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DEFINING CATEGORIES OF FINTECHS: A CATEGORIZATION PROPOSAL BASED ON LITERATURE AND EMPIRICAL DATA

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[1] **Itamir Caciatori Jr.**
[2] **Ana Paula Mussi Szabo Cherobim**

Abstract

Purpose – The analysis of the competitive impact of FinTechs requires the standardization of their categories to compare their products and services with the already delivered by incumbent banks. In this study, we address the problem of the multiplicity of FinTechs categories and provide a solution using content and cluster analysis.

Theoretical framework – The literature about FinTechs. In our bibliographical research, we do not find works aiming to present a standard definition of categories of FinTechs. This type of work is almost nonexistent and categorization of FinTechs is defined as a "blurry issue".

Design/methodology/approach – In this study, we address the problem of the multiplicity of FinTechs categories and provide a solution using content analysis, cluster analysis, and the software Gephi.

Findings – The result is a model comprised of nine FinTechs categories: Payments and Transfers; Exchange; Lending; Insurance; Investments; Advice; B2B; Digital Banks; and Others. We also elaborate a portfolio with 157 products and services offered by Brazilian incumbent banks, which allows the comparison between these two types of companies.

Originality/value – The main contribution is the use of objective criteria and existing literature, as well as Gephi software, to build categories of FinTechs analysis, an emerging theme in financial market studies.

Keywords - Fintech. Financial technologies. Categories. Cluster analysis. Incumbent banks.

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[1] Universidade Federal do Paraná - UFPR, Paraná, (Brasil). E-mail: itamircj@gmail.com Orcid id: https://orcid.org/0000-0003-0740-1475
[2] Universidade Federal do Paraná - UFPR, Paraná, (Brasil). E-mail: cherobimanapaula@gmail.com Orcid id: https://orcid.org/0000-0001-9380-5403

DEFININDO CATEGORIAS DE FINTECHS: UMA PROPOSTA DE CATEGORIZAÇÃO BASEADA NA LITERATURA E EM DADOS EMPÍRICOS

Resumo

Objetivo: . A análise do impacto competitivo das FinTechs demanda a padronização de suas categorias para comparar seus produtos e serviços com o atualmente disponibilizados pelos bancos incumbentes. Este estudo busca contribuir para a questão da multiplicidade de categorias de FinTechs e fornecer uma solução utilizando análise de agrupamentos (cluster) e de conteúdo.

Método: Análise de Agrupamentos e Análise de Conteúdo com a ferramenta GEPHI

Originalidade/Relevância: A literatura que tem por objetivo padronizar categorias de FinTechs é quase inexistente e essa categorização é denominada como uma questão controversa. Em sua maior parte, os autores não apresentam (ou não adotam critérios metodológicos) na escolha de categorias, sendo que foram encontrados trabalhos com até três categorias.

Resultados: O resultado é um modelo de nove categorias de FinTechs: Pagamentos e Transferências; Câmbio; Empréstimos; Seguros; Investimentos; Aconselhamento financeiro; B2B; Bancos Digitais; e outras. Um portfólio com 157 produtos e serviços oferecidos pelos bancos incumbentes brasileiros também foi elaborado, o que permite a comparação entre esses dois tipos de empresas.

Contribuições teóricas/metodológicas: a principal contribuição é a utilização de critérios objetivos e da literatura existente, bem como a ferramenta Gephi, para construir categorias de análise das FinTechs, um tema emergente no mercado financeiro.

Palavras-chave: FinTech. Tecnologias financeiras. Categorias. Análise de cluster. Bancos incumbentes.

1 INTRODUCTION

The market power of incumbent firms is threatened daily by innovations brought by other companies, mainly if these new companies are small (Porter, 1990). These new entrants can offer the same products and services as the incumbent companies (Porter, 1980). Besides, according to the disruptive innovation theory, new and small companies also offer fewer products and services with different technologies than big companies (Christensen, 2013).

In the Brazilian financial industry, as in other countries, FinTechs bring innovations to the market and can be seen as a threat to incumbent banks. FinTechs are business models based on the combination between financial services and the intensive use of information technology (D Arner, Barberis, & Buckley, 2016; Banco Central do Brasil, 2018; Chen, Wu, & Yang, 2019). However, the concept lack a consistent definition (Gromek, 2018; International Monetary Fund, 2019; Milian, Spinola, & Carvalho, 2019).

Nonetheless, the lack of a standard categorization from both types of companies makes it difficult to compare them in order to analyze the competitive relationships, for example. Thus, it is necessary to determine metrics and elements that allow the comparison of the products and services of the incumbent banks and these new categories of firms. The assortment of already existent categories converts this issue into a blurry field and a Pandora's box (Gromek, 2018).

One of the paths to compare these companies are the categories of products and services delivered incumbent banks and FinTechs. Therefore, it is necessary to establish common categories able to convert these products and services to a unique base, reflecting similarities between them. The categories used by comparison are a common issue and, at the same time, an essential element in the competition analysis

To the best of our knowledge, the literature about FinTechs does not present consistent works including a standard definition of FinTechs categories. Then, authors usually classify these companies according to the objectives of their works or following almost intuitive definitions, most of the time adopting the classification already existent in the traditional financial system. As an example of divergences in the categories, we can find different classifications in the work of Romanova & Kudinska (2018), where the authors use three different categorizations to talk about the FinTechs in the same document.

