


ARTICLES

# The implementation of Open Banking in Brazil: an overview from the perspectives of professionals from large retail banks

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## ABSTRACT

**Goal:** To provide an overview of the implementation of Open Banking in Brazil from the perspectives of financial sector professionals and specialists.

**Design / Methodology / Approach:** A systematic literature review was conducted on three databases: Scopus, Web of Science, and BDTD. This led to the selection of 15 articles discussing the implementation of Open Banking in Brazil based on key variables from international literature. Questionnaires were used to investigate divergences and additions to the theoretical findings among a group of 150 specialists. The results obtained in the questionnaire were analyzed through the application of multivariate statistical techniques, in addition to qualitative techniques.

**Practical Implications:** The main benefits and difficulties faced by countries that have already experienced Open Banking implementation were identified. The perception of respondents from different groups was investigated regarding the implementation of this system in Brazil and potential business models stemming from this phenomenon. Thus, this study offers an overview of Open Banking implementation in Brazil from the perspectives of financial sector specialists.

**Originality / Value:** The overview of Open Banking implementation in the Brazilian banking sector is highly connected to investments in technology. This process has been disruptive, requiring banks to adopt a client-centric strategy instead of one based on products and services. As for the regulatory aspects, despite the country possessing a favorable environment for the development of new products and services stemming from Open Banking, banks are facing challenges to fulfill the implementation schedule established by the Brazilian Central Bank.

**Keywords:** Open Banking; Regulation; Digital Transformation; Client Experience; Retail Banks.

## INTRODUCTION

Open Banking was a pioneering initiative taken by the United Kingdom, beginning in 2017 with the goal of increasing competition and innovation in that country's banking market (Open Banking Implementation Entity, 2019). This project was created by the CMA – COMPETITION AND MARKETS AUTHORITY on behalf of the United Kingdom's government

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(Competition and Markets Authority, 2020). The CMA's main motivation in this project was to use technology to recalibrate the banking market in favor of consumers through an open banking system (Open Banking Implementation Entity, 2019).

Specifically in Brazil, the country's Central Bank began the process of regulating and implementing Open Banking with Memorandum N° 33.455, of April 24th, 2019, establishing the proposal's main guidelines. The initiative seeks to promote higher competition and efficiency in the Brazilian banking sector, especially in the credit market and in payment services.

According to Brazil's Central Bank, Open Banking is defined by the sharing of data, products, and services among different financial institutions depending on clients' choices when the data refers to them, through the creation and integration of information system platforms and infrastructure, in a secure, quick, and convenient manner. Currently, the banking and financial data of clients in Brazil is stored in the systems of the institutions they use. In this new open environment, there is the possibility of integrating payment systems and financial product and service platforms. For this transformation to occur, it is important to have a strong regulatory environment, which establishes operational, normative, and technological standards.

Considering this new innovative regulatory scenario, Open Banking presents itself as a movement that will transform the operating mode of Brazilian banking system agents (Perez; Strohl, 2019). This digital transformation in the banking industry is a global movement and traditional financial institutions must decide how they want to begin this process, considering the impact for the interested parties (Frei et al., 2019).

Thus, the goal is to provide an overview of the concept of implementing Open Banking in Brazil from the perspectives of financial sector professionals and specialists.

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## **BACKGROUND RESEARCH**

### **Open Banking**

The Open Banking phenomenon is considered one of the biggest challenges facing retail banks around the world today (Ramdani et al., 2020). Despite being a current topic, this is a topic that has been discussed for 20 years, having started in Europe, given the existing challenges for the integration of a single payment and transfer system between member countries. In this context, the European Commission launched the SEPA project – Single Euro Payment Area and PSD1 – Payment Services Directive, whose main objective was to harmonize and integrate electronic retail payments in the region (Bolt and Schmiedel, 2009).

The PSD1 established a broad set of rules regarding payment services in European Union (EU) member states, as well as in six other countries outside the EU (Fiorini and Vasile, 2011). It was

created with two main objectives, the first being to promote greater competitiveness in the payments market by removing entry barriers for new institutions. The second aimed to simplify and standardize the regulation in the use of financial services. This was a far-reaching act aimed at restructuring the entire European Union payment market (Polasik et al., 2020).

Despite being considered disruptive regulation at the time, PSD1 was not ready to withstand the challenges surrounding the growth of payment services in the region. In addition, the development of innovation parameters and new market participants was neglected in the directive (Adeyemi, 2019). Issues related to security, privacy and oversight of information sharing systems needed to be improved to increase consumer confidence in the payment services regime (Wandhöfer, 2008). Faced with these challenges that could not be faced in PSD1, there was a need to publish PSD2 – Second Payment Services Directive.

According to Adeyemi (2019) the new PSD2 regulatory regime was published by the European Commission in December 2015, seeking to meet customer needs and incorporate the evolutions that have taken place in recent years in the payment services market. Significant improvements have been made to increase competition in the payments industry, reduce costs, open the market to new entrants and improve consumer protection. The new directive would come into effect on January 13, 2018.

Particularly in Brazil, the Central Bank of Brazil initiated the process of regulation and implementation of Open Banking through Communiqué No. 33,455, of April 24, 2019, establishing the main guidelines that will guide the proposal. The initiative seeks to promote greater competition and efficiency in the Brazilian banking sector, especially in the credit market and payment services.

According to the Central Bank of Brazil, Open Banking is defined by the sharing of data, products and services by financial institutions and other financial institutions, at the discretion of their customers, in the case of data related to them, through the opening and integration of information systems platforms and infrastructures, in a safe, agile and convenient way.

