MITIGATING NEGATIVE EXTERNALITIES THROUGH PLATFORM GOVERNANCE: THE CASE OF A DOCK-LESS BIKE SHARING SERVICE IN SÃO PAULO CITY

1. INTRODUCTION

The sharing economy is an emergent phenomenon that has been challenging the 'ownership' consumption paradigm (Belk, 2007, 2014). Favored by the development of information and communication technologies (ICT) in the last decades (e.g. internet, GPS, computers, smartphones and remote sensors), sharing economy business models offer temporary individual access to on-line and off-line resources (i.e. virtual or physical objects), either supplied by the services themselves or crowdsourced (i.e. providing 'Business to Customer' transactions or 'Peer to Peer' intermediations) through electronic platforms (i.e. webpages or smartphone applications) in exchange for monetary compensation (Eckhardt et al., 2019).

Among the vast range of services included in the concept, one has been particularly affecting the urban mobility routine of several metropolitan cities across the world by making self-service free-floating cars, bikes or scooters available throughout their streets for any person interested in renting them (Akbar & Hoffmann, 2020). Although these 'urban mobility free-floating sharing services' (UMFFSS) do not provide opportunities of contact among users (i.e. interactions are directly with the platform and its resources), they somehow depend on each other's behavior (Bardhi & Eckhardt, 2012). The physical condition and the geographic position of a resource used by someone affects the availability, safety and experience of the next user (Akbar & Hoffmann, 2020). The way a consumer uses the service may therefore cause negative externalities in the resource system, and this is a huge concern for the entrepreneur (i.e. service owner) (Akbar & Hoffmann, 2020; Eckhardt et al., 2019), who needs to maximize resource utilization in order to profit from considerable investments (i.e. the acquisition of resources and technology) (Acquier, Carbone, & Masse, 2019).

As UMFFSS have just opened a new market, several governance strategies have been applied to influence the way the resources are used (Zhang, Pinkse, & McMeekin, 2020). Constraints, sanctions and incentives have been used to manage endogenous factors, such as user motivations (Bardhi & Eckhardt, 2012; Habibi, Davidson, & Laroche, 2017) and cognition (Lan, Ma, Zhu, Mangalagiu, & Thornton, 2017). The

challenge of improving service efficiency through governance, however, also needs to consider exogenous factors to ensure sustainability, either to improve coordination between the platform, the government and the users (Y. G. Ma et al., 2019) or to adapt the rules of use to the frequent changes taking place in constitutional rules (Y. Ma, Lan, Thornton, Mangalagiu, & Zhu, 2018). From this scenario, an under-explored question has emerged that could be approached through institutional theories (Trenz, Frey, & Veit, 2018; Zhang et al., 2020):

What governance strategies can take advantage of endogenous and exogenous factors to improve the creation of value for the community of users and the entrepreneur in urban mobility free-floating sharing services?

In order to answer this question, the analysis takes inspiration from Lamberton & Rose's (2012) 'typology of sharing systems', which states that this type of service is "generally open to anyone who can pay the entry fee, but there are very few other limits on who may participate" (i.e. low exclusivity of the service) and that "one consumer's use of a unit of the shared good makes it unavailable for another consumer to use" (i.e. high rivalry amongst users) (Lamberton & Rose, 2012, p. 110). The incidence of both properties - the former a public good and the latter a private good characteristic - suggests that the investigated system has a similar conceptual level of exogenous factor influence (i.e. biophysical/material, social and institutional) as 'common pool resource' systems (CPRs), which have been so well-studied by Elinor Ostrom (1990). Ostrom used the "Institutional Analysis Development" framework (IAD), enhanced with decades of research by several scholars in political, social and economic fields, to evaluate what types of institutions have successfully constrained individualist actions and incentivized collective ones ensuring the sustainability of CPR systems (Ostrom, 1990, 2005; Ostrom & Cox, 2010). These insights motivated the authors of the current study to adapt the IAD framework to analyze the effects of changes in the rules for the use of a bike-sharing service operating in São Paulo, one of the largest cities in the world, situated in Brazil and characterized by a diversified profile of consumers and a heterogeneous urban landscape.

Through a triangulation of qualitative evidence from several sources (e.g. scientific findings, documental and netnographic data), it was possible to frame and describe certain effects of the governance of this service during three distinct moments, when they were modified by the entrepreneur, evaluating the value creation differences during its regular operation.

This research illustrates the level of dependence of this type of service on material/environmental, social and political contextual factors. It also shows how it can be manipulated through the deployment of specific rules of use to leverage higher utilization of the shared resources, delivering improved value to customers and the entrepreneur. Its main theoretical contribution, apart from adapting and testing the IAD framework for this type of service, is the explanation of the effects of the deployment of different rules of use (i.e. through the categorization of IAD rules) on such outcomes, extending New Institutional Economics (NIE) collective actions theories to this new field of strategic administration.

In the following section, a literature review will explain the functioning of the service and the potential effects of the governance on its outcomes. Subsequently, the IAD framework is introduced and its adaptation for this analysis is defended in conjunction with a theoretical validation of its constructs and their relations. In the next section, the employed method is described, through which the case is also explained. The study then proceeds with the analysis of the data and findings in each period with rule changes in the service. Finally, a conclusion is developed in line with the findings, describing the managerial and theoretical contributions, the limitations and future research suggestions.

2. LITERATURE REVIEW

2.1. Urban Mobility Free-Floating Sharing Service (UMFFSS)

Commercial UMFFSS systems with self-servicing resources are accessed through applications installed on the smartphone of their users. After registering and linking a credit line to fund periods of utilization, any individual is able to access and use resources that are made available freely throughout the public areas of a city (Akbar & Hoffmann, 2020). The users can then search for any available unoccupied vehicle close to them and go for it, with the assistance of a GPS that maps the position of both the users and the resources (Akbar & Hoffmann, 2020). They just need to approach the vehicle and unlock it, using the same application (Akbar & Hoffmann, 2020). When concluding the experience, users are informed of the value charged for the service right after they lock and leave the resource in any allowed public location of their convenience (Akbar & Hoffmann, 2020).

Coordinating supply according to demand is the main challenge of this type of service (van Waes, Farla, Frenken, de Jong, & Raven, 2018). The following negative externalities exist for such systems: (i) a vehicle is left in a geographic position with low demand; (ii) a vehicle is left in an unsafe point (e.g. dark, dangerous or risky alley); (iii) a vehicle is parked in a private area (i.e. with no possible access for another potential user); (iv) a vehicle is left in bad material conditions (e.g. broken or with some malfunction); or (v) a vehicle is vandalized. These externalities must be prevented and controlled by the service (Akbar & Hoffmann, 2020; Bardhi & Eckhardt, 2012; Eckhardt et al., 2019). In order to have high utilization levels - which will enable the return on investment in resources and technology – these types of services must have vehicles 'ready' to be used (i.e. in perfect conditions) in 'hot' areas (i.e. most demanding ones) (Acquier et al., 2019). In order to reinforce favorable economic rationales, the entrepreneurs need to take advantage of exogenous factors that influence the way the resources are used and re-supplied (de Chardon, Caruso, & Thomas, 2017; Shen, Zhang, & Zhao, 2018; Wang & Lindsey, 2019). Some theories usually define the user of the service as a co-creator of value or as a 'prosumer' of the system (Akbar & Hoffmann, 2020; Lan et al., 2017).

