

Applying Design Thinking to Address Users ATM Deposits Needs

A Case Study on the Financial Sector

Arturo Moquillaza
Pontifical Catholic University of Peru
Lima, Peru
email: amoquillaza@pucp.pe

Joel Aguirre
Pontifical Catholic University of Peru
Lima, Peru
email: aguirre.joel@pucp.pe

Fiorella Falconi
Pontifical Catholic University of Peru
Lima, Peru
email: ffalconit@pucp.pe

Freddy Paz
Pontifical Catholic University of Peru
Lima, Peru
email: fpaz@pucp.pe

Abstract—Nowadays, people can use their nearest Automated Teller Machine (ATM) to perform different banking transactions, such as cash withdrawals, cash deposits, bill payments, and transfer of funds between accounts and other banks. However, the total of deposits and cash payments that are made are still low, since ATMs do not give change, and in that sense, everything depends on the total to be paid be equal to the bills the client has available to deposit. This is due to what Shy calls “the burden of receiving and carrying change”. In this study, we used Design Thinking, as part of a development team, to address a problem as a challenge for the ATM channel of a well-known bank in Peru. As the problem, we found that the denominations an ATM could dispense generate a significant amount of not withdrawable change that makes people avoid the ATM, forcing to clients and not clients look for a human bank teller to make their operations. This bank adapted and incorporated Design Thinking into its Design practice inside and outside its corresponding division. A solution was proposed from the application of the methodology, giving encouraging results and motivating the financial customer to use other financial products to manage change in ATM cash operations.

Keywords – *Human Computer Interaction; Interaction Design; Self-Service; Automatic Teller Machine; Cash Deposit; Design Thinking; Cash Payment; Banking; Innovation.*

I. INTRODUCTION

The introduction of Automated Teller Machines or ATM was intended to decongest the banking halls as people can now go to the nearest ATM to perform their financial operations [1]. Odusina opined that ATM is a technological product developed to enhance quick service and diversified financial services, such as deposits, withdrawals, funds transfer, and payments [2]. However, according to Shy, experts consider that paying with bills subjects the user to what is known as “the burden of receiving and carrying change”. This burden is more substantial when the change is farther away from multiples of the available bills at an ATM, where customers look for smaller denomination coins [3].

About the "burden of receiving and carrying change" experienced by clients of banking institutions, this refers to the cost of obtaining cash, counting and receiving change

after each transaction. Shy explains that there is a cost proportional to the difference between the available cash and the payment amount. Shy also explains that Knotek called this problem the "relative inconvenience of price" [3]. In that sense, it is expensive for clients to have the exact cash to make the payments that they must make in cash, and in addition, it is unlikely that the payment amount is in multiples of 10, and that no change is required at the end of the transaction. This means that, in the long run, clients end up entering the branch looking for a human teller to perform their deposit or cash payment operation. The first suggestion would be to allow ATMs to give change, but technical and economic restrictions consider this solution as unfeasible in the context of a well-known bank of Peru.

In the past, digital developments were traditionally dedicated to the IT (Information Technology) Departments, but since customer behavior is changing, it is not enough simply to offer new digital services, or just copy the existing ones of the competition [4]. The concept of Design Thinking has driven successful innovation in several industries [5]. Adopting Design Thinking enables bankers to bring customers into consideration so they can know what the clients need and how the service should be delivered to be the most beneficial for its users [6].

In addition, there is insufficient consideration of user centered design guidelines or methodologies in the design of the interfaces for embedded systems in the ATM. This factor is critical to overcoming the complex financial environment [7]. This paper presents a case study, held in BBVA Peru, a leading bank in that country, where a Design Thinking approach is applied to bring a solution for “the burden of receiving change” its customers face when performing deposits and cash payments at an ATM, and, therefore, enter the branch for assistance.

