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TECHNOLOGICAL PLATFORMS AND SOCIAL CHANGE: THE UBER CASE

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1. INTRODUCTION

New peer-to-peer technologies have been emerging over the past years in the socio-economic environment, while environmental and social issues are playing an increasingly important role. Consider this a relevant point of discussion in the 2030 Agenda (UN, 2015).

These technologies can be perceived in different dimensions of social and economic life, especially considering the urban mobility segment—in which Uber is to be found—with the emergence of technology platforms and collaborative consumption (Lessig, 2008). The quick proliferation of hitchhiking and mobility applications has been affecting not only the organizational environment but also the way in which individuals relate to each other and the nature of social preferences, which is a process still poorly known and mapped.

Indeed, by directly connecting providers and consumers, peer-to-peer platforms (Edvardsson & Trovoll, 2020; Trabucchi & Buganza, 2020), in which access to goods and services is performed through online services (Hamari et al., 2016, Jha et al., 2016), provide an alternative to traditional mobility models and generate significant changes in the entire urban mobility segment. The impacts, however, go beyond this market and reach out to modify rules, habits, mental models, and the perception of individuals, indicating institutional disruption (Ferreira et al., 2021).

In this way, technological platforms can change people's mindsets and generate social transformation, solving social issues (Kolk & Ciulli, 2020), providing new services, employment opportunities, diversity, environmental sustainability (Jha et al., 2016) and socioeconomic development (Beliaeva et al., 2020).

Some researchers have more recently emphasized the need for practical studies that address technological platforms' approach to solving social problems (Caulier-Grice et al., 2012; Logue & Grimes, 2019; Misuraca & Pasi, 2019), specially empirical studies that examine how to meet social needs (Lee et al., 2019; Carida et al., 2022), and also, despite the complexity, measure the social change rate (Kavanagh et al., 2021).

As a result, the purpose of this article is to answer two fundamental questions that have received little attention in the literature: Does the use of Uber's platform provide social change, solving social issues? Has the Uber platform affected passengers and drivers at different levels?

The article investigates the social implications of peer-to-peer digital platforms, which enable large networks with members acting as both clients and/or suppliers. The central objective is to test if platform adoption is associated with many kinds of social change, including some that enable solving social issues; and if there are differences in the level of social change between drivers and passengers.

In pursuit of this goal, the present study is based on the hypothesis that the peer-to-peer technological platform Uber is associated with social change, solving social issues (Kolk & Ciulli, 2020), integrating habits, and other non-material culture elements (Ogburn, 1922), like unemployment, lack of services, goods access, life quality, and sustainability (Kavanagh et al., 2021).

This research contributes to a better understanding of peer-to-peer platforms influences on social transformation practices. It considers peer-to-peer platforms as a social transformation driver by identifying the elements that enable actors to collaborate in purposeful ways to achieve positive, systemic social change.

We propose a framework that integrates the social transformation discourse and peer-to-peer platforms by emphasizing how platforms' fundamental functions enable the core elements of social transformation and how the platform's architecture strengthens and empowers these elements by allowing dimensions of social transformation to emerge in the form of new forms of social change.

The article is organized into four parts. In the first, the theoretical framework addresses the topic of peer-to-peer platforms and social transformation. In the second, the methodological procedures that guided the research are presented. The results discussed in the third part present the hypothesis tests performed, demonstrating whether the technological platform Uber is associated with social transformation. Finally, the fourth part presents the study's discussions and conclusions.

2. TECHNOLOGICAL PLATFORMS AND SOCIAL CHANGE

2.1 Technological Platforms

Technology platforms of different types have been emerging and spreading throughout the world, hampering the creation of a concept that is concomitantly comprehensive and precise for each one of them. As commented by Milojević and Inayatullah (2015), technological consumer platforms, which are in full expansion, have been generating "disintermediation" between producer and final consumer and inflating expectations of material progress, social inclusion, and improvement in the quality of life of large population groups.

According to Gawer (2014), however, these different types of platforms share some basic properties, namely: the ability to coordinate agents capable of innovating and competing; the possibility to generate value and benefit from economies of scope associated with supply and/or demand; and the presence of a modular technological architecture presenting a core and a periphery, all connected in a network. In other words, these are communities based on shared access to certain types of resources (products, services, information, and so on).

Within such a context, technology platforms and the sharing economy are to be found. In line with Mattsson and Barnes (2016), sharing activities have been increasing drastically and have evolved from the exclusive field of information to comprise different kinds of products and resources, including peer-to-peer platforms, such as Uber (i.e., an information platform that connects globally local providers to local users for urban mobility).

An innovation supported by technological feedback mechanisms in urban sharing platforms helps replace existing behavioral models and facilitates new ways to create trust among strangers. In the specific case of Uber and many other platforms that provide services through peer-to-peer platforms, trust is built through a system of reputation based on transparency and legitimacy (Perren & Kozinets, 2018). Most of them invest in the creation of evaluation and classification systems, nurtured by the users individually (providers and/or customers) and useful not only to improve the system itself but to support the potential and decision-making processes of effective users.

