



**UNIVERSIDAD
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**Understanding Customer Experience: How Does the Lack of
Customer Service Affect the Frequency of Use and Retention of
Users in a Fintech? It is Profitable to Invest in Improving the
Customer Service Center?**

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Director: Elena Fumagalli, Ph.D. in Marketing, HEC Paris

Abstract

The present work focuses on evaluating the economic feasibility of providing a superior customer support experience to a major Latin American fintech's customers. The objective is to improve a real business initiative carried out within the company, which seeks to evaluate how the lack of a support center affects customer retention and the frequency of use of the platform's products.

The motivation for this work arises after various company metrics began to show a negative impact on the customer experience due to lack of access to a support center within the mobile application in Brazil, from which the management of the company began to evaluate the possibility of investing in improving this aspect.

To carry out the analysis, we have information from an experiment carried out by the fintech where a more direct and transparent access to the support center began to be provided to a random group of users. By using SQL we were able to extract all the information regarding contacts with the support center and the activity of the clients within the platform, as well as we were able to form a control group of customers to evaluate the treatment effect of providing direct access to customer service.

Using the Kruskal-Wallis statistical test, we were able to obtain two important conclusions regarding the impact of the new support center: 1) when starting to offer the new functionality, contacts with the customer service center increased by 134% and, 2) when starting to offer the new functionality, the amount of money transacted within the platform increased by 2.2%. The results of the financial viability analysis were positive, which implies that the incremental costs of starting to offer this new functionality are absorbed by higher profits due to the increased use of the platform.

Finally, after validating that the project is economically viable for the company, we proposed a segmentation strategy to begin providing this new functionality to the company's users. Due to a technical reason that implies that the project must be carried out in 18 stages/waves over the following one and a half year, using the K-means algorithm, we divided customers into 5 different clusters in order to prioritize them.

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1- Introduction

The present work focuses on evaluating the economic feasibility of providing a superior customer support experience to a major Latin American fintech's customers.

In order to understand the motivation behind this work, it is necessary to go back to the last 5 years of fintech's life. Like the entire fintech industry in general, the company has been experiencing high growth rates in recent years due to a greater number of products and services offered, which brought with it a growing number of customers. The fact of being able to offer various solutions to most of the financial problems of people and businesses in a single mobile application generated a great competitive advantage for the company due to the ecosystem of products offered, although it also led to an increase in the complexity of use of the platform.

Due to this increased complexity of the mobile application, the company was forced to adopt a customer-centric vision. Much of the work of the fintech teams in recent years has focused on detecting and correcting the main frictions of each of the products offered, with the aim of improving consumer satisfaction metrics. The argument to justify this work methodology was simple: the increase in the complexity of the mobile application generated a greater need of contact with the customer support center, but given that there were various opportunities of improvement in each one of the products offered by the company, the conditions to have a transparent support center were not met, so access was hidden within the mobile application.

Over time, the vast majority of frictions for which users complained were corrected, to the point that certain difficulties that previously went unnoticed in customer satisfaction metrics began to gain more relevance. One of those difficulties was the lack of access to the customer support center. It was from that moment that the company's management began to wonder if it was necessary to invest in improving access to the support center, but not without first evaluating the economic impact that such investment could have on the company's finances.

The objective of this work is to improve a real business initiative carried out within the fintech which seeks to evaluate how the lack of a support center affects customer retention and the frequency of use of the platform's products, with the idea of evaluating whether investing in providing a better access to the support center for users turns out to be economically viable for the company. The hypothesis that will start our analysis is based on the fact that the new functionality will generate a greater number of cases that enter the customer support center, but that incremental cost due to

greater demand will be absorbed by higher profits due to a greater use of the platform by customers. In addition, given that the proposed improvement for the support center implies a big change in relation to the current scenario, we believe that the expansion of the support center will have to be carried out in various waves/stages, so it will be necessary to prioritize the users of the platform to determine who to start providing this new functionality first. The structure of the next sections is detailed below.

In section 2 we will focus on the problem under analysis. To do this, we will provide more detail on the business case, as well as introduce various concepts that will allow us a better understanding of the context. We will refer to the definition of fintech and how these types of companies achieve sustainable growth, to the differentiation between the terms of customer experience and customer service, and we will carry out an evaluation of the company's business model and the competitive context in which it is immersed. Finally, in section 2.7 we will expose the questions that we seek to answer throughout the work to achieve the proposed objective in relation to the hypothesis established.

Section 3 seeks to understand how the lack of customer support impacts user retention and the frequency of use of the company's products. To do this, we will use customer satisfaction surveys, particularly from NPS. The results indicate that, when a user complains due to lack of access to the support center, the retention rate and frequency of future use is lower as compared to when users complain about other reasons.

Using the Kruskal-Wallis statistical test, in section 4 we will seek to evaluate whether the new support center functionality generates a greater number of contacts with the customer support center. The results indicate that, by improving access to the support center, the number of contacts by users increases by 134%. This implies that to maintain the same operating levels we must expand the installed capacity in the same proportion as to the increase in demand.

In section 5 we will carry out two analyzes to evaluate how the new functionality of the platform affects the behavior of customers in terms of transactions. On the one hand, by a statistical test of comparison of means, we will be able to prove that customer retention improves after the new functionality is turned on. On the other hand, using a methodology similar to the previous section, we will seek to evaluate whether the amount of money transacted on the platform increases. The results are the expected in terms that with this new functionality we were able to increase the transaction amount of users on the platform by 2.2%.

Section 6 closes the first part of the work, where through a sensitivity analysis we will build various scenarios to evaluate if the 2.2% improvement in user activity is enough to cover the 134% increase of the costs of the support center. The results obtained are positive regarding the impact on the company's finances, which gives us the necessary argument to move forward with this initiative and begin to provide this new functionality to all the fintech clients.

Sections 7, 8 and 9 are intended to evaluate how we will begin to deliver this new functionality to customers. Given that the expansion capacity is limited, and that we must increase the capacity of the support center by 134%, the project must be carried out in 18 waves/stages. Therefore, we must segment customers and then prioritize them, to determine to whom we will enable the new functionality at each stage of the project. We used the clustering methodology, K-means algorithm, to segment users for prioritization throughout the 18 waves of activation.

Finally, in section 10 we present the conclusions of the work, its limitations and a few possible opportunities for improvement to be considered for future research.

2- The Problem Under Analysis

2.1- Describing the Problem

Towards the end of 2019, access to customer support for a customer of the fintech was nearly defined as impossible. On average, a client needed to click seven times inside the mobile app to find a contact point, which meant that it was necessary to do a deep dive into the FAQs section in order to find a contact button. The explanation of this seemingly bad UX design choice was simple: hiding the contact button was the only way to reduce the number of people contacting customer service and to keep the system stable.

Over the years, the number of products and services offered by the fintech grew substantially. What at first only started as a payment processing engine, today has become a large ecosystem, with lots of different financial functionalities. The incursion into various branches of finance led to strong system growth that resulted in a more complex use of the app. As a consequence, many new customers entered the platform attracted by more and more functionalities available within the mobile application, which allowed them to cover the vast majority of their financial needs. This combination of a more complex application and a series of new inexperienced users created a higher demand for contact with the support center. The user experience metrics used to measure customer satisfaction, like the net promoter score, began to show higher levels of dissatisfaction because customers could not contact support, so they had no way of answering their main doubts or solving the problems that arose from the use of the application. Something that initially was considered a minor problem and did not stand out in the customer experience metrics, began to gain relevance.

As the number of users who complained because the lack of customer service grew, various analyses carried out by the Customer Experience area indicated that the same customers who could not access customer service were the ones that stopped doing business with the company in the future. In other words, those customers were the ones more likely to leave the platform. Thus, to solve this issue, company managers began to wonder if it was time they provided a more direct and transparent service to users. This implies that, to solve the problem, a strong expansion of customer service representatives would probably be needed, which would lead to the hiring of many new people and workspaces, an issue that would translate into monthly outlays of money in the future.

The objective of this work is to raise and solve the business case introduced, where what we seek to answer is whether or not it is needed to expand the customer support center and, if that is the

case, what would be the best way to implement such an expansion. The idea is to develop a holistic analysis of the importance of the customer service center in a fintech. Using data from a leading fintech from South America, we will develop and improve an initiative that was done in the company, about the roll out of a new feature for clients through which they can contact customer support in a very simple and direct way.

To better understand the problem under analysis, it is essential to take into consideration five fundamental aspects: 1) we need to understand what fintech’s are and their role in underdeveloped economies; 2) how do fintechs achieve sustainable growth; 3) what is the difference between customer experience and customer service; 4) the company's business model and, lastly, 5) the competitive context. Also, by the end of this section we will introduce the different questions we want to answer along the work.

2.2- What is Fintech?

According to an article from EY consultancy, “fintechs can be defined as organizations that combine innovative business models and technology to enable, enhance and disrupt financial services” (2019). In a simpler way, fintech are companies of digital origin that combine technology and finance, with the objective of improving financial inclusion, reducing financing costs, simplifying finance processes and disrupting the payments and savings industry. Fintech covers most of the topics and branches of finance, as we can see in figure 1.

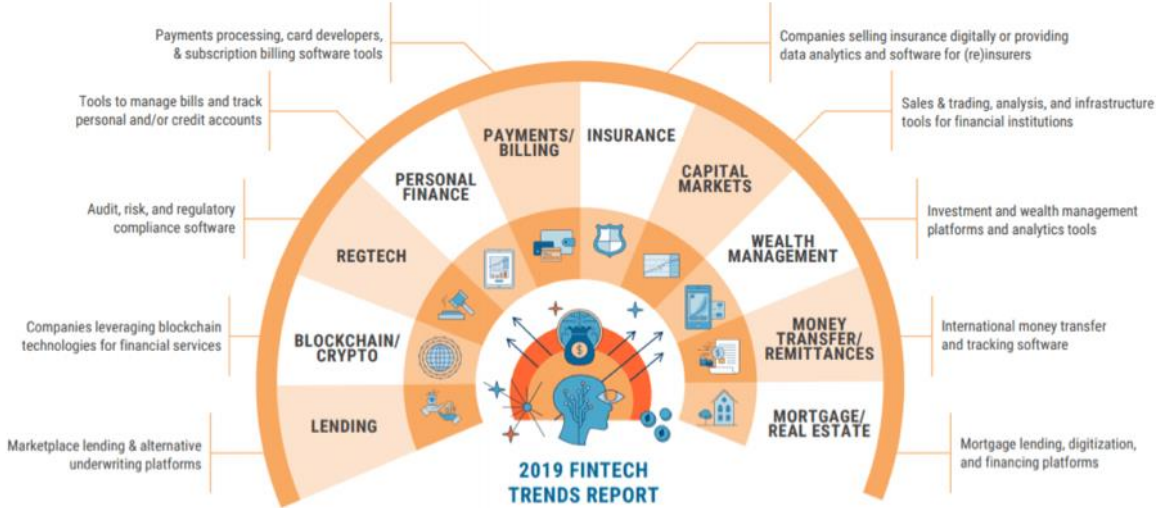


Fig.1: Fintech trends report (CBInsights, 2019).

Where we can appreciate that different kinds of products and services are offered, like credit or lending business in different marketplaces or physical stores, payments solutions like QR codes or bill payments, insurance, money transfers to friends and family, savings and investing tools and more innovative solutions like blockchain or crypto. Also, it is common to see that some fintechs build their own ecosystem around these services, where a variety of products are offered by the same company.

Talking about fintechs, it is important to point out that they strongly leverage technology, which allows them to offer their services to a large mass of users with a low marginal cost. Anyone with a smartphone can access the services in a very simple way. This is where the great advantage of this type of companies lies, which in addition to being intensive in the use of technology, they also leverage simplicity and ease of use. Unlike traditional financial companies, most of fintechs' processes, be it the creation of the account, identity validation or the use of any of its functionalities, are characterized by low bureaucracy and simplicity, so that anyone can successfully use their services, regardless of their level of financial knowledge or technological skills.

The last aspect that we must take into consideration refers to the kind of users to which a fintech targets. In this sense, there are two visions that are in some way antagonistic and that we must examine to better understand their role in the economy. On the one hand, many people see fintechs as being direct competitors of banks, and considering them as a great threat to the traditional financial system. On the other hand, there are people who see fintechs as a complement to the traditional banking system, and believe that they have a key role in monopolizing a certain segment of the market that cannot access the traditional financial system. These two visions raise a scenario where fintechs must compete with each other for clients and at the same time must complement traditional banks to ensure interoperability between the different systems. Our position will be in between the two visions presented above, taking as a starting point the fact that there are two particular segments of the population that fintechs are aimed at: unbanked people or those outside the traditional financial system, and young people who are studying or in the early stages of their professional career.

The first of the groups introduced as the target for fintechs is related to the second vision proposed above. According to a report from the World Bank, 28% of adults in the world does not have access to a bank account, but two out of three of them have access to a mobile phone with an internet connection (Klapper et al, 2012). That is the key for reaching that target of the population.

Leveraging technology, fintechs grant access to the financial system to anyone who owns a smartphone. If we focus on Latin America, it is important to highlight that it is a region of the world made up of under-developed countries, where the proportion of people without access to the traditional banking system is higher than in developed countries, and where many people could begin to take their first steps in the financial system through a fintech.

The second group, which refers to millennials and centennials, can be seen as a segment to be disputed between traditional banks and fintechs. Even though this segment can access a traditional banking system, its members prefer simple, bureaucracy-free, customer-centric and innovative systems to manage their money from their smartphone. Needless to say, all those characteristics are at the very core of fintechs' business models (Rajput, 2020; Netzer, 2021; How do FinTechs engage millennials and Gen Z?, 2021; Customers in the spotlight: How FinTech is reshaping banking, 2020).

2.3- Sustainable Growth in Fintech

The fintech company under analysis aims to capture those segments of the population that are outside the traditional banking system, so it is vitally important to understand the main variables that allow long-term sustainable growth. Given the inexistence of maintenance costs and that many of the products are free services, the key point is to understand how to expand and be adopted by a large mass of people and how, and on which segments, to monetize the different services. This is where the concepts of Customer Lifetime Value (CLV) and Customer Experience acquire an extremely important role for the management of the company.

The CLV concept is defined as the net present value of all future flows that a client generates for the company over time (Agarwal, 2016), which can be represented by the following formula:

$$CLV = m * \left(\frac{r}{1 + i - r} \right) - AC$$

Where it is clear that the profitability of a fintech, and also of every company, is mainly determined by four variables, that are the profit margin that each client leaves to the company (m), the customer retention rate from one period to the other (r), the customer's acquisition cost (AC) and the discount rate used to calculate the net present value of the future cash flows (i). By running a

simple simulation where we hypothesize an improvement on any of these variables, we demonstrate that user retention rate, which is the focus of this paper, is the variable with the greatest impact on CLV. For example, starting with the following values:

- $m = 1000$
- $r = 70\%$
- $AC = 100$
- $i = 10\%$

If we hypothesize an improvement of 1% on each of these variables, and we replace it in the CLV formula, we can show the impact each one has on the profitability of the company.

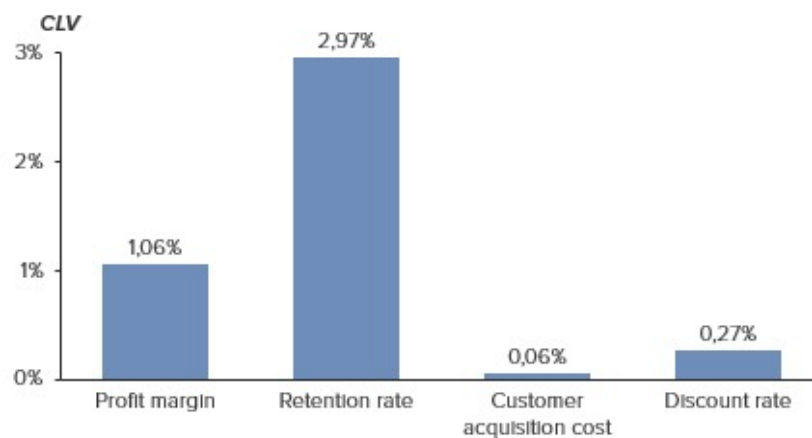


Fig.2: Impact of 1% increase of profit margin, user retention, cost of acquiring customers and discount rate on CLV.

