemic questions, the following scenario was adopted in this study: the population receives one of the available vaccines against the new coronavirus and the incidence of COVID-19 decreases, but it is still necessary to adopt sanitary measures such as the mandatory use of masks, social distancing to contain crowds and constant sanitation.

The calculation of the minimum sample required followed the methodology of Antunes and Simões (2013) and Barcelos et al. (2017), and is presented in Eq. (1) and Eq. (2). It was admitted a confidence level of 95% and sampling error of 5%, being necessary 400 responses.

$$n_0 = \frac{1}{E_0^2} \tag{1}$$

$$n = \frac{N * n_0}{N + n_0} \tag{2}$$

Where  $n_0$  is the first approximation of the sample size;  $E_0$  is the tolerable sampling error;  $n$  is the sample size and  $N$  is the population size.

## 4. RESULTS

### 4.1. Smart city initiatives to combat the pandemic of COVID-19

The selected initiatives were chosen according to the availability of studies in published academic articles (SÖDERSTRÖM, 2020):

1. Security cameras - detection or not of the use of masks in real time by security cameras in public spaces and notification of responsible authorities. In this case, cameras would

be installed inside public transportation vehicles and in their boarding and alighting stations (RAHNMAN et al., 2020);

2. Anonymous tracking of mobile devices - following the "Contact Tracking" strategy, it is possible to identify where a COVID-19 patient has been, with whom he or she has been, and thus organise an effort to sanitize sites, besides conducting tests and identifying potentially contaminated people. Anonymous tracking allows creating a real-time map of contamination risk zones and alerts (through messages or notifications in apps) of contact with people who have been diagnosed with COVID-19, providing guidance for testing when necessary. The information made available to the general public does not contain the identification of patients (SILVA et al. 2021; DAS & ZHANG, 2020; SONN & LEE, 2020);
3. Classification of exposure level - usually done in 4 groups: A) confirmed patients; B) people with whom people from group "A" had direct contact; C) people with whom group "B" had direct contact or who were in places where people from group "A" were (possibility of indirect contamination) and; D) people with no kind of exposure. According to the classification group, individuals may be automatically prevented (via mobile phone or transportation card) from entering places or using services such as public transportation (CHEN & PAN, 2020).

## 4.2. Demographics

We considered 414 answers to the questionnaire, seeking to proportionally approximate the percentage of collected answers to the population living in each Brazilian region, as well as to meet a minimum tolerable error. The capitals Boa Vista - RR and Cuiabá - MT did not return any answers. Table 1 presents the collection details and Table 2 presents the socioeconomic characterisation of the sample.

Table 1 - Division of the sample per Brazilian region

Region	Population (IBGE 2020)	% of resident population	Responses collected	% of responses collected
Central West	6.115.462	12,10%	43	10,39%
North	5.910.843	11,70%	53	12,80%
Northeast	12.602.080	24,94%	129	31,16%
South	3.945.704	7,81%	52	12,56%
Southeast	21.960.466	43,46%	137	33,09%
Total	50.534.555	100%	414	100,00%

Source: Authors, 2021.

Table 2 - Demographic Information of the Sample.

Items	Category	Frequency	Percent
Gender	Female	260	62,80%
	Male	151	36,47%
	Prefer not to say	3	0,72%
Age	< 20	19	4,59%
	21-30	194	46,86%
	31-40	109	26,33%
	41-50	46	11,11%
	51-60	33	7,97%
	> 60	13	3,14%
Ethnicity	Yellow (Geographical origin familiar: Japanese, Chinese, Korean, etc.)	4	0,97%
	White	238	57,49%
	Indigenous	3	0,72%
	Black	42	10,14%
	Brown	113	27,29%
	Prefer not to say	10	2,42%
	Other	4	0,97%
Education level	Incomplete Elementary Education	2	0,48%
	Complete Elementary School	0	0,00%
	Incomplete High School	1	0,24%
	Complete High School	18	4,35%
	Incomplete Undergraduate Education	73	17,63%
	Complete Undergraduate Education	64	15,46%
	Incomplete Post Graduation	95	22,95%
	Complete Post Graduation	162	39,13%
	Outros	1	0,24%
Employment	Student	132	31,88%
	Formal worker	77	18,60%
	Self-employed worker	56	13,53%
	Informal worker	9	2,17%
	Public employee	103	24,88%
	Retired	5	1,21%
	Unemployed	21	5,07%
	Other occupation	11	2,66%
Emergency Aid (monetary assistance)	Yes	79	19,08%
	No	335	80,92%

Source: Authors, 2021.

