



The transformative potential of banking service domains with the emergence of FinTechs

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Abstract

Most activities of FinTech companies in the real world are limited to a variety of banking services such as payment and funds transfer, while the scope of banking services is much broader than the current activities of FinTech companies. In recent years, extensive research has also been conducted on how FinTech companies contribute to the provision of banking services. The present study identifies ideas for new and innovative areas of FinTech companies' activity by reviewing the relevant literature. These areas are categorized using the Banking Industry Architecture Network (BIAN) service landscape and are identified and described through thematic analysis. The outcome of this study is a model which reveals that the main service domains belong to the "banking operations and execution," "sales and services," "risk and compliance," "business support," and "reference data." According to the findings of the present research, FinTech companies have the capability to provide banking services in 22 domains out of 36 BIAN domains. Theoretical contributions and comparative analysis are discussed.

Keywords Financial technologies · FinTech · Digital transformation · Banking service domain · Banking Industry Architecture Network (BIAN)

Introduction

The provision of information technology (IT)-based banking services in the banking industry ecosystem has undergone tremendous changes due to digitalization and technological advancements (Puschmann 2017). New players such as startups operating in "financial technologies" or "FinTechs" have been added to the financial ecosystem (Dhar and Stein 2017). Due to their agility and technology-oriented nature, FinTech companies offer new services and products to the financial industry customers (Lee and Shin 2018). In fact, FinTech companies have promised bank customers to provide them with a different experience of digital banking services through innovative and technology-based advances. These agile companies are appropriate for

delivering innovative services and act quickly and dynamically to compensate for the backwardness of banks (Alt et al. 2018). In recent decades, due to the growth of information technology, the financial industry has experienced a remarkable transformation in the provision of innovative services. This transformation has resulted storing and increasing the speed of processing information and the use of emerging technologies in the infrastructure of financial organizations (Gomber et al. 2017). Another reason for the tremendous impact of IT on the financial industry is the centrality of information and data (Organisation for Economic Co-operation and Development (OECD), 2020). For example, basic customer information, deposits, loans, and the history of all financial transactions are all data. These data are considered as the new source of wealth creation for the bank (Hanafizadeh and Harati Nik 2020). Due to the data-driven nature of the banking industry, IT and digital banking transformation have expanded more rapidly compared to other industries (Abubakar and Tasmin 2012). The application of IT in the financial industry has not only led to the digitalization of data and automation of processes but has also influenced the value created by banks and financial institutions so that the range of services provided by banks to the customers has expanded and the

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use of services has been facilitated (Lin 2007). Despite the great advances that banks have made in investing and deploying IT, supported by the advantage of having access to information and advance digital technologies, they have not yet been able to provide the innovative services that customers expect and to keep pace with developments in other sectors of the economy and industry.

Although various banking products and services are offered through a variety of channels to a diverse range of customers and markets, banks have not been able to keep pace with technological changes due to being heavily regulated, often inflexible, and conservative bodies in providing innovative services. Researchers believe that FinTech companies can compensate for this backwardness (Zalan and Toufaily 2017). Because of the change in customer behavior patterns, dependence on technology, and loss of market share in some banking services, banks need to change so as to survive through digital transformation (Klus et al. 2018). Indeed, banks that are more flexible about the unpredictable future and collaborate with their ecosystem players can use the potential of ecosystem actors to survive (An 2019). Therefore, by cooperating with FinTech companies as one of the crucial players of the banking ecosystem, banks may try to use their maximum capacity to provide innovative services (Hornuf et al. 2020).

According to the September 2020 report of the KPMG Institute, global investment in FinTech companies has reached 25.6 billion dollars, and some advances in this area have been due to the COVID-19 pandemic (KPMG 2020). These statistics show that financial institutions have embraced the transforming nature of FinTech companies. In fact, the global pandemic has facilitated the adoption of technological products and has greatly contributed to the growth of FinTech companies. At the same time, the US Business Research Company had predicted in 2020 that the revenue of the global market of financial services would reach 26 trillion dollars by 2022 (The Business Research Company 2020).

According to another study by PricewaterhouseCoopers (PwC) in 2017, 82% of the financial and banking service providers intend to increase their partnership with FinTech companies by 2022. Such a partnership has mutual benefits as both the banks and FinTech companies will benefit from this value co-creation. FinTech companies will provide banks with innovative services and more efficient and economical banking solutions (Coetzee 2018). FinTech companies will not only make money by providing such services but will also have access to a large group of customers to test their innovative ideas. Coetzee (2018) argues that banks, with their large, intertwined, and heavy regulated structures, will respond more quickly to customer needs by

providing innovative services if they cooperate with FinTech companies.

Because of the challenge of providing innovative services and products to customers and the need for digital transformation, banks have begun to cooperate with FinTech companies to meet the diverse financial needs of their customers (Hornuf et al. 2020). Moreover, according to Haddad and Hornuf (2021), FinTech companies not only have a positive effect on the financial sector's performance but also can improve financial stability (Haddad and Hornuf 2021).

The growth of FinTech and increasing innovations in information and communication technology (ICT) have led to a digital transformation in the provision of financial services. Such services are provided at the macro-level to various industries, including banks, credit unions, insurance, stock brokerages, accounting and auditing companies, investment funds and equity agencies, consumer finance companies, real estate agencies, exchange offices, and customer accreditation companies (Asmundson 2012). Previously, research articles and reports have dealt with the transformative role of FinTech companies in providing services to these industries. These studies have been conducted more from the FinTech perspective, and the use of these transformative services by industries has been less considered. The banking industry is no exception, and in previous research, the capability to change banking services relying on financial technologies has been less addressed. In studies that have examined the impact of financial technologies of FinTech companies on providing banking services, these services have been studied in general and often based on the most widely used areas of the bank's business area (e.g., payment, lending, and financing).

For example, Accenture's 2016 report mentions the key FinTech services to areas such as risk management, wealth management, payment, money transfer, lending, crowdfunding, and digital currency (Accenture 2016). In a study by Lee and Shin (2018), FinTech's business models were described in terms of payment, wealth management, crowdfunding, and lending (Lee and Shin 2018). In another study conducted on the services to be provided to FinTech customers, issues such as account management, money investment and savings, financing and collective investment, money payment and transfer, cryptocurrencies, financial planning, and interpersonal lending were identified as the main activity areas of Fintech Companies (Gimpel et al. 2017). Haddad and Hornuf (2018) classified FinTech companies based on their activity perspective into payment, lending, currency exchange, and risk management (Haddad and Hornuf 2018). In a study on the future of FinTech, Das (2019) pointed to issues such as money transfer and payment, lending and credit, financial management, currency exchange, and retail banking as the business areas of FinTech companies in the future (Das 2019).



The International Monetary Fund's report on FinTech companies' financial services indicates that so far, FinTech companies have been able to prepare the ground for the application of new technologies such as blockchain and distributed ledger technology, cryptocurrencies, the Internet of Things (IoT), cloud computing, artificial intelligence, and soft computations by having access to the banks' big data through application programming interfaces (APIs) (IMF Staff Team 2017). To a limited extent, they have had innovations in providing financial services such as "payment and clearing services," "capital increase through deposit and lending," and "capital management and banking data analysis services" (Group Of Twenty 2018). However, banks' collaboration with FinTech companies does not yet cover a wide range of banking services to a variety of customers (Omarini 2019), and FinTech companies have not yet been able to penetrate in all areas of banking services with the same intensity and weakness (Cai 2018).

Since banks are enthusiastic about using the transforming potential of FinTech companies for their own digital transformation (Westerman et al. 2014), bank managers and strategists are required to identify all potential services and areas of cooperation with FinTech companies.

Although the FinTech companies' potential has been used in some banking services, considering the diversity of banking service domains, it is clear that banks have not yet used the FinTech companies' potential in all banking service domains. In this regard, the present study contributes to the literature by identifying the neglected banking service domains that researchers recommend for the activity of FinTech companies.

Although the studies mentioned above have dealt with financial technologies, areas of activity, business models, and adoption of FinTech companies' products and services, the diversity of business areas in the banking industry and the number of services that can be provided in each area to customers have not been given priority. Therefore, the gap of not covering the transformation capacity of banking services with the advent of FinTechs is felt. Also, the transformative impacts of FinTech developments on bank customers have been less studied and used in banks due to the lack of knowledge about such developments.

In line with this research gap, in a study conducted by Bridbach et al. (2019) on the future research trends on digital transformation in financial services, it was mentioned that previous studies have extensively addressed the role of FinTechs in providing technical infrastructures, business models of FinTech companies and financial technology markets at the macro-level, while the capacity to change banking services through the services of FinTech companies at the micro-level has been overlooked (Bridbach et al. 2019). Therefore, this study aims to identify the service domains

that can be exploited by banks due to the emergence and development of FinTechs.

Gomber et al. (2017) reviewed the functions of FinTech companies in the digitalization of financial businesses. They introduced areas of "payment," "digital financing," "digital investment," "digital money," "digital payment," "digital insurance," and "digital financial advice" as the main areas of operation of FinTech businesses. The purpose of Gomber et al.'s (2017) study was to identify FinTech services in the digitalization of financial businesses. Since banks have a broad range of services, in this study, and in line with Gomber et al.'s research, we investigate the services of FinTech companies in all banking domains. Moreover, we posit that identifying the FinTech companies' service potentials is only possible through a review of state-of-the-art literature on FinTech companies' services in the banking industry, which have innovatively been devised by researchers and the banking service domain. Thus, the present study seeks to answer the following question:

- Which banking service domains have the transformative potential?

In this study, to answer the research question, first, the literature of FinTech companies' activity areas was reviewed. Then, the standards, frameworks, and best practices proposed in the banking industry were studied to find an appropriate reference list of banking services for the classification of FinTech companies' services research. The Banking Industry Architecture Network (BIAN) was then selected as the reference model for categorizing FinTech companies' services research. Then, the BIAN was used to encode the hidden concepts of the studies using thematic analysis deductively. In the following and based on the obtained findings, new areas and domains of FinTech companies' services and instances of services that can be provided to the bank are presented in the form of a model and tables in the findings section. In the discussion section, the theoretical contribution and comparative analysis of this study are determined based on a comparative comparison of the results of this research with accredited international studies and reports.

The present article is organized into six sections after the introduction. First, the standards relevant to the banking service domain are introduced. The aim is to obtain a relatively complete and agreed-upon list of banking services through one of these standards. The article is continued by a short introduction to the BIAN. Then, in the methodology section, the data search and collection, as well as analysis and processing methods, are described. The research question is answered in the findings section. Complementary interpretations are presented in the discussion section, and the article ends with the conclusion section.



How to choose the appropriate reference to cover entire banking services

As obtaining the scope of banking services is not part of this research, and we try to adapt the scope of banking services from a suitable source, in this section, we describe how to select the appropriate reference for adapting the list of banking services. Banking references include standards, frameworks, and models. The banking standards are the global standards that banks are required to comply with when providing their services and interbank exchanges. In the following, we first present the types of banking industry standards in the areas of banking ISOs (ISO), Basel Committee standards (Basel), International Financial Reporting Standard (IFRS), standards of the Financial Sector Assessment Program (FSAP), Anti Money Laundering (AML) advice, and Counter Financing of Terrorism (CFT). To achieve the full range of banking services and to select the appropriate framework for covering all banking services, the above standards are compared and evaluated according to Table 1. The two banking reference frameworks, MIRA-B (Microsoft Industry Reference Architecture for Banking) and the BIAN are more common in the banking industry than other frameworks (Ahmadalinejad and Hashemi 2015). There exist also two famous models for bank supervision which are FMI (Financial Market Infrastructures) and IFW (Information Framework) (Ahmadalinejad and Hashemi 2015). To have a complete overview, the descriptions of these frameworks and models are also added to Table 1. Due to the need to extract banking services to answer the research question and to present the functional differences between these standards, models, and frameworks, Table 1 is classified based on the following three functional areas:

- Service orientation: The concepts of the framework or standard are related to the structure of banking service provision and the relationship among service provision departments.
- Message orientation: The concepts of the framework or standard relate to the form or method of transmitting banking messages.
- Process orientation: The concepts of the framework or standard are related to the executive process of banking operations.

