

# Smartphone Users' Satisfaction and Regional Aspects: Factors that Emerge from Online Reviews

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**Abstract:** This study aims to analyze which factors related to smartphone users' satisfaction emerge from online reviews. In addition, as the study was conducted in Brazil which is a developing country with a lot of regional diversity, a secondary aim of this study is to test whether regional aspects can affect users' satisfaction level. Online reviews were analyzed through the Content Analysis technique. Next, we carried out a quantitative analysis using Ordinal Logistic Regression. The results showed that smartphones' features related to hardware and software and sellers' characteristics may significantly affect users' satisfaction. The socioeconomic factor, represented by the GDP per capita of the cities where users live, had a significant and negative impact, indicating that users in more economically developed regions attribute lower satisfaction level to smartphones. This study contributes to the literature as it used online reviews as data source, which helps identifying factors related to users' satisfaction beyond those analyzed in previous studies that applied questionnaires.

**Keywords:** Online reviews; IT users' satisfaction; Regionality; Smartphone Users; Electronic Commerce

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## Introduction

In the 21st century, Information Technologies (IT) usage is increasing in several areas of society, with the creation of new resources at an unprecedented rate (Ma, Chan, & Chen, 2016). Smartphones are one of the technologies broadly used worldwide and allow users not only to make phone calls, but also to execute several tasks (Kim et al., 2016; Liu & Yu, 2017). These mobile devices are becoming increasingly popular and have become one of the segments in the telecommunication industry with the highest world growth (Kim et al., 2015), even crossing the milestone of 1 billion devices sold (Rahim et al., 2016; Liu & Yu, 2017).

Due to smartphones' popularity and constant need for enhancement, previous studies have investigated issues related to smartphone users' satisfaction in the past years (e.g. Kim et al., 2015; Shin, 2015; Lee et al., 2015; Liu & Yu, 2017; Wang, Ou, & Chen, 2019). These studies have shown not only the relevance of users' satisfaction for the success of smartphones, but also the relevance of research on this theme, whose results can be crucial for the decision-making process of developers of such technology (Shin, 2015). Studies developed by Kim et al. (2015), Shin (2015), Lee et al. (2015), and Wang, Ou, and Chen (2019), for example, have shown that smartphone users' satisfaction may even affect the continuity of use of these devices and customer loyalty. Bayraktar (2012, p. 99) highlights that "higher customer satisfaction and loyalty can lead to stronger competitive position resulting in larger market share and profitability."

According to Rahmati et al. (2012), smartphone users consist in a very diverse group, and the differences among users may affect how mobile technologies are designed. The authors pointed out that demographic, social, and economic characteristics may affect the

adoption and use of smartphones. For example, Song et al. (2015) identified that the perception of smartphone users changes according to different regions of China. Thus, based on these studies, we can notice the relevance of considering regional aspects in research on the perception of technology users.

Brazil has 229 million cell phones and ranks 5th worldwide in cell phone usage (Anatel, 2019; CIA, 2019). Its density is 109.8 devices for each 100 inhabitants, which results in an average of more than one device per inhabitant (Anatel, 2019). Brazil has different regions, cultures, and levels of economic and social development, which reflects on the distribution of technological industries, bank branches and companies in the country and affects the innovation capabilities of each region (Hofstede et al, 2010; Malaquias & Hwang, 2016). However, despite the large amount of smartphone users and the regional diversity of Brazil, there is a lack of studies related to the satisfaction of Brazilian users regarding this technology.

Thus, considering (i) the importance of identifying the satisfaction level of smartphone users and the factors related to this satisfaction, and (ii) the existence of online shopping platforms that allow customers to provide feedback by means of post-purchase review tools, the main purpose of this study is to analyze which factors related to smartphone users' satisfaction emerge from online reviews. As online reviews are often posted by users from different regions in the country, a secondary aim of this study is to analyze if the socioeconomic factor – represented by the GDP per capita of the cities where users live – can affect the satisfaction level.

Regarding the data collection method, this study adopted a different approach from previous studies, since, instead of using questionnaires with pre-defined questions, we used online reviews posted

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by smartphone users who have purchased their devices through e-commerce websites. According to Li, Ye, and Law (2013, p. 785), “it is impossible to include all possible factors for extraction as reliable indicators to measure satisfaction in a questionnaire.” Considered as an important data source for both sellers and buyers, online reviews provide content for a broader assessment on the factors that can affect the satisfaction of smartphone users, since users may present factors beyond those considered in previously proposed models, which have been tested by means of questionnaires (Li, Ye, & Law, 2013; Zhang, Zhang, & Law, 2013).