Hence, the problem of the present work is that the literature about FinTechs presents a considerable number of categories, almost always involving different standards of comparison (e.g., types of products, technologies, regulation). As a result of this, neither all of these categories can serve as a tool to analyze the competition between FinTechs and incumbent

banks. This problem takes an account the competition between incumbent banks and FinTechs, the lack of research on the subject, and the need to define and compare the categories of products and services concerning FinTechs and incumbent banks.

In this research, we intend to propose an adequate framework of FinTechs categories based on the already categories existent in the literature. Besides, we apply these framework to the available products and services portfolio of the five biggest Brazilian incumbent banks. The final result is a framework with nine categories that can be used to compare the products and services available by incumbent banks and the FinTechs to analyze the competitive relationship between these companies.

The present work uses the content analysis and cluster analysis to define standard categories in order to compare the products and services available by the five biggest Brazilian incumbent banks and FinTechs.

We begin with the literature review about the FinTechs categorization, followed by the methodology and the results of the analysis. We finalize with the conclusion of the analysis and the suggestions for future works.

2 THEORETICAL FRAMEWORK

In this section, we present a literature review about how the FinTechs can threat the incumbent banks in a competitive scenario and some aspects about the issues involving the FinTechs categories found in the literature.

The research on FinTechs is essential due the lack of works about this subject in the academic literature (Caciatori Junior & Cherobim, 2020; Milian et al., 2019), their future impacts in the financial markets (BCBS, 2018; Buchak, Matvos, Piskorski, & Seru, 2018), and the concerns of the official institutions about the regulation of these companies (Banco Central do Brasil, 2018; International Monetary Fund, 2019).

2.1 COMPETITION BETWEEN FINTECHS AND INCUMBENT BANKS

Although it is initially believed that FinTechs belong effectively to the financial industry, this type of company also presents elements of the Information Technology industry as technological basis (Alt, Beck, & Smits, 2018; T Puschmann, 2017; Schueffel, 2016).

These situations also demand reflections on the position of FinTechs in the financial industry (or outside it). According to (Porter, 2004), new companies can establish themselves

in the industry, belong to a strategic group or constitute a new industry. In the case of FinTechs, this hypothesis can not be ruled out, because, in addition to the financial base, they also present elements of information technology not always present in the incumbent banks.

FinTechs also fit into the concept of financial innovation and perform different activities in the financial market. Some examples of these activities related by (Milian et al., 2019) are: loan technologies, personal finance, and asset management; value transfer; Blockchain / Cryptoassets; Institutional Technology / Capital Markets; crowdfunding and; technological security.

Thus, FinTechs specialized in specific categories of products and services are a fragmentation of activities and processes offered by incumbent banks. In line with this, FinTechs perform separately traditional functions from incumbent banks, which can generate changes in the competitiveness of the financial market.

This fragmentation is cited by (Anagnostopoulos, 2018) as a new paradigm in the financial market, as it allows FinTechs to specialize in specific segments, providing recognition from consumers and market share. Thus, customers who turn to the financial market do not need to acquire a vast offer of products/services if they individually demand only one of these items.

The author states that banks as institutions will not disappear in the future, however, many services performed by them can serve as a basis for new FinTechs. FSB (2019) defines that the technology is the element that allows the segmentation of the activities of these companies.

In Brazil, according to (Banco Central do Brasil, 2019), the concentration percentage of the five largest banks (Banco do Brasil, Itaú, Bradesco, Caixa Econômica Federal, and Santander) according to total assets, credit operations and total deposits in the country is 69.3% (December/2018). Zhang, Jiang, Qu, & Wang (2013) adds that the history of Brazilian hyperinflation allowed banks to take advantage of the profitability of short-term operations (float) and reduced incentives for the development of standard banking practices.

This banking concentration has as consequences the increasing costs and reducing the quality of banking services, especially for smaller customers. FinTechs arise in this scenario. These new companies can be considered an example of a financial intermediary because they act as *"agents specialized in buying and selling (at the same time) financial contracts and securities"* (FREIXAS; ROCHET, 1999, p. 15).

Despite this, (Gromek, 2018) reinforces that the FinTechs are a tool, not a destination. Then, the outputs to the customers are the same and the difference rely on the processes

performed by incumbent banks and FinTechs. For example, a customer that needs to pay a bill can do so using both types of companies, however, through a different process.

In Brazil, one of the uncertainties about the future of the relationship between FinTechs and the incumbent banks originates from the very structure of Brazilian banks. These banks act as multiple institutions offering a broad portfoloio of products and services (e.g., lending, investments, insurance, consortium), in a industry with a high level of concentration. The evaluation of the competition of these banks with new technology-based companies specialized in a specific product or service requires suitable theoretical structures to explore the consequences of this relationship.

The role of FinTechs as a threat to incumbent banks also derives from the culture of the operational efficiency of these new companies (Philippon, 2016). The author emphasizes that this usually occurs from the construction of computerized systems, which usually occur since the beginning of operations of FinTechs. Consequently, these systems enable the maintenance of reduced operating costs and encourage the emergence of this new type of entrants.

Regarding the performance of the banking industry with the emergence of FinTechs, FINANCIAL STABILITY BOARD (FSB) (2019) defines the relationship between incumbent banks and FinTechs as complementary and cooperative. It is because FinTechs do not have full access as banks to low-cost resources and have small customer bases in more developed market segments. Thus, partnerships between banks and these new companies allow even small FinTechs to have access to low-cost resources and the customers of incumbent banks.

