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Review

Challenges and Trends of Financial Technology (Fintech): A Systematic Literature Review

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Abstract: Digital transformation creates challenges in all industries and business sectors. The development of digital transformation has also clearly triggered the emergence of fintech (financial technology) initiatives, which are recognized as some of the most important innovations in the financial industry. These initiatives are developing rapidly, driven in part by the sharing economy, regulations, and information technology. However, research in the field of fintech remains in its infancy. Fintech offers several services, such as funding, payment (including electronic wallets), e-aggregators, e-trading, and e-insurance, and cryptocurrencies such as Bitcoin. This provides an opportunity to more closely examine fintech's research challenges and trends. This study aims to (1) determine the state of the art of financial technology research; (2) identify gaps in the financial technology research field; and (3) identify challenges and trends for future research potential. The novel proposal in this study includes theoretical contributions regarding financial technology. Using the systematic literature review approach of Kitchenham, in addition to thematic analysis, meta-analysis and observation to validate the quality of literature and analysis, the results of this study provide a theoretical basis fintech research from an information systems perspective, including the formulation of fintech technology concepts and their development.

Keywords: financial technology; fintech; systematic literature review; thematic analysis; meta-analysis

1. Introduction

Fintech is a new financial industry that applies technology to improve financial activities [1]. Moreover, according to Leong and Sung (2018), fintech can also be considered as "any innovative ideas that improve financial service processes by proposing technology solutions according to different business situations" [2]. Advances in e-finance and mobile technology for financial companies, which drove the innovation of fintech, emerged after the global financial crisis in 2008. This development was characterized by integration in e-finance innovation, Internet technology, social networking services, social media, artificial intelligence, and big analytic data [3]. This challenges many traditional financial institutions, such as banks, to develop their business models in a more practical direction [4]. In addition, start-ups saw this as an opportunity to enter the financial services industry [5].

Two types of start-ups are relevant to this research, e-commerce and financial technology (fintech). Fintech is one of the most important innovations in the financial services industry and is driven by economic sharing, regulation, policy, and information technology [3]. Like that of banks, the business model of fintech also focuses on payment and loan services. In addition, it includes personal financial consulting services, crowdfunding, virtual currencies, and security (e.g., cyber security) [6].

Zavolokina et al. examined how fintech is perceived. The term "fintech" can be interpreted as the application of information technology in the fields of finance, financial innovation, and digital

innovation, in addition to start-ups (the financial service industry outside of banks) [7]. There are six fintech business models: insurance services, crowdfunding, payment, lending, wealth management, and capital markets [3]. Clearly, the greater the level of development of financial technology services, the greater the challenges for businesses. Online loan services have caused controversy in communities, including moral hazard, loan defaults, and information asymmetry [8]. The case of money laundering via Bitcoin [8] has also been widely discussed. For this reason, it is important for regulators to formulate how this innovation should be addressed in the rules. Regulators encourage innovation in the financial sector and apply the principles of consumer protection and risk management to obtain safe and appropriate financial services [4].

The history of technological innovation in the financial sector began with the emergence of checks as a means of payment (1945). Subsequently, the Bank of America produced the first credit card (1958), and ATMs appeared to help process financial transactions in 1967, followed by the issuance of a debit card as a transaction tool. In the 1990s, supported by the advancement of the Internet, Internet banking was launched. In the 2000s, fintech developments of mobile payments and crowdfunding were introduced. This shows that fintech is a fast-growing industry, and it is thus necessary to review previous research to capture the evolution of financial services [9].

To increase the understanding of academics, industry players, and regulators about the extent to which the fintech industry is developing, it is necessary to conduct a literature review. This study aims to: (1) determine state of the art of financial technology; (2) identify gaps in the financial technology research; and (3) identify challenges and trends for future research potential. A systematic literature review is used to accomplish these objectives [10].

The need remains to discuss the initial problems raised by the development of fintech, such as moral hazard, loan defaults, and information asymmetry. Kitchenham's systematic literature review (SLR) method is required for the metadata process. From the journal work process and library extraction, analysis and grouping can be undertaken. Research related to using the SLR method was conducted by Suryono et al. to find the state of the art of peer-to-peer (P2P) lending [8]. The results of this analysis were validated by experts. Finally, this research provides an overview of the challenges, problems, and trends in the fintech sector.

2. Methodology

In developing the initial issue to investigate, we began by conducting an SLR. Related to the SLR is the concept of a literature study, which is widely adopted for research in the field of information systems and is useful for determining the state of the art of a research topic.

2.1. Research Question

The research question in this article is:

RQ1. "What are the challenges and trends of fintech research?"

Regarding RQ1, we tried to identify the need for a literature review. After identifying articles that discuss fintech, we obtained fintech articles published in early 2014. Therefore, the search for publications was limited to the period 2014 to 2019. In general, the term fintech was undefined at this time. Several articles mention digital financial innovations, in addition to electronic financial payments. For this reason, we attempted to review these innovations in the financial services sector.