This study also contributes to the literature by considering regional aspects that can affect smartphone users’ satisfaction. Previous studies have pointed out that regionality may affect smartphone users’ adoption and satisfaction, and the analysis of regional characteristics can contribute to a better understanding on satisfaction (Rahmati et al., 2012; Ma, Cha, & Chen, 2016; Song et al., 2016). However, most studies on smartphone users’ perception have the limitation of not having tested possible regional differences in the countries where they have been carried out, either for considering users of a single region, or for treating the country as a homogeneous market (Song et al., 2016; Ma, Cha, & Chen, 2016). Therefore, the inclusion of regional aspects in this research may contribute to the literature by identifying a possible relationship between regional aspects – particularly the socioeconomic factor – and Brazilian smartphone users’ satisfaction. It is important to emphasize that although Brazil ranks 5th worldwide in cell phone usage, to the best of our knowledge this is the first study conducted to evaluate factors related to smartphone users’ satisfaction in Brazil.

## Literature Review

### Smartphone Users’ Satisfaction

Several studies have focused on the relevance of analyzing IT (Information Technology) users’ perception due to its relevant role in the evolution of IT and company competition. Such studies follow two main streams in the Information Systems literature: i) the analysis of users’ satisfaction (Amin, Rezaei, & Abolghasemi, 2014; Finley et al., 2017; Wang, Ou, & Chen, 2019; Xu & Du, 2018) and ii) the analysis of technology acceptance (Alwahaishi & Snášel, 2013; Ma, Chan, & Chen, 2016; Park, Im, & Noh, 2016).

Concerning users’ satisfaction, some studies have investigated the satisfaction of users of particular technologies, such as internet banking (Liébana-Cabanillas et al., 2016), hospital information systems (Karimi, Poo, & Tan, 2015), social media (Liu, Cheung, & Lee, 2016), mobile technologies (Amin, Rezaei, & Abolghasemi, 2014; Finley et al., 2017; Wang, Ou, & Chen, 2019), electronic government services (Al Athmay, Fantasy, & Kumar, 2016), among other applications (Ma, Mo, & Luo, 2014; Sun; Fang; & Hsieh, 2014; Calvo-Porrá et al., 2017; Xu & Du, 2018). These studies have identified that factors such as efficiency, ease of use, perceived usefulness, content quality, perceived value, information quality, and system quality may affect the satisfaction of users of such technologies.

Particularly regarding smartphone users’ satisfaction, Finley et al. (2017) showed the relationship between social media and satisfaction of users of mobile devices, whereas Liu and Yu (2017) identified design features of devices that can determine users’ satisfaction.

Bayraktar et al. (2012) showed that factors such as perceived quality, perceived value, fulfillment of expectations, and manufacturer image can affect customers’ satisfaction and loyalty. Kim et al. (2016) also highlighted that both smartphone features, such as performance, applications, design, and ease of use, and corporate features, such as customer support, can impact satisfaction.

In order to analyze the factors related to smartphone acceptance by elderly Chinese, Ma et al. (2016) proposed a model that integrates variables from TAM and UTAUT models with other variables such as satisfaction and cost tolerance. The authors identified that enabling conditions and user satisfaction are important factors that influence the perceived usefulness and ease of use. The study also found that demographic variables included in the model as mediating variables such as age, economic status and education also influence the acceptance of smartphones by older Chinese.

Other studies have adopted a broader scope when considering various factors such as physical attributes, system characteristics, personality traits and the influence of the manufacturer and its brand on the satisfaction of smartphones and cell phone users (Oliveira, Cherubini, & Oliver, 2013; Chang & Huang, 2015; Shin, 2015; Kim et al., 2016). In Table 1 we present previous studies on smartphone users’ satisfaction.

