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A MULTIDISCIPLINARY APPROACH TO THE OPEN BANKING DEFINITION AND THE UNDERSTANDING OF ADOPTION DRIVERS BY END-CUSTOMERS

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"The most important thing in communication is hearing what isn't said."

Peter Drucker

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Abstract

Open banking is a major disruptor in the retail banking industry. It consists of the possibility of sharing data with third parties by customers. It should facilitate the entry of new players (fintechs, technology companies, utilities, retailers…) and increase competition and innovation in the market. Additionally, it should improve critical processes such as new customer registration and risk and fraud management.

However, the Open Banking Framework in the United Kingdom and the PSD2 in the European Union, world reference models, are not having the expected impact. This thesis aims to identify why and propose lines of evolution. To do this, it focuses on three questions: what precisely open banking is, the factors that explain its customer adoption, and what justifies its current deficient performance.

For this, various methodologies were used. The analysis of the literature and the definition of open banking were approached by applying bibliometric methodologies (clustering) to 990 articles. Through an ad-hoc methodology, forty-seven partial definitions found in the literature were analyzed to propose a generalized definition. To identify the factors of adoption, 553 surveys were carried out on a questionnaire developed on the literature on technology adoption. The results were analyzed with a structural equation model. To identify lines of evolution, in addition to the conclusions of the previous analyses, specific publications were examined, contextualizing them in the discussion on open banking, open finance and data-sharing models.

As a result of the research, the four contexts in which open banking is used (business platformization, data sharing, financial technology, and regulation) are identified, and a generalized definition of the concept across contexts is proposed. Additionally, a bias in the existing literature is identified because it undervalues the client's perspective. Utility, trust, and social influence are identified as the primary adoption factors, while ease of use is discarded. Finally, the importance of promoting research from the customer's perspective and the need for a framework of trust in new entrants as lines of evolution is proposed. This thesis is a pioneering approach to open banking research from the client perspective, incorporating specific and pragmatic recommendations addressed to regulators, supervisors, banks, and new entrants.

Keywords

Open banking, open finance, level playing field, clustering, Hirschman Herfindahl Index (HHI), Structural Equation Modeling (SEM), Technology Acceptance Model (TAM)

Resumen

Open banking es una de las tendencias más disruptivas en la banca minorista. Consiste en la posibilidad de compartir datos bancarios con terceros por parte de los clientes. Open banking debería facilitar la entrada de nuevos actores en el mercado (fintechs, empresas tecnológicas, *utilities*, gran distribución) e incrementar la competencia y la innovación. Asimismo debería mejorar procesos críticos tales como el alta de nuevos clientes y la gestión del riesgo y del fraude.

Sin embargo, el Open Banking Framework en el Reino Unido y la PSD2 en la Unión Europea, modelos de referencia a nivel mundial, no están teniendo el impacto esperado. Esta tesis persigue identificar el porqué y proponer líneas de evolución. Para ello, se centra en tres cuestiones: qué es exactamente open banking cuáles son los factores que explican su adopción por los clientes y qué explica el mal desempeño actual.

Para ello, se utilizaron diversas metodologías. El análisis de la literatura y la definición de open banking se abordaron aplicando metodologías bibliométricas (clusterización) sobre 990 artículos. Se analizaron asimismo, a través de una metodología ad-hoc, las 47 definiciones parciales encontradas en la literatura para proponer una definición generalizada. Para identificar los factores de adopción se ejecutaron 553 encuestas sobre un cuestionario desarrollado sobre la literatura sobre adopción tecnológica. Los resultados se analizaron con un modelo de ecuaciones estructurales. Para concretar líneas de evolución, además de las conclusiones de los análisis anteriores, se examinaron publicaciones específicas, contextualizándolas en la discusión sobre open banking, open finance y modelos de compartición de datos

Como resultado de la investigación, se identifican los cuatro contextos en los cuales se utiliza open banking (plataformización del negocio, compartición de datos, tecnología financiera y regulación), se propone una definición generalizada del concepto, válida en los cuatro contextos identificados, así como una visión de los sesgos en la literatura actual, que infravalora la perspectiva del cliente. Se identifican la utilidad, la confianza y la influencia social como los principales factores de adopción, mientras que se descarta la facilidad de uso. Finalmente se propone la importancia de impulsar la investigación de la perspectiva del cliente y la necesidad de un marco de confianza en los nuevos entrantes como líneas de evolución. Realizada en el marco de un programa DBA, esta tesis es un abordaje académico pionero al open banking, incorporando recomendaciones específicas y pragmáticas dirigidas a reguladores, supervisores, bancos y nuevos entrantes formuladas desde la perspectiva del cliente bancario.

Palabras clave

Open banking, Finanzas abiertas, level playing field, análisis cluster, Índice Hircshman Herfindahl (HHI), Modelos de ecuaciones estructurales (SEM), Modelo de aceptación tecnológica (TAM)

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Chapter 1: Introduction

1. Motivation

Open banking is an overly complex phenomenon. It can be summarized as transitioning from a closed and fully integrated value chain in the retail banking business to an open model. In a closed model, each traditional retail bank defines, builds, distributes, and operates a full range of financial products and services. In an open model, traditional banks and new entrants (e.g., financial technology-driven start-ups (fintechs) and prominent new generation technology players (big tech companies) collaborate and compete on each stage of the retail banking value chain. Through this, they aim to offer a full range of financial products and services in a more competitive, innovative, and efficient way. The mechanism to materialize this transition is to allow the clients[1] to share their financial data with third-party providers of financial services and, eventually, to allow third-party providers to initiate payments on clients' current accounts. Hence, open banking is often described as a "collaborative model in which banking data is shared through APIs between two or more unaffiliated parties to deliver enhanced capabilities to the marketplace" (Brodsky & Oakes, 2017).

The open banking idea originated from practitioners. Actually, the term's roots were traced back to Simon Redfern, a software engineer and pioneer in open banking that founded "The Open Banking Project" in 2010 (Redfern, 2021). The term open banking was somehow inspired by open data, open innovation, and application programming interface (API) philosophies (Pisano, 2015) applied to retail banking (Gozman et al., 2018).

It was first implemented in the United Kingdom upon the request of the Competition and Markets Authority (CMA).[2] Through open banking, the CMA wanted to provide a foundational remedy for making current personal accounts and small and medium-sized enterprises' banking markets work better for customers in the context of the retail banking market

[1] In this dissertation, the terms "client" and "customer" are used indistinctively.
[2] The non-ministerial government department in the United Kingdom that framed the Open Banking Initiative

investigation that finished in 2016 (Basso et al., 2018). Concerning this requirement for open banking, the CMA states, "In particular, we are requiring banks to allow their customers to share their bank data securely with third parties using an open banking standard" (Open Banking Implementation Entity, 2022). The initial spirit of the CMA was that "the sector is still not as innovative or competitive as it needs to be. […] This change, together with our other remedies, will help customers find and access better value services and enable them to take more control of their finances. This will also enable new entrants and smaller providers to compete on a more level playing field and increase the opportunities for new business models to develop" (Competition and Markets Authority, 2016). This open banking initiative also inspired the European Commission to publish the Second Payments Services Directive (PSD2) (Guibaud, 2016; Omarini, 2018). PSD2 is the central block of the open banking regulatory framework in the European Union. Although open banking is still in its initial stages of development, the concept has been embraced by practitioners and regulators. It has been regarded as one of the shaping forces of the financial industry worldwide (Omarini, 2018).

Concerning implementation, open banking frameworks are already fully operational in the U.K. and in the E.U., Australia, Brazil, and India have already deployed partial open banking frameworks under different regulatory coverage and scope (Consumer Data Right and New Payments Platform in Australia, "Open Banking" in Brazil and Unified Payments Interface in India). Additionally, other jurisdictions are currently considering the approval of open banking regulations (e.g., Canada) or are following a market-driven approach, where the ecosystem is expected to collaborate without a mandatory framework (e.g., Hong Kong, Singapore or the United States (Ziegler, 2021).

Open banking technical developments imply relevant costs for established financial institutions (Johansson et al., 2019). The average European bank spent €32 million on open banking adoption in 2020 (Kjellén, 2021). Moreover, the annual implementation costs for a large bank can exceed €200 million (Barbaschow, 2018).

Although it is still a nascent concept, open banking has already been expanding in three ways: deepening existing frameworks, spreading to different geographies, and extending to different sectors. First, open banking is expanding beyond transactional information and covering other financial data. For example, European regulators have been considering extending the current open banking regulation to a wide range of financial services beyond retail banking. This trend is called *open finance* (Morvan, 2020). Second, open banking regimes are spreading globally. In addition to the regimes mentioned above, various countries (e.g., Mexico and South Africa) have communicated their plans to implement open banking schemes in the short term. These regulatory developments replicate the U.K. and European

Union models (World Bank, 2022). Finally, regulators are considering symmetrical regulations to open banking in other sectors due to financial sector complaints. For example, the Digital Markets Act proposal (Cabral et al., 2021) imposes data-sharing obligations on large gatekeeper digital platforms (e.g., Google, Facebook, and Amazon). These obligations are like those for banks in open banking frameworks.

However, despite its sizeable implementation and running costs, there is still no compelling evidence of the success of open banking. On the contrary, there are emerging concerns in Academia (Stiefmueller, 2020) and the business community (Monitor Deloitte, 2020) that open banking has not been accomplishing its goals.

These emerging concerns are based on both finalist and technical evidence. From a finalist perspective, there has been no appreciable change in the competitive dynamics of the European banking sector or in customer behavior regarding the consumption of open banking-based services (Mastercard, 2022). Likewise, from a technical point of view, the use of open banking, measured through the consumption of the Application Programming Interfaces (APIs) through which open banking services materialize, is well below expectations. These two facts together are clear indications that open banking models are not working as expected (Konsentus, 2022).

This deviation between expectations and results raises questions about how the open banking models were designed. Notably, the regulatory discussions that have given rise to the open banking reference models worldwide were not based on market analysis but on theoretical approaches. This fact is, in itself, a wake-up call. Open banking's initial argument is robust: if access to customer data is a barrier to entry in the banking sector, facilitating access to customer data should lower the barriers to entry. However, a key element is missing from the discussion: the client's consent is necessary for data access. Unfortunately, there is no robust knowledge about what factors facilitate or hinder obtaining clients' consent for access to financial data, which is the cornerstone on which open banking is based. As a matter of fact, existing academic research on open banking or even financial data-sharing is minimal and highly fragmented. Actually, there is not even a generalized definition of open banking in Academia that specifies open banking as a research object.

This lack of concretion on the research object significantly limits the proper development of a solid research corpus around it. Additionally, as a highly multidisciplinary phenomenon involving technology, regulation, customer behavior and industrial policy, the absence of a shared definition among academic disciplines is a challenge for researchers to collaborate.

Finally, existing research is not comprehensive, with relevant gaps in critical areas such as the clients' perspective on financial data-sharing-based services.

Consequently, this thesis aims to enhance the current understanding of open banking, incorporating the customer perspective, to identify actionable levers to increase its adoption by clients and improve competition in the market.

In the given context, the relevance of this research project is three-fold. To begin with, the first paper contributes a conceptually thorough approach to open banking to existing knowledge. To this end, it structures the ongoing academic and professional research on open banking and identifies the critical themes around it. Next, the second paper analyzes the question of the end customer's actual drivers of open banking adoption rigorously. Finally, based on this, the third paper reflects on the reasons for the underperformance of existing models. It discusses the convenience of extending the open banking concept to a broader *open finance* framework, an issue currently considered by European regulators.

This research is also relevant for private agents involved in open banking frameworks. A deeper understanding of the primary adoption drivers of open banking-based services is crucial for developing compelling use cases that appeal to end customers. This perspective is valuable for incumbent financial institutions and new entrants that have to compete under a new set of rules that significantly changes the sources of competitive advantage in the retail banking industry.

2. Objectives

Since this thesis[3] is a compendium of three articles, there might be certain overlaps between the specific objectives, the structure, and the results. Each paper has its objective or research question and makes its original contribution, framed in the conceptual structure described below. However, the compendium of articles constitutes a comprehensive research project designed to fulfill general and specific research objectives.

2.1. General objectives of the research

This research's general objective is to enhance the understanding of open banking through a multidisciplinary approach, focusing on the customer's perspective. Through this, it attempts to understand the impact of the customer perspective on the usage of open banking-based services.

2.2. Specific research objectives

As for the specific objectives, the focus of this research is three-tiered. The first part of the research defines open banking, given that the academic literature has not yet consolidated a definition. This definition lays the foundations for the rest of the work. The second part of the research focuses on analyzing the factors explaining open banking adoption by customers. The third part of the research analyzes the implications of the answers to the two previous questions in the debate about the use of open banking-based services and the future of open banking models.

In the first part of the investigation, the study takes an explorative approach to analyze the constructs underlying open banking and related phenomena and to identify the potential relationships among them. To this end, this part of the research analyzes secondary data. This analysis includes academic literature and selected publications relevant to conceptualizing, among others, fintech disruption, big tech[4] (a.k.a., TechFin) disruption, Banking as a Service (BaaS), banking platformification, open APIs, open data, open innovation, and open banking. Although peer-reviewed literature has been thoroughly studied to provide a foundation for this

[3] Considering the lack of consensus in the terminology, the terms "thesis" and "dissertation" are used indistinctively.
[4] Big tech generally refers to large digital technology companies including Google, Amazon, Apple, Meta, Baidu, Alibaba and Tencent (Langley & Leyshon, 2021).

research, a deep analysis of grey literature and publications from practitioners has been performed as well, owing to the novelty of the subject.

The first part focuses on three aspects. First, it examines the question of the definition of open banking. Despite being a frequently cited concept in the professional and academic literature, there is no generalized definition. This lack of definition leads to a lack of collaboration between researchers and causes conceptual confusion. Hence, the first objective is to review the academic literature on the definition of open banking. Second, it explains the different contexts or connotations in which open banking is used. The starting hypothesis has been that, given the lack of a shared definition, researchers from different fields refer to different meanings of open banking when dealing with the concept. By integrating the previous two points, the study pursues the specification of a definition that can serve as a common ground for researchers analyzing the open banking phenomenon. Methodologically, this part relies on robust tools such as VoS-Viewer, one of the reference applications for bibliometric analysis. This first part of the study also leverages discourse analysis and innovative techniques, such as applying the Herfindahl–Hirschman index (HHI) to analyze convergence on the existing definitions.

Concerning the second part, the investigation focuses on the explanatory factors for the adoption of open banking-based services. To this end, based on the technology adoption literature, this research explains the factors driving the adoption of open banking-based services by retail banking customers. Despite being a consolidated area for academic literature, technology adoption is a permanently evolving subfield that benefits extraordinarily from new contributions. This second section conducts primary market research to gather data to perform a quantitative analysis of the drivers of end-customer adoption of open banking-based services. Data is analyzed by applying structural equation modeling, a standard approach for technology acceptance research.

As for the third part, the study focuses on identifying the practical implications. By combining the two research perspectives in the first and second parts, this section presents an integrated and complete vision of the challenges posed by open banking from theoretical and pragmatic perspectives. The current open banking conversation is focused on three questions: usage, open finance and level playing fields. Usage refers to improving end customers' adoption rates of existing open banking-based services. Open finance revolves around transitioning from "open banking" to "open finance", extending current open banking models to all the customers' financial data. Finally, the level playing field debate deals with the need to complete open banking models with symmetric data-sharing regulations in other fields such as insurance, asset management, technology, or utilities. This last part transforms the results

obtained in the first two sections, based on rigor and the scientific method, into specific answers to the questions raised by practitioners regarding the phenomenon of open banking.

Finally, this study discusses existing limitations and lays the foundations for future research on the concept of open banking and the drivers of open banking services' adoption.

3. Literature Review, research gaps and methodological approach

3.1. Literature Review

Open banking is a new phenomenon in the banking industry and an even newer concept for Academia. Before 2016, only four articles contained the term "Open banking" in academic or grey literature. Hence, Open banking can be considered a new study object. Since open banking's initial implementation in the U.K. and Europe, market practitioners such as global consulting firms and technology companies have published extensively about the phenomenon (Hallsworth et al., 2017; Khanna et al., 2017; McIntyre & McFarlane, 2018). However, academic literature has developed at a significantly lower pace.

Each of the following chapters of this dissertation includes specific literature reviews for the topics covered. In this section, the focus is to describe the current state of open banking research and frame the contribution of this research project.

Existing literature analyzes open banking under six perspectives: conceptual, regulatory, technological, economic, data sharing, and managerial.

3.1.1. Open banking as a research object

Despite accepting the importance of open banking as a global transformation driver of the retail banking sector, open banking as a research object still lacks theoretical and empirical conceptualization (van Zeeland & Pierson, 2021). The research around the open banking concept is limited, and only three academic publications analyze the concept of open banking.

To begin with, van Zeeland & Pierson (2021) follow a bibliometric and discourse analysis approach for open banking. However, they do not propose a definition, concluding that: "Open Banking could be all kinds of things, from a remedy to an ecosystem, or most often: a (business) model of some sort. Its purposes are to provide new ('better, 'customer-centric') services to customers and improve competition in the banking market by letting 'third parties' in." O'Leary et al. (2021), building on an open data le approach, focus on secure data sharing and enhancing product innovation. Nevertheless, their approach is not multidisciplinary, and their proposed definition can not be generalized. Finally, Laplante & Kshetri (2021) approach

the need for a definition of open banking but do not provide a generalized definition other than describing the phenomenon.

To sum up, open banking as a research object lacks both conceptualization and a proper formal definition, which is a relevant stopper for developing academic literature around the phenomenon for several reasons. Firstly, existing publications analyze different phenomena even though they all refer to "open banking. Second, scholars from different disciplines or geographies cannot collaborate or hold a conversation if a shared definition of the object does not exist. Finally, if open banking is not adequately defined as a research object, it is difficult to differentiate it from related topics such as open data, open innovation, open finance or open payments.

3.1.2. Open banking as regulation

Although the open banking phenomenon can occur without a specific regulatory framework (Muñoz & Díaz, 2020), the most relevant open banking frameworks worldwide rely on formal regulations. From a regulatory perspective (Leong, 2020), open banking describes the different regulations published in different geographies to promote data sharing within the retail banking industry. In this context, open banking refers, among others, to European Union's *Second Payment Services Directive* (PSD2), U.K.'s *Open Banking Standard*, Australia's *Consumer Data Right*, Singapore's *Personal Data Protection Act*, India's *Aadhaar* and *Unified Payments Interface* or similar regulatory pieces being analyzed and approved on Hong Kong, Canada, Brazil (*BCB Circular No. 4,015/2020*) or Mexico (*Ley Fintech*).

Existing literature on open banking as regulation can be divided into two streams: descriptive and analytical. Descriptive publications' main goal is to compare different open banking regulations worldwide. For example, Abudulai et al. (2020), Gardner & Leong (2021), Remolina (2019, 2020) or Ziegler (2021) identify and compare the key components of open banking regulations around the world (e.g., data protection regulation, data access infrastructure, electronic identity verification or third-party providers regimes) to propose best practices and potential evolution lines on existing frameworks. The main conclusion is that financial data sharing is the only common element for all existing open banking regimes. All the other aspects, such as electronic identity, strong customer authentication, or payment initiation, are present in some but not all the regulated open baking models. As for the maturity level of this research line, due to the novelty of the phenomenon, their approaches are mainly descriptive and qualitative, lacking any hard evidence or explanation about the performance of the different regulations.

On the other hand, analytical approaches Arner et al. (2020), Koeppl & Kronick (2020), Plaitakis & Staschen (2020) or Zetzsche et al. (2019) focus on the performance of a single jurisdiction, providing insights for policymakers and other stakeholders.

To summarize, open banking as regulation has generated a relatively high level of attention among scholars. However, a systematic approach to designing an open banking framework, considering the implications of different regulatory choices, is still missing.

3.1.3. Open banking as a technology

From a technological perspective, open banking can be identified with the underlying technology architecture that enables the transition to an open ecosystem in the retail banking industry (Ozcan et al., 2019).

Even though there is not a single technological standard, it is widely accepted that the Application Programming Interface (API) is the most suitable technology to enable this transition. APIs simplify the interconnection between players in an ecosystem, opening standard and self-explained interfaces that allow third parties to connect and interact with one system without previous interaction. Hence, "open financial APIs" or "API banking" is often used as a synonym for open banking in technology.

An emergent literature body analyzes open banking from a technology adoption perspective. (Chan et al., 2022) have analyzed open banking adoption in Australia by applying an extended version of the Unified Theory of Acceptance and Use of Technology (UTAUT). The same model was applied by (Rosati et al., 2022) in several European countries. (Sivathanu, 2019) used the Technology Readiness and Acceptance Model (TRAM) in India and (Valarini & Nakano, 2021) in Brazil.

While traditional technology adoption drivers (i.e., perceived usefulness and ease of use) are relevant to explain open banking adoption, other factors such as trust, risk, social influence or facilitating conditions should also be considered. The main caveat of this line of research is that although there are commonalities in all open banking regulations across regions, specificities in each country should be factored in to understand the phenomenon better. Additionally, although advanced technology adoption models (e.g., TRAM or UTAUT) are starting to be applied to open banking, there is still no consensus on the relevance of perceived usefulness and ease of use in the case of open banking. Thus a parsimonious

approach to open banking based on the initial Technology Acceptance Model – TAM, would be beneficial to set the foundations for the future application of modern technology adoption approaches. Perceived usefulness is highly correlated with use cases, and perceived ease of use is mainly obtained by user interfaces and user experience. Thus, a robust understanding of adoption factors would lead to specific, actionable items for improving open banking usage.

The interaction of open banking with other technologies is also a research focus for Academia. For example, Farrow (2020a; 2020b) describes open banking requirements for cloud infrastructure, and Wang et al. (2020) discuss the interaction of open banking with blockchain through the lenses of data privacy. Finally, Long et al. (2020) describe the interactions between open banking and federated learning.

While this line of research is certainly promising, the outcomes are still highly fragmented, and a consolidated view of all the technological requirements of open banking and which technologies fit better with an open banking philosophy is still to be developed.

3.1.4. Open banking as data sharing

Borgogno & Colangelo (2020a; 2020b) have analyzed open banking as a case of data-sharing, highlighting the profound implications of open banking to enhance competition in the retail banking market.

Another relevant stream of research analyzes open banking as a case of a broader open data trend O'Leary et al. (2021), identifying potential enhancers of open banking as a catalyzer of innovation and competition in the retail banking market.

Finally, the discussion has recently begun on the convenience and implications of extending the principles of open banking to other financial data (open finance) and even to other industries beyond finance (level playing fields) by applying reciprocity principles (De Pascalis, 2022).

3.1.5. The economic impacts of open banking

From an economic standpoint, the impact of open banking has not been adequately analyzed yet. Even though open banking has the potential to affect the retail banking value chain severely, the number of publications is still scarce. He et al. (2020) analyze the impact of open banking on credit market competition when borrowers own the data, concluding that

open banking could improve the entire financial industry but leave all borrowers worse off. Nevertheless, Goldstein et al. (2022), analyzing open banking with depositors monitoring, conclude that open banking may lead to inefficient resource allocation.

To sum up, academic literature on open banking economics is still at its very early stages of development, with no robust conclusions to evaluate the impact of open baking on the financial system or the overall economy.

3.1.6. Managerial implications

From a managerial or industry policy viewpoint (Brodsky & Oakes, 2017; Brodsky et al., 2018), open banking refers to the structural changes in the demand and supply of financial services in the retail banking space that drive the retail banking business's evolution to a platform model. In this space, retail banking platformification or Banking as a Service (BaaS) are widely used as a synonym for open banking.

The structural change in the retail banking industry is also confirmed under different frameworks, such as platformization (Zachariadis & Ozcan, 2017; Zachariadis, 2020), value chain disruption (Omarini, 2020) or business model disruption (Ramdani et al., 2020). All these studies anticipate structural changes in the retail banking industry after implementing open banking models due to the entrance of new competitors, namely fintechs and big techs.

However, considering the lack of data, all the existing approaches are still qualitative, theoretical and highly opinionative, lacking the required formal and quantitative support to extract generalizable conclusions.

3.2. Main research gaps identified

To begin with, although open banking is still in its early stages of development, there is already emergent literature about the phenomenon. However, there is still not a robust body of knowledge analyzing it but only evolving pieces of research. Thus, a systematic literature review on open banking could be helpful for the development of this field of study. The main challenge is that, given the nascent nature of the phenomenon, the existing literature is of heterogeneous quality and challenging to systematize through traditional literature review approaches.

Secondly, open banking is a complex phenomenon studied by several disciplines. Nevertheless, a consensus about what is precisely open banking shared by all the disciplines is still missing. A shared definition of open banking is crucial for different researchers collaborating across geographies and disciplines.

The research focus so far has been mainly on the open banking infrastructure (e.g., regulation, technology, and industry dynamics). However, a comprehensive view of open banking from the end customer's perspective is still to be developed. This client perspective should deal with different elements such as adoption factors, value creation levers or client satisfaction when using open banking-based services.

Finally, current approaches to open banking are either academic or professional. However, an integrated perspective on the phenomenon combining the outcomes of existing research with the concerns of the practitioners is still to be developed. This integrated perspective would also help to understand the reasons behind the limited adoption of open banking-based services, the final goal of this dissertation.

3.3. Methodological approach

Considering the objectives set for this research project and the current state of the literature, it is necessary to tap into various methodologies to develop the research program successfully.

Pondering the lack of consolidated academic literature on the concept of open banking, the starting point is the articles that directly or indirectly addressed the notion since its genesis in the first decade of the 21st century. It has been necessary to systematically analyze a comprehensive set of articles (initial set of 990, filtered to 282 according to relevance and language) of diverse nature and quality and to induce their underlying constructs to define open banking. To achieve this goal, bibliometric analysis, a mixed quantitative-qualitative approach, is applied. A database is built for this purpose, including all the titles, abstracts and keywords of the identified articles. Specialized software (i.e., VoS Viewer) is used for bibliometric analysis. The outcome of the bibliometric approach is the clustering of underlying constructs in the existing literature dealing with open banking based on Multi-Dimensional Scaling (MDS). Once the underlying constructs are identified, discourse analysis, a qualitative approach, is used to propose a definition. Without a specific methodology, it is necessary to develop an ad-hoc framework. It is built through the induction of the existing components in the existing descriptions and partial definitions of open banking (47 identified in the literature)

to propose a generalized definition containing all the elements that could be used in the different contexts identified.

Regarding the second objective planned, it is necessary to carry out specific fieldwork to build a vision of open banking from the client's perspective. For this, a questionnaire is designed incorporating the best practices identified in the literature on technology adoption. This questionnaire has been applied through online surveys to a sample of 553 respondents with the support of a company specializing in market research, guaranteeing the quality of its execution. The results are analyzed by applying structural equation modeling programmed ad-hoc using the "*lavan*" (latent variable analysis) package of R version "0.6-12".

Finally, to identify the practical implications of the research, an interpretation of the results obtained in the first two phases is carried out from the perspective of a practitioner specialized in strategic consulting in the financial sector, means of payment, innovation, and open banking, with more than eighteen years of experience in this field. This perspective incorporates the expertise of more than ten consulting projects serving seven of the ten largest Spanish financial entities in open banking projects.

4. Outline

The remainder of this dissertation is organized as follows. This thesis is written as a collection of articles[5]. As such, chapters two, three and four correspond to three stand-alone papers. Chapter 2 (corresponding to article 1, already published) and chapter 3 (corresponding to article 2, currently in review) are targeted at peer-reviewed high-impact index academic journals. Chapter 4 (article 3, accepted for publication) aims for a hybrid academic-professional journal. The three pieces together contain the complete results of the research project. Additionally, chapter five summarizes and discusses the main results and implications of the obtained results, identifying existing limitations and proposing future lines of research.

The three articles that compose the core of this dissertation are briefly summarized below, along with the gaps addressed, an overview of the results obtained, and details on their respective publications.

The first paper, "*Open banking: a bibliometric analysis-driven definition*" (Briones & Cassinello, 2022b), fully transcribed as chapter two, "What is open banking?", focuses on the definition of open banking. This article seeks to fill the gap that the lack of a generalized definition of open banking supposes in the academic literature. To do this, it proposes a two-pronged approach. First, applying bibliometric techniques, especially clustering, identifies the different contexts in which the term open banking is used through the analysis of 282 publications. As a result of this approach, platformization of the business model, data-sharing, technology and regulation are identified as the four contexts, areas or connotations of the term open banking.

The 47 existing partial definitions found in the literature are analyzed to propose a formal definition, and a generalized definition of open banking is presented. The proposed definition is based on the eight elements induced from the analyzed definitions (nature, consent, subject, action, object, recipient, process, and purpose). Likewise, after quantitatively analyzing the degree of consensus in the existing definitions, the proposed definition is deemed valid in the four identified contexts for open banking. Therefore, it is considered a generalizable definition and adequate to respond to the gap identified in the literature.

This paper was submitted in February 2022 to PLOS-ONE (ISSN 19326203, Journal Impact Factor 3.752, percentile 60.96 (Q2), Journal Citation Indicator 0.88, percentile 79.88 (Q1), Scimago Journal Rank 0.85 (Q1), peer-reviewed international Journal). It was accepted for publication

[5] In this dissertation, the terms "paper" and "article" are used indistinctively.

in September 2022 and published on October 3, 2022. This paper was presented at the Economics of Financial Technology Conference, held from May 11 to May 13, 2022, at Edinburgh by the University of Edinburgh.

The second paper, "*An Empirical Study on the Role of Trust and Social Influence in the Intention to Use Data-Sharing Technologies: the case of open banking*", (Briones & Cassinello, 2022a), is fully transcribed in chapter three, "What drives open banking adoption by clients?", analyzes the explanatory factors for the adoption of open banking-based services.

This article seeks to respond to the second most relevant gap identified in the academic literature: understanding the drivers that explain the adoption of open banking. The existing academic literature focuses on countries without open banking frameworks, such as Brazil (Valarini & Nakano, 2021), or with emerging frameworks, such as India and Australia (Chan et al., 2022; Sivathanu, 2019). However, this paper focuses on the E.U., a jurisdiction with a regulated and consolidated open banking framework available for the last four years.

This research builds on TAM, the reference technology adoption model, expanding it with initial trust and social influence to analyze the phenomenon of open banking. A questionnaire is constructed and applied to a sample of 553 people to obtain the necessary data for the analysis. The results attained are analyzed through a structural equation model. According to the results obtained, perceived usefulness, social influence and trust explain the tendency to adopt services based on open banking. Regarding the perceived ease of use, a key variable in traditional models of technological adoption, it is concluded that it is not relevant to explain the adoption of this technology. However, the results obtained align with the emerging literature on fintech adoption.

This paper was submitted in October 2022 to Sage Open (ISSN 21582440, Journal Impact Factor 2.032, percentile 52.7 (Q3), Journal Citation Indicator 0.89, percentile 65.97(Q2), Scimago Journal Rank 0.4 (Q2)). This paper is currently under review. This paper was submitted to the Conference on *Banking in the Age of Challenges,* organized by HEC Paris, to be held on December 13 to December 15, 2022, and to the *Economics of Financial Technology Conference,* to be held from June 21 to June 23, 2023, at Edinburgh by the University of Edinburgh and is currently under consideration.

Finally, the third paper, "*Why are open banking models in Europe underperforming?*", fully transcribed in chapter four, "*The future of open banking*", elaborates on the conclusions reached by both previous articles as well as previous open banking research, focusing on the practical implications for the different stakeholders.

This article brings to the open banking literature a critical and factual view of the performance of current open banking models. Its starting point is that financial institutions have made sizeable investments to comply with regulations and create an API infrastructure. However, the level of use of services based on open banking is minimal. It concludes that critical elements are missing in the definition of open banking models in the U.K. and the E.U. Thus, the trust in new providers or the design of use cases that add tangible value to the customers have not been adequately addressed. Therefore, the promotion of services based on open banking requires action by the different stakeholders (financial institutions, regulators and new entrants) to boost adoption levels. Likewise, it opens the reflection of the future of open banking. If existing identified stoppers are not previously removed, extending open banking to other financial data (open finance) or other industries (level playing fields) might be pointless.

This paper was submitted in September to the *Journal of Payments Strategy and Systems* (ISSN 17501806, Scimago Journal Rank 0.25 (Q3)). It was accepted for publication in November 2022 and will be published in the forthcoming issue (2022, volume 16, issue 4).

Finally, chapter five, "Main results, contribution and future work", presents the study's conclusions, discussion, original contributions, limitations, and future research scope. Building on the results obtained in the three papers, this last chapter focuses on contextualizing their meaning in the academic discussion from a practitioner's perspective. The main conclusion is that the client has not had a relevant role in the conception of open banking models. Thus, despite the effort made in its deployment and the conceptual robustness of the idea, if open banking is not reformulated with the customer at the center, it is doubtful that the existing models will achieve the desired objectives of increasing competition and innovation in the retail banking market.

