Analysis of innovation in individual public transportation usability: Uber case

Análise da inovação na usabilidade do transporte público individual: caso Uber

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Abstract
This study aims to analyze the users’ perception regarding the innovations of the individual public transportation in Federal District, focused on Uber company. Throughout Brazil, the individual public transportation was known as monopolized by taxi service. The lack of competition led to low service of service. However, with the technological development, private companies started to develop competitive and innovative forms for entering the market. Through the tool for multi-criterion analysis was verified the user perception in regard to the service provided by Uber. The survey of data was carried out in two ways. First, through group discussion with experts in transport of UnB and subsequently through the implementation of forms with the service users, through targeted dissemination carried out by social networks and via email. For analysis of the data the Multi-criteria Methodology for Supporting the Constructivist Decision (MCDA-C) was used, so that the qualitative data could

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be quantified. This methodology allows the consideration from the experts’ view of the experts for, from them, understand the users’. The survey results showed how the innovative processes that aim to raise the quality of care and implementation of individual transportation services in the Federal District are relevant to users.

**Keywords:** Individual Public Transportation. Innovation. Usability. Uber.

**Resumo**
Este estudo tem como objetivo analisar a percepção dos usuários quanto às inovações do transporte público individual no Distrito Federal, com foco na empresa Uber. Em todo o Brasil, o transporte público individual era conhecido como monopolizado pelo serviço de táxi. A falta de concorrência baixou o nível do serviço. Porém, com o desenvolvimento tecnológico, as empresas privadas passaram a desenvolver formas competitivas e inovadoras de inserção no mercado. Por meio da ferramenta de análise multicritério foi verificada a percepção do usuário em relação ao serviço prestado pela Uber. O levantamento de dados foi realizado de duas maneiras. Primeiro, por meio de discussão em grupo com especialistas em transporte da UnB e, posteriormente, por meio da aplicação de formulários com os usuários do serviço, por meio de divulgação direcionada realizada por redes sociais e via e-mail. Para análise dos dados foi utilizada a Metodologia Multicritério de Apoio à Decisão Construtivista (MCDA-C), para que os dados qualitativos pudessem ser quantificados. Essa metodologia permite considerar a partir da visão dos experts dos experts para, a partir deles, entender os usuários. Os resultados da pesquisa mostraram como os processos inovadores que visam elevar a qualidade do atendimento e implantação dos serviços de transporte individual no Distrito Federal são relevantes para os usuários.


**Introduction**

The public transportation is a fundamental tool in cities’ development and directly impacts population’s life. According to Gomide (2006), the public transportation service is the main means of displacement within the urban area and permits that population accesses the social services and activities which ensure the human dignity, job opportunities and social integration, besides enabling the consumption activities, moving the economy.
The public transportation is divided into two modes: collective and individual. Each mode has distinct concept and function. Brasil (2012) defines collective public transportation as public service of transportation that is affordable to all population upon individual payment with fixed prices and routes. But the individual public transportation is defined as a transportation service for passengers, not open to the public, by means of rental vehicles, for individual trips.

The factors which compound the public transportation usability are frequently studied, in order to allow bodies to find ways to provide population with all possible efficiency and comfort in transport use.

Throughout Brazil, the individual public transportation has always been monopolized by the taxi service. However, due to technological development, private companies have started developing innovative means for entering in that already considered mature market.

Uber, an American multinational of urban public transportation, has recently started its performance in Brazil, standing out because presents a quality service at a competitive price.

In Brazil, the first receiving Uber was Rio de Janeiro, in May 2014, followed by São Paulo, in June, same year. Today Uber is also in Belo Horizonte, Maceio and Brasília – Federal District.

The basic hypothesis is that usability innovations and improvement of processes, present as factors of differentiation in the service provided by the Uber, are visible and relevant to those who use them. If the hypothesis is confirmed, will be evident the importance of technological innovation and the improvement of processes for which an enterprise can differentiate before users, in a mature market of high competitiveness.

This study aims the analysis of the innovation in usability of individual public transportation in Federal District, focused on Uber company.