Table 1: Previous Studies on Smartphone Users' Satisfaction

Authors	Variables Tested as Antecedents of Smartphone Users' Satisfaction	Method	Region
Haverila (2011)	Battery/talk time; Quality; Ease of use; Price; Size of the display; Memory; Design; Aesthetics; Standard processes used, and Solidity.	Online Survey with 289 students in Finland.	No
Cho et al. (2011)	Human Interface Elements: Button, Display, Speaker, Body, Camera.	Web-based survey with 204 participants in South Korea.	No
Bayraktar et al. (2012)	Image; Customer Expectations; Brand; Perceived Quality; Perceived Value.	Survey with 282 individuals in Turkey.	No
Park and Lee (2011)	Stress; Perceived Enjoyment; Instant Connectivity; Usage Length; Gender	Survey with 33 students in South Korea.	No
Gerogiannis et al. (2012)	Fast communication, complexity, perceived enjoyment, memory, efficiency, convenience; service quality, 3G services	Survey online with 40 individuals.	No
Khayyat and Heshmati (2012)	Perceived Usefulness; Perceived ease of use; Perceived Enjoyment; Price; Brand; Demographic Characteristics of the Customers	Survey with 1458 individuals from Kurdistan region of Iraq.	No
Oliveira, Cherubini and Oliver (2013)	Perceived Usability; Personality; Behavior	Survey with 603 individuals	No
Kim et al. (2015)	System Quality; Contents Quality; Network Quality; Customer Support; Compatibility.	Online and paper based survey with 229 students in Korea.	No
Shin (2015)	Perceived utility; Perceived hedonicity; Content quality; Service quality; System quality.	Online Survey with 485 respondents and mobile calls to 89 smartphone users from Korea.	No
Chang and Huang (2015)	Perceived ease of use; Perceived Usefulness; Personality; Subjective Norms; Self-image Congruence	Online Survey with 40 smartphone users from Taiwan.	No
Kim et al. (2016)	Functions; Usability; Design; Applications; Device Price; Customer Support; Corporate Image.	Survey with 700 respondents in South Korea. The majority of the participants (58.5%) use Samsung smartphones.	No

## Online Reviews

Online customer reviews (also called electronic word of mouth – e-WOM) are reviews made by customers on e-commerce websites, third-party webpages, or social media (Mudambi & Schuff, 2010; Lee & Cranage, 2014). They have an informal, interpersonal nature (users are free to express their opinions) by means of communication channels focused on customers, so that they can share their shopping and use experiences with products and services, and aspects related to post-purchase experience, such as perceived quality and value (Mudambi & Schuff, 2010; Li, Ye, & Law, 2013; Lee & Cranage, 2014).

According to Park et al. (2007), online reviews have a double role: as an informer (they provide information about a product) and as an influencer (they provide recommendations of previous customers as

word-of-mouth information). The existence of customer reviews on a website improves users' perception about the page itself, attracts new visitors, and increases the time they spend on the website (Kumar & Bensabat, 2006; Mudambi & Schuff, 2010). Online communication channels affect the way people process information and make purchase decisions (Lee, Park, & Han, 2008). They allow customers to access and count the number of positive and negative reviews simultaneously, hence promoting a quantitative perception of a product or service quality (Lee & Cranage, 2014).

Sebastianelli and Tamimi (2018) pointed out the impact of valence (positive and negative aspects of online reviews) and volume (number of reviews) in the decision-making process of potential customers. Despite the consensus on the positive results of online opinions and reviews, the literature has also suggested that negative effects can be even more

significant (Herr, Kardes & Kim, 1991). Customers give more importance to negative reviews than to positive ones in their decision-making process, which results in negative impacts to companies' image, reputation, and sales. Besides, negative opinions can lead to less favorable reviews by potential users, which has motivated researchers to investigate the way customers process positive and negative opinions regarding products and services (Lee & Cranage, 2014).

Studies on online reviews and their impact has been developed in several areas, such as hospitality and tourism (Li et al., 2013; Abubakar & Ilkan, 2016), social media (Yan et al., 2016), information systems (Sebastianelli & Tamimi, 2018), and e-commerce (Kumar & Benbasat, 2006; San-Martín et al., 2015). Research studies by Casidy and Wymer (2015), San-Martín et al. (2015), Calvo-Porrá et al. (2017), and Zhang and Yang (2019) investigated the relationship between satisfaction and WOM reviews, meaning satisfaction increases the probability that users express their opinions about the product they purchased.

Online reviews have become a useful source of information to explore customer behavior (Li et al., 2013). Yang and Fang (2004), for example, carried out a content analysis on customers' online reviews to investigate aspects related to the service quality of securities brokerage and users' satisfaction. Li et al. (2013) analyzed the determining factors for satisfaction of hotel customers based on the content of online reviews. In line with these studies, this study uses as data source the online reviews posted by smartphone users who purchased their devices via e-commerce. We hope this can help advance the conclusions taken in this area in comparison with studies using questionnaires.