Table 1 shows that most models, frameworks, and standards of the banking industry are message-oriented and have standardized information exchange methods among banks and financial institutions. Some of them are process-oriented, and only two of them (MIRA-B and BIAN) are service-oriented. As the question of this research is related

to the service domain, we have to choose one of the service-oriented frameworks like MIRA-B and BIAN. MIRA-B is based on Microsoft technology. We ignore MIRA-B because banks may use other different technologies.

As mentioned in the introduction, banks have no choice but the digital transformation to survive in the competition. One of the components of digital transformation is the transformation of banking products and services. Banking structures are risk-averse, and due to the bureaucratic structures of traditional banking, they have to make their architecture agile for digital transformation (Nadkarni and Prügl 2021). The framework of the BIAN is the only framework in which both the agile structure of the banking industry architecture (Al-Fedaghi and Alsulaimi 2018) and the full range of banking services are addressed (see Table 1).

Since FinTech companies are active in a service-oriented environment and provide their services to banks in APIs (Watson financial services 2020), and as the BIAN is the only service-oriented framework in the banking service domain that is constantly updated, the framework of the BIAN was selected as the best option to achieve a complete list of banking services (Ahmadalinejad and Hashemi 2015). This framework is also included in the 2017 Gartner's Digital Banking Hype Cycle and Gartner's Open Banking Hype Cycle (2019) (Gartner Research 2019). Also, every bank that wants to be active in the digital transformation and move toward digital banking should be able to implement an agile enterprise architecture and use reference models such as BIAN (Farzi 2021). Therefore, the Banking Industry Architecture Network and the perspective of its banking services are introduced.

Banking Industry Architecture Network (BIAN)

The BIAN was officially introduced to the world in 2008 (Ahmadalinejad and Hashemi 2015). The BIAN is a model based on the service-oriented architecture in which banking services and the boundaries among these services are defined. The primary function of this network is to direct the banking industry toward a general agreement to achieve a flexible architecture. This architecture aims to meet the needs of the banking business, increase agility, and reduce costs (BIAN Organization 2018).

BIAN is a global, open, independent, and unique community where banks, software providers, and system integrators collaborate to define a common yet exceedingly flexible service-oriented architecture (SOA) framework for the banking industry to establish a common language. The service-oriented framework of the BIAN has the following three distinct and key features (Tesselaar et al. 2018):



Table 1 Standards and frameworks of the financial industry

Standards and frameworks	Description	Functional area
Advanced Message Queuing Protocol (AMQP)	It is a standard application layer protocol for message-oriented middleware. Some defining features of AMQP include message orientation, queuing, routing (point-to-point and publishing and sharing), reliability, and security (Vinoski 2006)	Message-oriented
eXtensible Business Reporting Language(XBRL)	It is a free and globally accessible framework for exchanging business information. This language allows stating the meaning needed in business reporting. It is based on XML. One application of this language is defining and exchanging financial information, such as financial statements (CFA 2009)	Message-oriented
ISO 20022-As the ISO	It is an ISO standard for the exchange of electronic data among financial institutions. This ISO is the repository of data used for messages and business processes and the repository content storage process. This standard covers financial information, data transferred among financial institutions, including payment transaction information, securities trading and accounts settlement information, credit and debit card transactions, and other financial information (ISO 2018)	Message-oriented
Financial Industry Business Ontology (FIBO)	It is a conceptual business model in the financial industry and shows how financial tools, businesspeople, and processes work in the financial industry (Petrova et al. 2017)	Process-oriented
Financial Information eXchange Protocol (FIX Protocol)	The protocol was implemented in 1992 for the exchange of information on the international securities transaction at the same time as the transaction (DeMarco 2012)	Message-oriented
Financial products Markup Language(FpML)	It is an XML-based standard of business information exchange that enables online financial derivatives trading through OTC in compliance with W3C standards (ISDA 2020)	Message-oriented
Legal Entity Identifier (LEI)	It is a unique global identifier for legal entities involved in financial transactions. Legal entities can be individuals, companies, or governmental institutions. This identifier is used in reporting to financial regulators, and all financial companies and funds are required to have such an identifier (getlei 2020)	Message-oriented
Market Data Definition Language (MDDL)	It is an XML-based messaging format for exchanging information on financial documents, corporate events related to financial instruments, and market-related data (MDDL 2020)	Message-oriented
Europay, MasterCard, and Visa (EMV)	It is a technical standard for card payments, payment terminals, and ATMs. This standard has been developed with the participation of European institutions, MasterCard, and Visa Card (THALES Authors 2020)	Process-oriented
Payment Card Industry Data Security Standard (PCI DSS)	It is an information security standard for organizations publishing credit cards (PCI 2020)	Process-oriented
Microsoft Industry Reference Architecture for Banking (MIRA-B)	MIRA-B shows the banking architecture on the Microsoft technology and services platform. MIRA-B provides the logical architecture of credit institutions for use in design purposes. By having its own technology platform along MIRA-B, Microsoft offers a comprehensive architecture of banking (Microsoft Corporation 2012)	Service-oriented



Table 1 (continued)

Standards and frameworks	Description	Functional area
Banking Industry Architecture Network(BIAN)	The Banking Industry Architecture Network is the outcome of the work of an independent, non-profit association established in 2008 to create and enhance a common architectural framework and enable interoperability among banks. The goal of BIAN is to develop a semantic framework for identifying and defining IT services in the banking industry. Its architectural model originates from a service-oriented architecture (SOA) (Tesselaar et al. 2018)	Service-oriented
Financial Market Infrastructures (FMI)	Financial market infrastructures (FMIs) facilitate the clearing, settlement, and recording of monetary and other financial transactions can strengthen the markets they serve, and play a critical role in fostering financial stability (Ahmadalnejad and Hashemi 2015)	Process-oriented
Information Framework (IFW)	It is an organizational architecture framework consisting of a comprehensive set of specific banking business models. This financial business architecture framework is proposed by IBM and is used as one of the most common architectures for creating banking solutions (IFW 2020)	Process-oriented

- It is built on a modern, practical, and service-oriented framework. The best experts of well-known IT companies participate in designing and updating the framework and its methodology.
- The content of this framework is prepared by specialized working groups consisting of banking industry experts from around the world and is continuously reviewed and corrected in several stages.
- This framework provides a standard definition of business performance and interactions of banking services and describes the overall mechanism of each banking service.

The BIAN deals with four separate banking sections, namely banking business, information, application, and technology, and it is compatible with the global M4Bank model¹ (BIAN Organization 2018). In fact, the BIAN is the most appropriate choice to achieve the full range of banking services due to its compatibility with the global M4Bank model and coverage of all components of the digital transformation in the bank.

In addition, the BIAN focuses on the standardization of shared services that perform the same operations in different banks. These services are related to back-end operations, and all banks need them to perform their daily operations. These services are published in the form of the BIAN service landscape document and are reviewed periodically. This study is based on the eighth version of the BIAN service landscape document that was the latest version at the time of

doing this research (Tesselaar et al. 2018). In this reference, banking services have been presented in five main banking business areas, 36 banking business domains, and 310 banking service domains. It is considered one of the most comprehensive references for investigating banking services (BIAN Organization 2018).

The structure of areas and domains of banking business and the domains of their sub-services according to the BIAN service landscape document are completely presented in <https://bian.org/deliverables/bian-standards/bian-service-landscape-8-0/>. BIAN service landscape structure is also shown in Appendix 1. It is the basis of the thematic analysis conducted in this study.

Methodology

In the present research, the systematic review method was employed for reviewing the literature on FinTech companies' services in the banking industry. The steps taken for the literature review are presented in Table 2.

Literature review strategy

The literature review strategy was the systematic review method. It is one of 14 methods proposed for literature review (Grant and Booth 2009). Due to the type and nature of the research problem, it was necessary to understand banking services and explore and extract related themes from the reference articles. Hence, the systematic review method was deemed to be one of the most appropriate approaches. In fact, the systematic review method is used to develop knowledge about any phenomenon and is based on

¹ Multiple locations/ Multiple Product types and lines of Business/ Multiple Customer Types/Multiple Channel Operations.



Table 2 The stages of research methodology

Stages	Description	Outcome
Literature review strategy	The reason for selecting the systematic review method using thematic analysis is presented	Research design
Searching and collecting data	2.1. The article search criteria: searching all articles with the word “FinTech” in the titles in search engines Scopus 2.2. Finalizing the articles collection: Removing articles that were not relevant to the present study’s research question	In this stage, 255 documents were extracted In this stage, after removing irrelevant documents, 87 articles remained for investigation
Data analysis and processing	Thematic analysis and the MAXQDA tool were used for data analysis and processing according to the steps mentioned in Table 4	Developing the list of themes and thematic analysis of 87 articles
Interpretation of the results	Answering the research question based on the findings	The results are interpreted in the discussion section

knowledge of the themes and constructs of the given phenomenon (Grant and Booth 2009), which is consistent with the overall objective of this paper. The systematic review is a qualitative and interpretive research method. Also, in this study, thematic analysis, which is a common method for determining, analyzing, and reporting hidden patterns in secondary data (Liñán and Fayolle 2015), was employed to extract FinTech companies’ banking services.

Data search and collection

The search protocol and selection of the reference articles involve major stages of determining keywords, deciding on the time span, the search databases, identifying the criteria for selecting or removing the article.

- *Keywords*

We used Scopus for searching the references. The keyword “FinTech” was searched in the titles of the articles. We used Scopus for two reasons: First, there was extensive coverage in the field of FinTech studies, and secondly, it was possible to enter a customized advance query and apply different filters to clean up the search results. Only the Scopus search engine was used because of the possibility of providing better coverage of the latest business and management literature. This coverage is 70% higher than Web of Science (Brzezinski 2015).

- *The time span of the searched articles*

Although the term FinTech was first coined in the early 1990s (Puschmann 2017), with the growth of new technologies such as artificial intelligence, big data analytics, Internet of Things (IoT), and the advent of APIs, the trend of studies

on FinTech has raised. To extract the references of this article, the keyword was searched in Scopus from 2015 to 2021.

- *Identifying the criteria for selecting or removing the articles in the first phase*

In searching the Scopus, some inclusion and exclusion criteria were set for the accuracy of the selection of articles. These criteria are presented in Table 3. Articles dealing with FinTech companies were considered the search references in the first phase. Also, since academics and professionals often use peer-reviewed journal articles to obtain information and publish new findings, articles published in English in the journal outlets were selected. Since the nature of the present study is a systematic review of the literature, all banking services of the FinTechs presented in the articles published in blind-reviewed journals, regardless of their ranking, were taken into consideration.

To achieve the desired result, we used the advanced search feature for query insertion. In this stage, 255 documents were extracted.

- *Selecting related articles in the second phase*

The extracted articles from the first phase require cleaning, mainly because the aggregated articles were collected from different subjects about the FinTech companies.