**Theoretical reference**

**2.1 Urban Mobility, Innovation, and Usability**

According to Duarte (2006), in urban history, the beginning of the urban circulation was limited to human bodies and owned animals´ domestication. The invariability of that stage of technological development for thousands of years has resulted in a geometric pattern of
design management of streets, lots, blocks and squares that was repeated in various cultures throughout history.

Within this context, Ferrari (1979) relates the advent of motorized individual transport (cars) to change the way urban space. This researcher says that while the urban displacement was predominantly carried out by public transportation, the cities had an almost star-shaped format. After the introduction of the cars, its flexibility has encouraged the occupation of spaces more away from collective transport routes leading cities to an almost circle-shaped format (see Figure 1).

![Figure 1. Interpretation of the influence of the automobile on the spatial form of cities. Source: Ferrari (1979).](image)

The advent of automobiles, along with the change in the format of the cities and its other consequences, influenced the whole dynamic of urban mobility. The efficiency of this new mode of individual transportation has completely changed the planning of displacements within the cities. From this moment, the people able to acquire an automobile became able to move quickly, starting their way independently, whenever they wanted.

According to Vargas (2008), the concept of urban mobility is the ability of people in the urban space, to carry out their everyday activities safely, comfortably and at a time considered appropriate. In this way, the means of transport must be selected according to the specific characteristics of the displacement (distance, time available for the route, cost, among others).

In this sense, users can choose the best transport option for their commute, since this is available, factor that takes into account not only their socioeconomic level, but also their city infrastructure, which may or may not have all the transport options.

Access to various types of transport and the quality and comfort at displacement are often associated to innovation. In various forms, innovation has an important role in the
implementation of transportation infrastructure, or improvement of existing ones, in order to better serve the population.

According to Tidd and Bessant (2020), a very important skill when it comes to innovation is the ability to identify where and when new markets can be created and improved. However, he still states that innovation is not only to identify new markets, but there is also the possibility of mature established markets.

Yet as Tidd and Bessant’s view (2020), the existing types of innovation can be divided between "4 P": Product Innovation – changes made in what company offers, products or services; Process Innovation – changes made in the processes of creation and delivery of products or services; Innovation of Position - changes made in the context in which the products or services are placed; and Innovation Paradigm – changes made in the underlying mental models that guide what the company does.

Innovation is able to add value to products and services of a particular company. In this way, innovation can differentiate or even reposition, albeit temporarily, a company in a competitive market. Having an effect even more apparent in competitions in which the products are very close.

The ability of a company to innovate in a mature market, clearing the limitations of traditional product and service quality that have stalled before the development of the market, is the main subject of this study. Showing yet, how technological advancement can interfere directly in the restructuring of these markets.

This analysis applies perfectly to the case of Uber company and its positioning in the public transportation market. In that conventional service, Uber presented innovative usability solutions and a differentiated service, making it clear what has to offer.

According to Cybis, Betiol and Faust (2017), usability is the property of actions that provide interaction between the man and a particular product or equipment, thus enabling that the desired objectives are achieved as easy, pleasant, comfortable, efficient and interactive as possible.

According to Sharckel (1991) the usability is the main feature that takes the product to be widely accepted in a competitive market. He points out efficiency, learning, attitude and flexibility as its main features. Efficiency is evaluated primarily from the perception of speed and number of errors that occurred in the interaction.

The learning associates the ease of comprehension and retention in the medium or long term. The attitude is related to exhaustion suffered by the user, such as discomfort and
tiredness. And flexibility is based on the ability of the product to adapt to activities other than those for which it was developed.

Cybis, Betiol and Faust (2017) indicate the most common types of usability problems and, for each type, analyze the intensity and how harmful it can be for system use. The first classification is structural, and the writers break them into other three subclasses, which are: I) barriers, when the problem prevents the accomplishment of a task; II) obstacles, when the user is harmed, but it manages to solve the problem; and III) noises, when the problem undermines performance, but does not prevent the execution.

The second classification evaluates the usability task level, where the need of specific knowledge for satisfactory performance is identified. Finally, the third classification evaluates the user's level, analyzing if it reaches to all users, or by virtue of a specific action.