### Regional Aspects and Satisfaction

Studies on customer satisfaction have considered regional and transnational differences in their models to investigate the influence of such differences in loyalty and satisfaction (Morgeson et al., 2011; Zhang; Zhang; Law, 2013). Such studies analyzed regional characteristics and determining individual aspects in user and customer behavior intention with the premise that individual experiences and perceptions are subject to structural influences (Ji et al., 2018). Thus, the economic development of a region can play as a satisfaction precedent (Zhang, Zhang, & Law, 2013; Zhang et al., 2019).

Some studies have shown that individuals from more developed areas tend to be more demanding and attribute lower satisfaction levels when reviewing products and services when compared to individuals from less developed areas (Zhang, Zhang, & Law, 2013; Xu et al., 2019). Such conclusion may be due to the fact that individuals with a higher economic status have higher expectations about products and services; therefore, they are more critical when reviewing their consumption or use experience (Morgeson et al., 2011; Ji et al., 2018). Fudge and Van Ryzin (2012), for example, investigated the influence of individual characteristics, such as socioeconomic factors, ethnics, gender, and political positioning, on the use of government websites. As a result, the authors concluded that such factors are so significant as they expected; however, such characteristics may vary according to the region investigated due to external factors, such as schooling, income, and political engagement.

Zhang, Zhang, and Law (2013) analyzed the influence of regional economic factors on customers' satisfaction regarding restaurants. They concluded that economic status and population density affect individuals' satisfaction. Similarly, Ji et al. (2018) studied the influence of regional differences in customers' experience in Chinese restaurants using a model that considered disparate economic and sociocultural indicators.

IT studies also have investigated the impact of regional factors on technology adoption and use by individuals (Fudge & Van Ryzin, 2012). Song et al. (2015) considered such factors when proposing a model for users from three different regions of China to adopt 3G technology. They concluded that cultural, normative and behavior values affect the technology adoption.

Cultural factors also affect the use and satisfaction levels of products, as showed by Sauer et al. (2018). Their study identified that individuals from different cultures and countries have different perceptions and reviews regarding the usability of smartphones. Further, socioeconomic factors can affect this perception.

According to Yang and Hsieh (2013), the online behavior of users is also affected by regional factors, since socioeconomic factors directly affect the pattern of internet use for educational purposes among individuals in urban and rural areas. Regional characteristics may also be considered in users' responses to online reviews posted by their peers, since factors such as region, ethnicity, or social distance from reviewers may affect the reliability of opinions and information presented (Lin & Xu, 2017).

Morgeson et al. (2011) proposes the use of GDP per capita as an indicator of economic prosperity of a nation or region, and it can be associated with customer satisfaction. The authors considered that the education level and literacy may also be related to higher satisfaction indexes due to individuals' better decision-making ability and use of autonomous services (Morgeson et al., 2011); in this case, the Human Development Index (HDI) is a possible alternative to measure such aspects.

### Method

#### Data Collection

In order to reach the research goal, we first selected retail websites based on a list with the greatest online retailers in Brazil. From this list we selected three platforms that sell smartphones and that allow customers to inform their city in the review. Then, we analyzed the content of online reviews available at the selected platforms.

The selection criteria of smartphone models for collecting users' reviews included a list of the five best-selling smartphones in Brazil in 2018 (BUSCAPE, 2018). In order to isolate the brand effect, we selected smartphones from one brand only, in this case, Samsung, which stood out in 2018 as the top company in the smartphone market in Brazil (IDC, 2018). Table 2 displays the models selected and their average price.

**Table 2:** Smartphone models selected and their average sale price

Device	Average Sale Price (BR\$)
Samsung Galaxy J6 32GB	799.00
Samsung Galaxy J8 64GB	1,299.00
Samsung Galaxy S8 Dual Chip 64GB	2,099.00
Samsung Galaxy S9 128GB	2,999.00
Samsung Galaxy S9+ Plus 128GB	3,499.00

We collected all the reviews on the smartphone models selected that were available on the e-commerce platforms until the day of collection which occurred in December 2018. We saved these reviews in files in a computer for further analysis.

The content produced by users online was organized in a spreadsheet with the following elements: i) identification name or nickname provided by the user; ii) user’s review text on the smartphone assessed; iii) the score given to the product, ranging from 1 to 5, indicating the satisfaction level; and iv) the user location, including the city and the state. After organizing the data, we proceeded to the analysis of reviews through the Content Analysis technique (Krippendorff, 2012).