The results of our simulation are shown in figure 2. Clearly, and by a large difference, improvements in user retention rate generate the highest percentage increase in CLV. After running various other simulations, we see that this result replicates regardless of the starting values used which strongly motivates us to focus on strategies aimed at increasing user retention rate. In particular, if we can demonstrate that turning on the new customer support functionality we can increase customer retention rate, our proposed strategy could even have a substantial short-term impact on the company's finances. In doing so, we will also try to understand whether the incremental cost of providing more customer support is indeed outweighed by higher profits originating from increased user retention.

Customer lifetime value (CLV) is only one side of value production, the company's side. At the same time, in the present work we will focus not only on the company's side of value but also to the customers' side, which is the customer experience, defined by Morgan as the perception that the

customer has of the brand (2017). In particular, we are interested in “The Two Sides of Customer Value” (Gupta and Lehman, 2005), defined as both the value that the customer provides to the company (Customer profitability or Value of Customers) and the value that the company provides to the customer (Customer experience or Value to Customers). Figure 3 provides a graphical representation of how these two dimensions interact as well as a classification of customer segments based on them.

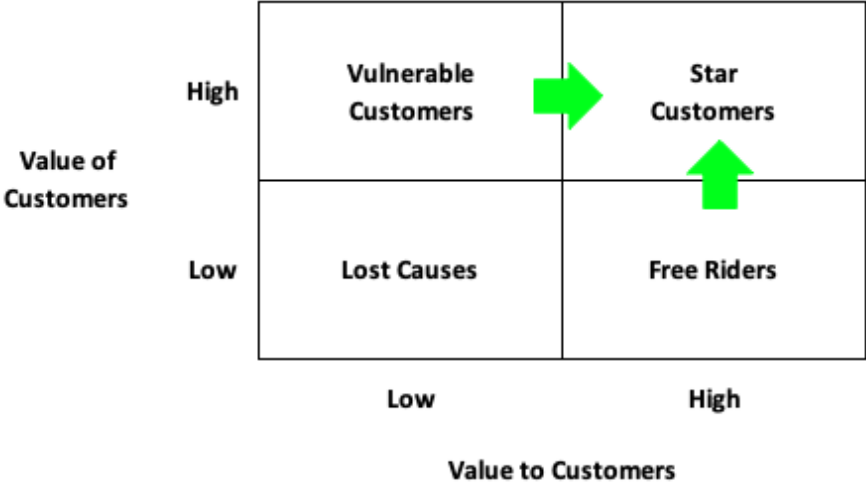


Fig.3: The two sides of customer value (Gupta and Lehman, 2005).

When taking the two sides of value creation into consideration, it becomes clear that, in order to be profitable, for a fintech it is essential to provide a good customer experience (high value to customers). The central idea is to understand that if we try to monetize the company by offering a bad user experience, it is most likely that customers will leave the platform (vulnerable customers). At the same time, it is important to be able to profit from free riders, who are currently getting a good experience, but they do not create growth in the long term. Therefore , fintechs should aim at gaining the largest number of star customers, who enable income growth and long-term financial sustainability.

Summing up, by combining the concepts introduced above, we can reach a solid testable hypothesis regarding the monetization of a fintech. The CLV formula tells us that working to improve the user retention rate could be a good strategy to improve the company's finances in the long term, since it is the variable that generates the greatest impact on the value we obtain from our clients. At the same time, as we also have to be able to monetize the company, it is essential to provide a good customer experience, given that if customers benefit from the usability of the platform, they will be

willing to give up part of their utility in order to continue using the products. Accordingly , our objective is to understand if providing a more transparent customer support service leads to a superior customer experience, which in turn leads to a higher user retention rate and higher CLV.

2.4- Customer Experience vs Customer Service

It is very common to observe a strong confusion between the concepts of customer experience and customer service in the business world, especially in those companies where a customer-centric vision is not adopted and rooted in the culture. Many people tend to believe that both concepts refer to the same thing, when in fact there is a wide difference between them.

In the previous section we defined the concept of customer experience as the perception that the customers have of the brand. It is the result of each interaction that the users have with the company, where their satisfaction is crucial to transform them into loyal business customers. In short, it is the holistic perception the client has of the company, which is built throughout the entire relationship process between the parties. In the case of fintechs, ease of use is the main differentiator of the consumer experience.

Customer experience is a concept that began to take great relevance with the emergence of technological companies, and to these days many of these companies base their growth and development on the satisfaction of their customers. If we look at the companies with the highest market capitalization, we can see that many of them adopted this customer-centric view, as reflected by their founders. A clear example is the case of Steve Jobs, Apple co-founder, that in a speech at Apple's Worldwide Developers Conference in 1997, expressed that "you've got to start with the customer experience and work backwards for the technology. You can't start with the technology and try to figure out where you're going to try to sell it", or the case of Jeff Bezos, Amazon founder and CEO, that constantly repeats phrases like "if there's one reason we have done better than of our peers in the internet space over the last years, it is because we have focused like a laser on customer experience".

Now, having a better understanding of the concept of customer experience, we are in a position to define the term of customer service. Customer service strictly refers to the customer support center, that is the set of people and processes whose sole purpose is to attend and solve the issues that customers have regarding the use of the company's products or services. That is where the

difference between the two concepts lies and, in simple accounts, we can reduce the explanation to the fact that customer service is technically an area of the company, while customer experience is a concept that encompasses and impacts the whole company: it is part of the company's culture. And the reason why these concepts are sometimes confused is probably due to the fact that the support center is the visible face of the company for customers and where the greatest amount of interactions between the parties takes place. Because of that, in most of the cases, the customer service area is placed under the customer experience area. Although it is not everything, we can say that customer service is one of the areas that has the greatest impact on customer satisfaction.

2.4.1- The Importance of Customer Service

When it comes to fintechs, customer support service is especially important because of two main factors: 1) it reassures customers when problems arise; 2) it collects relevant information about customers' experience that can be later distributed within the company. Relating to the first point, fintechs deal with customers' money, which is a very sensitive area and causes a great level of distress when problems arise. Most fintechs do not have physical branches to offer customer service support, so it is essential to be able to address doubts and solve users' problems remotely and in the simplest way possible. According to Camberato, companies that introduced a human element to digital services outperformed their competitors as compared to those that did not, producing five times more revenue and eight times more operating profits (2019). Being technology companies, problems due to system crashes or bugs are a constant and it is impossible to eliminate them, so in these cases, when a particular system is affected, it is essential to be transparent to customers and provide them with a rapid and efficient solution. This is where the customer support center takes a key role in the company's business model. As a customer, what could be worse than having a problem with our own money and that the problem cannot be resolved by the support center? The first answer that comes to our minds could be that there is nothing worse, but, wouldn't it be even worse not to be able to contact the support center? The latter aggravates the situation, since at first the user had a problem with the usability of our product, and now we add a second trouble by not letting him initiate his claim. After such bad experience, it is unlikely to think that the customer will continue to use any of our products in the future.

Relating to the second point, fintechs' support centers provide quality information about the experience of clients. As Microsoft co-founder, Bill Gates says, "your most unhappy customers are your greatest source of learning". And, in the case of fintechs, it is precisely the customer support center that deals with our most dissatisfied customers, making it an excellent source of information to detect problems and frictions that the company can try to eliminate. Once customer service detects problems, there still is the issue of transmitting customer complaints to all areas of the company and generating that customer-centric culture that will seek to prioritize and minimize the customer's need to contact support. The main idea is to solve the customer's problem by eliminating it before it occurs, not when they contact support. As expressed by Jeff Bezos, "the best customer service is if the customer doesn't need to call you, doesn't need to talk to you. It just works".

2.5- A Deep Dive into the Company's Business Model

The main objective of this section is to do a deep dive into the products and services offered by the fintech, in such a way as to be able to better understand the company's business model and the strategy adopted over the years.

2.5.1- The Business Model

The company is based on a multi-sided platform business model, which, although it is not a new concept in the field of business, has gained great relevance after the emergence of companies of a technological nature (Hagui, 2013). The central idea is based on the fact that it is a business model that helps two or more types of customers to find and establish mutually beneficial links with each other. In the case of the fintech that we are analyzing, these two parties are made up of buyers and sellers, which means that in order to grow over time, it is essential that both sides of the platform remain present, since both depend on the other. This will allow us to generate positive externalities over time. We have the indirect network externalities, which implies that the addition of a participant from one side of the network attracts more participants from the other side of the network, while the direct network externalities are related to the fact that adding a participant to one side of the network attracts more participants to the same side. The central question is how we can maintain this dynamic over time. We already know part of the answer, which is through a good

customer experience, although this implies going one step beyond the definition adopted in the previous section.

The ease and simplicity of use, coupled with meeting the basic needs of customers in relation to what the product promises is not enough to build a long-term sustainable relationship with users. In order to grow sustainably, what is needed is to exceed the expectations of our customers in a constant and consistent way. In a speech to the United States Congress, Jeff Bezos stated: "In my view, obsessive customer focus is by far the best way to achieve and maintain Day One vitality. Why? Because customers are always beautifully, wonderfully dissatisfied, even when they report being happy and business is great. Even when they don't yet know it, customers want something better, and a constant desire to delight customers drives us to constantly invent on their behalf. As a result, by focusing obsessively on customers, we are internally driven to improve our services, benefits and features", which relates to the concept we are proposing, that is the minimum awesome product (MAP).

Before getting into the concept of MAP, we must go one step back and define the minimum viable product (MVP). The MVP is a concept that has the central idea of creating a product with the minimum necessary attributes in order to meet the initial objectives and satisfy our first customers (Ries, 2009). In addition, over time, feedback from users will be collected for future developments and improvements. In this way, we seek to avoid incurring unnecessary costs and risks derived from a possible failure of our initial idea. Figure 4 shows us this concept.

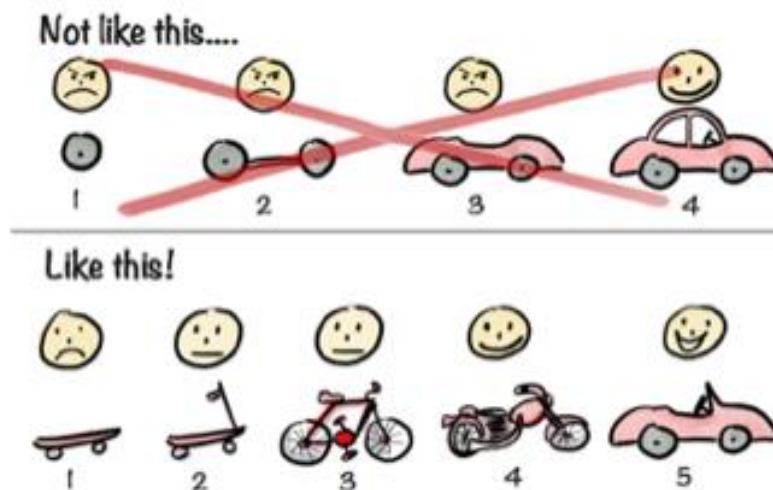


Fig.4: MVP, by Henrik Kniberg

And for a better understanding between these concepts, we could say that the MVP is not something sustainable over time, but applies only to the first developments of a product, while the MAP applies to all subsequent development, which should be accompanied by constant improvements to our products. The central idea is that, by thinking about a product from the MAP point of view, we will be able to satisfy this growing demand for better products that our customers constantly demand of us. In figure 5 we can see this (Patel, 2020).



Fig.5: MAP, <https://medium.com/swlh/the-mvp-is-dead-long-life-to-the-map-minimum-awesome-product-404df90fef7f>.

And what is clear is that, in order to maintain sustained long-term growth and to be able to retain our customers and generate direct and indirect network externalities, it is vitally important that the quality and the attributes of our products offered improve as over time, and the improvement must be above the minimum quality expected by customers. Our goal will be to keep the MAP curve above the knowledge curve, which is the minimum quality that customers expect.

The idea is to relate these concepts with the fintech under analysis. Basically, what we want to highlight is that these concepts are present in the company's business strategy. Throughout the years, it has always been sought to exceed customer expectations. The products that were launched to the market were characterized for adding value to the users of the platform, either by improving and perfecting what already existed or by creating new complementary functionalities, with the aim of allowing, from a single mobile application, the full management of personal or business finances. At the same time, many of the features made it possible to radically change people's behavior in relation to various daily aspects, adding an extra value to customers with a strong positive impact on quality of life.

2.5.2- Products and Services

Each of the products offered by the company plays an essential role within the fintech. As we saw previously in figure 1, fintechs cover a large part of the different branches of finance, and many of them decide to leverage themselves by offering different products that allow users to cover their main financial needs. It is here where the concept of ecosystem takes on great relevance, since it seeks to offer the greatest number of products that are complementary to each other. This is one of the main competitive advantages of the company under analysis.

Now that we have a better context on the business model and the main aspects taken into account over the years for the development of the different products, we are able to specify the different functionalities that the fintech offers through the mobile app.

- Account funding: the account can be used in the same way as a traditional bank account, so a balance can be entered to be used. The functionality to deposit money is of vital importance for the business, and there are different ways to do it.
 - o From a *lotérica*: involves going physically to an agency and recharging the account by cash payment.
 - o From a debit or prepaid card: it involves loading the card data in the application, and from there select the amount to enter.
 - o From a bank account: by bank transfer from the bank's application or website.

In all these cases, the challenge is to improve the operations and the compatibility of the different systems with the aim of simplifying the money deposit process and improving the transfer and crediting times of the money into the account.

- Online Payments: is a service designed entirely for sellers. It is the oldest product offered by fintech, so it is very consolidated and has a key role in the monetization of the company, since it is the product with the highest commissions.
 - o Payment link: from the mobile app, a link is generated for a certain amount of money that can be shared on social networks or WhatsApp. Customers enter to the link from where they can make the corresponding payment.

- o Payment button: it is a functionality that is embedded in the website of the seller's business. It is usually available in medium or large-sized companies that charge their online sales through this service. For these cases, the company functions as a payment processor, where in many cases the payers are unaware that it is the company that acts as an intermediary. A large part of the purchases made over the internet in Latin America are through the fintech systems.
- Mobile point-of-sale: it is also a product designed exclusively for sellers. It is a small device that can be linked to the mobile app and allows any seller to accept all types of cards, whether credit, debit or prepaid. The main characteristic is that the product does not have fixed commissions, which is a great advantage for small and medium-sized businesses. For many merchants, this type of device is the only possibility to accept card payments and take a first step towards financial inclusion. Another important feature is that they are portable or autonomous, so it can be used anywhere as long as we have an internet connection. There are two different types.
 - o Ideal for transporting: it is a small device that connects via bluetooth or USB cable to the cell phone, so it depends on the connectivity of the smartphone itself. It is very convenient for street vendors and occasional vendors, since its weight and size are very convenient to transport them.
 - o Ideal for small businesses: they have the size of a traditional postnet, with the difference that they have their own battery and include a chip to capture the internet signal, so they are totally autonomous. It also allows you to print proof of payment. It is very convenient for small or medium businesses that have a fixed location, since due to its size it is not convenient to transport.
- QR code: it is the third and last means of collection for sellers. It consists of a QR code that is available on the store, which is scanned by customers with the smartphone camera and allows payment to be made from any virtual wallet that the customer uses. The product has the advantage that it is faster than a traditional transaction and avoids contact between the parties, so as there is no card exchange, it is safer for the consumer. The downside is that the seller can use this option only if the buyer uses a virtual wallet. As it is a relatively new product on the market, not many people use it. This implies that it must be supplemented with another form of collection, at least until it gains greater market penetration.