The institution also defines that competition with FinTechs can put pressure on incumbent banks to adjust costs, with impacts on their profitability. As a consequence, this can lead to the assumption of greater risks by these banks to maintain profit margins. As stated by (Anagnostopoulos, 2018), frequent bank movements may present risks to the financial market and the inability to change of these incumbent companies may facilitate the expansion of FinTechs.

2.2 FINTECHS CATEGORIES IN THE LITERATURE

To the best of our knowledge, there is little research in the literature that present a standard definition of the FinTechs categories. Then, the authors use classify these companies according the objectives of their works or following almost intuitive definitions, most of the time adopting the classification already existent in the financial system.

(Gromek, 2018) describes some difficulties in the FinTechs categorization and conceptualization that arise because these enterprises can serve the final customers or other companies. The author argues that, due to the complexity of classification, the same FinTech can be placed in more than one category (ex. lending and investment). Another core idea is that despite the incumbent banks and FinTechs have different processes the outputs are similar.

As a consequence, the author stresses that these lack of standard in the classification of the FinTechs and the different definitions of these firms can have implications for robustness and become a source of misperception. Therefore, the author reinforces that if the mensuration of something not well defined can difficult this process.

Romanova & Kudinska (2018) is the first example of divergences in the use of categories to analyze FinTechs. The authors use three different categorizations to talk about FinTechs in the same document: the first from from Douglas Arner, Barberis, & Buckley (2015) that exemplify the five major areas of FinTechs; the second composed by a graph with a different classification from Statista Data (http://www.statista.com) and; a third classification from Ernst & Young (2015).

The (Hornuf & Haddad, 2019) use some industry and institutions reports (Ernst & Young 2016; He et al. 2017; World Economic Forum 2017) and categorize FinTechs into nine different categories. A compilation of categories is also used by (Milian et al., 2019). The authors adopt a classification of the Activity Sectors of Fintechs based on (Khandwe, 2016) and (CB Insights, 2019). In the literature review, we find a relative relevance in the use of this classification given by (CB Insights, 2019), since the (Banco Central do Brasil, 2018; Milian et al., 2019) documents also categorize the FinTechs using such classification.

A remarkable aspect in the categories is that each work can adapt the categories according to their research needs, as technology, evolution or consumer orientation, for example.

Among the literature review about FinTechs in the Scopus, ISI – Web of Science and financial institutions documents, we find 13 documents with different categories. **Figure 1** presents some examples of categories from the literature that we study in the present work and their explanations:

Category	Definition
Payments	The category payment entails business models that provide new and innovative payment solutions, such as mobile payment systems, e-wallets, billing, domestic transfers, and cryptocurrencies. (Gromek, 2018; Hornuf, L., & Haddad, C., 2018), allowing a new form of doing financial transactions easy and fast (ABFintechs, 2018).
Exchange	Companies that develop platforms and digital solutions to improve efficiency and relationship with customers for the exchange market and international remittances. ABFintechs (2018), international money transfer, and tracking software (CB Insights, 2019).
Lending and financing	Companies and digital platforms that enable loans and financing to individuals acquisition of goods, reduction of financial costs, personal credit, credit payroll, and working capital (ABFintechs, 2018). This category allows individuals, firms, and start-ups to use the Internet to acquire the necessary financing (Gomber, 2017). Some examples include startups that provide crowdfunding, crowdlending, microcredit, and factoring solutions (Hornuf, L., & Haddad, C., 2018)
Insurance	Companies that develop platform and digital solutions to improve the level of service and offer diverse insurances. ABFintechs (2018) and provide data analytics and software for (re)insurers CB Insights (2019). This category broker peer-to-peer insurance, spot insurance, usage-driven insurance, insurance contract management, and brokerage services as well as claims and risk management services (Hornuf, L., & Haddad, C., 2018).
Investment management	In the Gomber (2017) concept, (Digital) Investments support individuals or institutions in investment decisions and in arranging the required investment transactions on their own by use of the respective devices and technologies (Gomber, 2017 p. 545). This category embraces execution operations as mobile trading, social trading, and online brokerage/trading (Gomber, 2017), savings accounts, equity crowdfunding (Gromek, 2018), and crowdinvesting (Gimpel et al., 2017).
Advice	Companies that offer solutions focused on the offer and facilitation in decision making regarding investments (ABFintechs, 2018) and tools to manage bills and track personal and/or credit accounts (CBInsights, 2019), computer systems and programs that provide automated investment advice to customers or portfolio managers (Chen, M. A., Wu, Q., & Yang, B.,2019).
B2B	Services provided for other companies and not directly to the final customer. This category entails solutions involving capital markets, cybersecurity, data analytics, risk management, and Regtech, for example (CB Insights, 2019; Chen, M. A., Wu, Q., & Yang, B., 2019; Hornuf, L., & Haddad, C., 2018). Also entails companies leveraging blockchain and distributed ledger technologies for financial services (CB Insights, 2019; Chen, M. A., Wu, Q., & Yang, B. 2019).
Digital banks	Companies that position themselves as digital banks or develop digital solutions to digitally positioned the traditional institutions (ABFintechs, 2018)
Others	Companies cited by some authors as in the FinTechs context, but not directly related to the previous examples. Examples of these companies include monetization, real state, and loyalty program.