The conducted Design Thinking process consisted of four stages: Comprehension, Ideation, Prototyping, and Evaluation. This was part of a Design Challenge organized in BBVA Peru by Design UX division. The paper is organized as follows. Section II describes other successful cases where Design Thinking was applied in the banking industry. Section III describes in detail the problem that was addressed in this Design Challenge. Section IV describes,

step by step, the process conducted. Section V concludes this work.

II. DESIGN THINKING IN THE BANKING INDUSTRY

According to Brown, Design Thinking is a human-centered approach to finding the best ideas and solutions [8]. In the literature, there is some evidence of the application of Design Thinking in the financial sector. Klepek [6] made a study of five banks that implemented this approach. In that study, he mentioned the following cases:

- The ANZ Banking Group developed [6] a cutting-edge mobile app for their employees and changed the organizational culture to be more user-centered.
- The Juniper Bank redesigned [6] its Web banking making it more user-friendly by changing its customer service strategy.
- The PNC Bank developed [13] a new concept of Virtual Wallet with a powerful visualization to help customers with their savings management.
- The Suncorp used Design Thinking [6] visualization to successfully merge with the insurance giant Promina with a 94% rate of employees who understood the new post-merge vision.
- The Bank of America brought the “keep the change” [12] idea that enables customers to transfer small amounts of cents from every purchase they make, enrolling more than eight million users.

However, this kind of cases where banks include customers in the innovation process, usually engage with a specific business division, such as retail banking, but rarely with divisions such as IT [9]. The Deutsche Bank understood this need and adopted Design Thinking allowing them to get final user feedback on quickly developed or incomplete prototypes of new services [9]. To align to these ideas, the BBVA is focusing on implementing Design Thinking in the IT divisions.

III. CONTEXT AND THE REAL PROBLEM

For the BBVA Peru Bank, as in the rest of local banks, the ATM channel is still the most used by its customers. Despite the fact that it has more than 300 deposit ATMs, more than 40% of its bank branches are still crowded. This affects the digitalization of the bank, having only 40% of the deposit and payments made through this channel because of “the burden of change”.

According to Shy [3], when people face financial transactions that involve cash, they carry the burden of receiving and carrying their change (coins and low denomination bills). This is what he calls “the burden of change”, based on his study [3]. Paying with cash subjects the clients to receiving and carrying change, depending on the payment amounts. Shy observed that people tended to change to debit and credit cards when the amount exceeded the threshold of \$20. This affects directly the services an

ATM could offer, such as payments in cash and cash deposits, making people employ other channels.

Following the adoption of Design Thinking started by other banks, a few years ago, it was adopted by BBVA as the way of working for all its Design teams worldwide, as part of its digital transformation process. In addition, Design Ambassador Programs are carried out for all teams of the organization. In this sense, in BBVA Peru, teams other than the Design team are applying Design Thinking or adaptations in their own design and development processes [10] [11]. According to this, the ATM developing team from BBVA Peru is adopting those approaches and others in order to find an innovative solution to problems and pain-points. In this context, the proposed challenge was to solve the “burden of change” that final users of ATM face at the time of depositing and paying. This burden makes the users decide to look for a human-teller and stop using the ATM channel.

IV. CASE STUDY: APPLYING DESIGN THINKING

Tim Brown mentioned that Design Thinking is a system of space rather than a predefined series of orderly steps [8]. This case study was developed in the context of a Design Challenge inside the Bank. For this case study, the Design Thinking approach used was the adaptation the BBVA made [10] and socialized via Design Challenges for the local Banks as BBVA Peru. This motivates every team to align to the objectives of the organization. These Design Challenges had the constraint that the teams must employ the methods and approaches the organization had. In this particular case, the constraint was to use Design Thinking to design an innovative solution for the ATM channel.