2.2. Search Process

First, we determined the journal database portals or scientific publications to be used. The quality of the articles used as references is influenced by the selected journal databases. The databases used in this study included SCOPUS, ACM, ScienceDirect, and IEEE Xplore. Second, we formulated a protocol review to formulate research questions by classifying keywords according to the population, intervention, comparison, outcomes, and context (PICOC) strategy. Then, we identified populations

such as "fintech and financial technology" in the context of "trends, problems, adoption, innovation and challenges". We released the intervention section to obtain information on various fintech focuses, such as types of fintech payments, funding, and investment. The keywords used for searching literature reviews were as follows: (fintech OR "financial technology" AND (trends OR problems OR adoptions OR innovations OR challenges)).

2.3. Implementation

To minimize the subjectivity of article selection, inclusion and exclusion criteria were determined, such as choosing journal articles and papers in English and excluding other languages such as Mandarin and Spanish. Then, articles were selected that matched the research question and duplicate articles were removed. This research used Mendeley's software to organize articles. The methodology is shown in Figure 1.
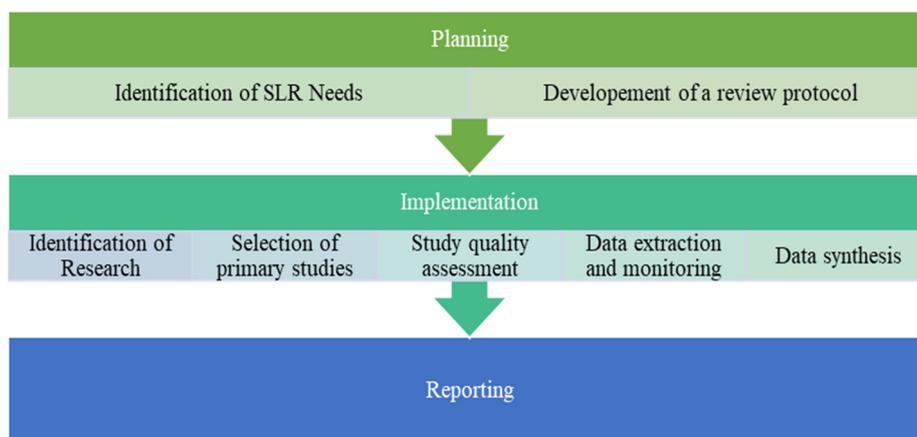

Figure 1. Systematic literature review (SLR) methodology.

After the final documents were obtained, data extraction and data synthesis were carried out. Figure 2 shows the document selection process, starting from the title and abstract selection, then the full text selection, which was synthesized using thematic analysis and meta-analysis.
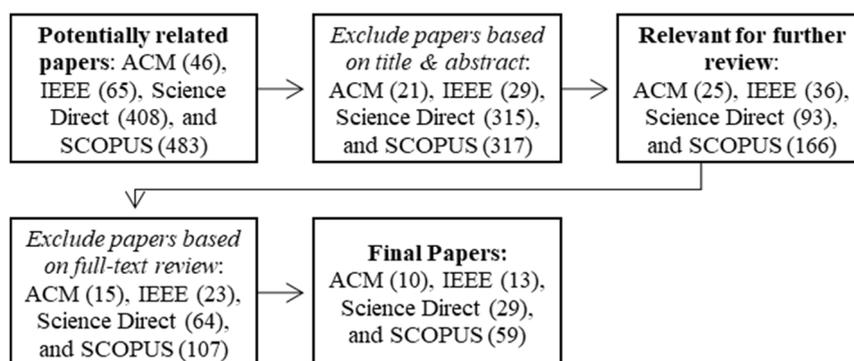

Figure 2. The selection process for final papers.

3. Results

This section discusses the results of the analysis and synthesis of literature on fintech. The discussion includes history and terminology, thematic analysis of methodology, and content analysis of fintech's business processes.

3.1. Background and Terminology

　　Fintech is a relatively modern concept. The biggest innovation in the financial industry was the creation of the ATM [11]. Previously, since 1838, financial transactions were carried out using telegraphs. The banking industry has developed information technology to improve its processes [12].

　　The development of the Internet in the United States and Europe marked technological advancements in various sectors. In the early 1990s, analog technology was transformed into digital technology for the financial services industry. Information communication technology (ICT) investment is relevant to the financial services industry. More recently, in 2009, Satoshi Nakamoto introduced a digital currency called Bitcoin. Bitcoin is a new currency or form of electronic money [13,14].

　　In their systematic literature review, Zavolokina et al. stated that fintech was not only the application of information technology in finance. Some literature argues that fintech can also be interpreted as start-ups, services, technologies, companies, digitalization, industry, new generations, chance, products, and threats [7]. The term fintech (sometimes Fin-tech or FinTech) is a new term that refers to modern relationships and, in particular, technologies related to the Internet (for example, cloud computing, mobile Internet) and business activities in the financial services industry (for example, lending money and banking transactions). Due to automatic processing and the availability of ICT, fintech represents a disruption to the financial sector [15]. Fintech has a variety of business models that consider security, speed, and innovation in the financial services sector [16]. The term fintech is also defined as a financial service and solution based on technological advancements [17]. A simple definition of fintech is an industry consisting of organizations that use sophisticated financial technology to trigger fast financial services without long procedures [18]. Fintech includes start-ups, the use of ICT for financial services, and start-up industry collaboration with traditional financial services.