- Digital or virtual wallet: is a product designed for shoppers that use the mobile app. It consists of various functionalities that allow customers to make different kinds of payments. The objective of the product is to eliminate the need to use cash and replace the traditional wallet with a virtual one, which is managed entirely from the smartphone. It has the advantage of being free for users and allows payments with money available in the account or with a credit, debit or prepaid card loaded in the application. In addition, as it is a relatively new product, it is strongly leveraged in discounts granted to customers, for which very good benefits can be obtained.
 - o QR code: it is essentially the same as we described above, only seen from the payer's side. It allows the customer to pay in a simple and agile way without the need to use cash or a bank card.
 - o Money transfer: it is designed to send money simply and quickly to any friend or family member who is also a fintech user. It also allows to divide expenses between people, which is a great advantage for the millennial segment.
 - o Cellphone recharge: allows the customer to recharge their cellphone balance. It is done through the line number used and is instantaneous. It has the advantage of eliminating the need to go to a physical charging point or having to download the signal provider's app.
 - o Transport recharge: is similar to the cellphone recharge function, with the difference that the user can recharge the urban transport card of a large number of cities. It has the same advantages that the cellphone recharge function.
 - o Utilities payments: applies for the payment of any type of service, such as electricity, gas, water, television or internet, and for the payment of any tax. It is done by scanning the barcode printed on the bill with the smartphone camera.
- Prepaid card: the fintech offers a prepaid card to consume the account balance, either through electronic payment in stores or with cash withdrawals at any ATM. Customers also have the possibility of joining different subscriptions, such as Netflix or YouTube. In addition, it can be used internationally.
- Asset Management: for the users who have money in the account, it exists the possibility of investing it with a higher return than market inflation and almost without any risk. It is an

investment fund that is characterized by investing the money in Brazilian Treasury Bonds and has the particularity, unlike the rest of the investment funds, of having immediate liquidity. This means that the money can be used at any time. Any person who has an amount greater than 2 reais in the account begins to generate returns automatically. For the fintech target user, having the possibility to invest money is very innovative.

- Credits business: the company also has its business unit related to the credit market. It is offered to both buyers and sellers and, like the investment fund, it is a product of difficult access for a person that is not banked.

The credits offered to sellers are:

- o Fixed installment loan: it is the most traditional type of credit, where the client returns the borrowed money and the interests in up to 12 installments of the same amount.
- o Loan as a percentage of sales: it is a loan designed specifically for medium or big sellers of the platform. The amount of money loaned is returned by taking a percentage of each sale that the seller makes in future occasions.
- o Short-term loan: it is intended to serve as an emergency aid for sellers, and consists of a loan that is granted with a duration of up to 21 days and for small amounts. It mainly targets the short-term liquidity problems that sellers may have.

In turn, two types of credits are offered to the buyers of the platform:

- o Loan for payments in the platform: the credit works as an additional payment method in the digital wallet. For example, when making a payment with QR Code, you can choose to do it with money you have in your account, a bank card or directly using this option.
 - o Personal loan: the borrowed money is deposited into the customer account, so they can freely decide what to do with it.
- Money withdrawals: in the same way as the account funding, having the possibility of withdrawing the money is essential for the operation of the fintech. In this sense, there exists the possibility of transferring the money from the mobile application to a bank account or withdrawing it from a physical agency.

Now that we have a more complete overview of the products offered by the company, we can clearly observe the relationship that exists between them and how each of the existing functionalities complement each other in order to provide a wide range of solutions to the main financial needs of customers, whether they are buyers or sellers.

The services offered to sellers allow two large segments to join the ecosystem. On the one hand we have the physical stores, which can accept payments with QR code or accept bank cards through the mobile point-of-sale. In turn, users with online stores can integrate with the online payment services offered by the company. In addition, the application has a special section for tracking the main business metrics, where the level of sales, costs, taxes and debts with suppliers is tracked. It also exists the possibility of generating returns automatically with the available balance and, if required, sellers can access to a loan for any momentary business need, be it improving cash flow, increasing or replenishing stock, paying suppliers or expanding their business. Finally, the money derived from sales can be withdrawn directly to the bank or extracted through ATMs, or also made use of for payments with the prepaid card or the virtual wallet.

On the other hand, fintech offers great functionalities for users who behave as payers within the ecosystem. The most prominent product in this sense is the virtual wallet, which eliminates the need to use cash, since everything can be done directly from the smartphone. In addition, the possibility of recharging the cellphone, the urban transport card or the payment of services and taxes saves a lot of time by eliminating the need to go to a payment point in person. The possibility of using the balance of the account with the prepaid card is also advantageous to carry out various transactions in shops that do not accept QR codes or online purchases. Finally, the vast majority of these users can access some type of consumer credit for the first time, while they also tend to have their first experience investing money.

In this way, given the great diversity of products that make up the company's ecosystem, the fundamental aspect that will become more relevant in the following sections of the document is to find a good way to select which products to prioritize when starting to grant the new functionality of the customer support center, and how to do it in the most strategic possible way.

2.6- The Competitive Context

The aim of this project is to 1) understand the needs of customer service center and, 2) propose how to implement the customer care center. The project will be developed for a major fintech company in Latin America, with a specific focus on Brazil. The choice of the country we are going to be working is simple:

- It is the largest market and with the greatest potential in Latin America.
- It is a market with a much more aggressive and disputed competitive environment than the rest of the countries in the region.

The potential of the Brazilian market is so huge that in 2001 it was included in the select group of BRICs, an association of four major emerging national economies: Brazil, Russia, India and China (South Africa was included in 2010 as the fifth country). The term was coined by then-chairman of Goldman Sachs (O’Neil, 2001), where the main idea was to start taking into real consideration these countries, because of their aggregate size and potential fast growing.

We can also introduce certain variables that will allow us to understand the importance of the Brazilian market to a greater extent. The first of these is the size of its economy (GDP) compared to the main countries in the region, as we can see in figure 6.

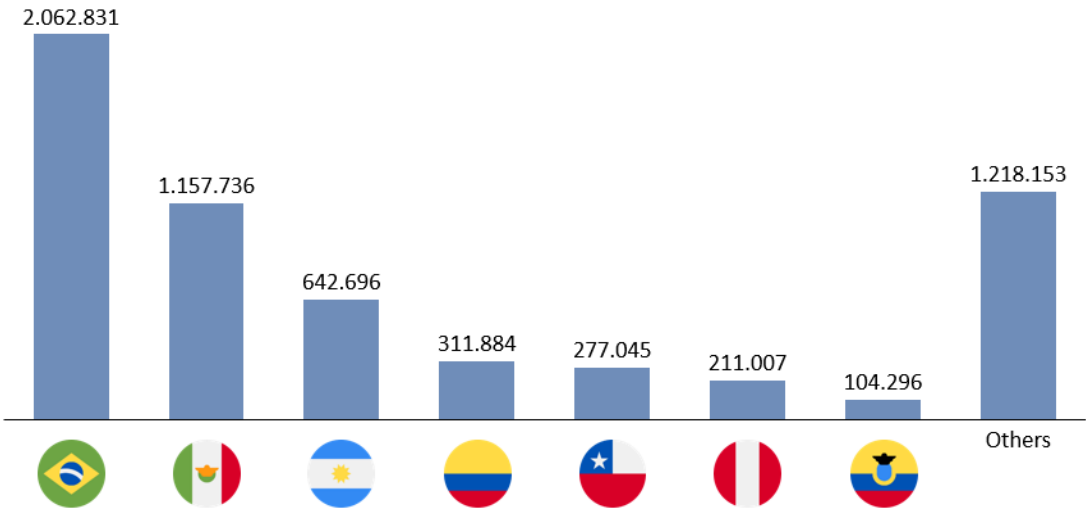


Fig.6: GDP of Latin American countries measured in millions (World Bank, 2019).

Where what can be observed is that Brazil fairly exceeds the rest of the countries in the region in terms of GDP, surpassing Mexico by 78%. Furthermore, if we look at the size of the Brazilian

economy in relation to the total of the region, we have that Brazil represents 34% of the GDP of Latin America.

Something similar happens with the number of inhabitants, where Brazil exceeds Mexico in number of people by 66%, and has a total relative participation in the continent of 33%, as can be deduced from figure 7.

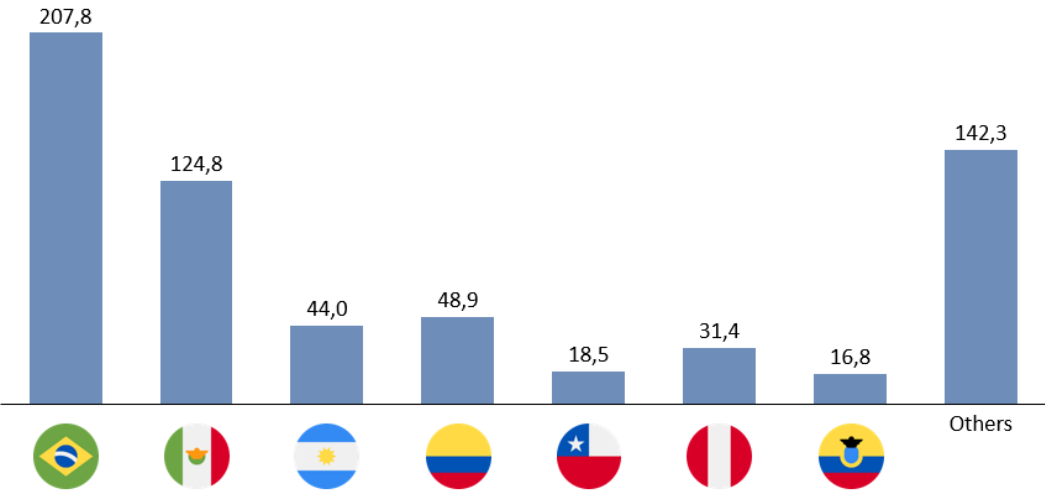


Fig.7: Population of Latin American countries measured in millions (World Bank, 2019).

Figure 8 shows the last data of great relevance for the analysis, that is the level of financial banking in the different countries.

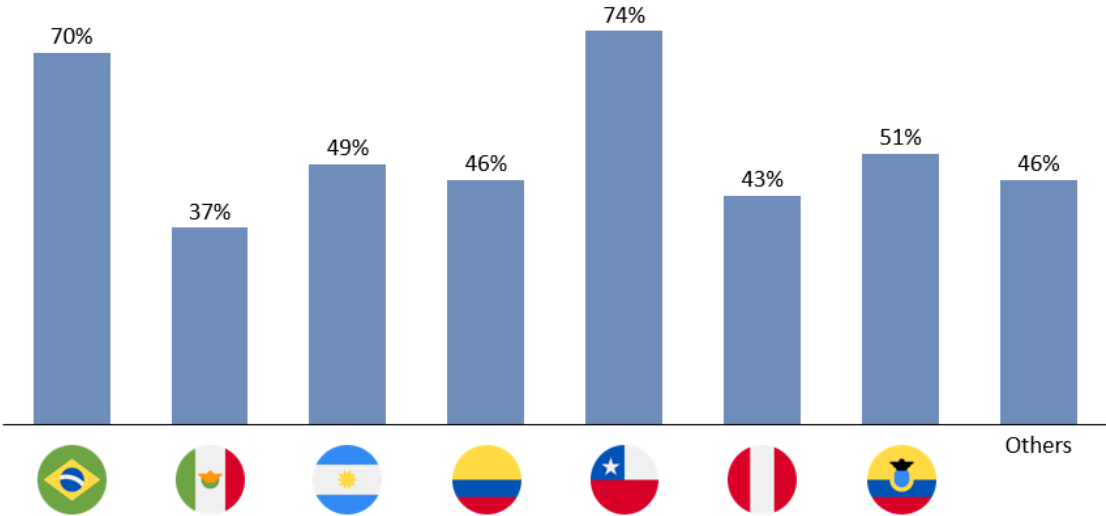


Fig.8: Bancarization level of Latin American countries for people over 15 years (World Bank, 2019).

From where two main aspects stand out:

- 70% of the population over 15 years of age in Brazil is banked, ranking second in the region after Chile.
- Mexico stands out for being the least banked country, reaching levels of only 37%.

Finally, for a better understanding of these variables as a whole, figure 9 shows all the variables in the same graph, whereas the abscissa axis represents the GDP, measured in millions of current dollars, the ordinate axis represents the level of bancarization, and the size of the flags shows the population size of each country.

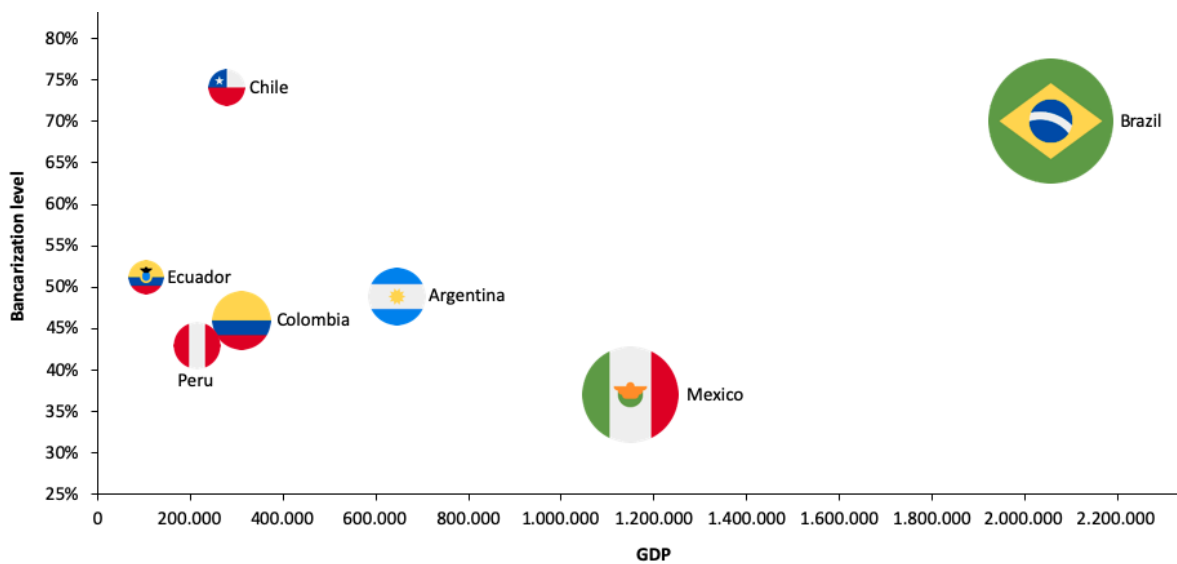


Fig.9: Bancarization level, GDP and population size of Latin American countries (World Bank, 2019).

Where automatically, from all the information presented, it seems that Brazil and Mexico are the two main countries where efforts could or should be focused regarding the acquisition and retention of users. The fact that Mexico has such low levels of bancarization leaves a door open to a market with a great potential, even greater than what we see in Brazil, if we only take into account the levels of bancarization and size of the population. So here, a key question arises for the choice of the country where we are going to be working: what makes us choose Brazil over México?

The first aspect to take into account is that the levels of bancarization are a proxy for understanding the financial system of each country and, despite the fact that Brazil has very high levels of bancarization in relation to the rest of the countries in the region, it does not imply that the vast majority of these people are not potential fintech clients. Also, having a bank account does not mean

to be financially included. In order to be financially included, the person must use financial services, and not only collect money in an account. For example, if a person receives money into an account and withdraws all of it and then uses it for cash payments, that person is not financially included. That kind of people are also fintech targets.