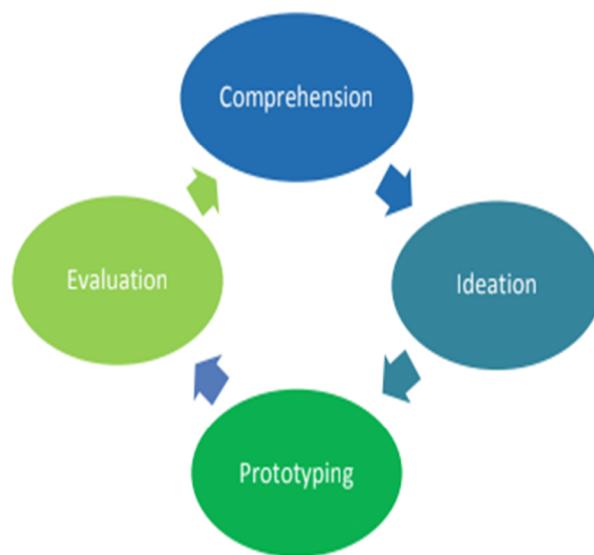


Figure 1. Phases of design thinking. Adapted from BBVA.

The following subsections, from A to D, detail the methods employed in this case of study. Subsection E details the results of the application. Finally, in subsection F, the experience is discussed. The phases followed were Comprehension, Ideation, Prototyping, and Evaluation, as we illustrated in Figure 1.

A. Comprehension

This phase consisted of two steps: the first one was about research and the second was about the analysis of the research made. The objectives of this last step, and in general of the first phase, were to empathize with the problem and obtain insight from the users. We detail methods and techniques we used in each step, as follows:

1) Research

a) *Defining the Objective:* The first step for the comprehension consisted in making the team aware of what they know, what they do not know, and who can give relevant information to the project. For this, a Field Study/Observation was held in two bank offices located at crowded avenues. We visited two bank branches that had a Deposit ATM inside. We observed that 3 out of 5 people who approached the ATM with cash in hands ended up performing their operations with a human teller. All the Service Payments were performed in the office instead of the ATM because the payment amount was not exact and the change was not withdrawable. On the other hand, all the users who made deposits showed familiarity and ease of use when performing this operation at the ATM. The customers who approached the branches did not know the operations that could be done at the ATM, in those cases the human teller helped them to migrate.

b) *User Profile:* Three user profiles were made to reflect the typical user of the Deposit Operation on ATMs. These profiles were ideated based on the users observed in the previous step. A man with technical studies who pay bills, a woman who manage the economy at home, and an elder woman not so familiar with technology and still carries cash. For all the profiles, gender and age were described, and why is important to talk to that profile.

c) *Interviews:* A semi-structured interview were conducted and addressed to people who matched the user profiles created. We selected six different final users, three young people, two men and a woman, with technical knowledge, two middle-age women, and one elder with low technical knowledge. The interview consisted in open questions about four main things, what they worry, what they wish, how they imagine the future, and what they need. The participants were customers from BBVA Peru and other leader banks in the country. We add time for a free conversation where each participant could talk about the problems they face when performing financial operations that involves cash and change in coins or bills. From all the interviewed customers, five out of six participants preferred using the ATM when carrying cash instead of the bank

office, but all of them agreed on the idea of an ATM that can give the exact change with coins if possible.

d) *Competitor Analysis:* The last step of the research consisted in the analysis of other solutions that the competitors might have implemented already. Three leading local banks were analyzed and the BBVA Spain. The analysis was aimed to find which competitor offers a solution to the “burden of change”. The results showed only one Peruvian bank that gives change in their ATM that dispense coins. This ATM with coins dispenser is also used in BBVA Spain; however, it is expensive to implement in the Peruvian context, and were given as a constraint for this experience.