3.2. Thematic Analysis of the Articles Selected

　　In this section, the results of the thematic analysis are explained. We summarize the areas of fintech that are discussed, per year, the general topics and business models of fintech, the main methodologies used in each study, and classification by country.

3.2.1. Publication Per Year

　　We selected articles from the past five years (2014–2019). From a comparison of the articles published each year, research on the topic of fintech (in general) was the most widely discussed (41 articles). Furthermore, research on the topic of payments began in 2014 with a total of 23 articles. In addition, research on the topic of P2P loans began to appear in 2017 with a total of 20 articles. In 2018, there were 54 articles on fintech. This included topics such as payments, risk management and investment, market aggregators, crowdfunding, P2P lending, and blockchain technology. This can be seen in Table 1.

Table 1. Literature review results.

Year	2014	2015	2016	2017	2018	2019	Total
Research on fintech(in general)	-	1	4	7	23	6	41
Research on payment, clearing, and settlement	1	2	2	4	11	3	23
Research on risk management and investment	-	-	-	2	7	3	12
Research on market aggregator	-	-	-	1	-	-	1
Research on crowdfunding	-	-	1	1	4	3	9
Research on P2P Lending	-	-	-	5	8	7	20
Research on cryptocurrency and blockchain	-	-	-	-	1	4	5
Total	1	3	7	20	54	26	111

3.2.2. Classification of Articles by Fintech Business Model

This section explains the theme of fintech's views in terms of general issues, such as adoption, problems, trends, challenges, and innovations. This grouping is seen from the titles, keywords, and article texts. See Table 2.

Table 2. Classification of articles by fintech business model.

Topic	Adoption	Problems	Trends	Challenges	Innovation
Research on Fintech (in general)	[19–26]	[27]	[5,7,17,28–36]	[3,15,37–46]	[16,18,47–52]
Research on Payment, Clearing, and Settlement	[53–62]	[63]	[64–66]	[67–69]	[9,70–74]
Research on Risk Management and Investment	[75,76]	[77]	[78–81]	-	[82–86]
Research on Market Aggregator	-	[87]	-	-	-
Research on Crowdfunding	-	-	[88–91]	[92–94]	[95,96]
Research on Peer-to-peer lending (P2P Lending)	[97–99]	[8,100–104]	[105,106]	[4,107–114]	-
Research on Cryptocurrency and Blockchain	[115]	[116]	[117]	-	[13,118]

3.2.3. Classification of Articles by (Main) Methodology

The collection of articles was also analyzed regarding the main methodologies they applied. It was found that the majority of articles (33) applied an empirical methodology, including using archival and survey data. Furthermore, qualitative methodologies, such as case study research and observations of certain phenomena, were used in 27 articles. In addition, adoption model research was used to build a conceptual model in a total of 18 articles. Experimental research was used in 12 articles. Literature review studies from various fields of fintech were conducted in eight articles. In addition, theoretical, scientific, and simulative research was also found. Table 3 classifies the articles by methodology.

Table 3. Classification of articles by (main) methodology.

Methodology (Main)	Total
Empirical	
– articles using archival data	13
– articles using survey data	20
Qualitative (case study/interviews/qual. analysis)	27
Experimental	12
Conceptual model	18
Simulative	3
Theoretical	5
Design science	5
Literature review	8
Total Articles	111

3.2.4. Classification of Articles by Publications

Six journal articles were published in *Electronic Commerce Research and Applications*, three articles in *Electronic Markets*, three articles in *European Business Organization Law Review*, three articles in

Investment Management and Financial Innovations, three articles in the *Journal of Economics and Business*, two articles in the *Computer Law and Security Review*, two articles in *Industrial Management and Data Systems*, two articles in the *International Journal of Engineering and Technology (UAE)*, and two articles in the *Journal of Retailing and Consumer Services*. Seven proceeding articles were obtained from the *ACM International Conference Proceeding Series*, three articles from *Procedia Computer Science*, and four articles from the *IOP Conference Series*. The grouping of papers based on publications can be seen in Table 4.

Table 4. Classification of articles by publication.