Figure 1. Nine FinTechs categories and their definitions and examples from the literature
Source: Elaborated by the Authors (2020) based on the literature review

3 METHODOLOGY

The objective of this section is to present the methodology and the steps adopted and applied to create a category framework that allows the comparison between products and services available by FinTechs and incumbent banks.

3.1 RESEARCH METHODOLOGY

We classify the research methodology adopted in the present as mixed (Creswell, 2010). This approach proves to be useful because of combine elements from the content analysis and modularity/clustering analysis, consequently qualitative and quantitative methods of research. It allows us to prepare data and define categories based on their relevance and similarity.

The qualitative and quantitative analysis took eight stages, involving content analysis, data collect, and cluster analysis, as can be seen in **Figure 2**.

Stage	Description	Stage Name
1	In the literature about FinTechs, use the context analysis to search for the available categories of FinTechs.	Compile FinTechs Categories
2	Disassemble the composite FinTechs categories to different terms, for example, from "Asset Management and Personal Finance" to "Asset Management" and "Personal Finance".	Disassembly of FinTechs Categories
3	Convert similar therms that represents the same meaning to a common word. Examples include: investments -> investment; cryptocurrencies -> cryptocurrency and; crypto -> cryptocurrency.	Conversion of terms
4	Create keywords for each one of the disassembled FinTechs categories based on the content analysis of the FinTechs categories already existent in the literature.	Keywords
5	Insert the data of FinTechs disassembled categories and their related keywords using the Force Based Atlas Algorithm of the software Gephi to create clusters of new categories according to the distance among the terms.	Reassemblage of New FinTechs Categories
6	Analyze the resulting categories from the "New Categories Creation" stage looking for inconsistencies and divergent categories generated by the software.	Data Analysis
7	In the Brazilian banks context, collect data from the products and services of the five biggest banks from the table of banking fees, banks websites, and official institutions regulations.	Banks Products and Services Data
8	Label the products and services of incumbent banks of the stage "Banks Products Categories" according to the standard categories of the stage "New Categories Creation" looking for a common standard.	Banks Products Categorization

Figure 2. Research design steps
Source: Elaborated by the Authors (2020)

3.1.1 CONTENT ANALYSIS

The content analysis is defined as "*the systematic analysis of the content of a text (e.g., who says what, to whom, why, and to what extent and with what effect) in a quantitative or qualitative manner*" (Bhattacherjee, 2012, p. 115). We use this method to categorize the banks products and services based on the results of the categories obtained from the cluster analysis and the explanations of the categories already existent in the literature.

Some examples of the use of content analysis can be seen in the study of subjects as FinTechs (Milian et al., 2019), innovation (Baregheh, Rowley, & Sambrook, 2009), and competitive advantage (Young, Smith, & Grimm, 1996).

Based on the results of the content analysis, we categorize the items. This process is defined as a "*classification operation of constitutive elements of a set, by differentiation and, after this, by regrouping according to the gender (analogy), with the previously defined criteria"* (Bardin, 2002, p. 117). The author suggests that we can use common characteristics to group the items and that the criteria can be semantic when performed by thematic categories.

In the present work, we use these definitions and processes to reinforce and justify the steps that we adopt in the analysis of the already existent categories and their definitions. Then, the content analysis and the categorization were used jointly with the literature review concerning the documents that contain and explain the FinTechs categories.

3.1.2 QUALITATIVE DATA ANALYSIS

We use the five-phased cycle (Yin, 2016) to collect the data and analyze the categories of FinTechs based on qualitative data. Besides, we also incorporate some of these steps in the final analysis in order to enhance the data and to discriminate/disassembly the already existent categories.

According (Yin, 2016), the collecting method results from a formal search or retrieval procedure from the electronic bibliographic searches. Although we can find some of these items in the field, most of them can come from other sources, as library archives, electronic sources, and websites. The author also suggests that these objects can produce a variety of data (e.g., verbal, numeric, and graphic) about the physical/social environment or even about things not directly observable. **Figure 3** shows the five-phased cycle to analyze qualitative data.

Step	Description
Compiling	Formally arranging all the notes in some useful order. The completed compilation might be considered a database
Disassembling	Breaking down the compiled data into smaller fragments or pieces, which may be considered a Disassembling procedure. The procedure may (but does not have to) be accompanied by your assigning new labels, or "codes," to the fragments or pieces
Reassembling (and Arraying)	The rearrangements and recombinations may be facilitated by depicting the data graphically or by arraying them in lists and other tabular forms
Interpreting	Using the reassembled material to create a new narrative, with accompanying tables and graphics where relevant, that will become the key analytic portion of your draft manuscript
Concluding	It calls for drawing the conclusions from your entire study. Such conclusions should be related to the interpretation in the fourth phase and through it to all the other phases of the cycle

Figure 3 – Five-phased cycle to analyze qualitative data
Source: Yin (2016, p. 257-258)

Even though the suggested method consists of these five steps, the phases can be recursive, and they do not follow a linear sequence. In this way, the researcher can go backward and forward at the same time without prejudice the final results of the collect and data analysis stages.

3.1.3 QUANTITATIVE DATA ANALYSIS

In this section, we detail how we use the five-phased cycle suggested by (Yin, 2016) illustrated in **Figure 3** to analyze and prepare the FinTechs categories obtained from the literature to the cluster analysis.