In the previous phase, using the advanced features of Scopus, we filtered out a large number of non-relevant records. At this point, due to the use of the “FinTech” keyword in different subject areas, many articles with irrelevant subjects such as FinTech definition, actors and players of FinTech, FinTech adoption, FinTech ecosystem, FinTech impact and implications, FinTech regulatory realms, and finally FinTech



Table 3 Criteria of selecting reference articles

Inclusion criteria for selecting the articles	Exclusion criteria for removing the articles
Articles published in journals	Conference papers, masters theses, and doctoral dissertations, course books, newspaper articles and reports
The publication stage is final	Articles published in books and book chapters
Subject area limited to business & management, social sciences, economics and finance, multidisciplinary	Lack of access to the full article's text
Access to the full text of the article	Published before the specified time span
Being published between 2015 and 2021	Redundant articles
Being written in English	
Relevance to the research topic	

technologies were extracted. So we exclude these irrelevant articles from the resources list after reading their abstracts. Eventually, we achieved a dataset of 87 related articles containing peer-reviewed papers.

Data analysis and processing

In thematic analysis, the unit of analysis is more than one word, and the context of the data and their nuances are also taken into account. This method goes beyond counting apparent words and phrases and focuses on identifying and explaining explicit and implicit ideas (Maguire and Delahunt 2017). The steps of data extraction, analysis, and processing by thematic analysis method using MAXQDA tool are shown in Table 4.

The steps of thematic analysis were performed according to steps specified in Table 4. In the coding definition stage, the structure of the BIAN service landscape was used according to Appendix 1. Table 5 shows the hierarchical structure of the definition of the main banking business areas and the sub-domains of the businesses in each area. Banking services are defined in the form of 5 main business areas and 36 business domains.

Findings

According to the results of coding and processing the themes of the studied articles (Table 5), both the number of articles in which the coded themes were addressed and the frequency of these themes in the articles were examined. In 9 articles, none of the identified themes were found, and in the remaining 76 articles, the five main areas (e.g., operation and execution) of banking business (based on the BIAN) were discussed. The review results showed that in 72 articles, the themes related to the banking services of "operations and execution area," in 27 articles, the themes related to "sales and services area," in 18 articles, themes of "business support area," in 17 articles, themes related to "risk and compliance area," and only in one article themes related to "reference data area" were dealt with. The frequency share of the themes related to these areas is as follows. In 87 articles reviewed, in total, 1484 themes related to "operations and execution area," 96 themes related to "business support area," 63 themes related to "sales and services area," 28 themes related to "risk and compliance area," and two themes related to "reference data area" were extracted. Table 5 presents the share of the themes related to codes attributed to banking business domains and the number of articles where these domains are mentioned, separately.

Table 4 Steps of thematic analysis

Steps	Description
Entering the article into the tool	In this step, 87 articles selected were separately entered into the MAXQDA tool.
Defining codes	In this step, based on the research question and objectives, the codes hierarchies were defined inductively according to the structure and hierarchy of service domains listed in the BIAN service landscape (Appendix 1). In this structure, five main business areas, 36 business domains, and 310 banking service domains were defined as codes.
Coding	In this step, the articles were studied, and the relevant themes were extracted and coded.
Reviewing the themes	In this step, the selected themes were reviewed, and it was specified if these themes offer a convincing narrative of the data and an answer to the research question.
Interpretation of the results	The final step involved analysis and interpretation of the data to answer the research question. This step is presented in the discussion section.



Table 5 The frequency share of banking business areas and domains in the themes extracted from FinTech articles

Bank business area	Bank business domain	The number of relevant coded themes in the articles	The number of relevant articles	The number of articles	Percent from 87 articles	Percent from 76 articles				
Reference data	Party	0	0	1	1.14	1.31				
	Market data	0	0							
	External agency	0	0							
Sales and services	Product management	2	1	27	31.03	35.52				
	Cross-channel	0	0							
	Channel specific	0	0							
	Sales	27	16							
	Marketing	15	11							
	Servicing	11	3							
	Customer management	10	4							
Operations and execution	Trade banking	34	12	72	82.75	94.73				
	Market operations	0	0							
	Payments	60	19							
	Corporate financing and advisory services	37	14							
	Account management	11	4							
	Collateral administration	8	5							
	Operational services	2	2							
	Loans and deposits	1264	63							
	Consumer services	15	8							
	Cards	0	0							
	Wholesale trading	2	2							
	Investment management	51	10							
	Risk and compliance	Models	1				1	17	19.54	22.36
		Bank portfolio and treasury	0				0			
		Regulations and compliance	23				12			
		Business analysis	5				3			
Business support	IT management	9	6	18	20.68	23.68				
	Building equipment and facilities	0	0							
	Non-IT and non-HR enterprise services	48	8							
	Finance	36	5							
	Business command and control	0	0							
	Knowledge and intellectual property	0	0							
	Human resource management	0	0							
	Business directions	3	2							
	Corporate relations	0	0							
	Document management and archive	0	0							
	Documents with code(s)							76		
	Documents without code(s)							9		
Analyzed documents				87						



In the following, each of the main five areas of the BIAN banking services is defined, and the concepts mentioned in the reviewed articles concerning each of these areas are investigated. The display order of banking business areas is sorted by the share of them in 87 reference sources.

Banking services of operations and execution area

According to the definition offered in the BIAN, the services include a wide range of services related to the provision of retail banking and wholesale banking products such as back-office, front-office, and middle-office activities (BIAN Organization 2018). Since the highest frequency of themes in the content of the studied articles were related to this area, we examined these concepts more thoroughly. Of the total business domains related to the first banking business area of the BIAN service landscape, i.e., “operations and execution,” the banking services themes “loans and deposits” and “payments” were more frequent than other banking business domains. The labeling topics and concepts related to the themes of service domains in this area are presented in Table 6.

To answer the research question, the banking services of all business domains of the “operation and executive area” were examined based on Table 6. Due to the large number of business domains, the patience of the audience/readers, and the limited length of the article, we will suffice to a brief description of the FinTech companies’ services and actions in each domain.

The first business domain of this area is “trade banking.” In this domain, services such as “trade financing,” “providing credit facilities such as debt purchase,” “project financing,” “letters of credit,” “bank guarantees,” and “credit management” are provided by the banks to trading companies. In response to the research question, the themes related to these services were reviewed, and it was found that the activities of FinTech companies in this domain are more focused on implementing applications for banks to predict the necessary credit for the execution of business projects based on artificial intelligence. In these applications, machine learning occurs based on the previous credits banks have given to commercial projects. FinTech companies can also provide platforms for supply chain accreditation. In China, for example, Foxconn helps in funding supply chains as an e-commerce platform (Tsai and Peng 2017). In the near future, such e-commerce platforms will provide the necessary capital for suppliers. Foxconn has obtained the necessary commercial licenses from the Chinese government to provide facilities, especially debt purchase facilities, financial guarantees, and equipment leasing, to merchants from banks (Chiu 2017). FinTech companies can also provide banks with platforms to receive debt purchase facilities from other organizations or businesses (Gomber et al. 2017).

These online platforms of e-debt purchase facilities greatly facilitate the relationship between businesses receiving debt purchase facilities and other supplying businesses (Gomber et al. 2017).

The second business domain in this area is the “loans and deposits,” dealing with themes such as “crowdfunding,” “crowdinvesting,” “peer to peer lending (P2P Lending),” “person to person loans,” “micro-loans,” “loan services,” “leasing,” “consumer loan,” “corporate loan,” and “deposit accounts.” According to studies, one of the main services of FinTech companies in this area is to provide the necessary platform and processes for “credit rating and customer risk forecasting based on analysis of data in the bank,” this is mainly done to assess the credit status and predict the resulting risk before giving loans to customers (Lee and Shin 2018; Li et al. 2017). The other FinTech companies service is to launch platforms and networks to “bring investors and owners of business ideas for crowd investing by investors in a variety of possible ways (such as charity/non-profit, profit and loss sharing, stock sharing)” (Chiu 2017; Gimpel et al. 2017; Gomber et al. 2017). Another service provided by FinTech companies in the area of microloans is the implementation of infrastructures necessary to bring together individuals for lending in a peer-to-peer manner, i.e., bringing the borrower and the lender,” and “managing the communications and obtaining the necessary guarantees for repayment for the borrower” (Ashta and Biot-Paquerot 2018; Aminah et al. 2020; Dhar and Stein 2017; Gomber et al. 2017; Lee 2017; Sinha 2017). Moreover, FinTech companies provide services on the implementation of platforms for leasing and leasing on the condition of ownership with accurate calculation of fees and repayment period based on customer credit rating and the predicted risk (Jun and Yeo 2016; Leong et al. 2017). The third business domain of this area is “collateral administration,” which covers themes like “collateral” and “collateral collection.” According to studies (Buchak et al. 2018; Cai 2018; Lee and Shin 2018), the main service of FinTech companies in this area is the implementation of the platform and processes to be used by the bank to “calculate the amount and type of collaterals required to get bank loans and evaluate the customers’ collaterals and assets” by analyzing customer data in the bank (Lee and Shin 2018). For example, the same operation is used in the Ant financials microloan risk assessment process in China (Lee and Shin 2018).

The fourth business domain in this area is “account management.” If banks and financial institutions outsource their account opening and management services to their trusted FinTech companies, FinTech companies will be able to operate in this domain as well. In this regard, themes such as “fraud detection” and “counterparty risk” have been pointed. One of the services of FinTech companies in this area is examining and analyzing the data of customer behavior



Table 6 The concepts of operations and execution area

Banking business domain	Themes of the relevant service domains	Articles of the relevant business domain
Trade banking	Trade financing Credit facility Project finance Letter of credit Bank guarantee Credit management	Cai (2018) Chiu (2017) Gomber et al. (2017) Iman (2018) Jun and Yeo (2016) Jung and Song (2018) Kauffman and Ma (2015) Kim and Hong (2016a, b) Moon and Kim (2017) Ng and Kwok (2017) Wonglimpiyarat (2018) Yoon and Jun (2018)
Loans and deposits	Crowd funding Crowd investing P2P lending P2P loans Micro-loans Loan services Leasing Consumer loan Corporate loan Current account Deposit account Saving account	Alt et al. (2018), Aminah et al. (2020) Anagnostopoulos (2018) Ashta and Biot-Paquerot (2018) Bollaert et al. (2021) Boot et al. (2021) Buchak et al. (2018) Chen (2016) Chen et al. (2020) Chiu (2017) Coetzee (2018) Cumming and Schwienbacher (2018) Davis et al. (2017) Dhar and Stein (2017) Du et al. (2018) Gabor and Brooks (2016) Geranio (2017) Gimpel et al. (2017) Gomber et al. (2018) Gomber et al. (2017) Gozman et al. (2018) Haddad and Hornuf (2018) Hornuf et al. (2020) Iman (2018) Jakšič and Marinc (2019) Jones (2018) Jun and Yeo (2016) Jung and Song (2018) Kauffman and Ma (2015) Kim and Hong (2016a, b) Kim and Hong (2016a, b) Lee et al. (2021) La and Kim (2018) Lee and Shin (2018) Lee Kuo Chuen (2018) Lee (2017) Leong et al. (2017) Li et al. (2017) Liu et al. (2020) Lu et al. (2021) Macchiavello (2018) Mackenzie (2015) Minto et al. (2017) Moon and Kim (2017) Nakashima (2018) Qi and Xiao (2018) Razzaque et al. (2020) Romanova et al. (2018) Roszkowska (2020) Sheng (2021) Shim and Shin (2016) Sinha (2017) Sinha et al. (2018) Stern et al. (2017) Stewart and Jürjens (2018) Strategic Direction (2018) Thakor (2019) Todorof (2018) Tran et al. (2018) Wonglimpiyarat (2017a, b) Wonglimpiyarat (2017a, b) Zalan and Toufaily (2017) Геннадійович Брігченко, Polishchuk, Sybirianska, Vasylyshen, and Dyba (2018)
Collateral administration	Collateral Collections	Chen et al. (2019) Boot et al. (2021) Buchak et al. (2018) Cai (2018) Lee and Shin (2018)



