

ARTIFICIAL INTELLIGENCE TO SUPPORT MANAGEMENT ACCOUNTING AND CONTROL SYSTEMS: AN ANALYSIS OF APP-BASED TRANSPORTATION COMPANIES

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ABSTRACT

Highlights: In a shared economy environment, the way control is exercised by companies may change radically. In this context, the use of decisions based on algorithms is growing. In particular, the use of artificial intelligence (AI) by companies to control the work of employees is increasingly popular. Such technological changes significantly influence the systems of control and management accounting (SCCG). **Objective:** To analyse the role of AI as a support to the different SCCG tools of 99 Tecnologia Ltda (99TL) and UBER in Brazil, based on the model proposed by Malmi and Brown (2008). **Design/Methodology/Approach:** The research is characterised as qualitative, exploratory, and documentary. Data (visual and verbal) were collected through publicly disclosed company documents and reports from partner drivers. These data were treated and analysed based on content analysis, with those based on the SCCG control packages proposed by Malmi and Brown (2008) used as main categories. Results: It was found that several control tools employed by 99TL and UBER can be categorized according to Malmi and Brown's (2008) control packages. Furthermore, there are many similarities between the companies concerning the tools employed in each SCCG package to incentivise drivers. Concerning the role of AI, there is evidence that it cuts across virtually all the control packages presented the cyber, premium and compensation and administrative controls.

Limitations of the research: (a) the use of a non-probability sample of drivers; (b) the fact that some drivers have a view of their locality of operation and may confuse regional with national situations; and (c) access to some controls via secondary data is limited (in particular, about financial controls).

Practical implications: The research demonstrates several pieces of evidence of the central role of AI in supporting the SCCG of app-based transport companies. Moreover, it highlights how drivers understand and react to the incentives of the companies' SCCG.

Originality/value: (i) the inter-relationship between SCCG and the sharing economy was focused on, something rare both nationally and internationally; (ii) it was demonstrated that it is possible to apply Malmi and Brown's (2008) model in companies with differentiated business models such as app-based transport; (iii) the increasingly central role of AI in management control systems was addressed; and (iv) a new methodological approach to research in the area was proposed, employing data based on public accounts.

Keywords: Artificial Intelligence (AI); Management Accounting and Control Systems (MACS); Transport by App.

1. INTRODUCTION

In the last decade, an emergence of the sharing economy (SE) has been observed. This can be understood as a new form of resource distribution that affects traditional markets, cities, individuals, as well as questions regulatory frameworks and social norms (Zvolkska et al., 2019). According to Sutherland and Jarrahi (2019), this economy is essentially dependent on advances in information technology (IT).

Among the IT innovations that support CE, artificial intelligence (AI) stands out. Although it is not a new concept, Ertef (2017) states that recently its applications have become widely employed in the social context. Hughes et al. (2019) point out that one of the uses of AI in the corporate environment of CE refers to the control of employees' actions to achieve business objectives.

It is emphasized that this type of control is usually related to the systems of control and management accounting (SCCG), which can be understood as the processes by which managers influence other members of the organization to implement corporate strategies (Anthony and Govindarajan, 2008). It is noteworthy that among the most widely used models to analyse corporate SCCGs is the one proposed by Malmi and Brown (2008), who consider such a system as a set of interdependent packages.

Cheng and Foley (2019) highlight that, traditionally, managers coordinate the activities of subordinates in companies based on SCCGs. However, according to Leoni and Parker (2019), the form of control changes drastically in a CE environment. In this case, decisions via algorithms become increasingly relevant (Cheng and Foley, 2019). One sector of CE that has been employing AI is the transport sector. Hughes et al. (2019) state that this intelligence is already employed in app-based transportation companies to constantly control the work of partner drivers.

Given the above, the study presented in this article aimed to analyze the role of AI as a support to the different tools of the SCCG of 99 Tecnologia Ltda (99TL) and UBER in Brazil, based on the model proposed by Malmi and Brown (2008). In this sense, the following specific objectives were proposed: (a) identify managerial control tools employed by companies, according to the model proposed by Malmi and Brown (2008); (b) understand the role of AI in each of the SCCG employed by both companies; (c) identify the effect of these systems (and consequently of AI) from the perspective of app drivers.