### 4.3. Safety perception

Participants were exposed to the description of the measures cited in 4.1 and then two questions were presented. For each question, the participant selected values from 1 to 5 on a Likert scale, where 1 meant "Not at all safe/concerned" and 5 "Very safe/concerned".

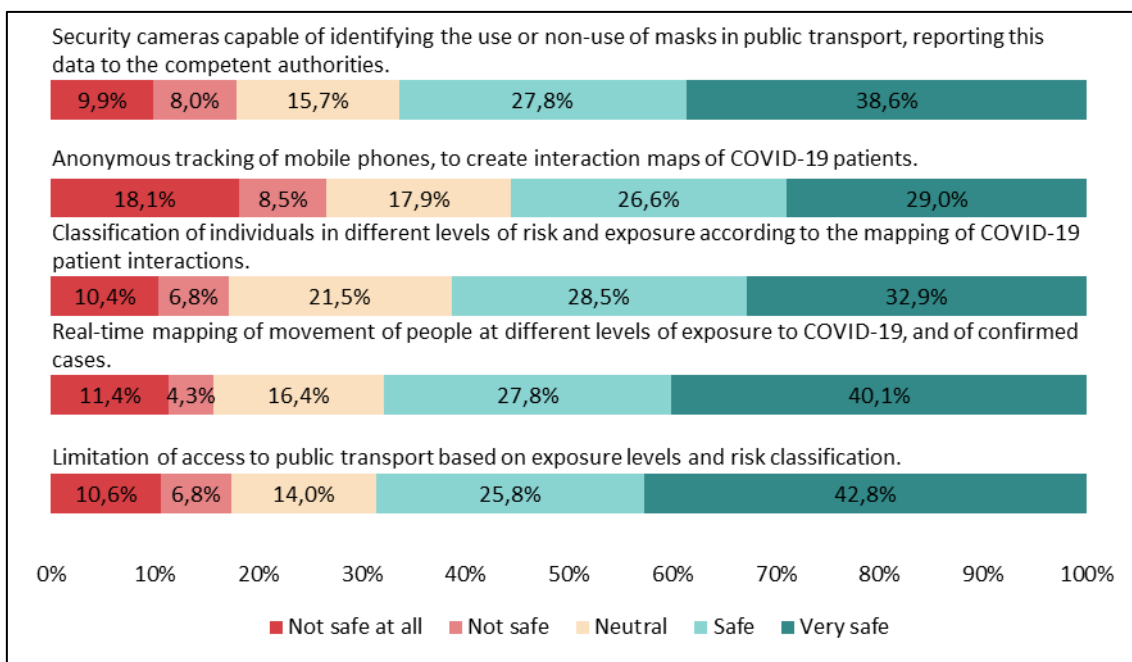
Figure 2, represents the result obtained in the first question regarding the safety passed by the possible use of technology to contain SARS-CoV-2 spread. The first three measures represent the technologies used, while the last two represent applicability of the classification of individuals in risk levels. Analysing only the technologies, it is observed that the use of cameras to compel the use of masks provides a greater sense of security. On the other hand,

the one which gives the least sense of security is the anonymous tracking of mobile phones for the creation of interaction maps.

As for the last two measures, both pass on a broad sense of safety, even more than the use of cameras, 40.1% and 42.8% respectively. Being the limitation of access to public transport based on exposure levels and risk classification, obtaining a 2.7% higher percentage of safety, the one with the highest positive responses.