2.2.Motivation, Interactions and [Platform] Governance

According to Zhang et al. (2020), it is crucial that sharing economy platforms have a clear comprehension of the nature of their users' motivation as well as of the type of interactions occurring during their service experiences if the governance of these platforms is to facilitate certain expected outcomes. The authors suggest evaluations of the platform practices along a continuum that goes from social relations, on one extreme, to economic transactions, on the other, to optimize the governance design for performance.

Several studies define the type of service analyzed here as economically motivated by its users (Bardhi & Eckhardt, 2012; Habibi et al., 2017), with interactions between users being very rare and those between user and platform being the rule, being mostly rational and utilitarian (Acquier et al., 2019; Bardhi & Eckhardt, 2012). People normally seek out the service to go from one place to another using a convenient, fast, and cheaper mean of transportation. Exceptions may occur for some people who use the service for environmental (i.e. lower carbon emissions), social, health, or even hedonic

reasons (e.g. for a trip during the weekend), but these are not as significant as economic motivations (Akbar & Hoffmann, 2018, 2020; Lamberton & Rose, 2012).

Regarding the patterns of interaction during the service experience, they are situational and calculative (Akbar & Hoffmann, 2020). They are clearly 'means' and not 'ends' of their users' actions (Habibi et al., 2017). According to Bardhi & Eckhardt (2012), the consumers of these services have a short, occasional and self-interested contact with the platform, where they avoid identification with the accessed object of consumption, wish to remain anonymous, are mostly opportunistic and have a negative reciprocity with other users. The appropriate type of governance to produce efficient outcomes in these types of services are contractual relations, centrally controlled through easily assimilated incentives, sanctions and assurance mechanisms (Bardhi & Eckhardt, 2012; Habibi et al., 2017; Zhang et al., 2020).

Apart from the platform governance, an UMFFSS is also impacted by other institutional levels of influence. Local social and cultural norms (Eckhardt & Bardhi, 2016), and municipal, regional and national constitutional rules (Y. Ma et al., 2018; Y. G. Ma et al., 2019) need to be aligned with the platform governance in order to produce the expected constraints and incentives.

2.3. Adaptation of the IAD Framework

> "Recall that the economic nature of a CPR creates incentives for users to free-ride on the efforts of others to sustain the resource, which can lead to degradation. A growing body of empirical and theoretical research suggests that the likelihood of this occurring depends critically upon the fit among the physical and material conditions associated with providing and producing the resource, community attributes, and institutional arrangements. This work suggests that using the IAD framework to guide CPR policy analysis and design is a very sensible thing to do." (Polski & Ostrom, 2017, p. 34)

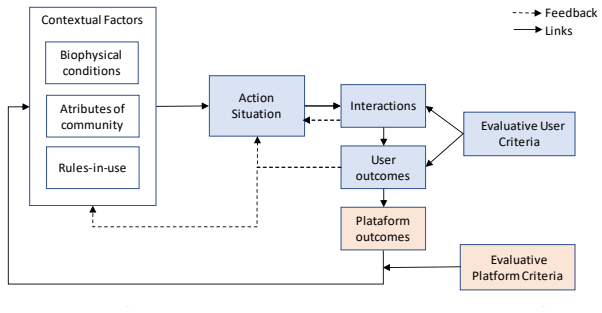
As anticipated in the introduction, this study expands on Lamberton & Rose's (2012) insight of typifying the proprieties of the services discussed herein as blending characteristics of public goods (i.e. 'low exclusivity' of resources) and private goods (i.e. 'high rivalry' amongst users to access them). This makes the systems of these services somewhat similar to those of CPRs (e.g. pasture, fishing, woodland and water

irrigation systems shared among local community members). In both cases, the opportunistic behavior of 'free-riders' must be prevented. That's why the exogenous factors influencing the consumption of goods, in the case of the CPRs, or influencing the usage of the resources supplied, in the case of the mentioned services, must be coordinated. It is therefore imperative to have a favorable participation of the community of users to maintain a beneficial economic rationale for collective gains (Akbar & Hoffmann, 2020). There is evidence to suggest that most UMFFSS users approve active surveillance and sanctions against service rule offenders (Hartl, Hofmann, & Kirchler, 2016), even collaborating in a 'Big Bother'-style monitoring of each other's behavior (Bardhi & Eckhardt, 2012), acting as 'prosumers' of the enterprise (Lan et al., 2017; Y. G. Ma et al., 2019).

Since contextual and situational factors can affect the level of utilization of these services' resources (Akbar & Hoffmann, 2020), and since "there is much potential to further explore how organizations combine governance practices […] and how the contextual factors mediate the governance process" (Zhang et al., 2020), the application of the Institutional Analysis Development (IAD) framework is very convenient for this analysis. It also allows for the evaluation of the influence of formal (i.e. constitutional rules) (Y. Ma et al., 2018; Y. G. Ma et al., 2019) and informal (i.e. social and cultural norms) (Eckhardt & Bardhi, 2016) institutions (North, 1990) that are somehow mixed with the operational rules (i.e. rules of use of the platform) (Lan et al., 2017), defining the effective 'rules in use' through a complex, multi-level and polycentric governance system (Ostrom, 2010). Another advantage of applying this framework is that "economic theory, game theory, transaction cost theory, social choice theory, covenantal theory, and theories of public goods and common-pool resources are all compatible with the IAD framework" (Ostrom, 2011).

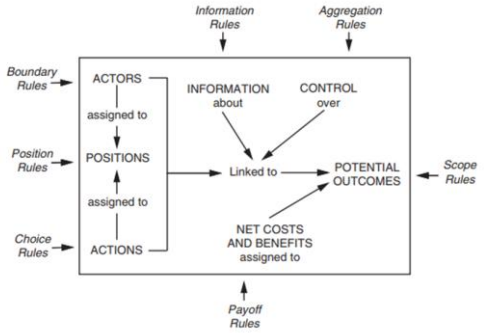
Minor adaptations were made to the framework to consider the independent mechanism of evaluation of the results of the platform (an independent organization) and its control of the rules of use defined for its users. As can be seen in Figure 1, the following two constructs were added (in pink) to the framework: (1) 'Service Outcomes' – a direct result of 'User Outcomes'; and (2) 'Evaluative Service Criteria' – a reference to the influence exerted by the platform on the contextual factors to improve outcomes.

Figure 1 - Adapted IAD Framework



Source: Adapted from Ostrom & Cox (2010)

Figure 2 – Elements of IAD action-situation



Source: Ostrom & Cox (2010)

With this reconfiguration, apart from illustrating the influence of contextual factors on the use of this service's resources, the adapted framework became useful for describing the control the service exerts on the context. Explanatory supportive elements were therefore added to the structure that helped establish the logic of how the service can influence material conditions (e.g. by adding more bikes to the system and/or maintaining the ones that are already in it), community attributes (e.g. through marketing activity) or the rules in use by the customers (e.g. changing the rules of the service by adding incentives or constraints) to improve outcomes for users and the entrepreneur.

To improve the validation of the constructs for this specific application of the IAD framework, this study considered exogenous factors that were confirmed in the literature as influencers of the use of a dock less bike sharing service (see Table 6).