Journal and Proceedings Name	Total
Electronic Commerce Research and Applications	6
Electronic Markets	3
European Business Organization Law Review	3
Investment Management and Financial Innovations	3
Computer Law and Security Review	2
Industrial Management and Data Systems	2
International Journal of Engineering and Technology UAE	2
Journal of Retailing and Consumer Services	2
ACM International Conference Proceeding Series	7
Procedia Computer Science	3
IOP Conference Series: Earth and Environmental Science	2
IOP Conference Series: Materials Science and Engineering	2
Others	74

3.2.5. Classification of Articles by Locations

Articles were grouped by location according to author location and case study location. The purpose of this grouping is to see trends and topics of interest in a location. We divided the locations based on continents, i.e., Asia, Europe, America, Africa, and Australia, in addition to Global (no specific area). From the data we obtained, the Asian Continent was ranked first in fintech research. This comprised the research of several countries, such as China, which produced 20 studies; Indonesia, which produced 19 studies; and Korea, which produced nine studies; in addition to several other countries, such as Taiwan, Malaysia, India, Japan, Singapore, Thailand, and Brunei Darussalam. Furthermore, the European continent occupied second position with representatives from Germany, with 10 studies; England, with eight studies; and several other countries, such as France, Switzerland, Russia, Finland, and the Netherlands. Furthermore, the American continent occupied third position with representatives from the USA producing 12 studies, Spain producing four studies, and other countries, such as Brazil and Canada. Finally, the continent of Australia produced a total of 10 studies.

The case studies from each study cannot be specifically identified. A total of 37 studies involved case studies. However, the largest number of case studies was produced by the Asian area, with 49 studies, including Indonesia, which was the most researched country with a total of 19 studies, and China with 17 studies. In addition to these two countries, countries including Malaysia, Taiwan, Japan, Korea, Thailand, and Singapore produced studies. Furthermore, the European area, which does not specify which country, produced 10 case studies in England, France, and Ukraine. Furthermore, the American area used the US as a case study with a total of 10 studies, and several regions such as Brazil and Canada. Finally, the continent of Africa undertakes little research on fintech, with Kenya producing one study.

3.3. Meta-analysis of the Articles Selected

We conducted a meta-analysis to further explore any issues relating to the fintech topic. Using NVIVO software, we performed selective coding, adapting it to the needs of the research question. As discussed in the methodology section of this review, this article explores the research challenges and trends of the topic of fintech. Table 5 describes the challenges, and Table 6 describes the research trends.

Table 5. Research challenges.

Challenges	Issues
Framework and Model	1. Developing a practical and systematic framework for fintech [33,34,75] 2. The model of the fintech p2p lending system needs to be detailed [52,112] 3. Development of culturally appropriate models [56] 4. Design new service configurations [5] 5. Fintech is changing the role of IT, consumer behavior, ecosystems, and regulations [18] 6. The challenges and dynamics of the FinTech crowdfunding platform [51]
Regulation and Policy	7. Fintech need for comprehensive regulation [4,15,38,44,50] 8. Development of international prudential standards [52] 9. Required regulatory reform regarding the information technology [44] 10. Revised licensing regime for financial companies [52] 11. Public policy requires a stable and efficient public infrastructure and trust in the payment system [74] 12. There must be clear rules in the agreement, including penalties, dispute resolution, and settlement mechanisms in the event of a business closure [4] 13. There are market standardization and transparency in the era of big data [100] 14. Fintech entrepreneurs should monitor upcoming changes in the regulatory environment [36] 15. Public policy against the financial revolution [72] 16. The online loan platform has registration requirements [113] 17. Securities law on the development of equity crowdfunding funding [89] 18. Fintech focus on changing the role of the state in encouraging national industrial growth [32]
Regulator	19. Institutional support for new financial technologies [52] 20. Creating a regulatory sandbox for fintech start-ups [52,103] 21. Regulators must secure and respect the conditions of the moral community [117]
Financial Ethics	22. Financial ethics must be following principles [47]
Financial Literacy	23. Financial literacy should be technology-based oriented as well [28] 24. Lack of knowledge of success factors of equity crowdfunding open to non-accredited investors [93]
Supervisory	25. Supervisory aspects by the financial services authorities are urgently [44] 26. Supervision of the problematic p2p lending platform [8]
Personal data protection	27. The protection of misuse of personal data [17,44] 28. The use of big data and new technologies raises significant data protection issues [103] 29. Blockchain solves data protection issues regarding data integrity [54] 30. Privacy protection on InsurTech [86]
Customer Protection	31. Trust in the payment system can fulfill consumer protection [74] 32. Utilization of electronic signatures for agreements [4] 33. Customer management [3]
Portfolio risk management	34. The risk exposure of individual stocks with portfolios [77]