The developed research is justified from several perspectives: (i) recent emergence of CE (Sutherland and Jarrahi, 2018); (ii) scarcity of studies on SCCG in CE in Brazil and abroad (Leoni and Parker, 2019); (iii) the employment

of Malmi and Brown's (2008) SCCG analysis model, an internationally highly recommended reference (Svensson and Funck, 2019); (iv) the importance of understanding the role of AI in managerial control; and (v) the socioeconomic role of app-based transportation companies, which influence hundreds of millions of people around the world (Securities and Exchange Commission - SEC, 2019; UBER, 2020a).

2. REVIEW OF LITERATURE

According to Silveira et al. (2017), the CE can be understood as a socio-economic system built around the sharing of human and physical resources, including the creation, production, distribution, trade and shared consumption of goods and services. Sutherland and Jarrahi (2018) add that this economy is heavily dependent on technology and digital transactions.

Cheng and Foley (2019) reinforce that these advances of the CE via technology are very related to the management through algorithms, which allows the processing capacity of numerous transactions with a low level of resources. In this case, the role of AI stands out. This can be defined as the ability of a computational system to monitor, evaluate and respond to the environment (Hughes et al., 2019). In the context of CE, Hughes et al. (2019) reinforce the role of AI to monitor and make decisions about employees. According to Cheng and Foley (2019), due to the scale of the workforce in CE, algorithm-based decisions have grown and are being adopted by organisations to make work more efficient via automation.

Hughes et al. (2019) point out that AI can be employed to control employees in two ways: (a) behavioural control - directing and monitoring employee activities to ensure that work conforms to previously stipulated standards; (b) outcome control - measuring employee performance after performing a task. Despite this control trend, Brougham and Haar (2019) also emphasize the tendency to psychological problems (such as depression) for workers who are affected by this type of intelligence.

Usually, these controls affected by AI and described by Leoni and Parker (2019), Cheng and Foley (2019) and Hughes et al. (2019) are characterised in the literature as SCCG. These are processes by which managers influence other members of the organisation, helping to implement the corporate strategy so that employees' decisions are consistent with organisational goals (Anthony and Govindarajan, 2008).

Malmi and Brown (2008) broadly conceptualize SCCG as rules, practices, values and other activities that are managed to direct employee behaviour. To enhance the discussions on SCCG in the literature, these authors proposed a way of an-

alysing this system as “packages”, detailed in Table 1. Svensson and Funck (2019) emphasise that such a model offers a more holistic view of managerial control in organisations, discussing “packages” rather than individualised systems.

Table 1. Packages of controls according to Malmi and Brown (2008).

Package	Descrição
Planning	A kind of ex-ante control. Firstly, the objectives of the functional areas of an organisation are stipulated, thus directing efforts and behaviour. In a second moment, this type of control provides the standards to be reached concerning the goals, making clear the level of effort and the type of behaviour expected from the employees. Planning can be divided into tactical and strategic, the latter being a longer-term approach, whereas the former usually refers to a period of approximately 12 months.
Cybernetic controls	It is a type of control that has five main characteristics: (i) it presents ways to measure phenomena, activity or a system; (ii) there are expected performance standards or goals to be achieved; (iii) there is a feedback process that allows the comparison between the result of the activities and the expected standard; (iv) there is an analysis of the variations between what is expected and what is obtained; and (v) ability to modify the behaviour or the related activities. There are four main types of cyber control linked to the MCS: (a) budget; (b) financial measures; (c) non-financial measures; and (d) hybrid measures, including both financial and non-financial measures.
Premium and compensation controls	They focus on motivating and improving the performance of individuals and groups within organisations to achieve congruence between agents’ and owners’ goals and activities. These are controls linked to cyber controls but can be treated as separate elements. The relationship between efforts and tasks can influence performance in three different ways: direction of effort (where it is directed); duration of effort (the time individuals devote to that task); and the intensity of effort (the individual’s level of attention)
Administrative Controls	Controls that direct employee behaviour through organisation between individuals and groups. Focuses on monitoring behaviour, making individuals responsible for their own, and encompasses the process of specifying how tasks or behaviour should be performed or not performed. There are three types of administrative controls: organisation design and structure; governance structure; and procedures and policies.