Table 6 (continued)

Banking business domain	Themes of the relevant service domains	Articles of the relevant business domain
Account management	Fraud diagnosis Counterparty risk	Jagtiani and Lemieux (2018) Jun and Yeo (2016) Ryu (2018) Wonglimpiyarat (2018)
Investment management	e-trading Investment Investment portfolio	Gomber et al. (2017) Iman (2018) Lee Kuo Chuen (2018) Lee S., 2017) Lee et al. (2021) Li et al. (2017) Razzaque et al. (2020) Thakor (2019) Yoon and Jun (2018) Zalan and Toufaily (2017)
Operational services	Disbursement	Buchak et al. (2018) Lee and Shin (2018)
Wholesale trading	Market making Program trading	Gozman et al. (2018) Ryu (2018)
Consumer services	Digital currencies Currency exchange Cryptocurrency Consumer advisory service	Cai (2018) Gomber et al. (2017) Iman (2018) Kauffman and Ma (2015) La and Kim (2018) Lee Kuo Chuen (2018) Lee (2017) Lu et al. (2021)
Payments	e-Commerce Digital wallet Digital payments Settlement Money transfer Clearing Card payments Payment order Mobile payment Mobile wallets Payment execution Financial message analysis Financial gateway Correspondent bank Cheque processing Central cash handling ACH fulfillment Card e-commerce gateway Card clearing Card financial settlement	Anagnostopoulos (2018) Buchak et al. (2018) Chen (2016) Dhar and Stein (2017) Du et al. (2018) Geranio (2017) Gomber et al. (2018) Jones (2018) Jung and Song (2018) Kim and Hong (2016a, b) Lee (2017) Li et al. (2017) Macchiavello (2018) Mackenzie (2015) Ng and Kwok (2017) Thakor (2019) Tran, Han, and Yun, 2018) Wonglimpiyarat (2017a, b) Геннадійович Брігченко, Polishchuk, Sybirianska, Vasylyshen, and Dyba (2018)
Corporate financing and advisory services	Online financing Corporate financing Financing chatbots Tax advisory Robo-advisor Public offering	Bollaert et al. (2021) Davis et al. (2017) Gabor and Brooks (2016) Jun and Yeo (2016) Kim and Hong (2016a, b) Lee et al. (2021) Lee and Shin (2018) Li et al. (2017) Mackenzie (2015) Nakashima (2018) Qi and Xiao (2018) Shim and Shin (2016) Wonglimpiyarat (2018) Yoon and Jun (2018)

during transactions and “identifying customer behavior patterns in the field of deposit and withdrawal,” and “determining customer behavior patterns and the time intervals and amounts of deposit and withdrawal” (Jagtiani and Lemieux 2018). As a result of this FinTech companies service, the bank will be able to “detect out-of-pattern behaviors and diagnose frauds and combat money laundering” and “determine the risk of out-of-pattern transactions” (Jun and Yeo 2016; Ryu 2018; Wonglimpiyarat, 2018). FinTech companies can also provide the necessary platform and tools for bank clearing rooms relying upon blockchain and distributed

general offices, thereby minimizing the risk of money transfers between banks (Jagtiani and Lemieux 2018).

The fifth business domain of this area is “investment management,” addressing themes like “investment,” “investment portfolio,” and “electronic trading.” The main services of FinTech companies in this area include “drafting proposals for directing the customer in investment” based on their financial background, risk-taking or risk aversion status, and financial goals. FinTech companies can also “implement and provide robotic consultants (robo-advisers) to provide appropriate pieces of advice to customers to guide



investment based on customer-accepted investment goals, and ultimately to “investor asset portfolio management” (Lee Kuo Chuen, 2018). Robo-advisers help customers with little knowledge of the capital market control their own investment portfolio (Li et al. 2017; Razzaque et al. 2020). In this regard, FinTech companies help bank customers in digital investments through channels such as mobile phones, social networks, and online brokerages in B2C² and B2B³ areas (Gomber et al. 2017).

The sixth business domain in this area is the “operational services,” where the “disbursement management” theme has been mentioned. Although digital transformation has led to a decrease in cash disbursements, and several alternative technologies have been developed for digital disbursement, FinTech companies’ main services in this area include the use of bank disbursement APIs in applications and social networks to facilitate the disbursement process of all types of bank loans from a single platform (Buchak et al. 2018; Lee and Shin 2018).

The seventh business domain in this area is “wholesale trading,” which focuses on themes such as “market-making” and “program trading to achieve market advantages and opportunities.” Two FinTech companies’ services in this area are “implementation of online trading platforms and pricing in accordance with the supply and demand in the market” and “providing advice for arranging commercial contracts” (Gozman et al. 2018; Ryu 2018).

The eighth business domain in this area is the “consumer services” related to themes such as “currency exchange,” “digital currencies,” and “consumer advisory service.” Some of FinTech companies’ services in this area include “preparation of currency exchange platforms” and “implementation of digital money exchange” (Cai 2018; Gomber et al. 2017; Iman 2018). Another service that FinTech companies offer to improve the user experience of bank customers is the “implementation of customer financial management tools and management of customer budgets and expenses” (Kauffman and Ma 2015). FinTech companies also provide facilities such as “platforms for tax calculations and connecting to related organizations for tax payment,” “helping banks and financial institutions gain access to customers through social networks, attract and retain customers,” “analysis of customer behavior data,” and “assist financial institutions in providing intelligent and personalized services tailored to customer needs” (Gomber et al. 2017; La and Kim 2018).

The ninth business domain in this area is the “payments.” It includes themes such as “e-commerce,” “digital wallet,” “financial settlement,” “and money transfer to accounts receivables,” “clearing center operations,” “payment order,”

“mobile payment and mobile wallet.” The themes in this area are currently very tangible for banks and bank customers (Kang 2018). Since these services have become the standards of the banking industry to a large extent, the existing articles have paid less attention to innovations in this area (Center for Latin American Monetary Studies (CEMLA), 2016). The main services of FinTech companies in this area include “implementation of software and application platforms in the payment area for paying the bills, taxes, payment to recipients of payment gateways” (Buchak et al. 2018; Dhar and Stein 2017) through various channels such as smartphones, web and virtual networks, “implementing e-wallets to be used in business applications,” and “creating payment platforms through cryptocurrencies” (Du et al. 2018; Geranio 2017).

Finally, the tenth business domain in this area is “corporate financing and advisory services,” in which themes such as “online financing,” “corporate financing,” “financing chatbots,” “tax advisory,” and “robo-advisors” have been mentioned. One of the services of FinTech companies in this area is “developing platforms for the implementation of various crowdfunding models,” which is also referred to as the loans domain. These platforms can be websites, applications, or social networks where the companies’ projects and plans for financing are announced, and various models for investor participation in project financings such as non-profit investment, partnership with a guaranteed profit, or partnership in company shares are addressed (Davis et al. 2017; Qi and Xiao 2018; Bollaert et al. 2021). Another FinTech companies’ service in this area is to provide advice to companies through the “implementation of web-based portals to compare the types of financing methods offered by banks and financial institutions for financing, financing chatbots, and robo-advisors for consulting about the stock exchange and financing companies” (Gabor and Brooks 2016). FinTech companies also provide platforms and portals for the initial public offering of corporate stocks (Lee and Shin 2018).

Banking services of the sales and services area

Banking services of the sales and services area is the second part as defined by the BIAN. These services include all marketing, business development, customer management, and sales and service activities (Tesselaar et al. 2018). This area also includes activities related to agreements concluded with customers (BIAN Organization 2018). The frequency of topics and concepts related to these themes was also examined in the service domains of the “sales and services of banks” area.

Of the total business domains related to this area, the studies included themes that were, respectively, related to the business domains of “sales,” “marketing,” “customer

² Business to consumer.

³ Business to business.



management” and “services.” The labeling topics, concepts, and articles related to this area are presented in Table 7.

To answer the research question, we review the services related to the business domains of the “sales and services” area in the articles listed in Table 7:

The first business domain in this area is “customer management.” Although FinTech companies’ services in this area may not be provided directly to bank customers, FinTech companies are involved as intermediaries in providing services in this area by banks and financial institutions to customers.

Nowadays, referrals to banks’ branches for receiving services have been reduced due to the automation of basic banking operations (The Economist Intelligence Unit Limited 2021). Also, issues such as providing banking services in 7*24 format, ensuring security and authentication of customers, and establishing advisory systems have all changed to the standards of the banking industry. FinTech companies, help banks determine the “customers’ financial life cycle needs” by offering platforms for analyzing the customers’ behavioral data. In fact, analyzing customer data by the platforms provided by FinTech companies allow banks to “provide a set of personalized financial services based on a 360-degree view of the customers” through their “preferred channel”; redefine “the journey path of different customers in using banking services” and improve “their user experience” (Barbu et al. 2021). Another service of FinTech companies in this domain is “providing platforms and processes and defining algorithms for clustering customers based on the parameters considered by the bank and helping to provide financial services according to the situation of customers in each cluster.” By mastering financial technologies, FinTech companies can help “create the infrastructure to maintain the confidentiality and security of customer data and transactions,” “increase the level of digitalization of financial services and reduce operational complexities” in the bank, and based on customer behavior data, “add the necessary intelligence to a variety of financial operations to prevent fraud,” and provide the bank with the “necessary platform to scheduled information and alerts to events contrary to the customer behavior pattern” (Gozman et al. 2018). FinTech companies, as an external entity, can also assist banks in “pricing products and services in a scientific manner, based on the financial level and the customer’s cluster.” They can also play a part in “monitoring customer satisfaction with the efficiency of financial institutions’ products and services by holding campaigns and receiving feedback.” In addition, “managing customer complaints and feedback, and assessing their level of satisfaction,” “managing and measuring customers’ loyalty, along with defining reward and rating systems” are other services of FinTech companies to banks (Gozman et al. 2018; Lim et al. 2018; Puschmann 2017).

The second business domain in this area is the “marketing,” which covers themes related to services such as “advertising” and “business development by comparing competitive performance, identifying market opportunities and business development initiatives.” In this area, FinTech companies contribute to the development of the banking business “by providing technical platforms for offering omnichannel services to banks and financial institutions” (Gozman et al. 2018). Also, by developing platforms for analyzing customer data, they “make it possible for banks and financial institutions to recognize customers’ preferences and provide intelligent and targeted customer-centered advertising” (Lee Kuo Chuen, 2018). In the advertising sector, FinTech companies can also offer financial training related to the use of financial service platforms, new models of loans such as P2P and crowdfunding, automated payment processes, validation, and personalized services to bank customers through social networks and media (Tran et al. 2018).