Technology is undermining cultural and cognitive assumptions about hosting strangers at home or sharing belongings with strangers. It reduces the risks associated with the new practice and reduces transaction costs by employing technological solutions. Another assumption undermined by this sort of innovation is the typical policing role of the state; on online platforms, a new peer policing system is utilized (Zvolska et al., 2019).

As it becomes more open, the platforms provide information on interfaces and launches of products, allowing external participants to develop complementary (Altman & Tushman, 2017; Wry et al., 2013) or substitute products and services, which is not common for organizations that do not operate through platforms of collaborative consumption.

By adopting a model of independent providers (Schor & Attwood-charles, 2017), the platforms introduce differentiated rewarding and evaluation systems in relation to employed workers (Andersson et al., 2013; Avital et al., 2014) and radically change work relations (for further information on this matter, see Codagnone et al., 2016; Graham, & Woodcock, 2018; Manyika et al., 2016; Todolí-Signes, 2017; Vaclavik, & Pithan, 2018).

In addition, some platforms utilize metrics focused on the interaction among users and depend on ratings and reputation data to reduce risk and increase trust (Avital et al., 2014).

Thus, they can promote social change (Caulier-Grice et al., 2012; Logue & Grimes, 2019; Misuraca & Pasi, 2019) by managing multiple interactions (Jarzabkowski et al., 2007; Reckwitz, 2002) and affecting the entire value chain (Altman & Tushman, 2017).

2.2 Social change and technological platforms

Social change is the alteration of the social order of a society which may include changes in social institutions, social behaviors or social relations. Sustained at a larger scale, it may lead to social transformation or societal transformation (Kavanagh et al., 2021).

There are many systematic approaches to understand social change. Social change can be understood, under the Marxist perspective, as structural contradictions of the system and as a regulating mechanism that allows the system to work through the periodic fluctuations, restore equilibrium, and grow further (Giddens, 1971, p. 59).

Eisenstadt (1983) approaches focus on the dynamics of modernization, which include social mobilization, structural differentiation, the development of free resources, and an institutional framework capable of continuous absorption of change. As society modernizes, new demands arise, new constituencies come to power, and the political, economic, social, and other spheres need to adapt to these changes and also maintain some kind of continuity.

For North (1996), institutions are the carriers of the processes of political, social, and economic change. He recognizes institutions as society`s formal rules (constitutions, statutes, common law, and regulations), informal constraints (norms of behavior, conventions, and internally imposed codes of conduct), and the enforcement characteristics of each (North, 1996). They are created to reduce uncertainty in pursuit of goals in economic, political, and social exchanges.

Murdock (1961) recognizes social change as a process that includes: a) innovation, which is "the formation of a new habit by a single individual that is subsequently accepted or learned by other members of the society" (p. 250); b) social acceptance, when the innovation is socially shared among the users; c) selective elimination, where those that are more rewarding than their alternatives are more likely to be picked up, while, consequently, those that are less adaptive are likely to be dropped, and disappear; d) integration: The final process of change is integration. The shared habits that are accepted become adapted to other shared habits, such that they all form, more or less, an integrated whole. The adopted habit is both modified as it is adapted and modifies the social situation, or culture, to which it is adapting.

There will be a ‘cultural lag’ between a change in the material culture (a technological invention) and differential changes in the non-material (social) culture—knowledge, belief, morals, law, and custom (Ogburn, 1922, p. 200–283). According to Kavanagh et al. (2021), it’s important to distinguish between the technological and the social; because we are compelled to assume that a change in one will lead to a change in the other. Moreover, the presumed causality is typically from the technological to the social, but the technological and the social are mutually embedded in one another because they are difficult to distinguish operationally, and because doing so is liable to lead to some form of technological determinism.

While the social and the technological are deeply implicated in one another, it still makes sense to (a) keep the distinction between the two (Kavanagh et al., 2021), specially to measure the rate of social change (Phillips, 2011).

Some scholars tried to measure social change in different ways (e.g., Lynd & Lynd, 1929; Bauer, 1966; Sheldon & Moore, 1968). Lynd and Lynd (1929) considered social change across six categories: working, home and family, youth and learning, leisure time, religion, government, and community. Sheldon and Moore (1968) organize their Indicators of Social Change into thirteen categories. The Lynds (1929) had six, while Caplow et al. (2001) divided them into fifteen chapters. Kavanagh et al. (2021) organized their data into seven categories: population; health; home, education e leisure; religion; work; wealth; law and order.

For the purpose of this study, we are interested in some aspects of social change regarding solving social issues (Kolk & Ciulli, 2020), like unemployment, lack of services and gods access, life quality, and sustainability. The main focus is to verify if the diffusion of a material culture, the technological platform Uber, has caused a change in the non-material culture of the users.