The second point to take into account is the competitive context in which we find ourselves immersed. Using data from private studies carried out by the company under analysis, we know that in Brazil the fintech industry has been developing at a much higher speed compared to Mexico. The reality is that the fintech sector in Mexico is at a much earlier stage in its development, so there are very few people who adopt this type of product and competitors are not very sophisticated companies, so there does not seem to be a threat for the moment. On the contrary, in Brazil there are several extremely sophisticated and competitive competitors that have been experiencing astronomical growth rates.

The last point to take into account is the one that will allow us to completely close the discussion on the strategy of focusing efforts on Brazil, and is based on the fact that, as we mentioned, Mexico is a country where the fintech industry It is not yet highly developed and the number of fintech users in this country is low compared to Brazil. This allowed us to apply the same strategy of making a direct point of contact available with the support center in a much simpler way, without having to prioritize users and establish power-on criteria, as is being done in Brazil.

Given this, and knowing that Mexico is the second country with the greatest potential where the fintech operates, it was decided to come out with this new functionality of the app for all the users from the first moment. This implies that Mexico already has access to fully transparent support for the customers, while Brazil will be rolled out by scales. In this way, it is clear that the priorities for the future are Mexico and Brazil, where regardless of the order of prioritization, Brazil requires more efforts and investment to bring this new tool to the fintech customers.

2.7- Analysis Structure

Now that we have a better understanding of the context and the different theories and aspects in relation to the problem under analysis, we are in position to propose the analysis framework in order to solve the business case. Our main objective is to be able to answer the following questions:

1. How does the lack of customer service affect the frequency of use and retention of users in a fintech? It is Profitable to Invest in Improving the Customer Service Center?
2. What is the best way to roll out the customer service center?

Where, based on the questions asked, it is observed that the analysis is divided into two main parts. The first has the objective of delving further into the problem posed by understanding the impact that the lack of a customer support center has on the frequency of use and retention of users in the fintech. This result will serve as an argument to justify the second part of the analysis, which basically consists in evaluating different segmentation strategies and prioritization of users to start providing the new customer support service.

Furthermore, in order to carry out a truly comprehensive analysis, various sub-questions emerge from the above questions, which will allow us to structure the steps to be followed in a more detailed way. The idea is to use them as triggers for various analyses, which together will give us the complete picture and the necessary information to make the corporate decision. The sub-questions that arise regarding the first part of the analysis are:

- a- Section 3 - Customer Service Excellence: What type of experience do customers seek and what constitutes an excellent customer service?
- b- Section 4 - New Demand Estimation: Does the number of contacts with the customer service center increase? How do we estimate the incremental cost of giving more direct access to our customers?
- c- Section 5 - User Retention and Frequency of Use: How do we measure user retention and frequency of use? How do we estimate a new rate of retention and frequency of use once the new customer service is turned on?
- d- Section 6 - Profitability Assessment: Is the incremental cost of providing more support offset by the incremental benefit due to higher retention and frequency of use?

In turn, for the second part of the problem, which refers to question 2, we have the following sub-questions:

- e. Section 7 - Support Center Expandability: What is the expandability of the customer service center? Is it limited? In how many stages should be done?

- f. Section 8 - Customer Segmentation: How do we segment customers based on their behavior in the platform?
- g. Section 9 - Customer Prioritization: To which customers do we want to provide this new service in the first place? Which ones do we deprioritize?

In sections 3 to 9 we will focus on answering these questions, introducing the data and methodology used for the analysis, and the results. The conclusion is presented in section 10.

3- Customer Service Excellence

a- *What type of experience do customers seek and what constitutes an excellent customer service?*

3.1- Data

We have information regarding the customer experience obtained through various satisfaction surveys done during 2020. In this particular case, to better understand how the lack of support affects user satisfaction, we will conduct an analysis for one of the company's products. The survey is used to determine the Net Promoter Score (NPS), a metric commonly used in many industries to measure customer satisfaction (Reichheld, 2013). In addition, the main positive and negative aspects of the product emerge from this survey.

The survey consists of six questions, which are detailed below.

1. Net Promoter Score: Considering your last experience using *product 3*, how likely would you be to recommend *company name* to a friend or colleague?
 - 0
 - 1
 - 2
 - 3
 - 4
 - 5
 - 6
 - 7
 - 8
 - 9
 - 10

2. Promotion reason - for question 1 = 9 or 10: That's good! What is the main reason why you rate us this way?
 - Promotion motive N°1
 - Promotion motive N°2
 - Promotion motive N°3

- Promotion motive N°4
 - Promotion motive N°5
 - Promotion motive N°6
 - **Customer service**
 - Other
3. Detraction reason - for question 1 = 0 to 6: We see that you are not satisfied, we are sorry.
What is the main reason why you rate us this way?
- Detraction motive N°1
 - Detraction motive N°2
 - Detraction motive N°3
 - Detraction motive N°4
 - Detraction motive N°5
 - Detraction motive N°6
 - **Customer service**
 - Other
4. Detraction sub reason - for question 3 = 'Customer service': For what reason did you select 'customer service'?
- Customer service didn't solve my problem
 - **I couldn't contact customer service**
5. For question 4 = 'Customer service didn't solve my problem': From 1 to 5, how difficult was it to contact customer service?
- 1 (very easy)
 - 2
 - 3
 - 4
 - 5 (very complicated)
6. Open comment: Do you want to leave us a comment regarding your previous answers?
- Blank space where the customer can add more information about the previous answers.

We have a total of 23,526 satisfaction surveys, out of 360,000 surveys sent. The parameters for sending surveys are:

- Surveys are sent every day of the year, with a uniform distribution.
- Surveys are sent via e-mail.
- Customers receive the survey the day after having used the company's product, and they are randomly selected by an algorithm.
- Once a user has been surveyed, they cannot receive the same survey again for the next 90 days.

3.2- Methodology

The methodology used for the analysis of the survey data will consist of three stages. First of all, using the information from the NPS question (question number 1) we will seek to evaluate the retention rate and frequency of use of the product in the next three months after the survey is answered. The retention rate will be calculated as the percentage of users who used the product again in the next three months after answering the survey, while the frequency of use will be calculated as the number of times they used the product again in the following three months after the end of the survey. The results will be presented depending on whether the user is a promoter, neutral or detractor, categorization that is defined according to the grade that the user assigns to the probability of recommending the product to a friend or colleague. The user is a promoter if he selects 9 or 10, neutral if he selects 7 or 8 and a detractor if he chooses between 0 and 6. The second stage will be to evaluate the user retention rate and frequency of use of the product according to the reason for detraction selected. For this we will only use information from surveys where users are detractors. The third step is similar with respect to the methodology of the previous two, with the difference that the analysis will be carried out on users who are detractors due to 'customer service'.

3.3- Results

The first point of analysis allows us to understand how the experience offered to customers affects the retention rate and frequency of use of one of the fintech products in the next 3 months after the NPS survey is answered. Figure 10 shows these results below.

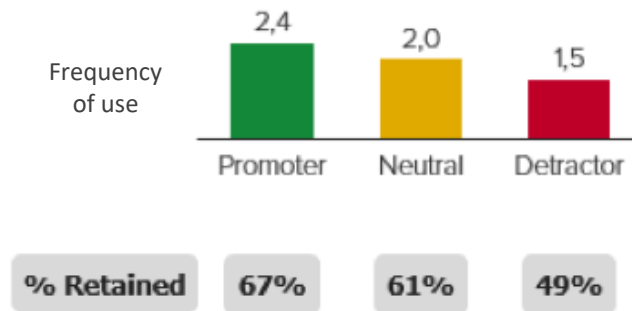


Fig.10: Frequency of use and retention rate in relation to NPS score.

Of the promoter users, 67% used the product again, with an average frequency of use of 2.4 times. Neutral users had a 61% retention rate and an average number of usage per customer of 2.0. Detractors had a retention rate of 49% and a subsequent average number of uses of 1.5. The conclusion is simple: by improving the experience we provide to customers, we can improve the retention rate and frequency of use of the products. If we take into account the results of the CLV formula presented in section 2.3, we see that customer experience plays a fundamental role in the sustainable growth of fintech. The CLV improves with a higher retention rate, and the retention rate improves with a higher level of NPS.

The second step is to delve into the detractor users. We will repeat the methodology of the previous point, with the difference that we will be computing the retention rate and frequency of use according to each detractor reason that users have chosen. The results are shown below in figure 11.

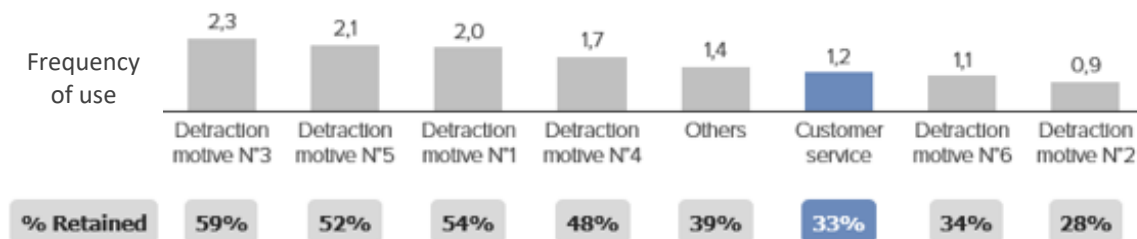


Fig.11: Frequency of use and retention rate in relation to NPS detractor reason.

The results show us that the detractors for customer service are one of the least retained in the future (33%) and with a low frequency of use (1.2). This indicates that problems related to customer service generate strong frictions among users, to the point that it is unlikely that they will continue to use our product.

Finally, the results of the third stage of the analysis are shown in figure 12. It is important to clarify that 67% of the detractors for customer service complain because they could not contact support, while the remaining 33% because their problem was not resolved as they expected.

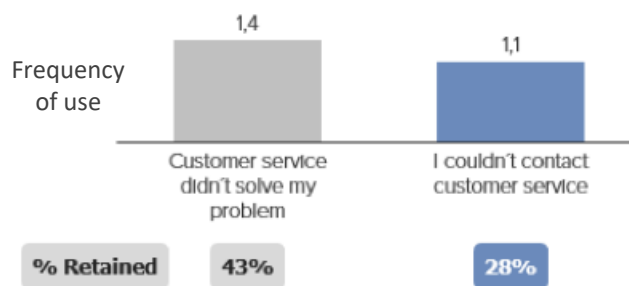


Fig.12: Frequency of use and retention rate in relation to 'customer service' detraction reason.

The result regarding how the lack of support affects the retention rate and frequency of use of customers is very clear: not being able to access customer service at all generates a worse retention rate (28%) and frequency of future use (1.1) even as compared to when users can contact support (43%, 1.4) and the response they receive is not satisfactory.

Finally, customer feedback in question number 6 reflects this problem related to the lack of customer service. Some of these comments are shown below, by way of example, in the original language of the survey and it's translation:

- 'Não tem atendimento, se tivesse atendimento melhor eu compraria muito mais, infelizmente qd tem algum problema vcs não resolvem, por isso compro pouco pelo péssimo atendimento' ('There is no customer service, if I had better service I would buy a lot more, unfortunately when there is a problem you don't solve, so I buy little because of the bad service').
- 'Dar um suporte telefônico pra falar com vcs estou tentando entrar em contato mais de um mês!' ('Give a phone support to talk to you I've been trying to get in touch for more than a month!').

- ‘Ter um jeito da gente entrar em contato quando precisa’ (‘Have a way for us to get in touch when we need to’).
- ‘Falta de opção de contato com o *fintech name*, muito ruim a comunicação’ (‘ack of contact option with *fintech name*, very bad communication’).
- ‘Nao existe suporte viavel ao cliente. Pra falar a verdade todo o suporte ao cliente do *fintech name* é muito ruim. Pelo menos deveria ter um canal melhor de atendimento para os consumidores mais assiduos’ (‘There is no viable customer support. To be honest, all the customer support on *fintech name* is pretty bad. At least there should be a better service channel for more frequent consumers’).

The analysis of user retention and frequency of use based on customer satisfaction surveys show strong results in the three stages developed:

1. Promoter users have a higher retention rate and frequency of use of the product in the following three months after completing the satisfaction survey.
2. Of the detractor users, those who complain due to ‘customer service’ are the second group with the lowest retention rate and the third group with the lowest frequency of future use of the product. This indicates that problems related to the support center are very painful for customers.
3. Of the detractor users for ‘customer service’, those who could not contact support have a lower frequency of use and retention rate than users who were able to contact but their problem was not resolved by customer representatives.

The general conclusion of the analysis, and trying to answer the question that gave rise to this section, gives us a fundamental result: the worst scenario is where the customer has the need to contact customer service and cannot do so. This leads us to conclude that to provide the best experience and have an excellent support center we must carry out 3 fundamental actions:

1. Work on eliminating those frictions that generate the need to contact support.
2. Give customers a direct and transparent access to the support center.
3. Work on answering the different inquiries from users in the best possible way.

And since the first action is impossible to implement at 100%, that is, we cannot completely eliminate the need to contact support, it is of the utmost importance that all those customers who

need to contact support can do so in the simplest possible way. As we saw in the satisfaction surveys, it is better to give access to support and not solve the user's query than to not give access to support at all.

The third actionable raised is an issue that exceeds the present work, since it is not the idea to emphasize how to improve the quality of the support center when users contact customer service. The only aspect to mention is that it is a matter of utmost importance for the company. To measure the performance of the support center, there is information from NPS surveys, quality metrics regarding the responses provided to customers and user recontact rate, from which it is sought to improve the service offered. For example, by looking at the data, we see that customers value ease of contact, short waiting time in line to be attended, and quality of the response offered.

4- New Demand Estimation

b- Does the number of contacts with the customer service center increase? How do we estimate the incremental cost of giving more direct access to our customers?

4.1- Data

We have information from a pilot test developed within the company to estimate the new demand for the customer service center once the new functionality of more direct and transparent access to support is turned on. The new functionality was enabled for a random group of customers, which we will call the test group. We also managed to build a second group of company users to whom this possibility was not turned on, which we will call the control group. This will allow us to compare the period before and after the experiment to obtain conclusions regarding the potential new demand that would fall on the support center in case of moving forward with the 100% of registered users.

Regarding the selection of users that make up the test and control group, we will base ourselves on a methodology commonly used within the company to carry out this type of experiments. When a client decides to open their account at the fintech, they are automatically assigned a user number associated to their personal email, which is unique and incremental. This allows us to form random groups of users based on the last digit of their customer number. For example, we could turn on the new functionality for those users whose customer number ends in 5 and use as a control group those users whose customer number ends in 7.

Our data contains information about the number of contacts generated with the support center by each of the users in the test and control group. The time window we examine comprises the 12 months prior to the start of the experiment and the 5 months after. We include the 5 subsequent months because they correspond to the duration of the experiment. Beginning in month 6, many priority users of the control group also began to have the new functionality available, making it impossible to extend the analysis period further. The following list summarizes the information we have on the database, which contains a single record for each customer indicating the group to which he belongs and the number of contacts generated in each of the months before and after conducting the experiment.

- CUS_CUST_ID: unique customer identification number.

- USER_TYPE: indicates whether the user belongs to the treatment or control group.
- INCOMING_BEFORE_N: number of contacts generated with the support center in each of the months prior to the start of the experiment. There are a total of twelve fields, so 'N' takes values 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1.
- INCOMING_AFTER_M: number of contacts generated with the support center in each of the months after the experiment started. There are a total of five fields, so 'M' takes values 1, 2, 3, 4, 5.