Cultural Controls	Culture can be considered a form of control when employed to regulate behaviour. Three aspects of cultural control are considered: (a) values-based control - values and direction that senior managers want subordinates to adopt, including mission, vision, beliefs and purposes; (b) symbol-based control - when the organisation creates symbols expressed visually to develop a particular type of culture; and (c) clans - microcultures of individual groups, in which casework controls occur by establishing values and beliefs through ceremonies and rituals.
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Source: Based on Malmi and Brown (2008).

Among the technological platforms most related to CE, and that use AI to support SCCG, are those linked to transportation by app (Hughes et al., 2019). Among such companies, two stand out in the performance in Brazil in recent years: 99TL and UBER. The latter is a company of global reach, which operates in more than 900 cities spread across 85 countries, Brazil is the second country with the largest number of cities served (124) (UBER, 2020a). As for 99TL, a company founded by Brazilians, its figures indicate that the platform connects 18 million passengers to 600 thousand drivers and is present in a thousand cities (99TL, 2020a).

Considering the exposed by Hughes et al. (2019), Cheng and Foley (2019), Leoni and Parker (2019), the millions of users presented by the companies (UBER, 2020a; 99TL, 2020a) and the strategic relevance of AI in UBER’s business model (SEC, 2019), it is considered, in this article, that this intelligence is widely employed in the control of the drivers of these companies, given such evidence.

3. METHODOLOGY

This research is characterized as qualitative, exploratory and documentary (SAMPIERI et al., 2006). The non-probability convenience sampling method was employed (Cooper and Schindler, 2003). The database used for the research was composed of secondary data: verbal and visual (Flick, 2004). The visual data were obtained through 99TL and UBER’s publicly disclosed documents, such as SEC Form S-1, management and financial reports, Terms and Conditions, Privacy Policy and the companies’ official websites in Brazil. Verbal and visual data of drivers linked to the referred platforms were also collected.

Given the impossibility of obtaining data from all drivers who use the 99TL and UBER platforms, those who are digital influencers were selected, more specifically those producers of content with the greatest relevance on YouTube, a worldwide video platform. It is noteworthy that the sample selection through the media generated by digital influencers has been frequently used for research in social sciences, both in

national and international studies because it is an important source of evidence (Amaral et al., 2018; Eldik et al., 2019). The influencers were selected based on the YouTube “Relevance” filter. To select the sample of drivers, the following keywords were entered: “UBER”, “app driver”, “99TL”, “99 Tecnologia Ltda.”, and “transportation by app”. Subsequently, the influencers’ channels that had the largest number of followers were selected. The channels of the selected drivers are listed in Table 1.

The selected drivers have tens or hundreds of thousands of followers, which demonstrates the power of reach and influence they have over drivers who consume their content. It is noteworthy that the selected drivers’ act (or have acted during a certain period) as partner drivers of 99TL and/or UBER and know the operational part of the platforms, thus, they present a varied set of criticisms about the platform’s SCCG. It is noteworthy that some drivers are sponsored in certain videos, which may bring a commercial bias apart from the topics addressed.

The data extracted from the channels of the influencers cited in Table 2 refer to the year 2019 and were collected in the first quarter of 2020. It is noteworthy that all videos of the year 2019 were watched, being coded and recorded only those related to the SCCG tools of the companies studied. Then, the data were treated and analyzed through content analysis, as proposed by Bardin (2016). The data obtained were categorized according to the SCCG packages proposed by Malmi and Brown (2008). In addition, the triangulation of different sources of evidence was used to ensure data reliability.

4. RESULTS

99TL SCCG

The company 99TL was founded in 2012 by Brazilians, being acquired by Didi Chuxing (“DiDi”) six years later. It is emphasized that DiDi aims to be the global leader in the revolution of transportation and automotive technology (DIDI, 2020). Concerning drivers, the Driver Terms of Use makes it

clear that the relationship between 99TL and the driver is of intermediation of races and facilitating payment, through the use of the software provided by the company, without any relationship of corporate, employment and economic nature, and the driver is free to accept or refuse the races from the application (99TL, 2020b). Furthermore, the company exempts itself from liability in case of damage or loss caused by passengers (99TL, 2020c).