This focus is justified by the fact that from ancient times to the present, technology in means of transport has shaped the size of urban areas and land use (Falcocchio & Levinson, 2015) and interfered with the quality of life of the population (Ferraz & Torres, 2004). From the third century on, the promotion of individual motorized transport led to an increase in the use of private vehicles, increasing traffic jams and occupying the available urban space (Schrank et al., 2015), which contributed to the concern about the mobility conditions of the city population in large urban centers, mainly due to the growth of traffic accidents with victims, traffic jams, atmospheric gases, poor public transport, and social inequality (Carvalho & Pereira, 2011).

Such flexible, low-cost solutions promise to improve quality of life, health, and economic activity (Taylor et al., 2015) and are increasingly meeting the need for private vehicles (Schrank et al., 2015; Guide, 2017; Public & Association, 2016; Vine & Polak, 2015), simplifying the value chain by using a peer-to-peer model, that is, directly connecting people who carry out the transaction with each other, through low-cost technology platforms with global operations (Hagel et al., 2015).

The creation of one of the largest transport companies on a digital platform, Uber, emerged in response to an urban mobility problem. This model changed the status quo of the urban private transport market, impacting various sectors, government, and society (Azevedo et al., 2015), affecting various components of the urban transport chain, such as the taxi industry (Azevedo et al. ., 2015), government (McKnight et al., 2003; Jorge & Correia, 2013), public policy (Vine & Polak, 2015), economy (CADE, 2015), vehicle assemblers (Guide, 2017; Vine & Polak, 2015), collective public transport, infrastructure (Hagel et al., 2015), and society (Guide, 2017; Vine & Polak, 2015).

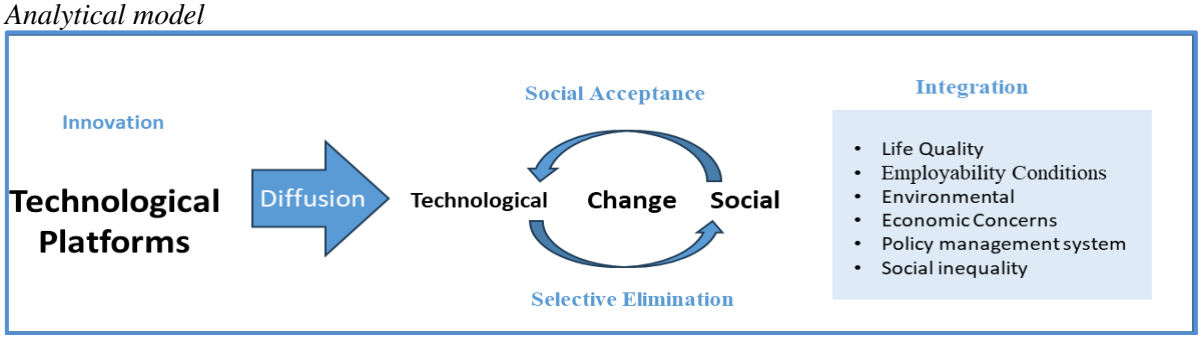
The emergence of shared mobility through digital platforms can drastically change society's standards of living. The increase in the pace at which these changes take place would pose a threat to incumbents (Christensen, 1997; Christensen et al., 2006; Christensen & Rosenbloom, 1995), in addition to distorting established institutions (Laurell & Sandstrom, 2016).

The social field has also been strongly affected by the app's entry, as people have changed their choices, behaviors, and urban mobility decisions (Hampshire et al., 2017), can earn income through the app, and the use of the application can reduce drunk driving and increase social well-being (Rogers, 2015), in addition to offering a mobility alternative to low-income people (Ferraz & Torres, 2004).

The political and governmental sphere has also been impacted by the entry of urban mobility applications such as Uber, as public authorities and unions in many cities offered strong resistance to the entry of the application (Azevedo et al., 2015), among the main reasons being 1) accusation of unfair competition, given that Uber did not have to observe the same regulations to which taxi drivers were subject; 2) concerns about safety, as the municipal authority did not supervise cars and drivers linked to the platform; and 3) work relationship between driver and Uber, since, for Uber, the driver is an entrepreneur, providing his services autonomously, while critics argued that there would be an employment relationship, which would require compliance with labor legislation (Azevedo et al., 2015).

Based on the considerations and analyses carried out here, we present the analysis model utilized in this research (Figure 1).

Figure 1
Analytical model



Note: Elaborated by the authors.