The third business domain in this field is “sales,” and it deals with “commission” and “underwriting.” One of the services of FinTech companies to banks in this area is “the reduction of bank fees by providing banking services through various channels” (Lee Kuo Chuen 2018; Kauffman and Ma 2015; Boot et al. 2021). Another service of FinTech companies is “providing a platform for underwriting and security underwriting offers to the customers based on artificial intelligence” (Kotarba 2016). These offers are based on algorithms operating on the basis of customers’ risk-taking and financial ability (Geranio 2017; Kotarba 2016; Mackenzie 2015).

The fourth business domain in this area is “servicing” and deals with the theme of “payment initiation”. One of the services of banks in the area of corporate banking is to create the necessary platform and processes for “obtaining payment licenses from the customer and delegating the payment process to the merchants or the companies and organizations” (Cai 2018). In fact, FinTech companies in this domain “implement the infrastructures for delegating payment on the part of the customer at specific deadlines or specific events (such as an invoice for payment)” (Iman 2018; Wonglimpiyarat 2018).

Banking services of the business support area

Banking services of the business support area defined by the BIAN as fourth part, include a wide range of management and public support activities that may be performed in any other business and, therefore, are not unique to the banking industry (Tesselaar et al. 2018). These services are included in the BIAN only because other business activities specific to the banking industry may need to receive these more general services (BIAN Organization 2018). The frequency of



topics and concepts related to these themes in the service domains of the “business support” area was examined.

This service area of banks is very general and is present in every business. Of the total business domains related to the “business support” area, the number of articles and the frequency of the themes mentioned in FinTech articles related to the services of the “non-IT and non-HR” and “IT management” domains were higher than other domains (Chiu 2017; Jun and Yeo 2016; Li et al. 2017; Todorof 2018; Tran et al. 2018; Yoon and Jun 2018; Геннадійович Брітченко, Polishchuk, Sybirianska, Vasylyshen, and Dyba 2018), (Buchak et al. 2018; Chen et al. 2020; Cumming and Schwienbacher 2018; Davis et al. 2017; Gimpel et al. 2017). The labeling topics, concepts, and articles of this domain are presented in Table 8.

To answer the research question, the services related to the “business support” domain mentioned in the articles in Table 8 are investigated.

The first domain in this area is “IT management,” which is related to the themes “system development” and “ecosystem development.” FinTech companies provide a variety of services in this area. They can help banks “develop IT infrastructures (software, hardware, and network)” and “develop customer service channels (mobile applications, banking websites, kiosks)” (Buchak et al. 2018). They are also able to “develop public infrastructures of digital authentication and signature, blockchain platforms, cloud computing, smartphones, robotics and Internet of Things (IoT), data storage platforms, and analysis and interpretation of customer data based on deep learning and artificial intelligence” (Gimpel et al. 2017). The “technical development of an integrated banking ecosystem based on international and national regulations, and the creation of banking technological service hubs for the exchange of financial institutions’ services” are other instances of FinTech companies’ services (Chen et al. 2020).

The second domain in this area is “enterprise services (non-IT and non-HR),” which focuses on the themes of “internal audit” and “procurement.” One of the services of FinTech companies in this area is the “implementation of procurement platforms of financial and banking institutions” (Jun and Yeo 2016; Tran et al. 2018). Another service is “implementing software for internal accounting and executing risk control and management processes, especially for cyber risk management” (Li et al. 2017).

The third domain is “finance” and deals with “financial statement reporting” and “audit and financial compliance reporting.” One of the main reasons for the trust of depositors to banks and financial institutions is to ensure that the bank or financial institution’s credit situation (based on the bank’s financial statements and audit report) complies with the regulations of the Central Bank. FinTech companies’ services in this area include “developing software for analyzing

credit data and preparing financial statements of banking institutions, auditing the credit status and classifying banks and financial institutions based on credit status” (Geranio 2017).

The fourth domain in this area is the “business directions” and focuses on the themes of “business architecture” and “bank strategy.” With FinTech companies’ services, banks, in addition to the digital transformation of their services, can develop services to reach customers who have not previously been served (Qi and Xiao 2018). FinTech companies’ services in this area include “providing advice to change the bank’s strategy to provide innovative services to customers,” “helping to promote the bank’s brand position among customers and competitors,” “lowering the cost of services using specialized technologies and the expert forces of FinTech companies,” and “implementing business architectural infrastructures such as payment channels, interbank clearing infrastructures, and banking APIs’ exchanges” (Buchak et al. 2018).

Banking services of the risk and compliance area

Banking services of the risk and compliance area are the third part as defined by the BIAN. According to the BIAN’s definition, these services focus on the areas of business risk analysis and management and asset and debt policy-making (Tesselaar, de Groot, and Rackham, 2018). Also, dealing with the regulatory obligations and reporting requirements to government agencies is another service in this area (BIAN Organization 2018). The frequency of topics and concepts related to these themes in the risk and compliance area service domains was studied. Of the total number of business domains related to the “risk and compliance” service area, a higher number is devoted to articles and the frequency of the themes in FinTech articles related to the business domain of investigating the compliance with law, which is a service of RegTechs (Anagnostopoulos 2018). The labeled topics, concepts, and articles related to the themes of this area are presented in Table 9.

To answer the research question, we review the services related to the “risk and compliance” business domains mentioned in the articles in Table 9:

The first business domain of this area is the “models” business domain, which involves themes like “gap analysis and assessment and management of risks like liquidity risk” and “estimating the economic capital required to confront a variety of risks.” FinTech companies’ services in this area include “creating a technological infrastructure for customer behavior,” “developing a monitoring platform for employee behavior analysis,” and “providing a technological infrastructure for determining customer credibility and risk assessment” (Geranio 2017).



Table 7 The concepts of sales and services area

Banking business domain	Topics/concepts related to the related service domains	Articles of the relevant business domain
Customer management	Customer relationship management	Gozman et al. (2018) Lim et al. (2018) Puschmann (2017) Roszkowska (2020)
Marketing	Advertising Business development	Coetzee (2018) Davis et al. (2017) Gozman et al. (2018) Jun and Yeo (2016) Kauffman and Ma (2015) Lee Kuo Chuen (2018) Lee et al. (2021) Li et al. (2017) Sheng (2021) Tran et al. (2018) Геннадійович Брітченко, Polishchuk, Sybirianska, Vasylyshen, and Dyba (2018)
Sales	Commissions Underwriting	Boot et al. (2021) Davis et al. (2017) Geranio (2017) Gozman et al. (2018) Kauffman and Ma (2015) Kotarba (2016) Lee Kuo Chuen, (2018) Leong et al. (2017) Lu et al. (2021) Mackenzie (2015) Minto et al. (2017) Sinha (2017) Thakor (2019) Wonglimpiyarat (2018) Yoon and Jun (2018) Геннадійович Брітченко, Polishchuk, Sybirianska, Vasylyshen, and Dyba (2018)
Servicing	Payment initiation	Cai (2018) Iman (2018) Wonglimpiyarat (2018)

The second business domain in this area is “business analysis,” dedicated to the “market research” theme. FinTech companies’ services in this area include “launching website and software for analyzing financial markets and comparing the services of financial and banking institutions” (Lee Kuo Chuen 2018; Strategic Direction 2018).

The third and most widely used domain in this area is the “regulations and compliance” domain, which deals with the themes of “regulatory compliance,” “regulatory reporting,” and “financial accounting” (Tesselaar et al. 2018). Banks and financial institutions often have outdated systems due to their old history, while international financial regulations and even the financial regulations of countries are changing every day with the advent of new financial technologies (Anagnostopoulos 2018). Financial Action Task Force (FATF) and Basel committee regulations have required

banks to comply, especially after the 2008 financial crisis, and due to the digital transformation of the financial industry and the vulnerability of banks with attacks. In this regard, a group of FinTech companies, called RegTechs, have been introduced due to the importance of complying with financial regulations and have provided the necessary technologies to help banks and financial institutions in this area (Anagnostopoulos 2018). One of the services of RegTechs in this area is “creating technological grounds for modeling regulations and evaluating the impacts of fiscal policies and regulations, before their implementation and predicting probable conflicts among regulations” (Geranio 2017). Other service of the FinTech companies is to “provide the technical basis for defining international/national/intra-bank financial regulations” to monitor customers’ financial behavior and to detect potential discrepancies with regulations at



Table 8 The concepts of the business support area

Banking business domain	Topics/concepts related to the related service domains	Articles of the relevant business domain
IT management	System development Ecosystem development	Buchak et al. (2018) Chen et al. (2020) Cumming and Schwienbacher (2018) Davis et al. (2017) Gimpel et al. (2017)
Non-IT and non-HR enterprise services	Internal audit Procurement	Chiu (2017) Jun and Yeo (2016) Li et al. (2017) Roszkowska (2020) Todorof (2018) Tran et al. (2018) Yoon and Jun (2018) Геннадійович Брітченко, Polishchuk, Sybirianska, Vasylyshen, and Dyba, (2018)
Finance	Financial statements Financial compliance	Davis et al. (2017) Geranio (2017) Liu et al. (2020) Mosteanu and Mosteanu (2020) Roszkowska (2020)
Business directions	Business architecture Corporate strategy	Buchak et al. (2018) Hornuf et al. (2020)

the time of occurrence” (Iman 2018; Ryu 2018). FinTech companies can also “prepare reports on money laundering and fraud for banks and financial institutions,” and provide “technical monitoring platforms and reporting panels and frameworks, as well as strategic frameworks for data accumulation and reporting the violations of financial institutions to the financial legislature, the executive and the judiciary powers” (Ahlstrom 2018; Geranio 2017). Implementation of “reporting platforms on the cyber security of banks and financial institutions” (Huei et al. 2018) and launching “technical platforms in accordance with the prudential macro-policies of the central bank to assess credit, security, and safety of financial institutions for investors” is another service of FinTech companies (Kim and Hong 2016a b).

Banking services of reference data area

Finally, banking services of reference data area is the last part according to the definition of the BIAN, these services deal with the management of business reference information and issues like customer information management, business partner information management, and product and market information details (Tesselaar et al. 2018). This reference data will be widely used in other areas of banking services (BIAN Organization 2018). The frequency of topics and the number of articles related to the themes in all service domains of the “reference data” area were examined. As expected, due to the FinTech companies’ dependence on the banks’ bulk and valuable data, FinTech companies provide the least services in this area. Of all the business domains

related to the “reference data” business area, the themes covered in the articles are dedicated only to the “product management” business domain (Du et al. 2018). Table 10 shows the labeled topics, concepts, and articles related to these themes.

To answer the research question, we review the services related to the business domains of “reference data” in the article by Du et al. (2018).

Regarding the “product management” domain, themes such as “product design” and “designing the products” were addressed. Since FinTech companies use advanced technologies such as the Internet of Things (IoT), blockchain, cloud computing, smartphones, social networks, artificial intelligence, and deep learning, they can both design innovative new products and use new technologies and processes in designing and launching these products (Du et al. 2018). FinTech companies can greatly help the bank in “designing new products and services according to the customers’ preferences and analyzing their needs,” and define and implement “processes necessary to manage financial and banking products throughout their life cycle from design, testing, deployment, and support” (Du et al. 2018). In China, for example, Ant FinTech has revolutionized designing financial and banking products by relying upon technology (Du et al. 2018). The blockchain platform has helped globally interconnected systems provide a trusted, secure network for storage, exchange, and processing (Du et al. 2018). Using artificial intelligence, Ant also offers new and personalized products and services based on customer behavioral data analysis on its financial services platform. Internet of Things



Table 9 The concepts of risk and compliance area

Banking business domain	Topics/concepts related to the related service domains	Articles of the relevant business domain
Models	Gap analysis Economic capital	Geranio (2017)
Business analysis	Market research	Lee Kuo Chuen (2018) Lu et al. (2021) Strategic Direction (2018)
Regulations and compliance	Regulatory compliance Regulatory reporting Financial accounting	Ahlstrom (2018) Boot et al. (2021) Dhar and Stein (2017) Geranio (2017) Gimpel et al. (2017) Haddad and Hornuf (2021) Huei et al. (2018) Iman (2018) Jun and Yeo (2016) Kim and Hong (2016a, (b)) Mosteanu and Mosteanu (2020) Roszkowska (2020) Ryu (2018) Геннадійович Брітченко, Polishchuk, Sybirianska, Vasylyshen, and Dyba (2018)

(IoT) has also helped Ants provide new financial services to customers through new platforms and develop a platform for collecting customer behavioral information to offer financial services such as loans (Du et al. 2018).