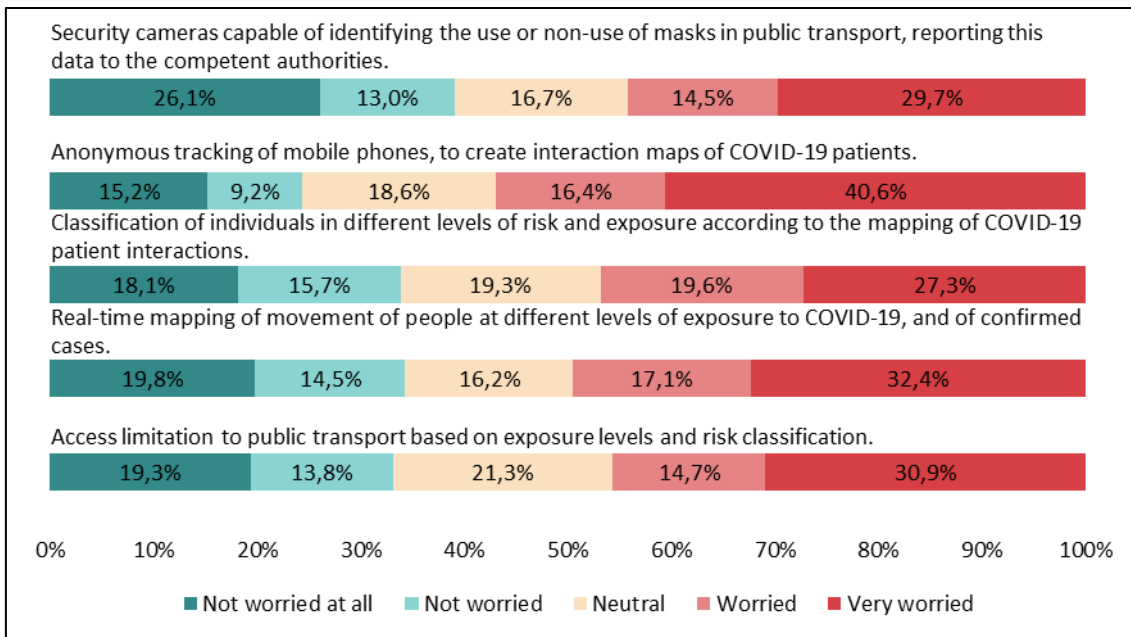
Figure 3, referring to the second question, presents the perception as to data safety and privacy, where the mirroring of answers is remarkable. The anonymous tracking of mobile devices for the creation of COVID-19 patient interaction maps generates the greatest concern among all technologies, with 40.6% of people very concerned. In fact, it is the only one that the people concerned, those who scored 4 or 5, exceeds 50%, reaching 57%. The use of cameras to identify the use of masks has the lowest percentage of rejection, with 26.1% of people marking the option "Not at all concerned".

Figure 2 - Safety perception of smart city technologies in public transport to contain the spread of the new coronavirus



Source: Authors, 2021.

Figure 3 - Safety perception of smart city technologies in public transport in relation to data privacy and safety



Source: Authors, 2021.

Analysing Figures 2 and 3, with the exception of anonymous tracking of mobile phones, all other options present a lower percentage of concern with data safety and privacy (answers 4 and 5), compared to that of the feeling of safety regarding coronavirus containment. The statement remains true when one analyses the opposite side of the spectrum, i.e., answers 1 and 2 on the Likert scale. Even so, the percentage of concern about data safety and privacy is too great to ignore.

#### 4.4 Additional aspects of using surveillance technologies in a pandemic and post-pandemic setting for COVID-19

##### 4.3.1. International Reality

In countries such as South Korea, China, Japan and Singapore there is a much deeper and more widespread "smartification" of urban life, laws and measures that provide the State greater power of control and data management and greater sociocultural acceptance of this type of initiative, as well as presented successful experiences applying the technological solutions cited in this article (CHEN & PAN, 2020; DAS & ZHANG, 2020; KASDAN & CAMPBELL, 2020; NAM, 2020; OH, 2020; KIM, 2020; SÖDERSTRÖM, 2020; SONN & LEE, 2020). However, in no case were the other recommendations, such as the use of masks, isolation and social distancing, sanitisation of public places, among others, dismissed.

As Chen and Pan (2020) and Sonn and Lee (2020) show, besides the points already mentioned, there is publicity and transparency of the systems applied. South Korea, in particular, has "a tradition of an interventionist state: South Koreans have a higher expectation of state intervention" (SONN & LEE, 2020). This fact combined with an aggressive smart city policy and previous experiences with epidemics, made the acceptance of these technologies by



the population somewhat easier (KASDAN & CAMPBELL, 2020; NAM, 2020; OH, 2020; KIM, 2020).

As Chen and Pan (2020), Fang, Nie, Penny (2020) and Lee and Lee (2020) demonstrate, the strategy of the three Ts "Test. Treat. Track.", a central aspect in epidemic and infectious disease control (WHO, 2012), has served as the basis for the extensive deployment of surveillance technologies in addition to recommended health measures. However, these technologies are applied with several other measures and are also embedded in a local, regional and national system (BUDD & ISON, 2020; CHEN & PAN, 2020; GKIOTSALITIS & CATS, 2020; SONN & LEE, 2020).