Table 5. *Cont.*

Challenges	Issues
Collaboration	35. Banks need to consider fintech and strategic partnerships [31,35,37,49,51,66] 36. Incubator model [108] 37. The channeling model can provide benefits for both fintech and banks [108] 38. Collaboration between online lending firms and banks [113] 39. Bank strategic planning for investment in fintech companies [38] 40. Offers strategic capabilities for a company to occupy a market niche in the financial sector [101] 41. Fintech collaboration with other industries [109] 42. Cross-Border Crowdfunding [91]
Security	43. Broad access to electronic financial transactions should enhance personal protection [63] 44. Data security standards for blockchain platform payment applications [54] 45. Authentication and access control mechanisms [17] 46. Secure data storage and processing [17] 47. Developing a trust-based financial system, including comprehensive and measurable security mechanisms [39] 48. Data security and consumer trust [24]
Infrastructure	49. Sources of infrastructure financing [79] 50. Role of infrastructure [79] 51. Factors affecting infrastructure construction projects [79]
Payment Systems	52. Developing payment systems on mobile phones with biometric fingerprints or voice payments [60,68] 53. The right framework or guidelines for a mobile/digital wallet [72] 54. Requires standard definitions of mobile payments (including mobile banking, mobile money, mobile wallets, mobile commerce, mobile pos, and mobile finance) [73] 55. Fintech mobile payment services in the future will develop into a more secure service [69]
Blockchain	56. The blockchain concept (including blockchain structures and payment transactions on the blockchain) [46,52,54,118] 57. Blockchain is a future technology [9,41]
Bitcoin	58. Price conversion between bitcoin and the physical currency or other virtual currencies [13] 59. Explore ideas about coins that have major crypto features [116]
Technology	60. Rapid developments in artificial intelligence (ai), machine learning, and blockchain [117] 61. Development of an optimization algorithm model and asset allocation to predict trends [82] 62. Develop integrated knowledge-based and generative models for the ai conversational robot advisor [82] 63. Need to ensure the quality of the software system at fintech [29] 64. Technology integration [3] 65. Alternative credit scoring based on non-traditional data [101] 66. Open Application Programming Interfaces (APIs) [43] 67. Digital identification and biometrics [43] 68. The design of big data-based lending markets [106] 69. Information collection for fraud detection [102]
Robo-Advisor	70. Banks and other companies in the financial industry must design Robo-advisors [76] 71. AI for conversational Robo-advisor [82] 72. Designing a Robo-advisor for risk-averse [84]
Digital Insurances	73. Concerning the business function of digital insurances [15] 74. Using Smart IoT to Provide Positive InsurTech Feedback [86] 75. Understand insurance value creation in a digital world [85]

Table 6. Research Trends.

Trends	Issues
Business Model and Ecosystem	1. Fintech has a variety of business models [3,5,7,15,16,18,23,33,42,43,46,48,50,78] 2. The fintech business model can be adopted by existing financial organizations [36] 3. Fintech is changing the business and economic landscape [23,45] 4. Analyzed the function and structure of FinTech [21] 5. Transformation of financial intermediation and financial stability [30] 6. P2P lending business model [8,104]
Adoption	7. The process of consumer self-regulation and behavioral intentions affects fintech adoption [53] 8. Adoption in mutual fund [75] 9. The attitude of consumers towards Robo-advisors influences adoption [76] 10. The adoption of mobile payments/fintech [20,22,25,26,56–59,62,97] 11. The adoption of fintech loans (P2P lending) [97–99] 12. Perceived usefulness of P2Pm-pay influences their decision to adopt [61] 13. Evaluating the usability of fintech [114]
Payment	14. Bitcoin is a popular financial asset [13] 15. Multi-perspective framework for mobile payment ecosystems [64] 16. comparing mobile payment systems for SMS (short message service), NFC (near field communication), and QR (quick response) [60] 17. The most severe barrier for crypto-acceptance is a lack of consumer demand [105] 18. Development Portfolio for the Payment FinTech Company [65] 19. Evolution of the mobile payments technology ecosystem [71] 20. Developing payment transaction mediation among heterogeneous FinTech payment schemes [67] 21. Fintech acceptance factors of e-wallet and digital cash [55] 22. Ecosystem concepts as applied to the new payment landscape [66]
Financing	23. Fintech is an alternative solution for small micro-businesses to obtain the funding through p2p lending model [44] 24. The company chooses a high level of profit margin [37] 25. The borrower decides a low level of debt time [37] 26. The lender chooses a high level of ROI [37] 27. Fintech is used to finance agriculture [94] 28. P2P platforms pose a considerable risk for market investors [100] 29. The advent of equity crowdfunding has had a fundamental impact on securities law and its legislative philosophy [89] 30. P2P lending consumer lending activity has penetrated areas that traditional banks may be underserved [111] 31. Success factors in equity crowdfunding [93,96] 32. Understanding P2P lending regulation [110]
Evolution of the mobile phone	33. Mobile devices with increased storage media and data transfer capabilities [9] 34. Proposes a framework called UMETRIX for evaluating the usability of mobile applications [19]
Companies	35. Early-stage companies will be at risk and do not understand market conditions [92]