According to Rodrigues (2014), usability is an instrument that allows the environmental suitability of the transportation system to the needs of users. It is the main basis for cultural, social and economic structures. Usability is related to ease of use, is identified as an interface, and is understood as a significant part of the product.

2.2 Uber company

Founded in 2009 by Garrett Camp and Travis Kalanick, the company had a different purpose than we see today. The Uber was born to be a luxury taxi service, offering high level cars in the city of San Francisco. The application was launched in 2010, being one of the pioneers in E-hailing (process of asking for a car, taxi, limousine or any other type of transport via virtual platform, computer or a mobile device).

Between 2010 and 2011, the company received investment millionaires made by angel investors and venture capital investors, both very common in the USA. In this way, the company can expand its business in many ways. Only in 2012, the Uber began its operations in London, auditioned for include the solicitation of conventional taxis in Chicago and began to offer air taxi by helicopter from New York.

In Brazil, the first city to receive the company was Rio de Janeiro, in May 2014. Then it was the turn of São Paulo, about two months later. In September of the same year, the company expanded, starting operations in Belo Horizonte and, now also operates in the cities of Porto Alegre and Brasília.

Not all responded positively to the entry of Uber in Brazil. Nationally, wherever the company performs, the local taxi drivers rebel against it. They claim that the competition is
unfair, based on arguments of questionable basis. In this way, the Uber services came to be banned temporarily in some places, but the restrictions were lifted and the company follows in search of the total settlement in the country.

The Uber entered the market in order to stand out in quality of service. In many places the amount charged by the company is considerably lower than traditional individual public transportation, besides brought with innovations in payment, in contract security, in consistency of its fleet, in the form of training of the workforce, among others.

Thus, this study aims to analyze the perception that enterprise users in the Federal District have about some essential points in providing this type of service by evaluating the points of emphasis, and the limitations of the service offered by Uber.

**Methodology**

The survey can be classified as descriptive, based on a case study, formed from data collection by means of documental and field research, with qualitative and quantitative analysis and interpretation of data, whose goal was to analyze the perceptions of users regarding innovation in usability of individual public transportation at Uber company.

The method adopted was divided into two stages. The first consisted of research and consultations with library collections, scientific articles, theses and dissertations for survey of knowledge that make up the theme. The second stage turned to an empirical study of qualitative and quantitative character. Qualitative due to data collection conducted among users of the service studied and in the use of quantitative multi-criteria analysis tool for better assessment of collected information.

Second Markoni and Lakatos (2021), the bibliographic survey is of extreme importance to connect the researcher with what has already been written on the subject researched. The literature research is not just a mere reading and interpretation of what has already been written, but the analysis of a topic under a new approach that generates different conclusions, some innovative.

As for the qualitative character, according to Santos (2000), the focus of research is in the perception of those involved as to the problem under study, namely, the focus of data collection is on the capture on users´ opinion on the studied service. For it was applied a questionnaire that seeks to identify the perception of quality of the services provided by the members of company Uber, aiming to highlight the research construct.
But the quantitative character, according to Richardson (2017), measures opinions, behaviors and attitudes. It is suitable also to check how many people have a similar opinion, in relation to population. Therefore, being an important tool to evaluate the perception of innovation of the company's customers.

For data collection questionnaires were applied, destined only to individuals who have already hired the services of Uber for once. The questionnaire consisted of 31 (thirty-one) questions assessed the perception of users on four main aspects: the application, the cars, the quality of the professionals and the experience regarding the service.

The population of this study consists of the users of the service provided by company Uber of the Federal District. A survey to consult all those people would be unfeasible in terms of time, access and resources, due to amount of users. Therefore, a sample extracted from that population was preferred.

For analysis of the data the Multi-criteria Methodology for Supporting the Constructivist Decision (MCDA-C) was used, so that the qualitative data could be quantified. This methodology allows the consideration from the experts’ view of the experts for, from them, understand the users’.

25 samples were collected, based on the method of multi-criterion mathematical analysis of the MAMADecisao, which brings 85% security on the margins of error of the survey.