The elements of the action situation illustrated in Figure 2 (inside the box, with capital letters) are described as "participants [ACTORS] in POSITIONS who must decide among diverse ACTIONS in light of the INFORMATION they possess about how ACTIONS are linked to POTENTIAL OUTCOMES and the COSTS AND BENEFITS assigned to ACTIONS and OUTCOMES" (McGinnis, 2011). For the case of this particular study, these elements are related to individuals (participants/actors) acting as users of dock-less shared bikes (position) and deciding about accessing, using, locking and leaving them (actions), supported by service messages, informative symbols or figures displayed on their smartphone applications (information), through which they recognize the cause-effect relations (links) between the actions they eventually take and their outcomes (potential outcomes). In a way, they estimate their final utility result (net costs and benefits) before deciding what to do.

The following rules of use affect these elements (in Figure 2, outside the box) (McGinnis, 2011):

- *"Position rules*: specify a set of positions, each of which has a unique combination of resources, opportunities, preferences, and responsibilities." This study is concerned about the rules that conceptualize the user (i.e. the individual who uses the service).
- *"Boundary rules*: specify how participants enter or leave these positions." In this particular case, they refer to rules that establish requirements, limitations and actions demanded for user registrations and terminations.
- *"Authority rules*: specify which set of actions is assigned to which position." Here they define the actions users are able to take for reaching, accessing, using and leaving the bikes.
- *"Aggregation rules*: specify the transformation function from actions to intermediate or final outcomes." There isn't any condition or intermediate step between actions and outcomes for the users of the service analyzed in this study. All possible actions taken by a user directly lead to precise outcomes (i.e. no other individual can have any interference in any user's specific outcome).
- *"Scope rules*: specify a set of outcomes" according to who performs the action and the initial or final position of a resource. It establishes different outcomes to competing actions to influence consumer choices. In this analysis, an example is the difference in costs and benefits resulting from users leaving bikes inside or outside the service area.
- *"Information rules*: specify the information available for each position." In this case, messages displayed on the user's smartphone app informing (or warning about) the consequences of their decisions.
- *"Payoff rules*: specify how benefits and costs are required, permitted, or forbidden to players." For this study, they are related to the general payoff formula defining the price of the service according to the duration of use of the resources by the individuals.

Assuming that "rules are important only to the extent that they allow the outcomes resulting from the choices of the participants to be unambiguously specified" (Rapoport, 1966, p. 18), there are basically two main ways of influencing outcomes through them: (1) rules that limit the choices of action of the actors, leading directly to some expected results (i.e. authority rules); and (2) rules that specify the expected results and give the actors freedom of choice, establishing the consequences they will

suffer in case they are not achieved (Coglianese, Nash, & Olmstead, 2003) (i.e. scope rules). The latter also depends on actors receiving prior information of the consequences of their choices, otherwise they can't produce the expected outcomes (Coglianese et al., 2003). Following this rationale, this study states the following:

Proposition: *Considering the level of control allowed by ICT technologies used in UMFFSS, 'scope rules' that are well-supported by 'information rules' should produce more efficient outcomes than 'authority rules'.*

In the next section, the data collection and analysis method is described.

3. METHOD

"Research in access and sharing is in its infancy" (Eckhardt & Bardhi, 2016) and theory building from case studies "is useful in early stages of research on a topic or when a fresh perspective is needed" (Eisenhardt, 1989). This explanatory, longitudinal, single case study is based on these statements and seeks to find and interpret qualitative evidence through an adapted IAD framework to describe the causes and effects of service governance regarding the actions of users of the first dock-less bike-sharing service ('Yellow') inaugured in the city of São Paulo, Brazil, in 2018. The chosen method also offers adequate resources for an in-depth investigation of a contemporaneous phenomenon in its natural context, where the boundaries between such phenomena and their context are not clear (Yin, 2010).

This single case (the 'Yellow' service platform) was selected because, apart from replicating an extending theory (Eisenhardt, 1989), it offered a rare opportunity for the transparent observation of the causes and effects of changes (Pettigrew, 1990) to the rules of use of the service, as its entrepreneurs were searching for an optimum service governance to improve the utilization of the supplied resources. The inexistence of any similar competing service in the market during the analyzed period (i.e. no other dock-less bike sharing service in the city) contributed to the minimization of undesired exogenous influences on the results.

For the development of this analysis, data was collected from:

(a) Documents - official ‘Yellow’ web (*Website_Yellow*, 2019) and social media pages (Facebook_Yellow_Group, 2019; LinkedIn_Yellow_Page, 2019), ‘Yellow’ smartphone app information and press or blogs articles (16 articles in total);
(b) File registrations - 110 customer claims registered within the period considered for this analysis, and answered by ‘Yellow’ on ‘Reclame Aqui! (Reclame_Aqui!, 2019), the (by far) most popular customer complaint and follow-up platform in Brazil;
(c) Direct observation using netnography (Kozinets, 2002) – interactions between users and the ‘Yellow’ customer service registered on ‘Yellow’s’ official Facebook page (Facebook_Yellow_Group, 2019), which had 27,003 registered followers by October 16, 2019; interactions between users themselves registered in ‘Yellow Bike Brasil’ (Facebook_Yellow_Bike_Brasil_Group, 2019), a closed group created on ‘Facebook’ by users of the ‘Yellow’ services with 2,485 registered members by October 16, 2019; and interactions between ‘Yellow’ and users registered in ‘Reclame Aqui!’(Reclame_Aqui!, 2019) regarding the resolution and follow-up of the complaints the users made on this platform;
(d) Participative observation - registrations of the service use experience by the researchers;
(e) Literature review – scientific confirmations of the influence of exogenous and endogenous factors on the use of dock-less bike sharing services.

The triangulation of data collection increased its sources and quantity, enabling higher potential variability for a meticulous discrimination of convergent and divergent pieces of evidence, which also contributed to a greater validity of the constructs (Yin, 2010).

The predominant collection of electronic data for the analysis is explained by the fact that any individual who wants to access and use the service is required to have a registered account either on the ‘Facebook’ social media platform or on the ‘Google Mail’ service. Furthermore, this decision was also taken because most consumers of this type of service are naturally fluent in electronic media communication (Kumar, Lahiri, & Dogan, 2018) and the electronic channels are also the only regular manner utilized by ‘Yellow’ to communicate with its users. In addition, the chosen method allowed for the recovery of data from the past, without which no progress could be made for the purposes of this study.

The following periods were analyzed:

- **(Situation 1)** From August 2 to September 11, 2018: when no service area restriction was in place for the users;
- **(Situation 2)** From September 12 to September 30, 2018: when the service area was first implemented and bikes left outside it were kept locked by the platform. No incentive was used to influence users' usage habits in this period;
- **(Situation 3)** From October 1 to December 31, 2018: when the service charged a return fee from users leaving bikes outside the service area and started to credit return bonuses to users taking bikes from it. The rules deployed during this period were kept by the platform with no substantial change;

For each period, a decision tree was designed according to the collected data, describing the service usage from start to finish. In order to describe all the patterns of usage, the process was divided into five steps: (1) finding the bike, (2) unlocking, (3) riding, (4) locking and leaving, and (5) payment compensation. The IAD framework (Figures 1 and 2), revised for this study, was the foundation of the logic applied for the definition of every possible action in each decision node.