Discussion

The present study sought to specify which areas of banking services has been studied and is recommended by researchers for FinTech companies' presence. To this end, this systematic literature review paper has identified the themes related to the BIAN service domains by thoroughly investigating 87 reference articles published from 2015 to 2021. The results of this study revealed that the FinTech companies, besides entering the bank's functional services to customers, can help the banks in areas such as providing infrastructural technologies, consulting on choosing the bank's digital transformation strategy, and improving processes and procedures, and training knowledge forces (Puschmann 2017). In the following, the areas of FinTech companies' banking services based on the BIAN and the atmosphere of communication with the bank, which is based on API exchange, are shown in Fig. 1.

In this model, banks use FinTech companies' knowledge to provide technological infrastructure, security, and support platforms such as distributed ledger, big data analysis, machine learning, cloud computing, and even the Internet of Things (IoT). In the banking business sector, the main body of banking business operations such as deposit and withdrawal operations, processes and regulations, customer

information, accounts and cards information, and transactions are also stored in the bank databases. These banking services are made available to FinTech companies as distributed micro-services in the form of APIs while maintaining security and confidentiality based on security protocols. FinTech companies can also use these APIs to implement value-added and innovative services and provide them to bank customers or through APIs to the banks themselves. Findings related to the study of each of the areas of FinTech companies' banking services are briefly presented as a model in Fig. 1.

Thematic analysis of 87 articles on FinTech companies' services revealed that the highest frequency of banking service area in the studied articles belongs to the "banking operations and execution" area and the business domain of "deposits and loans." The review results show that, banks have practically used investment and partnership with FinTech companies to provide these services. Other services related to banking business domains such as "sales and services," "risk and compliance," "business support," and "reference data," were also reviewed and explained. The summary of FinTech companies' products and services in each BIAN business domain is presented in Table 14 from Appendix 2. The findings outlined in Appendix 2 (Table 14) provide unique insights and new knowledge to bank decision-makers and the managers on how to utilize the opportunity of working with FinTech companies in business domains.

To confirm the results of the present study, its theoretical and comparative analysis are discussed in the following subsections.



Table 10 The concepts of reference data area

Banking business domain	Topics/concepts related to the related service domains	Articles of the relevant business domain
Product management	Product design Designing the products	Du et al. (2018)

Theoretical contribution

Previous studies have addressed the applicability of FinTech services in a variety of industries such as banking, insurance, stock brokerages, investment funds and equity brokers, and customer accreditation companies from a macro-perspective. They have investigated the transformative activities of FinTechs at the industry level and, in general, in their business areas. The main distinguishing aspect of this research compared to previous studies is examining the full range of FinTech products and services that have the potential to be used only in banking services. In other words, the present study is focused on the banking industry. This research is based on the BIAN service landscape.

The present study was inspired by the study of Gomber et al. (2017). Gomber, Koch, and Siering investigated the functions of FinTech companies in the area of digital finance. In the financial industry, digital finance has a wider scope compared to banking services. In Gomber et al.'s study, the concept of "digital finance cube," which has three dimensions, was introduced: The first dimension is digital finance business functions, and it mentions functions such as digital financing, digital investment management, digital money, digital payment, and digital insurance. The second dimension is digital technologies and technological concepts. It deals with technologies like blockchain, social networks, near field communication (NFC), peer-to-peer (P2P) technology, big data analytics, and further enablers. Finally, the third dimension is digital finance institutions, in which FinTech companies and traditional service providers (such as banks) are identified as providers of these services (Gomber et al. 2017).

In the present study, the areas and domains of banking services of FinTech companies are identified and discussed in the form of a model presented in Fig. 1. The domains categorized by the model have commonalities with the digital functions and technologies of FinTech companies proposed by Gomber et al. (2017) (the first and second dimensions of the "digital finance cube").

In order to validate the results of this research, in Table 11, the banking services of the present model are compared with those proposed by Gomber et al. (2017) as new potential areas of FinTech companies. The basis of this comparison is the complete list of areas and domains of banking business services indicated by the BIAN. Although it is possible that these two studies use different names to refer to the

same service or function, or these names do not correspond exactly, different names attributed to the same concept were specified, and then, a comparison was performed.

The areas and domains of banking services presented in the model of this research completely cover the functions and technologies reported in the study of Gomber et al. (2017). This confirms the fact that our model has the essential service domains of banking services and also demonstrates that the results and our proposed model are aligned with the previous findings in the literature.

Also, among the functions of digital finance proposed by Gomber et al. (2017), the domains of business and banking services such as consumer service, wholesale trading, collateral management, account management, customer management, sales, marketing, services, models, business analysis, regulation and compliance, and product management are not identified before. These new business domains put emphasis on the capabilities and merits of our study over the competing ones such as Gomber et al. (2017) and demonstrate the theoretical contribution of this research.

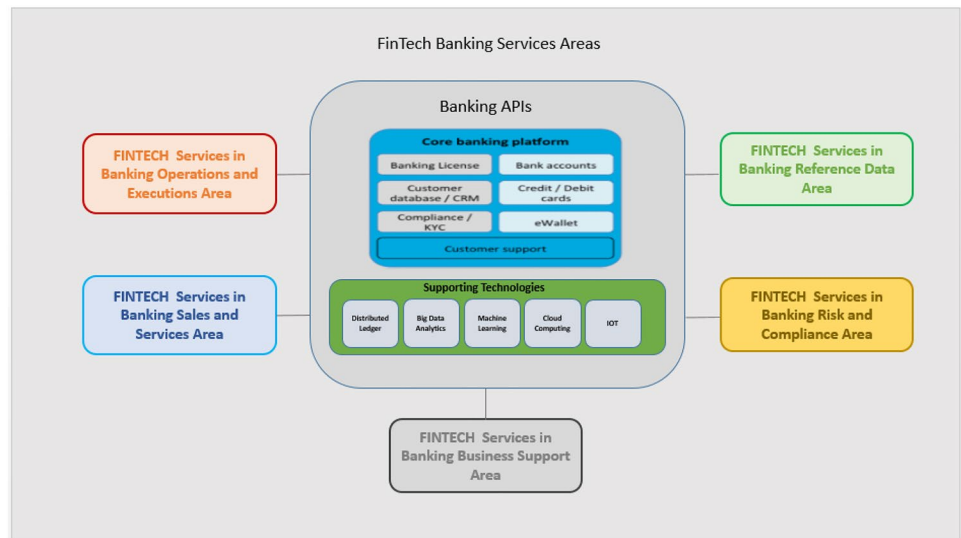
The theoretical contribution of this research is to determine the potential service domains for which banks can use the capacity of FinTechs. Figure 2 presents the business domains of the banking services in line with the BIAN. Also, those areas of banking services that, according to the findings of the thematic analysis, have sufficient potential to benefit from the FinTech services are identified. In fact, in the present study, the transformative activities of FinTechs in different areas and domains of banking business at the micro-level (at the level of banking services) were investigated. Services provided by FinTechs in each of these areas per banking services businesses domains were discussed in detail in Sect. 5. The use of FinTechs' capacity in providing these services can help to complement and innovate the bank's products and services and ultimately pave the way for the bank to achieve digital transformation.

Comparative analysis

According to the survey conducted in the 2017 report of the Basel Committee on banking supervision (BCBS), innovative FinTech companies' services in the banking domain were specified. In fact, the BCBS conducted an informal survey of its members, asking them to identify the significant FinTech companies' products and services.



Fig. 1 FinTech companies' banking service areas (our model)



In a graph which has been shown on page 9 of the Basel committee report (BIS 2017), the innovative service areas of FinTech companies are provided. The graph, which has four areas, is introduced: The first service area is “credit, deposit and capital raising,” and it includes sub-services such as crowdfunding, lending marketplaces, mobile banks, and credit scoring. The second service area is “payment, clearing, and settlement,” and it deals with retail and wholesale sub-areas. The retail sub-area includes services such as mobile wallets, peer-to-peer transfers, and digital currencies. The wholesale sub-area also contains services such as value transfer networks, FX wholesale, and digital exchange platforms. The third service area is “investment management,” and it mentions services such as high-frequency trading, copy-trading, e-trading, and robo-advice (BIS 2017).

Moreover, according to the Basel committee report, the technologies and technical platforms that can be provided by FinTech companies for offering banking services are also mentioned in the fourth service area which is called “market support” (BIS 2017). Market support services also refer to infrastructure technologies and facilitators for providing services such as portals and aggregators, ecosystems, data applications, distributed ledger technology, security, cloud computing, internet of things / mobile technology, and artificial intelligence.

Although the FinTech innovative services mentioned in the Basel report were based on survey and they may be developed over time, to validate the results of this study, the banking services of the present study were compared with the banking services of the Basel committee 2017 report (BIS 2017), according to Table 12. The basis of this comparison is the complete list of areas and domains of banking business services mentioned in the BIAN. Although it is possible that these two studies use different names to refer to the same service or function, or these names do not correspond exactly, different names attributed to the same concept were specified, and then, a comparison was performed. As shown in Table 12, the banking services of FinTech companies listed in the Basel committee report (BIS 2017) are also completely covered by the results of our model.

There exist some banking service domains that FinTech companies provide according to our model; these service domains were not mentioned in the Basel committee report. FinTech companies can help banks in the marketing and sale of banking products and services. Customer management and customer services can also be provided by FinTech companies. Checking the compliance of banking services and products with international and national financial regulations, helping banks in business analysis, preparing the recognition and gap reports for banks, and directing banks for their product management are other FinTech companies' services.