4.2- Methodology

To determine whether offering the new functionality of a better customer support center generates greater demand from clients, we must compare the number of contacts generated with the support center of the treatment and control groups in the period before and after the experiment. To do this, the first thing we must determine is whether or not the distribution of the data to be used follows a normal distribution. The results detailed in section 4.3 indicate that the contacts with the support center do not follow a normal distribution, so the statistical model to be used for the comparison of means between both groups must be a non-parametric one.

To carry out the analysis and to be able to estimate the new demand for the customer support center, we will use the Kruskal-Wallis statistical test, which is the non-parametric version of One-way ANOVA (McKight et al, 2010). The main advantage of the Kruskal-Wallis test is that the model does not make any assumptions about the distribution of the data, unlike the One-way ANOVA test that assumes a normal distribution of the dependent variable.

The Kruskal-Wallis test, like other non-parametric tests for the comparison of means, such as the Mann-Whitney and Wilcoxon rank-sum test, is based on ranked data. This means that the observations, regardless of the group to which they belong, are ordered from the lowest to the highest and ranked in increasing order, starting with the value 1 for the lowest value observation in terms of the variable of interest. Table 1 shows an example applied to the analysis in question.

Table 1: Observation Ranking Example for Kruskal-Wallis Test.

TREATMENT GROUP			CONTROL GROUP		
CUS_CUST_ID	INCOMING_BEFORE	RANKING	CUS_CUST_ID	INCOMING_BEFORE	RANKING
86328	0	5	70265	0	5
89274	0	5	54783	0	5
27489	0	5	29805	0	5
78346	0	5	45387	0	5
12937	0	5	43781	1	11
38204	1	11	4782	1	11
9843	2	13	84023	3	14
38958	5	16	73482	4	15
TOTAL (R1)	65		TOTAL (R2)	71	

In order to be able to compare whether the average contact rate with the support center differs between the two groups, we must carry out the following hypothesis test, where we seek to validate if the average contact rate of the treatment group (p_1) is higher than the average contact rate of the control group (p_2) after starting the experiment.

$$H_0: p_1 = p_2 \quad vs \quad H_1: p_1 > p_2$$

And to calculate the statistic that will allow us to determine whether or not there is a difference between the means of both groups, we apply the following formula.

$$H = \frac{12}{N(N+1)} \sum_{i=1}^k \frac{R_i^2}{N_i - 3(N+1)}$$

Where R_i is the sum of the rankings of each group and N_i the number of observations belonging to each group. This statistic test has a distribution known as chi-square distribution and for this distribution there is one value for the degrees of freedom, which is one minus than the number of groups ($k - 1$).

4.3- Results

The first point to highlight regarding the results obtained from the analysis involves justifying the reason why we decided to carry out a test of comparison of means using a non-parametric model, and it is because the data obtained from the number of contacts generated by users with the support center does not follow a normal distribution. We performed three different tests to understand the distribution of the data, which are the histogram plot, skewness coefficient and the Shapiro Wilk Test (Shapiro et al, 1965), all of which yield results that are very far from a normal distribution. Figure 13 shows the resulting histogram.

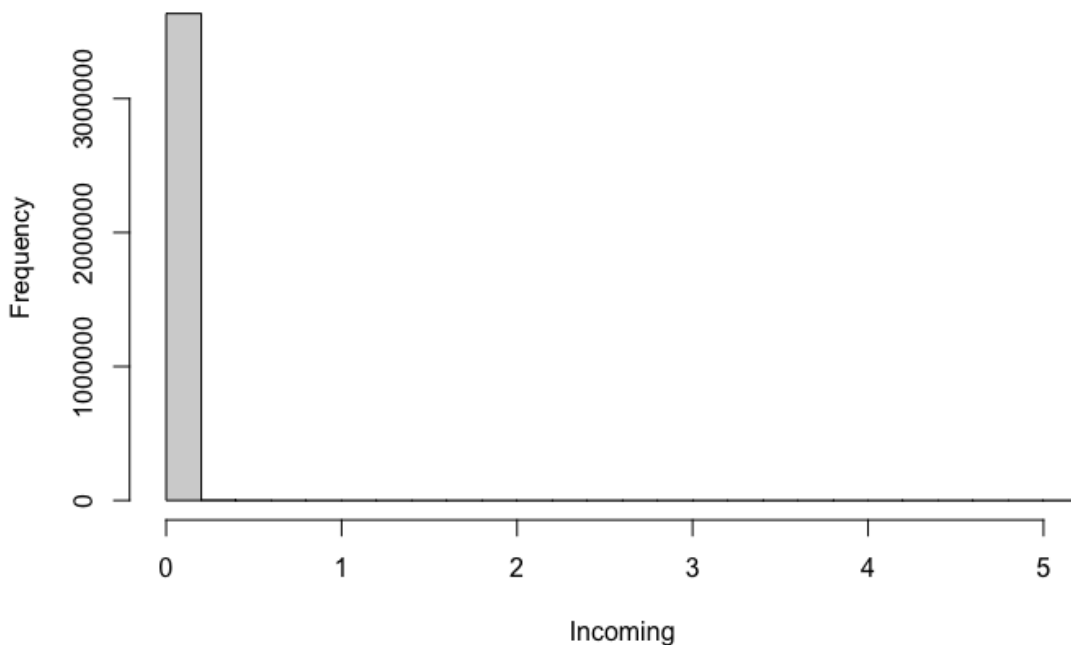


Fig.13: Histogram of incoming with the customer support center.

The visual result only allows us to observe that the vast majority of registered users do not have contacts with the support center. Those that do have, are not appreciated on the graph. This result is consistent with the skew coefficient, which gives us a result of 66, that is, a highly skewed distribution with a tail to the right. Shapiro's test gives a similar result, indicating that the variable is not normally distributed ($W = 0.0366, p = 5.68e - 95$).

From a business perspective, it is simple to understand why the majority of registered users do not have contacts with the customer support center. On the one hand, there are few registered users in the company that have activity on the platform, that is, most of the accounts are inactive.

Secondly, it is also important to understand that of the totality of users with activity on the platform, few customers need to contact customer service. This is because there are very few transactions that present any kind of inconvenience to require the help of a customer service representative and, also, if a problem appears most of the information needed to solve it is self-contained on the platform.

In this way, taking into account that the results of the different normality tests show an asymmetric distribution of the dependent variable, we are in a position to carry out the Kruskal-Wallis test. To assess whether the availability of a more direct access to the support center generates a greater number of contacts, we must make two comparisons: 1) demonstrate that, before conducting the experiment, the treatment and control groups are similar with respect to the amount of contacts generated with the support center, and 2) evaluate if the number of contacts with customer support between both groups differs after the experiment.

Regarding the first comparison, table 2 describes the main characteristics of the users of both groups in the twelve months prior to the experiment. It is observed that both groups are made up of more than 1.8 million users each and the average number of contacts generated on average per month per user is close to 0.0009, for both groups.

Table 2: Summary statistics of the variable INCOMING_BEFORE.

group	variable	n	min	max	median	iqr	mean	sd	se	ci
Control	INCOMING_BEFORE	1819224	0	4.75	0	0	0.00087	0.02	0	0
Test	INCOMING_BEFORE	1819019	0	5.17	0	0	0.00086	0.021	0	0

As figure 14 shows, there was not a statistically significant difference in the number of contacts with customer support between treatment and control groups assessed using the Kruskal-Wallis test ($H(1) = 1.38, p = 0.24$). This guarantees us that the group composition is valid and that selecting customers using the last digit of their customer number ensures a correct group randomization.

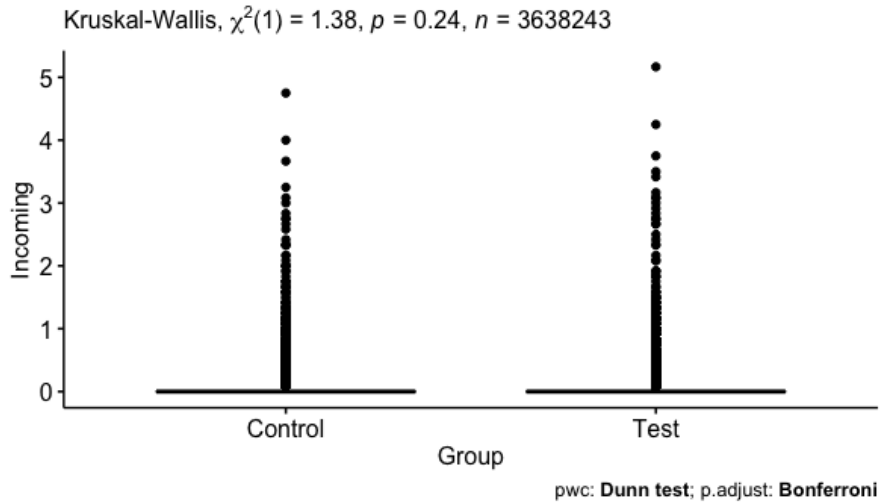


Fig.14: Kruskal-Wallis test result for comparison of test and control groups of the variable INCOMING_BEFORE

The second comparison, between the period of five months after the start of the experiment and the twelve months before, gives a different result. Table 3 describes the main characteristics of both groups for the five months after the initiation of the experiment.

Table 3: Summary statistics of the variable INCOMING_AFTER.

group	variable	n	min	max	median	iqr	mean	sd	se	ci
Control	INCOMING_AFTER	1819224	0	13	0	0	0.00109	0.032	0	0
Test	INCOMING_AFTER	1819019	0	20.8	0	0	0.00255	0.053	0	0

The final results of the second comparison between the treatment and control groups are seen in figure 15: 1) there is a statistically significant difference in the number of contacts with customer support between treatment and control groups assessed using the Kruskal-Wallis test ($H(1) = 1859.05, p < 0.0001$) and, 2) the average number of contacts per month with customer support for the control group is 0.00109, while for the treatment group the mean increases to 0.00255, which represents a difference of 134% between groups.

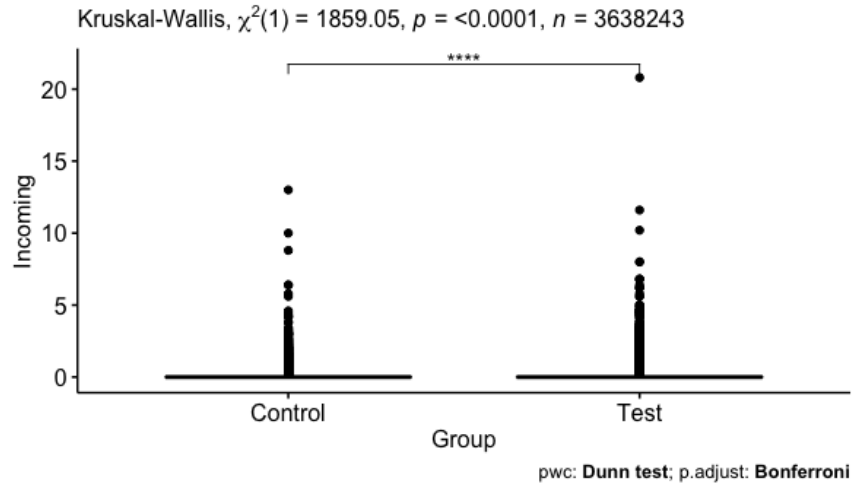


Fig.15: Kruskal-Wallis test result for comparison of test and control groups of the variable INCOMING_AFTER.

The salient results of the comparisons between the treatment and control groups support the expected result. What is observed is that the fact of providing more direct access to the customer support center generates a greater number of contacts from users, with an increase of 134%. This implies that, to maintain the same levels of availability and quality of current customer service, if the company moves forward with this initiative, it should more than double the amount of available resources dedicated to handling user inquiries. Figure 16 shows the average number of contacts by users in each of the months considered, split between the two groups. It can be seen how the average number of contacts per month increases for the treatment group once the feature is turned on.

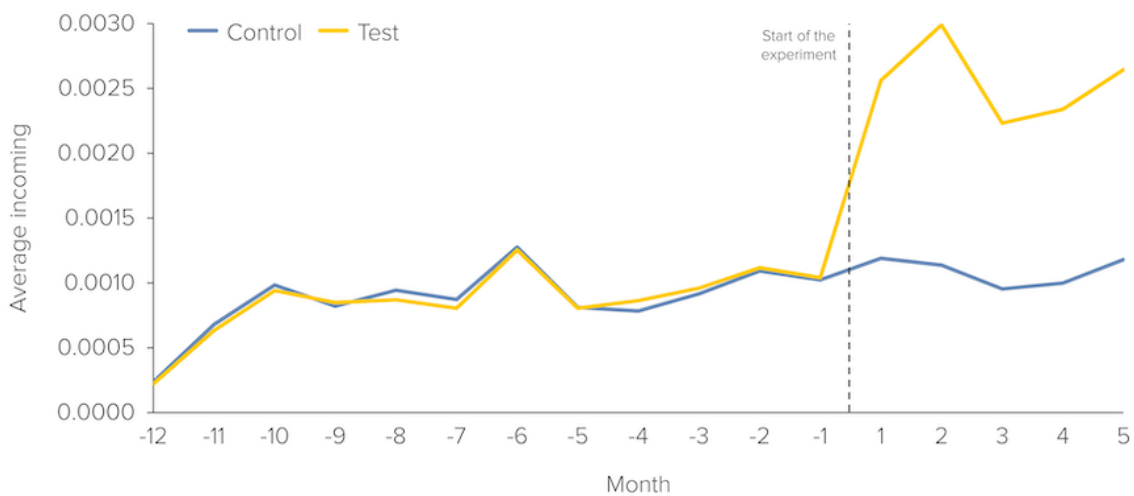


Fig.16: Average number of contacts with customer support center for test and control groups before and after the experiment.

5- User Retention and Frequency of Use

- c- *How do we measure retention and frequency of use? How do we estimate a new rate of retention and frequency of use once the new customer service is turned on?*

5.1- Data

In the same way as in the previous case regarding the contacts generated with the support center, we have access to all the movements made by users on the platform for each of the products or functionalities of the digital account described in the section 2.5.2. The treatment group and the control group are made up of the same users of the experiment. We also maintain the same time period previously used, so we have the number of transactions and amount operated in each of the 12 months prior and 5 months after the experiment for each of the clients. The result of this combination between the products/functionalities and the period of time used generates a database of more than 500 different fields, summarized below.

- CUS_CUST_ID: unique customer identification number.
- USER_TYPE: indicates whether the user belongs to the treatment or control group.
- PRODUCT_TPN_BEFORE_N: number of transactions carried out in each of the months prior to the start of the experiment. PRODUCT refers to the product of the fintech, which includes account funding, online payments sales, mobile point-of-sale sales, QR code sales, wallet payments, prepaid card payments and withdrawals, merchant and consumer credits and money withdrawals. There are a total of twelve fields for each product, so 'N' takes values 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1.
- PRODUCT_TPV_BEFORE_N: amount traded in each of the months prior to the start of the experiment. PRODUCT refers to the product of the fintech, which includes account funding, online payments sales, mobile point-of-sale sales, QR code sales, asset management, wallet payments, prepaid card payments and withdrawals, merchant and consumer credits and money withdrawals. There are a total of twelve fields for each product, so 'N' takes values 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1.
- PRODUCT_TPN_AFTER_M: number of transactions carried out in each of the months after the experiment was started. PRODUCT refers to the product of the fintech, which includes account funding, online payments sales, mobile point-of-sale sales, QR code sales, wallet

payments, prepaid card payments and withdrawals, merchant and consumer credits and money withdrawals. There are a total of five fields for each product, so 'M' takes values 1, 2, 3, 4, 5.