Limited by rules and driven by utilitarian motivation (Habibi et al., 2017; Lamberton & Rose, 2012), users estimate the costs and benefits related to the outcomes of the actions they may take, before deciding (i.e. assuming rational behavior). The value captured by (or created for) the user is defined as 'user surplus', or the difference between their 'willingness to pay' (B) and the 'effective price' paid for the service (P). Accordingly, the value captured by (or created for) the platform is defined as 'platform surplus' (i.e. their gross profit), or the difference between the 'effective price' of the service provided (P) and the 'cost of offering the service' (C) (Besanko, Dranove, Shanley, & Schaefer, 2013). As such, the total value created can be expressed as:

$$\textit{Value Created} = \textit{User Surplus} + \textit{Platform Surplus} = (B - P) + (P - C) = B - C$$

Following Akbar & Hoffmann (2018), this study applied perceived cost and benefit factors to estimate the 'willingness to pay' (B) of a user of a dock-less bike sharing service. According to this method, 'willingness to pay' (B) of is a sum of tangible (e.g. substitutability of the ownership) and intangible benefits (e.g. other perceived usage benefits) with transaction (e.g. search, technical and sunk costs) and emotional costs (e.g. perceived stock-out risk) (Table 1). Users will choose the service when their 'willingness to pay' (B) is higher than the effective price of the service (P)

(Akbar & Hoffmann, 2018). Table 1 describes all the endogenous factors included in the rationale, determining the consumer's intent to choose the service.

This study also takes the negative externalities produced by users in the system into consideration (section 2.1). As the actual user defines the position and condition of the resource when he uses and leaves it anywhere, that position and condition directly influences the next user's intention to use it (Akbar & Hoffmann, 2020; Bardhi & Eckhardt, 2012; Eckhardt et al., 2019). In order to do this, the value created during actual and subsequent utilization is calculated (i.e. potential consumer and service surpluses for actual and next use actions). This estimation enables a more proximate view of the value created in the system by any usage pattern.

Table 1 - Perceived benefits and costs for choosing free-floating bike sharing services

Willingness to Pay (B)	Factor of Influence	Condition of the Influence	Intention to Choose the Service
Perceived Usage Benefits	Substitutability of the ownership	The higher the degree of perceived substitutability, the higher is the consumer's intention to choose this service offer (and even higher for non-experience users).	+
	Need for socializing	The higher the consumer's need for socializing, the higher is the consumer's intention to choose this service offer (and even higher for experienced users).	+
	Desire for unique consumer products	The higher the consumer's desire for unique consumer products, the lower is the consumer's intention to choose this service offer.	-
	Preference for non-ownership	The higher the consumer's preference for non-ownership, the higher is the consumer's intention to choose this service offer.	+
	Enjoyment of sharing	The higher the consumer's enjoyment of sharing, the higher is the consumer's intention to choose this service offer.	+
Perceived Usage Costs	Search costs	The higher the search costs, the lower is the consumer's intention to choose this service offer (and even lower for experienced users).	-
	Technical costs	The higher the technical costs, the lower is the consumer's intention to choose this service offer (and even lower for experienced users).	-
	Sunk costs	The higher the sunk costs, the lower is the consumer's* intention to choose this service offer (*only affects non-experience users).	-
	Perceived stockout risk	The higher the predictability of personal usage, the stronger the influence of perceived stockout risk on the likelihood of choosing this service offer (and even stronger for non-experience users).	-
		The greater the consumer's environmental consciousness, the lower is the negative moderating influence of personal usage predictability on the relationship between a perceived stockout risk and the likelihood of choosing a PSS sharing offer.	+ (mitigate -)

Source: based on Akbar & Hoffmann (2018)

4. THE CASE

'Yellow'[1] used to define itself as "a micromobility and payment service that comes to change the way people live in their cities" (LinkedIn_Yellow_Page, 2019). Its mobility platform included sharing options for bike, e-bike and e-scooter services. Through its services, accessed via a free-of-charge smartphone app, the users could purchase credit, after registering and accepting service agreement conditions, and use

[1] 'Yellow' was founded in 2017 by Ariel Lambrecht and Renato Freitas, two of the three former owners of '99' (the first Brazilian 'unicorn', a ride-hailing service founded in 2012 and sold to the Chinese 'Didi Chuxing' in January, 2018), and Eduardo Musa, the former CEO of 'Caloi' (the biggest manufacturer of bicycles of Brazil for decades, purchased by the Canadian group 'Dorel Industries, Inc.' in 2013). None of 'Yellow' founders had previous experience with this specific kind of business model (i.e. UMFFSS).

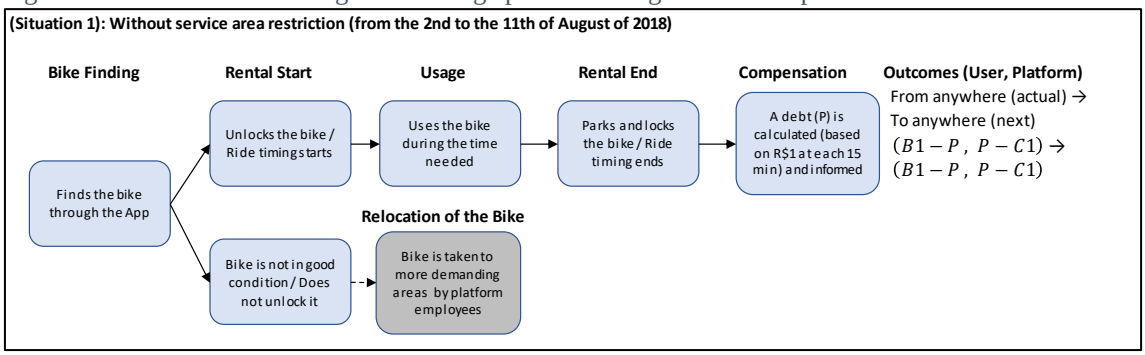
the service, leaving the shared resources at any location in the city. The cost charged for the service in São Paulo city was R$1.00 (equivalent to about US$ 0.24 in October 2019) for each new 15-minute period of use. Its services were very similar to those offered by ‘Mobike’ (China) and ‘Jump’ (USA). With credit in their account, consumers could unlock any unoccupied bike available through a QR code scanner with the assistance of an app installed on their smartphones. The bike lock would then be automatically released and the timer would start running. Whenever the user reached their destination, they only had to park and lock the bike again (manually this time) to conclude the service. Subsequently, a monetary charge would be automatically calculated and applied to the consumer’s account.

5. RESULT ANALYSIS

(Situation 1): Bike sharing service without service area restriction

On August 2, 2018, ‘Yellow’ launched its dock-less bike sharing service in São Paulo city. It debuted its operations without restricting the area of usage. The platform made 500 bikes immediately available in the South region of the city, promising a gradual deployment of more units until reaching an amount of 20,000 bikes by the end of the year. From the launch of the service until September 11, 2018, any user could rent a bike from any place where it was available and finish the ride by locking and leaving it in any area of the city, without restrictions of choice and without being charged for farther destinations. The service’s rules of use and usage patterns were confirmed through user comments and posts of its app’s print-screens on the official ‘Yellow’ ‘Facebook’ group, through users of the ‘Yellow Bike Brasil’ ‘Facebook’ group and through information found in blogs and press articles. Figure 3 illustrates the usage process of the service in this period.