In the proposed model, we propose that the diffusion of an innovation, such as a technological platform like Uber, once accepted and selected by the users (Murdock, 1961), could promote social change (Kavanagh et al., 2021), integrating the habits and other non-material culture elements (Ogburn, 1922), such as life quality (Milojević & Inayatullah, 2015; Taylor et al., 2015), employability conditions (Azevedo et al., 2015; Andersson et al., 2013; Avital et al., 2014), environmental conditions (Jha et al., 2016), economic concerns (Taylor et al., 2015; Jha et al., 2016), policy management systems (Zvolska et al., 2019; Azevedo et al., 2015) and social inequality (Carvalho & Pereira, 2011; Vine & Polak, 2015). Thus, this research focuses on the indicators of changes related to solving social issues (Kolk & Ciulli, 2020), despite the existence of many other categories in the literature already described (e.g., Lynd & Lynd, 1929; Bauer's, 1966; Sheldon & Moore's, 1968).

3. METHOD

3.1. Demographic profile of respondents

The research universe involves users of the Uber platform in the city of Belo Horizonte. Due to the application's confidentiality policy, it was impossible to accurately estimate the number of Uber users at the time of the survey, leading to considering Belo Horizonte's entire population as a research universe. According to the Demographic Census data of the Institute of Geography and Statistics carried out in 2010, Belo Horizonte's total population was 2,375,151. According to most up-to-date estimates, in 2019, the population was 2,512,070 inhabitants, with an adult population (18 to 65 years old) of 1,628,469 inhabitants.

3.2. Sampling design

Based on probabilistic and stratified sampling, two samples of users (drivers and passengers) of the Uber application in Belo Horizonte, Brazil, comprised the field research. In addition to being a large urban center, Belo Horizonte was one of the first Brazilian cities to allow the app's operation in September 2014. To calculate the sample size (n), we considered a 95% confidence interval with a 5% margin of error, resulting in a total of 384 customers and 384 drivers (Cochran, 1977). Considering the possibility of missing data and outliers, the authors decided to increase the sample to 843 users, comprising 446 consumers and 397 drivers. Subsequently, the authors stratified the sampling by gender (consumers) and city census tracts, which were randomly drawn (Malhotra, 2011). After excluding two interviews, following the European Social Survey criterion, the sample totaled 841 users (444 customers and 397 drivers) (Sambiase et al., 2014).

3.3. Questionnaire design

The validation of content involves elaborating and refining the data collection instrument (Hoppen et al., 1996). Theoretical propositions and hypotheses arising from the

literature review on platforms and social change guided the formulation of the questions, the internal consistency of the scale was performed through an exploratory factor analysis, and the Cronbach's alpha ensured content validation (Churchill, 1979). This sort of validation ensures that the indicators utilized consistently represent the phenomenon under evaluation. Following Perrien et al. (1984) guidelines, the researchers considered several factors in designing the questionnaire. Initially, we used a representative number of closed question options to cover all answers. Further, only questions strictly related to the research topic were applied. We also considered the questions' implications in the data tabulation and analysis procedures.

The research allowed the elaboration of a collection instrument with 25 structured questions, derived from the conceptual model. Two blocks were part of the questionnaire. In the first, the questions were related to the characteristics of the participants. In the second, the questions sought information about the user's perceptions of social changes, according to the six categories of integration.

3.4. Pretesting

Subsequently, the authors performed a pretest for the data collection instrument. The pre-test considered aspects such as clarity and precision of terms, number of questions, form, order and introduction (Gil, 2002). Interviews with the help of telephone, carried out with 65 users, operationalized the pre-test. The number of respondents met the criteria suggested for the stage (Malhotra, 2011).

3.5. Data Collection

According to Malhotra (2012), in stratified probability samples, first the universe must be divided into subgroups, called strata. Then the elements must be selected from random criteria. Here, the research universe was stratified in terms of gender (for consumer users) and defined by the duration of interviews and the number of interviews expected. In total, 32 census sectors were selected in the city of Belo Horizonte. The structured interviews took place between May and August 2019 with people who traveled near schools, malls, and shopping centers in the census sectors. Respondents signed a free and informed consent form on the virtual platform to operationalize the study. A dialog box displayed at the beginning of the section on the user's data was used to gather respondents' demographic details. The authors performed the following procedures to check the quality of the data collection: (a) audit of transcriptions of the electronic research forms; (b) phone calls made to interviewees to confirm the provided information; and (c) evaluation of the research forms, analyzing whether they were complete and matched the electronic research system's registration.

3.6. Non-response and common method bias

Non-response (Depner, 2007, p. 10) corresponds to 0.4% of the passengers; in the drivers' sample, non-response was not identified, which indicates, according to Batinic et al. (1999), good research reliability and quality. Longford (2000, p. 73) argues that less than 2% of non-response already indicates good research reliability. The occurrence of common method bias is frequent when scholars use the same type of scale with the same number of response options and when the analysis is transversal, i.e. at a specific moment (Podsakoff et al., 2003).