References

Abudulai, S., Ang, X., Goldberg, E., & Kearney, T. (2020). Regulation across the border: developments in canadian and U.S. consumer financial services. *The Business Lawyer, 75*(2), 1949-1956. https://search.proquest.com/docview/2400105352

Arner, D. W., Zetzsche, D. A., Buckley, R. P., & Weber, R. H. (2020). The future of data-driven finance and RegTech: lessons from EU big bang II. *Stanford Journal of Law, Business & Finance, 25*(2), 245-288. https://search.proquest.com/docview/2449281108

Barbaschow, A. (2018, October 12). Westpac predicts Open Banking to cost AU$200m to implement. *ZDNet.* https://www.zdnet.com/finance/westpac-predicts-open-banking-to-cost-au200m-to-implement/

Basso, A., Bon, J., Tasker, B., Timan, N., Walker, M., & Whitcombe, C. (2018). Recent Developments at the CMA: 2017–2018. *Review of Industrial Organization, 53*(4), 615-635. https://doi.org/10.1007/s11151-018-9668-2

Borgogno, O., & Colangelo, G. (2020a). Consumer inertia and competition-sensitive data governance: the case of open banking. *Journal of European Consumer and Market Law,* 9(4), 143 – 150. https://doi.org/10.2139/ssrn.3513514

Borgogno, O., & Colangelo, G. (2020b). The data sharing paradox: BigTechs in finance. *European Competition Journal, 16*(2-3), 20p. https://doi.org/10.1080/17441056.2020.1812285

Briones, G. K., & Cassinello, N. (2022a). *An Empirical Study on the Role of Trust and Social Influence in the Intention to Use Data-Sharing Technologies in the Financial Sector.* SSRN Electronic Journal. https://ssrn.com/abstract=4201446

Briones, G. K., & Cassinello, N. (2022b). Open banking: a bibliometric analysis-driven definition. *PloS One, 17*(10), e0275496. https://doi.org/10.1371/journal.pone.0275496

Brodsky, L., Ip, C., & Lundberg, T. (2018). *Open banking's next wave: perspectives from three fintech CEOs.* McKinsey & Company, Inc. https://www.mckinsey.com/industries/financial-services/our-insights/open-bankings-next-wave-perspectives-from-three-fintech-ceos

Brodsky, L., & Oakes, L. (2017). *Data sharing and open banking.* McKinsey & Company, Inc. https://www.mckinsey.com/industries/financial-services/our-insights/data-sharing-and-open-banking

Cabral, L. M., Haucap, J., Parker, G., Petropoulus, G., Valleti, T., & Van Alstyne, M. (2021). *The EU Digital Markets Act.* Publications Office of the European Union. https://doi.org/10.2760/139337 http://www.econis.eu/PPNSET?PPN=1749382520

Chan, R., Troshani, I., Rao Hill, S., & Hoffmann, A. (2022). Towards an understanding of consumers' FinTech adoption: the case of Open Banking. *International Journal of Bank Marketing, 40*(4), 886-917. https://doi.org/10.1108/IJBM-08-2021-0397

Competition and Markets Authority. (2016). *Retail banking market investigation Final report.* https://assets.publishing.service.gov.uk/media/57ac9667e5274a0f6c00007a/retail-banking-market-investigation-full-final-report.pdf

De Pascalis, F. (2022). The Journey to Open Finance: Learning from the Open Banking Movement. *European Business Law Review,* 33(3), 397-420. https://doi.org/10.54648/eulr2022018

Farrow, G. S. D. (2020a). An application programming interface model for open banking ecosystems. *Journal of Payments Strategy & Systems, 14*(1), 75-91. https://www.ingentaconnect.com/content/hsp/jpss/2020/00000014/00000001/art00010

Farrow, G. S. D. (2020b). Open banking: the rise of the cloud platform. *Journal of Payments Strategy & Systems, 14*(2), 128-146. http://openurl.ingenta.com/content?genre=article&issn=1750-1806&volume=14&issue=2&spage=128&epage=146

Gardner, J., & Leong, E. (2021). Open banking in the UK and Singapore: open possibilities for enhancing financial inclusion. *Journal of Business Law,* (5), 424-453. https://doi.org/10.17863/CAM.55421

Goldstein, I., Huang, C., & Yang, L. (Jun 19 - 21, 2022). Open Banking with Depositor Monitoring. Paper presented at the *China International Conference in Macroeconomics,* Shenzhen, China. 1-51. http://cicm.pbcsf.tsinghua.edu.cn/ueditor/php/upload/file/20220510/1652162396915810.pdf

Gozman, D., Hedman, J., & Sylvest Olsen, K. (June 23-28, 2018). Open banking: emergent roles, risks & opportunities. Paper presented at the *26th European Conference on Information Systems (ECIS) 2018,* Portsmouth, UK. (ECIS Research Papers 183) https://aisel.aisnet.org/ecis2018_rp/183/

Guibaud, S. (2016). How to develop a profitable, customer-focused digital banking strategy: Open banking services and developer-friendly APIs. *Journal of Digital Banking, 1*(1), 6-12. http://openurl.ingenta.com/content?genre=article&issn=2397-060X&volume=1&issue=1&spage=6&epage=12

Hallsworth, J., Kirby-Johnson, O., & Wagner, J. (2017). *Seizing the open banking advantage*. KPMG. https://assets.kpmg/content/dam/kpmg/xx/pdf/2017/10/seizing-the-open-banking-advantage.pdf

He, Z., Huang, J. & Zhou, J. (2020). *Open banking: credit market competition when borrowers own the data.* Cowles Foundation. Retrieved Sep 15, 2022, from https://cowles.yale.edu/publications/cfdp/cfdp-2262

Khanna, S., Ramadath, S., Stephens, D., & Iyengar, K. (2017). *What it really takes to capture the value of APIs.* McKinsey & Company, Inc. https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/what-it-really-takes-to-capture-the-value-of-apis

Kjellén, D. (2021). *Following the money.* Tink. https://resources.tink.com/hubfs/05%20Resources/Reports/2021%20reports/OBIU/Open%20banking%20investments%20and%20use%20cases%20-%20Tink%20survey%20report.pdf

Koeppl, T. V., & Kronick, J. (2020). *Open banking in Canada –The path to implementation.* Commentary 579. CD Howe Institute. https://www.cdhowe.org/sites/default/files/2021-12/Commentary_579.pdf

Konsentus. (2022). *Q4 2021 Konsentus Third Party Provider Open Banking Tracker.* Konsentus - Resources - TPP Trackers. Retrieved Aug 26, 2022, from https://www.konsentus.com/resources/tpp-trackers/q4-2021-konsentus-third-party-provider-open-banking-tracker/

Langley, P., & Leyshon, A. (2021). The Platform Political Economy of FinTech: Reintermediation, Consolidation and Capitalisation. *New Political Economy, 26*(3), 376-388. https://doi.org/10.1080/13563467.2020.1766432

Laplante, P., & Kshetri, N. (2021). Open banking: definition and description. *Computer, 54*(10), 122-128. https://doi.org/10.1109/MC.2021.3055909

Leong, E. (2020). Open Banking: the changing nature of regulating banking data - a case study of Australia and Singapore. *Banking & Finance Law Review, 35*(3), 443-469. https://search.proquest.com/docview/2435720729

Long, G., Tan, Y., Jiang, J., & Zhang, C. (2020). Federated Learning for Open Banking. In Q. Yang, L. Fan & H. Yu (Eds.), *Federated Learning. Lecture Notes in Computer Science, vol 12500* (pp. 240-254). Springer, Cham. https://doi.org/10.1007/978-3-030-63076-8_17

Mastercard. (2022). *Q4 2021 Open Banking tracker.* Mastercard - News & Insights. Retrieved August 26, 2022, from https://b2b.mastercard.com/news-and-insights/open-banking-tracker/q4-2021/

McIntyre, A., & McFarlane, A. (2018). *New World Of Open Banking The Brave Exploiting Inbound And Outbound Trade Opportunities.* Accenture. https://www.accenture.com/us-en/insights/banking/open-banking-moving-towards-open-data-economy

Monitor Deloitte. (2020). *Adoption of Open Banking in Spain. Do Spanish customers need Open Banking?* Deloitte. https://www2.deloitte.com/content/dam/Deloitte/es/Documents/estrategia/Deloitte-ES-strategy-monitor-deloitte-open-banking.pdf

Morvan, A. (2020). *A European open finance framework by 2024.* SSRN3732405. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3732405

Muñoz, J., & Díaz, E. (2020). Avances en la implementación del open banking. *Moneda,* (182), 60-64. https://www.bcrp.gob.pe/docs/Publicaciones/Revista-Moneda/moneda-182/moneda-182-09.pdf

O'Leary, K., O'Reilly, P., Nagle, T., Papadopoulos-Filelis, C., & Dehghani, M. (Jan 5 - 8, 2021). The sustainable value of open banking: insights from an open data lens. Paper presented at the *54th Hawaii International Conference on System Sciences,* Grand Wailea, Maui, Hawaii. 5891-5901. https://doi.org/10.24251/HICSS.2021.713

Omarini, A. E. (2018). Banks and fintechs: how to develop a digital open banking approach for the bank's future. *International Business Research (Toronto), 11*(9), 23-36. https://doi.org/10.5539/ibr.v11n9p23

Omarini, A. E. (2020). FinTech: a new hedge for a financial re-intermediation. Strategy and risk perspectives. *Frontiers in Artificial Intelligence, 3*(63), 63 (1-11). https://doi.org/10.3389/frai.2020.00063

Open Banking Implementation Entity. (2022). *UK open banking marks fourth year milestone with over 4 million users.* Retrieved May 31, 2022, from https://www.openbanking.org.uk/news/uk-open-banking-marks-fourth-year-milestone-with-over-4-million-users/

Ozcan, P., Zachariadis, M., & Dinckol, D. (2019). "Platformification" of banking: strategy and challenges of challenger versus incumbent banks in UK. *Academy of Management Proceedings, 2019*(1), 17147. https://doi.org/10.5465/AMBPP.2019.17147abstract

Pisano, G. P. (2015). You need an innovation strategy. *Harvard Business Review, 93*, 44-54. http://www.econis.eu/PPNSET?PPN=831874635

Plaitakis, A., & Staschen, S. (2020). *Open banking: how to design for financial inclusion.* Consultative Group to Assist the Poor. https://www.cgap.org/sites/default/files/publications/2020_10_Working_Paper_Open_Banking.pdf

Ramdani, B., Rothwell, B., & Boukrami, E. (2020). Open banking: the emergence of new digital business models. *International Journal of Innovation and Technology Management, 17*(5), 2050033 (19 p.). https://doi.org/10.1142/S0219877020500339

Redfern, S. (2021). *11 Years of the Open Bank Project.* Retrieved May 30, 2022, from https://www.openbankproject.com/11-years-of-the-open-bank-project/

Remolina, N. (2019). *Open banking: regulatory challenges for a new form of financial intermediation in a data-driven world.* Singapore Management University - Centre for AI & Data Governance. https://ssrn.com/abstract=3475019

Remolina, N. (2020). *Towards a data-driven financial system: the impact of COVID-19.* SMU Centre for AI & Data Governance. Research Paper 08. https://ink.library.smu.edu.sg/cgi/viewcontent.cgi?article=1007&context=caidg

Rosati, P., Fox, G., Cummins, M., & Lynn, T. (2022). Perceived Risk as a Determinant of Propensity to Adopt Account Information Services under the EU Payment Services Directive 2. *Journal of Theoretical and Applied Electronic Commerce Research, 17*(2), 506. https://doi.org/10.3390/jtaer17020026

Sivathanu, B. (2019). An empirical study on the intention to use open banking in India. *Information Resources Management Journal (IRMJ), 32*(3), 27-47. https://doi.org/10.4018/IRMJ.2019070102

Stiefmueller, C. M. (July 16-20, 2020). Open banking and PSD 2: the promise of transforming banking by 'empowering customers'. Paper presented at the *Conference on the Human Side of Service Engineering,* 299-305. https://doi.org/10.1007/978-3-030-51057-2_41 http://link.springer.com/10.1007/978-3-030-51057-2_41

Valarini, H., & Nakano, D. (2021). An analysis of open banking adoption among university students in São Paulo using the Technology Readiness and Acceptance Model (TRAM). *Exacta, 20*(3), 688-705. https://doi.org/10.5585/exactaep.2021.17453

van Zeeland, I., & Pierson, J. (2021). *The concept of open banking: from a remedy to an ecosystem.* (Policy Brief #44). Vrije Universiteit Brussel. https://cris.vub.be/ws/portalfiles/portal/67938789/Policy_Brief_44_final_1.pdf

Wang, H., Ma, S., Dai, H., Imran, M., & Wang, T. (2020). Blockchain-based data privacy management with Nudge theory in open banking. *Future Generation Computer Systems, 110*, 812-823. https://doi.org/10.1016/j.future.2019.09.010

World Bank. (2022). *Technical Note on Open Banking. Comparative Study on Regulatory Approaches.* World Bank Finance, Competitiveness & Innovation Global Practice. https://doi.org/10.1596/37483

Zachariadis, M. (2020). *Data-sharing frameworks in financial services: Discussing Open Banking Regulation for Canada.* Global Risk Institute in Financial Services. https://doi.org/10.2139/ssrn.2983066

Zachariadis, M., & Ozcan, P. (2017). *The API economy and digital transformation in financial services: The case of open banking.* SSRN2975199. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.2975199

Zetzsche, D., Arner, D., Buckley, R., & Weber, R. (2019). The evolution and future of data-driven finance in the EU. *Common Market Law Review, 57*(2), 331-359. https://doi.org/10.54648/cola2020030

Ziegler, T. (2021). Implementation of open banking protocols around the world. In R. Rau, R. Wardrop & L. Zingales (Eds.), *The Palgrave Handbook of Technological Finance* (pp. 751-779). Springer International Publishing. https://doi.org/10.1007/978-3-030-65117-6_27

Chapter 2: What is open banking?

The content of this chapter is a reproduction of the article titled "*Open banking: a bibliometric analysis-driven definition*", published in PLOS One on October 3, 2022. This article is co-authored by Dra. Natalia Cassinello Plaza[6].

Abstract

"Open banking," as a concept, was initially developed by a UK regulation to foster competition in banking through sharing client data (with their consent) amongst competitors. Today, it is regulated in several most relevant banking jurisdictions. Despite its growing relevance, consensus about the definition of open banking is lacking. This study examines 282 articles on open banking using bibliometric clustering techniques. Moreover, within the 282 articles and applying discourse analysis, we analyze 47 idiosyncratic definitions of open banking to test an integral framework that supports our proposed definition of the concept. Our study contributes to the literature by providing a generalized multidisciplinary definition of open banking. It identifies four main drivers behind the concept: business model change, client data sharing, incorporation of technological companies (fintechs and others), and regulation. These four elements, which should be considered in new regulations in the globalized banking sector, foresee open banking as a critical enabler of a new strategic dynamic in banking.

Keywords

open banking; bibliometric analysis; VoSViewer; HHI; clustering

1. Introduction

What is open banking? Since the inception of the "Open Banking Working Group" in the United Kingdom in 2015, open banking has generally been considered as the platformization of the

[6] (Briones & Cassinello, 2022)

retail banking industry (Diamond et al., 2019), (Basso et al., 2018). To date, it has spread worldwide from the UK to Continental Europe, America, and Asia, constituting one of the retail banking industry's shaping forces of the future (Ziegler, 2021) (Brackert et al., 2019). Thus, on top of the open banking initiative in the UK and PSD2 (Payment Services Directive 2) in the European Union, there are open banking regulations in Australia, India, México, and Brazil, and forthcoming regulations in Russia and Canada.

The essence of open banking regulations is to recognize the banking clients' right to share their transactional data with authorized third parties and detailed provisions on how to materialize this right (Zetzsche et al., 2019). Despite its apparent simplicity, this data-sharing right constitutes the primary vector for fostering the transformation of the retail banking sector from a closed business model to an open platform, similar to what occurred in the telecommunications, power, and gas industries (Westermeier, 2020).

Open banking originated from practitioners and was inspired by the open data, open-APIs (Application Programming Interfaces), and open innovation philosophies (Omarini, 2018) applied to the retail banking business (Basso et al., 2018; Gozman et al., Jan 1, 2018). The business community is analyzing this phenomenon extensively, understanding it as a "*collaborative model in which banking data is shared through APIs between two or more unaffiliated parties to deliver enhanced capabilities to the marketplace*" (Brodsky & Oakes, 2017).

Its first implementation worldwide materialized in the UK. It was requested by the Competition and Markets Authority as a foundational strategy to ascertain that personal current accounts, as well as small and medium-sized enterprises' banking markets, serve customers better. This issue emanated from a retail banking market investigation concluded in 2016 (Basso et al., 2018). It also inspired the European Commission to publish the PSD2 (Guibaud, 2016) (Omarini, 2018; Omarini, 2020). Although open banking is still in its initial stages of development, the concept has been embraced by practitioners and regulators, being regarded as one of the shaping forces of the financial industry worldwide (Brackert et al., 2019).

Nevertheless, despite existing literature acknowledging the importance of open banking as a critical retail banking industry's transformational lever (Rubanov, 2019), open banking as a research object still lacks conceptualization both theoretically and empirically (van Zeeland & Pierson, 2021). Academic literature on the subject is still in its early stages of development. Out of 990 documents registered in the Google Scholar database (Aug 6, 2021) containing the term "open banking," only 57 were published in Scopus-rated peer-reviewed academic journals.

Considering its international and multidisciplinary nature, open banking as a research object presents several challenges. To begin with, open banking is being studied in many academic fields, and researchers who represent different disciplines seem not to converge on a shared definition of open banking (van Zeeland & Pierson, 2021). Additionally, most authors researching the topic leverage idiosyncratic definitions aligned with their respective research focus (O'Leary et al., Jan 5, 2021). Moreover, subtle differences among open banking regulations worldwide create confusion when comparing publications from different geographies (Ziegler, 2021). Hence, our study aims to establish a generalized definition of open banking and its varying interpretations in different disciplines and geographies. A generalized definition of open banking would add consistency and robustness to existing research, laying out a solid foundation to support high-quality research on the phenomenon.

Apart from a generalized definition, understanding different contexts in which the term "open banking" is used is also essential. Open banking can be discussed from different perspectives (regulatory, technological, economic, and managerial) that imply different nuances which should be identified. Additionally, it is also critical to validate a generalized definition under these different contexts to ensure that it works properly in all of them.

This study aims to understand the contexts and meanings of the term "open banking" and proposes a generalized definition that can be used unambiguously in the academic literature. For this objective, two methodologies are used. First, through clustering-based bibliometric analysis, 282 academic articles are analyzed to identify the areas, contexts, or meanings of "open banking." Second, applying a "discourse analysis" methodology, the 47 definitions of open banking found in the literature are examined, and a generalized definition of the term applicable to all open banking connotations is proposed.

Our study makes several contributions to the literature. First, it performs a review of the pre-existing literature on open banking by applying bibliometric techniques. Second, a generalized definition of open banking and its four applications (business model, fintech, data-sharing, and regulation) is proposed. Third, the 47 existing open banking definitions are systematically analyzed, and a classification is proposed for them (institutional, ecosystem, and client). Likewise, generated inductively, an "open banking integrated definition framework" is formulated based on eight elements that can be applied to similar definitions. Finally, the Hirschman Herfindahl Index (HHI) is used innovatively within the discourse analysis to measure the degree of consensus regarding the definition.

2. Literature review and research question

Open banking is a new phenomenon in the banking industry and an even newer concept in academia. Before 2016, only four articles contained the term "open banking" in academic or grey journals. Hence, open banking can be considered a new study object.

Existing literature can be grouped into three blocks: regulatory, technical, and managerial. The regulatory literature analyzes the legislation that supports open banking (European Union's Second Payment Services Directive [PSD2], UK's Open Banking Standard, Australia's Consumer Data Right, Singapore's Personal Data Protection Act, India's Aadhaar and Unified Payments Interface, and similar regulatory pieces being analyzed and approved in Hong Kong, Canada, Brazil, [BCB Circular No. 4,015/2020], and Mexico (Ley Fintech). Existing publications either focus on a single jurisdiction (Arner et al., 2020; Buckley et al., 2020; Farrell, 2019; Koeppl & Kronick, 2020) or compare different legislations (Gardner & Leong, 2021; Remolina, 2019). From a technology perspective, existing literature focuses on the underlying infrastructure (Farrow, 2020a; Farrow, 2020b; Long et al., 2020) as well as on the acceptance of the open banking technology from the customer's perspective (Chan et al., 2022; Sivathanu, 2019; Valarini & Nakano, 2021). Managerial literature analyzes structural changes in the demand and supply of financial services in the retail banking market due to open banking (Brodsky & Oakes, 2017; Omarini, 2018; Omarini, 2020; Ozcan et al., 2019; Ramdani et al., 2020; Zachariadis & Ozcan, 2017). Finally, other fields, such as microeconomics, are also starting to analyze the phenomenon (He et al., 2020).

Nevertheless, despite a growing academic interest in open banking, foundational literature is still missing. There are no publications analyzing the origins of open banking (why open banking is needed), the nature of the phenomenon (how open banking has developed in different geographies) or, even more basic, what open banking is. As a matter of fact, there are only three publications devoted to establishing a definition of open banking. Van Zeeland and Pierson (2021) follow a bibliometric and discourse analysis approach for open banking, but they fail to propose a definition, concluding that:

> *"Open Banking could be all kinds of things, from a remedy to an ecosystem, or most often: a (business) model of some sort. Its purposes are considered to be providing new ('better', 'customer-centric') services to customers and improving competition in the banking market by letting 'third parties' in."* (van Zeeland & Pierson, 2021)

O'Leary et al. (2021), building on an open data lenses approach, propose the following definition:

> "*An initiative which facilitates the secure sharing of account data with licensed third parties through Application Programming Interfaces (APIs), empowering customers with ownership of their own data. The initiative aims to increase competition in retail banking by developing innovative products and services which will bring increased value to customers*." (O'Leary et al., 2021)

Finally, Laplante and Kshetri (2021) approach the need for a definition of open banking but do not provide a generalized definition other than describing the phenomenon as:

> "*Open banking describes a special kind of financial ecosystem. The ecosystem provides third-party financial service providers open access to consumer banking, transaction, and other financial data from banks and nonbank financial institutions through the use of application programming interfaces (APIs)*." (Laplante & Kshetri, 2021)

The existing definitions of open banking present three types of problems fundamentally: perspective bias, discipline bias, and purpose bias. Starting with the perspective bias problem, open banking is a tripartite scheme between the owner of the data, the custodian, and the third party who accesses it. Any general definition must consider the three agents to avoid partial or incomplete analysis of the phenomenon. Regarding the discipline bias problem, researchers tend to confuse the context in which open banking is used in their discipline with a generally applicable definition. Thus, technical literature focuses exclusively on the technological support of the phenomenon, the regulatory literature on its legal support, and the management literature on the possible implications for the business model. However, a generalized concept of open banking must be able to encompass all its contexts of use and not just one of the meanings. Finally, the purpose bias problem consists of giving open banking a specific purpose other than the one for which it was formulated: to increase competition in retail banking by facilitating the entry of new competitors. Considering the combined effect of the three biases, the definitions proposed so far of open banking do not allow the construction of solid and generalizable knowledge about the phenomenon, which is a significant caveat on its development.

One last question is why academic research on open banking is relevant. There are no global figures for the investment required to materialize open banking. According to Tink, one of the world's leading open banking service providers (Kjellén, 2021), the average open banking expenditure for a retail bank in Europe in 2020 was €83.1 Mn. So, the aggregated figure for the system should be in the range of tenths of billions annually, just for Europe. Nevertheless, we have no evidence, based on scientific studies, of the intention of customers to use services based on open banking. There is no scientific evidence on how open banking can impact value creation and distribution in retail banking. No robust academic studies explain the conditions under which customers are willing to share data with third-party providers. In short,

the academia has dealt with accessory elements of open banking but not with the central aspects of the phenomenon. The lack of a robust and generally shared definition of the phenomenon allowing collaboration among researchers and a holistic view of the phenomenon, is at the heart of this knowledge gap.

Thus, a generalized definition of open banking, together with a detailed understanding of different contexts in which the "open banking" concept is used, is a relevant gap in the academic literature that needs to be filled. A particular contribution of this study is that it tackles the research question through a multidisciplinary approach, integrating views from different knowledge domains and through mixed quantitative-qualitative techniques, specifically bibliometric research and discourse analysis.

3. Methodology

This study follows a three-tiered approach to present a potential generalized definition of open banking (Fig 1). First, using bibliometric techniques, we map existing literature (282 documents) and, by applying co-word analysis, cluster co-occurring terms to identify conceptual domains related to open banking. The clustering analysis is executed using *Visualization of Similarities* (VoS), an evolution of Multidimensional Scaling (MDS) algorithms. From this analysis, we identify four clusters that inform the existing open banking literature and examine the interaction among them. Second, by applying a discourse analysis approach, we analyze existing definitions of open banking in the literature (47 definitions found in the 282 articles) to reveal critical attributes mentioned in these definitions considering their disciplinary and geographical variations. We, then, profile the descriptors used concerning each attribute and propose a framework to analyze existing open banking definitions. Third, based on the analysis, we outline an integrative definition of open banking, identify limitations of the investigation, and propose future research developments.

The analysis supporting this publication combines two methodological approaches: bibliometric and discourse analysis. First, we identify and analyze all relevant open banking literature and cluster the main perspectives on the topic by leveraging bibliometric techniques. Then, we extract 47 idiosyncratic, partial, or working definitions of open banking identified in the dataset. Applying critical discourse analysis, a method that has been accepted in the academic literature as a valid procedure for social sciences research (Laplante & Kshetri, 2021; Wodak & Meyer, 2009), we systematically examine the 47 definitions to deduce a general definition for open banking and interpret the results.

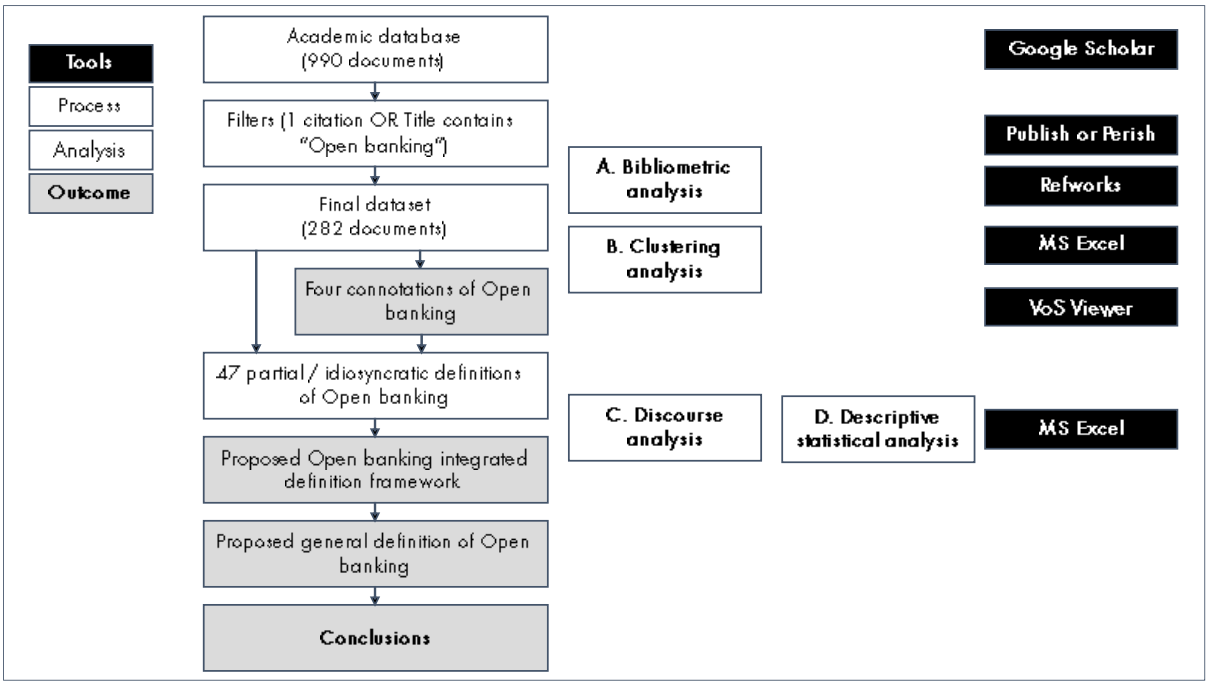

Fig 1: Overview of the process

3.1. Bibliometric analysis

3.1.1. Analytical approach

Bibliometrics refers to the field that investigates groups of publications applying quantitative analysis methods (Osareh, 1996). Although this technique was initiated during the 1950-1960 period, it gained traction in the last two decades with the emergence of large electronic databases of academic articles, such as Web of Science (WoS) and Scopus, and the generalization of bibliometric analytics software packages, such as Gephi, Leximancer, and VOSviewer (Zupic & Čater, 2015).

Bibliometric analysis techniques can be divided into three prominent families according to their goal (Donthu et al., 2021): techniques for establishing a relationship between authors (co-author analysis), techniques that aim at establishing a relationship between publications (citation analysis, co-citation analysis, and bibliographic coupling), and techniques for defining relationships within the content of selected publications (co-word analysis). Considering the relative novelty of the topic under consideration and the lack of consolidation of the academic sources considered, this study focuses on co-word analysis to identify the underlying constructs of the open banking concept.

From an analytical point of view, the core techniques of bibliometric analysis can be divided into performance analysis and science mapping (Donthu et al., 2021). As an evolution of science mapping core techniques, enrichment techniques allow outcome augmentation to produce more advanced insights. This study applies clustering and visualization, both enrichment techniques, to perform a co-word analysis on the dataset that comprises all relevant open banking academic literature. Co-word analysis clustering and visualization techniques' output is a network of topics and their associations, which represent the conceptual domain of a research field. Although clustering and visualization techniques are conceptually different, they usually go hand in hand (Donthu et al., 2021). In this study, they are applied simultaneously to analyze the dataset.

3.1.2. Dataset building and process

Although the first open banking regulation was approved in 2017 in the UK, the concept's origins are uncertain. Simon Redfern founded the Open Bank Project in 2012 (Asli, 2012). But even before that, academic articles have been containing references to "open finance" and "financial aggregation" since 2002 (Jakovljevic et al., 2002). Consequently, our database includes articles about "open banking" since 2002.

The initial dataset consists of 990 documents identified through a search in the Google Scholar database for articles using "open banking" as a keyword, conducted on August 6, 2021. The search is carried out through the Publish or Perish software tool.

Since its launch in 2004, Google Scholar has positioned itself as the most comprehensive academic citations database compared with alternative options such as WoS or Scopus, especially for humanities and social sciences (Martín-Martín et al., 2018). However, Google Scholar contains articles not published in peer-reviewed journals, which requires additional filtering to ensure the quality of the database. Thus, Publish or Perish is commonly used in bibliometric analysis to filter academic publications databases (Martín-Martín et al., 2018).

Only documents written in English are selected due to the clustering analysis' language requirements (663 articles). Two filters are subsequently applied: documents containing "open banking" in the title (92 papers) and records that contained "open banking" in the abstract and that had at least one citation (264 documents), obtaining 356 articles. To include articles with at least one citation is a potential quality filter of literature referenced in Google Scholar and is consistent with academic procedures (Hill & Provost, 2003; Aizenman & Kletzer, 2011) and recent bibliometric publications on the topic (van Zeeland & Pierson, 2021). An additional

check is performed to ensure that all the articles referenced in Scopus and WoS related to the topic are contained in the filtered database. After that, the remaining papers are fully read with two objectives. First, on the bibliometric side, to reject false positives of the combination of the words "open" and "banking," obtaining the final list of 282 documents from 2002 to 2021 (Fig 2). The resulting dataset is uploaded to RefWorks, a commonly used reference manager software (26). Second, on the content analysis approach, to extract all the definitions of "open banking" included in the dataset. Forty-eight definitions of "open banking," transcribed in Table 3, Table 4, and Table 5, are identified and recorded in an excel database (Annex 1) (42).

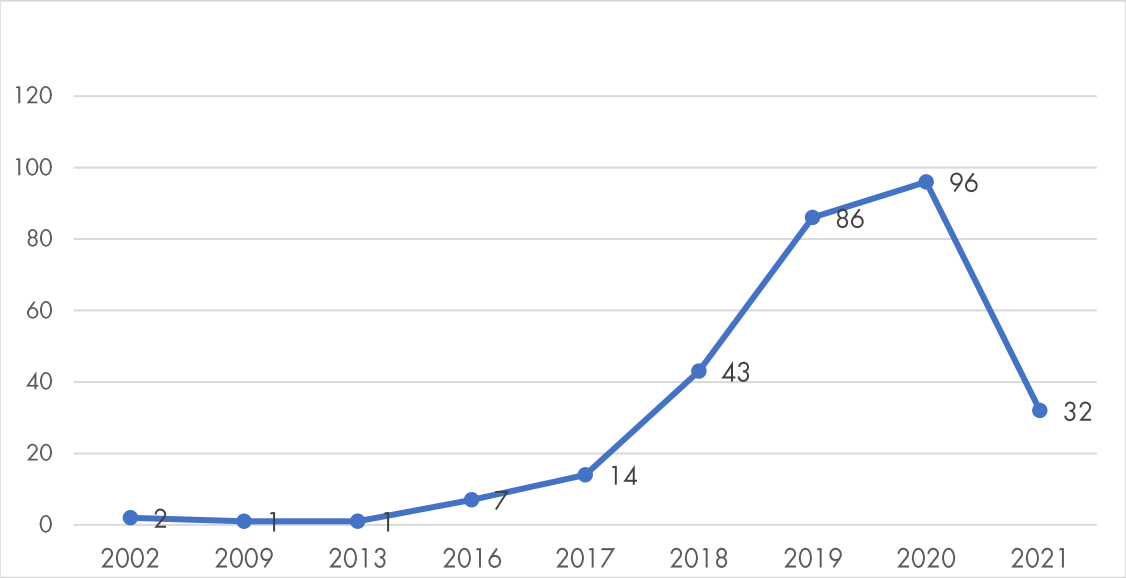

Fig 2: Final dataset publications per year

Due to limitations in obtaining full-text searchable versions of all the articles in the dataset, co-wording analysis is performed only on the titles and abstracts. This approach is consistent with existing bibliometric techniques as described in the literature (Zupic & Čater, 2015). These 282 articles yield 5,000 terms, out of which only those with five or more occurrences are selected (377). Ten generic terms (article, case, case study, chapter, example, interview, number, paper, study, and year) are removed from the selection, finishing with 367 terms. These terms are clustered, defining a minimum size of 25 items per cluster to avoid the micro fragmentation of clusters. This process results in four clusters discussed in the results section. The normalization method applied is Linear / Logarithmic, and the proposed visualization layer is built using an attraction parameter of 3 and a rejection parameter of 0. The minimum cluster size is set at 25 (Waltman & van Eck, 2012), and the iterations number is set at 50.

3.2. Discourse analysis

During the bibliometric analysis dataset-building process, 47 definitions of "open banking" are identified. Each one of them appears in just one article. Although only three articles (Laplante & Kshetri, 2021; O'Leary et al., Jan 5, 2021; van Zeeland & Pierson, 2021) are devoted to defining open banking, most articles dealing with the topic leveraged idiosyncratic or working definitions. The definitions are extracted and systematically analyzed from two perspectives.

First, a semantic approach is used to understand the role of each definition component. Eight semantic/grammatical elements are identified by applying an inductive approach: Nature, Consent, Subject, Action, Object, Recipient, Process, and Purpose. These eight elements constitute our proposal of an "open banking integrated definition framework," which is discussed in detail in the Results section.

Second, to test the framework's robustness, a descriptive statistics approach is applied to understand (i) the degree of completion of the definitions identified according to the proposed framework and (ii) the level of convergence/dispersion in the definitions. HHI is applied to the definitions to assess the convergence/dispersion within each element.

HHI is a well-established measure, often used in economics to analyze the degree of concentration of a given market. It is calculated according to the following expression (Rhoades, 1993):

$$HHI = \sum_1^n c_i{}^2, \qquad [4]$$

where ci accounts for the (market) share of the -I element and where

$$\sum_1^n c_i = 100 \qquad [5]$$

In our case, we calculate HHI for each conceptual field identified in the definitions. For each of the eight elements, if the 47 definitions used the same concept, HHI would yield a 10,000 (maximum value). If different concepts were used by the 47 definitions, HHI would be 212.8 [47 x (100/47)^2].