Figure 3 - 'Yellow' Bike Sharing service usage process during 'Situation 1' period



Source: Authors

All the bikes were free floating throughout the entire city. The consequence of supplying resources so widely was a high rate of customer complaints in 'Reclame Aqui!' regarding the unavailability of bikes in good conditions to meet the emerging demand. This generated 67% of the complaints in this period.[2] The combination of a small volume of bikes available and a vast service area caused a shortage of supply, frustrations for the consumers and major difficulties (and costs) for the platform to control the quality of the service and relocate bikes in good condition for usage in demanding zones. Table 2 summarizes the impacts on the value created during this period.

Table 2 - Value created in 'Situation 1'

↓ Value Created (1) ↑	Willingness to Pay (B1)	High perceived usage costs reduced consumer's willingness to pay	Perceived stockout risk	Shortage of bikes confirmed by consumers in registrations in a web site specialized in commercial complaints and by comments posted by them on 'Facebook'.
			Searching cost	Consumer frustrations for not finding bikes showed as available for usage on their smartphone's App screens (bikes were possibly kept inside private buildings by imprudent users) or because they couldn't unlock and use the bikes when located (informed as out of service for maintenance or for relocation to most demanding area).
	Service Cost (C1)	High service cost due to operational costs and the idle capacity of the resources	Operational cost	The relevant quantity of inoperative bikes waiting for maintenance denoted the difficulties of the platform to offer support for resources spread out in such an extensive and unlimited area. Relocation costs also emerged during this period, as did the costs for teaching a new service culture to new users over a vast area.
			Utilization of the resources	Bikes removed for maintenance, locked or in process of relocation to more demanded areas of the city or even not found because they were unduly kept inside private buildings by imprudent users were increasing the service cost.

Source: Authors

(Situation 2): Service area deployment and definitive locking of bikes left outside

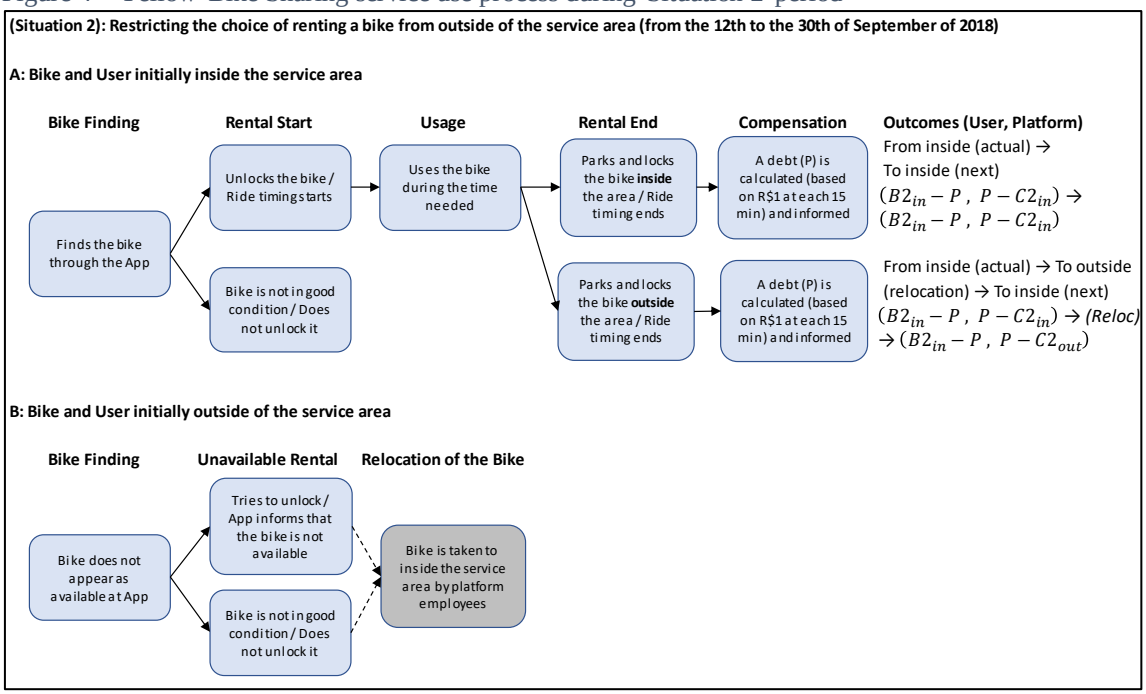
On September 12, 2018, after experiencing sufficient unsatisfactory operational outcomes generated both for the platform and for the users in general, 'Yellow' announced the implementation of a service area. There is a lot of evidence (e.g. interviews of the entrepreneurs published in the press, social media and press releases by 'Yellow', answers to consumer complaints in 'Reclame Aqui!' and answers to consumer comments on the official 'Yellow' 'Facebook' group) to suggest that the service area was established as a result of a previous analysis by the platform about the main patterns of usage of the rides (i.e. the most demanding areas of the city).

On September 13, 'Yellow' published a message on their official 'Facebook' group page informing their users about the new rules of use and showing a new map covering the service area adopted from then on. The same map and institutional messages started to pop up on the users' smartphone app, reminding them of the new

[2] According to 'Yellow', in the first month of operation alone, more than 150,000 bike trips had been performed by the users of the service.

service area. Several posts from users on the official 'Yellow' 'Facebook' group and on 'Yellow Bike Brasil' 'Facebook' closed group contained print-screens with such evidence. During this period, no fee was charged from users, nor was any physical restriction established to prevent bikes from being taken outside of the service limit. The only practical measure implemented by the service was the definitive locking of all bikes left outside the area, making them unavailable for use again in those regions. These bikes didn't appear as service options in the app for consumers who were searching for them outside the service area. They could not be released even if a user tried to unlock them by force. When approaching bikes in this condition, customers would be reminded through pop-up messages in the app that they were temporarily out-of-service due to maintenance or relocation. Print-screens of the app from consumers who experienced this were posted on the 'Facebook' groups by unsatisfied users. Figure 4 shows the usage process of a bike from the perspectives of a consumer during this period.