- PRODUCT_TPV_AFTER_M: amount traded in each of the months after the start of the experiment. PRODUCT refers to the product of the fintech, which includes account funding, online payments sales, mobile point-of-sale sales, QR code sales, asset management, wallet payments, prepaid card payments and withdrawals, merchant and consumer credits and money withdrawals. There are a total of five fields for each product, so 'M' takes values 1, 2, 3, 4, 5.

As in the previous section regarding the number of contacts with the support center, the assembly of the database with all the movements made by each of the fintech users was carried out through the advanced use of SQL, a language commonly used to extract information from relational databases.

5.2- Methodology

If we look in detail at the first part of the question posed in this subsection, we can see that it is divided into two analyzes: 1) we seek to understand if the turning on of the new support functionality has any impact on the customer retention rate and, 2) we seek to evaluate whether the new functionality generates a positive differential in users' transactions amounts. Initially we will group all the movements made by the customers in a single analysis, that is, we will calculate the retention rate and the amounts transacted combining all the company's products. Then we will carry out the same analysis by product, which will allow us to understand if there is any particular product that has a better retention rate once the new customer support functionality is turned on. Finally, from this moment on and in order to maintain the confidentiality of the company's information, we will stop calling each of the products by its name, and we will do so in a generic way, as can be seen in figure 17. The only product that is not included in the analysis is the mutual fund, because it does not require repeated transactions from users. It is an action that is carried out only once by the client.

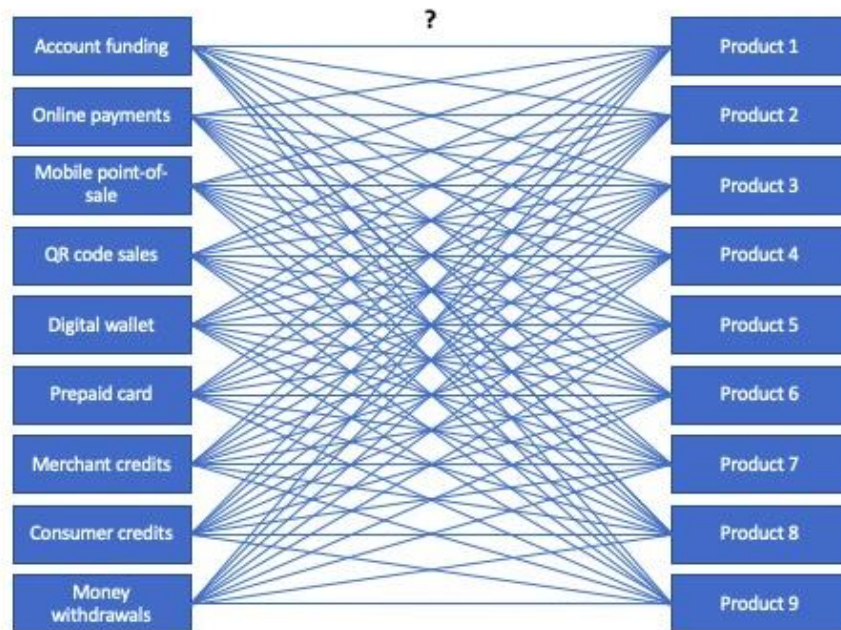


Fig.17: Product aleatorization.

5.2.1- Retention Analysis Methodology

To understand if a more transparent and direct access to the customer support center generates an improvement in the user retention rate in the short term, we must compare the number of users who were retained in the following five months after the experiment began. To do this, we will carry out a proportions' comparison test, which will allow us to determine if the percentage of users who returned to use any of the functionalities of the mobile application in the five months after starting the experiment differs between the treatment and control group. Also, before comparing both groups after the experiment begun, we will validate the retention rate between groups in the previous months, in order to check that the comparison is valid.

In this way, in order to check whether the user retention rate differs between the treatment and control groups, we must perform the following hypothesis test:

$$H_0: p_1 = p_2 \quad vs \quad H_1: p_1 < p_2$$

And the test statistic used will be a Two Proportion Z-Test comparison, where:

$$Z = \frac{p_1 - p_2}{\sqrt{\left(\frac{x_1 + x_2}{n_1 + n_2}\right) \left(1 - \left(\frac{x_1 + x_2}{n_1 + n_2}\right)\right) \left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

Where p_1 and p_2 are the retention rates of the control and treatment group, n_1 and n_2 are the number of users with some movement in the account in the twelve months prior to the experiment and x_1 and x_2 are the number of users retained in each group in the next five months. We assigned the subscript '1' to the control group and the subscript '2' to the treatment group. The calculated Z value will allow us to determine if the retention rate between the two groups differs significantly.

5.2.2- Total Payment Volume Analysis Methodology

To evaluate whether the access to a more direct and transparent support center generates a positive lift in the amounts transacted by the fintech users, we will compare the average amount transacted for all the products and services offered by the fintech between the test and control group. As in previous comparisons, we will make the comparison between the period before and after the experiment and we will use the Kruskal Wallis statistical test, since the data of the amounts transacted by each user does not follow a normal distribution. The final result of the comparison will be essential to understand if there is a short-term differential in relation to the implemented initiative, and thus be able to assess the impact on the company's finances.

5.3- Results

5.3.1- Retention Analysis Results

Table 4 shows the results of the comparison of the user retention rate for the period after the experiment, considering all the products offered by the company. Results for the period before the experiment are shown in Appendix 1.

Table 4: Customer retention rate for the period after the experiment.

	Control group	Treatment group
Total users	1819224	1819019
Users with activity	61183	61215
Retained users	27111	27385
Retention rate	44.31%	44.74%

Where we can highlight two main results. In the first place, it is observed that there are few users with account movements in the twelve months prior to the experiment, compared to the number of registered accounts. If we calculate the number of users with activity over the total users, we see that this number is close to 3%. This result is consistent with the results of section 4.3, where we argue that the majority of users do not have contact with support due to the fact that most of the accounts are inactive.

The second result is the most important, and implies observing that the user retention rate in the following five months after the experiment is turned on is slightly higher in the case of the treatment group, where we see a retention of 44.74% compared to 44.31% of the control group. Using the formula introduced in section 5.2.1 we can calculate the Z statistic, which gives us a value of 1.49. Given this result, and knowing that at a significance level of 10% in the normal table $Z_t = 1.28$, we have:

$$|Z| > |Z_{0.1}|$$

$$1.49 > 1.28$$

Therefore, we are in a position to reject the null hypothesis that there is no difference in the retention rate of users at a significance level of 10%. It is possible to conclude that the fact of placing a more direct access to the support center generates a positive impact on the user retention rate in the short term. In this case, the differential in the retention rate is 0.42%.

Next, we will carry out the same statistical analysis for each of the products offered by the fintech independently.

5.3.1.1- Retention Analysis Results for Product 1

Table 5 shows the results for the retention analysis of the product 1.

Table 5: Customer retention rate for product 1

	Control group	Treatment group
Total users	1819224	1819019
Users with activity	6024	6100
Retained users	1211	1310
Retention rate	20.10%	21.48%

The observed result is a higher retention rate for users of the treatment group. Customers with direct access to support have a better retention rate (21.48%) than customers of the control group (20.10%). $Z = 1.87, p = 0.03$.

5.3.1.2- Retention Analysis Results for Product 2

Unlike product 1, Table 6 shows that the results of the test of means for product 2 do not yield significant results regarding user retention.

Table 6: Customer retention rate for product 2

	Control group	Treatment group
Total users	1819224	1819019
Users with activity	4633	4683
Retained users	2780	2809
Retention rate	60.00%	59.98%

Although the retention rate is slightly higher for the control group (+ 0.02%), the result has no statistical relevance. There is not a significant difference in retention rate for treatment and control group for product 2. $Z = -0.02, p = 0.49$.

5.3.1.3- Retention Analysis Results for Product 3

The case of product 3 is similar to product 2. There is not a significant difference in retention rate for treatment and control group for product 3. $Z = 0.88, p = 0.19$. We cannot conclude that a

more direct access to the customer support center has a significant impact on the user retention rate for this particular product.

Table 7: Customer retention rate for product 3.

	Control group	Treatment group
Total users	1819224	1819019
Users with activity	30193	30173
Retained users	14167	14265
Retention rate	46.92%	47.28%

5.3.1.4- Retention Analysis Results for Product 4

The mean comparison test gives us a favorable result regarding the impact that the support center has on the retention rate of users of product 4. In table 8 we see that the retention rate for users of the treatment group is 56.70 %, which is 0.97% higher than for the users of the control group.

Table 8: Customer retention rate for product 4.

	Control group	Treatment group
Total users	1819224	1819019
Users with activity	20515	20431
Retained users	11434	11584
Retention rate	55.73%	56.70%

We can conclude that in the case of product 4, improvements in access to the support center have a positive impact on the user retention rate in the short term. $Z = 1.97, p = 0.02$.

5.3.1.5- Retention Analysis Results for Product 5

The case of product 5 is similar to that of product 2 and 3, where there is not a significant difference in the user retention rate between groups. $Z = 0.19, p = 0.42$.

Table 9: Customer retention rate for product 5.

	Control group	Treatment group
Total users	1819224	1819019
Users with activity	2289	2234
Retained users	1463	1434
Retention rate	63.91%	64.19%

5.3.1.6- Retention Analysis Results for Product 6

The impact on the user retention rate regarding the availability of a more direct point of contact is also positive. In table 10 we can see that the retention rate of the control group is 21.19%, while that of the treatment group is 22.16%.

Table 10: Customer retention rate for product 6.

	Control group	Treatment group
Total users	1819224	1819019
Users with activity	7466	7468
Retained users	1582	1655
Retention rate	21.19%	22.16%

It can be concluded that the user retention rate is higher for the treatment group. $Z = 1.44, p = 0.07$.

5.3.1.7- Retention Analysis Results for Product 7

The case of product 7 is similar to that of product 2, 3 and 5. The statistical test shows us that there is no significant difference in the retention rate. $Z = -0.27, p = 0.39$.

Table 11: Customer retention rate for product 7.

	Control group	Treatment group
Total users	1819224	1819019
Users with activity	1131	1108
Retained users	348	335
Retention rate	30.77%	30.23%

5.3.1.8- Retention Analysis Results for Product 8

As in the previous case, product 8 shows a slight difference in the user retention rate, but the statistical test does not allow us to conclude that there is a significant difference between both groups. $Z = -0.11, p = 0.46$. Table 12 shows this result.

Table 12: Customer retention rate for product 8.

	Control group	Treatment group
Total users	1819224	1819019
Users with activity	31719	31710
Retained users	12516	12498
Retention rate	39.46%	39.41%

5.3.1.9- Retention Analysis Results for Product 9

The retention analysis for product nine is similar to that of product 2, 3, 5, 7 and 8. In table 13 it can be seen that retention is slightly higher for the treatment group, although the statistical test establishes that there is no significant difference between both groups. $Z = 0.12, p = 0.45$

Table 13: Customer retention rate for product 9.

	Control group	Treatment group
Total users	1819224	1819019
Users with activity	1314	1230
Retained users	533	502
Retention rate	40.56%	40.81%

The user retention analysis allows us to obtain two conclusions: 1) at the aggregate level, the retention rate of the treatment group is higher than the retention rate of the control group (+0.42%) and, 2) when performing the retention analysis for each of the products separately, we obtain disparate results, where we see a higher retention rate for the users of the treatment group in 3 of the 9 products analyzed. Below, table 14 shows these results on a consolidated basis.

Table 14: Customer retention rate summary.

Product #	Control group retention rate	Treatment group retention rate	Result
1	20.10%	21.48%	Significant
2	60.00%	59.98%	Not significant
3	46.92%	47.28%	Not significant
4	55.73%	56.70%	Significant
5	63.91%	64.19%	Not significant
6	21.19%	22.16%	Significant
7	30.77%	30.23%	Not significant
8	39.46%	39.41%	Not significant
9	40.56%	40.81%	Not significant
Total	44.31%	44.74%	Significant

5.3.2- Frequency of Use Analysis Results

As we mentioned when introducing the methodology, the first thing we must take into account is the distribution of the data in relation to the amount transacted by each user. Figure 18 shows the histogram of the average transacted amount per customer. We can see that the data does not follow a normal distribution.

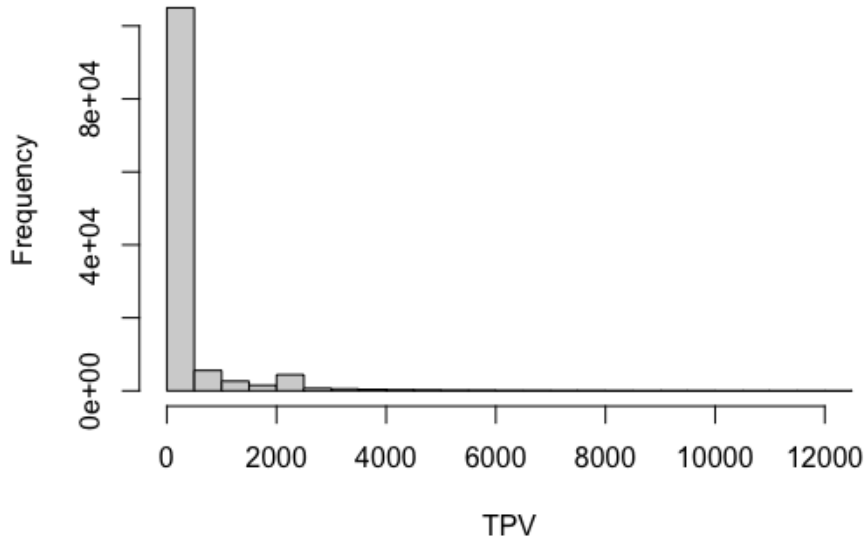


Fig.18: Histogram of average transacted amount per customer.

This visual result shows that the vast majority of users have movements in the digital account for less than 500 dollars on average per month, and it is consistent with a skew coefficient of 5.65.

Additionally, the Shapiro's test gives a similar result, indicating that the variable is not normally distributed ($W = 0.0456, p = 0.83$).

Now, we are in a position to carry out the Kruskal Wallis test. To do this, we will make two comparisons: 1) validate that in the period prior to the experiment the average amount transacted per user does not differ between the test and control groups and, 2) evaluate whether the new access to the support center has an impact in the amounts transacted by fintech users. For both comparisons, we carried out the analysis taking into account only those users who had some type of movement in the months prior to the experiment, that is, we left aside the users without activity on the platform. This means that we are not considering 1758041 customers from the control group and 1757805 from the test group, which represents 96.6% for each group. These numbers can be obtained from table 4 in section 5.3.1.

The results of the first analysis are shown below in Table 15. It is observed that the number of users that make up each group is slightly greater than 60,000, which are the users retained in the months following the experiment. It is also seen that the average amount transacted per user is \$333 for the control group and \$337 for the test group.

Table 15: Summary statistics of the variable AVG_TPV_BEFORE.

group	variable	n	min	max	median	igr	mean	sd	se	ci
Control	AVG_TPV_BEFORE	61183	1	12475	15.6	137.0	333	882	3.57	6.99
Test	AVG_TPV_BEFORE	61215	1	12671	15.9	135.0	337	1058	4.28	8.38

The result of the Kruskal Wallis test is presented below in figure 19.