Table 6. *Cont.*

| Trends	Issues
Investor	36. A higher level of participation of individual investors in the funding of new ventures [92] 37. Market consolidation trends through acquisitions and mergers between investors, start-ups, and financial shareholders [34] 38. Shareholders, including "big" banks, will continue to play a central role in the fintech ecosystem [34] 39. The rise of shadow banks [105] 40. Robo-advisors provide risky portfolios to individual investors based on an investment algorithm [81] 41. There are similarities in investor motivation in equity and crowdfunding rewards [88] 42. Connecting SME borrowers and consumer investors [90]
Start-up	43. Focused on improving the consumer experience [34] 44. Focuses on integrating services across various fintech categories [34]
Technology	45. The invisible robots of global finance [47] 46. Near Field Communication (NFC) antenna for fintech innovation [70] 47. New technological applications have emerged for electronic payments, electronic deposits, personal and consumer loans, insurance, various trade transactions driven by e-commerce [41] 48. Apply a priori algorithm to P2P lending [107] 49. Intelligent agent-based hedge and trading system design and development [80] 50. A reputation model for aggregating Ratings [87] 51. Big data platform architectural technology innovation combined with insurance [78] 52. NEC for Secure Multi-Party Computation (SMPC) technology [40] 53. The Random Neural Network with Genetic Algorithm [83] 54. FinTech Systems Automated Black Box Testing [27]

4. Discussions and Recommendations

4.1. Discussions

We performed a keyword mapping of all the articles. Using the VOS Viewer application, we found keywords that often appear, such as fintech, use, approach, process, finance, risk, need, problem, adoption, and investor. See Figure 3.

4.1.1. Research on Fintech (In General)

Fintech research generally begins with the evaluation of fintech (including machines and financial instruments) and the social and ethical consequences of the use of robots [47]. In addition, fintech is considered to modulate financial technology because it can provide added value to financial services [21]. Due to the evolution of technology and its application in the design and delivery of financial products, the monitoring, management, and control of financial services must pursue compliance and reporting for implementation in achieving effective objectives in the financial sector [31]. A large amount of research addresses the adoption of fintech in terms of technology and user perceptions [19–26]. The historical view of fintech, ecosystems, business models, and types of fintech investments was found to be a preliminary topic of study [3,15,18]. An important issue in developing fintech is data privacy and data security, hence, studies have been undertaken that propose methods to approach data-based processes, such as strong authentication functions [39]. For this reason, mechanisms for using innovative financial technology need to be refined, and rules relating to the experiences of various countries need to be integrated. Several countries appoint financial service authorities to build regulatory sandboxes as a process of assisting fintech start-ups [52,105]. This is a limited, safe trial space

for testing financial technology operators and their products, services, technology, and/or business models. [4,50].
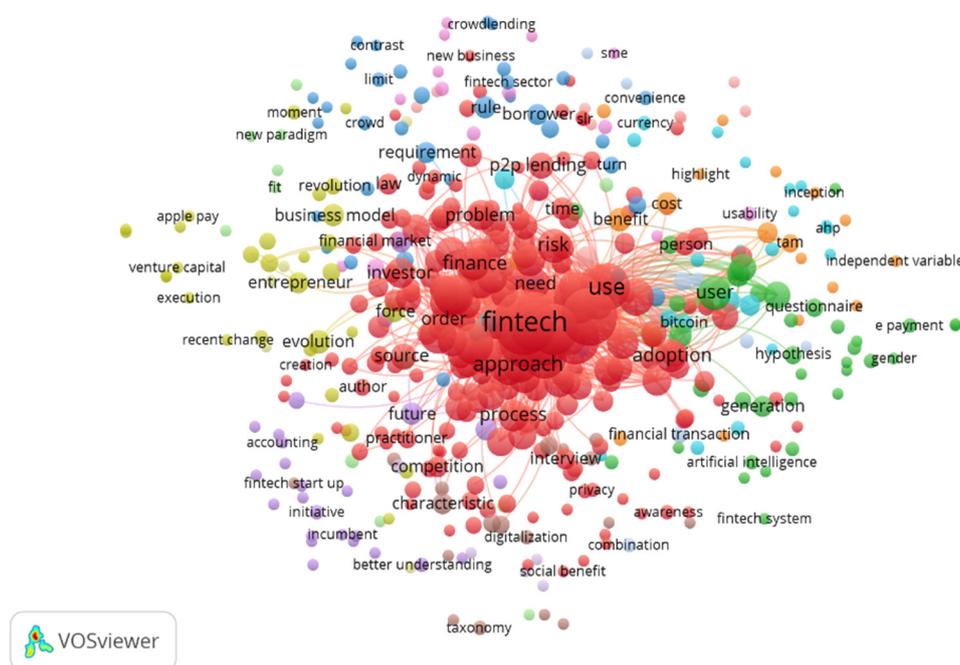
Figure 3. Result of content analysis using VOS Viewer.

4.1.2. Research on Payment, Clearing, and Settlement

At present, innovations in the fintech sector have had an impact on other fintech business models, such as the payment model. Several innovations have emerged in the form of electronic wallets, electronic money, and payment gateways [64,119]. This has happened because there is a high level of heterogeneity among payment schemes in terms of payment processing, transaction settlement methods, and e-commerce developers who apply numerous payment methods [54,67]. Because of the many payment methods available, adoption research also dominates this topic [53–62]. The mobile payment system currently operates in a complex and multidimensional network with the same shared infrastructure, and competes to produce and deliver value to customers [73]. Furthermore, studies have been conducted that explain biometrics regarding individual security issues, benefits received, and trust in electronic payments in the context of e-commerce [68]. In addition, due to the use of numerous virtual currencies for online transactions, it is feared that these could endanger the financial system because regulators have difficulty in the supervisory process [116].