Figure 4 - 'Yellow' Bike Sharing service use process during 'Situation 2' period



Source: Authors

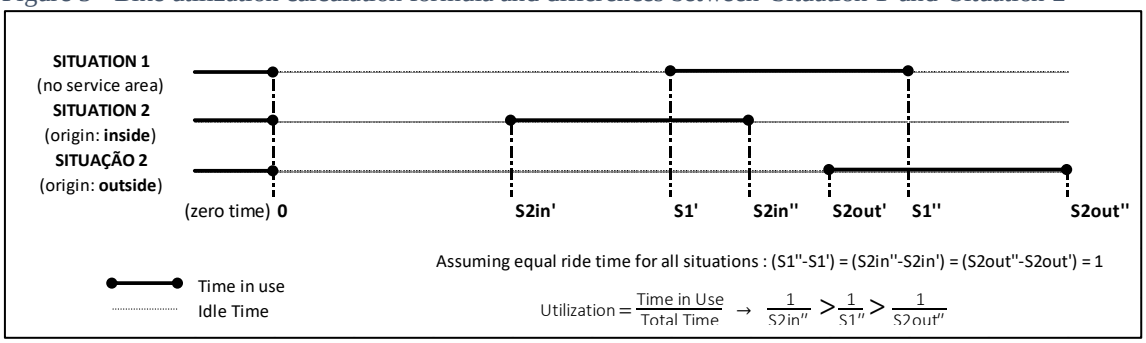
The consequence of the immediate implementation and announcement of the new rules of use were negative comments and complaints from a share of consumers on 'Facebook', both in the official 'Yellow' group and the users' 'Yellow Bike Brasil' group, as well as on the 'Reclame Aqui!' website. Several blogs and press articles also criticized the measure, suggesting that 'Yellow' was discriminating against users from

the city's marginal zones. The announcement of these changes alone, posted on the official 'Facebook' page of the service, provoked 234 comments, 55 forwards and 4.7 thousand views. On the 'Reclame Aqui!' website, in the short period between September 12 and 25, 2018,[3] 66% of the complaints registered were related to the restriction of service outside the defined area.[4]

Despite the negative impact on the image caused by the users who were not served, the new rules prevented that the bikes of the service were taken too far from the most demanding area. This improved the availability of bikes in the service area, where lots of new or experienced users were waiting for them. Despite solving the biggest part of the problem, the new rules were not able to bring down the high operational costs of the platform, which, according to the evidence, wasn't capable of quickly managing the logistics of bringing back the idle locked bikes outside the service area. 'Yellow' would therefore either have to hire more employees (or contract logistics services) or find new solutions to reduce the high idle time of bikes located outside the service area.

Figure 5 helps explain the higher utilization of the bikes originally inside the service area due to a higher demand there, contributing to lower costs (C2in in Figure 4). It also clarifies the cost impact of the higher idle times of those located outside the service area (C2out in Figure 4), in addition to the logistics costs for their relocation inside the service area.

Figure 5 - Bike utilization calculation formula and differences between 'Situation 1' and 'Situation 2'



Source: Authors

Table 3 summarizes the value created in this period relatively to previous one.

[3] On September 26, 'Yellow' publicly announced other rules of the service, which came into effect on October 1, and which initiated a new trend of complaints.

[4] By September 23, the 'Yellow' fleet had more than 2,000 bikes in São Paulo City, serving 1.5 million users in an area of 76 km2.

Table 3 - Value created in 'Situation 2'

↑ Value Created (2) ↓	Willingness to Pay (B2)	↑ B2in	Perceived stockout risk (many consumers)	Considerable reduction of perceived stockout risk compared to 'Situation 1' since the bikes that were left outside the area could be relocated inside again (for maintenance or to more demanded area) much more quickly than before. Bikes couldn't be taken indefinetely far from demand zone anymore.
		B2out (0)	Unavailable service (few consumers)	The definitive locking of all bikes that were parked outside the service area made the service unavailabe from outside to inside, causing the unsatisfaction of the consumers that were used to such route patterns.
	Service Cost (C2)	C2in ↓ ↓	Cost of bikes initially inside (many bikes)	Bikes that were kept in use inside the service area had a lower cost as they didn't demand much relocation, had much lower maintenance cost due to the proximity of the workshop service suppliers, and were available for usage for longer periods inside an area with much higher demand.
		↑ C2out	Cost of bikes initially outside (few bikes)	The intense necessity of relocation of the bikes and of logistics for the maintenance of the damaged ones, overcharged the costs of those that came from outside to inside the service area. The longer it took for their relocation also increased their cost. Besides, even if the desire of a consumer was to take a bike from outside to inside, this wasn't allowed.

Source: Authors

(Situation 3): Applying incentives to keep all the bikes inside the service area

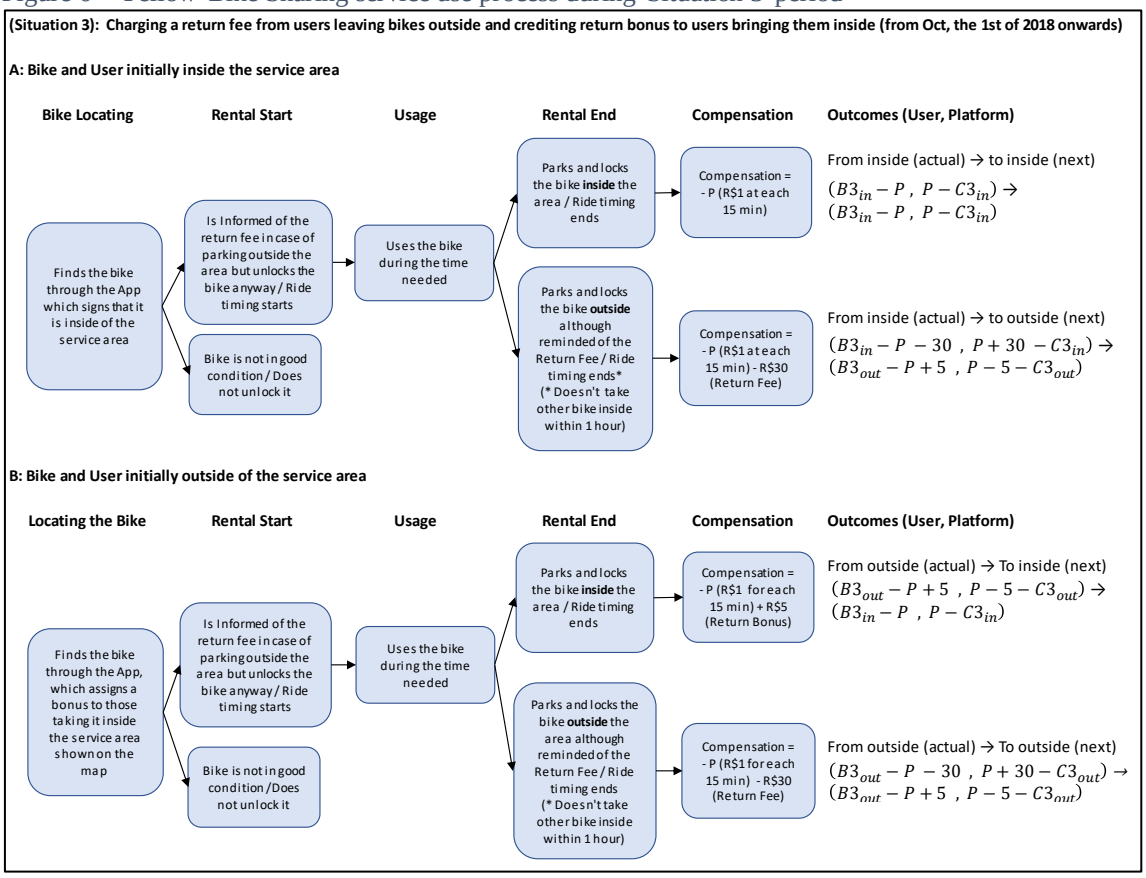
As of October 1, 2018, 'Yellow' started to charge a return fee of R$30.00 (about US$7.20 in October 2019) from the account of users who ended the ride outside the service area and didn't return the bike in question or any other bike parked outside the service zone to inside it within one hour. The incidence of the return fee was only conditioned to where the bike was left (i.e. outside the service zone) regardless if it was originally situated inside or outside the service area when accessed. 'Yellow' also started to credit a return bonus of R$5.00 (about US$1.20 in October 2019) to the account of any user bringing back a bike from outside to inside the area.