Currently, banking and financial data of customers in Brazil are stored in the systems of the institutions with which the relationship is established. In this new open environment, the possibility of integrating payment systems and platforms of financial services and products is foreseen. To enable this transformation to take place, a strong regulatory environment is needed that sets operational, regulatory and technological standards.

Traditional banks should focus their strategies on partnering with Fintechs, since they have a modest size and a specialized focus. The vicious circle of doing nothing is the main threat to banks (Petralia et al., 2019; Salmony, 2019).

Given the various initiatives that are being adopted with Open Banking, banks are facing an opportunity to alleviate the competitive pressure on them through partnerships. Fintechs can help develop new apps and services via app, facilitate compliance systems, and develop solutions to reduce customer pain and demands. In this context, traditional banks no longer must take care of everything themselves. They can act strategically, selecting the best Fintechs to achieve their organizational strategy (Salmony, 2019).

According to Salmony (2019) if banks are not willing to move together with a common goal, they will be forced to reinvent themselves by the regulator, new competitors or pressure from public opinion. On the other hand, if regulators perceive that banks are preparing for change and improving in terms of products and services, they will have much less motivation to develop a regulation that forces banks to act towards modernization.

According to Petralia et. al. (2019), the architectural projects of bank branches and bank headquarters are designed to inspire confidence and security in customers. The buildings are imposing, the lobbies are luxurious and full of security guards, symbolizing the protection of the money deposited in the institution and the maintenance of the privacy of the clients' financial data. This relationship of trust provides traditional banks with a low-cost source of funding to conduct their banking business.

About the regulatory aspect in Brazil, the country has been following the global trend and has entered the debate on Open Banking. The current regulation provides for the exchange of information between Brazilian institutions as well as the sharing of information with third parties, provided that fiscal secrecy is guaranteed and there is the consent of the user and data subject (Perez and Strohl, 2019).

Regulation plays an important role in Open Banking initiatives in Brazil as it forces the sharing of data from the largest financial institutions, stimulating competitiveness. If, on the one hand, strict regulatory measures can create an unfavorable environment for innovation and the development of competition, the total absence of regulation favors an increasing concentration in the main banks (Squassoni, 2019).

## Technology

The challenges that banks are currently facing are not new. For at least the last century, banks have faced numerous disputes that threaten their business model. By taking a deeper look at the banking industry, we identified that banks have been investing in fintech applications and platforms for years, with a focus on cost optimization, improving customer experience, better assessing customer credit risk or even to move resources. These investments have been fundamental to the growth strategy of traditional banks (Petralia et al., 2019).

The current challenge for companies linked to the financial sector is related to data processing, using Big Data, machine learning and artificial intelligence. In the 1960s, competition among banks was related to the automation of manual and paper processes, such as check processing, accounting operations and financial reporting. The business model of large processing centers already existed and they served large banks and their respective branch networks (Petralia et al., 2019).

Faced with this new era of Big Data, financial institutions need a huge infrastructure to store, process and manage all data collected from customers (Cordeiro et al., 2019).

Banks and companies linked to financial technology are exploring new technologies capable of transforming their systems, products and services offered. In addition to seeking to improve the customer experience, these companies must deal with different data privacy requirements and regulations (Kroner, 2018). In this context, blockchain has been used in various applications and sectors, combined with other available technologies, such as artificial intelligence, big data and the internet of things (Wang et al., 2020).

Blockchain technology provides a data storage system, which can be used by a network of users, bringing more transparency and trust to users (Meiriño et al., 2019).

## METHOD

### Study Classification

The present study's model can be classified as quali-quantitative (Vergara, 2016). As for its goals, it can be classified as exploratory and explanatory (Marconi; Lakatos, 2010) since it aims to identify the main challenges and opportunities encountered by Brazilian banks in implementing Open Banking in the country from the perspectives of the literature and financial market specialists.

This was developed with a methodological structure composed of a theoretical aspect and an empirical one, as proposed by Araujo (2011) and illustrated in Figure 1. These aspects, despite being separate, complement each other and are linked with the intention of fulfilling this study's objectives.

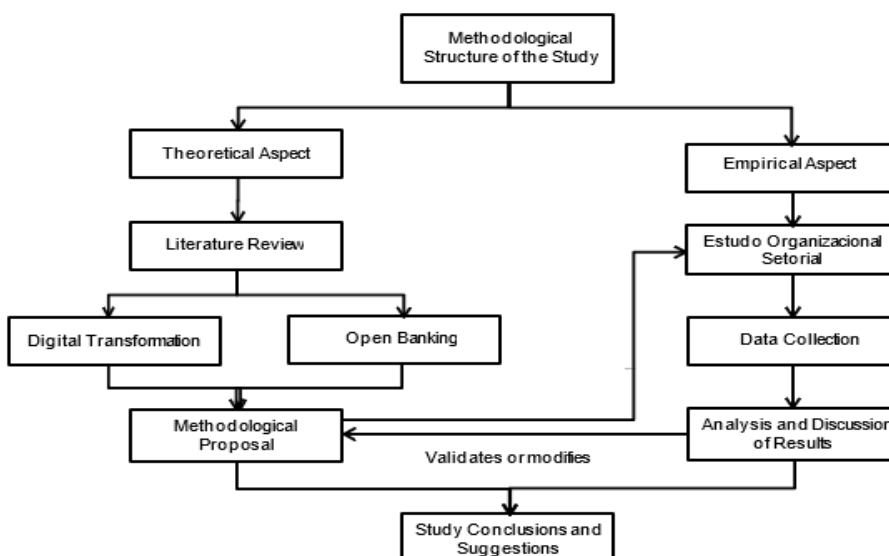


Figure 1 - Methodological structure of the study.