The **first step** of the FinTechs categorization, the compiling, consisted of the identification of the categories already existent for these type of companies. We based this step on the literature review, where we find 13 documents (including scientific papers and institutional documents) with 114 FinTechs categories (98 without duplicates). In some cases, we find explanations about elements included in these categories. We perform the first step procedures in Microsoft Excel software.

The **second step**, the disassembling, consisted of split one specific category in two or more. One example of this occurred with the Personal Finance and Asset Management category, which we split in "Asset Management" and "Personal Finance" categories. We did this to improve the power of discrimination among different categories in the future stages. At the end of this process, the database contained 142 categories considering the repetition of some terms.

In **the third step**, we search for similar terms and adapt them to general terms with the same meaning. Some examples included the conversion of the categories "investments" to "investment" and "cryptocurrencies" to "cryptocurrency". We keep the repeated categories because this repetition allows the identification of the importance and the weights of these categories.

Based on this new classification and the content analysis from FinTechs literature, in the **fourth step,** we attribute related keywords to each one of these new categories. To exemplify, to the "lending" category, we attribute the keywords "Financing", "Crowdfunding", "Factoring", "Borrow", "Credit Working capital", and "Peer-to-peer lending". We attribute these keywords according to the characteristics and the related categories found in the literature. At the end of this step, the database contained 589 keywords related to the new 142 categories that resulted from the second step.

T**he fifth step** uses the categories and the keywords from the previous steps to develop and design the new FinTechs categories. We performed this process in the software Gephi (Bastian, Heymann, & Jacomy, 2009). Gephi is open-source software for network analysis that also generates some statistics related to all type of networks, modularity, and clustering analysis.

The nodes and edges are the most critical components of the networks. In the present work, each node represents a specific category and its size is directly related to its length: the more often each category is cited in the literature, the larger the size node. Moreover, the edges are the lines that represent the links between the categories through their related keywords, as we observe in **Figure 4**.

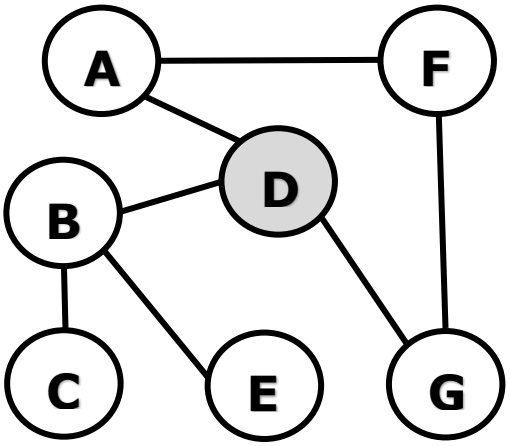

Figure 4. Example of Nodes ("A, B, C, D, E, F,") and Edges (black lines)
Source: (Cherven, 2015, p. 14)

The software Gephi allows working with two different but complementary tools to analyze data. The first is the layout algorithms. In the present work, we select the algorithm ForceAtlas2 (Jacomy, Venturini, Heymann, & Bastian, 2014). It is a force-directed layout that simulates a physical system in order to spatialize a network. Although, this algorithm is not deterministic and the coordinates of each point do not reflect any specific variable. Then, by contrast with the clustering analysis, the result cannot be read as a Cartesian projection.

The another tool available in the Gephi is the modularity clustering. According (Blondel, Guillaume, Lambiotte, & Lefebvre, 2008, p. 2) *"modularity of a partition is a scalar value between -1 and 1 that measures the density of links inside communities as compared to links between communities".* If we compare these two tools, *"clusterings and layouts complement each other as representations for the community structure of networks"* (Noack, 2009, p. 5). According the author, both of these representations partition the vertex (nodes) into

disjoint subsets, placing them at nearby positions or in the same cluster, reflecting the community structure. The modularity also can be seen as a quality index for clusterings (Brandes et al., 2008).

Different algorithms can be used to calculate the cluster and group the nodes of a network in line with distinct clusters. The Gephi uses the (Blondel et al., 2008) algorithm, a heuristic method based on modularity optimization used in the analysis of large networks from the decomposition of the networks into sub-units or communities. Then, this method group a specific cluster to each one of the nodes of the network, without the mandatory need to analyze separately the allocation of these nodes, as occurs in the cluster analysis, for example. In the **sixth step,** we search for inconsistencies in the structures of the clusters looking for errors or problems that could prejudice the classification.

In the **seventh step,** we build a Brazilian bank products and services portfolio of the five biggest incumbent banks measured by assets. As sources, we used the tables of banking fees and documents from regulators Central Bank of Brazil (BACEN), the Brazilian Financial and Capital Markets Association (ANBIMA), and the Superintendence of Private Insurance (SUSEP). We find others products and services not covered by these regulators in the own websites of banks. **Figure 5** presents the sources of the banking products and services used in the present work:

Name	Source	Definition
Bank fees table	Banks, based on the 3,919 and 4,196 BACEN and National Monetary Council Resolutions'	The products and services classification based in a mandatory and public document published by the banks that entails the maximum fees that their charge for their products and services
Lending and financing	BACEN document 3,050 and Circular nº. 3,870	Demonstrate the classification of the lending and financing operations, in line with the BACEN classification
Web Sites	Banks	Information retrieved from the websites of banks and not available from the other documents/sources analyzed
Consortium	Circular nº. 3,394 BACEN	Some Brazilian banks also offer consortium quotas for consumer and corporate clients, similar to goods financing operations
Investment funds classification	ANBIMA	Available investment funds according to a Brazilian market investment funds classification related to their characteristics of assets, duration, risks, and management styles and strategies

Figure 5. Banking Products and Services and their Respective Sources
Source: elaborated by the Authors (2020)

The choice of the five biggest banks by assets and the websites as sources for some of the products and services is also based methodology of (Oliveira & Von Hippel, 2011).