2) Analysis

a) *Empathy Map:* The first step was empathizing with the final users and understanding their motivations in order to have a process guided by the user needs. The empathy map generated considering four aspects:

- What they think and feel. This aspect showed that clients were not comfortable with carrying cash after making operations. This affected to their sense of security directly. In addition, the fact that ATM dispense only multiples of twenty made them to prefer a bank teller to the self-service.
- What they see. Throw observation, the team could evidentiate what the final users actually see in their daily visits to an office bank. Crowded offices, ATM that captured bills occasionally, and in most of the cases, their relatives influenced into selecting the bank-teller as a better way to perform their transactions.
- What they hear. The bank-tellers always tell the users that using the mobile banking is easier and safer now, but the observed sample claimed that they did not feel that was true. In addition, they heard about fraud stories, other people complaining in social media and others having trouble with the ATM. On the other hand, they are aware of a new type of ATM that dispense coins and that more people employ a debit or credit card.
- What they decide to do. They only used the ATM when the office was really crowded. If the office seemed empty to them, they went straightforward to the bank-teller inside the office. However, they were opened to the idea of not entering the account number (hard to remember), to the idea of not going to the office, and to use another attention channel with the same services as in the office.

b) *Insights Discovery:* In the Empathy Map, we identified what the customer felt and thought, what he or she saw and heard, and what he or she actually decided to do. This lets us identify the greatest pain points of the final users interviewed, which are listed as follows:

- People would continue looking for a human teller while the ATM did not offer any solution to the “burden of change”.

- The customers who paid at the ATM were not very digitized.
- The most important aspects for the clients to consider were security and fastness.
- The final users associated the word “change” with “money in cash” or “coins”.
- There was inadequate communication between the bank and its customers about the available channels.
- The final user did not perceive the value of the ATM for deposit operations when he or she was at the office due to the insufficient ubiquity about this type of ATM.

B. Ideation

After analyzing the context and comprehending the final user’s problem, it was necessary to define the exact necessity that would be solved. After that, the ATM team started the ideation of possible solutions. Finally, a meeting was held to converge all the different ideas.

1) Rethinking the challenge

a) New challenge: Based on the six insights discovered in the last phase of comprehension, and the constraint mentioned, the team defined the following specific challenge: “How could we give alternative options to physical change, quickly and safely, to achieve greater digitalization of our clients and non-clients?”

2) Generating Ideas

The ideation was started with a brainstorm performed between all the ATM team. For this collaborative idea-generation task, the team started with a divergent process, but later the ideas were filtered through a convergent process.

a) Divergence: All the member proposed different solutions; for instance, using typical operations, payments in advance and commission discounts, transfer change to a “savings account” without account number, integration with a “saving goals” program, convert the change into redeemable “bank points”, and a complex system where the change is transformed into coupons.

b) Convergence: In this process, the team classified ideas by their relevance. For this, each member assumed a role in the judgment: one member assumed the role of a positive and optimistic customer, the second member assumed the role of a negative and pessimistic customer, and the third one assumed the role of an internal user of the bank who ensured that the business goals were met. At the end of the process, the team made an election of the most relevant ideas. One was discarded and, from the rest, the team took the top three into consideration for the solution: transfer to accounts without the need of account number, integration with a “saving goals” program, and using typical operations.

C. Prototyping

Once the ATM team formulated, filtered and selected ideas, the next step was prototyping. First, a low fidelity prototype was made. Here, the user interaction was needed so we could progress to the high fidelity prototype.

1) Low Fidelity

The low fidelity prototype was a result of a paper prototyping. All the workflow for this operation was drawn. Examples of this are shown in Figure 2 through Figure 4.

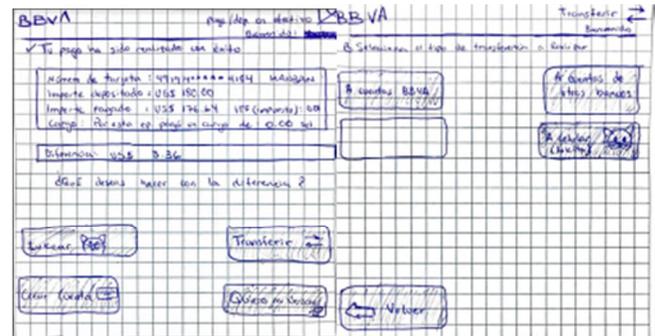


Figure 2. Low fidelity prototypes (I).