The authors therefore used Harman's single factor test to check for common method bias, as well as exploratory factor analysis using all the study variables to generate a single factor. According to Podsakoff et al. (2003), when the variance explained in the factor analysis is less than 50%, common method bias is not an issue. Using SPSS V.25, we adopted the component extraction method and unrotated factor solution, as suggested by Podsakoff et al. (2003). The exploratory factor analysis outcome indicated an explained variance of 34,23% via Harman's single factor test, i.e., no significant evidence of common method bias. The authors

also verified acquiescence bias indications, such as missing data, suspicious research response patterns, outliers, and survey straight-lining (Hair et al., 2013; Podsakoff et al., 2003). We also employed univariate outlier detection to detect outliers. This technique indicated values above four standard deviations as a reference to characterize an atypical observation.

3.7. Measuring Instruments

The researchers used Cronbach's alpha (α) to verify the reliability of the scales. The objective was to indicate the percentage of the variance of the measures free of random errors (Malhotra, 2011). Landis and Koch (1977) asserted that values above 0.61 are acceptable; in this research, Cronbach's alpha was 0.881, which demonstrates the utilized scales' internal consistency. In addition, researchers assessed the existence of missing data, suspicious response patterns, outliers, and linear response patterns (straight lining), which may indicate acquiescence bias (Podsakoff et al., 2003). To verify outliers, the univariate analysis admitted values greater than four standard deviations as a reference for characterizing an atypical observation (Hair et al., 2017).

The researchers developed indices to measure the social change rate in terms of employability conditions, social inequality, economic concerns, policy management systems, life quality, and environmental factors, making it possible to verify whether technological platforms like Uber have promoted social changes. These indices were operationalized through questions on a Likert scale. The questions were grouped into six key categories (Table 1).

Table 1.
Questions according to interest variables

Categories	Questions
I1. Employability conditions	P1. Uber generates the need to adapt to a new way of earning a living and being paid. P2. The platform increases the feeling of professional independence among service providers. P3. Uber changed a lot the relationship between company, employee, and service provider.
I2. Social inequality	P4. With Uber, I was able to access transportation alternatives that were previously limited to my social status. P5. Uber reduces my sense of social inequality and lack of accessibility.
I3. Economic concerns	Q6. Uber represents an alternative for obtaining income. Q7. I consider the platforms' remuneration logic to be more financially advantageous than conventional salaried employment. Q8. Uber reduces expenses for providing the service compared to individual passenger transport (taxi, bus, or own car). Q9. Uber reduced my overall commuting expenses.
I4. Policy management system	Q10. Uber has a very different operating logic from traditional companies. Q11. Performance appraisal systems (e.g. by reputation) are very different from what I was used to in traditional organizations. Q12. Uber increases uncertainty about the impacts of a possible change in the regulation of transport via platform.
I5. Life quality	Q13. Uber reduced stress and worries when commuting. Q14. Uber makes commuting in urban centers easy. Q15. Uber positively affects the quality of life of its users.
I6. Enviromental	Q16. Uber allows for better use of the vehicle's physical space compared to individual passenger transport. Q17. Uber reduced the number of vehicles on city streets. Q18. Uber makes a positive contribution to mitigating the impacts of transportation on the environment.

Note: Elaborated by the authors based on the research data.

To measure the social change rate in each category, the indicator Technological Social Change Rate was developed and operationalized through Likert scale questions applied to platform users. The questions were grouped into six key variables, namely: employability conditions, social inequality, economic concerns, the policy management system, life quality, and the environment. They were developed based on the theoretical framework.

The scale used was as follows: 1="totally disagree'", 2="partially disagree;" 3="neutral, or indifferent;" 4="partially agree;" and 5="totally agree." The values were converted into indices from –1 to +1, assigning –1 to 1, –0.5 to 2, 0 to 3, +0.50 to 4 and +1 to 5. The following equation was used:

$$Ts = \frac{\frac{\sum_k^p (I1)}{n} + \frac{\sum_k^p (I2)}{n} + \frac{\sum_k^p (I3)}{n} + \frac{\sum_k^p (I4)}{n} + \frac{\sum_k^p (I5)}{n} + \frac{\sum_k^p (I6)}{n}}{6} \quad \textbf{(1)}$$

where: *Ts*= technological social change rate; I1, I2, I3, I4, I5, I6=Likert-scale data; *n*=sample size; and *k*=the user (*k*=1, 2, ..., *p*).

The lower the indicator, the lower the impact of the platforms on social change. In turn, the higher the indicator, the greater the influence of technological platforms on social change. Using the indicator data, it is possible to compare the social change platform`s impact on drivers and passengers. Based on the data provided by the indicator, the researchers used the t-test for independent samples, associated with Levene's (1960) test, to verify whether, between 2014 and 2019, in Belo Horizonte city, the Uber platform has affected passengers and drivers at different levels.

The software used to perform the test was SPSS V.25. The tests performed correspond to univariate hypothesis testing and are utilized to compare means when the standard deviation is unknown (Malhotra, 2012). The following hypothesis tests were adopted:

H0 (t-test): The indicator for technological social change is equal to zero (p>0,05).