4. Results

4.1. Bibliometric analysis and main research trends

As previously mentioned, open banking is a relatively new term in academic literature. The first time it appeared in academic literature fully aligned with the current interpretation was in 2009, but it started to take-off after 2016. The data for 2020 and 2021 (Fig 2) might be affected by the criteria of choosing auxiliary publications that were cited at least once.

Regarding the nature of the documents, the dataset is highly heterogeneous: 20.2% of documents (57) are articles published in Scopus-rated journals; 5.0% (14) are Scopus-listed conference proceedings, and the remaining 211 are primarily reports, books or book sections, and academic dissertations (Fig 3).

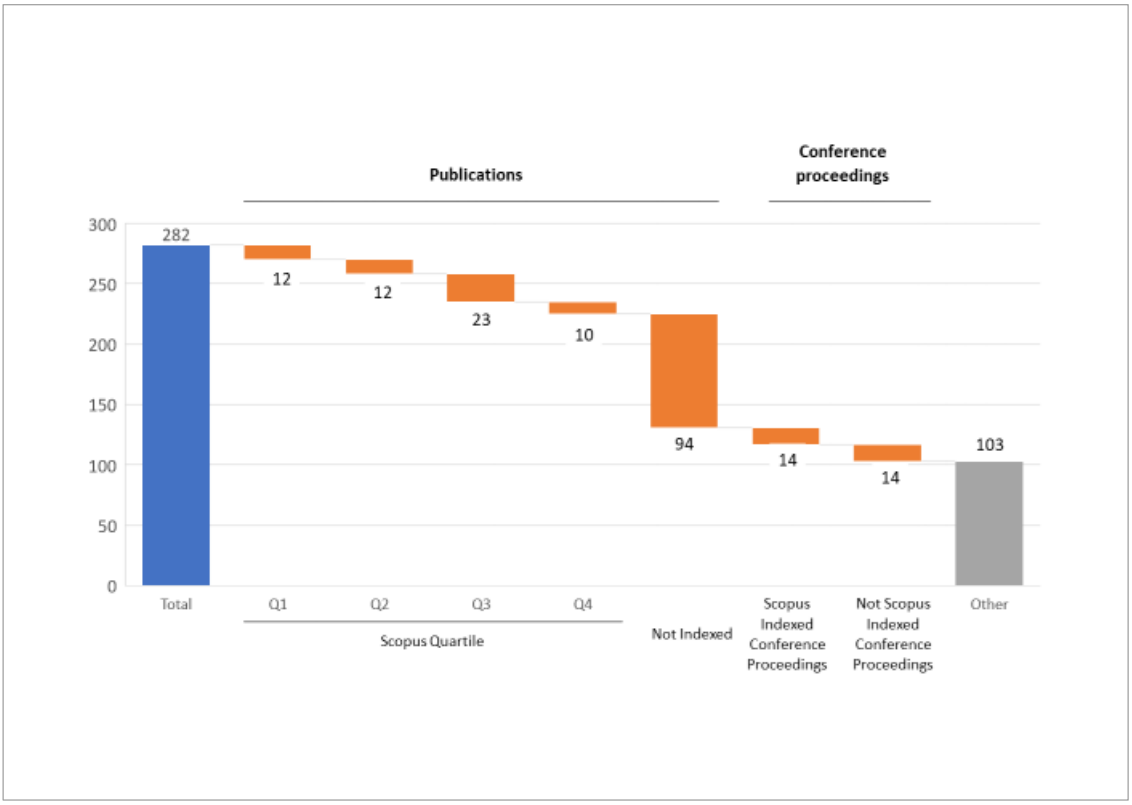

Fig 3: Dataset classification by nature

It is worth noting that despite the limited academic relevance of existing literature, it is evolving toward more journal publications and Scopus-listed conference proceedings, implying higher relevance within the academic community (Fig 4).

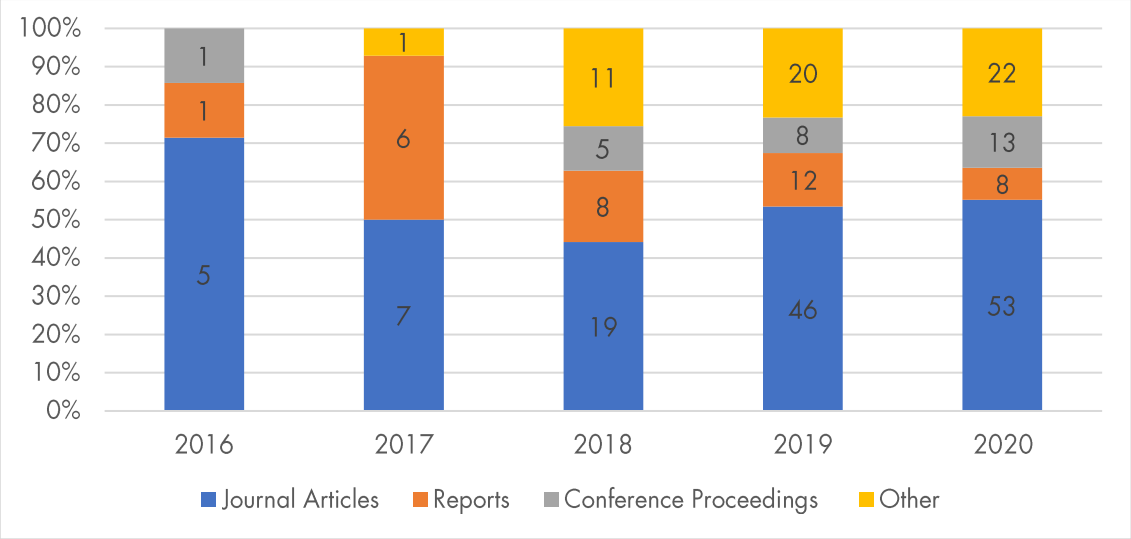

Fig 4: Evolution of documents in the dataset by category (2016-2020)

Although the main field of study for open banking, following Scopus classification, is *Business, Management, and Accounting*, interest in the phenomenon is growing in other disciplines, too. In fact, in 2020, *Business, Management, and Accounting* accounted for 30.2% of the documents published, *Computer Sciences* accounted for 27.1%, *Social Science – Law* accounted for 14.6%, *Economics, Econometrics, and Finance* accounted for 11.5%, and other fields (*Medicine, Engineering, Social Science – Other*) accounted for 16.7% (Fig 5).

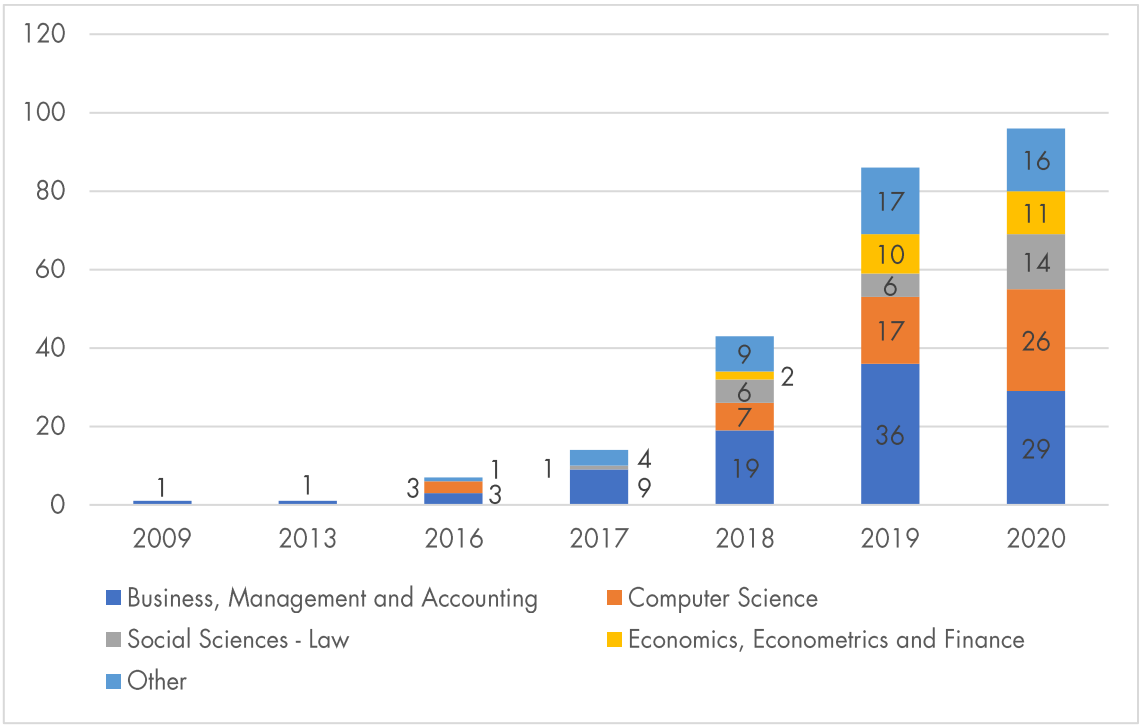

Fig 5: Final dataset documents by category (2009-2020)

Observation 1.1. While the interest of academia in the open banking phenomenon is still limited, it is growing significantly over the last few years.

Observation 1.2. The quality of academic literature analyzing open banking is increasing, with a higher number and proportion of publications in higher-rated magazines.

Observation 1.3. Open banking is a multidisciplinary phenomenon that is being studied by several disciplines.

4.2. Clustering analysis and main conceptual domains (drivers) of open banking

Through the application of the VoS algorithm, four clusters are identified (Fig 6). These clusters are groups of keywords that appear in at least five documents. Table 1 summarizes the top 10 keywords for each cluster.

Rank	Cluster 1 (Bus. Model Platform) (Red)	Cluster 2 (Data sharing) (Green)	Cluster 3 (Fintech) (Blue)	Cluster 4 (Regulation) (Yellow)
1	bank	open banking	fintech	psd2
2	customer	data	development	market
3	model	consumer	company	regulation
4	API	competition	financial service	access
5	technology	challenge	economy	finance
6	innovation	risk	world	EU
7	opportunity	framework	use	payment
8	industry	system	banking service	transaction
9	change	information	country	future
10	platform	adoption	implementation	account

Table 1: Main components by cluster

Before coding, both researchers agreed on the coding method: based on heuristics, assigning to the cluster a description that explained at least 50% of terms included in each cluster. Both researchers performed independent coding, and the results were compared and discussed to obtain the proposed interpretation.

Cluster 1 (*Business model platformization*): the initial list included both "bank" and "banking," and both terms were consolidated. Here, open banking could be interpreted as the transformation process of the retail banking business model toward a platform leveraging API technology and fostering innovation.

Cluster 2 (*Data sharing*): summarizes the main open banking features: a new framework involving data (information) sharing and opening the banking market to competition, which poses new challenges and risks for legacy players.

Cluster 3 (*Fintech*): summarizes the ecosystem impact of the fintech phenomenon as a new competitor for financial institutions. From the initial outcome of the analysis, several generic keywords were removed for interpretation purposes: "research," "impact," "use," "level," "role," "factor," and "effect." Additionally, "service" was consolidated with "financial services" for clarity.

Cluster 4 (*Regulation*): reflects the regulatory side, focusing on the legal and jurisdictional implications.

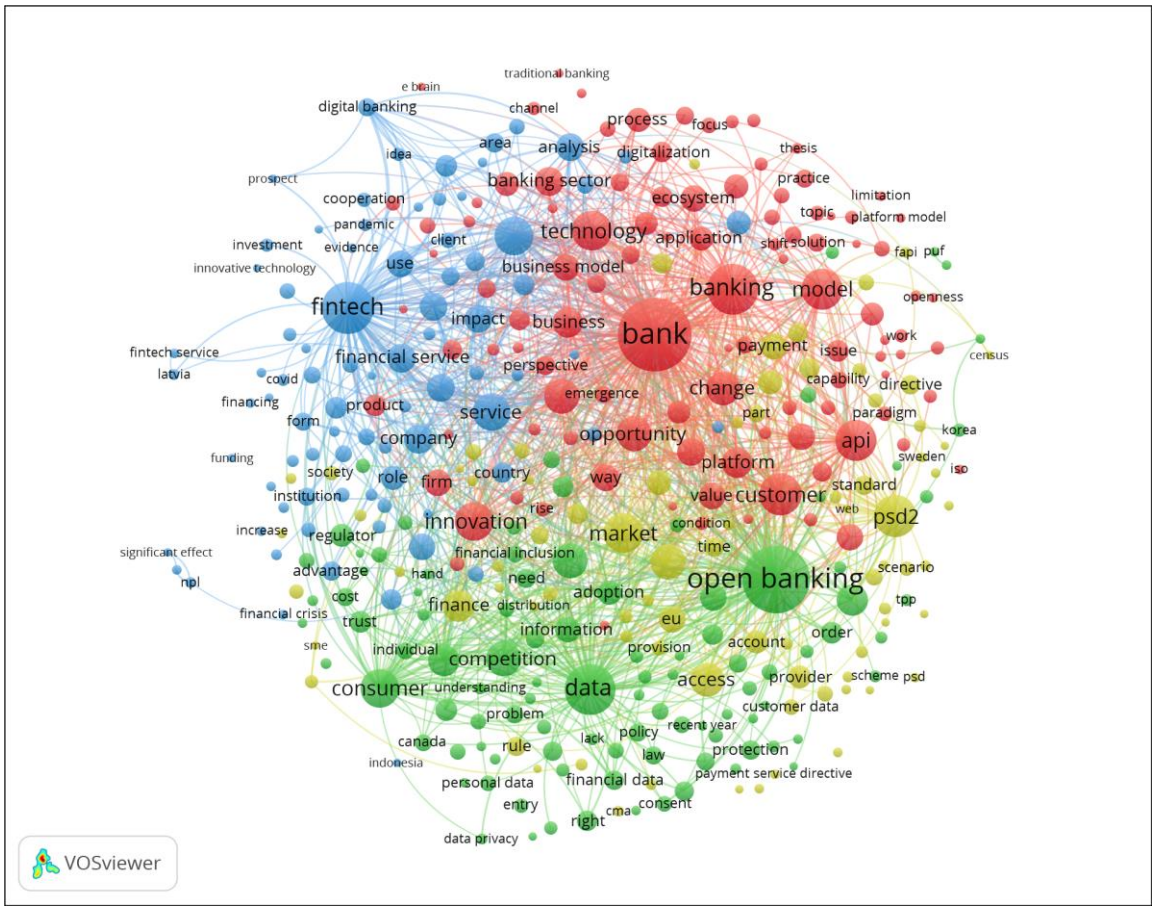

Fig 6: Graphical cluster representation

Observation 2.1. Open banking as a research field is built on four domains: business model platformization, data sharing, fintech, and regulation, all of which can be interpreted as different connotations of open banking.

Observation 2.2. Each identified cluster has a strong relationship with different knowledge domains.

Observation 2.3. Clustering analysis confirms the adequacy of a multidisciplinary approach, considering the heterogeneous nature of the phenomenon and the associated literature.

4.3. Analysis of open banking definitions

Next, the final 282-document dataset was manually read, searching for formal or idiosyncratic definitions of open banking, the result of which is 47 definitions (Annex 1, Table 3, Table 4, and Table 5).

Existing literature does not provide a framework to analyze "open banking" or similar definitions. Following similar approaches in the academic literature (Fernández Montes de Oca et al., 2021) (Pastrana et al., 2008), the authors proceed to build an ad-hoc framework: the "open banking integrated definition framework" based on induction from the 47 existing definitions. This process identifies eight elements in which all current definitions can be decomposed. The definitions are then decomposed into eight elements categorized into the following three blocks and analyzed to deduce a general definition of open banking constituting the "open banking integrated definition framework": (i) Conceptual elements: Nature (*How can the phenomenon be classified?*) and Consent (*What is the enforceability?*), (ii) Core attributes: Subject: (*Who is the actor?*); Action (*What is expected from the Subject?*); Object (*What is the target of the Action*); Recipient (*Who is affected by the Action?*) and Process (*How does the Subject interact with the Object and with the Recipient?*), (iii) Purpose (*What is the final goal?*). After applying the proposed framework to the 47 definitions, we find that 79% contain five or more elements of the definitions (Fig 7), which implies significant robustness of the proposed framework.

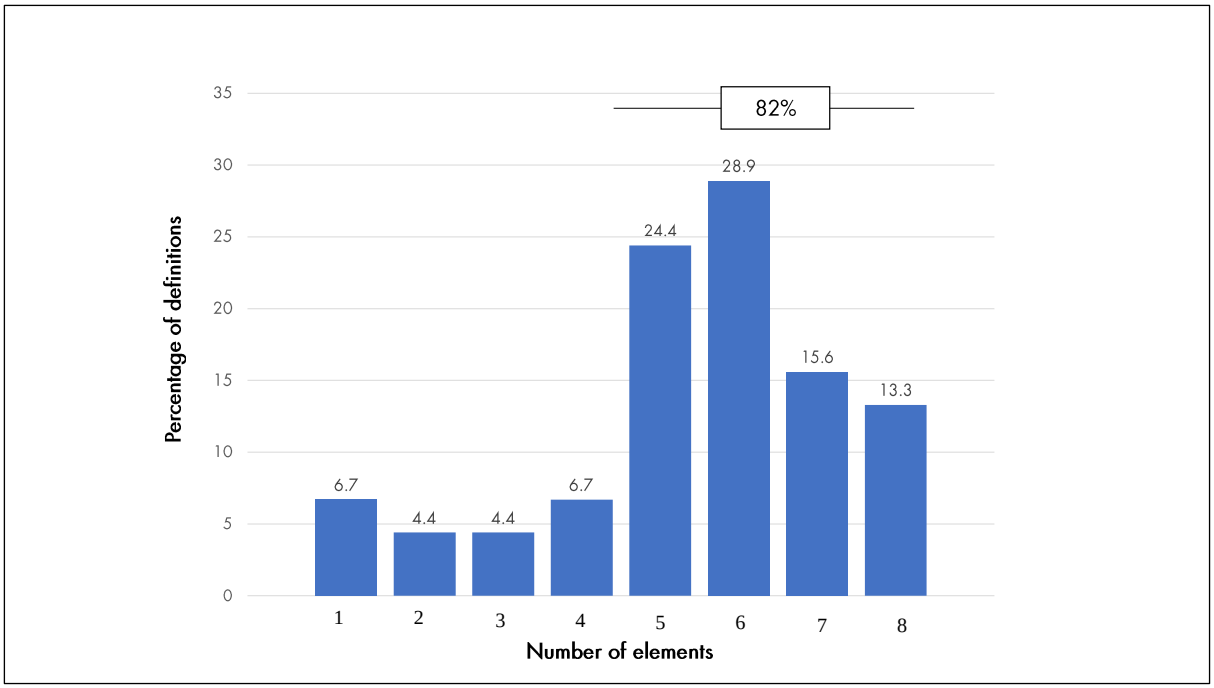

Fig 7: Completeness of the definitions

Table 2 shows the three primary outcomes for each element and the percentage of definitions containing the term. Not surprisingly, the level of consensus calculated through the HHI varies significantly across concepts. Additionally, for each element, the table contains the percentage of definitions that contain the element.

	HHI	1	2	3	% Def
Nature	822.1	regulation	framework	model	
(%)		16.1	12.9	9.7	64.6
Consent	1,035.2	enables	requires	allows	
(%)		21.9	12.5	12.5	66.7
Subject	2,052.5	customers	banks	third-parties	
(%)		30.6	25.0	19.4	75.0
Action	2,281.4	share	build	release	
(%)		46.2	5.1	2.6	83.3
Object	348.5	customer data	data	apps and services	
(%)		7.7	5.1	5.1	83.3
Recipient	593.1	3rd parties	Auth. 3rd parties	fintechs	
(%)		16.1	6.5	6.5	66.7
Process	3,395.1	APIs	open APIs	secure APIs	
(%)		50.0	27.8	5.6	50.0
Purpose	451.4	n.a.	n.a.	n.a.	
(%)		n.a.	n.a.	n.a.	37.5

Table 2: Summary of definitions' descriptive statistics

Starting with the conceptual elements, there are two different perspectives: the *regulatory approach*, where open banking is understood as a legal construct, and the *framework approach*, which focuses on the interactions between players, regardless of the regulation. This duality is compatible with the fact that there are specific open banking regulations in some

geographical areas (UK, Europe, and Australia). In contrast, in other regions (US and Canada), open banking exists as a phenomenon but without a specific regulation in place yet. We find a tight relationship between *Nature* and *Consent*, considering that regulation implies requirement, obligation, or empowerment, while framework implies enablement.

Regarding core attributes, the main keywords are "sharing" for *Action* and "APIs" for *Process*. Nevertheless, the interpretation of both should be significantly different. Regarding *Action*, there is a high consensus among all definitions around "sharing," which is consubstantial with the very notion of open banking as currently understood by practitioners (Brodsky et al., 2018). However, talking about *Process*, although currently, APIs are the most common system interface technology, the open banking phenomenon could be perfectly conceived by leveraging different interface technologies, such as screen scraping (Han-Wei Liu, 2020). That is why API should be deemed a relevant yet not essential element in the definition of open banking.

As for *Subject*, there is a low degree of consensus: 30.6% of definitions are built around "*customer*," 25.0% around "*banks*" (including synonyms such as "*financial institutions*"), and 19.4% around "*third parties*." This lack of convergence emerges from the fact that open banking can be formulated under three perspectives: the client perspective: "*customers – share*," institutional perspective: "*banks – make available*," and ecosystem perspective: "*third parties – access.*" However, it is still unclear which approach is better. Nevertheless, the fact is that comparing the roles of the three main actors in the open banking process, banks are passive agents, and their only function is to facilitate access to data. Similarly, third parties such as fintechs, for that matter any third party, cannot force a customer to enter into an open banking relationship with a banking client. That is why the client perspective seems crucial to understanding the essence of open banking as a "right to share" rather than a "right to access."

The *Object* of open banking is also unclear, ranging from "*data*" to "*applications and services.*" Lastly, concerning the *Recipient,* there are different levels of concretion, from a general conception ("*third parties*") to specific type players ("*fintechs*"). There is, however, one open matter, "payments initiation." Apart from data sharing, some regulations also include payment initiation as an object of open banking (e.g., UK, EU, India, and Brazil). However, there are minimal academic literature references to this matter. Thus, we will attach to the mainstream definitions of open banking as data sharing.

Finally, the *Purpose* element is highly undefined. Although "*transparency*" and "*competition*" appear in several cases, there is no convergence in the final goal of open banking in any of the analyzed definitions.

In sum, although consensus around different elements of open banking is limited, it could be defined as "a generally regulated framework that enables banking customers to share their data with third parties, commonly through standardized interfaces such as APIs, to increase competition in the financial sector." The proposed definition covers the eight elements identified in the proposed open banking integrated framework and could be understood as a generalization of all the analyzed partial definitions.

Observation 3.1. There is neither a single definition of open banking in the academic literature nor a specific definition by knowledge domain. Instead, there is a collection of idiosyncratic and paper-specific approaches toward its definition.

Observation 3.2. Among existing definitions, there are strong commonalities in some elements, while others show a high degree of dispersion. These differences arise mainly from different knowledge domains through which open banking is analyzed and various jurisdictions where it occurs.

Observation 3.3. Despite underlying divergences, a standard definition of open banking can be formulated and leveraged in all conceptual domains based on the proposed approach.

Observation 3.4. Despite customers playing a central role in different definitions of open banking as the owner of data, decision-maker of data sharing, and target of the framework's purpose, one key element where prior research lacks consensus and focus is the role of a banking customer within open banking. Only 30.6% of definitions are built around the word "client" (compared with 25.0% of definitions that are built around "banks" and 19.4% around "third parties").

5. Discussion and conclusions

Our bibliometric analysis confirms the academic community's limited but growing interest in open banking and the challenges of a multidisciplinary approach to the phenomenon. Together with the intrinsic fragmentation in the analysis of the phenomenon due to its regulatory facets, both elements result in a corpus of literature that is still getting consolidated but lacks some foundations for further development.

Based on the clustering analysis' results of the nascent literature, four conceptual clusters have been identified. These are (i) the platformization of the retail banking industry business model; (ii) a manifestation of the overall data sharing trend applied to the banking data; (iii) the interaction between the emergent fintech ecosystem and incumbent financial institutions; and (iv) the regulatory framework that, in some jurisdictions, bolsters the open banking phenomenon. These four clusters can be interpreted as different connotations underpinning the concept of "open banking." Hence, the complex nature of open banking is a considerable challenge for future literature development, as partial analysis of the phenomenon will yield limited conclusions. Thus, only multidisciplinary approaches will offer good insights.

A clustering analysis to identify the conceptual domains around the open banking definition is also a valuable contribution. As an unsupervised learning methodology, clustering analysis returns an objective output, eliminating pre-classification biases. Moreover, the clustering approach unveils all the critical factors behind the open banking concept, supporting our proposal of an integrative definition valid across all disciplines and realizations of open banking. Consequently, although there are strong linkages between Cluster 1 (Business model/Platform), Cluster 4 (Regulation), and the academic literature emanating from Business Management and Social Sciences-Law, respectively, Cluster 2 (Data sharing) and Cluster 3 (Fintech) unveil purely transversal conceptual domains, multidisciplinary in nature that do not match with a single academic field and that could not have been identified without the clustering approach.

The detailed analysis of the 47 identified idiosyncratic and working definitions of the phenomenon confirms the need for a generalized conceptualization that amalgamates all existing perspectives on the topic. The proposed framework arising from the definition analysis is by itself a valuable tool for understanding the depth of open banking and the importance of identifying all relevant components that intervene in its dynamics. It is also important to note that the different formulations for the *Subject* of open banking constitute three perspectives of the phenomenon. These include (i) the "institutional perspective," which analyzes open banking based on the obligations to comply with banking regulation; (ii) the "ecosystem perspective," which focuses on the potential mechanics and benefits for new entrants, especially fintechs, from accessing banking clients' data; and (iii) the "client perspective," which studies the fundamental data-sharing right that constitutes the basis of open banking. Although the literature has not been explicit on this matter, researchers need to understand the implications of each positioning.

This study contributes to filling the literature gap with a potential generalized multidisciplinary open banking definition. Our proposed definition encompasses the four conceptual domains identified through the cluster analysis of the existing literature. Further, our proposed definition contributes to synthesizing different approaches, serving as a catalyzer for further research on the topic and significantly enhancing multidisciplinary approaches to the question.

Our proposed generalized definition should help increase collaboration among researchers from different academic disciplines and cooperation among researchers in different geographies to analyze the open banking phenomenon. Additionally, the proposed definition is especially relevant for policymakers and private economic agents, considering current ongoing discussions around the evolution of open banking regulation. Finally, the generalization of the open banking concept is also relevant for end customers as data owners and primary beneficiaries of open banking regulations.

The main limitation of this analysis is the emergent nature of the existing literature. Although several quality filters have been applied to the inputs to ensure the quality of the outcomes, this approach could be replicated in the future on articles published in peer-reviewed journals once a sufficient corpus of high-quality literature has been developed.

Annex 1 – Open banking definitions

#	Definition	Author
1	[...] in order to promote and facilitate data sharing interactions between banks and third-party service providers, the eight major British banks were mandated to develop jointly a single, open, standardised application programming interface (API) freely available for the whole industry.	(Borgogno & Colangelo, [illegible])
2	This technology focuses on improving customer experience in more than one way. Use of application programming interfaces (APIs) is imperative to define how financial data can be created, shared, and accessed securely and efficiently. This technology forces the banks to be competitive with their counterparts. Hence, they are compelled to bring down the cost and implement improved technology for excellent customer-care experience. This technology requires banks to be transparent with their online and internal banking information, which must be unbiased and accurate. Additionally, it helps lenders to analyze their borrowers' financial situation and the risks related to it.	(Hasan et al., 2019)
3	European Union (EU) has forced banks to open up and make their customer information available with their permission so that other players in the financial market (TPP) can use them and take some of that work.	(Petrović, 2020)
4	[...] regulation which mandated that banks disclose data that they hold on individual consumer 0transactions—as well as on their own prices and services—to third-party services providers, such as price-comparison tools.	(Basso et al., 2018)
5	[...] regulations that would require banks to securely share customer data with authorized third parties. These […] regulations are designed to increase consumer choice and mobility, innovation, and competition in the financial services industry.	(Castro & Steinberg, 2017)
6	[...] requiring banks to release and make available through an open-APIs [...] a wide range of reference and product information, including the prices, charges, terms and conditions for all personal and business current account products (including overdrafts) and small business lending products and service quality indicators (for example customer recommendation scores) specified by the CMA in its remedy on service quality and at the time required by this remedy.	(Milne, 2016)
7	[...] require the nine largest banks to provide open standardised API data on their retail customers and SME account data to third parties (where the consumer elected to do so). This uses digital technology to create the possibility of a new market for firms to design applications that advise and help consumers to better manage their money and the financial products they use.	(Pike, 2018)
8	[...] with technology firms. It does so by granting a right to the user of payment services to make use of payment initiation and account information services, even where the payment institutions have not entered into a contract with the respective (new) service provider. It assigns to clients an ownership right over their data and provides at the same time a specific use case for the data subject's data portability right granted by Article 20 of GDPR, thereby linking the PSD 2 initiative to the GDPR objective laid out above. Open banking is the regulatory response to the anti-competitive tendencies of the data economy where the size of the data pool determines competitive strength92 and where technology firms like Amazon, Google and others have foregone profits for years to build dominant platforms.	(Arner et al., 2020)
9	Open banking is based on the bank's ability to engage non-banking intermediaries ecosystems and third parties (eg FinTech companies) to the banking service provision and to interact with them through such technologies as application programming interfaces (API).	(Rubanov, 2019)
10	[...] require inter alia banks and certain e-money institutions ("EMIs") to publish application programming interfaces ("APIs"). These APIs mainly enable licensed payment initiations ("PISP") and account information service providers ("AISP") as well as banks, to either initiate payments or retrieve account information after having obtained the end-client's consent.	(Morvan, 2020)
11	The exchange of consumer data between banks and other FSPs (i.e., data holders), on the basis of customer consent, with other FSPs and/or TPPs such as fintechs (i.e., AISPs and PISPs—both known as data users). Although payment initiation is an important element of open banking from a financial inclusion perspective (as discussed in Section 3), it is not essential to the functioning of open banking, and therefore it is not included in its definition.	(Plaitakis & Staschen, 2020)
12	[...] allows consumers to opt in to sharing their financial transaction data with fintechs and allows fintechs to use these data to develop products and services customized to individual needs.	(Abudulai et al., 2020)
13	[...] a new kind of business ecosystem characterized by the widespread use of data-enabled services to deliver innovative and more competitive services to consumers. Such development builds on the use of open application programming interfaces (APIs) that enable consumers to take advantage from their account data by sharing them with authorized third parties.	(Borgogno & Colangelo, 2020b)

Table 3: Definitions of Open banking (1/3)

14	[...] a new regulatory and technological framework called "open banking" raises the possibility of consumers being able to task trusted intermediaries with automatically analyzing their financial data, nudging them to achieve their goals, and switching them to better products, all in order to reduce the substantial inefficiencies in their financial lives.	(Fracassi & Magnuson, 2021)
15	[…] initiative that] allows customers to share their data securely with other banks and third parties (e.g., challenger banks, fintechs, utility companies, and other businesses) to provide a seamless route to accessing new products and services.	(Burton, 2020)
16	[…] remedy […] which enables customers to share transaction and other data with regulated third parties through secure APIs, thereby enabling third parties to offer services like budgeting advice or comparisons of different products based on customer needs.	(Bethell, 2019)
17	[...] enables its customers to easily and securely share their banking data with trusted groups.	(Arayesh et al., 2021)
18	[...] a universal undertaking that endorses a customer's right to share financial information with third parties.	(Kottayil, 2020)
19	[...] an initiative which facilitates the secure sharing of account data with licensed third parties through Application Programming Interfaces (APIs), empowering customers with ownership of their own data. The initiative aims to increase competition in retail banking by developing innovative products and services which will bring increased value to customers.	(O'Leary et al., Jan 5, 2021)
20	[...] framework to give customers access to and control over their financial data. As the experiences of the United Kingdom and Australia have shown, an open banking framework allows consumers to direct banks to securely share only the financial data that they choose, for the duration that they choose, through the use of application programming interfaces, or APIs.	(Black & Stewart Olsen, 2018)
21	Open Banking is a framework designed to give customers a right to direct that the information they already share with their bank be safely shared with others they trust. It is intended to give customers more control over their information, leading to more choice in their banking and more convenience in managing their money, and resulting in more confidence in the use of an asset mostly undiscovered by those customers – their data.	(Farrell, 2019)
22	Customer data [...] have become more "open" to external third parties, whenever customers who generate these data consent to share them. Open banking, an initiative led by several governments, including Australia and the United Kingdom, leads such a shift toward the open-data economy.	(He et al., 2020)
23	[...] generic term for regulations that oblige financial institutions to provide secure channels for customers to share their financial data with third parties, and in some cases requires the financial institution to provide third parties with the ability to move customer funds.	(Arslanian & Fischer, 2019)
24	[...] a platform cooperation mode, which uses open application programming interface (API) technology to realize data sharing between financial institutions and third-party providers, so as to improve customer experience.	(Zhang et al., October 11, 2019)
25	[...] is a sharing between incumbent financial institutions and third party financial service providers.	(Zeller & Dahdal, 2021)
26	[...] requirements whereby incumbent financial intermediaries must share client data with third parties, including potentially innovative new competitors.	(Buckley et al., 2020)
27	The Open Banking is the process which brings together the Financial service resources and Open Data resources and enables a path for Financial Services Providers to develop new methodologies of delivering Financial Services to a customer. Open Banking is based on the use of API access to the data pools, to the infrastructure of the regulatory compliant and to other financial services resources. If a bank entity will join the Open Banking Model it will consume and provide APIs also it will be a new Financial Service Provider.	(Coste & Miclea, 2019)
28	[...] an open banking regime will make it easier for individuals, including small businesses, to share their own transaction data securely with third-party service providers, such as potential lenders.	(Connolly & Bank, 2018)
29	[...] enables personal customers and small businesses to share their data securely with other banks and with third parties, allowing them to compare products on the basis of their own requirements and to manage their accounts without having to use their bank	(Gozman et al., Jan 1, 2018)
30	[…] involves third parties (e.g., fintech) accessing a customer's account using customers' personal security credentials, and in some cases, initiating transactions on their behalf.	(Han-Wei Liu, 2020)
31	[...] standardized interfaces to financial institutions' data. These interfaces enable third parties, in particular FinTech companies, to access users' bank account information and initiate payments through well-defined APIs. All around the world, API banking is being promoted by law or by industry demand: In Europe, the Payment Services Directive 2 (PSD2) regulation mandates all banks to introduce Open Banking APIs by September 2019 [2]. The US Department of the Treasury recommends the implementation of such APIs as well. In South Korea, India, Australia, and Japan, open banking is being pushed by large financial corporations.	(Fett et al., May 19, 2019)