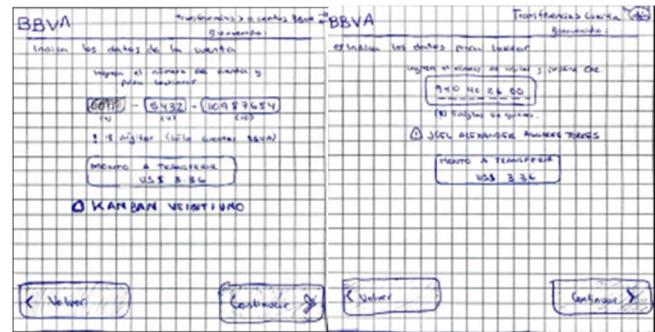


Figure 3. Low fidelity prototypes (II).

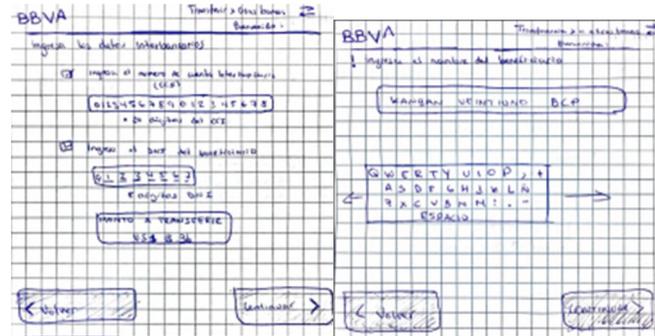


Figure 4. Low fidelity prototypes (III).

2) High Fidelity

The high fidelity prototypes were made taking into consideration what was found by evaluating the low fidelity prototypes. The team added a message for the user in order to notify in advance about the change they would receive. After finishing the operation, the team asked what the user would like to do with the change.

In Figure 5, we show how we notify the user differently for the payment amount and the deposited cash. With this information, the users will know in advance the amount of change they would receive, so they could make a better choice of what to do with this amount.



Figure 5. Notifying the user about the change.

Figure 6 shows the last screen of the payment operation where a sub-menu was introduced, giving the user options to manage the change. Also, we added messages to make clear to the user what would be done to their change. These options corresponded to the ideas selected in the last phase.



Figure 6. Asking the user what to do with the change.

D. Evaluation

This phase started with the elaboration of a list of activities. The users were recruited following the user profiles defined in the first phase of comprehension. The participants were internal users that were interested in the Design Challenge and wanted to collaborate.

1) User Testing

The user testing was held using the installations of the ATM laboratory of the BBVA Peru. Five final users were invited and asked to interact with the high-fidelity prototypes and complete a cash payment simulation where they had to transfer the change to a different account, but without using the account number, instead, they were asked to use another financial product that requires only a phone number.

For these tasks, the prototypes were displayed in a real ATM located in the ATM Laboratory. The “thinking aloud”

method helped in the tests. The participants had to raise their voice and tell the evaluator their feelings and ask questions, if they had any.

After completing the operation proposed, the participants were asked about the first impressions they had, the positive and negative aspects they found, and a final appreciation on a scale from 1 to 5. In the evaluation phase, the users found some improvements were needed in the iteration of the prototype. These changes were focused on the button of “return of change”, some text boxes that were confusing, and the last screen where the details of the completed transfer were shown in a non-friendly way. Figure 7 shows the participants during this evaluation.



Figure 7. User Testing.

2) Design Iteration

The participants liked the solution proposed. They found some confusing texts and images in the interfaces that had to be fixed through a design iteration. Some of the problems found in the interfaces were, for example, a button that confused the user with an image that might not relate correctly to the functionality of the button itself. Some texts were displayed repeatedly over more than one screen, and the final information about the change transfer was unclear to the user because a lot of unnecessary information was displayed. These errors are shown in Figure 8 and Figure 9, with a red circle to emphasize them.