H0 (Levene's test): The variance of the passengers` technological social change rate is equal to the variance of the drivers` technological social change rate (p>0.05).

H0 (*t*-test): The average of the passengers` technological social change rate is equal to the average of the drivers` technological social change rate (p>0.05).

3.8. Data Analysis

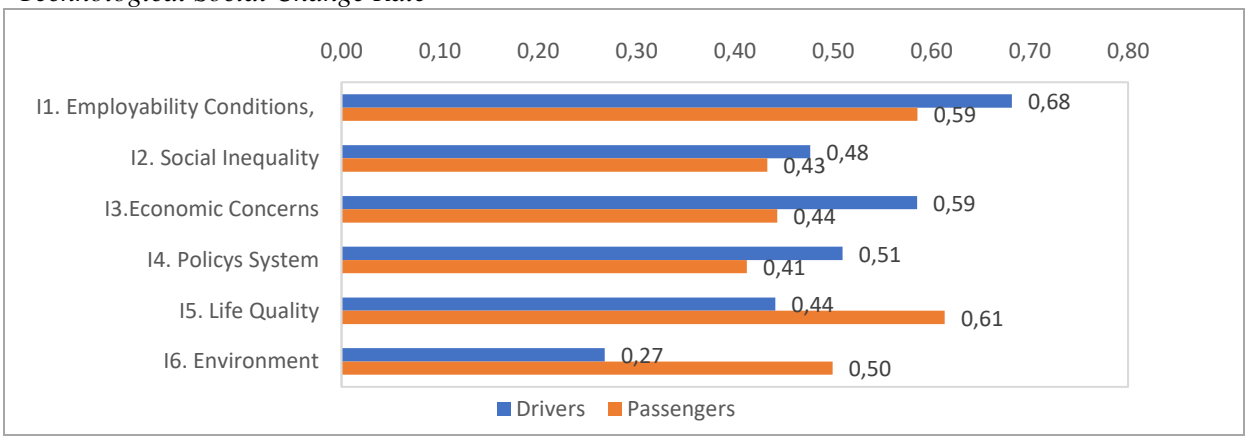
The authors carried out a multidimensional analysis of the data (Hair et al., 2017). The data provided by the questionnaire were grouped according to analysis categories and based on questions structured on a Likert scale. The researchers simultaneously analyzed more than two variables to summarize the findings or perform more in-depth analysis. The analysis categories were established based on literature, thus facilitating data interpretation and codification. The analysis categories grouped the data collected through the questionnaires. The indicator was created based on the structured questions, with support from the Likert-scale questions. Based on the data provided by the indicator, it was possible to carry out the t-test, which corresponds to univariate hypothesis testing and is utilized to compare means when the standard deviation is unknown (Malhotra, 2012).

4. RESULTS

Figure 2 presents the results of the indicator Technological Social Change Rate elements that comprise the perceived differences in employability conditions, social inequality, economic concerns, policy management system, life quality, and environment between Uber users in Belo Horizonte.

Figure 2

Technological Social Change Rate



Note: Elaborated by the authors based on the research data.

The data point to the indicator for technological social change, where the variables life quality (0.61), employability conditions (0.59) and environment (0.50) are emphasized for the passenger sample, and for the driver sample, the highest score was for employability conditions (0.68), economic concerns (0.59) and policy management system (0.51). The higher the value, the greater the social change associated with the platform's use.

While the most socially changing factor for drivers was employee conditions, for passengers, it was the improvement in life quality provided by the Uber platform. The changes in employee conditions are also recognized as the second most socially impactful factor from the passenger's perspective.

Through the equation of the indicator for Technological Social Change Rate, the following values were obtained: 0.49 for the sample composed only of drivers and 0.50 for the sample composed only of passengers, which indicates that, on a scale of -1 to 1, the Uber platform plays an important and significant role in social change (Kavanagh et al., 2021). In order to assess the significance of the data, hypothesis testing was carried out (Table 2) to verify if the platform Uber is associated with social change.

Table 2.

T-test Technological Social Change Rate

One-Sample Test						
	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Employability	62,990	840	,000	,6310912	,611426	,650756
Social inequality	32,059	840	,000	,4536	,426	,481
Economic concerns	47,524	840	,000	,5102061	,489134	,531278
Policy management	34,332	840	,000	,4582894	,432089	,484490
Life quality	42,311	840	,000	,5322001	,507511	,556889
Enviromental	24,225	840	,000	,3901034	,358497	,421710

Note: T-test considered p< 0.05 for average different than 0.

It is observed that the p-value is less than 0.05 in all variables related to social change, thus rejecting the null hypothesis. It is possible to assume, therefore, that Uber plays an important role in changing the non-material culture of its users, such as employability conditions, social inequality, economic concerns, the policy management system, life quality, and the environment.