### 4.3.2. Brazilian Reality

In Brazil, the reality is different. Although smart city policies and efforts towards greater ubiquity and digitalisation of the urban exist, the density of these initiatives lags far behind international experiences (ANTUNES, 2020; BRAZIL, 2020a; DOWBOR, 2020). State transparency, as well as laws regulating and protecting data use and privacy not only have questionable applicability, but sometimes are non-existent (ANTUNES, 2020; BIONI, 2019; BRASIL, 2018; SABARIEGO, AMARAL & SALLES, 2020; ZANATTA, 2015).

The General Law on Personal Data Protection (Law 13.709/2018), adopts initiatives close to the European standard, considered by many, despite severe criticism, the most ambitious movement to control privacy and personal data in the face of a "datacentric capitalism" (BRASIL, 2018; DOWBOR, 2020; EU, 2016). With Decree 10.474/2020, the National Data Protection Authority was created (BRASIL, 2020b), enabling greater oversight regarding the protection of personal data. Regulation and protection are still incipient issues in the Brazilian reality and, as in international experiences, they must constantly struggle with new forms of exploitation of this "datacentric" format of capitalism.

As for the protection and containment measures of COVID-19, according to NTU (2021) the most used in public transport systems by buses were disinfection by nebulisation, the end of fare payment in cash, physical distancing signalling, passenger limitation, body disinfection tunnels and temperature measurement. According to ANPTrilhos (2020), the main measures adopted in railway systems were the cleaning of stations, trains and contact areas, adoption of sanitation technologies, such as spraying of disinfectant products and use of ultraviolet, temperature measurement through cameras, passenger orientation campaigns, installation of specific visual communication to indicate distance and maintenance of the supply of trains at levels well above demand. Therefore, one notices that there was no significant implementation of smart city technologies in public transportation systems in Brazilian capitals.

### 4.3.3. Considerations on surveillance and data protection technologies

Democracy's tug-of-war between safety and freedom, the latter as privacy and personal data protection, is at the heart of this debate. "Today's surveillance technology, especially in cities in advanced economies, is almost incessant," Sonn and Lee (2020) rightly assert. Countless national and international platforms and companies have almost unfettered

access to the data generated by their users. David Harvey (2007) elaborates the theory of accumulation by spoliation, whereby the capitalist system seeks, through any possible means including spoliation, to generate value and profit. Morozov (2018), Sonn and Shin (2020), Thatcher, O'Sullivan, and Mahmoudi (2016), Bruno et al. (2018), make valid arguments for the understanding that these surveillance technologies are a business model, a market in which this logic of accumulation by spoliation is the rule.

Sonn and Lee (2020), state that "When big data companies collect data with or without an individual's approval and use that data for their profit, it is hard to argue that the state should not use the same data for the safety and security of people." Yet, they fail to take a critical stand on the mode of production through spoliation. And, they further raise the argument that the perception of privacy is changing because of the wide and voluntary disclosure of personal information on social media and the internet (SONN & LEE, 2020). The creation of a content-producing consumer, or prosumer (FUCHS, 2010, 2012 and 2014), and the commodification of this content, via spoliation, does not justify or rationalise a thickening and deepening of this logic in other ways.

Sonn and Lee (2020) also state that in the pandemic scenario two perspectives remain: 1) extensive use of surveillance technology on a portion of the population, contaminated or at risk, to thereby protect lives and ensure the freedom and mobility of the remaining population amount; 2) Lockdown, which is "practically a weaker form of house arrest and which damages the economy, which, in turn, further impoverishes the poorest of society". In this way, the authors force a dichotomy, or a trade-off, between technology use and income protection of the poorest parts of the population. However, first of all, one must oppose the loss of privacy by the use of surveillance technologies and their effectiveness in containing the new coronavirus, and at the basis of this discussion is data and privacy protection, or more precisely, regulations and instruments of protection and enforcement (DOWBOR, 2020; BRUNO et al., 2018; MOROZOV & BRIA, 2019). In other words, the freedom-security binomial is inserted in a context.