**Data Analysis**

As Li et al. (2013) pointed out, text analysis techniques (such as content analysis) allow the analysis of semantic guidelines for users’ reviews and the exploration of factors not considered previously. Thus, the first stage of data analysis was the building up of a review-factor spreadsheet, in which each line refers to an individual review and each column represents a particular factor. This organization allowed the calculation of the number of reviews regarding each specific variable.

After data organization, we read the review texts and identified and coded the keywords. We identified 31 variables that can be viewed at Table 4 in the next section. The content of reviews was coded by two different researchers. We verified inter-coder consistency and there was a consensus among the researchers.

For each variable/attribute identified, a column was created and we analyzed if the customer review indicated a positive or a negative opinion. For each review, the cells corresponding to the attributes were filled according to their mention by the users, being assigned (i) the value 1 when the attribute was positively mentioned by the user, (ii) the value -1 for negative mentions to the attribute and (iii) 0 (zero) when there was no mention of the item in the user evaluation, as shown in Figure 1.

**Figure 1 –** Spreadsheet Model used for Data Analysis

	Score	Memory	Camera	Screen	Design	...	Ease of use
Review 1	3	1	0	1	0	...	1
Review 2	1	0	1	0	0	...	0
Review 1	4	1	-1	1	1	...	0
...	...	...	...	...	...	...	...
Review 508	2	-1	0	-1	-1	-1	1
Review 509	5	1	-1	0	0	1	1

We collected 509 online reviews for analysis. However, after excluding those reviews where the customer did not inform the city or state, the database reduced to 470 reviews. We collected the GDP per capita of each city, so it was a scalar variable representing a proxy for different Brazilian regions.

The variables obtained were analyzed following the descriptive analysis. To assess which variables identified in the survey presented a significant relationship with the IT user’s satisfaction, we used the Ordinal Logistic Regression Analysis (considering that the dependent variable is an ordinal number and admits five values in a 1-5 scale).

**Results**

**Descriptive Analysis**

We analyzed the data collected based on the descriptive statistics. Table 3 displays information related to smartphones, including the number of reviews and the average score given to each smartphone. The database has 470 reviews, and most of them was posted by users who purchased a device with an average price of R\$ 2,135.40.

**Table 3:** Descriptive statistics related to the smartphones in the study sample

Device	Freq.	Price (R\$)	Users Scores Mean
Samsung Galaxy J6 32GB	89	799.00	4.618
Samsung Galaxy J8 64GB	97	1,299.00	4.515
Samsung Galaxy S8 Dual Chip 64GB	248	2,135.42	4.593
Samsung Galaxy S9 128GB	17	2,999.00	4.647
Samsung Galaxy S9+ Plus 128GB	19	3,499.00	4.789
Total	470	1,796.09	4.591

Table 4 displays information about the number of reviews per region in Brazil, and the average score given by reviewers from these regions. The sample has reviews from all Brazilian regions. However, most reviews were posted by individuals living in the southeast region, which is the richest and most industrialized region of Brazil (Malaquias et al.,2016).

**Table 4:** Analysis of the reviews and average GDP per capita per state

Region	Freq.	City GDP per capita - Statistical mean	Users Scores Average
North	21	22,363.7	4.528
Northeast	72	20,388.9	4.732
Central-west	35	43,615.3	4.788
Southeast	279	42,545.6	4.497
South	63	41,859.1	4.640
Total	470	40,752.1	4.591

Table 5 shows all items that appeared in the content analysis of reviews and may have affected the satisfaction of smartphone users. This table also indicates the number of positive and negative mentions concerning each item. Each variable was defined with value “1” when the user’s review had a positive opinion about it, and value “-1” when the user’s review had a negative opinion about it, as explained in the methodology.

**Table 5:** Number of (positive and negative) mentions per item identified

Variables	Positive	Negative	Total	Variables	Positive	Negative	Total
System performance	97	3	100	Durability	1	16	17
Design	71	4	75	Memory	14	2	16
Camera	65	3	68	System security	12	3	15
Delivery service	52	10	62	Technological innovation	9	0	9
Cost-benefit	33	21	54	Multichannel integration	8	1	9
Perceived usefulness	49	0	49	Ease of handling	6	3	9
Battery duration	30	17	47	Build material	2	7	9
System applications	40	4	44	Weight of the device	7	0	7
Fulfillment of expectations	42	1	43	Included accessories	1	6	7
Proper functioning	17	19	36	Attributes as advertised	5	1	6
System without freezes	16	14	30	Gaming performance	4	2	6
Customer service	15	11	26	Charging speed	3	2	5
Perceived quality	23	1	24	Sound quality	1	4	5
Ease of use	21	2	23	Ease of setting	4	0	4
Display quality	14	9	23	Payment options	3	0	3
Size of the display	14	7	21				