For identifying the elements of evaluation (criteria), a brainstorming (storm of idea) with representatives of users and experts was used, as a tool for generating ideas. The elements´ identification took into account some relevant aspects based on the value judgment of representatives and experts.

The following process was confronting the primary elements of evaluation (EPA) with the company's innovation concepts studied, confirming or dismissing them. After this process, the confirmed EPA began to assume the classification of Fundamental Points of View-PVF (criteria) and its branches are identified as Elementary Point of View-PVE (sub-criteria).

After the procedures of defining the fundamental and basic points of view, regarding actions of evaluation, the next step was the definition of descriptors, which represent the best possible way of the performance of each criterion analyzed.

Once the model is built, the descriptors of the various criteria are compiled into a single document to optimize data collection: the questionnaire.

After the end of the collection process, the data were tabulated for enabling the raise of the score for the various criteria and sub-criteria.
The software used to carry out multi-criterion analysis, the MAMADecisao, is a tree-structured Excel spreadsheet. Graphics are made available from criteria and final results in order to facilitate the identification of performance.

First, it is necessary the records of the case studies and of the criteria. The case study is entered only once, being automatically reproduced for other appropriate fields, while the criteria and sub-criteria must be fulfilled individually.

Then, the levels of attractiveness (N5, N4, N3, N2 or N1) of every sub-criterion are recorded, which correspond to the performances of each criterion or sub-criterion. This stage was set with the users’ representatives and experts to fill the semantic arrays.

Finally, the median of each answer of the questionnaire (N5, N4, N3, N2 or N1) is recorded in the worksheet and allocates the replacement rates (weight) of each criterion and sub-criterion. Then, all graphics and results are ready and available for analysis.

**Analysis of Innovation in UBER Usability**

After the analysis and data tabulation collected, it was possible to trace a brief profile of the Uber users and analyze the perception of them as to the quality and innovation of the criteria assessed.

**4.1 Demographic analysis**

The profile extracted by the research, as exposed in the Graphic 1 shows that, of the satellite towns/districts that make up the Federal District, the North Wing and the South Lake are home to the largest share of users, 19% each, followed by South Wing, with 15%.

The age range of the vast majority of users is between 21 to 30 years, accounting for 74% of the total, followed by people from 31 to 40 years, which represents 11%. The male dominates, comprising 52% of total users, as shown in the graphs in Figure 2.
4.2 Application

The Uber application is the focus of usability evaluation, since it is one of the key differentiators of the company, besides having tools that provide comfort and safety to the customer. As for the criterion "Application", have been raised questions that were split basically into two sub-criteria: "Hiring" and "Equipment".

The sub-criterion "Hiring" assessed the quality perception as to the usability of the application at the time of hiring the service of the company. For assessing, the payment details and clarity and control were used as criteria. But the sub-criterion "Equipment" evaluated items like the battery of the device as a limiting factor and the mobile internet, with a focus on application.

There was a good evaluation in relation to the criterion "Application", with reference to the minimum and maximum values of performance of usability; this criterion had a result very close to the maximum. The sub-criterion "Payment" had excellent evaluation, achieving top marks. On the other hand, the sub-criterion "Equipment" had a reasonable evaluation, generating a median that is closest to the minimum (see Graphic in Figure 3).
4.3 Car

The company offers different types of vehicles and uses them as a distinct form of differentiation from the competition. The car is one of the most efficient forms of the company pass customer credibility, so follow a rigid pattern of demands. There was a division between the sub-criteria "Structure" and "Service offered by the vehicle".

The sub-criterion "Structure" assessed the perception of quality regarding the car itself, being divided into Inner and Outer. But the sub-criterion "Service offered by the vehicle" evaluated items such as relaxation (sound, multimedia) and the availability of water and candies for the user.

The criterion "Car" also had a good evaluation, taking both their sub-criteria evaluated positively, which generated a clearly balanced graphic, with their values close to the maximum performance (see graphic in Figure 4).
4.4 Professional Requirements

Drivers, professionals who provide the service itself, are valued at each itinerary. They are the direct contact with the client, being of the utmost importance that be well trained. Drivers must not only drive with excellence, but also are instructed to get out of the car every time they collect a customer, to greet them and open the door for them. Their evaluation was divided between the sub-criteria: "Driveability" and "User interaction".