When likening the sample of drivers to the sample of passengers, it is observed (Table 3) that the social changes on economic concerns are 32% higher compared to passengers, followed by policy management systems (24% higher), employability conditions (16% higher), social inequality (10% higher), life quality (28% shorter), and the environment (46% shorter).

Table 3.

Comparative individual social capital rate

Category	Passengers	Drivers	Delta %
I1. Employability conditions,	0,59	0,68	16%
I2. Social inequality	0,43	0,48	10%
I3. Economic concerns	0,44	0,59	32%
I4. Policy management system	0,41	0,51	24%
I5. Life quality	0,61	0,44	-28%
I6. Environment	0,50	0,27	-46%

Note: Elaborated by the authors based on the research data.

Regarding the percentage of Uber users, 92% of passengers and 100% of drivers agreed that Uber changes employability conditions; 76% of passengers and 83% of drivers agreed that Uber changes social inequality; 87% of passengers and 93% of drivers agreed that Uber changes economic aspects, solving economic concerns; 71% of passengers and 84% of drivers agreed with changes in the policy management system with different roles and metrics, 88% of passengers and 88% of drivers agreed that Uber improves the quality of life; and 69.8% of passengers and 58.9% of drivers affirm that Uber reduces environmental issues.

The Independent samples test was performed to verify if the indicator scores for passengers and drivers are statistically different (Table 4). Levenes` test and t-test show that all the scores are significantly different between the two samples, except social inequality.

Table 4.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Employability conditions	Equal variances not assumed	82,754	,000	-4,934	756,658	,000	-,09520	,019295	-,13308	-,05732
Social inequality	Equal variances not assumed	81,868	,000	-1,577	778,602	,115	-,0437	,0277	-,0981	,0107
Economic concerns	Equal variances assumed	,007	,932	-6,794	839	,000	-,14256	,020983	-,18375	-,10138
Policy management system	Equal variances not assumed	62,973	,000	-3,699	820,336	,000	-,09689	,026192	-,14830	-,04547
Life quality	Equal variances not assumed	33,847	,000	7,129	808,431	,000	,17153	,024062	,12429	,21876
Enviroment al	Equal variances not assumed	90,387	,000	7,556	810,606	,000	,23242	,030758	,17205	,29280

Note: Levene's test considers $p<0,05$ when equal variances are not assumed, and $p>0,05$ for equal variances assumed; t test considers $p< 0.05$.

Thus, the analysis of the *t*- and Levene's test results compared to the indicator data, with a significance level of 5%, indicates that the Uber platform has affected passengers and drivers at different levels in all categories, except for social inequality, but the positive rate of the indicator suggests that the platform has promoted positive changes, reducing social issues.

5. DISCUSSION

The research findings corroborate the propositions that the peer-to-peer technological platform, Uber, is associated with social change (Kavanagh et al., 2021); as the platform provides interaction among users (Avital et al., 2014), it could meet social needs (Lee et al., 2019; Carida et al., 2022); and solve social issues (Kolk & Ciulli, 2020).

In a general way, the technological social change indicator demonstrates a positive impact on social change in both samples, where the platform has impacted a little more passengers (0.50) than drivers (0.49).

According to the employability conditions, the indicator confirms the proposition that the Uber platform has changed the employability conditions (Azevedo et al., 2015; Andersson et al., 2013; Avital et al., 2014) of drivers (0.68) and passengers (0.59), considering that the platform provides employment opportunities (Jha et al., 2016; Azevedo et al., 2015; Andersson et al., 2013; Avital et al., 2014), the higher level for drivers reflects the immersion of a new employment alternative informed by the drivers.

Regarding Social inequality, the indicator also demonstrates a higher score for drivers (0.48) compared to passengers (0.43), but there is no significative difference among drivers and passengers. Nonetheless, the positive rate shows that Uber has been reducing social inequality and accessibility (Carvalho & Pereira, 2011; Vine & Polak, 2015) by providing a cheaper mobility alternative and social inclusion by offering a mobility alternative to low-income people (Ferraz & Torres, 2004), for both drivers and passengers.

The indicator index also demonstrates that, being a peer-to-peer flexible, low-cost solution (Hagel et al., 2015; Taylor et al., 2015), the platform supports solving economic concerns (Beliaeva et al., 2020; Taylor et al., 2015; Jha et al., 2016), being an alternative for obtaining income and reducing transportation expenses compared to traditional means of transport (taxi, bus, or car), the driver`s rate was higher (0.59) compared to passengers (0,41).

The policy management system has also changed with Uber's operation (0.51 for drivers and 0.41 for passengers), and the users agreed that the operation logic is very different compared to traditional companies, the performance evaluation considering the reputation of the users, and the more sensitive aspects regarding changes in government and law regulations. The positive rate confirms the hypotheses that Uber has changed public policy (Vine & Polak, 2015) and is impacting various sectors of government and society (Zvolska et al., 2019; Azevedo et al., 2015).