Among the items indicated by customers in the reviews (according to Table 5), we can mention smartphone features (related to hardware and software) and sellers' characteristics, which corroborates a study by Kim et al. (2016). As this study involves customers who purchased their smartphones through e-commerce, the delivery and customer services provided by the retailer becomes an important factor that affects users' satisfaction. Many items identified in the analysis corroborate factors indicated in previous studies as potential influencers of smartphone users' satisfaction. Bayraktar et al. (2012), for example, analyzed factors such as perceived quality, cost-benefit (perceived value), and fulfillment of customers' expectations, whereas Liu and Yu (2017) analyzed design features. Kim et al. (2016) investigated aspects such as performance, resources, design, ease of use, and customer service. However, we did not find studies that analyzed items such as ease of setting, technological innovation, and durability, for example.

The items with the largest number of positive mentions were performance, design, and camera, and the items with most negative mentions were cost-benefit, proper functioning, and durability. According to Sebastinelli and Tamini (2018), (negative and positive) online reviews can impact customers' trust. However, as Lee and Cranage (2014) pointed out, negative reviews may have an even higher impact on customers' decision-making than positive mentions. Therefore, smartphone developers and sellers should take into account the negative aspects pointed out by users. The results indicated in Table 4 can help identify these aspects.

### Analysis of the Relationship between Satisfaction and the Items Extracted in the Content Analysis of Reviews

We analyzed the relationship between satisfaction and the items mentioned by users using the scores given by reviewers as indicators of

the satisfaction level of smartphone users. Due to the ordinal nature of the dependent variable "Users' Satisfaction", we used the Ordinal Logistic Regression analysis technique.

We estimated the first model considering users' satisfaction as a dependent variable, and price, GDP per capita of the cities, and all the variables listed in Table 4 as explanatory variables. As most of reviews were from users that live in the southeast region of Brazil we also included a dummy variable called Region which received value "1" if the user lives in the southeast region and value "0" if the user is from other regions. The results for this more general model are available in Appendix A, and they indicate, among the items extracted from the reviews, 13 items that may have significant influence on users' satisfaction, considering a significance of up to 10%. One of these items were GDP per Capita of the city where the user lives. Region, on the other hand, did not present a significant effect on user satisfaction, maybe because a possible effect of region is already captured by the GDP per capita variable which is a scalar variable that presents more variation.

Based on the results presented in Appendix A, we estimated a new model considering users' satisfaction as a dependent variable and the 13 statistically significant items as explanatory variables. Table 6 summarizes these results.

In Table 6, factors such as price, proper functioning, durability, design, cost-benefit, customer service, and battery life were significant at 1%. Ease of setting had a negative effect on satisfaction, with significance of only 10%. This possibly occurred because smartphones easier to set up may be the ones with more simple settings, too. The GDP of cities, represented by the natural logarithm of the GDP per capita, had a significant, negative impact on

customers' satisfaction level, which is in line with previous studies about customer behavior related to other types of products and services (Morgeson et al., 2011; Zhang, Zhang, & Law, 2013; Ji et al., 2018; Zhang et al., 2019; Xu et al., 2019) and smartphone adoption (Song et al., 2016). In other words, customers living in cities

with higher GDPs per capita tend to be more demanding in the reviews, hence presenting lower values for the variable satisfaction. Based on the results found, we propose a model of factors determining smartphone users' satisfaction, as demonstrated in Figure 2.