Finally, on the **eighth step,** we use the characteristics, explanations, and examples of the FinTechs categories from the literature to classify the 157 banks products and services (seventh step) according the new categories generated in the fifth step.

4 ANALYSIS AND DISCUSSION OF RESULTS

In this section, we demonstrate the results of the conversion of qualitative data resulting from the five-phased cycle (Yin, 2016). Besides, we also exhibit the operationalization of variables in the Gephi Software and the resulting classification of the five biggest Brazilian incumbent banks products and services according to these clusters.

4.1 CATEGORIES ANALYSIS

The numbers of categories in the works from the literature vary from four to 20, depending on the source. In the **first step** (compilation), we find 114 categories from the literature (98 without duplicates), that we convert to 142 after the second **step** (disassembly). Although we found some repeated categories, we maintain these repetitions because the more often they appear in the literature, the higher their weight and relevance on the final results. In **Table 1** we resume these quantities of categories and their respective sources:

Table 1
FinTechs Categories from the Literature

Document source	**Categories**	
	Initial	**After disassembly**
(Associação Brasileira de Fintechs & Serviço Brasileiro de Apoio às Micro e Pequenas Empresas, 2018)	11	14
(D. W. Arner, Barberis, & Buckley, 2015)	5	9
(BCBS, 2018)	14	14
(CB Insights, 2019)	10	14
(Dorfleitner, Hornuf, Schmitt, & Weber, 2017)	4	4
(FSB, 2017)	20	26
(Gimpel, Rau, & Röglinger, 2017)	11	16
(Gomber, Koch, & Siering, 2017)	6	6
(He et al., 2017)	5	5
(Haddad & Hornuf, 2019)	9	9
(Gromek, 2018)	5	6
(Milian et al., 2019)	8	13
(Thomas Puschmann, 2017)	6	6
Total	**114**	**142**

Source – Elaborated by the Authors (2020) from the Literature Review

Then, after the **third step** (terms conversion), we attribute keywords to each one of these categories (**fourth step**). The keywords represents the own names of the categories plus other four terms found in the literature that we did not found before as categories (e.g., brokerage, mortgages, factoring, and working capital). At the end of this process, these keywords totalized 778 terms (with repetitions).

Using the Gephi software, in the **fifth step** we input these categories and keywords data to generate a network and calculate the subsequently statistical data concerning the clusters. The results calculated by the modularity algorithm created by (Blondel et al., 2008) generated nine categories connecting the categories and their related keywords. Using the Force Atlas 2 layout mode (Jacomy et al., 2014) and the already cluster algorithm, we displayed the resulting network composed of 98 nodes and 283 edges in **Figure 6**.