Source: Adapted from Araujo (2011).

The theoretical aspect has to do with the literature review that was conducted to provide a theoretical base for the topics discussed in the study, which are conceptual models that present guidelines for the digital transformation of large companies, since the innovation

model helps companies overcome their institutional restrictions, as well as the concept of open banking applied to financial institutions. These concepts serve as a base for the investigation of conceptual models.

The empirical aspect includes the collection and analysis of data from the companies in question. This employs data collection methods that enable the analysis of the sample field identified in the organization to validate the literature-based conceptual model.

The combination of both aspects leads to an analysis of the results that were found and to the conclusions that aim to answer the research question and establish possibilities for future investigation.

Furthermore, to obtain the primary data, a questionnaire was applied with key professionals involved in projects related to Open Banking at their respective institutions. This instrument was developed specifically for this goal and is based on the aforementioned literature.

### Characterization of the study's subjects

According to Silva; Menezes (2005), the study universe (population) is the sample space which contains all individuals possessing the same characteristics for a study. The sample is a part of this population and is selected according to certain rules.

The present study intends to analyze the main perceptions of key professionals within the Brazilian financial market who are implementing strategies tied to Open Banking. In this context, the research subject addresses the previously mentioned motivation, and the respondents are identified and characterized.

The criterium used for considering possible respondents as research subjects is based on the fact that they are involved at tactical and strategic levels at their respective institutions, and work on projects related to Open Banking.

To estimate the population of Brazilian professionals who conduct projects linked to Open Banking, we used the LinkedIn social network. It is the largest professional social network in the world and is used by professionals who want to present their experiences, education, and skills. The information shared by the users is self-declared. In light of this, there may be people who declare participation in activities related to Open Banking and do not, in fact, participate in such activities. On the other hand, there are professionals who conduct activities related to the topic and do not report them on the social network.

In a search conducted on LinkedIn on January 21st, 2021, the estimated population of professionals linked to the main Brazilian banks with self-declared activities related to Open Banking is of 750 professionals, as shown in Figure 2. Since these professionals are a part of different hierarchical levels within the companies (technical, tactical, and strategic), the goal was to collect data from a sample of 203 people involved in the tactical and strategic

segments, corresponding to 27% of this population and the margin of error that was considered for the study was of 5%, as per Barillet et al. (2001).

It is important to observe that due to the covid-19 pandemic and the excess of information professionals are receiving by e-mail, it was not possible to guarantee the sample number would be observed. The questionnaire link was sent to 400 professionals who reported being specialists in Open Banking, many of whom were full and senior level professionals.

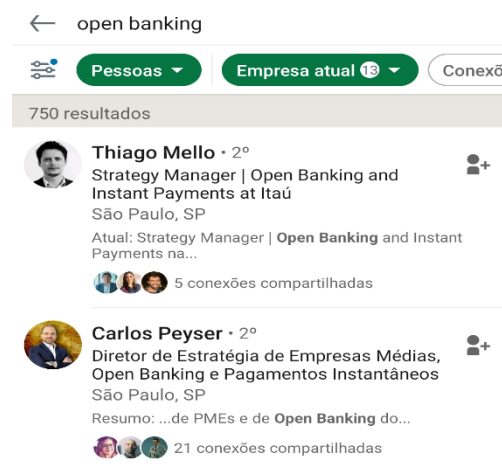


Figure 2 - Population of professionals linked to Open Banking.

Source: The author.

To reach this estimated number of professionals, the LinkedIn search tool was employed with the use of search filters such as keyword (open banking), type of search (people) and for the “current company” filter, the 13 largest financial institutions in Brazil were selected according to the classification conducted by the Central Bank in Resolution 4553, of January 30th, 2017. The chosen institutions were: Banco do Brasil, Itaú Unibanco, Bradesco, Caixa Econômica Federal, Santander Brasil, Banco BV, Banco Nacional de Desenvolvimento Econômico e Social – BNDES, Banco do Nordeste do Brasil, Banco Safra, Citibank Brasil, Credit Suisse Brasil, Banco do Rio Grande do Sul – Banrisul and Banco BTG Pactual.

Considering that the group of interlocutors is available on a social network, that it can support the current study, and also that the number of respondents who can be contacted remotely is large, the proposed form of contact was the sending of a personalized message including the data collection instrument, which was composed of open and closed questions.

The data collection instrument was transcribed onto the Google Forms platform and the questionnaire was provided to the research subjects at the following link: <https://forms.gle/NG2YZnysxPFP9Wvj8>.

### **Data collection technique**

First, the data collection happened through a bibliographical search for secondary sources. The data was collected through a bibliometric survey, using the PICO acronym and with the use of the Cochrane protocol for systematic literature reviews on databases.

The procedure was applied through a form containing a questionnaire which aimed to analyze the perception of specialists regarding technological, regulatory, and strategic aspects of Open Banking implementation in Brazil.

The interviewees received their forms ahead of time and were also told about the study's main points, its objectives, its relevance, and the main points of the questionnaire, as per Marcos; Lakatos (2003).

With support from the literature, a questionnaire was created to be used as a guide for analyzing organizational adherence. The instrument was created considering the study's specific objectives, with theoretical support from the literature and a heterogeneous respondent profile.