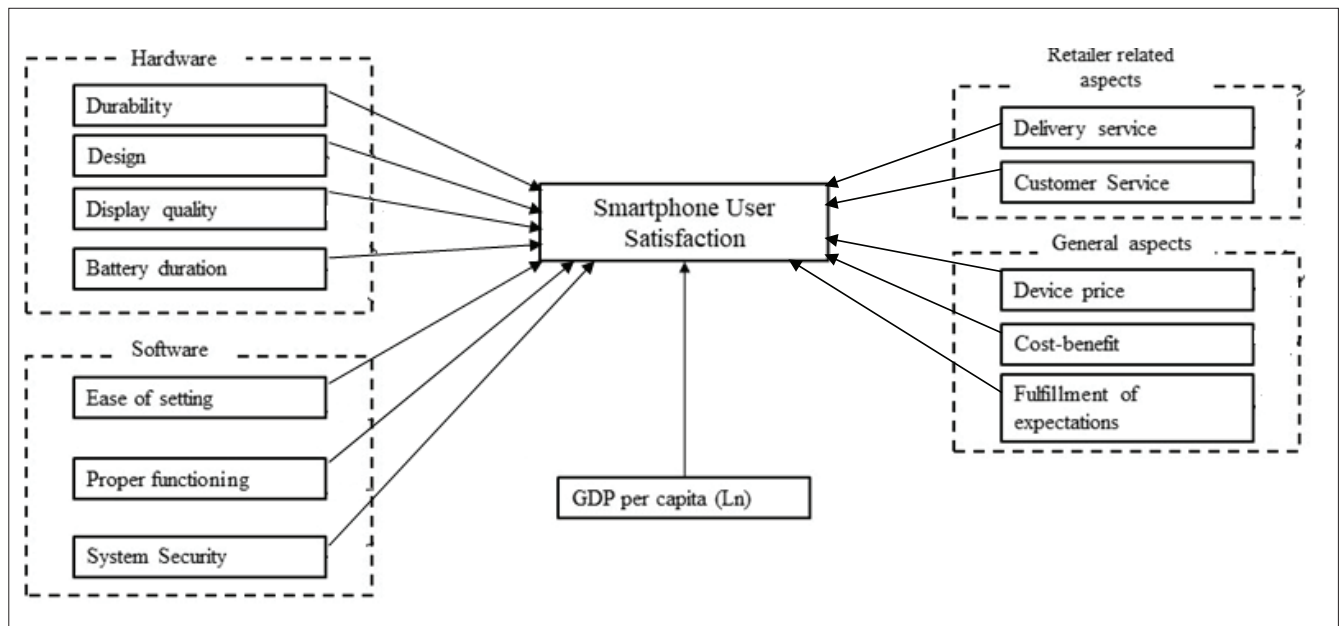
**Table 6:** Results of the Ordinal Logistic Regression Analysis including only the significant variables of the first estimated model

Variables	Coef.	Erro Padrão	z	Signif.
Device Price	0.0008	0.0002	3.910	0.000 ***
GDP per Capita (Ln)	-0.475	0.233	-2.040	0.041 **
Ease of setting	-1.712	0.980	-1.750	0.081 *
Proper functioning	3.698	0.552	6.700	0.000 ***
Durability	2.362	0.637	3.710	0.000 ***
Design	1.125	0.404	2.780	0.005 ***
Cost-benefit	1.280	0.399	3.200	0.001 ***
Delivery service	0.898	0.422	2.130	0.033 **
Customer service	2.485	0.718	3.460	0.001 ***
Display quality	1.577	0.669	2.360	0.018 **
Battery duration	1.157	0.444	2.610	0.009 ***
Fulfillment of expectations	1.036	0.535	1.940	0.053 *
System Security	2.250	0.906	2.480	0.013 **

n=	470
LR chi2(12)=	163.08
Prob > chi2=	0.000
Pseudo R2=	22.20%

**Figure 2 – Model of Factors Determining Smartphone Users' Satisfaction**



## Discussion and Conclusions

The general goal of this study was to analyze which factors related to smartphone users' satisfaction emerge from online reviews. Considering a database comprising 470 reviews, we identified 31 variables mentioned by customers. The analysis of reviews also considered if the customer opinion was positive or negative. We analyzed the relationship between users' satisfaction and the variables mentioned by customers by means of the Ordinal Logistic Regression.

The results showed that both smartphone features and sellers' characteristics may significantly affect users' satisfaction. Among those features, we can mention price, ease of setting, proper functioning, durability, design, cost-benefit relationship, delivery service, customer service, display quality, battery duration, fulfillment of expectations, and system security. These factors may significantly affect users' satisfaction, which indicate that smartphone users' perception can be related to both hardware and software (operating system and applications), being difficult to dissociate these two dimensions of Information Systems.

As the study involves customers who purchased their smartphones through e-commerce platforms, the delivery and customer services provided by the retailer are important factors that affects users' satisfaction. The effect of the socioeconomic factor represented by the GDP per capita of the cities of users was also significant, which is in line with studies about customer behavior. It may indicate that users in more economically developed cities may have more expectations regarding smartphones.