Figure 8. Problem in the button.

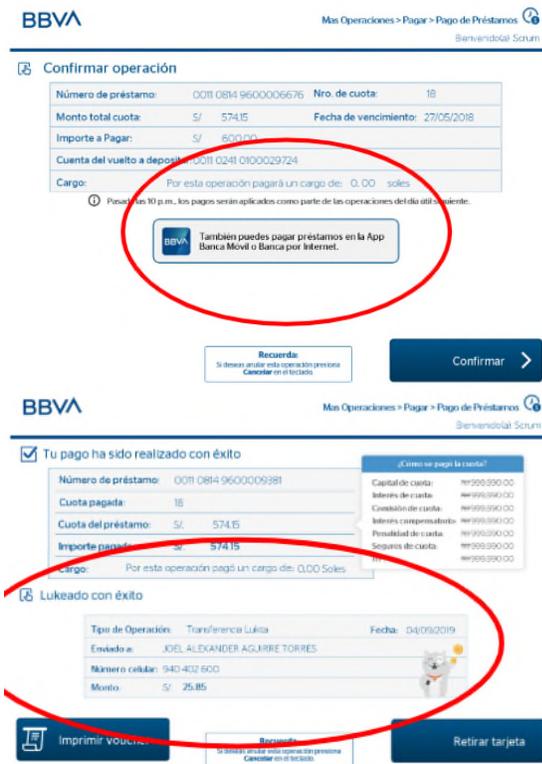


Figure 9. Problems in the text box and information.

E. Results and Valuable Final Proposal

A redesign was done after the user testing, so we could fix the problems they had. After another interaction the users had with the redesigned interfaces, we could finally accept a final proposal that really adds value. Figure 10 and Figure 11 show the final valuable proposal.

F. End of the Experience

The design experience using Design Thinking ended with the delivery of the prototypes in the context of the Design Challenge mentioned. After this, the most relevant projects were selected to be presented to a panel composed

of all the departments of the bank, especially the business department. This project was selected as one of the finalists. In the presentation, the experience and everything learned was shared, and valuable feedback could be obtained from the business areas, as well as plans for future implementations of the presented work.

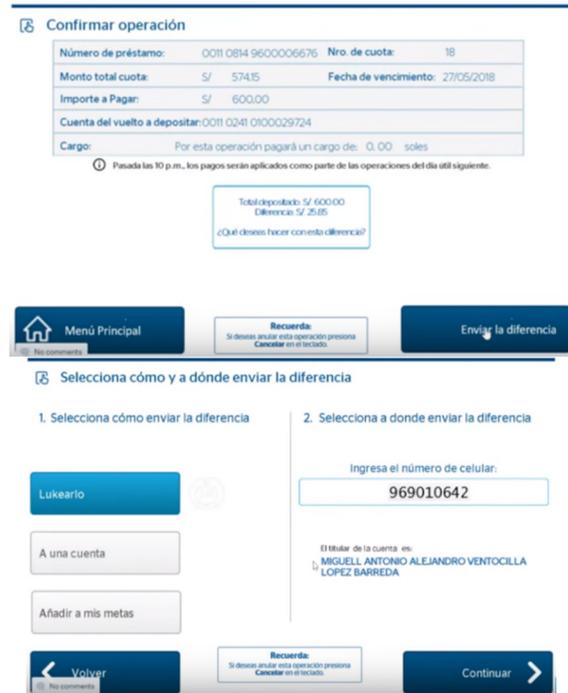


Figure 10. Valuable Final Proposal (I).



Figure 11. Valuable Final Proposal (II).

V. CONCLUSIONS

The Design Thinking approach allowed us to propose an innovative solution to the problems that users discovered, adding value to the prototypes. This assured that the final prototypes improved the experience of the final user because the whole design process was user-centered. At the end of the process, we made an analysis of the results and could identify what we learned.