These new rules were announced, in advance, on September 26 on 'Yellow's' official 'Facebook' group. The repercussions of that announcement caused 514 comments and 21 follow-ups there. Several press articles and blogs also informed the changes to come. Consumer complaints registered in 'Reclame Aqui!' related to the anticipated dissatisfaction generated by that news peaked 83% between September 26 and 30, when most of the users explicitly asked for the money back that they had deposited in their platform account.

Important improvements deployed in the service's rules of information made the trend of complaints cool down, reducing them to 29% in October, 11% in November and 7% in December, 2018, in 'Reclame Aqui!'. 'Yellow' used its app to keep consumers aware of the consequences of their actions as of October 1. Even before the deployment of the new rules, the app started highlighting the service area map in a clearer background color and with 'no parking' signs spread all over the zone outside of it. Messages informing users in advance of the forthcoming return fee also started to pop up in the app to keep users aware before the implementation of the new rules. It was

clear that the service was using this informative tool in a much more strategic way than before. Figure 6 synthetizes the new usage process according to the origin of the ride.

Figure 6 - 'Yellow' Bike Sharing service use process during 'Situation 3' period



Source: Authors

As soon as the new rules came into effect, app pop-up messages started to remind users, in real time, of the implications of their actions as they approached a bike to unlock it, when the limits of the service area were surpassed, or when they tried to lock a bike again outside of it. The app also started reminding users about bonus opportunities when they were close to bikes parked outside the service area. The evidence not only showed the desertion of consumers who were mainly interested in using the bikes in routes that went against the logic of the service (i.e. from inside to outside the service area), but also revealed the motivation of certain consumers who acted as 'prosumers' of the service, bringing bikes from outside to inside the area in order to collect extra credits in their accounts. These incentives, increasingly supported by real time information provided through the app, changed consumers' intentions, habits and decisions in such a way that economically convenient ride patterns were forged, improving the outcomes (see Table 4).

Table 4 - Influence of the monetary incentives in service usage patterns

Flow of Bikes				Actual Use				Next Use		
Start	End	User action consequences for the whole system of resources	Incentive to the User	User Outcomes	Platform Outcomes			User Outcomes	Platform Outcomes	
IN	IN	Does not alter the quantity of units of resources in the service area	0	B3in - P	→ P - C3in	&	B3in - P	→	P - C3in	
	OUT	Subtracts one unit of resource from the service area	-30	B3in - P - 30	→ P + 30 - C3in	&	B3out - P + 5	→	P - 5 - C3out	
OUT	IN	Adds one unit of resource from outside to inside the service area	5	B3out - P + 5	→ P - 5 - C3out	&	B3in - P	→	P - C3in	
	OUT	Allows a farther positioning of one unit of resource that was already outside the area	-30	B3out - P - 30	→ P + 30 - C3out	&	B3out - P + 5	→	P - 5 - C3out	

Decision pattern trend resulting from the influence of the incentives implemented by the platform through 'scope' rules of use

Source: Authors

Table 5 below shows how the lower cost caused by a higher presence of bikes inside the area improved the value creation, because of user behavior favoring the system's logic.

Table 5 - Value created in 'Situation 3'

↑ ↑ ↑ **Value Created (3)** ↓ ↓ ↓	**Willingness to Pay (B3)**	↑ ↑ B3in	Perceived stockout risk (many consumers)	The perceived stockout risk was significantly reduced for consumers who accessed the service form inside the service area, since more bikes were available for more time there.
			Perceived benefits of users ending the ride outside (few consumers)	The perceived benefits of users ending the ride outside were completely neutralized by the burden of the return fees, which made that pattern of usage economically unviable for them. The loss of those consumers was highly compensated by the gain resulting from a much longer availability of bikes inside the area (a much more demanding zone).
		↑ B3out	Perceived benefits of users ending the ride inside (few consumers)	If in 'Situation 2' there was no option for accessing bikes from outside to go inside, in 'Situation 3' that lack of service was restored. The scarce bikes left outside could be used again for this route, with the reinforcement of a return bonus as an important incentive.
	Service Cost (C3)	C3in ↓	Cost of bikes initially inside (many bikes)	The cost of the bikes originally inside the area became much lower than in 'Situation 2' thanks to the concentration of resources there, which contributed to economies of density both for a centralized maintenance of the bikes and for higher efficiency of their relocations to even hotter zones.
		C3out ↓ ↓	Cost of bikes initially outside (few bikes)	The cost of the bikes originally outside the area was reduced by their lower volume there because of the deployment of the return fee. Moreover, this cost was compensated by the new credits on behalf of the platform (R$30,00). The return bonus also contributed to an idle time reduction through a quicker redistribution of them inside the area at a lower cost for the platform (R$5,00).

Source: Authors

The platform's ability to define a service area within demanding zones also needed to be confirmed, since the results also depended on it. Following the logic of the IAD framework (Figure 1), empirical evidences were compared with the contextual factors with a validated positive influence (see the references on Table 6) for the use of this service. Table 6 shows (i.e. on last column) the exogenous influencers found in the 'Yellow' dock less bike sharing service area in São Paulo city according to the data, proving that the most recently-adopted rules promoted the convergence of the resources' availability in areas of high potential demand.

Table 6 - Contextual factors influencing the use of 'Yellow' bike sharing service inside the service area

Contextual Perspective	Type of Factor	Influence Factor	Reference	Use
Material and Biophysical Conditions	Sharing resources and system	Fleet size	Shen et al. (2018)	+
		Density of supply in areas of higher accessibility of the resources	Wang & Lindsey (2019)	+
		Proximity of the resources to areas with higher usage trend	Shen et al. (2018)	+
	Transportation urban infrastructure	Areas with dedicated cycle lanes and bicycle parkings	de Chardon et al. (2017); Noland, Smart, & Guo (2016)	+
		Regions with buses and subways stations	Mooney et al. (2019); Shen et al. (2018); Noland et al. (2016)	+
	Urban environment	Regions with higher density of commercial buildings	Wang & Lindsey (2019)	+
		Areas with higher diversity of economic activities	Shen et al. (2018)	+
		Regions with smaller blocks and streets	Shen et al.(2018)	+
		Regions with parks and community centers	Mooney et al. (2019)	+
		Regions with more employment offers, during weekdays	Noland et al. (2016)	+
		Residential area, during the weekends	Noland et al. (2016)	+
	Weather conditions	High temperatures	Shen et al. (2018)	-
		Precipitation (rain)	Shen et al. (2018)	-
		Wind	de Chardon et al. (2017)	-
Atributes of community	Age and generation	'Generation Y' individuals (born from 1980 to 2000)	Kumar, Lahiri, & Dogan (2018)	+
		'Generation X' individuals (born from 1965 to 1979)	Kumar, Lahiri, & Dogan (2018)	+
	Level of education	Higher level of education	Mooney et al. (2019); Akbar & Hoffmann (2018)	+
	Average income	Higher average income	Mooney et al. (2019)	+
	Weekdays	Higher weekday utilization	Shen et al. (2018)	+
	Day time	Peaks at early mornings (when individuals go to work)	Shen et al. (2018)	+
		During lunch time	Shen et al. (2018)	+
		Peaks in late afternoon (when leaving the workplace to home)	Shen et al. (2018)	+
Rules-in-use	Laws	Obligation of using helmet	de Chardon et al. (2017)	-
	Rules of use	Controls that induce higher equity and punish egoistic behavior	Bardhi & Eckhardt (2012); Hartl et al. (2016); Hofmann et al. (2017)	+
		Rules of use that promote co-criation value (users and platform)	Lan et al. (2017); Eckhardt et al. (2019); (Akbar & Hoffmann, 2020)	+
	Alignment	Higher alignment with existing laws, rules and customs	Y. Ma, Lan, Thornton, Mangalagiu, & Zhu (2018)	+

