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Smart Cities demand new strategies and forms of control. The traditional model of public regulation is challenged by a renewed relationship between technology, government, and society. Another social dynamic and structure reflects then into neologisms using “smart” as a prefix. We see smart economy, smart mobility, smart environment, smart people, smart living, smart governance, etc. (1). As argues Clarke (2), the technological development raises questions about whether the existing legal mechanisms will be coherent and balanced for the present time. The public sector should be creative to address this issue, not only establishing reasonable standards for new technologies and services but also facilitating control and encouraging innovation. The object of this commentary is, therefore, to highlight the difficulties and possible solutions for regulation in the context of a Smart City, provided by the largest city in Brazil: São Paulo.

As seen in Table 1, the scope of regulation can be divided into economic and social issues. The former focuses on market failures, while the latter focuses on external goals, regarding consumers, third parties, environmental concerns, or other public policies (as the incentive for innovation). New technologies, for instance, create and intensify market failures and

Smart Cities through Smart Regulation

The Case of São Paulo

social concerns, which demand other forms of regulation.

Following that schema, economic regulation in Smart Cities deals with two major competition issues:

- 1) Regulatory asymmetry: Different rules applied to companies in the same market. New business models sometimes take regulatory shortcuts (3), leading to an unreasonable difference in rules and standards of control (e.g., taxi drivers versus individual

transportation platforms). In this case, regulators must guarantee not the same rules and standards but an equilibrium in the market, without giving unfair protection to incumbents or over-regulating innovation.

- 2) Barriers to entry: Proprietary protocols and the network effect keep away new players in a given market (4). Here, regulators should try to decrease barriers and to create incentives for new players.



TABLE 1. Context Of Regulation in Smart Cities According to Concepts of Economic and Social Issues.

ECONOMIC REGULATION IN SMART CITIES (market failures)		
Issues	Examples	Possible Solutions
Regulatory shortcuts	– Rules for taxi drivers are inapplicable to software platforms of individual transportation service (like Uber, Cabify, etc.). – Rules for hotels are inapplicable to software platforms of private accommodation services (like Airbnb).	– Establishment of coherent regulatory asymmetry to encourage innovation and guarantee fair competition. – Deregulation of incumbents and regulation of software platforms to allow competition.
Barriers to entry	– Use of proprietary protocol, that avoid interconnection and hamper the substitution of service providers. – Abuse of network effect (understood as the capacity to maintain and increase market share and to exclude new players according to the size of the network).	– Establishment of an open communication protocol. – Incentive to new players and new networks (when desirable). – Guarantee of interconnection. – Rules to networks about essential facilities.
SOCIAL REGULATION IN SMART CITIES (external to the market)		
Issues	Examples	Possible Solutions
Informational asymmetry between service providers and users	– Collection and process of personal data without express consent. – Ignorance of risks regarding new services (like lack of insurance by accident or compliance to security standards).	– Standards of information duty to service providers in favor of users. – Standards upon service level and its requirements. – Regulation by design that could avoid these problems (as privacy by design).
Third parties concerns	– The invisibility of new technologies that hide risk situations (as in Internet of Things). – Lack of protection and risk exposure in specific cases.	– Standards of protection in favor of third parties. – Regulation by design that could avoid these problems.
Environment protection	– Uncertainty about risks to health and nature brought by new technologies.	– Standards of environmental protection based on the precautionary principle.

Social regulation in Smart Cities, beyond traditional goals, aims to protect society against its own technological development. The risk society, as named by Beck (5), understands technology as a source of solutions but also of new problems. Threats to privacy and to personal data and even digital exclusion are new issues arising from Smart Cities that, according to Baldwin, Cave, and Lodge (6), have changed the frontiers of regulatory regimes.

All these challenges require a review of the regulatory capacities of the public sector, adapting its tools towards an effective control. In other words, to conceive a smart regulation, Government must improve its own capacity of control to follow the development of technologies and the changes observed in every dimension of the city.

Two solutions are given to regulators: 1) the use of new technologies to enhance control (technology embedded to the public sector); and 2) the

use of design solutions to foresee and then to avoid problems. These are not mutually exclusive and can work together. For example, for the definition of an open protocol in a given network (a type of design regulation), the regulator could access and control in real time regulated activities through its own system, centralizing data in a control center.

Thus regulation in Smart Cities, or smart regulation, envisions multiple tools to change and to improve means of control.