Several studies have pointed that regional factors may affect users' satisfaction regarding services like hotels and restaurants, but these factors have not been tested in previous studies on smartphone users' satisfaction. Thus, this study contributes to the literature by analyzing regional aspects that can affect smartphone users' satisfaction in a country with a lot of regional and socioeconomic diversity like Brazil. It is important to emphasize that although Brazil ranks 5th worldwide in cell phone usage, to the best of our knowledge this is the first study conducted to evaluate factors related to the satisfaction of Brazilian smartphone users.

Concerning the data collection method, this study presents an innovating approach compared to previous studies that used questionnaires, since it considered online reviews posted by users and publicly available on the e-commerce websites that sold the smartphones. Moreover, the content analysis of reviews allowed a broader assessment of the factors that may affect smartphone users' satisfaction, since it enabled the identification of factors beyond those proposed in previous studies and tested by means of questionnaires (e. g. ease of setting, technological innovation, and durability).

Added to it, social influence is a relevant construct in the research field of Information System, which turns online reviews into important information sources for customers who wish to purchase a

product online and check the opinion of other people before making their decision to buy it. The factors pointed out by a user may be taken into account by other buyers, because reviews are public. Thus, vendors and product developers also should take online reviews into consideration.

A research limitation is the fact that the database only included reviews made by online consumers. So, the results represent the characteristics of this particular audience and they must not be interpreted with the purpose of generalization. Further, the reviews available on online shopping websites only represent part of the customers that use such sale channels, since not all users comment their satisfaction impressions on e-commerce platforms. Therefore, for future studies we suggest the investigation of reviews and opinions of other customers, for example, offline customers who purchased their smartphones at physical stores, so that they can verify the existence of similarities or differences between the audiences.

We also suggest extending our study analysis to a customer sample of other countries, in order to verify the impact of economic and cultural differences on smartphone users' satisfaction. In addition, we suggest the analysis of customer reviews and comments on several platforms, such as social media, to observe the satisfaction level of users by means of opinions posted at informal channels focused on the users themselves.

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**Appendix A:** Results for the first ordinal logistic regression analysis

<b>Variables</b>	<b>Coef.</b>	<b>Std. Err.</b>	<b>z</b>	<b>Signif.</b>
Device Price	0.001	0.000	3.300	0.001 ***
Region	-0.035	0.300	-0.110	0.908
GDP per Capita (Ln)	-0.473	0.261	-1.810	0.070 *
Ease of use	-0.159	0.605	-0.260	0.792
Ease of setting	-2.361	1.302	-1.810	0.070 *
Perceived quality	0.880	0.867	1.020	0.310
Proper functioning	3.561	0.573	6.210	0.000 ***
Perceived usefulness	0.199	0.424	0.470	0.639
Durability	2.284	0.704	3.240	0.001 ***
System Performance	0.242	0.383	0.630	0.527
Design	1.246	0.454	2.740	0.006 ***
Cost-benefit	1.203	0.418	2.880	0.004 ***
Delivery service	0.822	0.429	1.910	0.056 *
Customer service	2.350	0.742	3.170	0.002 ***
Multichannel integration	1.062	1.140	0.930	0.352
Camera	0.595	0.437	1.360	0.173
Display Quality	1.293	0.734	1.760	0.078 *
Battery duration	1.347	0.516	2.610	0.009 ***
Memory	-0.033	0.986	-0.030	0.973
System without freezes	0.764	0.507	1.510	0.131
Fulfillment of expectations	1.017	0.572	1.780	0.075 *
Ease of handling	0.607	0.917	0.660	0.508
Weight of the device	-1.541	1.140	-1.350	0.176
Charging speed	1.493	1.416	1.050	0.291
Technological innovation	-0.096	1.255	-0.080	0.939
Build material	1.392	1.059	1.310	0.189
Size of the device	0.489	0.679	0.720	0.471
Attributes as advertised	-0.277	0.922	-0.300	0.764
System applications	0.663	0.583	1.140	0.255
Sound quality	1.406	1.416	0.990	0.321
System security	2.037	1.015	2.010	0.045 **
Payment options	12.706	413.785	0.030	0.976
Gaming performance	-1.849	1.150	-1.610	0.108
Included Accessories	0.253	0.782	0.320	0.746
	n=	470		
	LR chi2(35)=	178.34		
	Prob > chi2=	0.000		
	Pseudo R2=	24.28%		