#### 4.3.4. Smart cities in the post-pandemic

Kunzmann (2020) foresees an intensification of the development of, and via, smart cities, which implies a deepening of the "datafication" and digitalisation of society, economy and culture. He also foresees an increase in disparity and socioeconomic inequality between central and peripheral countries, as well as within countries themselves. He states that the pandemic will not stop the "smartification" of cities, but it will corroborate with the efforts of the digital economy to "accelerate digital transformation processes in cities" (KUNZMANN, 2020). It is worth mentioning that several authors claim that these technologies can be a way out to enable an economic recovery, as occurred after the 2008 crisis (GROSSI & PIANEZZI, 2017; HOLLANDS, 2008 and 2015; WIIG, 2015a and 2015b).

In Brazil, with the recent Brazilian Smart Cities Charter (BRASIL, 2020a), the already present national trend should follow the international movement, even if inserted in a Global South and dependent economy context. The "smartification" may be slower and not so densified, but it is already reality. And what should be done is an effort to regulate and democratically control this process and the technologies implemented.

## 4.3.5. Public transportation in the post-pandemic

Analysing the results obtained in the questionnaire, presented in Table 3, one can perceive an alignment with the predictions made by De Vos (2020) and with the results found by Budd and Ison (2020) regarding the modal split before and during the pandemic, such as a drop in the use of public transport, an increase in the use of active modes such as walking and cycling and of individual motorised modes such as private cars and motorbikes, taxis or ridesharing services.

Table 3 - Modal split before, during and after (expected) the pandemic of COVID-19

Mode of transport	Modal split (before)	Modal split (during)	Modal split (after – expected)
Walking	5,8%	7,9%	5,1%
Cycling	3,1%	3,6%	8,0%
Bus	44,2%	13,0%	33,8%
Train / metro	7,7%	1,0%	7,5%
Motorcycle	0,2%	1,2%	1,7%
Car	33,3%	49,5%	36,5%
Car on demand (by app of a ridesharing company)	4,1%	21,9%	5,6%
Other	1,4%	1,9%	1,9%
Total	100%	100%	100%

Source: Authors, 2021.

As presented in Table 3, despite a possible recovery in demand in the post-pandemic scenario, the percentages will be lower than before for public transport and higher for individual motorised modes. The forecasts of Kunzmann (2020) and analyses by Budd and Ison (2020) show the same behaviour. To mitigate this trend, public transport operators and vehicle manufacturers are taking measures such as reconfiguration of the internal seating layout and circulation spaces, contactless door sensors, hand sanitiser dispensers, transparent screens between seats, etc. (BUDD & ISON, 2020).

These efforts are in line with what Lyons (2020) states, when he advocates not replacing or demoting "mundane" or non-technological solutions with those typically referred to as "smart". Both solutions should be applied, from changing the internal seating arrangement and sanitisation of vehicles, such as automatic doors and cameras to check the use of protective masks (BUDD & ISON, 2020; LYONS, 2020).

In more central economies where the digitalisation of cities and urban services is already advanced or is in the process of being, the joint use of intelligent and "mundane" solutions may be more easily promoted - either by the economic aspect, by the more advanced discussions on the protection and use of personal data and privacy, by the expectation of State intervention or by transparency and high degree of public and private Accountability (DOWBOR, 2020; SONN & LEE, 2020; DAS & ZHANG, 2020). Brazil, as a peripheral economy and from the Global South, does not present the same reality (DOWBOR, 2020).

As seen in Figure 2, the perception of public transport safety due to the use of technological measures varies from 55.6% to 68.6% among the options presented in the

questionnaire. However, the variation of concern regarding the security of personal data and privacy, as seen in Figure 3, is between 44.2% and 57%. Thus, some considerations may be done as to the Brazilian reality of public transportation in a post-pandemic scenario: 1) intelligent solutions, as surveillance technologies, have effectiveness in fighting the new coronavirus, as well as can be an essential part of the strategy of the three Ts; 2) intelligent and "mundane" measures can be successfully used in an attempt to pass more safety regarding the use of public transport; 3) intelligent measures only, do not solve the problem; 4) along with the use of intelligent measures, in the form of surveillance technologies, comes the need for a system composed of laws, institutions and mechanisms to protect personal data and privacy; 5) use of surveillance technologies without proper regulation and without concomitance with health and "mundane" measures, may only represent an unnecessary expense to public coffers and have the opposite effect to the intended one, being one more reason to avoid public transport.