Table 4: Definitions of Open banking (2/3)

32	[...] legislation [that] allows European financial services to become truly platformized by permitting third parties (usually tech firms) to access mountains of customer data sequestered inside banks, insurers, and other financial services providers. [...] permits technology companies to access banks' customer data with customers' permission. The digital key to unlocking transparency in platformized markets is the open API (application programming interface), a software tool which allows data sharing between websites and online services, making it possible for tech companies to have a transparent view of financial providers' customers.	(Bourne, 2020)
33	[...] allow third-party access to consumers' bank data (with the consumers' consent) and are becoming a fundamental tool of digital disruption.	(Vives, 2019)
34	[...] a financial services term as part of financial technology that refers to: The use of open APIs that enable third-party developers to build applications and services around the financial institution; Greater financial transparency options for accountholders ranging from open data to private data ; The use of open-source technology to achieve the above.	(Hsieh, June 29, 2019)
35	[...] the use of open application programming interfaces (APIs) that enable third-party developers to build applications and services around the financial institution;, greater financial transparency options for account holders ranging from open data to private data, and the use of open-source technology to achieve the above; can be naturally evolved into a new ecosystem of data marketplaces where participants can buy and sell data.	(Long et al., 2020)
36	Open banking describes a special kind of financial ecosystem. The ecosystem provides third-party financial service providers open access to consumer banking, transaction, and other financial data from banks and nonbank financial institutions through the use of application programming interfaces (APIs).	(Laplante & Kshetri, 2021)
37	[...] policie [that] require banks to provide access to their customers' payment account data to third-party providers of payment services, subject to customer consent, to enable them to offer new, differentiated services based on the use of these data.	(Stiefmueller, July 10, 2020)
38	[...] involves opening up banking systems (functionality and customer data) to third parties to allow them to provide services directly to customers.	(Remolina, 2020)
39	[...] a technological platform that supports the use of third-party digital shopping assistants (labelled aggregators), through the adoption of standard application programme interfaces (APIs), with the aim of reversing the persistent low level of switching activity due to consumer disengagement.	(Eccles et al., 2019)
40	[...] all kinds of things, from a remedy to an ecosystem, or most often: a (business) model of some sort. Its purposes are considered to be providing new ('better', 'customer-centric') services to customers and improving competition in the banking market by letting 'third parties' in.	(van Zeeland & Pierson, 2021)
41	[...] will enable banks to share their data with third-party service providers. It will allow customers to open new accounts or make their banking transactions easily from a single user interface that can be fed by data by many banks and fintech companies. In this way, consumers will have the chance to compare the offerings of various banks and make their transactions easily since the information about customers' accounts will be aggregated and viewed by the customers in one interface.	(Tosun, September 23, 2020)
42	[...] a standardised framework for sharing bank customer data. Open banking reduces barriers to entry and eliminates banks' monopoly over their customers' data, making it easier for FinTech firms to innovate. The secure sharing of customer banking data has the potential to promote financial system soundness. By increasing competition and unbundling banking services across a larger range of firms, it reduces the systemic importance of large banks. Greater sharing of customer data may also create opportunities for more personalised financial products and lower switching costs (which may promote market discipline). Open banking also presents risks, including making the banking sector more prone to cyber risk.	(Bascand, 2020)
43	[...] a model in which banking data is shared through Application Programming Interface (API) to third parties.	(Premchand & Choudhry, February 15, 2018)
44	[...] is an emerging financial services model that focuses on the portability and open availability of customer data held by financial institutions.	(Leong, 2020)
45	[...] the EU's regulatory response to the anti-competitive tendencies of the data economy where the size of the data pool determines competitive strength and where technology firms like Apple, Amazon, Google and others have foregone profits for years to build dominant platforms.	(Zetzsche et al., 2019)
46	Evolution of banking, leading to more transparency, customer choice and customer control over personal data.	(Szmukler, 2016)
47	[...] involves sharing business services such as data, algorithms and transactions with business ecosystems of employees, customers, partners, fintechs and others. Open banking enables business ecosystems to build new apps, products, and services; match buyers and sellers; and create new business models.	(Sivathanu, 2019)

Table 5: Definitions of Open banking (3/3)

Annex 2 - Analytical approach

Mathematically, different options exist to perform clustering analysis. The most popular approach is MDS (Eck et al., 2010). MDS is an analysis technique that aims at locating similarity or relatedness between any two items based on the distance between them, rooted in the premise that the smaller the distance, the stronger the relationship. In this study, however, we apply VoS, a version of MDS that properly factorizes association strength when ordinal or interval factors are applied, as in the case of co-word analysis (Eck & Waltman, 2009)

VoS provides a low-dimensional visualization where items are positioned so that the distance between any pair reflects their similarity as precisely as possible. Thus, VoS minimizes the weighted sum of the squared Euclidean distances between all pairs of items, assuming that the higher the similarity between two objects, the higher the weight of their squared distance in the summation (Eck & Waltman, 2010). The objective function to be minimized in VOS is given by:

$$\mathrm{E}(\mathbf{X};\ \mathbf{S}) = \sum_{i<j} s_{i,j} \left\| x_{i-} x_j \right\|^2, \qquad [1]$$

where $\|..\|$ denotes the Euclidean distance, $s_{i,j}$ denotes the similarity between object *i* and object *j*, and the vector $\mathrm{xi} = (x_{i,1}, \ldots, x_{i,m}) \in \mathbb{R}^m$ denotes the *i*-th row of $\boldsymbol{X}$ and contains the coordinates of object *i*.

The minimization of the objective function is subject to:

$$\sum_{i<j} \left\| x_i - x_j \right\| = 1 \qquad [2]$$

For visualization purposes, each object is positioned close to its ideal coordinates, given by:

$$c_i(\boldsymbol{X};\boldsymbol{S}) = \frac{\sum_j s_{i,j} x_j}{\sum_j s_{i,j}} \qquad [3]$$

References

Abudulai, S., Ang, X., Goldberg, E., & Kearney, T. (2020). Regulation across the border: developments in canadian and U.S. consumer financial services. *The Business Lawyer, 75*(2), 1949-1956. https://search.proquest.com/docview/2400105352

Aizenman, J., & Kletzer, K. (2011). The life cycle of scholars and papers in economics–the 'citation death tax'. *Applied Economics, 43*(27), 4135-4148. https://doi.org/10.3386/w13891

Arayesh, M. B., Rezaeirad, M., Aidi, M., & Lamoki, T. G. (2021). Thematic analysis on a model of implementation of open and technological banking in commercial banks in Iran. *Revista De La Universidad Del Zulia, 12, Tercera Epoca*(32), 414-443. https://doi.org/10.46925/rdluz.32.2

Arner, D. W., Zetzsche, D. A., Buckley, R. P., & Weber, R. H. (2020). The future of data-driven finance and RegTech: lessons from EU big bang II. *Stanford Journal of Law, Business & Finance, 25*(2), 245-288. https://search.proquest.com/docview/2449281108

Arslanian, H., & Fischer, F. (2019). Fintech and the future of the financial ecosystem. *The Future of Finance* (pp. 201-216). Springer International Publishing. https://doi.org/10.1007/978-3-030-14533-0_16

Asli, M. H. (2012). Open innovation: quels enjeux pour le secteur bancaire? *Innovations,* (3), 27-48.

Bascand, G. M. (2020). *Banking the economy in post-COVID Aotearoa.* Reserve Bank of New Zealand Te Pūtea Matua. https://natlib-primo.hosted.exlibrisgroup.com/primo-explore/search?query=any,contains,9918994067102836&tab=catalogue&search_scope=NLNZ&vid=NLNZ&offset=0

Basso, A., Bon, J., Tasker, B., Timan, N., Walker, M., & Whitcombe, C. (2018). Recent Developments at the CMA: 2017–2018. *Review of Industrial Organization, 53*(4), 615-635. https://doi.org/10.1007/s11151-018-9668-2

Bethell, O. (2019). *Competition Law and Tech - a new approach.* SSRN3348636. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3348636

Black, D., & Stewart Olsen, C. (2018). *Open banking: What it means for you?* Senate of Canada. https://sencanada.ca/content/sen/committee/421/BANC/reports/BANC_SS-11_Report_Final_E.pdf

Borgogno, O., & Colangelo, G. (2020a). Consumer inertia and competition-sensitive data governance: the case of open banking. *Journal of European Consumer and Market Law,* 9(4), 143 – 150. https://doi.org/10.2139/ssrn.3513514

Borgogno, O., & Colangelo, G. (2020b). Data, innovation and transatlantic competition in finance: the case of the access to account Rule. *European Business Law Review, 31*(4), 573 – 610. https://doi.org/10.2139/ssrn.3251584

Bourne, C. (2020). Fintech's transparency–publicity nexus: value cocreation through transparency discourses in business-to-business digital marketing . *The American Behavioral Scientist, 64*(11), 1607-1626. https://doi.org/10.1177/0002764220959385

Brackert, T., Chen, C., Colado, J., Desmangles, L., Dupas, M., Roussel, P., Sachse, H., Stewart, S., & Wegner, M. (2019). *The race for relevance and scale.* Boston Consulting Group. https://www.bcg.com/publications/2019/global-retail-banking-race-for-relevance-scale

Briones, G. K., & Cassinello, N. (2022). Open banking: a bibliometric analysis-driven definition. *PloS One, 17*(10), e0275496. https://doi.org/10.1371/journal.pone.0275496

Brodsky, L., Ip, C., & Lundberg, T. (2018). *Open banking's next wave: perspectives from three fintech CEOs.* McKinsey & Company, Inc. https://www.mckinsey.com/industries/financial-services/our-insights/open-bankings-next-wave-perspectives-from-three-fintech-ceos

Brodsky, L., & Oakes, L. (2017). *Data sharing and open banking.* McKinsey & Company, Inc. https://www.mckinsey.com/industries/financial-services/our-insights/data-sharing-and-open-banking

Buckley, R. P., Arner, D. W., Zetzsche, D. A., & Weber, R. H. (2020). The road to RegTech: the (astonishing) example of the European Union. *Journal of Banking Regulation, 21*(1), 26-36. https://doi.org/10.1057/s41261-019-00104-1

Burton, D. (2020). Digital debt collection and ecologies of consumer overindebtedness. *Economic Geography, 96*(3), 244-265. https://doi.org/10.1080/00130095.2020.1762486

Castro, D., & Steinberg, M. (2017). *Blocked: why some companies restrict data access to reduce competition and how open APIs can help.* SSRN3108763. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3108763

Chan, R., Troshani, I., Rao Hill, S., & Hoffmann, A. (2022). Towards an understanding of consumers' FinTech adoption: the case of Open Banking. *International Journal of Bank Marketing, 40*(4), 886-917. https://doi.org/10.1108/IJBM-08-2021-0397

Connolly, E., & Bank, J. (2018). *Access to small business finance.* Reserve Bank of Australia. https://www.rba.gov.au/publications/bulletin/2018/sep/access-to-small-business-finance.html

Coste, R., & Miclea, L. (2019). API testing for payment service directive 2 and open banking. *International Journal of Modeling and Optimization, 9*(1), 7-11. https://doi.org/10.7763/IJMO.2019.V9.675

Diamond, S., Drury, N., Lipp, A., Marshall, A., Ramamurthy, S., & Wagle, L. (2019). The future of banking in the platform economy. *Strategy and Leadership, 47*(6), 34-42. https://doi.org/10.1108/sl-09-2019-0139

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: an overview and guidelines. *Journal of Business Research, 133*, 285-296. https://doi.org/10.1016/j.jbusres.2021.04.070

Eccles, P., Grout, P., & Siciliani, P. (2019). *Open Banking and Capital Requirements.* European Central Bank.

https://www.ecb.europa.eu/pub/conferences/shared/pdf/20190328_financial_intermediation/Session1_continued_open_banking_capital_requirements.pdf

Eck, N. J., & Waltman, L. (2009). How to normalize cooccurrence data? An analysis of some well-known similarity measures. *Journal of the American Society for Information Science and Technology, 51*(8), 1635-1651. https://doi.org/10.1002/asi.21075

Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics, 84*(2), 523-538. https://doi.org/10.1007/s11192-009-0146-3

Eck, N. J., Waltman, L., Dekker, R., & van den Berg, J. (2010). A comparison of two techniques for bibliometric mapping: Multidimensional scaling and VOS. *Journal of the American Society for Information Science and Technology, 51*(12), 2405-2416. https://doi.org/10.1002/asi.21421

Farrell, S. (2019). Open for better - Applying Open Banking to Small Business Banking. *The Australasian Journal of Applied Finance, 2*, 18-23. https://www.proquest.com/openview/a217b07e7cf2f0aa3234ef05061709be/1?pq-origsite=gscholar&cbl=54115

Farrow, G. S. D. (2020a). An application programming interface model for open banking ecosystems. *Journal of Payments Strategy & Systems, 14*(1), 75-91. https://www.ingentaconnect.com/content/hsp/jpss/2020/00000014/00000001/art00010

Farrow, G. S. D. (2020b). Open banking: the rise of the cloud platform. *Journal of Payments Strategy & Systems, 14*(2), 128-146. http://openurl.ingenta.com/content?genre=article&issn=1750-1806&volume=14&issue=2&spage=128&epage=146

Fernández Montes de Oca, A. I., Gallardo Cruz, J. A., Ghilardi, A., Kauffer, E., Solórzano, J. V., & Sánchez-Cordero, V. (2021). An integrated framework for harmonizing definitions of deforestation. *Environmental Science and Policy, 115*, 71-78. https://doi.org/10.1016/j.envsci.2020.10.007

Fett, D., Hosseyni, P., & Kusters, R. (May 19, 2019). An extensive formal security analysis of the openID financial-grade API. Paper presented at the *2019 IEEE Symposium on Security and Privacy,* San Francisco, United States. 453-471. https://doi.org/10.1109/SP.2019.00067 https://ieeexplore.ieee.org/document/8835218

Fracassi, C., & Magnuson, W. (2021). Data autonomy. *Vanderbilt Law Review, 74*(2), 327-383. https://search.proquest.com/docview/2506761296

Gardner, J., & Leong, E. (2021). Open banking in the UK and Singapore: open possibilities for enhancing financial inclusion. *Journal of Business Law,* (5), 424-453. https://doi.org/10.17863/CAM.55421

Gozman, D., Hedman, J., & Sylvest Olsen, K. (June 23-28, 2018). Open banking: emergent roles, risks & opportunities. Paper presented at the *26th European Conference on Information Systems (ECIS) 2018,* Portsmouth, UK. (ECIS Research Papers 183) https://aisel.aisnet.org/ecis2018_rp/183/

Guibaud, S. (2016). How to develop a profitable, customer-focused digital banking strategy: Open banking services and developer-friendly APIs. *Journal of Digital Banking, 1*(1), 6-12. http://openurl.ingenta.com/content?genre=article&issn=2397-060X&volume=1&issue=1&spage=6&epage=12

Han-Wei Liu. (2020). Two decades of laws and practice around screen scraping in the common law world and its open banking watershed moment. *Washington International Law Journal, 30*(1), 28-62. https://digitalcommons.law.uw.edu/wilj/vol30/iss1/5

Hasan, N., Arya, S., & Rajkumar, A. (2019). E-Brain (Artificial Intelligence): an edge to indian banking system. *International Journal of Management, IT and Engineering, 9*(7), 312-322. https://www.indianjournals.com/ijor.aspx?target=ijor:ijmie&volume=9&issue=7&article=025

He, Z., Huang, J. & Zhou, J. (2020). *Open banking: credit market competition when borrowers own the data.* Cowles Foundation. Retrieved Sep 15, 2022, from https://cowles.yale.edu/publications/cfdp/cfdp-2262

Hill, S., & Provost, F. (2003). The myth of the double-blind review? Author identification using only citations. *Acm Sigkdd Explorations Newsletter, 5*(2), 179-184. https://doi.org/10.1145/980972.981001

Hsieh, K. (June 29, 2019). Open banking: a case study for open API economy. Paper presented at the *International Symposium on Information Application Development of Smart Enterprises,* 1-7. https://9lib.co/document/ky65mlnz-open-banking-case-study-open-api-economy.html

Jakovljevic, M., Magid, S., Caravtas, C., & Meyer, C. (2002). Financial aggregation and open finance: views from South Africa's financial portals. *South African Journal of Information Management, 4*(1), 1-9. https://doi.org/10.4102/sajim.v4i1.150

Kjellén, D. (2021). *Following the money.* Tink. https://resources.tink.com/hubfs/05%20Resources/Reports/2021%20reports/OBIU/Open%20banking%20investments%20and%20use%20cases%20-%20Tink%20survey%20report.pdf

Koeppl, T. V., & Kronick, J. (2020). *Open banking in Canada –The path to implementation.* Commentary 579. CD Howe Institute. https://www.cdhowe.org/sites/default/files/2021-12/Commentary_579.pdf

Kottayil, N. M. (2020). Consumer security and liability model for open banking. *International Journal of Trend in Research and Development, 7*(4), 230-232.

Laplante, P., & Kshetri, N. (2021). Open banking: definition and description. *Computer, 54*(10), 122-128. https://doi.org/10.1109/MC.2021.3055909

Leong, E. (2020). Open Banking: the changing nature of regulating banking data - a case study of Australia and Singapore. *Banking & Finance Law Review, 35*(3), 443-469. https://search.proquest.com/docview/2435720729

Long, G., Tan, Y., Jiang, J., & Zhang, C. (2020). Federated Learning for Open Banking. In Q. Yang, L. Fan & H. Yu (Eds.), *Federated Learning. Lecture Notes in Computer Science, vol 12500* (pp. 240-254). Springer, Cham. https://doi.org/10.1007/978-3-030-63076-8_17

Martín-Martín, A., Orduna-Malea, E., Thelwall, M., & Delgado López-Cózar, E. (2018). Google Scholar, Web of Science, and Scopus: a systematic comparison of citations in 252 subject categories. *Journal of Informetrics, 12*(4), 1160-1177. https://doi.org/10.1016/J.JOI.2018.09.002

Milne, A. (2016). Competition policy and the financial technology revolution in banking. *DigiWorld Economic Journal (Communications and Strategies),* (103 Third Quarter 2016), 145-161. https://hdl.handle.net/2134/22668

Morvan, A. (2020). *A European open finance framework by 2024.* SSRN3732405. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3732405

O'Leary, K., O'Reilly, P., Nagle, T., Papadopoulos-Filelis, C., & Dehghani, M. (Jan 5 - 8, 2021). The sustainable value of open banking: insights from an open data lens. Paper presented at the *54th Hawaii International Conference on System Sciences,* Grand Wailea, Maui, Hawaii. 5891-5901. https://doi.org/10.24251/HICSS.2021.713 https://hdl.handle.net/10125/71333

Omarini, A. E. (2018). Banks and fintechs: how to develop a digital open banking approach for the bank's future. *International Business Research (Toronto), 11*(9), 23-36. https://doi.org/10.5539/ibr.v11n9p23

Omarini, A. E. (2020). FinTech: a new hedge for a financial re-intermediation. Strategy and risk perspectives. *Frontiers in Artificial Intelligence, 3*(63), 63 (1-11). https://doi.org/10.3389/frai.2020.00063

Osareh, F. (1996). Bibliometrics, citation analysis and co-citation analysis: a review of literature I. *Libri, 46*(3), 149-158. https://doi.org/10.1515/libr.1996.46.3.149

Ozcan, P., Zachariadis, M., & Dinckol, D. (2019). "Platformification" of banking: strategy and challenges of challenger versus incumbent banks in UK. *Academy of Management Proceedings, 2019*(1), 17147. https://doi.org/10.5465/AMBPP.2019.17147abstract

Pastrana, T., Jünger, S., Ostgathe, C., Elsner, F., & Radbruch, L. (2008). A matter of definition – key elements identified in a discourse analysis of definitions of palliative care. *Palliative Medicine, 22*(3), 222-232. https://doi.org/10.1177/0269216308089803

Petrović, M. (2020). PSD2 influence on digital banking transformation -banks' perspective. *Journal of Process Management.New Technologies, 8*(4), 1-14. https://doi.org/10.5937/jouproman8-28153

Pike, C. (2018). *Competition and open API standards in banking.* SSRN3487628. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3487628

Plaitakis, A., & Staschen, S. (2020). *Open banking: how to design for financial inclusion.* Consultative Group to Assist the Poor. https://www.cgap.org/sites/default/files/publications/2020_10_Working_Paper_Open_Banking.pdf

Premchand, A., & Choudhry, A. (Feb 15-17, 2018). Open banking & APIs for transformation in banking. Paper presented at the *2018 International Conference on Communication, Computing and Internet of Things (IC3IoT),* Chennai, India. 25-29. https://doi.org/10.1109/IC3IoT.2018.8668107 https://ieeexplore.ieee.org/document/8668107

Ramdani, B., Rothwell, B., & Boukrami, E. (2020). Open banking: the emergence of new digital business models. *International Journal of Innovation and Technology Management, 17*(5), 2050033 (19 p.). https://doi.org/10.1142/S0219877020500339

Remolina, N. (2019). *Open banking: regulatory challenges for a new form of financial intermediation in a data-driven world.* Singapore Management University - Centre for AI & Data Governance. https://ssrn.com/abstract=3475019

Remolina, N. (2020). *Towards a data-driven financial system: the impact of COVID-19.* SMU Centre for AI & Data Governance. Research Paper 08. https://ink.library.smu.edu.sg/cgi/viewcontent.cgi?article=1007&context=caidg

Rhoades, S. A. (1993). The herfindahl-hirschman index. *Fed Res Bull, 79*, 188-189. https://EconPapers.repec.org/RePEc:fip:fedgrb:y:1993:i:mar:p:188-189:n:v.79no.3

Rubanov, P. M. (2019). Transformation of the banking sector in the digital era. *Mechanism of an Economic Regulation,* (4), 110-118. https://doi.org/10.21272/mer.2019.86.11

Sivathanu, B. (2019). An empirical study on the intention to use open banking in India. *Information Resources Management Journal (IRMJ), 32*(3), 27-47. https://doi.org/10.4018/IRMJ.2019070102

Stiefmueller, C. M. (July 16-20, 2020). Open banking and PSD 2: the promise of transforming banking by 'empowering customers'. Paper presented at the *Conference on the Human Side of Service Engineering,* 299-305. https://doi.org/10.1007/978-3-030-51057-2_41 http://link.springer.com/10.1007/978-3-030-51057-2_41

Szmukler, D. (2016). *Understanding the business relevance of open APIs and open banking for banks.* European Banking Association. https://www.abe-eba.eu/media/azure/production/1522/business-relevance-of-open-apis-and-open-banking-for-banks.pdf

Tosun, P. (September 23-25, 2020). Brand trust for digital-only bank brands: consumer insights from an emerging market. Paper presented at the *ATLAS 7th International Congress on Social Sciences,* 75-85. https://hdl.handle.net/20.500.11779/1370

Valarini, H., & Nakano, D. (2021). An analysis of open banking adoption among university students in São Paulo using the Technology Readiness and Acceptance Model (TRAM). *Exacta, 20*(3), 688-705. https://doi.org/10.5585/exactaep.2021.17453

van Zeeland, I., & Pierson, J. (2021). *The concept of open banking: from a remedy to an ecosystem.* (Policy Brief #44). Vrije Universiteit Brussel. https://cris.vub.be/ws/portalfiles/portal/67938789/Policy_Brief_44_final_1.pdf

Vives, X. (2019). Digital disruption in banking. *Annual Review of Financial Economics, 11*(1), 243-272. https://doi.org/10.1146/annurev-financial-100719-120854

Waltman, L., & van Eck, N. J. (2012). A new methodology for constructing a publication-level classification system of science. *Journal of the American Society for Information Science and Technology, 63*(12), 2378-2392. https://doi.org/10.1002/asi.22748

Westermeier, C. (2020). Money is data - the platformization of financial transactions. *Information, Communication & Society, 23*(14), 2047-2063. https://doi.org/10.1080/1369118X.2020.1770833

Wodak, R., & Meyer, M. (2009). *Methods for critical discourse analysis*. SAGE Publications.

Zachariadis, M., & Ozcan, P. (2017). *The API economy and digital transformation in financial services: The case of open banking.* SSRN2975199. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.2975199

Zeller, B., & Dahdal, A. M. (2021). *Open banking and open data in Australia: global context, innovation and consumer protection.* SSRN3766076. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3766076

Zetzsche, D., Arner, D., Buckley, R., & Weber, R. (2019). The evolution and future of data-driven finance in the EU. *Common Market Law Review, 57*(2), 331-359. https://doi.org/10.54648/cola2020030

Zhang, Q., Zhu, J., & Ding, Q. (October 11–13, 2019). OBBC: A blockchain-based data sharing scheme for open banking. Paper presented at the *Second CCF China Blockchain Conference,* 1-17. https://doi.org/10.1007/978-981-15-3278-8_1

Ziegler, T. (2021). Implementation of open banking protocols around the world. In R. Rau, R. Wardrop & L. Zingales (Eds.), *The Palgrave Handbook of Technological Finance* (pp. 751-779). Springer International Publishing. https://doi.org/10.1007/978-3-030-65117-6_27

Zupic, I., & Čater, T. (2015). Bibliometric methods in management and organization. *Organizational Research Methods, 18*(3), 429-472. https://doi.org/10.1177/1094428114562629

Chapter 3: What drives open banking adoption by clients?

The content of this chapter is a reproduction of the article titled "*An Empirical Study on the Role of Trust and Social Influence in the Intention to Use Data-Sharing Technologies: the case of open banking*". This article was submitted in October 2022 to Sage Open, and is co-authored by Dra. Natalia Cassinello Plaza[7].

Abstract

Open banking seeks to improve the retail banking market's lack of competitiveness by enabling client data sharing with third-party providers. This study analyzes clients' intention to use open banking-based services by applying the extended Technology Acceptance Model (TAM). The study enhances traditional TAM constructs (perceived usefulness and perceived ease of use) with initial trust and social influence to understand clients' behavioral intention to adopt open banking-based services. The proposed model and the hypothesized relationships have been adapted from previous studies. The study analyzes a sample of 553 surveys replicating Spanish population demographics. The proposed model showed robust explanatory capacity. Performance expectancy and social influence are two critical elements in adopting new technologies. Initial trust is vital in determining the behavioral intention to embrace open banking. Perceived ease of use plays a minor role in the adoption of open banking-based services. Thus, private agents, especially new entrants, should focus on highlighting the benefits of open banking-based services to increase adoption. Policymakers should work to improve social influence around adopting services based on open banking and a regulatory framework that increases clients' confidence in adopting these services.

Keywords

Open banking; Technology Acceptance Model; Unified Theory of Acceptance and Use of Technology; Social influence; Initial trust

[7] (Briones de Araluze & Cassinello Plaza, 2022), as of November 2022 under review in Sage Open (ISSN 21582440)

1. Introduction

The open banking model sought to remedy the issue of limited competition in the traditional banking industry (Basso et al., 2018). As a general rule, the design and pricing of financial products and services are heavily customized to the customer's profile (Winter, 2002). Client knowledge is critical to competing in all banking products and services, including onboarding new clients, lending, financial advisory, transactional services, and insurance product distribution. For this purpose, first, in all jurisdictions, financial institutions are obliged to assess the fraud risk that a new customer entails (Know Your Customer processes, KYC) and carry out various regulatory controls (e.g., prevention of money laundering) (Al-Suwaidi & Nobanee, 2021; Koster, 2020). Second, credit products require an assessment of the customer's default risk, which translates into different limits and prices depending on the client's specific risk (He, Z. et al., 2020). Regarding financial advisory, investment products require knowing the customer's propensity for risk and the expected return for a given level of risk (Jung et al., 2019). Likewise, transactional products must be adapted to the different types of transactions preferred by the customer. The same transactional need can be met with various financial instruments such as traditional transfers, immediate transfers, direct debits, payments with credit cards, debit cards, or alternative means of payment such as Paypal or Alipay (de la Mano & Padilla, 2018). Finally, banks distribute risk coverage products for various circumstances (car, home, health) that also require a high level of customer (He, X. et al., 2022). Due to all of the above, it is very complex for a new entrant to compete with the incumbent financial entities, given the existing asymmetry regarding customer knowledge (Ramdani et al., 2020)

The starting premise of open banking models was that the inability to access customer data makes it almost impossible for new entrants to compete with traditional financial institutions. Thus, access to customer data lowers the entry barriers for new competitors, enhancing higher competition. The need for data access and the consolidation of the API technology constitute the core of the open banking philosophy. The first formulation of open banking was the development of the "Open Bank Project" by Simon Redfern in 2010. According to Redfern, "Standardised RESTful JSON APIs protected by OAuth and powered by open-source software could raise the bar of financial transparency and foster greater innovation around bank accounts" (Redfern, 2021). Thus, open banking frameworks should allow higher levels of competitiveness in the banking sector, facilitating the entrance of third-party providers through a level playing field with incumbent financial institutions (Nicholls, 2019).

Open banking can be defined as "an initiative which facilitates the secure sharing of account data with licensed third parties through Application Programming Interfaces (APIs), empowering customers with ownership of their own data. The initiative aims to increase competition in retail banking by developing innovative products and services which will bring increased value to customers" (O'Leary et al., Jan 5, 2021). Open banking can be understood as follows: (1) as a synonym for platformization of retail banking, (2) as data sharing, (3) as financial technology, and (4) as regulation. This study regards open banking as financial technology (fintech). It is essential to distinguish between fintech as a technology and fintech as an agent that leverages it. Fintech as a technology refers to the set of disruptive technologies transforming the banking business (e.g., blockchain, API, mobile, cloud, quantum) (Lee et al., 2018) and the industry built around them (Schueffel, 2017). Fintech as an agent refers to start-up companies that, using these disruptive technologies, are breaking into the financial sector. This study analyzes the adoption of open banking fintech (mainly API-fication) and not the adoption of fintechs as providers of financial products (Gogia & Chakraborty, 2022).

Open banking is based on three essential elements. First, a stable regulatory framework that facilitates the transition to banking customers' data sharing. However, there are also data-sharing cases (e.g., United States) based on private agreements without a specific regulatory framework (Greenberg, 2021). Second, generalizing APIs as interconnection technology within an ecosystem facilitates data sharing between its actors. Nevertheless, data-sharing models can also be based on alternative technologies, such as screen scraping (Liu, 2020). Finally, customer consent is an essential element in the evolution of the open banking model in all cases (Stiefmueller, July 10, 2020). Open banking is impossible without the clients' prior consent for a third party to access their bank data. Contrary to what happens with the regulatory framework and technology, there is no substitute for customer consent in any open banking scheme.

Existing research about open banking is centered around three axes. First, a strand of literature analyzes open banking from the perspective of business model innovation (Omarini, 2020; Ozcan et al., 2019). A second strand focuses on the regulatory view of open banking and its specificity in different jurisdictions (Ziegler, 2021). Finally, the third strand analyzes the technological aspects of open banking and the perspective of data sharing (Farrow, 2020). However, the analysis of the perspective of the final customer in open banking models is minimal, especially considering the central role of the customer in open banking models. This study aims to deepen our understanding of the drivers of adopting services based on open banking by retail banking clients. The research question underlying this study is: What drives customers' intention to adopt open banking-based products and services?

Our research contributes both to theory and practice in three ways. First, it is a first attempt to analyze the intention of customers to adopt open banking models and the underlying explanatory factors. This analysis is especially relevant for those jurisdictions where open banking regulations have not yet been adopted, considering the significant investments in deploying open banking models. Additionally, in specific geographies where there is already an open banking regulation, the convenience of evolving it to include transactional accounts and all the client's financial products (Open Finance in the UK or the latest update of the Payment Service Directive [PSD3] in Europe) is being analyzed (Morvan, 2020). This research can provide relevant insights for regulatory policy. The academic literature is emerging around open banking adoption. Some studies analyze the phenomenon in Australia (Chan et al., 2022), India (Sivathanu, 2019), Brazil (Fernandes, 2020; Valarini & Nakano, 2021), Colombia (Zulueta Londoño & Giraldo Botero, 2021) and the Netherlands (Marzouk, 2021). However, there is no similar analysis in Southern Europe. Second, our research contributes also to the literature on technology adoption models. Although technology adoption models have indeed been successfully tested in the past in various technologies, this is not the case with "API-fication." Therefore, our contribution is especially relevant in the analysis of the adoption path of this technology. Finally, this study analyzes the role of initial trust (INT) and social influence (SI) in technology adoption processes. Our research contributes to understanding the role played by both elements in the field of fintech, especially open banking. Our results are especially relevant for private and public agents. Financial services providers must understand the role of INT and SI in adopting business cases and value propositions based on open banking—for example, when launching new solutions on the market. At the same time, policymakers, especially regulators and supervisors, must work on legal frameworks that ensure the reliability of the new third-party providers to promote open banking-based services adoption.

2. Literature Review and Research Objectives

2.1. Literature Review

Three key elements in the definition of open banking must be considered to understand customer intention to adopt open banking: the regulatory framework, the data sharing, and the supporting technology.

Open banking regulatory frameworks are either deployed or are in the implementation phase in several countries worldwide. While there are differences in these regulations across jurisdictions (Ziegler, 2021), there is a common axis—the need for the client to authorize data sharing with third parties. Open banking-based relationships exist even in jurisdictions without open banking regulations, subject to clients' approval (Arner et al., 2020; Podder, 2021). Therefore, the regulatory aspect is secondary in analyzing the clients' intention to adopt models based on open banking.

Furthermore, a relevant body of academic literature exists around clients' motivations to transfer their data to third parties (Borgogno & Colangelo, 2019; Borgogno & Colangelo, 2020a; Borgogno & Colangelo, 2020b; Borgogno & Colangelo, 2020c) and the relevance of privacy (Smith et al., 2011). In the open banking context, consumers have shown a limited but growing interest in banking data sharing (Open Banking Implementation Entity, 2022). The question on data sharing focuses not only on sharing but also on the trust in the data recipient and the rewards received in exchange for the data (Dimachki, 2019).

Finally, although several technologies might support data sharing, API is the reference technology for open banking in most jurisdictions (Premchand & Choudhry, February 15, 2018; Zachariadis & Ozcan, 2017). It can be argued that API is mainly an interconnection technology (Jacobson et al., 2012) and that, as such, it is transparent for end customers. However, open banking has its specificities as a customer-oriented technology—for example, how to give consent to third parties to account data or existing frictions within the open banking customer journey (Gencheva, 2018). Thus, open banking can be considered a new fintech. Consequently, we leverage technology adoption theories and tools to analyze customer intention to use open banking.