### **Quantitative data analysis**

To condense and summarize the information obtained from the questionnaire application, the chosen technique was multivariate analysis. Within the various existing multivariate techniques, the present work focused on exploratory factor analysis (EFA) type R, with SPSS (Statistical Product and Service Solutions) software. The exploratory type was chosen because Open Banking is a recent phenomenon worldwide and researchers do not possess knowledge on how these factors are related.

The exploratory factor analysis is considered one of the most used and recommended quantitative methods for large sample sizes (N), as long as N = 50 is the absolute minimum and, preferably, N = 100 (Dodou et al., 2009). EFA technique permits data reduction, identifying the most important variables or creating a new set of variables that is smaller than the original with minimal loss of information (Hair et al., 2009; Anderson et al., 2009).

### **Qualitative data analysis**

The responses obtained from the questionnaire were grouped in the following categories: respondent number, banking institution categorization, respondent's perception of the opportunities and challenges presented by Open Banking.

NVivo software was used to support the content analysis and the word frequency survey process. This program allows researchers to import material collected through open questions and helps with data management.

Finally, there is a word cloud that was created based on the word frequency list and supported by the answers to the open questions on the questionnaire. Thus, the qualitative data analysis was conducted along with content and lexical analyses.

## RESULTS

### Description of the respondents

The questionnaire was answered by 150 professionals, with 135 of them linked to banking institutions in Brazil. Among these, 126 are specialists who work directly with initiatives connected to Open Banking implementation. The questionnaire was applied between April 27th and June 10th, 2021. The 126 validated respondents represent 62% of the ideal sample size.

Regarding the 135 professionals with ties to banking institutions, 65 (47.4%) of them reported working in private banks, 49 (35.8%) were employed by mixed-capital banks, 11 (8%) worked in credit cooperatives, 10 (7.3%) worked in public banks, and 2 (1.4%) reported being employed in other sectors.

It was also possible to observe the time these professionals spent working on projects related to Open Banking: 83 (66%) of them declared working in the area for up to a year, 30 (24%) respondents worked in the area for 1 to 2 years and 7 (6%) respondents reported working in this field for more than 3 years.

As for the respondents' ages, 7 (6%) respondents were born between 1960 and 1970, 22 (17%) were born between 1971 and 1980, 70 (56%) were born between 1981 and 1990 and, finally, 25 of them (20%) were born between 1991 and 2000.

Pertaining to their education levels, most of the respondents had a higher level of educational experience. The results are as follows: 4 (3.2%) of the respondents had a technical education, 35 (27.8%) of them had a degree in their fields, 73 (57.9%) of the respondents had a Specialist's degree, 23 (18.3%) reported having a Master's degree and 2 (1.6%) of them had a doctorate.

As for the respondents' gender profile, 83 (65.9%) of them were men and 43 (34.1%) were women.

In short, the questionnaire's respondents were mostly specialists working in private and mixed-capital institutions (83.2%), who have been working with Open Banking initiatives for at least two years (90%), were around 36 years old, and possessed a Specialist's degree as their highest educational achievement (58%).

### Quantitative research results

For the quantitative questions, a Likert type scale going from 1 to 5 was used, with answers going from 1 – completely disagree to 5 – completely agree with the theoretical proposition shown in the research instrument.

### Open Banking section

Of the 126 specialists who responded, 68 of them agreed, 14 disagreed, and 44 neither agreed nor disagreed that their financial institution was prepared for the technological, operational, and client relations challenges that Open Banking will bring about during the next five years.

As for the influence of their respective institutions' organizational culture on promoting innovative actions focusing on Open Banking, amid the 126 responding specialists, 74 of them agreed, 23 disagreed, and 29 neither agreed nor disagreed.

From the sample of 126 respondents, 61 of them agreed with the topic, 30 disagreed, and 35 neither agreed nor disagreed on whether their institutions possessed a clear action strategy in Open Banking, with defined goals for the next five years.

Finally, among 125 respondents, 88 of them agreed, 15 disagreed, and 22 neither agreed nor disagreed on whether their institutions had teams dedicated to developing new products and services for clients based on the opportunities Open Banking affords banks.

### Regulatory section

In terms of scope size (operational, normative, and technological standardization) and consumer protection, the Open Banking regulations in Brazil are among the most modern in the world. Among 121 respondents, 99 of them agreed with the point, 4 disagreed, and 19 neither agreed nor disagreed.

Still regarding regulation, the next question had to do with the specialists' perception of the following statement: Brazil possesses a favorable regulatory environment for the development of innovative financial products and services. Of the 121 respondents, 78 of

them agreed with the point, 13 disagreed, and 30 neither agreed nor disagreed.

To finish the regulatory subsection, the specialists were asked to weigh in on the following question: Do Brazilian regulations promote a balance between consumer protections and the development of innovative products and services? Among the 121 respondents, 85 of them agreed with the question, 9 disagreed, and 27 neither agreed nor disagreed.

### **Technology section**

Of the 126 respondents, 74 of them agreed with the question, 23 disagreed, and 29 neither agreed nor disagreed about whether their financial institutions had enough technology to identify their clients' behavior and provide them with a personalized experience.

Regarding the importance of eventual partnerships with Fintechs to promote the advancement of the digital agenda in their respective institutions, 126 respondents agreed with the point, 48 disagreed, and 24 neither agreed nor disagreed.

The open platform business model for investment, credit, and payment products is the most adequate strategy for traditional retail banks in Brazil. Of the 126 respondents, 69 of them agreed with this statement, 14 disagreed, and 43 neither agreed nor disagreed.