## 5. CONCLUSION

Surveillance technologies already exist and are extensively used, which does not mean that the struggle and arguments against them are not valid and do not deserve to be discussed. However, this study looks at another aspect of existing and future technologies, data protection. Initiatives such as the General Protection Data Regulation, or GDPR (EU, 2016), should be expanded and enhanced to return to individuals, as far as possible, control and disposition over their own data. Democratic, transparent and participatory control should be an essential element of future public policies and laws addressing these issues.

In the name of a great evil, it is common to give up freedom and privacy for the sake of greater security, for example, the post September 11, 2001 measures in the United States. But it is necessary to get away from the heat of the moment and analyse the consequences of the flexibilization of laws, the reduction of protection and individual guarantees. The result obtained in the questionnaire of this study is clear: the population of Brazilian capitals would feel safer with the use of surveillance technologies in the post-pandemic context, but they also want guarantees of protection of their personal data and privacy.

Unlike other containment strategies, whose deadline for implementation expired a long time ago and the longer the delay lasts, the more lives will be lost, the initiatives dealt with in this article may become a reality only in the future. Until then, one must accept the task given and pay attention to the concerns regarding privacy and data safety, as well as guarantee in the most diverse ways the safety of the population that uses public transportation.

## REFERENCES

ANPTrilhos. Balanço do Setor Metroferroviário. 4º trimestre 2020. **Associação Nacional dos Transportadores de Passageiros sobre Trilhos (ANPTrilhos)**, 2020. Disponível em: <https://anptrilhos.org.br/wp-content/uploads/2020/12/anptrilhos-balanco-metroferroviario-4trimestre-2020.pdf>. Acesso em: 03 mar. 2021.

ANTUNES, E. M.; SIMÕES, F. A. Engenharia urbana aplicada: um estudo sobre a qualidade do transporte público em cidades médias. **Urbe. Revista Brasileira de Gestão Urbana**, v. 5, n. 2, p. 51-62, 2013.

ANTUNES, R. **Uberização, trabalho digital e Indústria 4.0**. São Paulo: Boitempo, 2020.

- BIONI, B. R. **Proteção de dados pessoais: a função e os limites do consentimento**. Rio de Janeiro: Editora Forense, 2019.
- BARCELOS, M.; LINDAU, L. A.; PEREIRA, B. M.; DANILEVICZ, A. M. F.; TEN CATEN, C. S. Inferindo a importância dos atributos do transporte coletivo a partir da satisfação dos usuários. **TRANSPORTES**, v. 25, n. 3, p. 36-48, 2017.
- BIBRI, S. E.; KROGSTIE, J. Smart sustainable cities of the future: An extensive interdisciplinary literature review. **Sustainable cities and society**, v. 31, p. 183-212, 2017.
- BRASIL. **Lei nº 13.709, de 14 de agosto de 2018**. Lei Geral de Proteção de Dados Pessoais [2018]. Disponível em: [http://www.planalto.gov.br/ccivil\\_03/\\_ato2015-2018/2018/lei/L13709.htm](http://www.planalto.gov.br/ccivil_03/_ato2015-2018/2018/lei/L13709.htm). Acesso em: 05 mar. 2021.
- BRASIL. Ministério do Desenvolvimento Regional. **Carta Brasileira para Cidades Inteligentes**. Brasília, 2020a. Disponível em: <https://www.gov.br/mdr/pt-br/assuntos/desenvolvimento-regional/projeto-andus/carta-brasileira-para-cidades-inteligentes>. Acesso em: 05 mar. 2021.
- BRASIL. **Decreto nº 10.474, de 26 de agosto de 2020**. Diário Oficial da União: seção 1, Brasília, DF, edição 165 p. 6, 27 de agosto de 2020b. Aprova a Estrutura Regimental e o Quadro Demonstrativo dos Cargos em Comissão e das Funções de Confiança da Autoridade Nacional de Proteção de Dados e remaneja e transforma cargos em comissão e funções de confiança. Disponível em: <https://www.in.gov.br/web/dou/-/decreto-n-10.474-de-26-de-agosto-de-2020-274389226>. Acesso em: 05 mar. 2021.
- BRUNO, F.; CARDOSO B.; KANASHIRO, M.; GUILHON, L.; MELGAÇO, L. (Eds.). **Tecnopolíticas da vigilância: perspectivas da margem**. Boitempo Editorial, 2019.
- BUDD, L.; ISON, S. Responsible Transport: A post-COVID agenda for transport policy and practice. **Transportation Research Interdisciplinary Perspectives**, v. 6, p. 100151, 2020.
- CHEN, Q.; PAN, S. Transport-related experiences in China in response to the Coronavirus (COVID-19). **Transportation Research Interdisciplinary Perspectives**, v. 8, p. 100246, 2020.
- DAS, D.; ZHANG, J. J. Pandemic in a smart city: Singapore's COVID-19 management through technology & society. **Urban Geography**, p. 1-9, 2020.
- DELEUZE, G. **Conversações**. (1972-1990), Trad. Peter PálPelbart. São Paulo: Ed, v. 34, 2013.
- DE VOS, J. The effect of COVID-19 and subsequent social distancing on travel behavior. **Transportation Research Interdisciplinary Perspectives**, v. 5, p. 100121, 2020.
- DOWBOR, L (Ed.). **Sociedade Viglada**. São Paulo: Autonomia Literária, 2020.
- EUROPEAN UNION, 2016. The General Data Protection Regulation (GDPR). Disponível em: <https://eur-lex.europa.eu/eli/reg/2016/679/oj>. Acesso em: 05 mar. 2021.
- FANG, Y.; NIE, Y.; PENNY, M. Transmission dynamics of the COVID-19 outbreak and effectiveness of government interventions: A data-driven analysis. **Journal of medical virology**, v. 92, n. 6, p. 645-659, 2020.
- FUCHS, C. Labor in Informational Capitalism and on the Internet. **The Information Society**, v. 26, n. 3, p. 179-196, 2010.
- FUCHS C. Dallas Smythe today – the audience commodity, the digital labour debate, Marxist political economy and