Two cybernetic controls stand out concerning 99TL’s SCCG: (i) evaluation through stars (feedback); and (ii) acceptance rates. The evaluation can vary between one (very bad evaluation) and five (very good evaluation) stars. After each trip performed, both passengers and drivers are asked to evaluate each other. The drivers’ ratings are calculated based on the average of the last 100 ratings received, recorded chronologically. The evaluations are important for drivers and they understand that the notes have great importance for access to benefits and to ensure their continuity on the platform. According to the company, drivers can access their ratings and receive tips for improvement (99TL, 2020d). In 2019, drivers reported that 99TL implemented acceptance rate metrics. These rates interfere with their performance.

As a form of premium control and compensation, in its “Privacy Policy”, 99TL states that it will use drivers’ data to identify and personalise their experience and use of the app and company services, including for providing promotions and financial incentives (99TL, 2018). Following the document, several drivers reported that the application of the platform’s promotions is according to the driver’s profile (number of trips, cancellation rate, passenger ratings, number of runs, etc.). 99TL also conducts campaigns with exclusive promotions on commemorative dates and of greater demand, such as Christmas, New Year and Carnival, according to several drivers.

Regarding the fare paid by the company for the races, Driver I made a point of mentioning that they would be low with the expenses demanded by the activity. It should be noted that, in 2019, several drivers reported that there was a change in the way the fare was calculated, creating a strong resistance among them. Moreover, the company works with the dynamic fare, when the price of trips is increased to bal-

Table 1. Channels of drivers selected for the study

Code	YouTube channel name	No. of registered participants	Code	YouTube channel name	No. of registered participants
A	UBER Do Marlon	580 thousand	F	Falando De Uber	45,3 thousand
B	Escola Para Uber	272 thousand	G	Motorista 6 Estrelas	33 thousand
C	Fernando Uber Floripa	247 thousand	H	Uber 24 Horas SP	17,9 thousand
D	Uber Do Marcelo, O Uber Fora Da Curva.	84,3 thousand	I	Cardona Motorista Prime	5,61 thousand
E	Uber Do Lucas, O Uber Acima Da Média	58,5 thousand			

Source: The authors themselves

ance supply and demand for cars. However, driver C points out that it would not always be people calling for rides that would inflate demand but rather people “testing” prices.

About administrative controls, 99TL establishes minimum criteria to which the vehicles must meet to be registered in the system, and the common requirements to all cities are that the vehicle must have four doors and air conditioning. The minimum year of manufacture accepted may vary according to the city in which the driver wishes to work. Still in this type of control, it is relevant to inform that the company monitors the exchange of messages of drivers on the app, quite possibly through its AI, according to its privacy policies, and that may influence the permanence of the platform (99TL, 2018).

Concerning cultural control, some drivers report the benefits of the 99 Prime club, a club of exclusive advantages. It is also highlighted the Somos 99 program, cited by driver G. According to the company, five categories of advantages are offered (Partner, Silver, Gold, Ruby and Diamond), and this program is organized on four fronts: Partnerships, Training, Events and Exclusive Advantages (99TL, 2020e). Also according to the company, weekly and monthly targets of trips are presented so that the driver can achieve the different categories, to encourage the engagement of drivers (99TL, 2020e).

5. UBER SCCG

Part of UBER’s planning became clearer after the company’s initial public offering (IPO) in the US in 2019. This planning would start from UBER’s mission which, according to the company’s president, is to create “opportunities by putting the world in motion” (SEC, 2019; UBER, 2020b). Importantly, the company’s president emphasises the essential role of technology for the organisation (SEC, 2019). The company also highlights the paramount role of its AI, which can run hundreds of models based on its data and direct services to customers with quality and safety (SEC, 2019). Thus, it can be said that UBER’s intensive employment of AI is a key part of its strategy, being used as part of the SCCG for employee control.