In general, the participants of the evaluation found added value in the new proposed interfaces, considering using them according to their necessities. However, the participants opined that the solutions only solve the “burden of change” partially. They mentioned that, in the Peruvian context, the users who paid in cash expect their change to be in cash so they could use it somewhere else, for instance, transportation or groceries.

From this challenge, we learned that Design Thinking is an approach that seeks innovation. Adopting the approach proposed by the organization brought encouraging results and created an expectation in the impact it would have if we integrate it into the whole construction process. However, it is a constraint and different results could be delivered by adopting different design approaches, but this first step aligned with one of the principal strategies of the organization helped the ATM team to be more emphatic with the final customer.

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REFERENCES

[1] E. O. C. Mkpojiogu and E. A. Augustine, “The user experience of ATM users in Nigeria: a systematic review of empirical papers,” *International Journal of Science and Engineering Applications*, June 2018, ISSN 1596-8303.

[2] A. O. Odusina, “Automated Teller Machine usage and Customers’ Satisfaction in Nigeria,” *Type: Double Blind Peer Reviewed International Research Journal* Publisher: Global Journals Inc, 2014, 14(4), ISSN: 2249-4588.

[3] O. Shy, “How the ATM Affects the Way We Pay,” *Federal Reserve Bank of Atlanta, Working Papers*, February 2019, doi:10.29338/wp2019-02.

[4] P. Fehér, and K. Varga, “Using design thinking to identify banking digitization opportunities – Snapshot of the Hungarian banking system,” *30th Bled E-Conference: Digital Transformation - From Connecting Things to Transforming Our Lives, BLED 2017, December 2017*, pp.151–168, doi:10.18690/978-961-286-043-1.12.

[5] A. J. H. Chia, and J.-J. Lee, “Banking Outside-in: How Design Thinking is Changing the Banking Industry ?” *IASDR 2019*, October 2019.

[6] C. Klepek, “Design Thinking: The case of Banking Services,” *Proceedings of The 5th International Conference Innovation Management, Entrepreneurship and Sustainability, IMES 2017*, pp.416–425, 2017, Available from <https://www.ceeol.com/search/chapter-detail?id=544899>

[7] J. Aguirre, A. Moquillaza, and F. Paz, “A User-Centered Framework for the Design of Usable ATM Interfaces,” *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, 11583 LNCS, July 2019, pp.163–178. doi:10.1007/978-3-030-23570-3_13.

[8] T. Brown, “Design Thinking,” *Interaction Design Foundation 1*, Available from <https://www.interaction-design.org/literature/topics/design-thinking>, retrieved: January, 2020.

[9] C. Vetterli, F. Uebernickel, D. Stermann, and C. Petrie, “How Deutsche Bank’s IT Division Used Design Thinking to Achieve Customer Proximity,” *MIS Carterly Executive*, March 2016.

[10] A. Moquillaza, F. Falconi, and F. Paz, “Redesigning a Main Menu ATM Interface Using a User-Centered Design Approach Aligned to Design Thinking: A Case Study,” *International Conference on Human-Computer Interaction*, pp. 522-532, July 2019, Springer, Cham, doi:10.1007/978-3-030-23535-2_38

[11] BBVA, “Design Thinking. Serie Innovation Trends. BBVA Innovation Center,” 2015, Available from https://www.bbva.com/wp-content/uploads/2017/10/ebook-cibbva-design-thinking_es_1.pdf, retrieved: January, 2020.

[12] Keep the Change Savings Program from Bank of America. Retrieved March 17, 2020, from <https://www.bankofamerica.com/deposits/keep-the-change/>

[13] Virtual Wallet is Checking & Savings. Together. PNC. Retrieved March 17, 2020, from <https://www.pnc.com/en/personal-banking/virtual-wallet-overview.html>