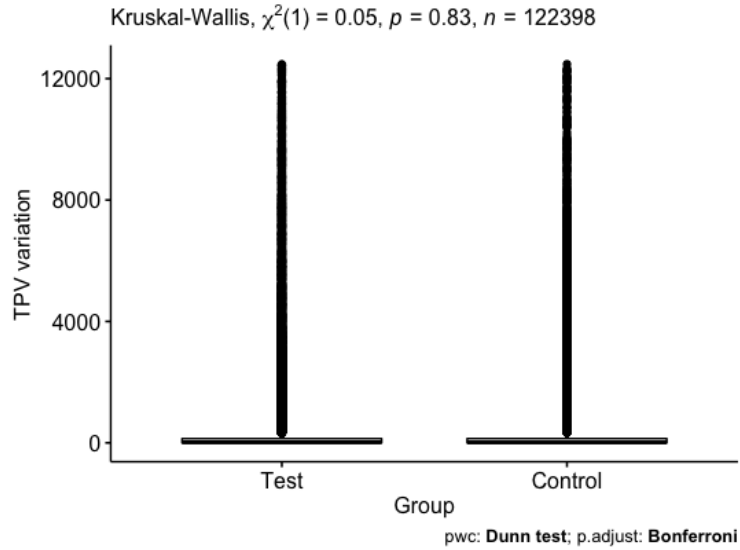


Fig.19: Kruskal-Wallis test result for comparison of test and control groups of the variable AVG_TPV_BEFORE.

We can conclude that the difference of 4 dollars in the average amount transacted between the test and control groups is not statistically significant ($p = 0.83$). Again, as we saw for the number of contacts generated with the support center in section 4.3, we have evidence that both test and control groups are very similar in the pre-experiment period, so the comparison is valid.

In the same way, now we can focus on the second part of the analysis to understand if the users to whom we gave the possibility of contacting support in a more direct way began to transact more within the platform in the months after the experiment was turned on. Table 16 shows the first results, where it is observed that the average amount transacted by the users of the test group is 496 dollars, and 485 for those of the control group.

Table 16: Summary statistics of the variable AVG_TPV_AFTER.

group	variable	n	min	max	median	igr	mean	sd	se	ci
Control	AVG_TPV_AFTER	61183	0	83595	0	188.0	485	1637	6.62	13
Test	AVG_TPV_AFTER	61215	0	87932	0	80.3	496	2219	8.97	17.6

An interesting comparison, and even a possible question about the results of the analysis may lie in understanding the reason why the average amount transacted by each user increases in relation to the months prior to the experiment, and this is mainly due to the fact that fintech is in a strong

growth stage, so it is common to observe exponential growth rates when making comparisons between periods.

Finally, figure 20 shows the results of the Kruskal Wallis test, where it is observed that the difference between the average amounts transacted by both groups is statistically significant ($p < 0.0001$).

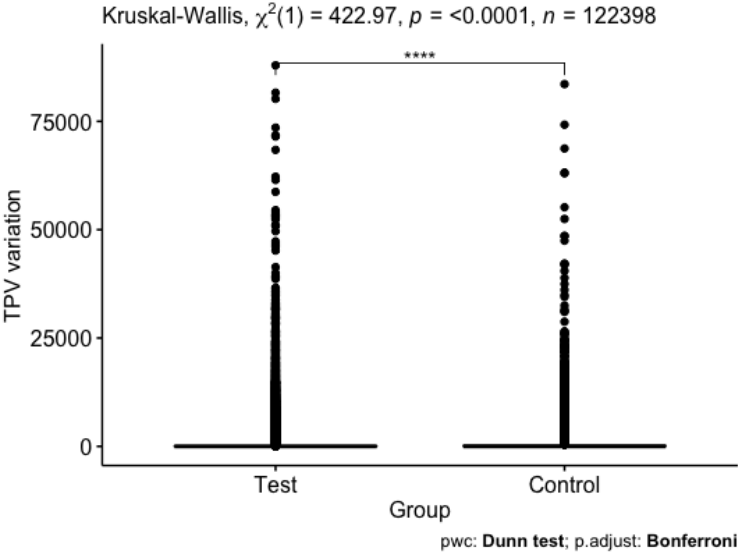


Fig.20: Kruskal-Wallis test result for comparison of test and control groups of the variable AVG_TPV_AFTER.

We can affirm that access to a more direct and transparent support center for customers has a significant impact on the amount of transactions carried out on the platform. Comparing the mean between both groups (496 for the test group and 485 for the control group), a positive differential of 2.2% is observed. In the next section, we will try to determine if this observed improvement is large enough to cover the incremental cost of providing a better support center for customers.

6- Profitability Assessment

d- *Is the incremental cost of providing more support offset by the incremental benefit due to higher retention and frequency of use?*

6.1- Methodology

The methodology to estimate the impact of the new support center on the company's finances is relatively simple, since we only have to compare the incremental income for providing this new functionality against the incremental costs for having to answer a greater number of customer inquiries. The impact will be determined by two variables:

1. The new cost of the customer support center.
2. The new income derived from providing better customer service.

And the final result can be calculated from the following equation:

$$\text{Impact on earnings} = \text{Income variation} - \text{Cost variation}$$

Where the term 'Income variation' is given by the additional amount that users transact multiplied by the net commission obtained by the fintech for acting as an intermediary, as seen in the following equation:

$$\text{Income variation} = \text{Transacted amount variation} * \text{Fintech commission}$$

And the term 'Cost variation' is made up of the number of additional income to the support center multiplied by the average cost of answering each case:

$$\text{Cost variation} = (\text{New number of cases} - \text{Old number of cases}) * \text{Average cost per case}$$

From these calculations we will be in a position to determine the final impact on the company's finances. The result will be presented in a matrix with different scenarios for different possible values of the average cost of answering each case and different possible percentages of commissions obtained by the transactions carried out on the platform.

6.2- Results

Taking into account the results previously obtained in sections 4.3 and 5.3.2, we are in a position to estimate the impact of the new support center on the company's finances. As we clarified at the time of establishing the methodology to be used in this section, we will present the results in the form of a matrix, taking different values for the average cost per incoming case and different values of the average net commission obtained from the operations carried out in the platform. This will give us two advantages: 1) know the sensitivity of the possible impact on fintech finances for different cost and profitability scenarios and, 2) we eliminate the need to disclose confidential company data, since we will use different average cost values per case to estimate the incremental cost and different values of revenues due to commissions.

In addition, in order to build the matrix, we must take into account the following results obtained in the previous sections:

1. 134% increase in contacts with the support center, which implies a number of 2656 additional cases for the test group.
2. 2.2% increase in the total amount transacted in relation to the control group, which implies a differential of \$11 more transacted per month per user.
3. The results should be applied to the number of users that make up the test group, that is 61215.

At the same time, we will use the following values for the average cost per case and commission earnings:

1. Average cost per case, measured in US dollars: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.
2. Commissions earned, measured as a percentage: 0.5%, 1%, 1.5%, 2%, 2.5%, 3%.

Table 17 shows the results of the matrix with the different parameters used.

Table 17: Profitability Matrix.

		Net commisions					
		0.5%	1.0%	1.5%	2.0%	2.5%	3.0%
Average cost per incoming case	1	711	4078	7444	10811	14178	17545
	2	-1945	1422	4788	8155	11522	14889
	3	-4601	-1234	2132	5499	8866	12233
	4	-7257	-3890	-524	2843	6210	9577
	5	-9913	-6546	-3180	187	3554	6921
	6	-12569	-9202	-5836	-2469	898	4265
	7	-15225	-11858	-8492	-5125	-1758	1609
	8	-17881	-14514	-11148	-7781	-4414	-1047
	9	-20537	-17170	-13804	-10437	-7070	-3703
	10	-23193	-19826	-16460	-13093	-9726	-6359

The results of the matrix show two relevant results: 1) it is observed that the fact of having a positive or negative impact on the finances of the company depends strictly on the value of the parameters to be considered, since we are close to the point of equilibrium between losses and earnings. And, 2) it is important to note that although the final values are small in terms of money for the company, it must be taken into account that we are considering a low percentage of fintech users. Extending the new functionality to 100% of users could have a huge impact on the profitability of the fintech.

Finally, it is important to note that the analysis developed to understand the economic viability of implementing the new support center was carried out taking into account only the direct impact on the behavior of the customers. There is also an indirect effect that we are not including in the analysis, and it is related to the user experience. An important piece of information that the company's management has is that the new support center has a positive effect on the customer experience, particularly in the NPS. By improving the NPS, we generate not only that users begin to use the products more frequently, but it also happens that they begin to recommend the product to friends, colleagues and family, so there is an indirect effect that generates more people entering the ecosystem. This effect is much more complex to quantify.

7- Support Center Expandability

e- What is the expandability of the customer service center? Is it limited? In how many stages should be done?

Given the results regarding the impact of the new support center on the company's finances presented in the previous section, we are in a position to decide to move forward with this project and implement it to 100% of the customers. The ideal scenario would be to be able to carry out the entire project immediately, but due to various technical restrictions this is not feasible.

The results of section 4.3 indicate that, in order to provide this new service to all users, we must increase our customer service capacity by 134%. This is where we find the difficulty on how to expand the support center. It must be taken into consideration that increasing the capacity requires hiring more employees, training them, expanding the offices, purchasing the necessary supplies for the operation, and various other additional issues. Within these categories, training the new customer service representatives is the most complicated topic, since it requires an additional effort to introduce them to the company culture and to get them to know the different products and possible answers that they can provide to customers. It is also the most delicate aspect to take into account, since it is common that recently hired customer service representatives provide lower quality responses to clients as compared to when they have worked several months for the company. The NPS score for the customer support center is near 8 point higher for old representatives than new ones.

For these two reasons, the planning team, which is in charge of determining the number of customer service representatives required by the company, established that the expansion of the operation cannot exceed 7.5% of the existing base. This implies that, to increase operating capacity by 134%, we must increase our installed capacity by 7.5% during 18 months, which is equivalent to one and a half year.

Consequently, we need to figure out which is the best way to start rolling out the new customer support center. Since we cannot do it immediately, we need to segment our customers and prioritize them before turning on the new service. This is what we will do in the next two sections.

8- Customer Segmentation

f- How do we segment customers based on their behavior in the platform?

In order to determine how we prioritize the customers for accessing the new customer support functionality, we must first segment the users of the platform. We could say that there are almost infinite ways to segment and prioritize the customers of the fintech, but there are two general ways to do it that cover most of these possibilities: 1) using a strictly business view and, 2) using an analytics-focused view.

The business view of turning on the new functionality focuses on strategically prioritizing users employing some particular variable of interest to the business. Some examples of how the company could apply this vision could be:

- Rank users according to the amount transacted within the platform: make the support tool available to the largest users first, who are the ones that generate the highest commissions.
- Rank users by prioritizing the ones that use the most profitable company products: for example, enable the functionality to all those users who have an active loan, or to all sellers who use payment links, or, more generally, to all those who have high profitability. It can be applied to any product of high interest to the management of the company.
- Rank users based on how long they have been a customer (based on when they started using the platform).

In the case of the fintech under analysis, the segmentation and prioritization of users was carried out using a methodology based on the business vision, with some additional complexity added to the previously mentioned examples. In particular, to segment their customers and prioritize them, the company ended up adopting a methodology combining the first two examples above.

On the contrary, in this work we will propose to use another type of methodology to segment and prioritize users, with a focus on analytics. Using data analysis tools, we will segment the customers using a clustering methodology, which is a tool belonging to the unsupervised branch of machine learning.

8.1- Data

We will use a dataset very similar to the one we used in the previous sections, with some differences regarding the users to consider, the time window of the data and the variables to include in the model.

Regarding the *time window* to consider, our dataset contains information on the last 17 months of transactions and contacts with the customer support center, as we include both the 12 months prior to the experiment and the 5 months after it. In this case, we will only use the last 12 months of activity, that is, the last 7 months before the experiment and the 5 months after the experiment. This is because we assume that we are standing in the month following the end of the experiment, and we must start from now to segment customers and activate the service.

Regarding which *users* to consider, given that the customers of the test group were already turned on during the experiment period, we will only take into account the users that are part of the control group to perform the analysis in order not to add confounding elements to our analyses.

Finally, in relation to the *variables* to include in the model, we will use the amount traded by each customer in each product (instead of the number of transactions) which is the most representative variable in relation to user behavior and is the most common variable used in the company to segment user groups.

- PRODUCT_1: monthly average amount traded using product 1 in the last 12 months.
- PRODUCT_2: monthly average amount traded using product 2 in the last 12 months.
- PRODUCT_3: monthly average amount traded using product 3 in the last 12 months.
- PRODUCT_4: monthly average amount traded using product 4 in the last 12 months.
- PRODUCT_5: monthly average amount traded using product 5 in the last 12 months.
- PRODUCT_6: monthly average amount traded using product 6 in the last 12 months.
- PRODUCT_7: monthly average amount traded using product 7 in the last 12 months.
- PRODUCT_8: monthly average amount traded using product 8 in the last 12 months.
- PRODUCT_9: monthly average amount traded using product 9 in the last 12 months.
- PRODUCT_10: product 10 is Asset Management. Average amount invested per day in the last 12 months.

Lastly, it is important to mention that each of the data points was transformed using the function $\ln(x + 1)$, in order to reduce the variance volatility of the data set.

8.2- Methodology

The clustering methodology for user segmentation is part of the unsupervised learning branch of Machine Learning.

The objective of this methodology is to discover interesting patterns in the data, which in this case will help us to detect similar subgroups of customers. The methodology consists of partitioning the data in such a way that:

1. The observations that belong to a group are similar to each other.
2. The observations of different groups are different from each other.

At the same time, there are multiple families of clustering algorithms:

- Partitioning
- Hierarchical
- Density-based
- Grid-based
- Model-based

Where the most traditional algorithms correspond to the first two families introduced: partitioning and hierarchical.

In the present work we will use the K-means algorithm, belonging to the partitioning family, because it is the most widely used at a general level, and unlike the algorithms of the hierarchical family, it has several advantages over the computation and use of large volumes of data.

The K-means algorithm divides the data set into K distinct subsets without overlap (James et al., 2017). The algorithm is characterized by the fact that the value of K, that is, the number of subgroups, must be set before running the model. Clusters must meet the following conditions:

- 1- $C_1 \cup C_2 \cup \dots \cup C_K = \{1, \dots, n\}$. In other words, each observation belongs to at least one of the K clusters.

- 2- $C_k \cap C_{k'} = \emptyset$ for all $k \neq k'$. In other words, the clusters are non-overlapping: no observation belongs to more than one cluster.

And it is assumed that a good assignment is one where, given a value of K, the intra-cluster variance is minimized as much as possible.

Mathematically, if $W(C_k)$ is a measure that indicates how much the observations of a cluster differ between them, the problem can be written as:

$$\min (C_1, \dots, C_k) \left\{ \sum_{k=1}^k W(C_k) \right\}$$

And if we use the Euclidean distance as a measure of dissimilarity, $W(C_k)$ can be written as:

$$W(C_k) = \frac{1}{|C_k|} \sum_{i, i' \in C_k} \sum_{j=1}^p (x_{ij} - x_{i'j})^2$$

So the problem can be written as:

$$\min (C_1, \dots, C_k) \left\{ \sum_{k=1}^k \frac{1}{|C_k|} \sum_{i, i' \in C_k} \sum_{j=1}^p (x_{ij} - x_{i'j})^2 \right\}$$

Where $W(C_k)$ can be expressed as the distance to a centroid:

$$\frac{1}{|C_k|} \sum_{i, i' \in C_k} \sum_{j=1}^p (x_{ij} - x_{i'j})^2 = 2 \sum_{i \in C_k} \sum_{j=1}^p (x_{ij} - \bar{x}_{kj})^2$$

In this way, the K-means algorithm process works as follows:

- 1- Randomly assign a number from 1 to K, to each of the observations. These serve as initial cluster assignments for the observations.
- 2- Iterate until the cluster assignments stop changing:
 - a- Assign each observation to the cluster whose centroid is closest (where closest is defined using Euclidean distance).

- b- Assign each observation to the cluster whose centroid is closest (where closest is defined using Euclidean distance).

Finally, it remains to determine how we select the number of K clusters to use. Although it is not clear how it should be chosen, a commonly used practice is to run the algorithm with increasing values of K and evaluate how the function to be minimized varies. We will select the value of K using the elbow methodology (Thorndike, 1953), which determines the value of K to be used in such a way that the marginal gain from adding an additional cluster is low in terms of the function to be minimized.