Despite being cited in essential aspects by UBER (SEC, 2019), many drivers have criticised the relationship the company has with them. Contrary to what the drivers have stated, UBER highlights the critical role that these agents have in its development, presenting increased engagement as one of its growth strategies (SEC, 2019). The distancing between the company and the drivers is reinforced in the former’s Terms of Use, which highlight the non-employment relationship existing between the company and the drivers (UBER, 2020c). It should be noted that UBER is keen to highlight

that this non-employment relationship is considered one of the main risks to the business model in different locations around the world (SEC, 2019). Some drivers also point out that they engage in dangerous conditions when excerpting work.

Several elements of cyber control can be discussed about UBER’s SCCG, however, two stands out: (i) the evaluation through stars (feedback); and (ii) the acceptance and cancellation rates. As in the case of 99TL, the evaluation varies between one and five stars, but in UBER’s case, a weighted average of the last 500 trips is considered. About the rates, according to UBER (2019), the acceptance rates refer to the number of trips that the driver accepts concerning those proposed by the app in the last 30 days (the company indirectly recommends a rate above 90%). The cancellation rate, on the other hand, refers to the proportion of cancelled trips with the vines accepted by drivers, and a rate of less than 10% is indirectly recommended (UBER, 2019).

Many premium and compensation controls are closely linked to cyber controls. Furthermore, there are many contextual promotions especially on commemorative dates and periods, as in the case of 99TL. Another promotion reported by drivers refers to the use of rewards on consecutive trips. A much-cited award was the one that occurred shortly before UBER’s IPO, in which several prizes were paid to them, based on the number of trips made by them.

About the fare paid by UBER for the services provided, drivers point out that it can be divided into two parts: a fixed and a variable one. The fixed-rate is the base value of the trip, and the variable rate depends both on the time (in minutes) that the driver takes to make the trip and the kilometres travelled. According to the professionals, the variable fare is influenced more by kilometres than minutes, that is, there is an incentive for the driver to keep moving. Many of them emphasized that the fare currently paid by UBER is low and is not readjusted. Finally, all drivers analysed to highlight the so-called “dynamic fare” (dynamic pricing), used by UBER to balance the supply of cars to passenger demand. When the company estimates a high demand in a given region, the app’s AI increases the fare for trips in the locality, to encourage drivers to travel there. Some of them recommend using the REBU app to take better advantage of such increased fares.

In general, cars are the focus of UBER’s administrative controls. The company uses cars as one of the bases for segregating its drivers according to different levels of a category (in general, the higher the level, the higher the fare paid to drivers). Finally, it is very relevant to highlight that the company can monitor drivers’ message exchanges through the app (UBER, 2020d; 2020e), being able to employ its AI.

On the cultural control by UBER, it is important to highlight the role of the “6 Star Club” and “UBER Pro”. According to UBER (2018), the 6 Star Club was created to value partner drivers who stand out within the platform, being present in some Brazilian cities. UBER Pro, on the other hand, is a more recent program in Brazil and available in some locations. According to UBER (2020f), this program has different categories, namely: Blue, Gold, Platinum and Diamond. The company also points out that the category of each member is given, among other factors, by goals in cyber controls, such as acceptance rates and the average user rating (minimum of 4.85).

General analysis

As of the presentation of results, one observes several similarities between the SCCG employed by both companies addressed in this article. Chart 2 presents a summary of findings in each of the analyzed systems according to the different packages proposed by Malmi and Brown (2008).

Based on the analysis in Table 2, it can be observed that several control tools employed by the companies can be categorized according to Malmi and Brown’s (2008) control packages. Furthermore, there are many similarities concerning the tools employed in each SCCG package to encourage drivers. Since they are companies that compete in the same market, a certain level of mimetic isomorphism would indeed be expected. In this sense, there are also many similarities of drivers’ complaints regarding the SCCGs of both companies, such as the dangerous situations to which they are exposed and the low value of the fares.