The Case of São Paulo

With around 12 million inhabitants and an area of more than 1500 km², the city of São Paulo is a complex environment with multiple actors, stakeholders, networks, and services. The path to becoming a Smart City goes through improving the regulatory capacity of the public sector to achieve economic and social goals. Specifically in urban mobility, São Paulo is adapting its laws to deal with technology by establishing standards, rules, and design. Moreover, in the last years, local development in technology regulation has expanded itself into the federal level, what may lead to a deeper change in Brazil as a whole.

Communication Protocol for Urban Mobility Technologies

The Ordinance of the São Paulo's Transportation Office no. 02/2014 (7) established the communication protocol that must be adopted by any intelligent transportation system (ITS), closed circuit television (CCTV) system, or traffic management system. Thereby, integration of center-to-center communication must adopt National Transportation Communication for ITS Protocol (NTCIP) for ITS, Open Network Video Interface Forum (ONVIF) for CCTV and urban traffic management control (UTMC) or National Transportation Communications for Intelligent Transportation System Protocol (NTCIP) for traffic management systems. These standards affect the design of networks and guarantee interconnection among them and the public sector.

In its economic scope, an open protocol introduces competition and thus allows the regulator to replace public equipment with any provider that adopts the protocol and to substitute incumbents without changing the given network. On the other hand, the regulation could improve public capacity to control urban mobility

making becoming feasible a control center with centralized and aggregated data from different sources.

Later on, the Brazilian Data Protection Law, enacted in August 2018, turned mandatory the standardization of data and communication in activities under public interest throughout the federation (8). The main reason seems to be the demand for data sharing between public bodies, so ensuring new uses of data, as a Big Data solutions (9). While the standards themselves remain open in this legal framework, São Paulo's ordinance may be the reference for a forthcoming federal standardization in urban mobility.

Regulation Of Software Platforms of Individual Transportation Services

São Paulo's Executive Order no. 56.981/2016 (10) regulates the use of urban mobility infrastructures (especially roads and streets) for economic activities of individual passenger transport. In a few words, it establishes rules for software platforms that provide individual transportation, covering the lack of regulation of these activities. Actually, these rules were triggered by the rise of companies like Uber, Cabify, etc. and by the necessity to control and tax their activities, especially due to São Paulo's problem with traffic and excessive use of transportation infrastructure.

These pioneering regulations in Brazil led to a heated debate over local jurisdiction over software platforms. To solve this question, the Federal Parliament enacted a new legal framework (11) in which minimal conditions to the service were established and the local jurisdiction was confirmed. More than a legitimization of São Paulo's Executive Order, the federal law fosters other municipalities to regulate this kind of technology, which can

already be noted in Rio de Janeiro's new Executive Order (12).

Following the economic scope, the regulation equalizes the asymmetry between taxis and software platforms and decreases barriers to entry of new apps through an escalated tariff according to fleet size and quantified by the traveled distance. The Executive Order also aims at social goals, encouraging women and handicapped drivers through a reduction in the public tariff.

Of note is the general duty of software platforms to share data with the public sector. Data about displacement, service reviews by users, driver identification, and any other information requested by the regulator must be shared in real time, which creates direct concerns about privacy and personal data protection. In fact, this kind of mandatory data sharing, more than simply economic regulation, seems like an implementation for surveillance purposes (13).

Path to a Smart Regulation

This article seeks to shed light on the challenges posed by the Smart City's concept in the regulation of market failures and externalities. In particular, it examines São Paulo's handling of technology in infrastructure (ITS) and services (platforms of individual transportation services) regarding urban mobility. The selected example suggests that the key point of technology regulation at the local level would be both assuring socioeconomic goals and enabling the control itself.

When new technologies put the efficiency of public activities in doubt, the government should evaluate if its instruments are still suitable to guarantee the public interest. For instance, blockchain, smart contracts, autonomous vehicles, and other sorts of technologies promise radical changes affecting not only companies or people but also public activities (14),

which will, in turn, entail an adaptation in public models of control.

The respective new standards, rules, and design enhance control capacity in the Smart Cities' context. However, the reinforcement of regulation cannot cross certain limits. First, the regulation must assume multiple economic and social goals, such as fair competition, user safety, and environmental protections, considering the society's systems as a whole. Secondly, the authorities must take into consideration values such as privacy, data protection, informational self-determination, and most important, civic dignity (15) to weigh their measures. In a democratic state, regulatory power is only legitimated when counterbalanced by fundamental rights. Thirdly and at last, regulatory changes are a continuous and reflexive process, by which authorities should analyze the impacts of each novel implementation rules and also technological development, before considering any changes.

While the concept of a Smart City is an ongoing progress, the optimal level of regulation remains a challenge in today's scenario. Smart regulation is always aware of the impacts of technology's implementation into

society and, most important, guarantees human values along the way.

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OPINION

(continued from page 24)

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