The life quality social change rate was higher for passengers (0.61) than drivers (0.44). The users agreed that Uber has reduced stress and worries, facilitated mobility, and improved life quality with comfort and convenience (Kavanagh et al., 2021; Ferraz & Torres, 2004; Milojević & Inayatullah, 2015; Taylor et al., 2015).

Finally, the environmental rate (0.50 for passengers and 0.27 for drivers) indicates that the platform makes a positive contribution to mitigating the impacts of transportation on the environment, contributing to sustainability (Jha et al., 2016), and reducing space requirements and the number of vehicles in cities. The higher rate for passengers means that the impact was higher for passengers than drivers; this difference may be explained by the still high dependence on vehicles by drivers.

Thus, from a broad perspective, the technological social change rate demonstrates that all changes associated with Uber adoption have a significant impact on the statistics tests and occur at different levels (except for social inequality) for drivers and passengers, but they have

a positive impact in both samples, assisting in the resolution of social issues (Kolk & Ciulli, 2020) and promoting socioeconomic development (Beliaeva et al., 2020).

6. CONCLUSION

6.1. Theoretical and methodological implications

This study presents important contributions. By associating technological platforms and social change approaches to measure and analyze the technological social change of Uber platform users with a set of totally original indicators, this article helps to fill gaps associated with the still current lack of studies that address the technological platform approach to solving social problems and needs (Caulier-Grice et al., 2012; Logue & Grimes, 2019; Misuraca & Pasi, 2019; Lee et al., 2019; Carida et al., 2022).

Indeed, this article also has a significant contribution to measure the social change rate (Kavanagh et al., 2021), in a different perspective of many scholars (Lynd & Lynd, 1929, Bauer's, 1966; Sheldon & Moore's, 1968; Caplow et al., 2001, Kavanagh et al., 2021), the approach presented focuses on the non-material culture aspects to solve social issues (Kolk & Ciulli, 2020).

This article allows for a more integrated understanding of the social changes associated with a technological platform and shows, with the technological social change indicator, that life quality and employability conditions were the most impacted factors for passengers, and employability and economic concerns were the major factors impacted from the drivers' perspective.

6.2. Practical implications

Initially, this article emphasizes the importance of a better understanding of the social changes associated with a peer-to-peer technological platform. The proposal of a model that integrates six variables to measure social change, as proposed here, can help researchers measure the impact of platforms on solving social issues. Indeed, knowledge of these variables can help managers formulate strategies to enhance markets and services oriented toward platform users. In addition, by demonstrating that the platform has significantly impacted drivers and passengers in different ways, life quality for passengers, and employability conditions for drivers, this study sheds light on the relevance of the different social impacts of the peer-to-peer technological platform on different users, which are still little known and explored.

6.3. Implications at the level of public policies

Social issues are a concern in many societies, and peer-to-peer platform diffusion has been increasing over the last few years. This study shows the main factors of social change that technological platforms have impacted. This impact also affects the institutions that could benefit from the policies to reduce drunk driving, increase social well-being (Rogers, 2015), and provide a mobility alternative to low-income people (Ferraz & Torres, 2004), but in the same way that they have to adapt the public policies to solve social issues, as unemployment. Therefore, these findings can also support public policies to drive social changes in socioeconomic development.

6.4. Limitations

This study is not without limitations. The first is related to the cross-sectional analysis of the social impacts promoted by the Uber platform. The study addresses the immediate perception of the changes associated with the technological platform. However, social changes can have a long-term effect, the results of which can be better observed over a longer time horizon than that understood in this work. Another limitation is that although the technological

social change indicator provides a way to quantify the impact of a technological platform on social change, including more variables may allow the indicator to be adapted to other and more specific contexts, e.g., health and real state. Finally, the absence of a qualitative research approach that could enable the establishment of a deeper explanation of the impacts caused by peer-to-peer platforms on the social context.

6.5. Suggestions for future research

New research could, for example, investigate the impacts of peer-to-peer platforms over a long period of time and check if the social benefits are sustainable. In addition, other studies could expand the horizons of platforms. There are peer-to-peer platforms in different sectors, and with many intermediate purposes, the social impact of these platforms, and the real social benefit are an unexplored field, representing research opportunities.

6.6. Concluding remarks

This article attempted to address some of the many scholars' requests for practical studies that address technological platforms' approach to solving social problems, meeting social needs, and also how to measure the social change rate. Field evidence allows us to conclude that: i) The peer-to-peer platform has a significant positive impact on changing the non-material culture, such as employability conditions, social inequality, economic concerns, the policy management system, life quality, and the environment. ii) Platform interaction enables users to meet social needs and solve issues. Life quality and employability conditions are the most impactful factors for passengers, while employability and economic concerns are from the drivers' perspective.

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