Contextual factors that influence the use, reinforced through the permanence of the bicycles inside the service area

Source: Authors

Thus, the implementation of the ‘scope rules’ somehow ‘segmented’ the service within the most potential market (i.e. contemplating positive influences of the attributes of the community) and in the most structured area of the city for that offer (i.e. taking advantage of positive influences of material and biophysical conditions) by changing consumer outcomes through incentives. Moreover, by doing so, ‘Yellow’ also benefited from economies of density over the maintenance costs (concentrating repairs in service-shops inside the service area), relocating bikes to the locations with the ‘hottest’ demand.

This analysis therefore confirmed the previously-formulated proposition, showing that UMFFSS can benefit from the advantages of ‘scope rules’, instead of limiting user choice with ‘authority rules’, since information and communication technologies embedded in these types of services allow for the definition of ‘information rules’ that keep users aware of the results of their actions. The freedom of choice made possible by ‘scope rules’ creates the opportunity for maximizing ‘prosumer’ collaboration with the economic logic of the system through incentives, as Table 4 makes clear.

After making the last changes to the rules of use of their bike sharing service in São Paulo city, ‘Yellow’ launched the same service in another 13 Brazilian cities, keeping essentially the same configuration of rules. These rules were also replicated in

their e-bike and e-scooter sharing services launched in São Paulo (see the service areas in Figure 7) and in other cities of Brazil.

Figure 7- Map of the service areas defined by the platform in São Paulo City

Legend: — Bikes — Scooters — E-bikes
Source: Yellow official website

Although it is clear that the use of certain governance strategies are necessary for improving the creation of value for the platform and the community of users in UMFFSS, it is important to point out that this isn't sufficient to ensure the sustainability of this very complex type of business.[5]

6. CONCLUSION

The main objective of this study was to determine governance strategies capable of improving the value created simultaneously by an UMFFSS platform and its user community through taking advantage of endogenous and exogenous factors positive influence. By adapting and applying the IAD framework to empirically analyze the

[5] In January 2019 'Yellow' merged with the Mexican company 'Grin' to form 'Grow', but the new venture plans did not succeed and almost one year latter 'Grow' terminated their bike-sharing, e-bike-sharing and scooter-sharing services all over Brazil. It looks like the entrepreneurship wasn't successful in capturing enough positive value from its investments in a sustainable way. Some reports highlighted administration conflicts among the entrepreneurs and the lack of new investments from venture capitalists in the platform (the last one was of USD 50,000 on May 24, 2019). The service also had conflicting relationships with municipal administrations of some cities where they were operating. Other scooter sharing services like 'Lime' and 'Uber' also had issues with their operations in Brazil, terminating their operations there.

changes made in the rules of use of the 'Yellow' dock-less bike sharing service, it was possible to categorize them and evaluate the differences in the outcomes of the system according to the implementation of different strategies (i.e. Situation 1: no geographical restriction for the service; Situation 2: application of authority rules for a service area restriction; Situation 3: application of scope rules to restrict the same area). This study has made several contributions by expanding the collective action developments from New Institutional Economics theories and frameworks to an emergent field of strategic administration (i.e. a typical sharing economy business model).

The first contribution was the empirical validation of the adaptation of the IAD framework used here to investigate the effects of institutions on the value created by UMFFSS, filling a gap of this new field of study (Zhang et al., 2020). Although this analysis was focused on changes made to the rules of use of the service (i.e. operational rules), the same framework can be applied in future studies to evaluate the outcomes of informal (i.e. culture and social norms) (Eckhardt & Bardhi, 2016) or formal (i.e. constitutional rules) (Y. Ma et al., 2018) institutions (North, 1990), including the Meso institutions (Menard, 2018) responsible for their enforcement (e.g. regulatory agencies and traffic police), reminding that all of them determine the effective 'rules in use' together. The IAD framework also allows for the investigation of the effects of other exogenous factors, such as material-biophysical conditions or community attributes, or of some endogenous factors, such as cognitive factors or individual motivations, integrating the analysis of UMFFSS influencers in an inclusive systemic structure.

A second contribution was the categorization of the UMFFSS rules of use, revealing the potential of scope rules, which require support of information (Coglianese et al., 2003) to optimize the collective action results of the service. With the confirmation of the suggested proposition, this analysis could confirm findings from the Game Theory (Rapoport, 1966) and Economic Regulations literature (Coglianese et al., 2003) for the Sharing Economy Governance field of research. The relevance of this is highlighted by the advice from Eckhardt et al. (2019, p. 21) that "… scholars should keep a close eye on technology developments to understand their potential impact", keeping in mind that information technologies will sooner rather than later achieve a higher level of influence in businesses administration with the development of 5G infrastructure. Enabling faster information access thought technological resources will certainly enable a higher use of incentives to motivate more cooperation of the "prosumers" for the creation of value through platform governance (Lan et al., 2017).

Since interactions in UMFFSS occur between the platform and users (i.e. through smartphone apps and 'Internet of Things' technologies), there is an emerging area for developing the potential of scope rules in strategic governance studies.

As a managerial contribution, this study described the higher potential of scope rules to improve UMFFSS results, demonstrating that a strategic hierarchy of sequential steps must be followed to this end. The first measure of this plan is the correct definition of a service area that must concentrate the maximum exogenous positive influences for the use of the resources, making it 'hotter' than others (i.e. more demanding). After establishing that, the service must develop scope rules, instead of authority rules, to define ways of keeping the resources in good conditions of use and inside the area of service for the longest possible time. Considering the utilitarian motivation of the consumers, the incentives applied in combination with the suggested type of rules must be economic in nature to have more impact on usage pattern decisions in UMFFSS. As shown, monetary incentives are generally a good recommendation since they enable a clearer utilitarian quantification of the outcomes by users (Habibi et al., 2017), but this must be further investigated according to user profiles in certain regions (e.g. residential versus commercial) and different moments of use of the service (e.g. weekdays versus weekends). Apart from correctly designing the quality and the quantity of the incentives, the service must deploy rules of information capable of improving the awareness of the consequences whenever users act in favor or against the economic logic of the service when interacting with the resources.

The limitations of this study include the specific cultural characteristics of the local population where the analysis took place. Differences in cultures can influence the motivations of the individuals oscillating somewhere between their social or economic orientations (Eckhardt & Bardhi, 2016). The development of a similar analysis in countries with an Asian culture could contribute to more insights.

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