Technology adoption is a phenomenon widely analyzed in the academic literature. Technology Acceptance Models (TAMs) have their roots in the innovation diffusion theory (Rogers, 2003) and emerged in the 1970s (Rondan-Cataluña et al., 2015). Currently, diverse models are being applied to analyze information systems (IS) adoption: Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1977), TAM (Davis, 1986), TAM2 (Venkatesh & Davis, 2000), Technology Readiness and Acceptance Model (TRAM) (Lin et al., 2007), TAM3 (Venkatesh & Bala, 2008), Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003), and UTAUT2 (Venkatesh et al., 2012).

The academic literature analyzing fintech and open banking adoption through technology adoption models is significant (Table 1).

Technology	Author	Year	Model	Country
Fintech service adoption	(Chuang et al., 2016)	2016	TAM	Taiwan
Fintech service adoption	(Hu et al., 2019)	2019	TAM	China
Fintech service adoption	(Meyliana et al., 2019)	2019	TAM	Indonesia
Financial technology services adoption	(Akinwale & Kyari, 2022)	2020	TAM	Nigeria
Fintech acceptance	(Graužinienė & Kuizinienė, 2021)	2020	TAM	Lithuania
Fintech services acceptance	(Joo, 2017)	2017	TAM, DTPB	Korea
Fintech adoption	(Ferdaous & Rahman, 2021)	2021	UTAUT2	Bangladesh
Fintech services adoption	(Jünger & Mietzner, 2020)	2020	Principal Components + Logit	Germany
Fintech services acceptance	(Khatri et al., 2020)	2020	TAM	India
Fintech service adoption	(Kim et al., 2015)	2015	TAM	Korea
Fintech adoption	(Najib et al., 2021)	2021	UTAUT2	Indonesia
Fintech use	(Ryu, H., 2018)	2018	TRA	Korea
Financial technology application	(Sarengat & Mahadwartha, 2021)	2021	TAM	Indonesia
Fintech innovation	(Senyo & Osabutey, 2020)	2020	UTAUT2	Ghana
Fintech adoption	(Setiawan et al., 2021)	2021	TAM	Indonesia
Fintech service intention to use	(Singh et al., 2021)	2021	TAM	India
SMEs' adoption of Blockchain-based loan system	(Sun et al., 2021)	2021	Complexity theory	China
Fintech services adoption	(Tun-Pin et al., 2019)	2019	UTAUT	Malaysia
Biometric identification in Fintech application	(Wang, 2021)	2021	TAM	Taiwan
Fintech service acceptance	(Lee, W., 2018)	2018	TAM	Korea
Open banking intention to use	(Sivathanu, 2019)	2019	TRAM	India
Open banking acceptance	(Valarini & Nakano, 2021)	2020	TRAM	Brazil
Open banking adoption	(Chan et al., 2022)	2022	UTAUT	Australia
Open banking adoption	(Fernandes, 2020)	2020	Ad-hoc model	Brazil
Open banking products and services adoption	(Marzouk, 2021)	2021	Extended TAM	Netherlands
Banking as a service use intention	(Zulueta Londoño & Giraldo Botero, 2021)	2021	TAM	Colombia

Table 1: Summary of Financial Technology Adoption Research
Note: DTPB, decomposed theory of planned behavior; TAM, Technology Acceptance Model; TRA, Theory of Reasoned Action; TRAM, technology readiness and acceptance model; UTAUT, unified theory of acceptance and use of technology.

There is tension between early parsimonious models such as TAM and the latest, more complex approaches such as UTAUT2, which includes many variables. Our analysis adopted a two-tiered process and extended TAM by adopting some elements from UTAUT and other relevant variables.

We choose TAM for several reasons. First, the model is based on TRA (Ajzen, 1991), a psychological theory adapted for IS adoption. TAM is a robust, effective, and parsimonious model for predicting user acceptance (Legris et al., 2003). The model is based only on two internal variables, namely perceived usefulness (PU) and perceived ease of use (PEOU), to explain the behavioral intention (BI) to use a specific system. It has been extensively used in fintech, specifically in open banking adoption. Our analysis extends TAM, including two additional variables—INT and SI.

There is a large number of academic publications studying trust (Lewicki et al., 2006). Trust has been analyzed as a relevant factor in customer-bank relationships (Carbo-Valverde et al., 2013) and specifically in banking IS adoption (Joubert & Van Belle, 2013; Kaabachi et al., 2017; Yousafzai et al., 2009). There are two main approaches when analyzing trust. According to the knowledge-based trust model, trust is a consequence of interaction. Hence, trust develops over time and from experience (Mayer et al., 1995). However, extensive research shows a certain level of trust at the very early stages of human interaction. (McKnight et al., 1998) formalized this idea of "initial trust," which has been extensively applied in technology adoption (Chiu et al., 2017; Maadi et al., 2016). We leverage this INT approach due to the novelty of the open banking technology.

Moreover, SI can be relevant in explaining the adoption of a significantly regulated interaction like open banking. It is a factor in UTAUT, which is considered the evolution of TAM in the history of technology adoption models (Rondan-Cataluña et al., 2015).

2.2. Research Gap and Objectives

Our study focuses on bridging several literature gaps. First, although nascent literature has analyzed open banking adoption, this is the first analysis that enhances a purely internal approach (i.e., TAM) with internal (PU, PEOU, INT) and external (SI) variables. This approach allows us to better understand the moderating factor of external variables in the adoption of fintech, specifically open banking. Second, we investigate the relevance of INT and SI within the context of open banking adoption in a jurisdiction with consolidated open banking regulation. This perspective lets us compare the results with previous studies performed in emergent economies or jurisdictions with non-consolidated open banking regulations. Finally, we analyze the BI to use open banking-based services, adding significant insights to existing research on this matter.

3. Conceptual Framework and Hypotheses Structure

3.1. Conceptual Framework

The core variables are common across most technology adoption models. In the case of TAM and UTAUT, PU and performance expectancy on the one hand and PEOU and effort expectancy on the other can be interpreted as the same underlying constructs. Although these constructs progressed in the academic literature, most authors recognized their similarities. The proposed models use constructs from existing approaches by incorporating or removing some constructs to make them applicable to the open banking context (Table 2). Specifically, building on existing TAM and UTAUT structures, we extend the model to analyze the moderating impact of INT and SI in open banking technology acceptance.

Variable	Abbreviation	Definition	Reference
Perceived usefulness (TAM) – Performance expectancy (UTAUT)	PU	"prospective user's subjective probability that using a specific application system will increase his or her job performance"	(Davis, 1989; Venkatesh et al., 2003)
Perceived ease of use (TAM) – Effort expectancy (UTAUT)	PEOU	"the degree to which the prospective user expects the target system to be free of effort"	(Davis, 1989; Venkatesh et al., 2003)
Social influence	SIN	"the degree to which an individual perceives that important others believe he or she should use the new system" ·	(Venkatesh et al., 2003)
Trust	INT	"the willingness of a party to be vulnerable to the actions of another party based on the expectations that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party"	(Mayer et al., 1995)
Behavioral intention to use	BI	"the individual's intention to perform a given behavior"	(Ajzen, 1991)

Table 2: Definition of variables

Note: PU, perceived usefulness; PEOU, perceived ease of use; BI, Behavioral intention; SI, social influence; INT, initial trust; TAM, Technology Acceptance Model; UTAUT, unified theory of acceptance and use of technology

3.2. Hypotheses Development for the Proposed Model

Figure 1 summarizes our proposed model with the eight hypotheses tested in this article.

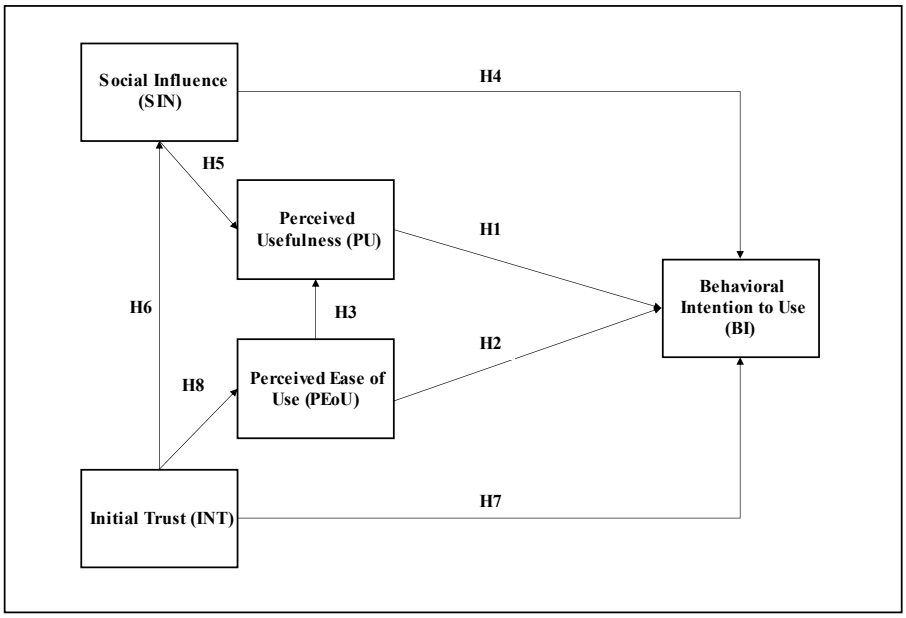

Figure 1: Augmented TAM model

3.2.1. Perceived Usefulness

PU, or performance expectancy, is arguably the most relevant driver of technology adoption. The underlying rationale is that individuals will not adopt new technology if it does not have a positive impact on their performance. Studies have confirmed that PU is relevant in explaining fintech adoption, especially for open banking-based services adoption (Chan et al., 2022; Sivathanu, 2019). Hence, we hypothesize that the following:

Hypothesis 1 (H1): Users' PU positively impacts the BI to use open banking-based services.

3.2.2. Perceived Ease of Use

Similarly, PEOU is highly relevant in explaining technology adoption, as supported by several studies (Table 1). Studies have supported its relevance for open banking adoption as well (Marzouk, 2021; Valarini & Nakano, 2021).

Hypothesis 2 (H2): Users' PEOU has a positive impact on the BI to use open banking-based services.
Hypothesis 3 (H3): Users' PEOU has a positive impact on the PU of open banking-based services.

3.2.3. Social Influence

SI was introduced early in the TAMs. TRA (Fishbein & Ajzen, 1977) and TAM2 (Venkatesh & Davis, 2000) include subjective norm as an antecedent of the concept. (Venkatesh et al., 2003) include SI in a voluntary adoption context as a differential factor in the adoption of new technologies, and it has been supported in fintech (Najib et al., 2021) and open banking-based-services adoption (Chan et al., 2022).

Hypothesis 4 (H4): SI has a positive impact on the BI to use open banking-based services.
Hypothesis 5 (H5): SI has a positive impact on the PU of open banking-based services.

3.2.4. Initial Trust

INT has been extensively analyzed as a key element to explain technology adoption within a fintech context. Recent research shows a significant relationship between INT and PU (Meyliana et al., 2019), both PU and PEOU (Singh et al., 2021), and BI to use (Graužinienė & Kuizinienė, 2021). Based on that, we hypothesize the following:

Hypothesis 6 (H6): INT has a positive impact on the SI on open banking-based services.
Hypothesis 7 (H7): Users' INT in open banking-based services has a significant impact on their BI to use open banking-based services.
Hypothesis 8 (H8): Users' INT in open banking-based services has a significant impact on the PEOU of open banking-based services.

4. Research Methodology

4.1. Instrument Development

The measurement instruments and scales have been adapted from the extant literature on technology adoption and adjusted to meet the requirements of this study (Table 3). Specifically, instruments from the original technology adoption literature have been used (Davis, 1989; Venkatesh et al., 2012). As required, we have included instruments from fintech

adoption literature (Akinwale & Kyari, 2022)). Table 2 summarizes the measurement instruments.

Following (Venkatesh et al., 2012), all items were measured using a seven-point Likert scale. Anchors were set as 1 = "strongly disagree" and 7 = "strongly agree".

Main construct	Measurement		Source
Perceived Usefulness	PUF1	Open banking would help me save me time.	(Davis et al., 1989)
	PUF2	Open banking would help in faster bank transactions.	(Davis et al., 1989)
	PUF3	Open banking would enhance my effectiveness in bank transactions.	(Davis et al., 1989)
	PUF4	Open banking would make it easier to do my banking transactions.	(Davis et al., 1989)
	PUF5	Open banking services helps me accomplish things more quickly.	(Venkatesh et al., 2012)
Perceived Ease of Use	PEOU1	Learning how to use open banking services is easy for me.	(Najib et al., 2021)
	PEOU2	I find it easy to use open banking services.	(Najib et al., 2021)
	PEOU3	I believe it will be easy for me to understand and use open banking services.	(Venkatesh et al., 2012)
	PEOU4	It is easy for me to remember how to perform tasks using new open banking technology.	(Davis et al., 1989)
	PEOU5	It is easy to have the equipment to use open banking services.	(Cheng et al., 2006)
Social Influence	SIN1	People who are important to me think I must use open banking services.	(Najib et al., 2021)
	SIN2	People who influence my behavior think I should use open banking.	(Najib et al., 2021)
	SIN3	People whose opinions that I value prefer I use open banking services.	(Najib et al., 2021)
Initial Trust	INT1	I believe open banking services are reliable.	(Gefen et al., 2003; Pavlou, 2003)
	INT2	I believe open banking services keep my personal information safe.	(Yee-Loong Chong et al., 2010)
	INT3	I believe open banking services maintain my privacy.	(Yee-Loong Chong et al., 2010)
Behavioral Intention	BI1	I would like to use open banking services soon.	(Marakarkandy et al., 2017)
	BI2	I intend to use open banking services in the near future.	(Joo, 2017)
	BI3	I intend to use open banking services in the short term.	(Joo, 2017) (Moon & Kim, 2001)
	BI4	I will continue using open banking services.	(Setiawan et al., 2021)

Table 3: Measurement instruments
Note: PUF, perceived usefulness; PEOU, perceived ease of use; BIN, Behavioral intention; SIN, social influence; INT, initial trust

4.2. Data Collection

Before collecting data, three subject matter experts were consulted to assess the goals and scope of the analysis, and their feedback was incorporated to develop the questionnaire. The questionnaire was pre-tested with ten respondents with an average knowledge of open banking. The questionnaire was revised according to their feedback to ensure that all the questions were adequately understood. The questionnaire was developed and administered in Spanish.

The study was conducted in Spain, a European Union country where PSD2 regulations have been implemented since 2018 (Real Decreto-Ley 19/2018 de Servicios de Pago y Otras Medidas Urgentes en Materia Financiera). In Spain, open banking-based services are already a reality in the market (Monitor Deloitte, 2020). A market research specialist with previous experience in financial services electronically delivered the survey through an online platform. The market research specialist provided the market research panel, composed of Spanish banking customers, and managed all the required consents. The survey was self-administered and completed using either a laptop, tablet, or mobile devices. We used quotas to ensure that the sample was representative of the age, income, education level, and gender at the national level.
A second pre-test of 50 surveys was delivered between May 9, 2022, and May 18, 2022. The results were analyzed to check that the questionnaire was understandable and that the time to completion was reasonable. The survey was launched between May 23, 2022, and June 10, 2022. A total of 553 responses were received.

On average, respondents hold 1.95 bank accounts and have 1.68 financial services providers. Respondents spent 10.75 minutes on average answering the survey (standard deviation of 6.8 minutes). To ensure a proper understanding of the context of the survey, respondents were shown three slides explaining what open banking is (Appendix B). After that, they had to answer two screening questions (Appendices C and D). Only 410 out of the 553 respondents answered both screening questions correctly (107 had only one correct answer, and 36 failed both questions).

The statistical software R was used to conduct the data analysis. Using the lavaan package, the hypotheses developed in Section 3 were tested.

4.3. Respondents' Demographics

Concerning demographic aspects, the sample was designed to represent the Spanish population as much as possible (Appendix E). The retained sample after filtering, fundamentally maintains Spanish population representativeness. Women comprised 53.17% of the sample. Regarding age, 11.22% were younger than 24 years, 15.61% were between 25 and 34 years old, 38.94% were between 35 and 54, 22.93% were between 55 and 64, and 11.71% were older than 65. As for the education level, 2.68% of the respondents were not educated, 38.29% had completed high school, 41.71% had a first-level university degree, 14.88% had a master's degree, and 2.44% had a doctoral degree. Finally, 21.71% declared an average income of fewer than 15,599 Euros per year; 14.39%, between 15,600 and 25,999 Euros; 44.39%, between 26,000 and 41,599 Euros; 15.61%, between 41,600 and 64,999 Euros; and the remaining 3.9%, 65,000 Euros and above.

5. Results

To build the model, the two-stage procedure recommended by (Anderson & Gerbing, 1988) and further developed by (Hair et al., 2011) was followed. The first stage was the development of a confirmatory factor analysis (CFA) to evaluate the measurement model's validity and reliability. Based on the satisfactory results of the CFA, the causal relationship between the latent variables was modeled using structural equation modeling (SEM). SEM was chosen due to its ability to model phenomena such as technology adoption. By estimating a series of latent variables and exploring their relationships, we attempt to maximize the explanation of the variance of the dependent variable (Kline, 2016).

One of the requirements of the CFA is the normal distribution of the variables. To test that hypothesis, skewness and kurtosis were evaluated for all measures. The kurtosis ranged between 1.862 and 2.809, while skewness ranged between -0.505 and 0.502 (Table 4), both of which are within the acceptable interval to assume a normal distribution (Kline, 2016)).

Measures	Kurtosis	Skewness
PUF1	2.290	-0.314
PUF2	2.161	-0.244
PUF3	2.277	-0.081
PUF4	2.130	-0.163
PUF5	2.200	-0.035
PEOU1	2.809	-0.505
PEOU2	2.507	-0.365
PEOU3	2.467	-0.451
PEOU4	2.574	-0.410
PEOU5	2.586	-0.482
SIN1	2.201	0.459
SIN2	2.403	0.502
SIN3	2.249	0.262
INT1	2.203	-0.033
INT2	2.219	0.061
INT3	2.228	0.070
BIN1	2.061	0.126
BIN2	1.862	0.085
BIN3	1.882	0.091
BIN4	2.111	0.007

Table 4: Skewness and Kurtosis of the Measures
Note: PUF, perceived usefulness; PEOU, perceived ease of use; BIN, Behavioral intention; SIN, social influence; INT, initial trust

5.1. Measurement Validity and Reliability

The main target of the CFA is to assess the validity and reliability of the identified measures (Kline, 2016). The outcome of the measurement model is an estimate of the fit between the research model and the data obtained from the survey.

To assess reliability, factor loading and cross-loadings were analyzed. All items had factor loadings well above 0.7. The results reveal that the following conditions were met: primary factor loadings should be above 0.4, cross-loadings should be below 0.3, and the difference between the main factor loading and all the cross-loadings should be higher than 0.2 (Howard, 2016) (Table 5).

Construct reliability was assessed using composite reliability. Composite reliability is equal to or above 0.9 for all five constructs, which is well beyond the accepted threshold of 0.7.

Measure	PE	PEOU	BI	SI	INT
PUF1	0.928	0.135			
PUF2	0.891				
PUF3	0.876				
PUF4	0.820				
PUF5	0.744			0.130	
PEOU1		0.985	-0.167		
PEOU2		0.774	0.126		
PEOU3	0.189	0.809			
PEOU4		0.873			
PEOU5		0.742	0.286	-0.145	
SIN1				0.944	
SIN2				0.888	
SIN3				0.788	
INT1					0.858
INT2					0.837
INT3					0.933
BIN1	0.186		0.725		
BIN2	0.109		0.805		
BIN3			0.889		
BIN4			0.759		

Table 5: Factor cross-loadings
Note: PUF, perceived usefulness; PEOU, perceived ease of use; BIN, Behavioral intention; SIN, social influence; INT, initial trust

5.1.1. Convergent Validity

Convergent validity was assessed using average variance extracted (AVE). The AVE threshold to accept a sufficient convergent validity is 0.5. In other words, the latent variable can explain at least 50% of the indicators' variance(Fornell & Larcker, 1981). AVEs for all constructs range between 0.671 and 0.843 (Table 6).

Indicators	Mean	Standard Deviation	AVE	Loading	p-value	CR
PUF1	4.359	1.723	0.756	0.928	<0.001	0.940
PUF2	4.102	1.752		0.891	<0.001	
PUF3	3.917	1.657		0.876	<0.001	
PUF4	3.956	1.749		0.82	<0.001	
PUF5	3.754	1.691		0.744	<0.001	

PEOU1	4.834	1.560		0.985	<0.001	
PEOU2	4.480	1.619		0.774	<0.001	
PEOU3	4.693	1.695	0.671	0.809	<0.001	0.910
PEOU4	4.688	1.592		0.873	<0.001	
PEOU5	4.615	1.626		0.742	<0.001	
SIN1	3.017	1.753		0.944	<0.001	
SIN2	2.973	1.700	0.756	0.888	<0.001	0.902
SIN3	3.229	1.709		0.788	<0.001	
INT1	3.578	1.809		0.858	<0.001	
INT2	3.588	1.840	0.843	0.837	<0.001	0.956
INT3	3.654	1.903		0.933	<0.001	
BIN1	3.788	1.793		0.725	<0.001	
BIN2	3.837	1.633	0.748	0.805	<0.001	0.900
BIN3	3.695	1.655		0.889	<0.001	
BIN4	3.641	1.646		0.759	<0.001	

Table 6: Convergent validity of constructs
Note: AVE, average variance extracted; CR, composite reliability; PUF, perceived usefulness; PEOU, perceived ease of use; BIN, Behavioral intention; SIN, social influence; INT, initial trust

5.1.2. Discriminant Validity

Discriminant validity evaluates if the constructs are properly distinguishable from one another. We verified that the square root of the AVE for each variable exceeded the correlations between the other constructs (Fornell & Larcker, 1981). Table 7 presents the AVE values on the diagonal of the matrix, which were between 0.819 and 0.918. These values were higher than the correlation between any other two constructs (all the values below the diagonal in the matrix). Overall, discriminant validity could be accepted for this measurement model, and the results support the discriminant validity between the constructs.

Measurement	PU	PEOU	BI	SI	INT
PU	0.869				
PEOU	0.581	0.819			
BI	0.782	0.556	0.869		
SI	0.626	0.335	0.672	0.918	
INT	0.674	0.505	0.708	0.586	0.865

Table 7: Discriminant validity of constructs
Note: PU, perceived usefulness; PEOU, perceived ease of use; BI, Behavioral intention; SI, social influence; INT, initial trust

5.2. Structural Model (TAM)

After the verification of the convergent and discriminant validity of the model, we performed a path analysis to evaluate the structural model. The results of the model fit analysis demonstrated satisfactory results for all indicators (Kyndt & Onghena, 2014); however, CMIN/DF was just on the cut-off limit (Table 8).

Indicators	Value	Standard	Category
RMSEA	0.051	RMSEA ≤ 0.080	Good Fit
SRMR	0.043	SRMR ≤ 0.080	Good Fit
CMIN/DF	2.082	CMIN/DF ≤ 2.000	Acceptable Fit
NFI	0.958	NFI ≥ 0.900	Good Fit
IFI	0.978	IFI ≥ 0.900	Good Fit
TLI	0.974	TLI ≥ 0.900	Good Fit
CFI	0.978	CFI ≥ 0.900	Good Fit

Table 8: Goodness of Fit Measures
Note: RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual; NFI, normed fit index; IFI, integrated fit index; TLI, Tucker-Lewis Index; CFI, Comparative fit index

The coefficient of determination (R2) for the overall model is 0.850, which indicates that 89.5% of the variance of the BI to use open banking-based services could be explained by the proposed model. According to academic literature (Hair et al., 2011) and comparable studies, this is a significantly high value (Table 9). R2 can also assess how well the model predicts future values.

Reference	R2
(Meyliana et al., 2019)	0.703
(Graužinienė & Kuizinienė, 2021)	0.880
(Joo, 2017)	0.573
(Najib et al., 2021)	0.640
(Ryu, 2018)	0.397
(Sarengat & Mahadwartha, 2021)	0.544
(Senyo & Osabutey, 2020)	0.614
(Setiawan et al., 2021)	0.687
(Singh et al., 2021)	0.660
(Tun-Pin et al., 2019)	0.624
(Lee, 2018)	0.275
(Sivathanu, 2019)	0.726
Average	0.610

Table 9: R^2 of comparable studies

The proposed structural model was evaluated to test eight research hypotheses, as seen in Table 10. This study found that PU (β=0.586, p-value <0.001), SI (β=0.274, p-value <0.001) and INT (β=0.278, p-value <0.001) had positive impacts on open banking-based services adoption. Thus, H1, H4 and H7 are accepted. However, PEOU (β=0.088, p-value = 0.087) had no significant direct effect on BI to adopt open banking-based services. Hence, H2 is rejected. However, PEOU positively impacted PU (β=0.459, p-value <0.001). Thus, H3 is accepted. SI had a positive impact on the PU (β=0.561, p-value <0.001). Thus, H5 is accepted. Finally, INT had a positive effect on SI (β=0.777, p-value <0.001) and on PEOU (β=0.581, p-value <0.001) and accordingly, H6 and H8 are accepted (Figure 2).

Hypothesis	Path	Path coefficient	Standard error	P(>|z|)	Conclusion	
H1	PU → BI	0.586	0.063	<0.001	***	Supported
H2	PEOU → BI	0.088	0.052	0.087	--	Not supported
H3	PEOU → PU	0.459	0.047	<0.001	***	Supported
H4	SIN → BI	0.274	0.06	<0.001	***	Supported
H5	SIN → PU	0.561	0.045	<0.001	***	Supported
H6	INT → SI	0.777	0.057	<0.001	***	Supported
H7	INT → BI	0.278	0.057	<0.001	***	Supported
H8	INT → PEOU	0.581	0.051	<0.001	***	Supported

Table 10: Structural Model Hypotheses Testing.
Note: * p<0.05; **p<0.01; ***p<0.001; N.S.: Not Supported; PU, perceived usefulness; PEOU, perceived ease of use; BI, Behavioral intention; SIN, social influence; INT, initial trust

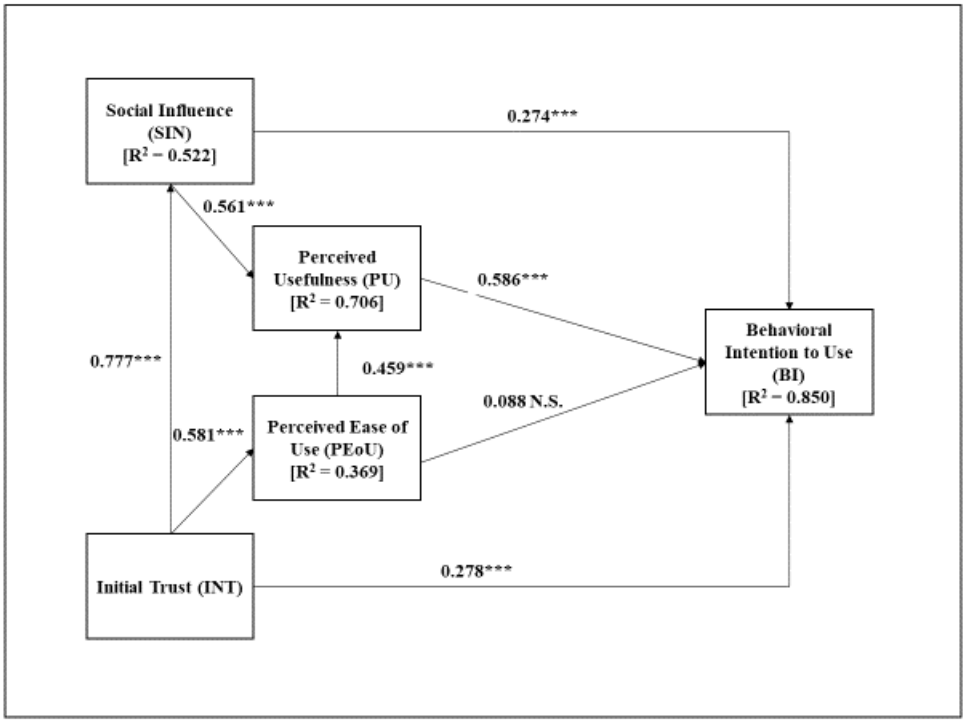

Figure 2: Results of path analysis. **p<0.01; ***p<0.001; N.S.: Not Supported

Additionally, there were relevant indirect effects of identified constructs in the BI to adopt open banking-based services. Table 11 shows the total effect of latent variables in the endogenous variable, obtained through the multiplication and addition of different path coefficients. The most relevant factor was INT, with an aggregated path coefficient of 0.955 due to its direct impact on SI, PU, and PEOU.

Indicators	Direct effect	Indirect effect	Total effect
PU	0.586		0.586
PEOU		0.269	0.269
SIN	0.274	0.329	0.603
INT	0.278	0.677	0.955

Table 11: Total effect calculation

Note: PU, perceived usefulness; PEOU, perceived ease of use; BI, Behavioral intention; SIN, social influence; INT, initial trust

6. Discussion and Conclusions

6.1. Discussion of Findings

A vast body of literature on technology adoption exists, including on TAM and extended TAM models. However, the analysis of the adoption of fintech is still emerging, especially in the case of open banking-based services. To our knowledge, there are no studies as yet in Southern Europe that analyze the BI to adopt open banking services. Our study follows a parsimonious approach regarding the specific studies on the adoption of open banking-based services. It presents evidence of the validity of TAM in the context of adopting fintech and, specifically, of services based on open banking. Additionally, our analysis extends the TAM model, incorporating a key element of the UTAUT model—SI—and the theory of trust—INT—thereby significantly increasing the model's explanatory capacity.

In the context of the literature on technological adoption applied to fintech, our study confirms the relevance of PU as a critical factor in the adoption of fintech in general (Najib et al., 2021; Senyo & Osabutey, 2020) and services based on open banking in particular (Chan et al., 2022; Sivathanu, 2019). However, our conclusions differ regarding the role of PEOU. Although this factor directly influences BI in the literature on the adoption of open banking, the literature on fintech adoption concludes that it is not a relevant factor (Hu et al., 2019; Najib et al., 2021;

Senyo & Osabutey, 2020). In this sense, our results align with the existing literature on fintech adoption. Although the PEOU has some indirect impact, the direct effect is not significant.

Additionally, our study confirms the emerging hypothesis in the literature (Kesharwani & Singh Bisht, 2012) of the impact of PEOU on PU. Although this relationship is not incorporated in the original TAM or the UTAUT models, our study confirms this point.

Regarding the role of SI, our model confirms the hypothesis of its relevance as an explanatory factor in the adoption of fintech directly and through its impact on the PU and the PEOU. Its total effect on the BI to adopt services based on open banking (0.603) is even more significant than the effect of PU (0.586). The literature is divided on this aspect, as it has been confirmed in some studies (Tun-Pin et al., 2019) and rejected in others (Ferdaous & Rahman, 2021; Senyo & Osabutey, 2020).

According to our analysis, INT is the most relevant factor in adopting open banking. The literature supports this aspect of fintech adoption (Singh et al., 2021) and open banking-based services (Chan et al., 2022). The differential contribution of our article is the identification of the impact of INT, not only indirect but also direct (Graužinienė & Kuizinienė, 2021), for the specific case of services based on open banking, being the factor with the highest total weight (0.955).

6.2. Theoretical and Practical Implications

6.2.1. Theoretical implications

Our research extends the applicability of the TAM model to services based on open banking. Previous studies also analyzed the adoption of services based on open banking using the TRAM (Sivathanu, 2019) or UTAUT (Chan et al., 2022) models. There was a gap in the literature exploring the applicability of more parsimonious models such as TAM, and this study provides robust knowledge of its applicability. Second, adding two additional variables, INT and SI, significantly increases the model's explanatory power: The mean of R2 of the previous related studies was 0.61 compared to an R2 of 0.85 obtained in our study (Table 9).

Additionally, our study analyzes the interactions between the different constructs of technology adoption. Identifying the importance of INT as a relevant factor in SI is pertinent to better understanding the dynamics in adopting fin tech such as open banking. Likewise, the

indirect effect of SI on PEOU and of the latter on PU had not been adequately identified in the previous literature until now.

6.2.2. Practical implications

From a practical perspective, our research provides numerous actionable insights for all stakeholders in delivering open banking-based services (Supervisors, regulators, financial institutions and potential new entrants). First, open banking aims to promote increased competition in the retail banking market. Based on the results of our study, INT is the main factor in the adoption of services based on open banking. Therefore, policymakers must foster confidence in open banking schemes. This objective can be achieved through a reinforcement of the guarantees of the open banking framework (for example, publicity and accessibility of the registers of open banking-based service providers, intensification of the supervisory activity on these activities, or an increase of the official communication on the operational procedures of open banking schemes). Second, SI is a high-impact factor in adopting open banking-based services. From a perspective of SI as a cognitive process (Graf-Vlachy & Buhtz, 2017), two types of SI are distinguished: normative and informational. Regarding normative SI, generalizing open banking as a tool to guarantee that clients receive the best products under the best conditions would reinforce the adoption of open banking. Moreover, intensifying public and private communication about the benefits of open banking would strengthen the informative aspect of SI.

As far as private operators are concerned, it is essential to strengthening communication about the usefulness of services based on open banking. The relevance of the perceived utility variable is very high in the BI to adopt services based on open banking. Therefore, marketers must intensify communication about the customer benefits of using these services. These benefits can be made tangible in terms of better prices, more customized products, or simpler processes. It is also essential to reinforce simplicity in adopting this type of service. Thus, although the PEOU does not directly influence the intention to adopt services based on open banking, it is an important variable in PU. Therefore, marketers need to reinforce the positive trade-off between the benefits of open banking-based services and the complexity of using them.

With regard to new entrants, or the so-called third-party providers, they should prioritize combining all the identified variables to promote the adoption of their services. Thus, adoption rates of their services can be improved by deploying actions aimed at increasing confidence in new entrants that provide services based on open banking. This target can be achieved by

enhancing the transparency of services or by being endorsed by trusted references in the market. Additionally, the increase in viral marketing and social networks could also influence the reinforcement of SI for the adoption of this type of service. Finally, clear communication reinforcing the ease of use of the new services based on open banking and the tangible benefits for customers would also boost their adoption.