To end the Technology subsection, the specialists were asked whether the number of APIs (Application Programming Interface) that were open and available for partners' use had increased at the institution where they worked since Open Banking was launched in the country. Of the 126 respondents, 103 agreed with this point, 10 disagreed, and 13 neither agreed nor disagreed.

### **Business model section**

The questionnaire's last section contemplated the investigation of 7 business models that appeared around the world after Open Banking was implemented and that, from the viewpoint of the Brazilian specialists, would be applicable in the country's banking market within the next three years.

The specialists' perception regarding the appearance of business models based on predictive risk and credit analysis using economic forecasting, artificial intelligence, behavior and Big Data to identify risks led to 83 (67%) out of 122 respondents declaring that this business model was being implemented, 26 (22%) reporting that it had already been implemented and 13 (11%) of the respondents doubting it would be implemented.

As for said specialists' perception organized by type of banking institution, private banks stand out with 32% of the respondents stating that the predictive risk and credit analysis had already been implemented. In mixed-capital banks, 79% of the specialists reported that this business model was being implemented, and in public banks, 38% of the specialists doubted that this solution would be implemented within the next three years.

Thus, the private banks stand out from the others in terms of already-delivered solutions, while mixed-capital banks are making an effort to create new products and services related to the subject and public banks consider that the solution will probably not be implemented.

Concerning the appearance of new business models connected with clients' financial management which use their behavior as a source of data and aim to make personalized financial recommendations, 108 (88%) of 122 respondents declared that this model was being implemented, while 9 (8%) stated that it probably would not be implemented and 5 (4%) said that the solution had already been implemented.

When separating this according to type of banking institution, it is clear that the private and mixed-capital banks and credit cooperatives are all focused on developing this solution. Around 90% of the specialists from these institutions declared that this business model was already a reality. The public banks exhibited a neutral profile, since 50% of the respondents considered that initiatives related to this matter probably would not be implemented while the other 50% stated that initiatives of this sort were on track to be implemented within the next three years.

The specialists' perception regarding the appearance within the next three years of business models related to data protection showed that of the 122 respondents, 73 (61%) of them stated those solutions were being implemented, 47 (38%) reported that they had already been implemented and 2 (2%) declared that their respective institutions probably would not implement this type of solution.

Dividing the responses by category of banking institution shows the private banks standing out, since 44% of them declared the solution had already been put into action, while 3% of them stated that this initiative probably would not be conducted. As for the mixed-capital banks, 74% of the specialists said the solution was in the midst of its implementation stage.



Considering this, the private banks stood out for having the highest percentage of delivered solutions, according to the specialists while the mixed-capital banks showed strong engagement in developing and delivering solutions related to this subject within the next three years.

Among 115 respondents, 60 (52%) said that business models based on sustainable consumption probably would not be implemented, 49 (43%) stated that this business model was being developed, and 6 (5%) declared that this initiative had already been implemented at their respective institutions.

When the specialists' perceptions are divided by type of banking institution, the credit cooperatives take the lead with 30% of them declaring that the solution had already been implemented. As for public and mixed-capital banks, around 65% of employees involved in Open Banking projects stated that a solution in this category probably would not be implemented. Finally, 55% of specialists from private banks declared that a solution was being developed.

Thus, it seems business models with connections to sustainable initiatives are in the focus of credit cooperative specialists since these institutions had significantly more solutions delivered in consumption and investments.

Finally, the specialists' perception regarding the appearance of business models tied to the creation of a financial marketplace with the services being provided on platforms capable of comparing banking and non-banking products and services brought up the following results: Of the 119 respondents, 82 (69%) stated they were developing these solutions, 27 (23%) said these solutions probably would not be implemented in the next three years, and 10 (8%) declared that business in this model had already been implemented.

When sorting their perceptions by type of banking institution, it is possible to observe a high level of engagement from public, mixed-capital, and private banks in developing marketplace solutions. The percentages for these institutions reached 88%, 75%, and 67% respectively. On the other hand, the credit cooperatives showed 50% of their specialists considering that an initiative of this type would be implemented by their institutions within the next three years.

### Factor analysis

Factor analysis was applied to summarize a group of eleven variables, by extracting factors that represent an overview of Open Banking implementation in Brazilian banking institutions.

Before applying factor analysis, a correlation matrix was built to investigate the existence of connections between the selected variables and to guarantee the results of this analysis. The correlation matrix shows values in the interval [-0.252; 0.672] and, thus, indicates that the connections between the variables are moderately strong. Table 1 illustrates the Pearson correlation matrix.

**Table 1 - Pearson Correlation Matrix.**

|                                     | A.1.2  | A.1.3  | A.1.4  | A.1.5  | A.2.2  | A.2.3  | A.2.4  | A.3.1  | A.3.2 | A.3.3 | A.3.4  |
|-------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|-------|-------|--------|
| A.1.2 – Technological Challenges    | 1      | .672** | .595** | .547** | -.033  | .194*  | .136   | .505** | -.046 | -.093 | .253** |
| A.1.3 – Organizational Culture      | .672** | 1      | .711** | .541** | -.054  | .073   | -.046  | .553** | -.129 | .045  | .178*  |
| A.1.4 – Action Strategy             | .595** | .711** | 1      | .565** | -.024  | .055   | -.025  | .505** | -.162 | -.034 | .136   |
| A.1.5 – New Products and Services   | .547** | .541** | .565** | 1      | -.107  | .081   | -.030  | .487** | -.088 | -.047 | .182*  |
| A.2.2 – Modern Regulation           | -.033  | -.054  | -.024  | -.107  | 1      | .290** | .416** | -.033  | .117  | -.014 | -.087  |
| A.2.3 – Innovative Reg. Environment | .194*  | .073   | .055   | .081   | .290** | 1      | .641** | .192*  | .046  | .009  | -.014  |