Concerning AI, it can be seen that its role cuts across practically all the control packages presented, reinforcing

the important role of algorithms in controlling drivers, as emphasized by Cheng and Foley (2019). UBER, specifically, makes clear its role in company planning (SEC, 2019). Moreover, it is evidenced that AI companies use data from cyber controls to enable access to the benefits of the other control packages employed. In this case, the dynamic tariff, which is adjusted recurrently to provide different incentives to different drivers to balance the supply of cars to demand, guaranteeing service to users, stands out in particular. It is a functionality that would not be likely to be implemented without the support of an AI.

Moreover, this intelligence also presents a very relevant role in administrative controls, considering that it is expected to be responsible for evaluating the messages exchanged between drivers and users, to ensure a relationship within the expectations of the companies. Considering both the cyber controls and the reward and compensation ones, it is verified the simultaneous employment of the two forms of control via AI emphasized by Hughes et al. (2019): the behavioural and the performance ones. It is noteworthy that, only in the case of the cultural control package, the role of AI does not seem to be so highlighted, since the metrics employed to access each level do not seem to depend on such complex decisions, but, only on well-defined logical rules.

6. CONCLUDING REMARKS

The study presented in this article aimed at analysing the role of AI as support to different SCCG tools at 99TL and UBER in Brazil, based on the model proposed by Malmi and Brown (2008). It was verified that the tools employed in the SCCG by both analyzed companies may be classified based on the control packages of the model proposed by those authors.

Table 2. Characteristics of the SCCG employed by the companies studied.

Package	99POP	UBER
Planning	No corporate, employment and economic relationship between drivers and the company.	Essential role of technology and AI in its business model. No employment relationship between drivers and the company.
Cybernetic controls	Evaluation through stars and feedbacks; and acceptance rates.	Evaluation through stars and feedbacks; and acceptance/cancellation rates.
Premium and compensation controls	Platform promotions according to the driver’s profile: fixed values for meeting targets, distribution of gifts and promotions during festive seasons. Dynamic fare.	Promotions during festive seasons. Award of R\$ 5 thousand reais to drivers who reach 5-star ratings. Awards in consecutive trips.
Administrative Controls	Characteristics of the cars accepted, as well as different categories. Evaluation of messages exchanged on the platform.	IPO awards. Dynamic tariff
Cultural Controls	Club 99 Prime and Somos 99	Characteristics of the cars accepted, as well as different categories. Evaluation of messages exchanged on the platform.

Source: The authors

Furthermore, several pieces of evidence of the central role played by AI in supporting the SCCG of these companies were verified. The role of this intelligence seems to practically transcend the tools of all identified control packages (except for cultural control). The control exercised over drivers in these cases is equivalent to both behavioural and performance control. Furthermore, it is noteworthy that drivers demonstrate understanding of the companies' SCCG incentives by reacting to the incentives. In this case, we highlight the reference to the REBU application in the case of UBER drivers. There are also questionings of their value vis-à-vis the companies and the fares paid.

This research presents several contributions to the literature on SCCG and AI: (i) it focuses on the interrelationship between this system and CE, something rare both nationally and internationally, according to Leoni and Parker (2019); (ii) it demonstrates that it is possible to apply Malmi and Brown's (2008) model in companies with differentiated business models such as app-based transportation, ratifying the importance of this model, quite internationally recognized (Svensson and Funck, 2019); (iii) it addresses the increasingly central role of AI in managerial control systems, as emphasized by Hughes et al. (2019); and (iv) proposes a new methodological approach to research in the area by employing data based on public accounts.

Despite these contributions, the research presented some limitations. Initially, there is a non-probability sample of drivers, which focused on their engagement in content production. It is also noteworthy that some drivers analyzed are sponsored in some videos, which can influence, at least in part, their position on some topics. Moreover, each one of them has the vision of their locality of operation and may confuse regional rules with national ones. Finally, access to some controls via secondary data is limited, especially for controls using financial metrics.

Future research could: (a) explore SCCG's relationship with drivers from other app-based transport companies operating in the country, such as Cabify; (b) compare the controls employed by UBER on drivers from different countries, since it is a multinational company; (c) collect primary data that could better elucidate some controls not addressed in this paper; and (d) analyse other modalities of the CE, such as delivery via apps (UBER Eats, iFood, Rappi etc.).

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