critical theory. Prolegomena to a digital labour theory of value. **tripleC: Communication, Capitalism & Critique. Open Access Journal for a Global Sustainable Information Society**, v. 10, n. 2, p. 692-740, 2012.

FUCHS, C. **Digital Labour and Karl Marx**. Routledge, 2014.

GKIOTSALITIS, K.; CATS, O. Public transport planning adaption under the COVID-19 pandemic crisis: literature review of research needs and directions. **Transport Reviews**, p. 1-19, 2020.

GROSSI, G. E PIANEZZI, D. (2017) Smart cities: Utopia or neoliberal ideology?, **Cities**, vol. 69, Pp. 79-85.

HOLLANDS, R. G. Critical interventions into the corporate smart city. **Cambridge journal of regions, economy and society**, v. 8, n. 1, p. 61-77, 2015.

HOLLANDS, R. G. Will the real smart city please stand up? Intelligent, progressive or entrepreneurial?. **City**, v. 12, n. 3, p. 303-320, 2008.

HARVEY, D. **A brief history of neoliberalism**. Oxford University Press, USA, 2007.

KASDAN, D. O.; CAMPBELL, J. W. Dataveillant Collectivism and the Coronavirus in Korea: Values, Biases, and Socio-Cultural Foundations of Containment Efforts. **Administrative Theory & Praxis**, v. 42, n. 4, p. 604-613, 2020.

KIM, P. S. South Korea's fast response to coronavirus disease: Implications on public policy and public management theory. **Public Management Review**, p. 1-12, 2020.

KUNZMANN, Klaus R. Smart Cities After Covid-19: Ten Narratives. **disP-The Planning Review**, v. 56, n. 2, p. 20-31, 2020.

LEE, D.; LEE, J. Testing on the move: South Korea's rapid response to the COVID-19 pandemic. **Transportation Research Interdisciplinary Perspectives**, v. 5, p. 100111, 2020.

LEVY P. **Cibercultura**. São Paulo: Editora 34, 2010.

LYONS, G. Walking as a service—Does it have legs?. **Transportation Research Part A: Policy and Practice**, 137, 271-284, 2020.

MOROZOV, E. **Big Tech**. São Paulo: Ubu Editora, 2018.

MOROZOV, E.; BRIA, F.; **A cidade inteligente: tecnologias urbanas e democracia**. São Paulo: Ubu Editora, 2020.

MUSSELWHITE, C.; AVINERI, E.; SUSILO, Y. Editorial JTH 16—The Coronavirus Disease COVID-19 and implications for transport and health. **Journal of Transport & Health**, v. 16, p. 100853, 2020.

NAM, T. How did Korea use technologies to manage the COVID-19 crisis? A country report. **International Review of Public Administration**, p. 1-18, 2020.