|                                    |            |            |            |            |            |            |       |           |            |            |           |
|------------------------------------|------------|------------|------------|------------|------------|------------|-------|-----------|------------|------------|-----------|
| A.2.4 – Balanced Regulation        | .136       | -.046      | -.025      | -.030      | .416<br>** | .641<br>** | 1     | .178      | .102       | .051       | -.042     |
| A.3.1 – Client Experience          | .505<br>** | .553<br>** | .505<br>** | .487<br>** | -.033      | .192<br>*  | .178  | 1         | -          | -.078      | .228<br>* |
| A.3.2 – Partnerships with Fintechs | -          | -.129      | -.162      | -          | .117       | .046       | .102  | -         | 1          | .305<br>** | .048      |
| A.3.3 – Open Platforms             | -.046      | .045       | -.034      | -.088      | -.014      | .009       | .051  | -.078     | .305<br>** | 1          | .150      |
| A.3.4 – Increase in APIs           | .093       | .178<br>*  | .136       | -.047      | -.087      | -.014      | -.042 | .228<br>* | .048       | .150       | 1         |

Correlation is significant at 0.01 level (two-tailed)

\* Correlation is significant at 0.05 level (two-tailed)

Source: created by the author.

To investigate whether the application of factor analysis is valid and adequate, the Kaiser-Meyer-Olkin (KMO) criterion and Bartlett’s Test of Sphericity were used. According to Hair et al. (2009), this technique seeks to provide the statistical significance that the correlation matrix exhibits significant correlations between at least two variables.

Table 2 shows that the index obtained by applying the KMO criterion was 0.761 and the significance of Bartlett’s Test of Sphericity was 0.000. When interpreting the index obtained by the KMO criterion, values above 0.70 are considered middling, values above 0.80 are meritorious and indexes above 0.9 are classed as marvelous (Hutcheson et al., 1999). A Test of Sphericity under 0.05 indicates that are sufficient correlations between the variables (Hair et al., 2009; Anderson et al., 2009). Table 2 presents the KMO and Bartlett’s Test of Sphericity results.

Table 2 - KMO and Bartlett’s Test of Sphericity.

|   |                    |
|---|--------------------|
| <b>Sample Adequacy Kaiser-Meyer-Olkin Criterion (KMO)</b> | <b>.761</b>        |
|   | Aprox. Chi-squared |
|   | 421.121            |
| Bartlett’s Test of Sphericity                             | df                 |
|   | 55                 |
|   | Sig.               |
|   | .000               |

Source: created by the author.

As suggested by Hair et al. (2009), after specifying the variables and constructing the correlation matrix, researchers are ready to apply factor analysis and identify the latent correlative structures. The method chosen for obtaining the factors in this study was ACP, and the first factor explained 31.58% of total variable variance.

Since this is an exploratory study on a subject that is not very well known, no minimum number of factors was determined for extraction. However, all factors with self-values above 1 were extracted. For this analysis, it was possible to observe that 61.62% of the original data variance is concentrated in three factors and, thus, above the reference value of 60% or more (Hair et al., 2009; Anderson et al., 2009). The remaining factors, which showed a variance level under 1%, were considered insignificant and discarded. Table 3 presents the self-values and total applied variance.

Table 3 - Self-value and total applied variance.

| Compo<br>nent | Initial Self-values |               |              | Extraction Sums of Squared Loadings |               |              | Rotation Sums of Squared Loadings |               |              |
|---------------|---------------------|---------------|--------------|-------------------------------------|---------------|--------------|-----------------------------------|---------------|--------------|
|               | Total               | % of Variance | Cumulative % | Total                               | % of Variance | Cumulative % | Total                             | % of Variance | Cumulative % |
|               | 1                   | 3.474         | 31.586       | 31.586                              | 3.474         | 31.586       | 31.586                            | 3.452         | 31.381       |

|    |       |        |         |       |        |        |       |        |        |
|----|-------|--------|---------|-------|--------|--------|-------|--------|--------|
| 2  | 1.953 | 17.756 | 49.342  | 1.953 | 17.756 | 49.342 | 1.961 | 17.825 | 49.206 |
| 3  | 1.351 | 12.279 | 61.621  | 1.351 | 12.279 | 61.621 | 1.366 | 12.415 | 61.621 |
| 4  | .954  | 8.677  | 70.297  |       |        |        |       |        |        |
| 5  | .775  | 7.043  | 77.341  |       |        |        |       |        |        |
| 6  | .677  | 6.152  | 83.493  |       |        |        |       |        |        |
| 7  | .456  | 4.144  | 87.637  |       |        |        |       |        |        |
| 8  | .429  | 3.904  | 91.540  |       |        |        |       |        |        |
| 9  | .371  | 3.375  | 94.915  |       |        |        |       |        |        |
| 10 | .328  | 2.985  | 97.901  |       |        |        |       |        |        |
| 11 | .231  | 2.099  | 100.000 |       |        |        |       |        |        |

Source: created by the author.

Continuing with the factor analysis, in terms of communality, its size is a useful index to evaluate how much variance in a particular variable is explained by the factor solution as per Hair et al. (2009). After extracting the communality factors from this study, it was possible to note that all values are above 0.406 and, among the 11 existing variables, 6 of them have an index above 0.600.