Table 11 Comparison of the present research's model with Gomber et al. (2017)

BIAN banking business areas and domains		FinTech companies' functions/technologies, according to Gomber et al	FinTech companies' services according to our proposed model	
Reference data	Party	✗	✗	
	External agency	✗	✗	
	Market data	✗	✗	
Sales and services	Product management	✗	✓	
	Channel specific	✗	✗	
	Cross-channel	✗	✗	
	Marketing	✗	✓	
	Sales	✗	✓	
	Customer management	✗	✓	
	Servicing	✗	✓	
Operations and execution	Trade banking	✓	✓	
	Loans and deposits	✓	✓	
	Cards	✗	✗	
	Consumer services	✗	✓	
	Investment management	✓	✓	
	Wholesale trading	✗	✓	
	Market operations	✗	✗	
	Corporate financing and advisory services	✓	✓	
	Payments	✓	✓	
	Collateral administration	✗	✓	
	Account management	✗	✓	
	Operational services	✗	✓	
	Risk and compliance	Bank portfolio and treasury	✗	✗
		Models	✗	✓
Business analysis		✗	✓	
Regulations and compliance		✗	✓	
Business support	IT management	✓	✓	
	Non-IT and non-HR enterprise services	✗	✓	
	Building equipment and facilities	✗	✗	
	Business command and control	✗	✗	
	Finance	✓	✓	
	Human resource management	✗	✗	
	Knowledge and intellectual property	✗	✗	
	Corporate relations	✗	✗	
	Business directions	✗	✓	
	Document management and archive	✗	✗	

✓ FinTech companies have the capacity to provide services

✗ FinTech companies don't have the capacity to provide services



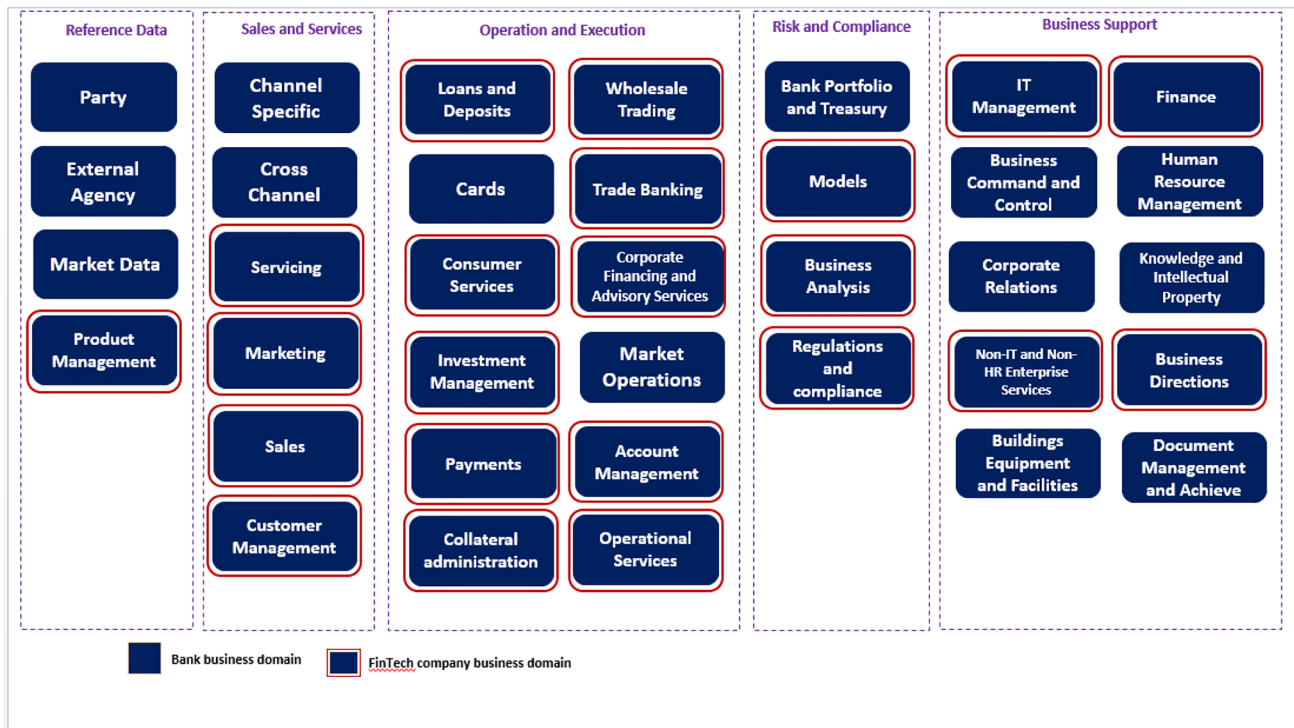


Fig. 2 Bank service domains vs. FinTech companies' service domains according to BIAN service landscape

Conclusion

In this study, while reviewing the literature of FinTech companies' banking services, an attempt was made to provide new insights into those FinTech companies' banking services that banks have less used so far. FinTech companies' banking services were also compared with the banking services listed in the eighth version of the BIAN service landscape document. BIAN service landscape covers all banking services for all customer segments (retail, corporate, and investment banking), and this comparison is the main advantage of this research over previous research. The main purpose of this study is to perform a systematic review of relevant literature and determine the areas of banking services that academic researchers have addressed in studies conducted between 2015 and 2021 on FinTech companies. Based on the review results, the FinTech companies' services and products that can be provided to the banking industry in the business areas are "operations and execution," "business support," "sales and services," "risk and compliance," "reference data" and related business domains are presented in Table 14, respectively. Based on the findings of this research, banking industry strategists can identify the neglected banking services of FinTech companies such as: wholesale trading, trade banking, collateral management, account management, operational services, IT management, organizational services (non-IT and non-HR services), business directions, financial audit, customer management,

sales, marketing, services, models, banking business analysis, regulations and compliance and product management and benefit from the capacity to cooperate with FinTech companies. The results show that the FinTech companies do not enter all areas of banking services and consider the banks' failure in using the full capacity of FinTech companies in the banking services domain.

There are some limitations in this research. First, we have done our best to collect, document, and analyze the data as carefully as possible. However, it is possible that not all standards of banking service domain were found. Second, we compare the areas of FinTech banking services with the latest version of the BIAN banking services landscape document (Tesselaar et al. 2018). However, the BIAN banking services landscape document is updated periodically, and at the time of writing this paper, a newer version of it might be released.

There are some recommendations and suggestions for future research. We suggest addressing issues such as (i) the reasons and challenges of FinTech companies' failure to enter all banking services, (ii) the impact of the working service area on selecting the appropriate model of collaboration or competition between banks and FinTech companies, and (iii) the success factors of banks' collaboration with FinTech companies in future studies.



Table 12 Comparison of the present research’s model with Basel committee report (2017)

BIAN banking business areas and domains		FinTech companies’ services according to Basel committee report	FinTech companies’ services according to our proposed model	
Reference data	Party	✗	✗	
	External agency	✗	✗	
	Market data	✗	✗	
Sales and services	Product management	✗	✓	
	Channel specific	✗	✗	
	Cross-channel	✗	✗	
	Marketing	✗	✓	
	Sales	✗	✓	
	Customer management	✗	✓	
	Servicing	✗	✓	
Operations and execution	Trade banking	✗	✓	
	Loans and deposits	✓	✓	
	Cards	✗	✗	
	Consumer services	✗	✓	
	Investment management	✓	✓	
	Wholesale trading	✓	✓	
	Market operations	✗	✗	
	Corporate financing and advisory services	✗	✓	
	Payments	✓	✓	
	Collateral administration	✗	✓	
	Account management	✗	✓	
	Operational services	✗	✓	
	Risk and compliance	Bank portfolio and treasury	✗	✗
		Models	✗	✓
Business analysis		✗	✓	
Regulations and compliance		✗	✓	
Business support	IT management	✓	✓	
	Non-IT and non-HR enterprise services	✗	✓	
	Building equipment and facilities	✗	✗	
	Business command and control	✗	✗	
	Finance	✗	✓	
	Human resource management	✗	✗	
	Knowledge and intellectual property	✗	✗	
	Corporate relations	✗	✗	
	Business directions	✗	✓	
Document management and archive	✗	✗		

✓ FinTech companies have the capacity to provide services

✗ FinTech companies don’t have the capacity to provide services

Appendix 1

In Table 13, all banking business areas, banking business domains, and banking service domains structure according

to BIAN service landscape is shown. Banking service domains are the codes and we used these codes in thematic analysis.



Table 13 The banking business areas, business domains, and service domains according to BIAN service landscape

Bank Business Area	Bank Business Domain	Bank Service Domain(Codes)
Reference data	Party	Party Data Management Customer Profile
	External agency	Information Provider Administration Syndicate Management Interbank Relationship Management Correspondent Bank Relationship Management Correspondent Bank Data Management Sub Custodian Agreement Product Service Agency Product Broker Agreement Contractor/Supplier Agreement
	Market data	Information Provider Operation Market Information Management Financial Market Analysis Financial Market Research Quant Model Market Data Switch Administration Market Data Switch Operation Financial Instrument Reference Data Management Counterparty Administration Public Reference Data Management Location Data Management
Sales and services	Product management	Product Design Product Deployment Product Training Product Quality Assurance Discount Pricing Product Directory Special Pricing Conditions
	Channel specific	Branch Location Management Contact Center Management Branch network management e-branch management Advanced voice services management ATM network management Contact center operations Branch location operations e-branch operations Advanced voice services operations ATM network operations Branch currency management Branch currency distribution Product inventory item management



Table 13 (continued)

Bank Business Area	Bank Business Domain	Bank Service Domain(Codes)
		Product inventory distribution Card terminal administration Card terminal operation
	Cross-channel	Party authentication Transaction authorization Point of service Servicing event history Contact routing Contact dialogue Interactive help Contact handler Customer workbench
	Marketing	Business development Brand management Advertising Promotional events Prospect campaign management Prospect campaign design Customer campaign management Customer campaign design Customer surveys
	Sales	Prospect campaign execution Party lifecycle management Lead/opportunity management Customer campaign execution Customer offer Sales planning Underwriting Commission agreement Commissions Product matching Product expert sales support Product sales support Sales product
	Customer management	Customer relationship management Customer product/service eligibility Customer agreement Sales product agreement Customer access entitlement Customer behavioral insights Customer credit rating Account recovery Customer event history Customer reference data management Customer precedents Customer proposition



Table 13 (continued)

Bank Business Area	Bank Business Domain	Bank Service Domain(Codes)
Operations and execution	Servicing	Servicing issue Customer case management Case root cause analysis Customer case Card case Servicing order Servicing mandate Payment initiation
	Loans and deposits	Loan Leasing Current account Deposit account Corporate current account Consumerloan Corporate loan Corporate deposits Corporate lease Merchandising loan Mortgage loan Fiduciary agreement Saving account
	Cards	Credit/charge card Card authorization Card capture Card billing and payments Merchant relations Merchant acquiring facility Card network participant facility
	Consumer services	Corporate trust services Currency exchange Bank drafts and travelers checks Brokered product Consumer investments Customer tax handling Consumer advisory services Trust services Service product
	Investment management	Investment portfolio planning Investment portfolio analysis Investment portfolio management e-trading workbench
	Wholesale trading	Trading book oversight Trading models



Table 13 (continued)

Bank Business Area	Bank Business Domain	Bank Service Domain(Codes)
		Dealer workbench
		Quote management
		Suitability checking
		Credit risk operations
		Market making
		ECM/DCM
		Program trading
		Traded position management
		Market order
		Market order execution
	Market operations	Mutual fund administration
		Hedge fund administration
		Unit trust administration
		Trade confirmation matching
		Order allocation
		Settlement obligation management
		Securities delivery and receipt management
		Securities fails processing
		Trade/price reporting
		Custody administration
		Corporate events
		Financial instrument valuation
	Trade banking	Letter of credit
		Bank guarantee
		Trade finance
		Credit management
		Credit facility
		Project finance
		Limit and exposure management
		Syndicated loan
		Cash management and account services
		Direct debit mandate
		Direct debit
		Cheque lock box
		Factoring
	Corporate financing and advisory services	Corporate finance
		Merge and acquisition advisory
		Corporate tax advisory
		Public offering
		Private placement
	Payments	Payment execution
		Financial message analysis
		Financial gateway
		Correspondent bank
		Payment order
		Cheque processing



Table 13 (continued)