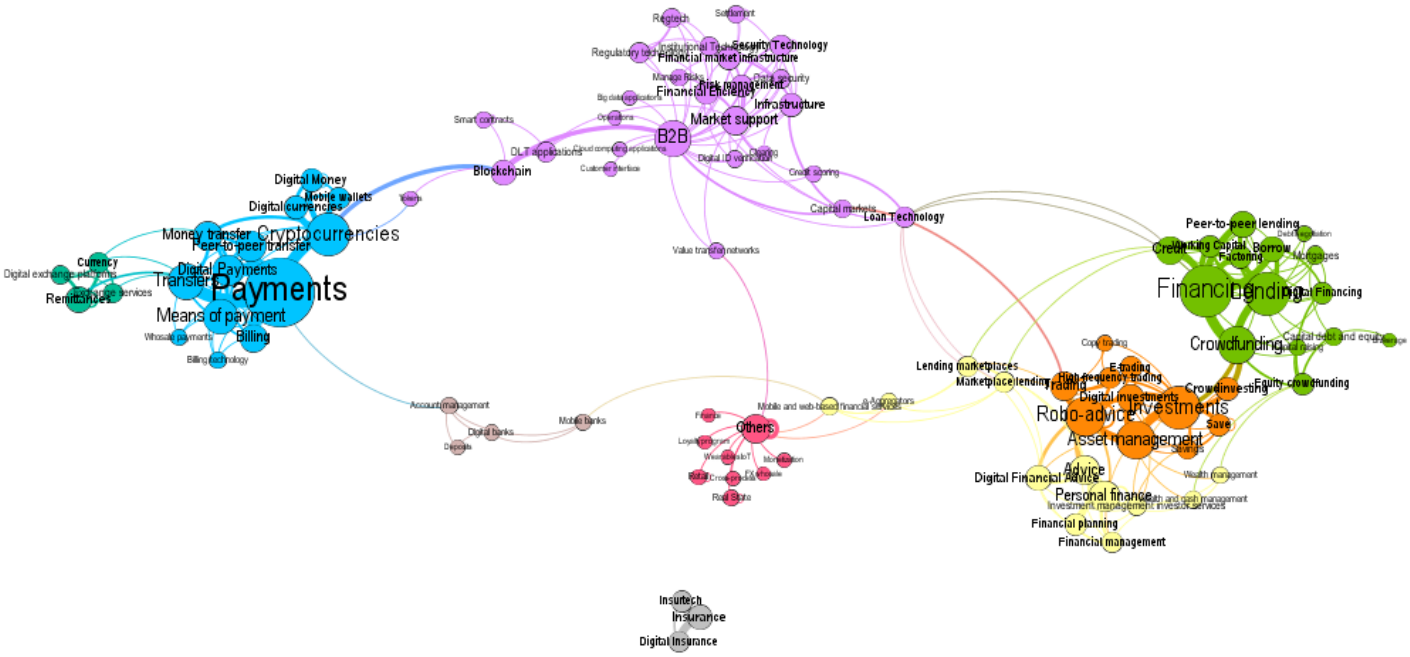

Figure 6. Layout of final categories generated by Gephi
Source: Elaborated by the authors (2020)
Note: Force Atlas 2 Parameters

Tolerance Speed	Approximation	Scaling	Approximate Repulsion	Prevent Overlap	Edge Weight Influence
1.0	2.0	10.0	Yes	Yes	1.0

As illustrated by the **Figure 6**, the Force Atlas 2 algorithm segments and design the networks in a way that allows the comprehension of the distance among the clusters. Otherwise, the division of the modularity algorithm generates nine different clusters, represented by the different colors of the network.

This process generates nine clusters of the FinTechs categories that, according their elements and the content analysis of the selected literature, we call as: Payments and Transfers;

Exchange; Lending; Insurance; Investments; Advice; B2B; Digital Banks and; Others. We detail the components of each one of these categories in **Figure 7**.

Category	Components
Advice	Digital Financial Advice; e-Aggregators; Financial management; Financial planning; Investment management investor services; Lending marketplaces; Marketplace lending; Mobile and web-based financial services; Personal finance; Wealth and cash management; Wealth management
B2B	B2B; Big data applications; Blockchain; Capital markets; Clearing; Cloud computing applications; Credit scoring; Customer interface; Data security; Digital ID verification; DLT applications; Financial Eficiency; Financial market infrastructure; Infrastructure; Institutional Technology; Loan Technology; Manage Risks; Market support; Operations; Regtech; Regulatory technology; Risk management; Security Technology; Settlement; Smart contracts; Tokens; Value transfer networks
Digital banks	Account management; Deposits; Digital banks; Mobile banks
Exchange	Currency; Digital exchange platforms; Exchange services; Remittances
Insurance	Digital Insurance; Insurance; Insurtech
Investments	Asset management; Copy trading; Crowdinvesting; Digital investments; E-trading; High-frequency trading; Investments; Robo-advice; Save; Savings; Trading
Lending	Borrow; Brokerage; Capital debt and equity; Capital raising; Credit; Crowdfunding; Debt Negotiation; Digital Financing; Equity crowdfunding; Factoring; Financing; Lending; Mortgages; Peer-to-peer lending; Working Capital
Others	Cross-process; Finance; FX whosale; Loyalty program; Monetization; Others; Real State; Retail; Wearables IoT
Payments and transfers	Billing; Billing technology; Cryptocurrencies; Digital currencies; Digital Money; Digital Payments; Means of payment; Mobile wallets; Money transfer; Payments; Peer-to-peer transfer; Transfers; Whosale payments

Figure 7. Nine categories of FinTechs and their components
Source: elaborated by the Authors (2020)

Table 2 demonstrates some statistics about the structure of network and the cluster generated by the software Gephi.

Table 2
Graph and Cluster Statistics

Type of Measure	Settings	Concept	Value
Network measures	*Diameter*	How many steps are necessary to traverse the graph between the most distant points	***10***
	Average path length	The shortest possible path between all nodes in the network	***4.103***
	Connected components	The number of distinct components within the network.	***2***
	Average diameter	Mean of the diameter steps to traverse the graph	***4.103***
	Average degree	Typical number of neighbors by node	***5.776***
	Clustering coefficient	Graph density means the % of the possible graph triangles that are complete	***0.5633***
Clustering metrics	*Clustering coefficient*	The average number of closed triangles (triplets) relative to the potential number of triangles available in the network.	***0.632***
	Modularity	Assess the number of distinct groupings within a network.	***0.722***

Source: Elaborated by the Authors (2020) and concepts by (Cherven, 2015)

In **Table 2** we highlight the "connected components" value (2) because the division of the "Insurance" category from the rest of the network and the "modularity" of the value of 0.722 **represents** the ability to clusters be distinct between them (between 0 to 1). The **sixth step** did not generate divergences in the clusters' composition.

Afterward, on the **seventh step**, we used five different sources shown in **Table 1** and identified 157 different products and services offered by the five biggest Brazilian incumbent banks according the ranking of total assets by (Banco Central do Brasil, 2018). According to each data source, we demonstrate: bank fees table (78); lending and financing (60), banks' web sites (9); consortium (6) and; investment funds classification (4).

At the **eighth step**, we use the nine FinTechs categories to classify the 157 products and services offered by incumbent banks based on main characteristics and similarities with the already existent FinTechs products and services. We displayed the results in **Table 3**.