Table 4 - Communalities

|                                     | Initial | Extraction |
|-------------------------------------|---------|------------|
| A.1.2 – Technological Challenges    | 1.000   | .694       |
| A.1.3 – Organizational Culture      | 1.000   | .758       |
| A.1.4 – Action Strategy             | 1.000   | .704       |
| A.1.5 - New Products and Services   | 1.000   | .592       |
| A.2.2 – Modern Regulation           | 1.000   | .452       |
| A.2.3 – Innovative Reg. Environment | 1.000   | .684       |
| A.2.4 – Balanced Regulation         | 1.000   | .783       |
| A.3.1 – Client Experience           | 1.000   | .626       |
| A.3.2 - Partnerships with Fintechs  | 1.000   | .488       |
| A.3.3 – Open Platforms              | 1.000   | .593       |
| A.3.4 – Increase in APIs            | 1.000   | .406       |

Source: created by the author.

Next, the matrix of non-rotated components was created. However, it does not offer the most adequate interpretation. Table 5 presents the Components Matrix.

Table 5 - Components Matrix.

|                                     | Components |       |       |
|-------------------------------------|------------|-------|-------|
|                                     | 1          | 2     | 3     |
| A.1.2 – Technological Challenges    | .829       | .081  | .000  |
| A.1.3 – Organizational Culture      | .839       | -.097 | .211  |
| A.1.4 – Action Strategy             | .828       | -.104 | .087  |
| A.1.5 - New Products and Services   | .746       | -.129 | -.138 |
| A.2.2 – Modern Regulation           | -.044      | .666  | -.081 |
| A.2.3 – Innovative Reg. Environment | .231       | .793  | -.036 |
| A.2.4 – Balanced Regulation         | .122       | .876  | -.020 |
| A.3.1 – Client Experience           | .789       | .046  | .037  |

|                                    |       |       |      |
|------------------------------------|-------|-------|------|
| A.3.2 – Partnerships with Fintechs | -.325 | .221  | .578 |
| A.3.3 – Open Platforms             | -.115 | .068  | .758 |
| A.3.4 – Increase in APIs           | .177  | -.116 | .601 |

**Extraction Method:** Principal Component Analysis.  
 3 components/factors were extracted.  
**Source:** Created by the author.

To obtain simpler and theoretically more significant factor solutions, an orthogonal rotation of the factors was conducted with the VARIMAX method. This is the most successful and most used technique in studies among the orthogonal methods (Damasio, 2012). The variables that showed components above 0.50 are highlighted in blue. Table 6 presents the Matrix of Rotated Components.

**Table 6 -** Matrix of rotated components.

|                                     | Components |       |       |
|-------------------------------------|------------|-------|-------|
|                                     | 1          | 2     | 3     |
| A.1.2 – Technological Challenges    | .818       | .148  | -.056 |
| A.1.3 – Organizational Culture      | .858       | -.042 | .140  |
| A.1.4 – Action Strategy             | .838       | -.042 | .018  |
| A.1.5 - New Products and Services   | .740       | -.058 | -.202 |
| A.2.2 – Modern Regulation           | -.101      | .664  | -.029 |
| A.2.2 – Innovative Reg. Environment | .166       | .810  | .004  |
| A.2.2 – Balanced Regulation         | .053       | .882  | .034  |
| A.3.1 – Client Experience           | .783       | .108  | -.018 |
| A.3.3 – Partnerships with Fintechs  | -.293      | .155  | .615  |
| A.3.3 – Open Platforms              | -.059      | .009  | .767  |
| A.3.4 – Increase in APIs            | .232       | -.140 | .576  |

**Extraction Method:** Principal Component Analysis.  
**Rotation Method:** Varimax with Kaiser normalization  
**Source:** Created by the author.

Hair et al. (2009) suggest guidelines for identifying significant factor loads based on sample size. Considering sample sizes of 120 and 150, the significant factor load would be of 0.50 and 0.45, respectively.

The correlations between the factors are shown in Table 7. There are positive and negative factors in the matrix within the interval [-0,077 a 0,082]. However, no factors with a high level of correlation were found.

**Table 7 -** Factor correlation matrix.

| Component | 1     | 2     | 3     |
|-----------|-------|-------|-------|
| 1         | .994  | .082  | -.075 |
| 2         | -.077 | .994  | .072  |
| 3         | .080  | -.066 | .995  |

**Extraction Method:** Principal Component Analysis.  
**Rotation Method:** Varimax with Kaiser normalization  
**Fonte:** Created by the author.

The classification of factors 1, 2 and 3 followed the same nomenclature of the macro attributes found in the literature review. Thus, factor 1 was named Open Banking, factor 2 was called Regulation and factor 3 was called Technology.

A reliability test was conducted with the questionnaire as well to conduct an evaluation among multiple measurements of a variable. Cronbach’s alpha is the most-commonly used reliability coefficient in research. According to Hair et al. (2009), the lowest limit that is generally accepted in exploratory research is 0.60. The questionnaire has a Cronbach’s alpha coefficient of 0.64, as seen in Table 8 below.

**Table 8** - Factor correlation matrix.

| Cronbach's Alpha | Cronbach's alpha based on standardized items | No of items |
|------------------|--|-------------|
| .640             | .639   | 11          |

Source: Created by the author.

In light of the quantitative results that were presented, it is suggested that variable A.3.1 – Client Experience is highly correlated with the other variables pertaining to the Open Banking macro attribute, and not with Technology, according to an analysis conducted with VOSViewer. This variable has to do with the respondents’ perception regarding the maturity of their banking institutions in providing clients with personalized experiences based on their behavior.