Bank Business Area	Bank Business Domain	Bank Service Domain(Codes)
		Central cash handling ACH fulfillment Card e-commerce gateway Card clearing Card financial settlement
	Collateral administration	Collateral allocation management Collateral asset administration Collections
	Account management	Position keeping Reward points account Account receivable Account reconciliation Counterparty risk Position management Fraud evaluation Transaction engine Product combination Customer position Fraud diagnosis
	Operational services	Issued device administration Issued device tracking Disbursement Open item management Leasing item administration Dunning Customer billing Reward points award and redemption Channel activity analysis Channel activity history Card transaction switch Delinquent account handling Dard collections
Risk and compliance	Bank portfolio and treasury	Corporate treasury analysis Corporate treasury Asset securitization Asset and liability management Bank portfolio analysis Bank portfolio administration Stock lending/REPOS
	Models	Market risk models Financial instrument valuation models Gap analysis Credit risk models Economic capital



Table 13 (continued)

Bank Business Area	Bank Business Domain	Bank Service Domain(Codes)
		Liquidity risk models Business risk models Customer behavior models Fraud models Credit/margin management Production risk models Operational risk models Contribution models
	Business analysis	Segment direction Product portfolio Customer portfolio Branch portfolio Channel portfolio Competitor analysis Market research Market analysis Contribution analysis
	Regulations and compliance	Guideline compliance Regulatory compliance Compliance reporting Regulatory reporting Fraud/AML resolution Financial accounting
Business support	IT management	IT systems direction IT standards and guidelines Systems administration Development environment System development Production release System deployment Systems operations Platform operations Systems help desk Systems assurance Internal network operations
	Non-IT and non-HR enterprise services	Legal compliance Internal audit Security advisory Security assurance Approved supplier directory Procurement Company billing and payments Fixed asset register
	Building equipment and facilities	Property portfolio



Table 13 (continued)

Bank Business Area	Bank Business Domain	Bank Service Domain(Codes)
		Site operations Site administration Equipment maintenance Equipment administration Utilities administration Building maintenance
	Business command and control	Organization direction Business unit financial analysis Business unit financial operations Business unit accounting Business unit direction Business unit management
	Finance	Financial statements Financial control Financial compliance Enterprise tax administration
	Human resource management	Human resource direction Employee assignment Employee data management Employee/contractor contract Employee certification Employee evaluation Employee payroll and incentives Travel and expenses Employee access Employee benefits Workforce training Recruitment
	Knowledge and intellectual property	Management manual Intellectual property portfolio Knowledge exchange
	Corporate relations	Corporate communications Corporate alliance/stakeholder Corporate relationship Regulatory and legal authority Investor relations
	Business directions	Corporate strategy Corporate policies Products and services direction Business architecture Continuity planning
	Document management and archive	Document services Archive services Correspondence



Appendix 2

corresponding FinTech companies' products and services in each domain are presented in Table 14.

As the result of this research, the banking business areas and banking business domains according to the BIAN and

Table 14 The business areas and domains of cooperation between banks and FinTech companies based on the BIAN

Banking business area	Banking business domain	FinTech products and services
Reference data	Product management	<p>Designing new products and services in accordance with the customer knowledge and analysis of their needs</p> <p>Designing the necessary processes for managing financial and banking products in their life cycle from design to testing, deployment, and support</p>
Sale and services	Servicing	<p>Receiving payment permits from the customer and delegating payment to acceptors/small and medium companies trusted by the bank</p> <p>Implementing infrastructures for payment by customers at specific deadlines or in special events such as billing</p>
Sale and services	Customer management	<p>Reducing the dependence of customers on referring to branches to receive services</p> <p>Automation of basic banking operations and presenting them in a 7*24 manner</p> <p>Ensuring security and customer authentication</p> <p>Establishing advisory systems in the financial and banking services area</p> <p>Creating platforms for analyzing customer behavioral data</p> <p>Determining the needs of the customer's financial life cycle</p> <p>Guaranteeing the efficiency of products and services of financial institutions by conducting campaigns and receiving feedback</p> <p>Pricing products and services in scientific methods and based on customer level</p> <p>Clustering customers and providing financial services according to the situation of customers in each cluster</p> <p>Creating the infrastructure to maintain the confidentiality and security of customer data and transactions</p> <p>Increasing the digitalization level of services and reducing operational complexity</p> <p>Providing a set of personalized financial services based on a 360-degree view of the preferences extracted from customer data</p> <p>Providing integrated services in various channels</p> <p>Defining the travel routes of different types of customers in terms of user experience</p> <p>Managing customer loyalty and defining reward and ranking systems</p> <p>Managing customer complaints and feedback and evaluating the level of satisfaction</p> <p>Adding intelligence to a variety of financial operations and preventing fraud by measuring customer behavioral data</p> <p>Providing the necessary platform for scheduled informing and warning and in events to customers</p>
Sale and services	Sales	<p>Reduction of fees by providing banking services through various channels</p> <p>Creating platforms for underwriting and offering to underwrite securities to the customer based on artificial intelligence innovations and purchase offer algorithms based on the degree of risk-taking</p>
Sale and services	Marketing	<p>Establishing technical platforms for providing omnichannel services for banks and financial institutions</p> <p>Providing smart and targeted customer-centered advertising based on customer data analysis and customers' preferences and needs</p> <p>Providing financial training related to the use of financial services platforms, new models of receiving loans such as P2P and crowdfunding, automated payment processes, accreditation, and receiving personalized services to bank customers through social networks and media</p>



Table 14 (continued)

Banking business area	Banking business domain	FinTech products and services
Operation and execution	Loans and deposits	<p>Credit rating and predicting the customers' risk by analyzing the data in the bank to assess the credit status and predict the resulting risk before giving loans to customers</p> <p>Implementing platforms and networks to bring together investors and business idea owners for crowdfunding by investors into a variety of possible models (charity/non-profit, profit and loss sharing, stock partnership)</p> <p>Implementing infrastructures to bring people together in a peer-to-peer way to give loans or bring the borrower and the lender together</p> <p>Communication management and receiving the necessary guarantees for repayment by the borrower</p> <p>Implementing platforms for leasing and leasing on condition of ownership by accurately calculating fees and repayment period based on the customer's credit rating and predicted risk</p>
Operation and execution	Consumer services	<p>Developing currency exchange platforms</p> <p>Implementing of digital money exchange platform</p> <p>Implementing customer financial management tools and managing customer budgets and expenses</p> <p>Providing platforms for tax calculations and connecting to related organizations to pay taxes</p> <p>Assisting banks and financial institutions to access customers through social media, and attract and retain customers</p> <p>Analyzing customer behavioral data and assisting financial institutions in providing intelligent and personalized services tailored to customer needs</p>
Operation and execution	Wholesale trading	<p>Implementation of online trading platforms and pricing in proportion to supply and demand in the market</p> <p>Providing advice for arranging business contracts</p>
Operation and execution	Investment management	<p>Drafting proposals to direct the customer in investment based on the customer's financial background, risk-taking or risk aversion status, and financial goals</p> <p>Implementing and preparing robo-advisors to provide appropriate offers to the customer, to guide the investment based on the customer's accepted investment goals</p> <p>Portfolio management of investors' assets</p> <p>Implementing and providing robo-advisors to customers with little knowledge of the capital market to manage their investment portfolio</p>
Operation and execution	Trade banking	<p>Implementing applications for banks to predict the necessary credit for executing business projects based on artificial intelligence</p> <p>Creating platforms for financing supply chains</p> <p>Establishing platforms for receiving debt purchase loans from other organizations or businesses</p>
Operation and execution	Corporate financing and advisory services	<p>Establishing platforms for implementing various crowdfunding models</p> <p>Implementing web-based portals to compare financial products of financial institutions to finance companies</p> <p>Financing chatbots and robo-advisors to provide advice on the underwriting of stock companies and financing</p> <p>Creating platforms/portals for the initial public offering of companies</p>
Operation and execution	Payments	<p>Implementing payment applications to pay bills, taxes, payments to recipients of payment gateways</p> <p>Supporting payment in various channels such as smartphones, web, and virtual networks</p> <p>Implementing e-wallets for use in business applications</p> <p>Creating payment platforms through cryptocurrencies</p>
Operation and execution	Collateral administration	<p>Implementing a platform and process to be used by the bank to calculate the amount and type of collateral to get for bank loans</p> <p>Evaluating the collaterals and assets of the customers based on customer data analysis</p>



Table 14 (continued)

Banking business area	Banking business domain	FinTech products and services
Operation and execution	Account management	<p>Reviewing and analyzing data related to customer behavior in transactions and identifying customer behavior patterns in deposit and withdrawal</p> <p>Determining the pattern of deposit and withdrawal amounts and thus discovering the out-of-convention behavioral pattern and detecting frauds, and helping to combat money laundering</p> <p>Determining and classifying the risk of transactions out of the customer behavior patterns</p> <p>Minimizing money transfer risk by creating blockchain-based authentication technologies</p>
Operation and execution	Operational services	Using bank loan APIS in applications and social networks to facilitate the repayment process of different loans
Risk and compliance	Models	<p>Creating a technological infrastructure to analyze customer behavior</p> <p>Creating a technological infrastructure to analyze employee behavior</p> <p>Creating a technological infrastructure to determine customer credibility and risk assessment</p>
Risk and compliance	Business analysis	Implementation of websites and applications for financial market analysis, comparison of financial and banking institutions services of
Risk and compliance	Regulations and compliance	<p>RegTech services in this area include:</p> <p>Creating technological platforms for modeling regulations</p> <p>Assessing the impacts of fiscal policies and legislation before they are implemented</p> <p>Predicting potential conflicts among regulations</p> <p>Providing technical bases for defining international/national/intra-bank financial regulations</p> <p>Monitoring customers' financial behavior at the moment of occurrence based on customer behavioral data analysis, artificial intelligence, and deep learning</p> <p>Preparing reports on money laundering and fraud for banks and financial institutions</p> <p>Providing technical monitoring platforms and reporting panels and frameworks, as well as strategic platforms for data collection and reporting of financial institutions' violations to financial regulators, the executive, and the judiciary power</p> <p>Providing reporting platforms on cyber security status</p> <p>Preparing technical bases in accordance with the prudential macro-policies of the Central Bank to assess the security situation and the safety of financial institutions for investors</p>
Business support	IT management	<p>Developing IT infrastructure</p> <p>Developing customer service delivery channels</p> <p>Developing public infrastructures for digital authentication and signature</p> <p>Establishing blockchain, cloud computing, ad smartphones, robotics, and IoT platforms</p> <p>Developing data storage platforms, analyzing and interpreting customer data based on deep learning and artificial intelligence</p> <p>Technical development of an integrated banking ecosystem, based on international and national regulations</p> <p>Establishing banking technological services hubs for the exchange of financial institutions' services</p>
Business support	Non-IT and non-HR enterprise services	<p>Implementing procurement platforms of financial and banking institutions</p> <p>Implementing software for internal accounting and executing risk control and management processes, especially for cyber risk management</p>
Business support	Business directions	<p>Changing the bank's strategy in providing innovative services to customers</p> <p>Improving the position of the bank's brand among customers and competitors</p> <p>Lowering the service costs by utilizing FinTech technologies and expertise</p> <p>Implementing business architecture infrastructures such as payment channels, interbank settlement and clearing infrastructure, exchange of banking APIs</p>



Table 14 (continued)

Banking business area	Banking business domain	FinTech products and services
Business support	Finance	Bank or financial institution validation based on the report of financial statements and audit reports of the bank's financial compliance with central bank regulations by providing software for data analysis of credit institutions and preparation of financial statements, credit status audit, and classification of banks and financial institutions based on credit status

Declarations

Conflict of interest On behalf of all authors, I hereby—Payam Hanafizadeh the corresponding author—state that there is no conflict of interest.

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