The sub-criterion "Driveability" measured the credibility that drivers spend for users along the way. In the case of the sub-criterion "User interaction", was assessed the quality of interpersonal relationship of drivers, from kindness and readiness to the knowledge of these professionals about the Uber itself.

The criterion "Professional Requirements" resulted in a great evaluation. The sub-criterion "Driveability" has reached the maximum level of performance, while the sub-criterion "User interaction" came very close to the same result, getting 9 points below the ideal, which resulted in just 4 points at the total criterion if compared to the Maximum Usability. (See graphic in Figure 5).
4.5 Origin-Destination

The criterion "Origin-Destination" is the experience that the customer has between the time when requests an Uber car, until the moment they arrive at their destination. So basically is the product that the company sells. That was divided into the sub-criteria: "Itinerary", "Time" and "Satisfaction regarding cost/benefit".

The sub-criterion “Itinerary” evaluates the perception of the best itinerary safety and choice. The sub-criterion "Time" takes into account not only the length of the itinerary, but also factors such as punctuality, opening hours and total time of the service.

Finally, the perception regarding the sub-criterion "Satisfaction cost/benefit" measures user satisfaction when compares the amount paid for the service and how this service is worth to them.

The final criterion evaluated, "Origin-Destination", had an outstanding result. Their sub-criteria "Itinerary" and "Satisfaction cost/benefit" had maximum usability and the sub-criterion "Time", although it has not achieved the maximum score, had a very close result. Thus, the total was only 3 points out of maximum performance assessment criteria (see Graphic in Figure 6).
4.6 Overall Analysis of UBER Usability

In general, the goal of the research, which focused on the analysis of the users’ perception of the Uber regarding its innovation and differential in its usability, was achieved. It was noticed that the identification of innovation was observed by users, which considered it as relevant in the provision of the service, with the predominance of the assessment as something very significant by respondents.

Analyzing the graph of global results, one realizes that the four major criteria had high-performance score. The criterion "Origin-Destination" was what had the highest score (148), also being the closest to peak performance, getting only three points below.

The criteria with the lowest performance was "Application", however, analyzing the responses from users, there can be clearly seen that there has not been discredited with the usability of the software, but rather a discontent regarding the limitations of complementary equipment services, focusing mainly on the need for a smartphone charged and in a stable internet network.

The research result shows clearly that Uber users not only started the process and tools evaluated, but also they deemed significant to the quality of service of individual transport. This demonstrates how users respond well to the analyzed criteria of comfort, safety and efficiency, as graphic of Figure 7. In this way, the hypothesis was confirmed, demonstrating the power that the technological innovation and the quality of processes have on a market as mature as the public transportation.
The overall or total assessment presents the results of the usability of Uber close to maximum performance achievable, as can be seen in the red bars of the Graphic of Figure 8, that are located close to the maximum possible scores (blue bars) and away from the minimum scores (green bars).
Conclusions

Users of Uber company see importance in every detail of every process of the service that is provided, from the software tools that hires and pays for the service to the time of the trip. All points raised by research, both innovations as simple differentials, were relevant to customer satisfaction.

The objectives proposed for the research have been achieved since became clear the perception of users regarding the differences and innovations entered in Uber service.

The criterion that had lower performance, "Application", makes it clear which the limitation of company is perceived by employees, causing some may stop using the service in case of lack of the necessary infrastructure for hiring in time of need. However, although with lower scores, even this criterion has a result considered good according to the method used.

The highest performance criteria, "Professional Requirements" and "Origin-Destination", leave the positive perception of the users as the service provided by the company. Differentials as readiness to open the door for customers and professional kindness had top marks in all the questionnaires.

The Multi-criteria Methodology for Supporting Constructivist Decision (MCDA-C) allowed a greater proximity to reality, since it considered the point of view of transport experts, from the analysis of the problem to the construction of the questionnaire for data collection. The application of the questionnaire with the users was important because it brought the vision of those who live the experience of the service into the research.

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