6.3. Limitations and Future Directions

This study presents several limitations that should be addressed in subsequent research:

First, the phenomenon of open banking-based services is still emerging. In the case of Spain, despite the PSD2 regulations being implemented for more than two years, the services available in the market are still scarce, and an understanding of the service is limited. In our study, despite prior exposure to the service, only 410 of the 553 respondents answered the screening questions correctly. Therefore, this research should be replicated later when there is a more effective implementation of services based on open banking. Second, the BI to adopt services based on open banking can be a good predictor of their adoption. However, it would be appropriate to introduce the BI and the actual use of the services in the model. Third, our approach could be enriched by adding additional variables. Thus, based on the UTAUT model, the incorporation of facilitating conditions could help explain, for example, how a financial app could have a positive impact on the adoption of services based on open banking. Besides traditional technology adoption models, risk has been incorporated into several technology adoption models and could be interesting to include in this analysis. Finally, various services have different propensities for use within the open banking paradigm. For example, the aggregation of account information for a Personal Financial Manager is not the same as a risk assessment based on open banking or a payment initiation service by a third-party provider. Therefore, replicating our analysis for specific open banking applications could help improve our understanding of the variables that explain the adoption of this technology.

Appendices

Appendix A: Questionnaire (Original, Spanish)

1. Utilizar servicios basados en banca abierta me ahorraría tiempo
2. Utilizar servicios basados en banca abierta ayudaría a agilizar mis transacciones bancarias
3. Utilizar servicios basados en banca abierta mejoraría la eficacia de mis transacciones bancarias
4. Los servicios basados en banca abierta harían más sencillas mis transacciones bancarias
5. Usar servicios basados en banca abierta me ayudaría a conseguir mis objetivos más rápido
6. Aprender a usar servicios basados en banca abierta es sencillo para mi
7. Encuentro sencillo utilizar servicios basados en banca abierta
8. Creo que sería sencillo para mi utilizar servicios basados en banca abierta
9. Sería sencillo para mi recordar cómo utilizar servicios basados en banca abierta
10. Sería sencillo obtener los medios para usar servicios basados en banca abierta
11. Personas importantes para mi usan servicios basados en banca abierta
12. Personas que influyen en mi opinión piensan que debería utilizar servicios basados en banca abierta
13. A personas cuyo opinión valoro les gustaría que utilizase servicios basados en banca abierta
14. Me gustaría utilizar servicios basados en banca abierta pronto
15. Tengo la intención de utilizar servivios de banca abierta próximamente
16. Tengo la intención de utilizar servivios de banca abierta a corto plazo
17. Seguiré utilizando servicios basados en banca abierta
18. Creo que los servicios de banca abierta son fiables
19. Creo que los servicios de banca abierta mantienen mi información segura
20. Creo que los servicios de banca abierta mantienen mi privacidad segura

Appendix B: Survey background (Explaining the open banking concept)

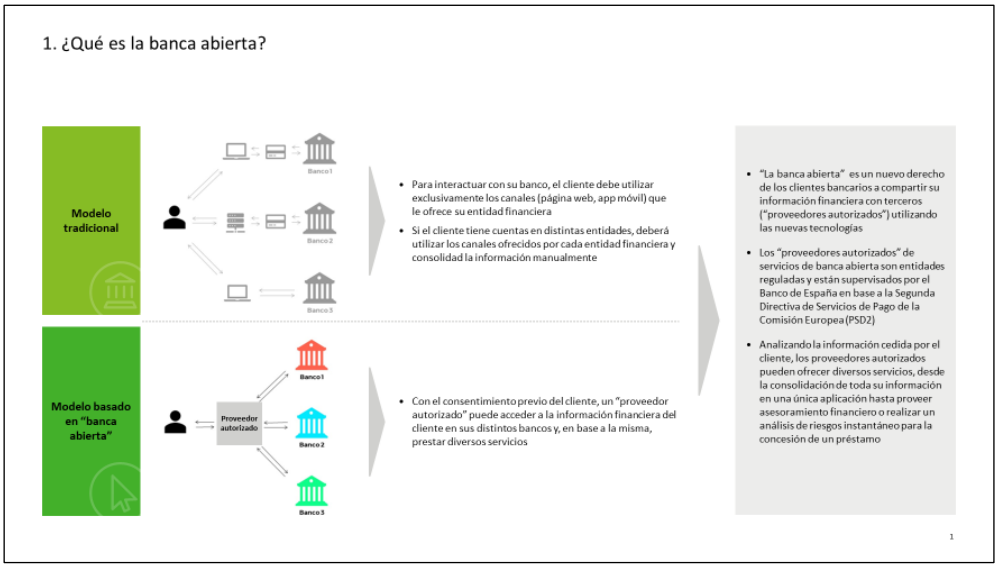

Figure B.1.: Open banking explanation (conceptual)

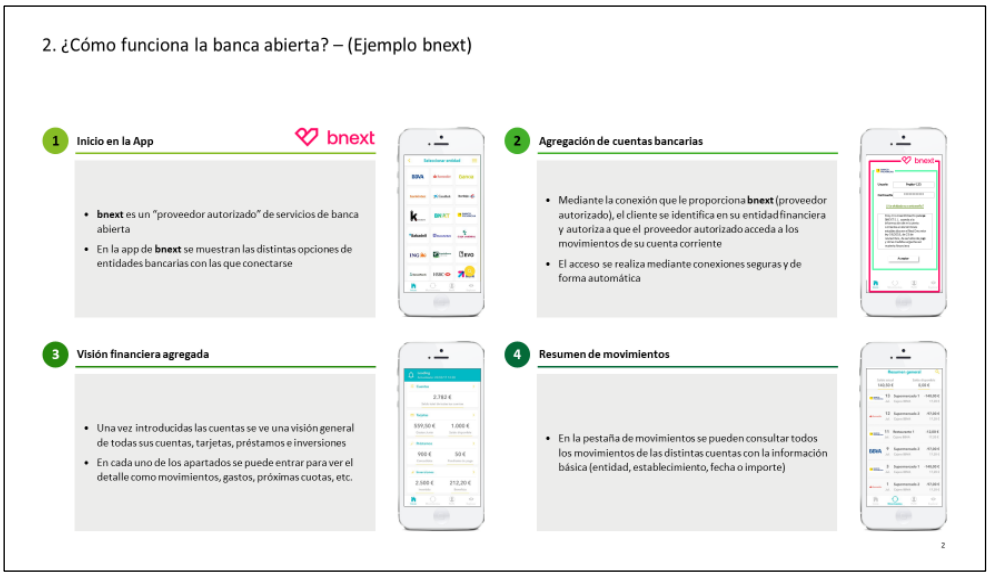

Figure B.2.: Open banking explanation (practical)

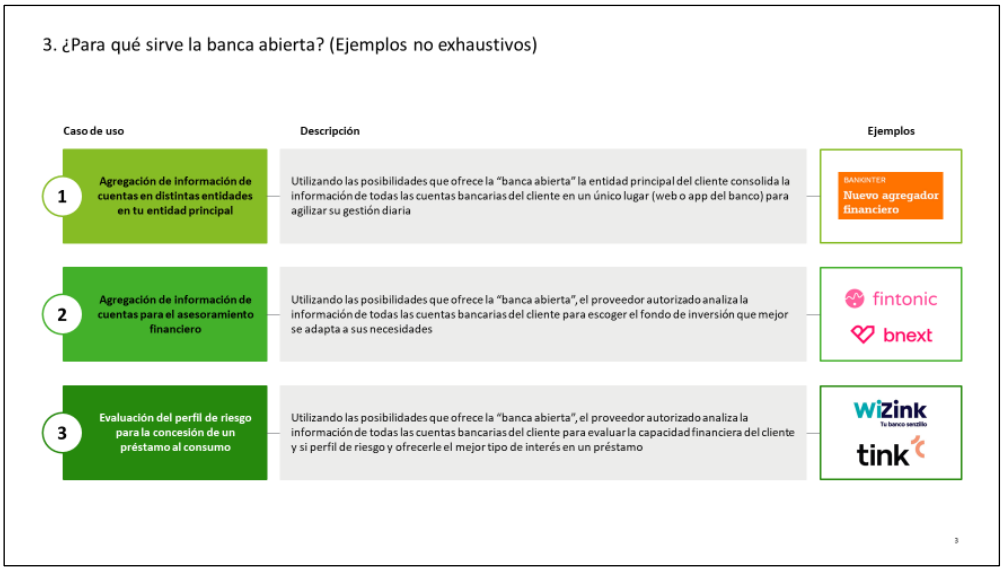

Figure B.3.: Open banking explanation (examples in the Spanish market)

Appendix C: Screening Questions (Original, Spanish)

Question 1: ¿Cuál de las siguientes afirmaciones es cierta? (sólo una es correcta)

(1) La banca abierta es un nuevo banco
(2) La banca abierta es una innovación que permite a los clientes bancarios, previo consentimiento, dar acceso a su información bancaria a terceros (otros bancos, asesores financieros, financieras de crédito)
(3) La banca abierta es un nuevo producto financiero que permite obtener mejores rentabilidades
(4) Ninguno de los anteriores

Question 2: ¿Cómo funciona la banca abierta? (sólo una es correcta)

(1) Necesito darme de alta en un registro en el Banco de España y comunicárselo a todos mis proveedores financieros
(2) Cualquier compañía tecnológica puede prestar el servicio. Simplemente suscribiéndote, la compañia tecnológica puede acceder automáticamente a todos tus datos bancarios
(3) A través de la web o app móvil del proveedor a quien quieras dar acceso a tus datos, conectas con la entidad financiera a la que quieras dar acceso y das permiso para que accedan a tus datos
(4) Ninguna de las anteriores

Appendix D: Screening Questions (English)

Question 1: Which of the following statements is true? (only one is correct)

(1) Open banking is a new bank
(2) Open banking is an innovation that allows banking customers, with prior consent, to give access to their banking information to third parties (other banks, financial advisors, credit finance companies)
(3) Open banking is a new financial product that allows for better returns
(4) None of the above

Question 2: How does open banking work? (only one is correct)

(1) I need to register with the Bank of Spain and notify all my financial providers
(2) Any technology company can provide the service. Simply by subscribing, the technology company can automatically access all your bank details
(3) Through the website or mobile app of the provider to whom you want to give access to your data, you connect with the financial institution to which you wish to provide access and give permission for them to access your data
(4) None of the above

Appendix E: Demographics

Variable	Category	Pre-filter (%)	Post -filter (%)
Device			
	Desktop	38.52%	38.54%
	Mobile	59.67%	59.76%
	Tablet	1.81%	1.71%
Gender			
	Male	48.46%	46.83%
	Female	51.54%	53.17%
Age			
	18–24	10.31%	11.22%
	25–34	13.56%	15.61%
	35–54	38.16%	38.54%
	55–64	26.58%	22.93%
	65–99	11.39%	11.71%
Generation			
	Post Millennials (Gen Z)	10.31%	11.22%
	Millennials (Gen Y)	13.56%	15.61%
	Generation X	38.16%	38.54%
	Boomers-Builders	37.61%	34.63%
Education			
	No studies	5.06%	2.68%
	High school	39.06%	38.29%
	Bachelors degree	38.70%	41.71%
	Masters Degree	14.83%	14.88%
	Doctoral degree	2.35%	2.44%
Income (yearly)			
	€1–€15.599	22.4 %	21.71%
	€15.600–€25.999	16.27%	14.39%
	€26.000–€41.599	40.33%	44.39%
	€41.600–€64.999	16.09%	15.61%
	€65.000 and above	4.88%	3.90%
Number of bank accounts currently owned			
	1	40.33%	36.83%
	2	36.35%	38.54%
	3	15.55%	17.07%
	4	5.61%	6.10%
	5	0.72%	0.49%
	6	0.72%	0.49%
	More than 6	0.72%	0.49%
Number of financial institution relationships			
	1	51.90%	47.80%
	2	33.45%	36.34%
	3	10.49%	11.95%
	4	3.25%	3.66%
	5	0.36%	0.24%
	More than 5	0.54%	0.00%

Table E.1: Demographics

Appendix F: R Script

```
#Package installation
install.packages("readxl")
install.packages("writexl")
install.packages("lavaan", dependencies=TRUE)
install.packages("psych", dependencies=TRUE)
install.packages("psy", dependencies=TRUE)
install.packages("corrplot", dependencies=TRUE)
install.packages("semPlot", dependencies=TRUE)
install.packages("semTools", dependencies=TRUE)
install.packages("moments", dependencies=TRUE)
install.packages("graphics", dependencies=TRUE)

library(corrplot)
library(readxl)
library(lavaan)
library(psych)
library(psy)
library(writexl)
library(semPlot)
library(semTools)
library(moments)
library(ggplot2)
library(graphics)

#Initial CFA
# File load
MVD <- read.csv2(file.choose())

#Initial data assessment
kurtosis(MVD)
skewness(MVD)

#corr and var-cov matrixes
MVD.cor<- cor(MVD)
MVD.cov<- cov(MVD)
```

```
#Corr matrix plot
corrplot(MVD.cor, method = "number",type="full")

#PCA, Promax rotation
pc <- principal(MVD.cor,5,rotate="promax")
pc$loadings
pc$rms
pc$r.scores
summary (pc)

#Corr Matrix with latent variables estimations
TAM <- pc$r.scores
rownames(TAM) <- colnames(TAM) <-
  c("PU", "PEOU", "BI", "SIN","TRU")
TAM

#Validation of calculations through fa package
factores <- fa(MVD.cor, nfactors=5, rotate="promax")
factores$loadings

# Kaiser-Meyer-Olkin calculation
KMO(MVD.cor)
scree.plot(MVD,type = 'R')

# lavaan CFA
CFA.model <- '
# measurement model
  PU =~ PUF1 + PUF2 + PUF3 + PUF4 + PUF5
  PEOU =~ PEOU1 + PEOU2 + PEOU3 + PEOU4 + PEOU5
  SIN =~ SIN1 + SIN2 + SIN3
  BIN =~ BIN1 + BIN2 + BIN3 + BIN4
  TRU =~ INT1 + INT2 + INT3'
fit <- cfa(CFA.model, data=MVD)
summary(fit, rsquare=TRUE, fit.measures=TRUE)

#SEM definition
PD.model <- '
```

```
# measurement model
  PU =~ PUF1 + PUF2 + PUF3 + PUF4 + PUF5
  PEOU =~ PEOU1 + PEOU2 + PEOU3 + PEOU4 + PEOU5
  SIN =~ SIN1 + SIN2 + SIN3
  BIN =~ BIN1 + BIN2 + BIN3 + BIN4
  TRU =~ INT1 + INT2 + INT3'
# inner model LV regressions
  BIN ~ PU + PEOU + SIN + TRU'

#SEM data analysis
sem.fit.dem <- sem(PD.model, data = MVD, representation = "LISREL")
# Get summary results of fit measures:
summary(sem.fit.dem, standardized=TRUE, fit.measures=TRUE, rsquare="TRUE")
# Plot path diagram:
semPaths(sem.fit.dem, title=FALSE, curvePivot = TRUE)
# Standardized parameters:
semPaths(sem.fit.dem, "std", edge.label.cex=0.5, curvePivot = TRUE, exoVar = FALSE)
# Non-standardized parameters:
semPaths(sem.fit.dem, "est", edge.label.cex=0.5, curvePivot = TRUE, exoVar = FALSE)

#Covar saturation model
PD.model_sat <- '

# measurement model
  PU =~ PUF1 + PUF2 + PUF3 + PUF4 + PUF5
  PEOU =~ PEOU1 + PEOU2 + PEOU3 + PEOU4 + PEOU5
  SIN =~ SIN1 + SIN2 + SIN3
  BIN =~ BIN1 + BIN2 + BIN3 + BIN4
  TRU =~ INT1 + INT2 + INT3'

# inner model LV regressions
  BIN ~ a*PU + b*PEOU + c*SIN + d*TRU
  PU ~ e*SIN + f*PEOU
  PEOU ~ g*TRU
  SIN ~ h*TRU
        ea := e*a
        totalSIN := c + (e*a)
        gfa := g*f*a
```

```
        gb:=g*b
        hc:=h*c
        hea:=h*e*a
        totalINT := d + (g*f*a)+(g*b)+(h*c)+(h*e*a)'

#SEM data analysis
sem.fit.dem_sat <- sem(PD.model_sat, data = MVD, representation = "LISREL")
# Get summary results of fit measures:
summary(sem.fit.dem_sat, standardized=TRUE, fit.measures=TRUE, rsquare="TRUE")
# Plot path diagram:
semPaths(sem.fit.dem_sat, title=FALSE, curvePivot = TRUE)
# Standardized parameters:
semPaths(sem.fit.dem_sat, "std", edge.label.cex=0.5, curvePivot = TRUE, exoVar = FALSE)
# Non-standardized parameters:
semPaths(sem.fit.dem, "est", edge.label.cex=0.5, curvePivot = TRUE, exoVar = FALSE)

#Data verification
modindices(sem.fit.dem)

#Composite reliability  calculation
cfa_fit <- cfa(PD.model_sat, data = MVD)
inspect(fit, 'r2')
sl <- standardizedSolution(fit)
sl <- sl$est.std[sl$op == "=~"]
re <- 1 - sl^2
ajuste <- sum(sl)^2 / (sum(sl)^2 + sum(re))

# Model fitting results
fitmeasures(cfa_fit,fit.measures="all",baseline.modle=null)

#Display the overall summary result, standardized=TRUE parameter shows the standardized
result
summary(cfa_fit,standardized=TRUE, rsquare=TRUE, fit.measures=TRUE)

#Path analysis drawing
semPaths(cfa_fit,whatLables="std", style="lisrel",nCharNodes=0,nCharEdges=0,
        title=TRUE, layout="spring",edg.lable.cex=1)
```

```
# AVE and CR calculation
reliability(sem.fit.dem)
lavInspect(sem.fit.dem, what = "free", add.labels = TRUE, add.class = TRUE,
          list.by.group = TRUE,
          drop.list.single.group = TRUE)



#R2 calculation
lavInspect(sem.fit.dem, "rsquare")

# Test statistic for the original sample
T.orig <- fitMeasures(cfa_fit, "chisq")

# bootstrap to get bootstrap test statistics
T.boot <- bootstrapLavaan(cfa_fit, R=1000, type="bollen.stine",
                          FUN=fitMeasures, fit.measures="chisq")

#bootstrap based p-value
pvalue.boot <- length(which(T.boot > T.orig))/length(T.boot)
```

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-211.

Akinwale, Y. O., & Kyari, A. K. (2022). Factors influencing attitudes and intention to adopt financial technology services among the end-users in Lagos State, Nigeria. *African Journal of Science, Technology, Innovation and Development, 14*(1), 272-279. https://doi.org/10.1080/20421338.2020.1835177

Al-Suwaidi, N., & Nobanee, H. (2021). Anti-money laundering and anti-terrorism financing: a survey of the existing literature and a future research agenda. *Journal of Money Laundering Control, 24*(2), 396-426. https://doi.org/10.1108/JMLC-03-2020-0029

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin, 103*(3), 411-423.

Arner, D. W., Zetzsche, D. A., Buckley, R. P., & Weber, R. H. (2020). The future of data-driven finance and RegTech: lessons from EU big bang II. *Stanford Journal of Law, Business & Finance, 25*(2), 245-288. https://law.stanford.edu/publications/the-future-of-data-driven-finance-and-regtech-lessons-from-eu-big-bang-ii/

Basso, A., Bon, J., Tasker, B., Timan, N., Walker, M., & Whitcombe, C. (2018). Recent Developments at the CMA: 2017–2018. *Review of Industrial Organization, 53*(4), 615-635. https://doi.org/10.1007/s11151-018-9668-2

Borgogno, O., & Colangelo, G. (2019). Data sharing and interoperability: Fostering innovation and competition through APIs. *The Computer Law and Security Report, 35*(5), 105314. https://doi.org/10.1016/j.clsr.2019.03.008

Borgogno, O., & Colangelo, G. (2020a). Consumer inertia and competition-sensitive data governance: the case of open banking. *Journal of European Consumer and Market Law, 9*(4), 143 – 150. https://doi.org/10.2139/ssrn.3513514

Borgogno, O., & Colangelo, G. (2020b). The data sharing paradox: BigTechs in finance. *European Competition Journal, 16*(2-3), 20p. https://doi.org/10.1080/17441056.2020.1812285

Borgogno, O., & Colangelo, G. (2020c). Data, innovation and transatlantic competition in finance: the case of the access to account Rule. *European Business Law Review, 31*(4), 573 – 610. https://doi.org/10.2139/ssrn.3251584

Briones de Araluze, G. K., & Cassinello Plaza, N. (2022). An Empirical Study on the Intention to Use Data-Sharing Technologies in the Financial Sector [Abstract]. *SSRN Electronic Journal,* https://ssrn.com/abstract=4201446

Carbo-Valverde, S., Maqui Lopez, E., & Rodriguez-Fernandez, F. (2013). *Trust in Banks.* SSRN2310273. SSRN Electronic Journal. http://www.econis.eu/PPNSET?PPN=1792518722https://doi.org/10.2139/ssrn.2310273

Chan, R., Troshani, I., Rao Hill, S., & Hoffmann, A. (2022). Towards an understanding of consumers' FinTech adoption: the case of Open Banking. *International Journal of Bank Marketing, 40*(4), 886-917. https://doi.org/10.1108/IJBM-08-2021-0397

Cheng, T. C. E., Lam, D. Y. C., & Yeung, A. C. L. (2006). Adoption of internet banking: An empirical study in Hong Kong. *Decision Support Systems, 42*(3), 1558-1572. https://doi.org/https://doi.org/10.1016/j.dss.2006.01.002

Chiu, Bool, & Chiu. (2017). Challenges and factors influencing initial trust and behavioral intention to use mobile banking services in the Philippines. *Asia Pacific Journal of Innovation and Entrepreneurship, 11*(2), 246-278. https://doi.org/10.1108/APJIE-08-2017-029

Chuang, L., Liu, C., & Kao, H. (2016). The Adoption of Fintech Service: TAM perspective. *International Journal of Management and Administrative Sciences, 3*(07), 1-15. https://www.ijmas.org/3-7/IJMAS-3601-2016.pdf

Davis, F. D. (1986). *A technology acceptance model for empirically testing new end-user information systems : theory and results* Massachusetts Institute of Technology]. http://hdl.handle.net/1721.1/15192

Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly, 13*(3), 319-340. https://doi.org/10.2307/249008

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. *Management Science, 35*(8), 982-1003. https://doi.org/10.1287/mnsc.35.8.982

de la Mano, M., & Padilla, J. (2018). Big Tech Banking. *Journal of Competition Law & Economics, 14*(4), 494-526. https://doi.org/10.1093/joclec/nhz003

Dimachki, M. E. (2019). More data and more data sharing: Navigating an open banking world. *Journal of Digital Banking, 3*(3), 206-214. http://journal.bup.edu.bd/Journals/Article/55

Farrow, G. S. D. (2020). An application programming interface model for open banking ecosystems. *Journal of Payments Strategy & Systems, 14*(1), 75-91. https://www.ingentaconnect.com/content/hsp/jpss/2020/00000014/00000001/art00010

Ferdaous, J., & Rahman, N. (2021). Banking Goes Digital: Unearthing the Adoption of Fintech by Bangladeshi Households. *Journal of Innovation in Business Studies, 1*(1), 7-42. https://doi.org/10.1080/23311975.2016.1262107

Fernandes, K. D. (2020). *Modelo de adoção de Open Banking: motivadores e barreiras que influenciam o potencial adotante* [Master Thesis, Escola de Comunicações e Artes da Universidade de São Paulo]. Available from Biblioteca Digital de Teses e Dissertações da USP. https://doi.org/10.11606/D.27.2020.tde-04032021-224111 https://www.teses.usp.br/teses/disponiveis/27/27154/tde-04032021-224111/pt-br.php

Fishbein, M., & Ajzen, I. (1977). Belief, attitude, intention, and behavior: An introduction to theory and research. *Philosophy and Rhetoric, 10*(2)

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39-50.

Gefen, Karahanna, & Straub. (2003). Trust and TAM in Online Shopping: An Integrated Model. *MIS Quarterly, 27*(1), 51-90. https://doi.org/10.2307/30036519

Gencheva, A. (2018). Consumer Perceptions to Friction in the Context of the Privacy vs Convenience Trade-Off – The Case of an Open Banking Consent Journey. *iSCHANNEL - the Information Systems Student Journal, 13*(1), 4-11. https://ischannel.lse.ac.uk/articles/abstract/133/

Gogia, J., & Chakraborty, D. (2022). Open banking: a revolution in the Tech-Fin industry. *International Journal of Electronic Banking, 3*(2), 100-120. https://doi.org/10.1504/IJEBANK.2022.122224

Graf-Vlachy, L., & Buhtz, K. (Jun 5-10, 2017). Social influence in technology adoption research: a literature review and research Agenda. Paper presented at the *25th European Conference on Information Systems (ECIS), Guimarães, Portugal,* Guimarães, Portugal.

Graužinienė, S., & Kuizinienė, D. (2021). Research on factors identification in FinTech acceptance: Lithuania context. *Applied Economics: Systematic Research, 14*(1), 41-57. https://doi.org/10.7220/AESR.2335.8742.2020.14.1.3

Greenberg, J. (2021). *The Future Is Open: The U.S. Turns To Open Banking.* https://fpf.org/. Retrieved Sep 15, 2022, from https://fpf.org/blog/the-future-is-open-the-u-s-turns-to-open-banking/

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a Silver Bullet. *Journal of Marketing Theory and Practice, 19*(2), 139-152. https://doi.org/10.2753/MTP1069-6679190202

He, X., Liu, D., & Xiao, Y. (Mar 22-25, 2022). Research on Building Open Insurance in the Insurance Industry Based on the Concept of Open Banking. Paper presented at the *Proceedings of the 2022 7th International Conference on Social Sciences and Economic Development (ICSSED 2022),* Wuhan, China. 608-613. https://doi.org/https://doi.org/10.2991/aebmr.k.220405.100 https://doi.org/10.2991/aebmr.k.220405.100

He, Z., Huang, J. & Zhou, J. (2020). *Open banking: credit market competition when borrowers own the data.* Cowles Foundation. Retrieved Sep 15, 2022, from https://cowles.yale.edu/publications/cfdp/cfdp-2262

Howard, M. C. (2016). A Review of Exploratory Factor Analysis Decisions and Overview of Current Practices: What We Are Doing and How Can We Improve? *International Journal of Human-Computer Interaction, 32*(1), 51-62. https://doi.org/10.1080/10447318.2015.1087664

Hu, Ding, Li, Chen, & Yang. (2019). Adoption Intention of Fintech Services for Bank Users: An Empirical Examination with an Extended Technology Acceptance Model. *Symmetry (Basel), 11*(3), 340. https://doi.org/10.3390/sym11030340

Jacobson, D., Brail, G., & Woods, D. (2012). *APIs: A strategy guide* (1st ed.). O'Reilly Media, Inc.

Joo. (2017). Understanding Acceptance of Fintech Service in Korea: Focused on Decomposed TPB into TAM. *Journal of Digital Convergence, 15*(4), 171-179. https://doi.org/10.14400/JDC.2017.15.4.171

Joubert, J., & Van Belle, J. (2013). The role of trust and risk in mobile commerce adoption within South Africa. *International Journal of Business, Humanities and Technology, 3*(2), 27-38. http://www.ijbhtnet.com/journals/Vol_3_No_2_February_2013/3.pdf

Jung, D., Glaser, F., & Köpplin, W. (2019). Robo-Advisory: Opportunities and Risks for the Future of Financial Advisory. In V. Nissen (Ed.), *Advances in Consulting Research: Recent Findings and Practical Cases* (pp. 405-427). Springer International Publishing. https://doi.org/10.1007/978-3-319-95999-3_20

Jünger, M., & Mietzner, M. (2020). Banking goes digital: The adoption of FinTech services by German households. *Finance Research Letters, 34*, 101260. https://doi.org/10.1016/j.frl.2019.08.008

Kaabachi, S., Ben Mrad, S., & Petrescu, M. (2017). Consumer initial trust toward internet-only banks in France. *International Journal of Bank Marketing, 35*(6), 903-924. https://doi.org/10.1108/IJBM-09-2016-0140

Kesharwani, A., & Singh Bisht, S. (2012). The impact of trust and perceived risk on internet banking adoption in India. *International Journal of Bank Marketing, 30*(4), 303-322. https://doi.org/10.1108/02652321211236923

Khatri, A., Gupta , N., & Parashar, A. (2020). Application Of Technology Acceptance Model (Tam) In Fintech Services. *International Journal of Management, 11*(12), 3520-3548. https://doi.org/10.34218/IJM.11.12.2020.328

Kim, Y. J., Park, Y., Choi, J., & Yeon, J. (2015). An Empirical Study on the Adoption of "Fintech" Service: Focused on Mobile Payment Services. *Advanced Science and Technology Letters, 114*(26), 136-140. https://doi.org/10.14257/astl.2015.114.26

Kline, R. B. (2016). *Principles and practice of structural equation modeling* (4th ed.). The Guilford Press.

Koster, H. (2020). Towards better implementation of the European Union's anti-money laundering and countering the financing of terrorism framework. *Journal of Money Laundering Control, 23*(2), 379-386. https://doi.org/10.1108/JMLC-09-2019-0073

Kyndt, E., & Onghena, P. (2014). The Integration of Work and Learning: Tackling the Complexity with Structural Equation Modelling. *In: Harteis, C., Rausch, A., Seifried, J. (eds) Discourses on Professional Learning. Professional and Practice-based Learning, vol 9. Springer, Dordrecht.* https://doi.org/10.1007/978-94-007-7012-6_14

Lee, M. R., Yen, D. C., & Hurlburt, G. F. (2018). Financial Technologies and Applications. *IT Professional, 20*(2), 27-33. https://doi.org/10.1109/MITP.2018.021921648

Lee, W. (2018). Understanding Consumer Acceptance of Fintech Service: An Extension of the TAM Model to Understand Bitcoin. *IOSR Journal of Business and Management, 20*(7), 34-37. https://doi.org/10.9790/487X-2007023437

Legris, P., Ingham, J., & Collerette, P. (2003). Why do people use information technology? A critical review of the technology acceptance model. *Information & Management, 40*(3), 191-204. https://doi.org/10.1016/s0378-7206(01)00143-4

Lewicki, R. J., Tomlinson, E. C., & Gillespie, N. (2006). Models of Interpersonal Trust Development: Theoretical Approaches, Empirical Evidence, and Future Directions. *Journal of Management, 32*(6), 991-1022. https://doi.org/10.1177/0149206306294405

Lin, C., Shih, H., & Sher, P. J. (2007). Integrating technology readiness into technology acceptance: The TRAM model. *Psychology & Marketing, 24*(7), 641-657. https://doi.org/10.1002/mar.20177

Liu, H. (2020). Two decades of laws and practice around screen scraping in the common law world and its open banking watershed moment. *Washington International Law Journal, 30*(1), 28-62. https://digitalcommons.law.uw.edu/cgi/viewcontent.cgi?article=1858&context=wilj

Maadi, M., Maadi, M., & Javidnia, M. (2016). Identification of factors influencing building initial trust in e-commerce. *Iranian Journal of Management Studies, 9*(3), 483-503. https://search.proquest.com/docview/1825187531

Marakarkandy, B., Yajnik, N., & Dasgupta, C. (2017). Enabling internet banking adoption. *Journal of Enterprise Information Management, 30*(2), 263-294. https://doi.org/10.1108/JEIM-10-2015-0094

Marzouk, E. (2021). *Consumer Adoption of Open Banking Products and Services. The influence of psychological ownership of data on consumer adoption of open banking products* [Master Thesis, Delft University of Technology]. Available from TU Delft Education Repository. https://repository.tudelft.nl/islandora/object/uuid%3A0b4afdd8-78c0-4294-be43-d74c1751a6bd

Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995). An Integrative Model of Organizational Trust. *The Academy of Management Review, 20*(3), 709-734. https://doi.org/10.2307/258792

McKnight, D. H., Cummings, L. L., & Chervany, N. L. (1998). Initial Trust Formation In New Organizational Relationships. *The Academy of Management Review, 23*(3), 473-490. https://doi.org/10.5465/AMR.1998.926622

Meyliana, M., Fernando, E., & Surjandy, S. (2019). The Influence of Perceived Risk and Trust in Adoption of FinTech Services in Indonesia. *CommIT (Communication and Information Technology) Journal, 13*(1), 31-37. https://doi.org/10.21512/commit.v13i1.5708

Monitor Deloitte. (2020). *Adoption of Open Banking in Spain. Do Spanish customers need Open Banking?* Deloitte. https://www2.deloitte.com/content/dam/Deloitte/es/Documents/estrategia/Deloitte-ES-strategy-monitor-deloitte-open-banking.pdf

Moon, J., & Kim, Y. (2001). Extending the TAM for a World-Wide-Web context. *Information & Management, 38*(4), 217-230. https://doi.org/10.1016/S0378-7206(00)00061-6

Morvan, A. (2020). *A European open finance framework by 2024*. SSRN3732405. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3732405

Najib, M., Ermawati, W. J., Fahma, F., Endri, E., & Suhartanto, D. (2021). FinTech in the small food business and its relation with open innovation. *Journal of Open Innovation, 7*(1/88), 1-17. https://doi.org/10.3390/joitmc7010088

Nicholls, C. C. (2019). Open Banking and the Rise of FinTech: Innovative Finance and Functional Regulation. *Banking & Finance Law Review, 35*(1), 121-151. https://www.proquest.com/docview/2322611475

O'Leary, K., O'Reilly, P., Nagle, T., Papadopoulos-Filelis, C., & Dehghani, M. (Jan 5 - 8, 2021). The sustainable value of open banking: insights from an open data lens. Paper presented at the *54th Hawaii International Conference on System Sciences,* Grand Wailea, Maui, Hawaii. 5891-5901. https://doi.org/10.24251/HICSS.2021.713 https://hdl.handle.net/10125/71333

Omarini, A. E. (2020). FinTech: a new hedge for a financial re-intermediation. Strategy and risk perspectives. *Frontiers in Artificial Intelligence, 3*(63), 63 (1-11). https://doi.org/10.3389/frai.2020.00063

Open Banking Implementation Entity. (2022). *UK open banking marks fourth year milestone with over 4 million users.* https://www.openbanking.org.uk. Retrieved May 31, 2022, from https://www.openbanking.org.uk/news/uk-open-banking-marks-fourth-year-milestone-with-over-4-million-users/

Ozcan, P., Zachariadis, M., & Dinckol, D. (2019). "Platformification" of banking: strategy and challenges of challenger versus incumbent banks in UK. *Academy of Management Proceedings, 2019*(1), 17147. https://doi.org/10.5465/AMBPP.2019.17147abstract

Pavlou, P. A. (2003). Consumer acceptance of electronic commerce: Integrating trust and risk with the technology acceptance model. *International Journal of Electronic Commerce, 7*(3), 101-134.