Finally, according to the factor analysis that was conducted, the 11 variables related to the implementation of Open Banking in the country were grouped in 3 factors. Together these factors represent a variance of 61.62%. Factor 1 is responsible for 31.38% of the total variance and is the one with the strongest ties to the country’s retail banking specialists’ perceptions of the Open Banking phenomenon. Factor 2 is connected to the regulation variables and represented a total variance of 17,82%. As for factor 3, it has to do with the technology variables, and its total variance was 12.41%.

Thanks to the factor analysis, it was possible to group the variables that represent the factors related to the implementation of Open Banking in the country and analyze them in depth, identifying each one’s characteristics. The 11 variables were grouped into three factors through exploratory factor analysis.

### Qualitative Research Results

This section contains the results obtained in the primary data collection through the research instrument that was sent to the Open Banking specialists. The data was treated and condensed to reflect the main challenges and opportunities pertaining to the implementation of Open Banking in Brazil.

### Lexical and Content Analysis Results

By using NVivo software, it was possible to generate a list of the most frequent words among the data collected by the research instrument. Words such as definite or indefinite articles, locutions, contractions, or those that did not add value to the analysis were eliminated from the list. Derived and similar words were also grouped. Table 9 shows the results of this processing.

**Table 9** - Lexical Analysis with word frequency.

| No. | Word          | Frequency | No. | Word         | Frequency |
|-----|---------------|-----------|-----|--------------|-----------|
| 1   | Challenge     | 129       | 21  | Experience   | 24        |
| 2   | Opportunities | 98        | 22  | Better       | 23        |
| 3   | Clients       | 78        | 23  | Bank         | 22        |
| 4   | Data          | 75        | 24  | Development  | 22        |
| 5   | Legacies      | 66        | 25  | Financial    | 22        |
| 6   | Businesses    | 65        | 26  | APIs         | 20        |
| 7   | New           | 62        | 27  | Institutions | 20        |
| 8   | Larger        | 61        | 28  | Sharing      | 19        |
| 9   | Open          | 59        | 29  | Models       | 18        |
| 10  | Banking       | 55        | 30  | Relationship | 18        |
| 11  | Products      | 54        | 31  | Implantation | 16        |
| 12  | Systems       | 53        | 32  | Credit       | 15        |



Another frequently mentioned challenge is linked to people, from the difficulty in hiring specialized professionals to the banks' organizational culture. Regarding this challenge, respondent 87 stated that: "[it is] difficult to hire professionals to develop solutions" and respondent 61 declared that "[there is] a need for cultural change in order to work with BAAS – Bank-as-a-Service (Banks as a Platform for Financial Services) and BAAP – Bank-as-a-Platform (Banks as Platforms for Products)".

Regarding opportunities and clients, the respondents cited the creation of new products and services, data use and aggregation, and an emphasis on client experience. Respondent 99 said that "In terms of business opportunities, Open Banking will promote the "client-centric" strategy, since the old strategy of business for products and services will be eliminated by Open Banking, as clients will no longer view banks from a product viewpoint, but from that of relationships instead. Understanding and knowing the clients and prioritizing relationships instead of product sales and proprietary services are key points for success in this new ecosystem".

## CONCLUSION

The present study aimed to conduct a systematic literature review to investigate the main difficulties that are faced and gains that are obtained by countries that have already undergone the Open Banking implementation process from the perspectives of banks and society.

To achieve the study's objective, a systematic survey of the literature was conducted, involving the use of the PICO (Cochrane Protocol) tool through the application of a search string in two international databases (Web of Science and Scopus) and one national database (BDTD). After an extensive triage process to analyze the conformity of the results obtained from the bases, 15 documents were obtained that had the potential to contribute to the study's objectives.

By critically analyzing the selected documents, it was possible to identify 3 macro attributes within the study topic's scope: Open Banking, Regulation, and Technology. An investigation of the academic works revealed 21 elements related to the macro attributes, demonstrating the relevance of investing in technology for banks and the importance of a favorable regulatory environment for the development of new financial products and services. Thus, this study contributed to improving the discussion and to deeper studies on the subject.

The empirical investigation was conducted through the application of a questionnaire with 150 respondents. However, only 126 of them were validated. The questionnaire was answered by specialists in the subject, possessing significant qualifications and performing strategic functions at their respective institutions.

The instrument was created based on the literature, especially on the 23 elements of Open Banking, with the goal of investigating each respondent's perception of the country's Open Banking implementation overview. The answers were consolidated and codified through a multivariate data analysis technique. The qualitative data underwent a joint content and lexical analysis conducted through a word frequency survey process.

In the results discussion, this study presents an overview on the implementation of Open Banking in banking institutions from the specialists' standpoint. Challenges include a concern shared by various professionals regarding the integration of data shared via Open Banking with their institutions' legacy systems. Opportunities include the fact that there are various initiatives related to the development of new products and services by using data, artificial intelligence, and Big Data.

At the end of the discussion, the study presents new business models that appeared around the world after Open Banking was implemented and that, from the Brazilian specialists' standpoint, could be applicable to the Brazilian banking market within the next three years. In this sense, a relevant amount of engagement was detected (88% of the specialists) in the development of business models based on client financial management and on the creation of financial Marketplace platforms (69% of the specialists).

Finally, it was possible to conclude that, by fulfilling the specific goals and answering the research questions, this study's general objective has been achieved. The study provided a panorama of Open Banking implementation in Brazil, demonstrated the adherence of new business models to the Brazilian market, and conducted an international benchmark test concerning the challenges and opportunities faced by other countries relative to this phenomenon.

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