Table 3
Incumbent banks products and services classification

FinTechs Categories	Number of Banks Products and Services
Lending	73
Digital banks	29
Payments and transfers	27
Exchange	14
Investments	8
Insurance	4
Advice	2
Total	**157**

Source: elaborated by the Authors (2020)

5 DISCUSSION

In this section, we provide a discussion about the results of the categories analysis and some thoughts about the competitive consequences that different FinTechs categories and products and services can bring to the Brazilian financial market.

Similarity of categories - Among the 13 documents obtained from the literature, some of them present similarities with the categories generated in the Results section. The three most cited similar categories are Insurance (seven documents), Payments and Transfers (six), and Lending (three).

Digital banks – The digital banks category has some specific features that differ from others. In a similar way the incumbent banks, this category can encompass almost all of the items of the other categories (e.g., payments, investments, and lending). The differences rely on the fact that the services offered by these new type of companies are virtual, and not

presential, as occurs in the incumbent banks. In the cluster analysis, the clustering algorithm grouped this category separately.

Another essential characteristic that differ the digital banks from the other FinTechs is the bank deposit. As these companies can offer this service, they can use part of these resources to lend to their clients, and, subsequently, multiply the value of these deposits. Even though the digital banks are categorized as FinTechs, if they want to provide their services on the Brazilian market, they need to attend most of the applicable regulations already existent to incumbent banks. This is another critical characteristic that needs to be highlighted because FinTechs enter in a market that already has specific national and international established regulations (e.g. Basel Accord).

Blockchain and cryptocurrencies – From the 13 documents with FinTechs categories, five of them differentiate these categories from the others. Following the idea of FinTechs as a tool not as destination (Gromek, 2018), the blockchain was placed by the clustering algorithm in the "B2B" category and the cryptocurrencies in the "Payments and Transfers" category.

Despite the specific characteristics of these two categories, the present work keeps this classification because we intend to use these nine final categories to analyze the similarities between FinTechs and incumbent banks. Then, at this moment, we consider cryptocurrencies and blockchain as means to attend already existent customer needs, in the present case the payments/transfer for cryptocurrencies and the support the cryptocurrencies given by the Blockchain.

***B2B* Category** – On the competition analysis, the customers are the level of analysis of the present work. Then, regardless of the non-existence of a specific "B2B" category in the analyzed literature, we include this keyword in the categories analysis to split the final customers products and services from the services provided by FinTechs to the banks or other FinTechs.

Among the 27 categories of this cluster, we can highlight: big data applications; loan technology; regtech; data security and; settlement. Some of these categories represent considerable innovations compared to the traditional processes already applied by the incumbent banks. However, they will serve as support and background to products and services that meet traditional customers needs (e.g. payments, lending, and investments).

Competition – Banks can adapt their products and services in a way that seems similar to FinTechs or even buy or establish partnerships with these companies in a competitive market. Besides, customers can not perceive the difference between processes brought by FinTechs and those already available in incumbent banks. Although, unless the products and services do not

contain significant differences, as the value transfer without the need of a bank account, the people can be reluctant in change their behavior.

This result can be resulting from the affirmation of (Gromek, 2018) that FinTech is a tool, not a destination because the differences between the FinTechs and incumbent banks rely on the processes applied to meet the same customers needs.

In line with this affirmation, despite the technology applied in business processes, the customers needs (destination) are almost immutable. If they do not perceive the differences in efficiency or costs between the traditional or the new products or services, they can be reluctant about their adoption. Then, as the customers always will need to pay their bills, have insurance plans or make investments, for example, they might require additional advantages to change their behavior.

In this competitive scenario, although digital banks not always offer a wide-ranging products and services portfolio at their beginning, they can be seen as buckets (e.g., Banco Inter - Brazil). Then, they are a category that threat the incumbent banks because they can bundle other categories of FinTechs as payments, lendings, insurance, and investments. Therefore, if these institutions can offer similar products and services at low prices or in a more efficient way, the customers can perceive this completeness and change their habits and become customers of this new type of companies.

Some new technologies change some products and services in a way that the incumbent banks do not have options yet. One example is the Peer-to-Peer (P2P) technologies to lending or transfers, that allows financial transactions without the need of a bank acting as a third part. In the P2P lending, for example, people can lend and borrow money without the need of a bank to fund the operation. In this case, the lender acts as an investor and without the need of a bank, earning interest rates paid by the borrower.

6 CONCLUSION

In this study, we addressed the research problem about the multiplicity of FinTechs categories in the literature and provided a solution composed by nine categories in order to address this issue using qualitative and quantitative analysis. Furthermore, we proposed a method to classify banks products and services and connect the portfolio of the five Brazilian biggest banks to the nine categories FinTechs proposal.

Although the innovation enables the FinTechs to bring some new products and services, it is essential to emphasize that, most of the times, the FinTechs are just a tool to solve

traditional problems faced by the bank customers. Then, even though these new companies look like a robust competitive player, the adoption by the customers will depend on different characteristics beyond the innovation offered by these companies.

With this study, we also intend to offer a framework that can be applied in different countries, noting that specific issues regarding the structure of bank portfolios may vary by country in terms of regulation and institutional structure.

Future studies can involve an application of this framework to other countries and creation of a categorization framework of FinTechs according different aspects like innovation, portfolio's extent, or customer adoption, for example.

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