Podder, S. (2021). Australian Open Banking: The regulatory dilemma of balancing different policy objectives. *Australian Journal of Competition and Consumer Law, 29*(1), 15-28. https://search.informit.org/documentSummary;res=AGISPT;dn=20210701049158

Premchand, A., & Choudhry, A. (Feb 15-17, 2018). Open banking & APIs for transformation in banking. Paper presented at the *2018 International Conference on Communication, Computing and Internet of Things (IC3IoT),* Chennai, India. 25-29. https://doi.org/10.1109/IC3IoT.2018.8668107 https://ieeexplore.ieee.org/document/8668107

Ramdani, B., Rothwell, B., & Boukrami, E. (2020). Open banking: the emergence of new digital business models. *International Journal of Innovation and Technology Management, 17*(5), 2050033 (19 p.). https://doi.org/10.1142/S0219877020500339

Redfern, S. (2021). *11 Years of the Open Bank Project.* https://www.openbankproject.com/. Retrieved May 30, 2022, from https://www.openbankproject.com/11-years-of-the-open-bank-project/

Rogers, E. M. (2003). *Diffusion of Innovations* (5th ed.). Simon and Schuster.

Rondan-Cataluña, F. J., Arenas-Gaitán, J., & Ramírez-Correa, P. E. (2015). A comparison of the different versions of popular technology acceptance models. *Kybernetes, 44*(5), 788-805. https://doi.org/10.1108/K-09-2014-0184

Ryu. (2018). What makes users willing or hesitant to use Fintech?: the moderating effect of user type. *Industrial Management + Data Systems, 118*(3), 541-569. https://doi.org/10.1108/IMDS-07-2017-0325

Ryu, H. (2018). What makes users willing or hesitant to use Fintech?: the moderating effect of user type. *Industrial Management + Data Systems, 118*(3), 541-569. https://doi.org/10.1108/IMDS-07-2017-0325

Sarengat, L. M., & Mahadwartha, P. A. (2021). The Effect of Technology Acceptance Model and Internet Usage Factor to Financial Literacy of Active User of Financial Technology Application among Millennial Generation. *Business and Finance Journal, 6*(2), 119-126.

Schueffel, P. (2017). Taming the Beast: A Scientific Definition of Fintech. *Journal of Innovation Management, 4*(4), 32-54. https://doi.org/10.24840/2183-0606_004.004_0004

Senyo, & Osabutey. (2020). Unearthing antecedents to financial inclusion through FinTech innovations. *Technovation, 98*, 102155. https://doi.org/10.1016/j.technovation.2020.102155

Setiawan, B., Nugraha, D. P., Irawan, A., Nathan, R. J., & Zoltan, Z. (2021). User innovativeness and Fintech adoption in Indonesia. *Journal of Open Innovation, 7*(3), 1-18. https://doi.org/10.3390/joitmc7030188

Singh, S., Sahni, M. M., & Kovid, R. K. (2021). Exploring trust and responsiveness as antecedents for intention to use FinTech services. *International Journal of Economics and Business Research, 21*(2), 254-268. https://doi.org/10.1504/IJEBR.2021.113152

Sivathanu, B. (2019). An empirical study on the intention to use open banking in India. *Information Resources Management Journal (IRMJ), 32*(3), 27-47. https://doi.org/10.4018/IRMJ.2019070102

Smith, H. J., Dinev, T., & Xu, H. (2011). Information Privacy Research: An Interdisciplinary Review. *MIS Quarterly, 35*(4), 989-1015. https://doi.org/10.2307/41409970

Stiefmueller, C. M. (July 16-20, 2020). Open banking and PSD 2: the promise of transforming banking by 'empowering customers'. Paper presented at the *Conference on the Human Side of Service Engineering,* 299-305. https://doi.org/10.1007/978-3-030-51057-2_41 http://link.springer.com/10.1007/978-3-030-51057-2_41

Sun, W., Dedahanov, A. T., Shin, H. Y., & Li, W. P. (2021). Using extended complexity theory to test SMEs' adoption of Blockchain-based loan system. *PloS One, 16*(2), e0245964. https://doi.org/10.1371/journal.pone.0245964

Tun-Pin, C., Keng-Soon, W. C., Yen-San, Y., Pui-Yee, C., Hong-Leong, T., Julian, & Shwu-Shing, N. (2019). An Adoption Of Fintech Service In Malaysia. *South East Asia Journal of Contemporary Business, Economics and Law, 18*(5), 134-147. http://seajbel.com/wp-content/uploads/2019/05/seajbel5-VOL18_241.pdf

Valarini, H., & Nakano, D. (2021). An analysis of open banking adoption among university students in São Paulo using the Technology Readiness and Acceptance Model (TRAM). *Exacta, 20*(3), 688-705. https://doi.org/10.5585/exactaep.2021.17453

Venkatesh, V., & Bala, H. (2008). Technology acceptance model 3 and a research agenda on interventions. *Decision Sciences, 39*(2), 273-315.

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science, 46*(2), 186-204.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly, 27*(3), 425-478. https://doi.org/10.2307/30036540

Venkatesh, V., Thong, J. Y. L., & Xu, X. (2012). Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology. *MIS Quarterly, 36*(1), 157-178. https://doi.org/10.2307/41410412

Wang. (2021). Exploring biometric identification in FinTech applications based on the modified TAM. *Financial Innovation (Heidelberg), 7*(1), 1-24. https://doi.org/10.1186/s40854-021-00260-2

Winter, R. (2002). Mass Customization and Beyond — Evolution of Customer Centricity in Financial Services. In C. Rautenstrauch, R. Seelmann-Eggebert & K. Turowski (Eds.), *Moving into Mass Customization* (pp. 197-213). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-56192-4_12

Yee-Loong Chong, A., Ooi, K., Lin, B., & Tan, B. (2010). Online banking adoption: an empirical analysis. *International Journal of Bank Marketing, 28*(4), 267-287. https://doi.org/10.1108/02652321011054963

Yousafzai, S., Pallister, J., & Foxall, G. (2009). Multi-dimensional role of trust in Internet banking adoption. *The Service Industries Journal, 29*(5), 591-605. https://doi.org/10.1080/02642060902719958

Zachariadis, M., & Ozcan, P. (2017). *The API economy and digital transformation in financial services: The case of open banking.* SSRN2975199. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.2975199

Ziegler, T. (2021). Implementation of open banking protocols around the world. In R. Rau, R. Wardrop & L. Zingales (Eds.), *The Palgrave Handbook of Technological Finance* (pp. 751-779). Springer International Publishing. https://doi.org/10.1007/978-3-030-65117-6_27

Zulueta Londoño, N., & Giraldo Botero, M. J. (2021). *Modelo de Aceptación Tecnológica TAM para determinar la intención de uso del servicio financiero de Banco como servicio* [Master Thesis, Colegio de Estudios Superiores de Administración]. Available from Biblioteca Digital CESA. http://hdl.handle.net/10726/4273

Chapter 4: The future of open banking

The content of this chapter is a reproduction of the article titled "*Why are Open Banking Models in Europe underperforming?*". It was accepted for publication in October 2022 in the Journal of Payments Strategy and Systems and published in November 2022[8].

Abstract

Scholars find fluctuating outcomes from the open banking models implemented in the United Kingdom and the European Union, more than four years after their launch. Open banking also poses several challenges in practice. For example, the critical mass necessary to make these services profitable has not been reached. In the given context, this study summarizes the results of a research project developed over the last three years. The study attempts to understand the foundations that provide a basis for the open banking models and identifies levers to improve their performance. It unveils several caveats in the current open banking models. First, it reveals a lack of understanding of the definition of open banking. It conducts a bibliometric analysis, which yields four contexts for open banking—platformization, data sharing, fintech, and regulation. It also conducts surveys among open banking services' users to determine factors of adoption and to identify the entities customers trust with their data and funds. The results reveal the lack of users' understanding of the open banking-based services and attribute it to the low adoption rate of these services. The results also show that usefulness and initial trust play a significant role in influencing adoption. Customers trust big tech companies with data, while they do not trust fintech firms as custodians of data or funds. Second, it highlights the disproportionate attention toward the service provider infrastructure and the ecosystem of new entrants. The results indicate the relegation of the end customer in the open banking frameworks. Hence, the study proposes a roadmap based on five key elements that could mitigate the main weaknesses in the current open banking models. This study demonstrates the significance of including these elements when designing open banking regulations. Additionally, the conclusions of this study should be considered in the reflection about extensions of open banking-like data-sharing regulations to non-banking sectors (a.k.a.

[8] Reference 2022, Vol. 16 Issue 4

level playing field discussions). Hence, the study presents implications for developing these regulations in countries such as the United States and Canada.

Keywords

Open banking; Open finance; Data sharing; Technology acceptance model; Trust; Digital Markets Act

1. Introduction

Open banking was introduced in the United Kingdom to transform retail banking. Specifically, it was developed to act as a catalyst to increase competition in the banking sector (Basso et al., 2018). The two fundamental constructs of open banking in its European configuration are access to account information and payment initiation. Through the first construct, the account information service providers (AISPs) can, with the client's consent, access the transactional information of the client's accounts. Conceptually, an analysis of this information would allow new entrants to offer financial products and services to customers on an equal footing with incumbent financial entities. Through the second construct, the payments initiation service providers (PISPs) can initiate (i.e., order) a payment from the customer's current account. This second construct allows third-party providers (TPPs) to provide transactional services without meeting the capital requirements of a depository institution. The regulatory requirements are even lower than those of an electronic money institution. Thus, Europe (i.e., the United Kingdom and the European Economic Area (EEA)) gave approval to 529 TPPs at the end of 2021 (Mastercard, 2022). Combining both elements will allow new entrants to compete on an equal basis with existing players, thus creating *virtual banks* operating on existing infrastructure. Conceptually, this regulatory strategy is similar to that adopted in the other sectors (e.g., energy and telecommunications) in that it implies the fragmentation of the value chain to allow the entry of new players in some parts of it to foster competition.

Despite its potential, open banking has failed to exploit the consumer base. In this regard, it must be noted that open banking has been fully operational for over two years in continental Europe and over four years in the United Kingdom. However, the adoption statistics are inconspicuous. As of May 2022, open banking reached 6 million users in the United Kingdom, and API calls reached 1 billion/per month. While the EEA does not publish statistics, it is estimated that the aggregate number of API calls/per month would be around 6 billion for all the countries that make up the EEA. Although these figures may seem relevant, the total

number of open banking users (the United Kingdom and EEA) would account for around 40 million of the total population of more than 519 million. This shows that open banking users account for less than 10% of the total population(Konsentus, 2022).

However, open banking implementation involves a substantial investment in the United Kingdom and the European Union. Although there are no official figures in this regard, Tink (one of the leading operators of open banking services in Europe) estimates that every depository institution makes an average investment of €80 million (Kjellén, 2021). Qualified voices in the sector, such as the CEO of Starling, a neo-bank, consider open banking implementations a failure "*the implementations of open banking that we have are clunky. You know, you wouldn't want to use them*" (Johansson, 2021). This raises the question about the root of the problem.

We must answer three critical questions in order to understand the phenomenon of open banking. The first question focuses on the definition of open banking. Although it is indeed an intuitive idea, the concretion of the phenomenon is different in each country—there is no homogeneous vision regarding the phenomenon. The second question explores the factors driving the adoption of open banking-based services. As mentioned, an initiative such as open banking may make sense from a regulatory design perspective. Nevertheless, the client's perspective in adopting technological services based on open banking has not been sufficiently studied. Finally, the third question examines whether the customers are prepared to share their financial data with third parties. In the data economy, customers understand that they must allow third parties to access their information in order to avail of certain goods or services. However, in most frequent data-sharing use cases (e.g., free email, geolocation applications, and search engines), applications cannot directly access confidential and sensitive information. This is also the case with open banking (e.g., aggregation of data from multiple current accounts).

These three questions have been answered through a research project developed over three years. It combines the academic rigor of a doctoral program with the expertise of management consulting practice. This project uses various analytical approaches to answer the three questions. The following paragraphs summarize the project's results, propose some mitigating factors, and open a discussion about the potential extensions of open banking and about the demand of financial institutions for regulations symmetrical to open banking allowing the access of financial players to client's non-financial data from technology companies (i.e., level playing field discussion).

2. Definition of open banking

Although there are numerous partial or idiosyncratic definitions of the phenomenon, there is no shared and precise view on the meaning of open banking. In certain geographies (i.e., the United Kingdom, the EU, India, and Australia), it is a regulatory-based phenomenon. However, in others (Canada or United States), it is a market phenomenon supported by general principles on data protection and data sharing. In some geographies, it is characterized by access to transactional information, the initiation of payments, and even electronic identity (e.g., India). In others, like Australia, while it is limited to access to financial data, it has a broad scope, including all financial data (e.g., loans, mortgages, mutual funds, pension funds). In short, open banking refers to phenomena with a shared base but wildly divergent materializations. This fact, which can be a relatively minor problem in the business world, is a severe problem in the academic field. The lack of a shared definition of the phenomenon jeopardizes the collaboration between researchers, mainly if they belong to different geographies or disciplines.

At the starting point of the project (Briones & Cassinello, 2022b), we analyze the scientific literature dealing directly or indirectly with open banking. We use bibliometric techniques to identify four contexts for open banking use—platformization of the banking business model, data sharing, financial technology (fintech), and regulation. A definition of open banking should be valid in all four areas to allow dialogue on the phenomenon. However, this approach does not lead to a definition of the phenomenon. Hence, we analyze the academic literature's existing descriptions (47 partial or idiosyncratic definitions out of 282 articles dealing with open banking). Based on this analysis, we define open banking as a regulated framework enabling banking customers to share data with third parties through standardized interfaces (e.g., APIs), and thereby intensifying competition in the financial sector.

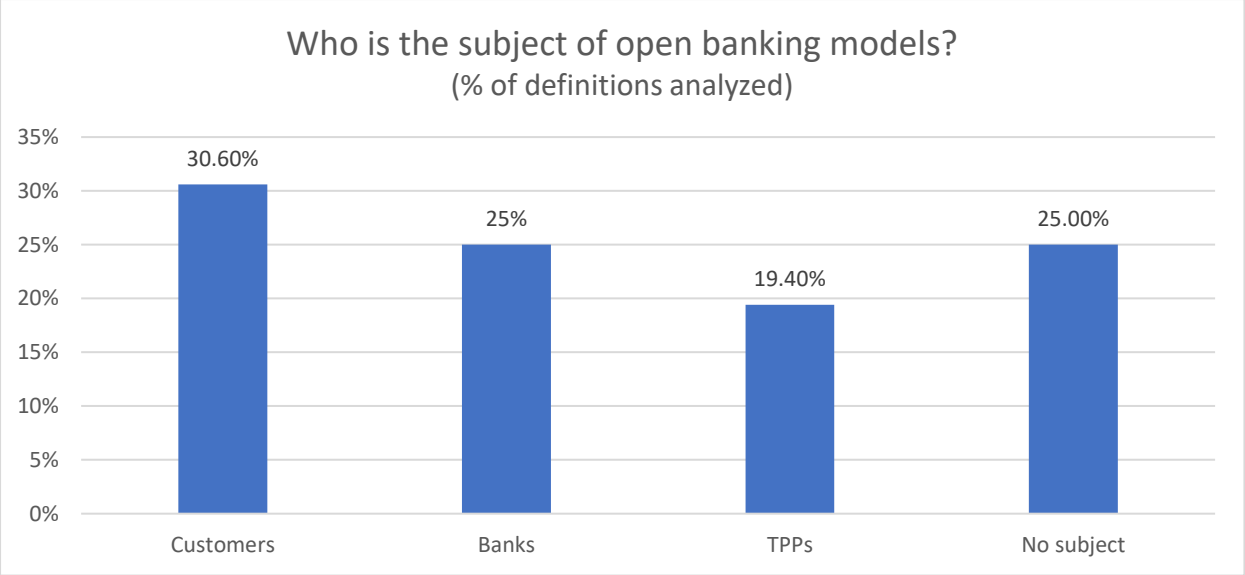

Figure 1: Open banking models' subjects

Beyond the relevance of the definition, the most significant finding is that only 30.6% of the definitions focus on the customer (see figure 1). This is not a minor matter. Open banking services evolve from customers' willingness to share data or give third parties access to initiate payments from their accounts. However, open banking is understood as the right of third parties to access data or the obligation of financial institutions to provide that access. This understanding relegates the role of the customer in the framework. This misunderstanding of the role of the client can have significant consequences. Irrespective of the infrastructure for data access and the richness of the ecosystem of TPPs, open banking is not possible if customers do not give access to their accounts.

3. Factors driving end-customer adoption of open banking services

The second stream of the project (Briones & Cassinello, 2022a) deals with customers' willingness to use the technology supporting open banking. Regardless of the specific underlying technology (i.e., API, software development kits (SDK), or even an unstandardized and unsecured screen scraping previous to current open banking frameworks), open banking requires customers to give third parties access to their bank accounts both for the provision of account information services and the initiation of payments. However, this third-party access increases cybersecurity risks. Therefore, regulated open banking models require increased security around client identification (reinforced authentication). This authentication requires customers to adopt technologies that drive authentication processes, such as confirming one-

time passwords (OTPs) sent via SMS, whitelisting trusted third parties, or activating biometric systems on a mobile device.

In this phase, we focus on customers' willingness to use the aforementioned technologies. To this end, we commission a market research company to build a representative sample (553 valid responses) of the Spanish population already exposed to digital banking services. We prepare a written and graphical explanation of the operation of open banking. Subsequently, we ask two control questions to the participants to determine their understanding of the service. Despite the service explanation, the proportion that could not answer the questions accounts for 26% (143 of the 553) of the total sample.

This study also provides insights into the most used open banking services (see figure 2). In most legislations, although open banking is limited to accessing account (X2A) information, the primary use case referred to by customers is the initiation of payments, either carried out by their bank or a third party. This phenomenon can be explained by the success of global schemes such as PayPal or the Spanish instant payment app Bizum. Bizum is not technically a TPP, but it is perceived as such by bank customers.

In this context, it is noteworthy that the mere aggregation of accounts or financial data access when requesting a loan are considered minority use cases from the customers' perspective. This may be consistent with customers' concentration of financial services providers. The study shows that the clients, on an average, hold two current accounts and work with 1.7 financial entities. Considering this, account information aggregation services may have limited potential to create customer value.

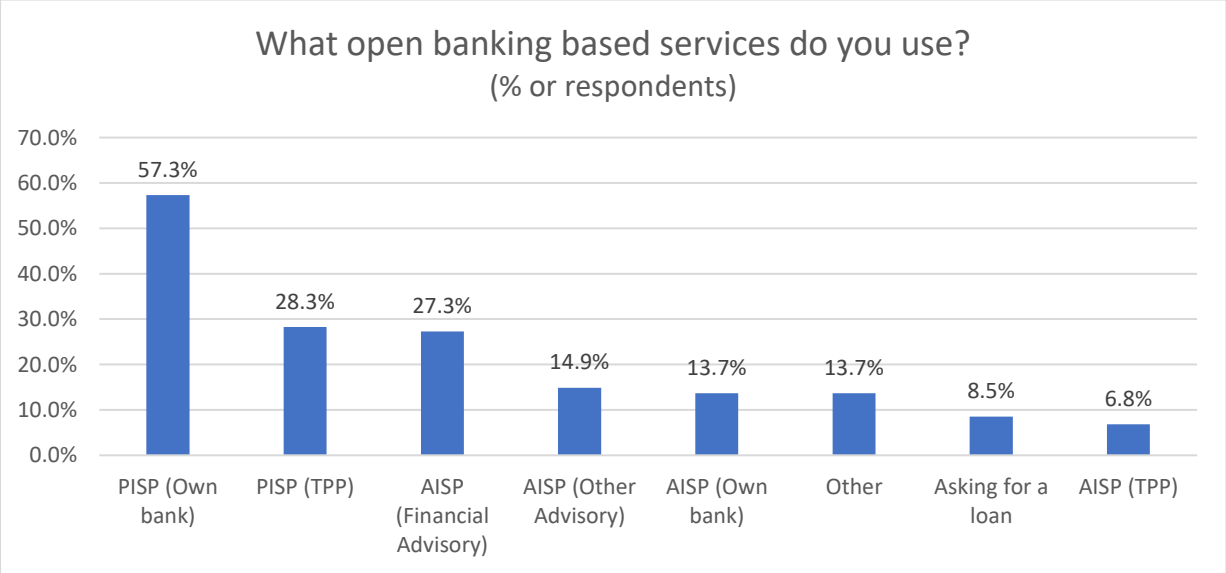

Figure 2: Open banking use cases
Note: PISP (own bank) and AISP (own bank) refer to payment services rendered from one bank operating over an account deposited in a different bank.

This section presents the results of the variables explaining the adoption of open banking as a technology. Our results differ from classic technology adoption studies. Generally, the two main drivers of technology adoption are ease of use and usefulness. While ease of use does not influence open banking adoption, usefulness and trust exert the most significant direct impact on adoption. Social influence plays also a role in driving adoption.

These findings lead to the following reflections. First, as a general thought, the digital age may require practitioners and scholars to conduct a general review of the technology adoption models. The advancements in the user experience and interface platforms and customers' technological immersion make the ease of use a less relevant element in influencing new technology adoption such as open banking.

Concerning usefulness, a question arises about the effort made by the government and financial institutions to explain the potential benefits of open banking to customers. Given that 26% of the sample could not answer fundamental questions about the service, it is imperative for institutions to escalate efforts to improve their understanding of the service. In other words, if customers and their environment fail to understand the meaning and use of open banking, then they may not adopt the new technology. Hence, efforts to provide an understanding of the technology and social influence, especially in this social media era, are critical to open banking adoption.

Trust in the open banking ecosystem is a critical factor. It is true that, at least in the regulated frameworks of open banking, specific legislations have been developed for data access. However, this supervision framework has not been explained sufficiently to the users. Given that trust is critical to open banking adoption, financial institutions should invest efforts in informing clients about how they are protected in this new model.

From a conceptual viewpoint, open banking is a powerful tool for inducing competition in the financial sector. However, this competition can materialize only if customers adopt the technology, which requires customer education. There are only a few good examples of communication that explain to customers the potential of and protection framework around open banking.

4. Customers' preparedness to share financial data

As explained above, open banking operates on trust. From a conceptual viewpoint, there is a solid theoretical construction around the concept of trust. However, this research follows an intuitive approach and asks the following question: Who do customers trust to manage their finances and information? To answer this question, we conduct market research in collaboration with an external agency (Monitor Deloitte, 2020). We ask 1,000 bank customers about their trust in the open banking provider ecosystem. We choose a sample such that it represents the total universe of the population in sociodemographic and financial provider terms. In order to assess customers' trust, we compared trust in current providers of financial services (i.e., medium size and large banks) with new entrants (i.e., big techs and fintechs) and other traditional non-banking players with relatively high levels of trustworthiness (i.e., telecommunications providers, energy companies, retailers or airlines).

First, from an information and funds safekeeping perspective, the big banks serve as the reference points for customers (see Figure 3 and Figure 5). Second, large distribution companies build a high level of customer trust by safeguarding information and funds. However, fintechs fail to gain customer trust, both as custodians of information and funds (see Figure 4 and Figure 6). This fact is especially relevant considering that the main objective of open banking is to allow new entrants to the provision of financial services. The proliferation of TPPs authorized by the respective national authorities will fail to influence the competitive dynamics of the markets, if customers do not trust TPPs and adopt them as providers. In this context, it is also noteworthy to discuss the case of the big techs (Google, Apple, Facebook, and Amazon (GAFA)/Baidu, Alibaba, and Tencent (BAT)). Customers trust these companies as custodians of funds but not as custodians of information. The latter is an essential caveat for the big techs to provide open banking-based financial services. Another relevant element is the role of incumbent companies from other sectors as potential providers of financial services in open banking models. For example, players in the large distribution sector can play a more relevant role in open banking ecosystems than in their own sector.

The results show several limitations of the open banking model. However, the most significant gap is seen in the case of consumer trust generated by current financial service providers, relative to alternatives.

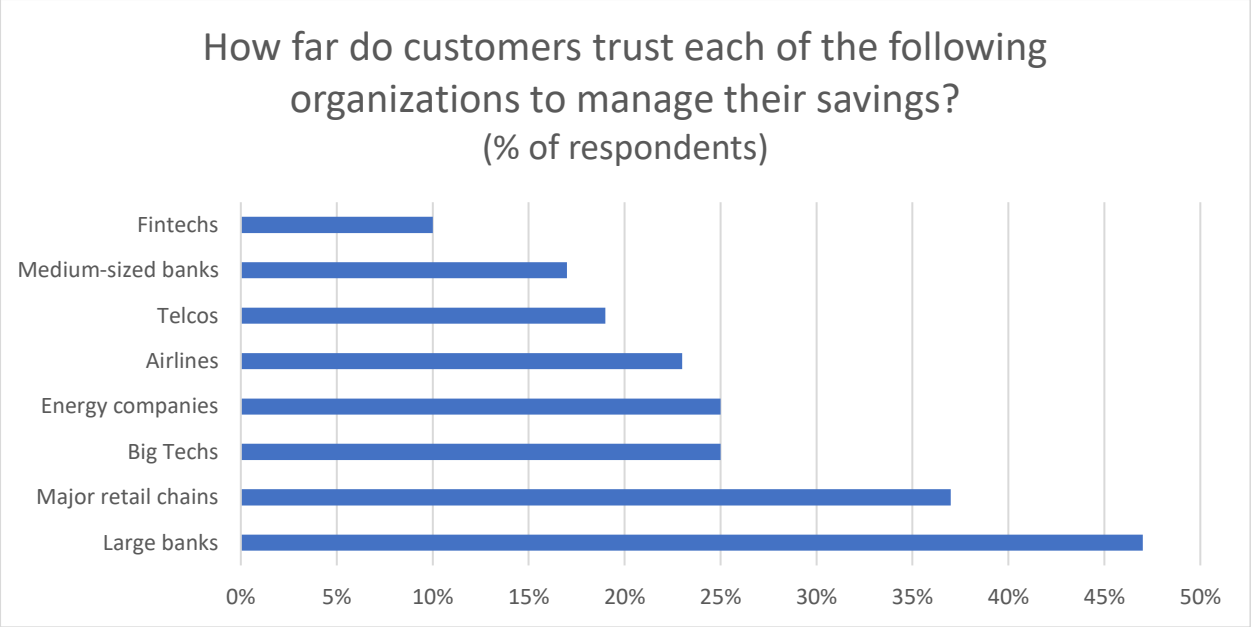

Figure 3: Trust analysis (1/4)

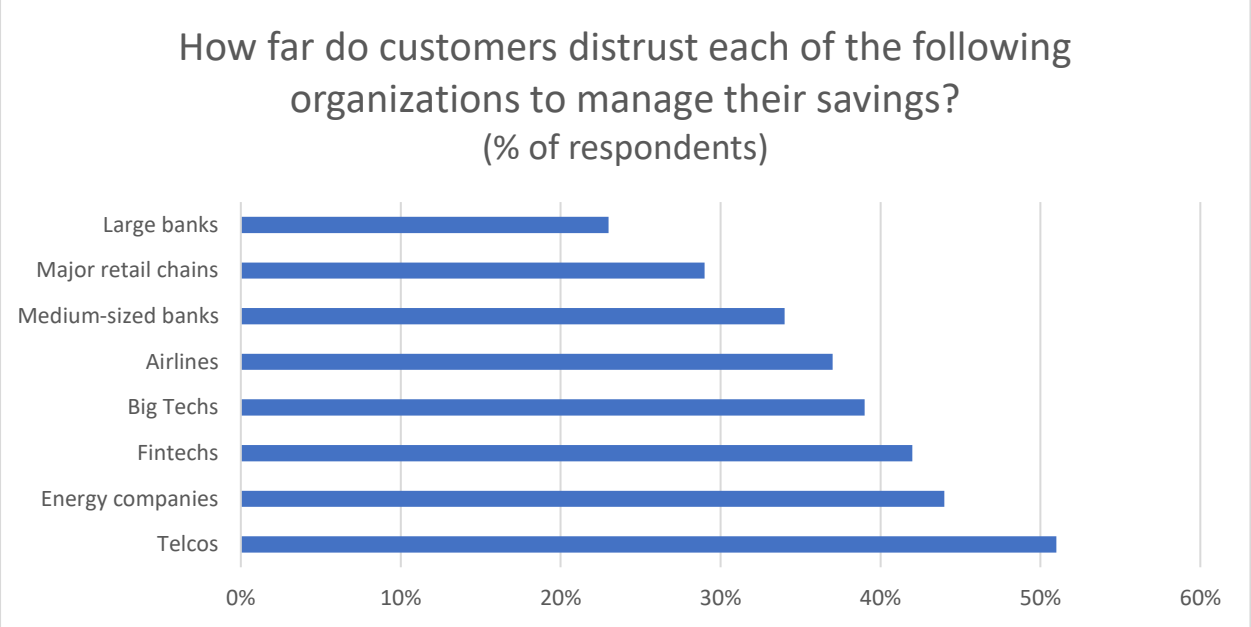

Figure 4: Trust analysis (2/4)

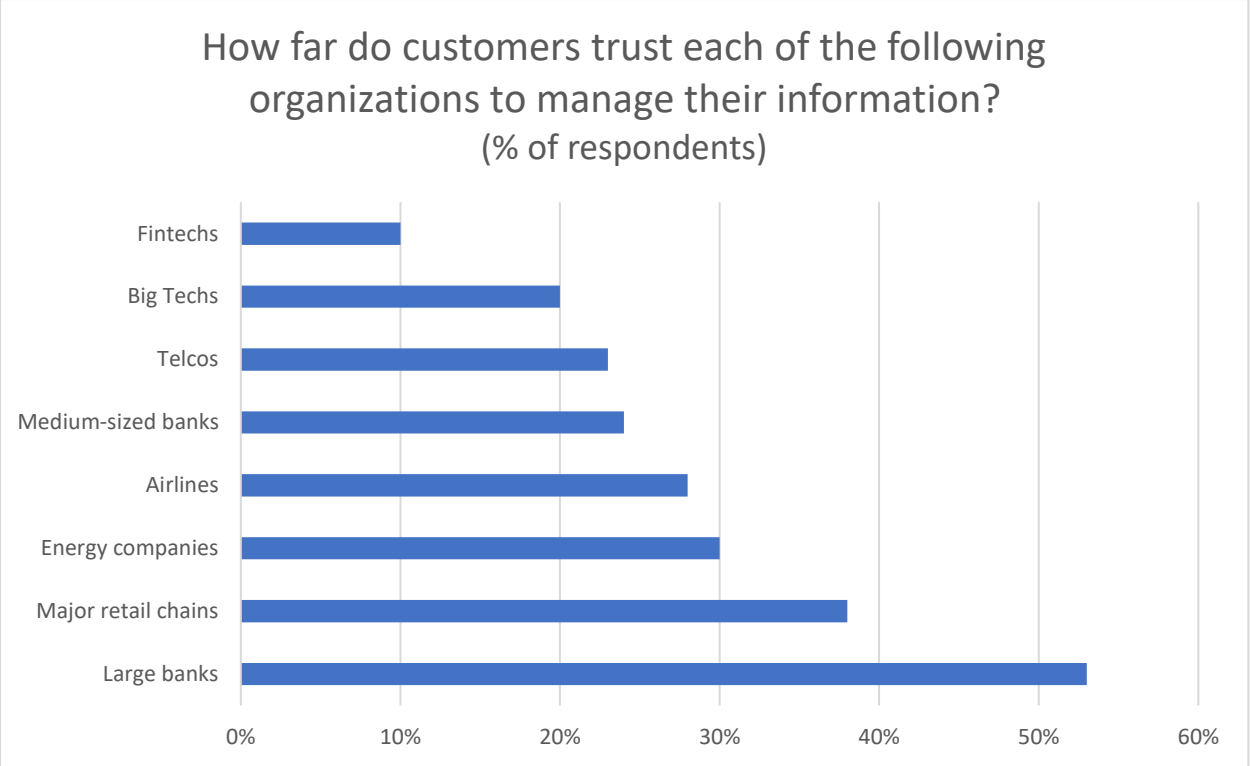

Figure 5: Trust analysis (3/4)

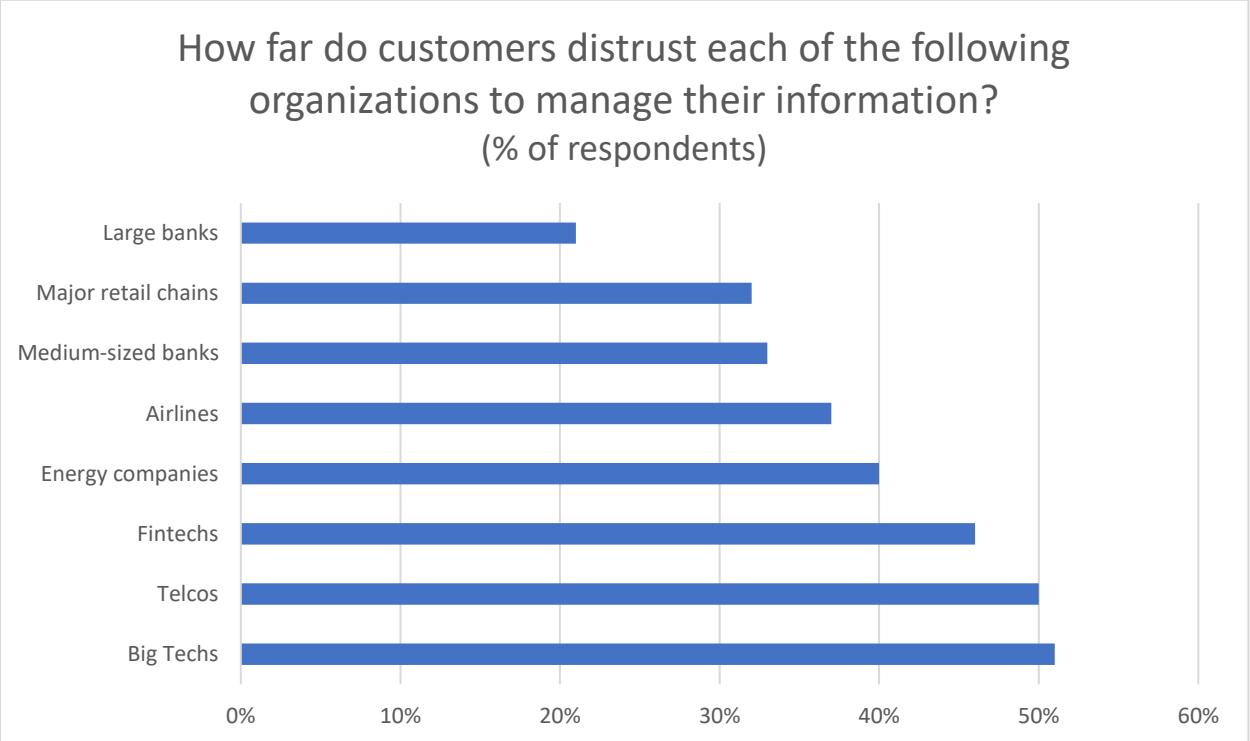

Figure 6: Trust analysis (4/4)

5. Main conclusions

In relation to the main research question, we derive the following conclusions. First, open banking is a complex and hitherto imprecise concept. The lack of specificity regarding the definition of open banking elicits limited interest from academia, which yields shallow and partial analyses of the phenomenon. This implies the lack of a solid theoretical foundation to explain open banking frameworks' underlying mechanisms and dynamics. Second, open banking regulatory frameworks do not focus on the customer. Open banking was born as a theoretical remedy from the Competitions and Markets Authority in the UK to a lack of competition in retail banking services. Although the regulation was meant to address some use cases (e.g., account aggregation and easing of supplier switching), the focus was setting up the infrastructure rather than provoking changes in customers' behaviors. From an industrial policy perspective, open banking should reduce the barriers to entry in the business, increase the number of competitors, and therefore, positively impact price levels and improve innovation. However, the customer has not been sufficiently considered in the definition of these models. The main concern has been to regulate their structural elements (e.g., API architecture, service Levels of traditional financial entities, and TPP regulation). Despite the structural focus, no deep reflection has been undertaken on how these models create better and more efficient banking services. Open banking has the potential to change the dynamics of the retail banking industry allowing new entrants to create and deliver innovative and efficient financial services. However, for this potential to materialize, clients need to understand the benefits of sharing their financial data and the secureness inherent to regulated open banking frameworks. Third, customer utility, trust, and social influence are the main drivers of the adoption of open banking as a technology. However, the design of the current open banking frameworks has focused on less relevant factors in terms of adoption, such as strong customer authentication systems, related to risk (e.g., Regulatory Technical Standards on strong customer authentication and secure communication under PSD2), which also deteriorate ease of use. This mismatch between the focus of regulators and customers' concerns must be resolved to encourage the evolution of open banking models. Fourth, the initiation of payments is a critical construct. Based on the evidence from the United Kingdom, payment initiation and the associated value-added services are vital to the adoption of open banking models. Initially, the regulators, at least the European ones, were clear about their importance. In this regard, it must be noted that, in the EU, open banking is regulated by the PSD2. In order for these payments to compete with existing services (e.g., credit and debit cards, direct debits, and credit transfers initiated by financial institutions), TPPs must be allowed to initiate instant transfers in an economically competitive manner. Payments initiation has been primarily implemented in Europe through the initiation of i-SCT (instant Single Euro

Payments Area Credit Transfers). Theoretically, this is the right approach, as an instant account-to-account payment should be an appealing alternative to traditional card payments. However, although PISPs are not subject to any additional fees by the banks holding customer's current account (the Account Servicing Payment Service Provider or ASPSP), this type of payment is subject to significantly high fees for the customer by most entities. This situation makes, de facto, PISPs non-competitive operators when compared with other payment methods, such as traditional cards or bank-owned account-to-account payment schemes. Finally, the lack of a framework of trust in new entrants significantly limits the possibilities of developing open banking. The new generation of clients (digital natives) may have a greater predisposition to adopt services based on data sharing. However, a significant part of the client base is made up of builders (>65 years old), baby boomers (45–65 years old), and millennials (20–45 years old), with a much lower propensity to data sharing.