4.1.3. Research on Risk Management and Investment

Smartphones are pervasive. At present, many financial planning applications are available on smartphones [80]. Users can determine financial plans based on personal data [79]. This trend started from the discussions of insurance companies [78,85,86], who developed an integrated, knowledge-based model for AI (artificial intelligence), the robo-advisor [76,81–84], to evaluate equity portfolios and study negative and positive reactions to portfolio risk management [77]. In addition, research on the adoption of mutual fund services has also been discussed [75].

4.1.4. Research on Market Aggregators

Market aggregators are portals that collect various information on financial service options for users. Based on this information, users can compare the best financial products, including credit cards,

insurance, or investments. Research has proposed a new model that aims to produce a more accurate and effective reputation score from aggregation methods based on normal distribution [87].

4.1.5. Research on Financing (Crowdfunding and P2P Lending)

Fintech research in the field of financing is divided into crowdfunding and P2P lending research. Despite having different goals, P2P lending and crowdfunding both represent financial marketplaces. This type of platforms is able to bring together those who need funds with those who provide funds as capital or investments [90]. Crowdfunding can be divided into two types, reward-based and equity-based [95,96]. Reward-based crowdfunding entails an individual who contributes to a project or business in the hope of receiving non-financial rewards, such as goods or services, at a later stage [88]. By comparison, equity-based crowdfunding works more like conventional investments in the form of shares [88,89,93]. A crowdfunding campaign is a matter of convincing the audience, especially potential donors, of the ideas and business models offered. However, due to the higher level of individual investor participation in funding new ventures, asymmetric information is generated [92]. Thus, the challenge for future research is to reduce information asymmetry and protect the market by building investor confidence [91]. P2P lending is a financial service that brings lenders and borrowers together on one platform [120]. Suryono et al. examined issues such as information asymmetry, which can make it difficult for investors to make P2P investments, and the determination of the score borrowers need to utilize big data. In addition, moral hazard is also an issue in the development of the P2P lending industry that influences investment decisions. For this reason, regulations and policies continue to be discussed to determine the feasibility of the P2P loan platforms [8]. Therefore, research related to the adoption of P2P loans is still growing [97–99]. Studies on government policies continue to be carried out to provide regulations that can be accepted by all stakeholders [4].

4.1.6. Research on Cryptocurrency and Blockchain

A cryptocurrency is any digital currency that is secured by encryption. Examples of some popular cryptocurrencies are Bitcoin, Ethereum, Litecoin, Ripple, Dash, Peercoin, and Dogecoin [116]. "Secure by encryption" means that on the blockchain there is an encryption technique in use. In addition, the blockchain is not limited by the government because this technology is centralized among its users [46]. However, blockchain has vulnerabilities and loopholes that lead to exploits such as operation without regulatory rules [54]. Blockchain technology has four advantages: (1) it is freely accessed by users who agree to join the database; (2) the system gives each user a copy of millions of transactions with visible updates; (3) with complex algorithms, blockchain can be updated for each ledger; and (4) it utilizes network technology [41].

4.2. Recommendations

We have seen that the development of articles about fintech has attracted the attention of researchers. From the results of our meta-analysis, we found many themes that consist of numerous keywords. Thus, we define three main challenges and means to overcome them.

The first is collaboration. The challenge for the future is the development of a practical and systematic framework for fintech [33,34,75]. Several research trends are trying to establish sustainable adoption models, identifying factors that influence a person to use fintech services [53]. However, it is still unclear how consumers will continue to use these services. Moreover, the identification of these factors is not the only way to look at adoption rates. Public knowledge about financial literacy and support from stakeholders can support the running of the Fintech industry. This is an important role in the collaboration of all stakeholders [108]. Fintech should no longer be considered a disruptive business. Good relationships are required between fellow financial service industries, such as banks [113], and good relationships between fintech and regulators significantly affect the continuation of fintech practices [109]. Fintech should be able to aid transition of the economy. The government must see the fintech sector as helping with this transition, for example, by providing

permission to use electronic money and digital wallets and their implementation as a payment method. These methods clearly make it easier for people to pay in cash via their smartphones. Previously, fintech was the enemy of banking, but now banks can collaborate, and the government is not only a regulator but a player to create a better digital payment ecosystem.