NTU. BOLETIM NTU - Impactos da COVID-19 no transporte público por ônibus. **NTU – Associação Nacional das Empresas de Transportes Urbanos**, 2021. Edição nº 3, Janeiro/2021. Disponível em: <https://ntu.org.br/novo/upload/Publicacao/Pub637474260048364846.pdf>. Acesso em: 19 fev. 2021.

OH, S.-Y. From a 'super spreader of MERS 'to a 'super stopper 'of COVID-19: Explaining the Evolution of South Korea's Effective Crisis Management System. **Journal of Asian Public Policy**, p. 1-16, 2020.

- RAHMAN, M. M.; MANIK, M. M. H.; ISLAM, M. M.; MAHMUD, S.; KIM, J. H. An Automated System to Limit COVID-19 Using Facial Mask Detection in Smart City Network. In: 2020 **IEEE International IOT, Electronics and Mechatronics Conference (IEMTRONICS)**. IEEE, 2020. p. 1-5.
- SABARIEGO, J.; DO AMARAL, A. J.; SALLES, E. B. C. **Algoritarmos**. São Paulo, BR, Valencia, ES: Tirant lo Blanch, 2020.
- SCHAFFERS, H.; KOMNINOS, N.; PALLOT, M.; AGUAS, M.; ALMIRALL, E.; BAKICI, T.; VENTURA, J. L. Smart cities as innovation ecosystems sustained by the future internet. 2012. Disponível em: <<http://hal.archives-ouvertes.fr/docs/00/76/96/35/PDF/FIREBALL-White-Paper-Final2.pdf>>. Acesso em: 15 jan. 2021.
- SHAPIRO, J. M. Smart cities: quality of life, productivity, and the growth effects of human capital. **The review of economics and statistics**, v. 88, n. 2, p. 324-335, 2006.
- SILVA, J. C. S.; DE LIMA SILVA, D. F.; NETO, A. D. S. D.; FERRAZ, A.; MELO, J. L.; JÚNIOR, N. R. F.; ALMEIDA FILHO, A. T. A city cluster risk-based approach for Sars-CoV-2 and isolation barriers based on anonymized mobile phone users' location data. **Sustainable cities and society**, v. 65, p. 102574, 2020.
- SÖDERSTRÖM, O. The three modes of existence of the pandemic smart city. **Urban Geography**, p. 1-9, 2020.
- SONN, J. W.; LEE, J. K. The smart city as time-space cartographer in COVID-19 control: the South Korean strategy and democratic control of surveillance technology. **Eurasian Geography and Economics**, v. 61, n. 4-5, p. 482-492, 2020.
- SONN, J. W.; SHIN, H. B. Contextualizing accumulation by dispossession: The state and high-rise apartment clusters in Gangnam, Seoul. In: **Annals of the American Association of Geographers**, v. 110, n. 3, p. 864-881, 2020.
- THATCHER, J.; O'SULLIVAN, D.; MAHMOUDI, D. Data colonialism through accumulation by dispossession: New metaphors for daily data. **Environment and Planning D: Society and Space**, v. 34, n. 6, p. 990-1006, 2016.
- WORLD HEALTH ORGANIZATION. Test, treat, track: scaling up diagnostic testing, treatment and surveillance for malaria. **World Health Organization**, 2012. Disponível em: . Acesso em: 15 jan. 2021.
- WORLD HEALTH ORGANIZATION. WHO Director-General's opening remarks at the media briefing on COVID-19. **World Health Organization**, 11 Mar. 2020. Disponível em: <https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020>. Acesso em: 15 jan. 2021.
- WIIG, A. IBM's smart city as techno-utopian policy mobility. **City**, v. 19, n. 2-3, p. 258-273, 2015a.
- WIIG, A. The empty rhetoric of the smart city: from digital inclusion to economic promotion in Philadelphia. **Urban geography**, v. 37, n. 4, p. 535-553, 2016.
- WINNER, Langdon. Do artifacts have politics?. **Daedalus**, p. 121-136, 1980.
- ZANATTA, R. A proteção de dados pessoais entre leis, códigos e programação: os limites do Marco Civil da Internet. In: **Direito e Internet III**, São Paulo: Quartier Latin, 2015, v. 1, p. 447-470.
- ZANELLA, A.; BUI, N.; CASTELLANI, A.; VANGELISTA, L.; ZORZI, M. Internet of things for smart cities. **IEEE Internet of Things journal**, v. 1, n. 1, p. 22-32, 2014.