This leads to the question of whether it is possible to redesign open banking models to increase the levels of competition and innovation in retail banking businesses. The answer to this question is not simple. However, the aforementioned conclusions provide a clear roadmap.

First, it is necessary to speed up academic research on the open banking phenomenon to gain a better understanding of its underlying factors. As with other emerging technologies (e.g., the Central Bank digital currencies), the development of open banking requires constructing a solid conceptual, theoretical framework serving as the foundation for possible regulatory developments. Second, it is necessary to carry out a stress-testing exercise of the current open banking models from the client's perspective. This exercise can provide an understanding of the setbacks and advantages of the models and help the creators upgrade and contribute toward the evolution of their design. Focusing exclusively on setting up an excellent infrastructure for open banking and neglecting customer perspective may lead to open banking-based services adoption below expectations. The current supply-driven perspective must be completed with a demand-driven understanding of open banking adoption dynamics. Therefore, it is necessary to shift the current focus from the provider ecosystem to the user.

Second, in order to evolve, it is essential to increase the consumer perceived utility of open banking-based services. In this regard, it must be noted that, while considerable investments have been made in constructing the infrastructure, insufficient efforts have been made to explain to the average customer the potential of these new services. This fact indicates a mismatch between investments and needs. Traditional financial institutions have no incentive to explain to customers the possibilities offered by the new open banking framework. The new entrants also lack the financial muscle to conduct financial education campaigns for clients.

Additionally, the endorsement of supervisors and regulators of this new family of services, essential for its widespread adoption by customers, has been limited.

Finally, it is critical to work on the trust front. Thus, despite the effort to create a regulatory regime for TPPs, the nature of TPPs and how they compare with current providers have not been clearly communicated. In this context, as in the case of financial advisory providers, it is essential that the supervisory bodies proactively communicate the protection regime to the open banking clients. This would be crucial in clarifying the nature of TPPs.

6. Implications for the evolution toward *open finance* models

The results highlight the evolution of *open payments* or *open banking* models toward *open finance*. From a theoretical perspective, the transition of data-sharing frameworks from transactional information to non-transactional financial information seems like a logical step. Thus, shortly after the approval of the PSD2 in the EU, there were discussions about its evolution. The scope of the directive also included all the financial information (e.g., investments, credits, and insurance) of the clients.

However, considering the limited impact of the current open banking models, this evolution should be reconsidered. Based on the results obtained in this study, it would be necessary to fix the bases of open banking before proposing an evolution toward open finance models. Articulating access to customer information is costly and increases cybersecurity risks. An evolution in this direction will make sense if there is apparent customer demand, current or potential, for these services. However, extending the open banking framework without an underlying demand could lead to stakeholder dissatisfaction. The disappointment of the regulators may stem from their inability to increase the levels of competition and innovation. The frustration of traditional incumbent financial entities stems from their investments into services that are not used by their clients or monetized. The suppliers also face dissatisfaction owing to their inability to reach critical masses of customers through a viable business model. Customers face disappointments owing to the new cybersecurity requirements inherent to the open banking/open finance models. These setbacks affect the service level and its efficiency, further dissatisfying the customer.

7. Regulatory initiatives to create level playing fields

Since the beginning of the development of open banking regulatory frameworks, the incumbent financial entities have vigorously protested the *unleveled playing fields* (Santander,

2018). Given that the obligation to make customer data accessible is asymmetric, from the perspective of the incumbents, the PSD2 regulations would mean leaving the traditional sector in a position of inequality compared to the new entrants.

In this context, the unique position depository institutions hold in the financial system could justify their being subject to unique regulations. Therefore, since they are the only companies that can hold customer deposits and offer current account services, it is natural that they are subject to a particular regulatory regime. Furthermore, considering their role as crucial in driving the monetary policy, it is natural for them to have a unique regulatory regime. Despite this argument, the supervisors have responded to the calls for attention from the banking sector. Thus, the EU has been considering approving the Digital Services Act and Digital Markets Act (Cabral et al., 2021). Among the other provisions, both regulatory pieces would create a more balanced data-sharing framework, especially for large digital platforms. They would impose certain data-sharing obligations in line with the open banking philosophy.

The introduction of data-sharing regulatory frameworks for large platforms also raises challenging questions. First, the factors inhibiting the development of open banking services could lead to the failure of data-sharing models imposed on large digital platforms. Second, these frameworks neglect customer drivers, under a narrow industrial policy perspective. These frameworks ignore the fact that the data belongs to the clients and that data sharing would be impossible without their explicit and informed consent. Extending data-sharing models (e.g., open banking) to other sectors without a better understanding of their underlying dynamics could exponentially increase investments and cybersecurity risks. This will be justified to the extent that value is created for the customer and the economy.

Author's Note

The views expressed herein do not engage or represent those of any of the organizations with which the author is associated.

References

Basso, A., Bon, J., Tasker, B., Timan, N., Walker, M., & Whitcombe, C. (2018). Recent Developments at the CMA: 2017–2018. *Review of Industrial Organization, 53*(4), 615-635. https://doi.org/10.1007/s11151-018-9668-2

Briones, G. K., & Cassinello, N. (2022a). *An Empirical Study on the Role of Trust and Social Influence in the Intention to Use Data-Sharing Technologies in the Financial Sector.* Unpublished manuscript. https://ssrn.com/abstract=4201446

Briones, G. K., & Cassinello, N. (2022b). Open banking: a bibliometric analysis-driven definition. *PloS One, 17*(10), e0275496. https://doi.org/10.1371/journal.pone.0275496

Cabral, L., Haucap, J., Parker, G., Petropoulos, G., Valletti, T., & Van Alstyne, M. (2021). *The EU Digital Markets Act.* Publications Office of the European Union. https://doi.org/10.2760/139337 http://www.econis.eu/PPNSET?PPN=1749382520

Johansson, E. (2021). *Starling CEO says open banking a flop: Other fintech chiefs beg to differ.* Verdict - Extra Categories - Editor Pick. Retrieved Aug 26, 2022, from https://www.verdict.co.uk/open-banking-starling/

Kjellén, D. (2021). *Following the money.* Tink. https://resources.tink.com/hubfs/05%20Resources/Reports/2021%20reports/OBIU/Open%20banking%20investments%20and%20use%20cases%20-%20Tink%20survey%20report.pdf

Konsentus. (2022). *Q4 2021 Konsentus Third Party Provider Open Banking Tracker.* Konsentus - Resources - TPP Trackers. Retrieved Aug 26, 2022, from https://www.konsentus.com/resources/tpp-trackers/q4-2021-konsentus-third-party-provider-open-banking-tracker/

Mastercard. (2022). *Q4 2021 Open Banking tracker.* Mastercard - News & Insights. Retrieved August 26, 2022, from https://b2b.mastercard.com/news-and-insights/open-banking-tracker/q4-2021/

Monitor Deloitte. (2020). *Adoption of Open Banking in Spain. Do Spanish customers need Open Banking?* Deloitte. https://www2.deloitte.com/content/dam/Deloitte/es/Documents/estrategia/Deloitte-ES-strategy-monitor-deloitte-open-banking.pdf

Santander. (2018). *Responsible Banking, Level Playing Field Are Key Subjects in Santander's Annual Conference.* Retrieved Sep 1, 2022, from https://www.santander.com/content/dam/santander-com/en/contenido-paginas/sala-de-comunicaci%C3%B3n/actualidad/do-actualidad-Responsible-Banking-in-an-age-of-disruption-2-en.pdf

Chapter 5: Main results, original contribution, limitations, and future work

This closing chapter recapitulates and reflects on the results obtained in the initial chapter and the three articles composing this thesis. It is structured in four parts. Firstly, "main results" focuses on summarizing and interpreting the research outcomes in the academic and practitioner's current discussion. Secondly, "original contribution" reviews this thesis's methodological and material contributions to academic literature. "Limitations" is devoted to identifying and analyzing the constraints of the study. Finally, "future work" outlines recommendations for future research on open banking.

1. Main results

This section begins by summarizing the research questions and the results obtained from the three articles and then contextualizes the results in the academic discussion about open banking. The conclusion focuses on both the academic outcomes of the study and the practical implications of these outcomes.

1.1. Discussion

The main goal of this thesis is to enhance the current understanding of open banking, incorporating the customer perspective towards identifying actionable levers that increase its adoption by clients and improve competition in the market. This objective derives into three specific questions. The first question is to formulate a multidisciplinary definition of open banking that delimits the object of research. The second question, driven by the current lack of demand, is to understand the factors that explain customer adoption of services based on open banking. Finally, the last goal is to contextualize both issues within the current discussion on the use of open banking-based services and the convenience of extending open baking models to other financial data (open finance) and even other sectors (level playing fields).

The starting point of the research, addressed in the first paper, is the definition of open banking. Due to the multidisciplinarity and novelty of the phenomenon, there are no consolidated threads in academic literature. For this reason, a bibliometric approach is applied to identify the existing literature's underlying elements. The starting point is a database of the 990 articles dealing directly or indirectly with open banking listed in Google Scholar, out of which 282 are considered relevant through objective filters (language, citations and presence of the term in the title, abstract or keywords). Clustering techniques are applied to them. Through an interpretive analysis of the resulting clusters, the four areas, contexts or connotations of open banking are identified. Open banking as business model platformization, open banking as data-sharing, as financial technology and as regulation.

Likewise, forty-seven partial or idiosyncratic definitions of open banking are identified in the literature. An analysis framework is established through the application of discourse analysis techniques. This framework is based on the induction of the eight underlying elements in the existing idiosyncratic or partial definitions of open banking: nature, consent, subject, action, object, recipient, process, and purpose. The existing definitions are subsequently analyzed using the proposed framework. The elements with a greater degree of consensus are identified by applying the Hirschman Herfindahl Index (HHI). Consequently, the following generalized definition of open banking is proposed: "*a generally regulated framework that enables banking customers to share their data with third parties, commonly through standardized interfaces such as APIs, to increase competition in the financial sector*."

An additional conclusion emerges from the work conducted. Of the forty-seven definitions analyzed, only 30.6% define open banking as the possibility for customers to share their data. In contrast, 25% focus on the obligations that open banking entails for financial institutions and 19.4% do so on the opportunities that open for potential new entrants. This fact denotes the secondary role that the client has had until now in the formulation and analysis of open banking models.

This work synthesizes previous research on the definition of open banking. Specifically, this approach is based on the methodology proposed by (van Zeeland & Pierson, 2021). However, it deepens and extends its application by giving an interpretation of the resulting clusters and proposing a generalized definition of the concept. Regarding the discourse analysis approach, this thesis proposes a structured framework that can be applied beyond open banking and introduces a quantitative approach to analyze existing definitions. This dissertation extends van Zeeland & Pierson (2021) initial approach by proposing an ad-hoc framework to analyze the existing definition, leading to a generalized definition of open banking.

From a broader perspective, this study provides a more comprehensive perspective than previous attempts to define the concept (Laplante & Kshetri, 2021; O'Leary et al., Jan 5, 2021). Additionally, applying bibliometric techniques supports a generalized definition valid in all contexts. This vision integrates the pre-existing partial visions such as (Brodsky & Oakes, 2017) or (Zachariadis, 2020), materializing the first attempt at formulating a comprehensive definition of open banking.

To answer the second research question, the drivers of the adoption of services based on open banking, the reference framework is the literature on technology adoption. In the second paper, the analysis of the existing literature leads to the identification of various models (e.g., TRA[9], TPB[10], TAMx[11], TRAM[12], UTAUTx[13]), in many cases extended with various additional variables (e.g., trust, risk, stickiness to traditional banking...). The most robust and parsimonious model (TAM) is chosen due to the novelty of open banking and the lack of consolidated literature. On top of traditional TAM variables (perceived usefulness and perceived ease of use) and based on previous specific studies on the adoption of open banking in other geographies, initial trust and social influence are also included in the analysis as potential explanatory factors.

Data gathering is done through market research. A questionnaire is developed based on the best practices identified in the literature. A company specializing in market research applied the questionnaire to a sample of 553 respondents, representing the population. A structural equation model is designed to assess the importance of the underlying factors. As a result, it is concluded that perceived usefulness and initial trust are the main explanatory variables and that social influence also has some relevance. On the contrary, the analysis does not support that perceived ease of use is essential in adopting services based on open banking. The proposed model yields high explanatory power (R^2 = 85%)

These results reinforce the conclusions of all previous studies (Chan et al., 2022; Marzouk, 2021; Sivathanu, 2019) on the relevance of perceived usefulness. However, do not concur with existing literature on open banking adoption regarding perceived ease of use. On the contrary, they align with the relevant publications on fintech adoption (Hu et al., 2019; Najib

[9] Theory of Reasoned Action
[10] Theory of Planned Behavior
[11] Technology Acceptance Model (1,2 and 3)
[12] Technology Readiness and Acceptance Model
[13] Unified Theory of Acceptance and Use of Technology (1 and 2)

et al., 2021) regarding the declining relevance of the perceived ease of use as an explanatory factor.

As for the two additional factors explored, trust and social influence, the results align with (Chan et al., 2022) regarding the relevance of social Influence as a significant factor, both direct and indirect, in explaining the adoption of services based on open banking. Likewise, they concur with previous open banking adoption research on the role of initial trust as a relevant factor in adopting open banking. However, according to our results, it is also direct and not just an indirect factor. This last point could be explained by the fact that (Chan et al., 2022) include risk as an explanatory variable in the analysis while we build on the idea that risk is embedded as the antithesis of trust.

A side but relevant outcome must be noted. In the application of the questionnaire, after explaining the service to a sample of digital banking services customers, only 410 of the 553 customers surveyed (74.1%) could answer the two fundamental questions about open banking.

The answer to the third research question, the convenience of extending open baking models, is addressed through the interpretation of the results of the two previous questions and the analysis of previous publications on the matter. In addition to the conclusions described above, in paper three, the relevance of trust is incorporated into the discussion, explicitly concerning data management and savings management. Empirical evidence shows that banks continue to be the primary reference for customers in terms of trust[14] and that new entrants, especially technology companies (fintechs and big techs), have a significant improvement path in this regard. It highlights that fintechs are trusted by less than 10% of the population in terms of managing savings or data. Thus, the appropriateness of extending the existing open banking framework to more financial data (a.k.a. open finance) or other non-financial industries (level playing fields) should be questioned based on the results obtained in this study

In this last point, the results of the study counterbalance, to some extent, existing over-optimistic approaches to the potential impact of open banking, such as those proposed by (Ramdani et al., 2020) and (Omarini, 2020).

[14] In this third article, "Trust" is focused on specific subjects (fintechs, banks, utility companies) while in the second article trust refers to "Initial Trust" which is interpreted as the propensity to generate trust.

Condensing all the above, the results obtained in this thesis can be summarized as follows. First, the current open banking models and the research around them have not significantly factored into the customer's perspective. On the contrary, the focus has been the technological and regulatory infrastructure deployment and the potential disruption in the banking business model. Secondly, from the customer's perspective, it is necessary to delve into the perceived usefulness and develop a trust framework in this new model, supported by social influence factors, to accelerate the adoption of services based on open banking. Finally, it is necessary to deepen customer trust in potential new entrants to promote the open banking model. Consequently, evolving in the above elements should be prioritized over the opportunity to extend open banking principles to other types of data, financial or non-financial.

1.2. Conclusion

As explained before, this thesis aims at enhancing the current understanding of open banking, incorporating the customer perspective towards identifying actionable levers that increase its adoption by clients and improve competition in the market. The results indicate that the customer's perspective has not been sufficiently considered in the definition of current open banking models. Further findings support that this may be one of the reasons for the limited adoption of open banking-based services.

Based on the proposed definition of open banking and the results found in the development of this research, five conclusions show the limited relevance that, until now, the customer perspective has had in the development and analysis of open banking reference models.

First, the literature review shows the practical inexistence of academic research before 2017. Only eleven relevant academic articles had been published before HM Treasury in the UK formalized the "Open Banking Standard." In fact, none of the published articles directly addressed the impact of open banking from the customer's perspective.

The second relevant element to consider is the role that the customer's perspective has had until now in the definition of open banking. Open banking models assume a tripartite scheme between the owner of the data (i.e., the client), the recipient of the data (i.e., the new entrant) and the custodian (i.e., the financial institution depositary of the client's account). However, open banking is, by definition, a customer's right. Therefore, the customer perspective should be central in defining open banking models. However, according to our results, it has been paired with the perspective of banks or new entrants, if not subordinated.

The third critical conclusion of this study derives from the nature of the drivers of the adoption of services based on open banking by customers. Starting with the perceived usefulness, the cases of use defined for open banking must suppose a tangible benefit for the client. Otherwise, their propensity to adopt them is likely to be limited. Second, building customer trust is essential for open banking models to be successful. To begin with, initial trust is a critical element in the adoption of open banking-based services adoption. Additionally, social influence implies that achieving a certain social inertia facilitates the widespread adoption of services based on open banking. Thus, promoting open banking models requires a deep understanding of the customer's perspective to increase trust and generate social influence.

Fourth, the development of this thesis has shown the limited understanding customers currently have about services based on open banking. Unless customers understand the dynamics and guarantees around services based on open banking, it is foreseeable that their degree of adoption will be, at least, limited.

Finally, increasing trust in new entrants is essential for the success of open banking models. Thus, if customers do not trust new entrants to manage their information and savings, services based on open banking are unlikely to succeed. In short, the customer's perspective is again evident as a critical element for the success of open banking models.

The deployment of open banking models is, to a certain extent, independent of the customer's perspective on the matter. In this sense, the UK and the EU objectively have fully functional open banking frameworks. However, the success of existing models depends on widespread adoption by customers. To the extent that the customer perspective has not been sufficiently considered in the definition of existing models, the development and adoption of services based on open banking are facing significant challenges that compromise the model's viability.

1.3. Practical implications

The regulatory boost to open banking models, initiated by the Competition and Markets Authority (CMA) in the UK and quickly spread to other jurisdictions, was based eminently on theoretical approaches and the supply-side perspective. However, there was neither empirical evidence nor prior academic research on data-sharing models in the banking environment from the customer's perspective. Regarding the first two aspects, the virtual absence of studies on open banking before 2017 and the lack of an academic formulation of

the concept are unequivocal proof. Sixty-nine percent of the forty-seven definitions found on open banking were not formulated around the client. This is evidence of the limited weight of the demand perspective in the configuration and reflection on the phenomenon. In this sense, the first practical implication of this thesis is the need for a profound reflection on the client's vision regarding sharing banking data to assess the adequacy of the existing open banking regimes.

Secondly, the lack of knowledge among the population about the possibilities of open banking is a highly striking fact. The sample used in the second article of this thesis was made up of people with previous exposure to digital banking services. After a textual and graphic explanation of the concept of open banking, 26% were unable to answer two fundamental questions about the model. This fact supports the need for a financial education program that explains to citizens the operation and possibilities of services based on open banking. The relevance of social influence as an explanatory factor for adopting this type of service is also proof of the importance of promoting the familiarization of citizens with open banking. Otherwise, the current situation of limited use may be perpetuated, with the consequent waste of the significant investments made for its deployment.

A separate mention deserves the relevance of perceived usefulness as a driver of the adoption of open banking. The bias in the definition of open banking towards the supply side also affects how providers have configured open banking/based services. It is vital to define services with a tangible utility for customers to promote the adoption of open banking. There is a potential asymmetry in how many of the existing open banking-based services have been configured. The value received by the financial institution implementing open banking (e.g., more profound knowledge of the client that allows optimization of banking marketing, pricing models, fraud prevention or risk management) (Al-Suwaidi & Nobanee, 2021) could be significantly higher than the usefulness perceived by the client sharing data through open banking-based services. Consider, for example, the limited value for the client of account-data aggregation when the average number of bank accounts in the sample analyzed is less than two per client.

Another relevant aspect highlighted in the third article is the need to boost trust in new entrants. The empirical evidence shows that trust is crucial for adopting open banking-based services. However, as shown in the third article, trust is deposited in traditional providers (i.e., banks). Promoting open banking-based services requires creating a trust framework for new entrants. In this sense, regulators and new entrants must explain the value of strong customer authentication, the supervisory framework for new entrants, and data protection regulation, elements that establish a complete open banking framework.

Finally, it is necessary to match the extension of open banking to other financial data (open finance) or to other sectors (level playing fields) with the resolution of the identified challenges. Data-sharing models have specific negative implications, such as increased cybersecurity risks. Facing these challenges has two clear consequences: making large investments in financial institutions and a significant worsening of the customer experience. For example, implementing a double authentication factor to secure open banking-based payments implies a worse customer experience than existing "one-click" models (Hatfield, 2017). Extending open banking models is questionable until it is ensured that the trade-off between the value perceived and the effort required is positive for customers.

In short, for open banking models to achieve the desired relevance, stakeholders (regulators, financial institution supervisors and new entrants of all kinds) must revisit their design premises and imbue the customer's perspective in them, leading to an "open banking 2.0".

2. Original contribution

This thesis presents several original contributions from a methodological perspective as well as some material insights.

2.1. Methodological contributions

Starting with the methodological contribution, this research contributes four elements to academic literature.

First, to the best of our knowledge, this thesis conducts the first complete bibliometric analysis of the academic literature on open banking. The bibliometric approach allows for condensing a large and unstructured body of literature and identifying the underlying elements. In this case, the bibliometric approach made it possible to identify the four fundamental connotations of open banking—business model transformation, data sharing, fintech, and regulation. Our contribution allows for systematizing and explaining the four meanings and providing clarity and rigor in the discussion and research.

Second, this thesis uses the HHI[15] to conduct a discourse analysis. To our knowledge, this is the first time the HHI has been used to measure the degree of convergence or divergence of different definitions of a given concept.

Third, our proposal for the open banking integrated definition framework, structured on eight elements (nature, consent, subject, action, object, recipient, process, and purpose), can be extended to other phenomena analogous to open banking (e.g., open payments and open finance). This framework would ensure a rigorous and comprehensive formulation of phenomena like open banking.

Finally, to the best of our knowledge, this research applies an extended version of the technology acceptance model to open banking in an area with an open banking framework for the first time. It also proposes an extension of the model with initial trust and social influence variables. Although technology adoption models (e.g., TRAM (Sivathanu, 2019) or UTAUT (Chan et al., 2022)) have been applied to open banking, their excessive complexity implied an artificial construction. The application of the original TAM has allowed us to obtain relevant

[15] Hirschman Herfindahl Index

insights into the interaction of the model's main variables and propose a more parsimonious and robust model.

2.2. Material contributions

Regarding the material contributions, the conclusions presented can first accelerate the investigation of open banking models. To date, there has been no generalized definition of open banking that can provide a theoretical base for future studies. Our proposed definition specifies the object of investigation for future analyses, thereby contributing to the robustness of academic literature.

Second, we could detect a clear bias in identifying the three perspectives that lend to the partial definitions of open banking (institutional, ecosystem, and customer). Open banking must be built exclusively around the customer, given that the customers must consent to the data transfer and that open banking aims to provide better and cheaper financial services.

Third, regarding adoption drivers, trust and social influence play a fundamental role in influencing the users' intention to adopt services. These factors have been quantified, and this insight can accelerate the implementation of private strategies and public policies for improving open banking models. Likewise, financial institutions can influence their adoption by explaining the usefulness of open banking-based services to customers.

Finally, the discussion on the future of open banking models should incite academics and practitioners to engage in the debate of the trade-off between extending open banking versus enhancing with the customer perspective.

In short, this thesis makes methodological and material contributions to research on open banking. These contributions will undoubtedly contribute to the academic environment and the professional and economic policy fields.

3. Limitations

This thesis has been developed assuming five main limitations that, despite not affecting the validity of the results obtained, must be considered when contemplating their applicability in other environments.

First, open banking is a very recent phenomenon, and the academic literature around it is not fully developed. Owing to the novelty of the phenomenon, there is a lack of a solid theoretical body on which to build. Moreover, considering the almost exponential growth in the number of publications on open banking, our results may need to be refreshed periodically.

Second, in the bibliometric approach followed in Chapter 2, the analyses have been carried out based on the abstracts of the articles and not the entire body. Although this is a widespread practice in bibliometric analysis, it is fair to indicate that the conclusions obtained might not be the same if the complete content of all the articles had been examined.

Third, in Chapter 2 as well, only articles with an abstract in the English language have been considered. Although translation algorithms provide robust results, given the relevance of the literalness of the terms used in the bibliometric analysis, it is appropriate to use abstracts written in English.

Fourth, in Chapter 3, there may be a lack of exposure of bank customers to services based on open banking. Thus, even though a portfolio of services based on aggregation or initiation of payments is already available in various geographies, the client's exposure to these services has been limited. Hence, we could only evaluate the behavioral intention to use instead of actual usage.

Finally, open banking has a relevant regulatory component; therefore, there is a divergence between its different materializations in different jurisdictions. In our case, despite working on the highest common denominator of open banking in different jurisdictions, we may attribute customer perceptions to a regulatory specificity and not to a generalizable fact.

Although the conclusions mentioned above are robust and applicable to different geographical and temporal areas, it is necessary to consider all the above aspects to generalize them.

4. Future work

Taking the results obtained in this research project as a starting point, a series of areas have been identified where further research would be beneficial.

First, based on the analysis of the discourse on the definition of open banking, a relevant gap has been recognized in understanding the client's role in open banking models. As our analysis shows, only a third of the publications focus on open banking from the customer's perspective, even though customers are crucial to its implementation. This study recommends delving deeper into understanding the tangible benefits of this type of scheme for the client. Given the implementation costs of this model and its potential regulatory extension to other customer data currently outside the scope of open banking (e.g., PSD3 and Digital Markets Act in the EU), it would be crucial to determine whether the customer perceives a tangible value in these schemes.

Second, concerning analyzing the variables explaining the adoption of services based on open banking by customers, it would be convenient to delve into two areas. First, additional variables (e.g., perceived risk, facilitating conditions, or hedonistic motivations) could help better understand the phenomenon. After the consolidation of the services based on open banking, the introduction of actual use as an endogenous variable, in addition to the behavioral intention to use, would provide insights into how to promote the adoption of these services.

Third, although open banking models in Europe are highly regulated, how open banking has been implemented varies widely among banks. An inquiry into the different open banking implementation models, both in regulation-led and market-led open banking models, could yield valuable insights into key success factors to enhance open banking adoption rates on the client side.

Finally, regarding the open banking business model, there is a significant gap in understanding the implications on the supply side—for financial institutions and new entrants. Specifically, the impact of open banking on the economics of the retail banking industry is a highly relevant area for future research. In this context, the research on business model innovation should conduct a systematic and quantitative investigation of how open banking models can transform the business model in the financial industry. Likewise, research on how open banking impacts value creation in retail banking would provide relevant insights into promoting adopting this model.

References

Al-Suwaidi, N., & Nobanee, H. (2021). Anti-money laundering and anti-terrorism financing: a survey of the existing literature and a future research agenda. *Journal of Money Laundering Control, 24*(2), 396-426. https://doi.org/10.1108/JMLC-03-2020-0029

Brodsky, L., & Oakes, L. (2017). *Data sharing and open banking.* McKinsey & Company, Inc. https://www.mckinsey.com/industries/financial-services/our-insights/data-sharing-and-open-banking

Chan, R., Troshani, I., Rao Hill, S., & Hoffmann, A. (2022). Towards an understanding of consumers' FinTech adoption: the case of Open Banking. *International Journal of Bank Marketing, 40*(4), 886-917. https://doi.org/10.1108/IJBM-08-2021-0397

Hatfield, J. (2017). Innovation in payments and the revised Payments Services Directive . *Journal of Payments Strategy & Systems, 11*(1), 78-80. http://openurl.ingenta.com/content?genre=article&issn=1750-1806&volume=11&issue=1&spage=78&epage=80

Hu, Ding, Li, Chen, & Yang. (2019). Adoption Intention of Fintech Services for Bank Users: An Empirical Examination with an Extended Technology Acceptance Model. *Symmetry (Basel), 11*(3), 340. https://doi.org/10.3390/sym11030340

Laplante, P., & Kshetri, N. (2021). Open banking: definition and description. *Computer, 54*(10), 122-128. https://doi.org/10.1109/MC.2021.3055909

Marzouk, E. (2021). *Consumer Adoption of Open Banking Products and Services. The influence of psychological ownership of data on consumer adoption of open banking products* [Master Thesis, Delft University of Technology]. Available from TU Delft Education Repository. https://repository.tudelft.nl/islandora/object/uuid%3A0b4afdd8-78c0-4294-be43-d74c1751a6bd

Najib, M., Ermawati, W. J., Fahma, F., Endri, E., & Suhartanto, D. (2021). FinTech in the small food business and its relation with open innovation. *Journal of Open Innovation, 7*(1/88), 1-17. https://doi.org/10.3390/joitmc7010088

O'Leary, K., O'Reilly, P., Nagle, T., Papadopoulos-Filelis, C., & Dehghani, M. (Jan 5 - 8, 2021). The sustainable value of open banking: insights from an open data lens. Paper presented at the *54th Hawaii International Conference on System Sciences,* Grand Wailea, Maui, Hawaii. 5891-5901. https://doi.org/10.24251/HICSS.2021.713 https://hdl.handle.net/10125/71333

Omarini, A. E. (2020). FinTech: a new hedge for a financial re-intermediation. Strategy and risk perspectives. *Frontiers in Artificial Intelligence, 3*(63), 63 (1-11). https://doi.org/10.3389/frai.2020.00063

Ramdani, B., Rothwell, B., & Boukrami, E. (2020). Open banking: the emergence of new digital business models. *International Journal of Innovation and Technology Management, 17*(5), 2050033 (19 p.). https://doi.org/10.1142/S0219877020500339

Sivathanu, B. (2019). An empirical study on the intention to use open banking in India. *Information Resources Management Journal (IRMJ), 32*(3), 27-47. https://doi.org/10.4018/IRMJ.2019070102

van Zeeland, I., & Pierson, J. (2021). *The concept of open banking: from a remedy to an ecosystem.* (Policy Brief #44). Vrije Universiteit Brussel. https://cris.vub.be/ws/portalfiles/portal/67938789/Policy_Brief_44_final_1.pdf

Zachariadis, M. (2020). *Data-sharing frameworks in financial services: Discussing Open Banking Regulation for Canada.* Global Risk Institute in Financial Services. https://doi.org/10.2139/ssrn.2983066

List of abbreviations

AISP	PSD2's Account Information Service Provider
API	Application Programming Interface
AVE	Average Variance Extracted
BI	Behavioral Intention
CBC	Banco Central do Brasil
CDR	Australia's Consumer Data Rights Act
CEO	Chief Executive Officer
CFA	Confirmatory Factor Analysis
CMA	United Kingdom's Competition and Markets Authority
DMA	European Union's Digital Markets Act
EEA	European Economic Area
EU	European Union
HHI	Hirschmann Herfindahl Index
INT	Initial Trust
JSON	JavaScript Object Notation
KYC	Know Your Customer
MDS	Multi-Dimensional Scaling
OAuth	Open Authorization
OTP	One Time Password
PEOU	Perceived Ease of Use
PISP	PSD2's Payment Initiation Service Provider
PSD2	European Union's Second Payments Directive
PU	Perceived Usefulness
RESTFul	REpresentational State Transfer
SDK	Software Development Kit
SEM	Structural Equations Modeling
SI	Social Influence
SMS	Short Message Service
TAM	Technology Acceptance Model
TPP	Third-Party Provider
TRAM	Technology Readiness and Acceptance Model
UK	United Kingdom
US	United States
UTAUT	Unified Theory of Acceptance and Use of Technology
WoS	Web of Science
X2A	Access to Account

DBA

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