8.3- Results

The first result to present in relation to the clustering of fintech users corresponds to the number of clusters that we are going to use in our K-means algorithm. Figure 21 shows the elbow method result.

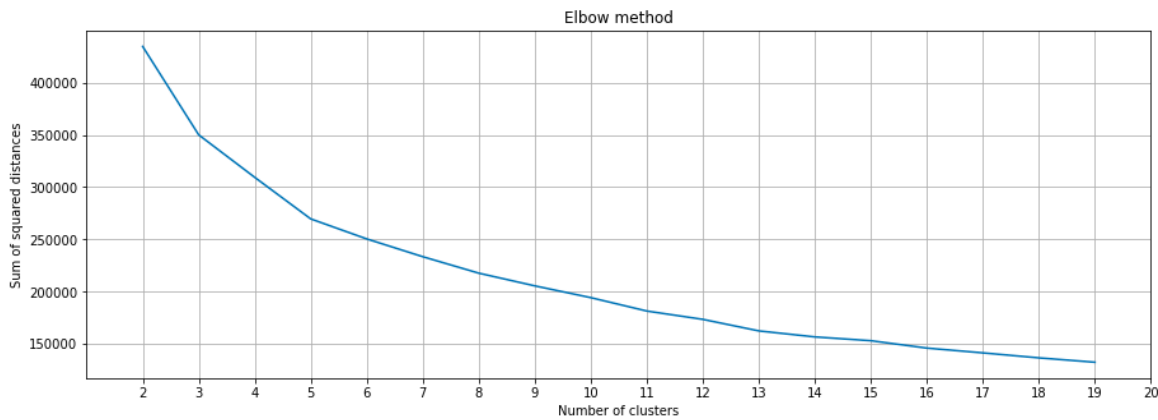


Fig.21: Elbow method graphic.

In the elbow graph, two breaking points of the curve are observed, which is for the cases of 3 and 5 clusters. We selected the 5 clusters solution, since it appears that starting from cluster 6 the fact of adding an additional cluster generates a lower marginal gain in terms of the reduction of the sum of squared differences.

The main results of customer clustering are presented in table 18.

Table 18: Clusters characteristics.

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
% Customers	86%	10%	2%	1%	1%
% Incoming	68%	18%	4%	3%	7%
Incoming	0.01	0.03	0.03	0.07	0.10
Product_1	0.12	0.50	0.19	1.27	0.69
Product_2	0.03	0.94	0.37	1.54	3.31
Product_3	1.00	1.46	1.02	3.58	3.44
Product_4	0.11	4.72	0.58	2.73	6.65
Product_5	0.00	0.00	3.98	0.12	0.05
Product_6	0.20	0.20	0.67	0.52	0.63
Product_7	0.02	0.03	0.01	4.48	0.22
Product_8	0.49	4.80	1.03	4.51	6.19
Product_9	0.00	0.02	0.00	0.28	4.10
Product_10	0.00	0.12	0.02	0.24	0.18

The results obtained are aligned with the results that we have been observing in the previous sections. The fact that the majority of the users have few movements in the account, generates a large cluster with many customers, and 4 remaining clusters of smaller size.

By analyzing the characteristics of each cluster, we can interpret them as follows:

- Cluster 1: it is made up of 86% of the users, who generate 68% of the contacts with the customer support center. The average number of cases with the support center generated by these users is the lowest compared to other clusters. Also, it is observed that they use very little the products of the fintech.
- Cluster 2: it is the second-largest cluster, grouping 10% of the users that generates 18% of the contacts with the support center. They differ from cluster 1 because they have a greater number of account movements in most of the products, except for product 5 and 6.

- Cluster 3: made up of 2% of users. This group has the particularity of making an intensive use of products 5 and 6 of the platform, an aspect that differentiates them from cluster 1.
- Cluster 4: it is made up of 1% of the users and generates 3% of the contacts with the support center. They are characterized by being users who use products 1, 3, 7 and 10 to a greater extent. The majority of the customers of this cluster are sellers.
- Cluster 5: is made up of 1% of users, but they generate the 7% of contacts with the customer support center. Cluster 5 has the characteristic of grouping the users with the greatest number of contacts with the support center, and also is the group of customers with more activity in the platform. The cluster is strictly formed by sellers of the platform.

It is interesting to note that the clusters made up of users with the highest use of the platform are the ones that generate the greatest number of contacts, on average, with the customer support center.

9- Customer Prioritization

g- To which customers do we want to provide this new service in the first place? Which ones do we deprioritize?

Once the different clusters are formed, we are in a position to determine the prioritization of users to begin providing the new access to the customer support center.

A key result obtained in the previous section indicates that the customers who contact the support center the most are those who have the highest activity level on the platform. This result leads us to make a trade-off when prioritizing the users to whom to start providing the new functionality. On one hand, if we decide to start with the most active users on the platform (cluster 5), at first we will be turning on the new functionality only to a very small group of users. On the other hand, if we turn on the new functionality to users with less activity (cluster 1), doing so would allow covering a larger proportion of users' segments within the first phases of the project.

Judging by the type and quantity of products that the users of clusters 2, 4 and 5 typically use, we can deduce that those are clusters made up mostly of users who are sellers within the platform. And sellers transact more systematically within the platform than buyers generally do. Another interesting aspect to take into account is that, of the total number of users who use the platform, sellers are a minority compared to buyers, who seem to be mostly included in clusters 1 and 3.

Taking into account that the fintech business model is a multi-sided platform, both segments of users that make up the ecosystem (i.e., buyers and sellers) are of vital importance to the operation and to the sustained growth of the company. For this reason, and due to their strategic priority, in order to include the less active clusters of the platform (i.e., buyers) in the first waves of the customer service activation project, we decided to prioritize users based on two variables:

1. Total activity within the platform, which favors the users of clusters 5, 4 and 2.
2. Strategic priority, which favors the inclusion of users of clusters 3 and 1.

This strategy to prioritize the users of different clusters seeks to maintain a balance between the different types of customers within the platform's ecosystem, and is based on both the results obtained through an analytical technique and a more strategic business vision that complements it qualitatively.

9.1- Methodology

The way in which we propose to turn on the new functionality of the support center is to allocate the same operational capacity to each of the clusters in each of the waves to be implemented. This implies that, if, for example, in wave 1 we have the possibility of increasing the service capacity by 5,000 contacts with the support center, 1,000 of them will be allocated to each cluster. Naturally, given that cluster 4 is the one that generates the least amount of contacts with support (3%), it will be the first to be 100% covered when the new functionality is turned on, followed by cluster 3 (4%) and cluster 5 (7%). Cluster 1 will be the last group with the new functionality turned on for 100% of its customers, since it groups 68% of the total incoming cases.

Finally, it is important to note that the prioritization of users *within* each of the clusters will be done by ranking users from highest to lowest, in terms of the amount of money they transact on the platform. This implies that we will be prioritizing the largest users in each cluster first.

9.2- Results

The result of interest regarding the prioritization of users involves understanding how many of the customers we will be activating in each wave of the project. These results are seen below in figure 22.

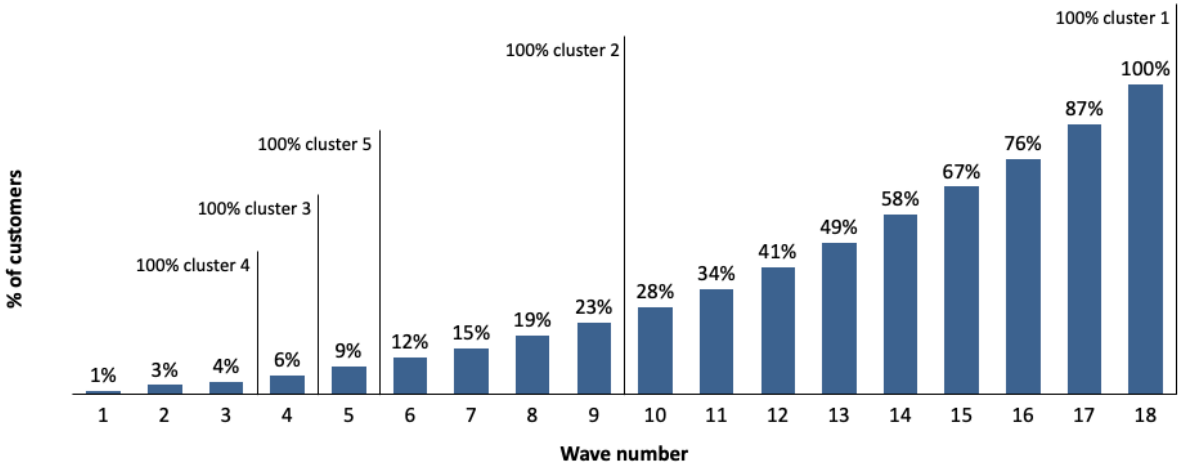


Fig.22: Percentage of customers covered in each wave number.

The result is the expected one in terms of the slope of the observed curve, which is exponential. In the first waves, few customers are included in the prioritization. When we have reached wave 9 of

the project, we will have covered half of the contacts that are generated with the support center under the new customer support functionality, although only 23% of the users will be included. This is because the most active users are the ones who generate the most contacts, on average, with the customer service center. The other aspect to highlight is the wave in which the different clusters end up being covered by 100%. This occurs after wave 3 for cluster 4, in wave 4 for cluster 3, in wave 5 for cluster 5 and in wave 9 for cluster 2. From wave 10 onwards, all users prioritized will correspond entirely to those of cluster 1.

With these results, we reached the end of the proposed analysis regarding the economic feasibility of starting to provide a more direct and transparent customer support center, as well as discussing possible methodologies to segment and prioritize users within the platform. The following section presents the conclusions of the present work.

10- Conclusions

In this paper we seek to evaluate the technical and financial feasibility of improving the access to the customer service center of a major Latin American fintech. In the case of the company under analysis, we faced the challenge of evaluating whether it would have been convenient to start providing users with a more direct and transparent access to the customer support center.

The motivation for this work arises from the fact that various company metrics began to show evidence that the lack of direct access to the support center was beginning to be detrimental to the user experience and its subsequent retention within the platform. Over the years, the different fintech teams had focused on resolving the main frictions of each of the products offered through the feedback obtained from users through satisfaction surveys. So far, the company had not made any effort to improve access to the support center, because this aspect did not seem to generate complications for customers and, at the same time, it required a large amount of resources to be carried out. The cost was too high for a low benefit, at least compared to the rest of the frictions that needed to be resolved.

Once the company solved the main frictions of the products it offered, the lack of direct access to the support center became a more relevant pain point among users, whose complaints began to be more frequent. As a consequence, the fintech managers began evaluating the possibility of improving the customer support center, by means of including the option to contact support on the main screen of the mobile app.

The hypothesis on which we developed the analysis throughout the paper was that improving the access to the support center would generate a greater number of contacts by customers, but at the same time that greater number of contacts would be accompanied by a greater customer retention rate and a greater amount of transacted money within the platform, in such a way that the incremental cost for the expansion of the support center would be absorbed by higher income due to more transactions within the platform.

To validate our hypothesis, we used information from an experiment carried out in the company, where the new support access functionality began to be provided to a small random group of customers in Brazil. In addition, in order to quantify the impact of the new support functionality, we built a second random group of users as a control group. Regarding the data used, we had to build the database from the company's systems, which we accessed through SQL. The time period

considered was 17 months, of which 12 belong to the period prior to the experiment and 5 to the period after that. Given the high number of products offered by fintech and the length of the period to be considered, the final database used comprises a total of more than 500 fields, for a total of 3.6 million users.

In section 3, we first empirically showed the negative impact that not pursuing this strategy would have generated for the company. Using data from customer satisfaction surveys (i.e., Net Promoter Scores), we were able to highlight that lack of customer service negatively impacted on retention rate and frequency of use in one of the fintech products. The results showed that users that are detractors specifically because of bad customer service were among the least retained in the future (33% of retention rate and 1.2 usages per customer in the next 3 months after answering the survey), and that such a negative effect was amplified when they mention “difficulty of accessing the support center” as their main reason to complain.

In sections 4 and 5 we present the central results of the analysis. Using the Kruskal-Wallis statistical test, we were able to obtain two important results that validate the proposed hypothesis:

1. By turning on the new support center access functionality, we increased the number of contacts generated by users by 134%.
2. By turning on the new support center access functionality, we increased the amount of money transacted on the platform by 2.2%, which represents 11 dollars more per month per customer.

Following up, in section 6 we present a sensitivity analysis to assess whether the incremental cost of having to expand the support center by 134% was indeed offset by higher gains from a 2.2% increase in platform activity. The final results in the fintech finances turned out to be positive and shows that the project is economically viable, which gives us the necessary argument to move forward with the initiative to start providing this new support functionality to 100% of the clients.

In sections 7, 8 and 9 we carry out a secondary, but not less important, analysis regarding the prioritization of users for the activation of the new functionality. Given that we cannot increase the capacity of the support center by more than 7.5% of the current installed capacity at any given time (section 7), we had to evaluate how to segment and prioritize fintech users, in order to define to which customers we should start providing this new functionality in each of the 18 stages of the implementation project. Using the K-means algorithm, we grouped fintech clients into 5 different

clusters and proposed a prioritization strategy that allows not only to benefit the most active clients in the platform, but also to maintain balance in the ecosystem through the inclusion of users from all clusters in the early stages of the project.

Finally, we want to address the limitations of this paper and to discuss future research ideas that could extend or even improve the analysis carried out.

First, we have to highlight that when estimating the incremental demand of the support center after implementing the new functionality, we assume that the average time it takes to answer each user's claim is the same before and after the experiment. In the analysis, we used the variable of the number of cases that enter to the support center, when we should have used the amount of time incurred in answering the various cases. Unfortunately, we had to resort to using the suboptimal variable because we did not have data regarding the time it takes to respond to each case.

Second, to evaluate the economic viability of the new support functionality, we only used data from transactions carried out by customers in the following months. What we did not take into account is the impact generated in the NPS metric after new functionality was offered. Even though it is obvious that it improves, it is very difficult to quantify its indirect effect on the company's bottom line. Understanding that an improvement in the NPS translates into better and greater recommendations of the platform by customers to their friends, colleagues and family, we should include this impact as a variable in the model. Fortunately, the results considering only the direct effect on each of the users (the amount transacted in the platform) are enough to justify going ahead with the project.

Finally, although the evaluation of the economic viability of the project is the most important section of the paper, there are two possible improvements regarding the segmentation and prioritization of users carried out in sections 8 and 9. On one hand, when clustering users, we used as model variables the transactions carried out by customers in the different product categories, when the inclusion of other variables could also be evaluated. For example, an interesting possibility would be to contemplate the number of social interactions that each customer has within the platform, which would allow prioritizing these cases in order to maximize the effect of the positive recommendation of the platform (i.e., social network analysis). Lastly, we know that there are almost infinite ways to prioritize users to start delivering this new functionality. In the present work we use one of them as an example, although it would be possible to build an optimization model that prioritizes customers by means of maximizing a pre specified function.

11- Appendix 1

Customer retention rate for the period before the experiment.

	Control group	Treatment group
Users with activity	49935	50074
Retained users	18606	18702
Retention rate	37.26%	37.35%

The results were calculated using information of the 12 months prior to the start of the experiment. The customers taken into account were those who transacted on the platform in 10 of the previous 12 months (Users with activity), while the retained users are those who continued using the platform in the next two months (Retained users), just before the start of the test.

The results show a slightly higher retention rate for the treated group, but this is not statistically significant. $Z = 0.29$, $p = 0.39$. The comparison between groups is valid.

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