The second is supervision. Loans are one of the many financial service models influenced by fintech, in addition to payments, wealth management, and digital insurance [101]. Although the idea of P2P lending is not new, it is a product of fintech that is developing in countries such as the USA, China, and Indonesia [4]. The hope is that this business model can help SMEs and individuals to obtain loan capital [43]. However, many illegal fintech loans have emerged due to fintech practices that rely on user trust [30]. The approaches taken to fintech regulation vary widely. For example, the US has taken a reactive approach by relying on its rules and regulations, whereas China is taking a proactive step in developing a specific regulatory structure [4]. Product-focused regulatory oversight sometimes does not lead to rapid technological advances. There is an impression that regulations and policies are slow and incompatible with digital transformation.

For this reason, regulators should adopt a "regulatory sandbox" approach. The sandbox allows regulators to work alongside industry players to develop this industry [52]. Fintech operators should be officially registered and members of government-recognized fintech associations. The regulator should implement a direct inspection mechanism by checking the website and application channels. In addition, the government is also advised to have a complaint forum for illegal fintech. A more interesting suggestion is to explore public opinion using social media commentary data, highlight fintech product reviews, and analyze user complaints using text analysis, such as sentiment analysis and opinion mining [119].

The third is protection. New technology trends in the development of fintech cannot be separated from the use of Big Data, artificial intelligence, and machine learning [117]. The effect of using data is complicated and extensive, motivating this industry to pay close attention to its security [54,103]. Security in this context applies not only to technology, but also to data [17]. Fintech must protect consumers from issues regarding data leaks and data access restrictions, including personal data protection. Thus, the existence of strict rules regarding personal data protection is needed [44]. Consumers must also be aware of digital literacy. Digital literacy demands smart technology users [28]. Furthermore, the fintech industry must maintain the quality of fintech software, taking advantage of technology integration to avoid fraud [102].

5. Conclusions

Based on an SLR, 1002 articles were obtained from the ACM, IEEE, SCOPUS, and ScienceDirect databases. The articles were selected by title and abstract. Then, 111 final articles were reviewed using thematic analysis and an annotated bibliography. From the literature review results, fintech research was divided into several business processes: research on payments, risk management and investment, financing (crowdfunding and P2P lending), market aggregators, and cryptocurrency and blockchain technology. The most common research theme was around the adoption of fintech itself.

The meta-analysis results show that the challenges of fintech research begin with determining the fintech framework [33,34,75], including business models and models that are appropriate to the culture of each country [56]. These conditions clearly affect the regulations and policies made by the government [4,15,38,44,50]. This industry requires broad principles in which these rules must be adapted to technological advances [44]. For this reason, several countries have applied the regulatory sandbox concept (incubation for fintech start-ups) [52,103]. Fintech requires a large amount of personal data [103], so monitoring the platform is also beneficial for consumer protection [74]. On this basis, the level of data security and infrastructure must be continuously developed [41,43,102,117]. Currently, fintech is also required to collaborate with traditional financial institutions such as banks [31,35]. This addresses the problem that fintech is a disruptive technology [38]. Banks need fintech as a strategic partner because fintech is considered to be faster in following digital transformation [108].

Then, the research trend continues by developing a conceptual model for fintech adoption [53,75,76]. Various variables, such as perceptions that build attitudes, intention to use, government support, user innovation, brand image, trust, and technology risk, continue to be developed [20,22,25,26,56]. Furthermore, the development of the fintech business model and ecosystem is a widely discussed research topic [3,5,7,15,16,18]. This exploration is supported by the evolution of mobile phones and the Internet [9,19]. Start-ups are starting to receive special attention as development teams' expertise continues to improve [34,41,60]. Several technologies, such as the robo-advisor [47,76], artificial intelligence [82], big data [78], and a combination of decision support algorithms, are of interest among fintech researchers [80,83,107]. Finally, many opportunities remain that can be obtained from fintech research, including policy, security, monitoring, and even other technological developments.

This research contributes to improving the education about digital finance, in which experiences from fintech practices are an important point of the expansion of digital finance. Practically speaking, the selection of articles, journal databases, and proceedings can provide a reference for research in the field of fintech to obtain quality literature. Other researchers can also see the development of research on fintech topics from year to year. The article classification can help future researchers to review references according to their research needs.

Future studies can use this literature review as an initial foundation to understand fintech. In the field of computer science, future work can address AI, including algorithms, methods, and techniques for fintech systems. For example, payments can develop payment gateways or other easy payment methods and use biometrics as security for transactions [64,65,67]. In P2P lending research, the profile matching method can be used to connect lenders and borrowers [8,104]. Big data techniques can present financial service information, including the development of robo-advisors [76,84]. Further research can also be conducted on blockchain technology and cryptocurrency [118].

In the field of information systems, research can discuss technology adoption, including combining user acceptance models with other behavioral models [19–26]. Collaboration on the fintech business model with other industries is also possible (particularly for funding) [109]. It is also feasible to measure the maturity of the technology used and provide technical and non-technical recommendations [121], use social media data to analyze public opinion on the development of fintech [122,123], and review policies to create regulations that are acceptable to stakeholders and in accordance with the fintech system [121]. It is also an important to include fintech in education [124] to prepare the potential workforce for the market [12].

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