

Utilizing the collective wisdom of fintech in the gcc region: A systematic mapping approach

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Abstract

Globally, with the maturity of information technology, society is now in the information age, magnifying the significance of integrating innovative applications in different financial and other regulatory arenas. The emergence of financial technology (FinTech) based applications has transformed the traditional banking and regulatory systems and enhanced customer satisfaction by providing a balanced environment for protecting its customers from risky behavior or other potential disruptions. Besides these critical applications of FinTech in the financial industry, it is not developed in the Gulf Cooperation Council (GCC) region as in China, United States, and other developed countries. In order to bridge the gaps in the extant by identifying the critical factors involved, this research work presents a systematic analysis of the available literature reported during the period ranging from 2016 to 2021. This systematic mapping of the extant was performed by selecting five different research questions. The key objectives of this systematic research work are, (1) To identify the barriers that restrict the rise of FinTech in the GCC region, (2) Analyze the behavior of different communities regarding the adaptation of FinTech by evaluating the case studies reported, (3) the impacts of FinTech on different communities in the GCC region. (4) The findings of this research work will not only help the state development bodies by encouraging its stakeholders to use FinTech-driven applications in banking, markets, etc. but it will also help the people in maintaining long-term connection with the Ministries of Foreign Affairs, the Dutch regulators, Economic Affairs, the Dutch Central Bank (DNB), as well as with the Authority on Financial Markets (AFM), and (5) this study work will present new research directions for the research community to explore in the near future.

Keywords

Systematic literature review, finance, FinTech, banking system, Middle East, GCC

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Introduction

During the last few years, the FinTech-driven applications has gained significant attention of the research community and other financial gurus. The key motivation behind this significant attraction is the potential of the FinTech to incorporate supply-chain networks in all business sectors.¹ It is an integration of digital technologies facilitating its users to perform transactions via online and mobile banking.² For example, high speed internet connectivity and mobile applications facilitate users to promote financial operations/activities using smart IoT devices, including e-bill payments and direct payroll deposits. These online banking facilities and integration of digital technologies have proposed a secure and efficient business model in place of traditional business models that were mostly error-prone. A good business model especially FinTech-integrated model provides high facilities to its customers and poor communities by restricting corruption and ill-

legal fees by providing non-cash community,³ smart intelligent interface using advanced artificial intelligence and machine learning models,⁴ presenting globalized economy, providing a centralized controlling mechanism where the customers can have access from everywhere and every time.

During the research analysis performed by KPMG and H2 Ventures in 2016,⁵ it was reported that more than half of the top 50 FinTech “unicorns” were born after 2010. The FinTech has become a buzzword among Silicon Valley entrepreneurs and Wall Street investors,

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and their investment is considered as the fastest growing investment in this modern technological application. Inspired by this significant interest of the financial industries and research communities, both the government and non-government organizations have shown a keen interest in transforming the traditional banking systems toward FinTech-driven systems. This transformation will not only ensure the higher facilities for their customers but will help in boosting the economy of the country by restricting fraudulent mechanisms and strategies, no-corruption, and helping the poor community to borrow money for their basic needs and new business startups. Inspired from the world, the FinTech is also emerged speedily in the Gulf Cooperation Council (GCC) countries, especially in the State of Qatar. The researchers reported work on FinTech using case studies of MENA region (an English-language acronym describing the Middle East and North Africa).^{6,7} While some researchers reported work on GCC member countries using FinTech as the point of consideration.⁸⁻¹⁰

Consequently, the maturity of research on digitization and FinTech begs to systematically analyze the extant that can explicitly identify the materiality, variability, emergence, and richness of FinTech as a phenomenon. The systematic research work is extensively reported in many research fields, including healthcare,¹¹ intelligent homes,¹² crowdsourcing,¹³ network IPv6 domain,¹⁴ navigation assistant,¹⁵ and many others, due to its higher capabilities to analyze the literature in a systematic manner by flushing lights on the gaps in a specific research domain and suggest new research directions by bridging these gaps. To perform this systematic literature review (SLR) process a total of five different research questions are formulated in this systematic analysis to assess the proposed FinTech domain with different perspectives. Five different peer-reviewed online repositories are selected for the accumulation of the relevant articles for the systematic mapping. A total of 91 most relevant research articles are analyzed and systematically assessed in this research work. The prime objectives of this research work include:

- The identification of the critical barriers that restrict the rise of FinTech in the Middle East. Identifying these key barriers will help the research community to address these challenges by suggesting new and enhanced solutions to gain customer satisfaction and encourage them toward the use of FinTech-driven applications.
- Analyze existing work by identifying the behavior of different communities regarding the adaptation of FinTech by evaluating the case studies reported. Some of the critical problems faced by FinTech during the adoption process are unfamiliar with FinTech, intimidated feelings, and lack of understanding.¹⁶ Although the researchers performed workshops, conferences, and present news reports to encourage people toward FinTech, a large number of the

population still show dubious behavior. The second and most important objective of this research work is to identify the residents' sentiments regarding FinTech and suggest some future research directions based on the assessed information.

- The impacts of FinTech on different communities in the Middle East. The findings of this systematic research work will not only help the state development bodies by encouraging its stakeholders to use FinTech-driven applications in banking, markets, etc. but it will also help the people in maintaining lifelong relationships with the Ministries of Foreign Affairs, Economic Affairs, the Dutch regulators, the Dutch Central Bank (DNB), as well as the Authority on Financial Markets (AFM), and
- Based on the systematic analysis and findings, this study will present new research directions for the research community to bridge the gaps in the selected FinTech domain.

The rest of the paper is organized by presenting the related work in section 2 of the paper. Section 3 of the paper explains the research protocol followed for the proposed systematic mapping. At the same time, section 4 of the paper presents the quality assessment criteria and systematic analysis. Section 5 of the paper outlines the results and discussion section of the article. Based on the systematic assessment of the literature the future research directions are outlined in section 6 of the paper followed by the conclusion in section 7 of the paper.

Related work

The 21st century has astonished us with its advancement by introducing numerous smart applications ranging from banking system to smart financial systems,¹⁷ routing systems¹⁸ to smart navigation applications,¹⁹ and many others. Surprisingly, its pace is so quick that we obviously raise our hands and desist any feign of watching what is the latest in innovation. This gape, in its own pervasiveness, presents itself in Finance, likely more so than anywhere else does. It must be noted; we do not allude to Finance as Finance any longer yet FinTech.²⁰ This idea can be a touch devilishly extended, FinTech itself is at the brink of the redesign as though there was a need. The researchers shown a significant interest in this transition process, initiating from the zephyr of Blockchain darting its wings, which is found to be a hot topic of research in the labs, financial industries, and in research centers.²¹⁻²³

In 2008, Nakamoto (a Japanese researcher) reported an article by presenting a plot that introduced the new advanced money, termed as Bitcoin (XBT or BTC).²⁴ It is believed that this new advanced money was a reply to the 2008 global financial crisis (GFC), and

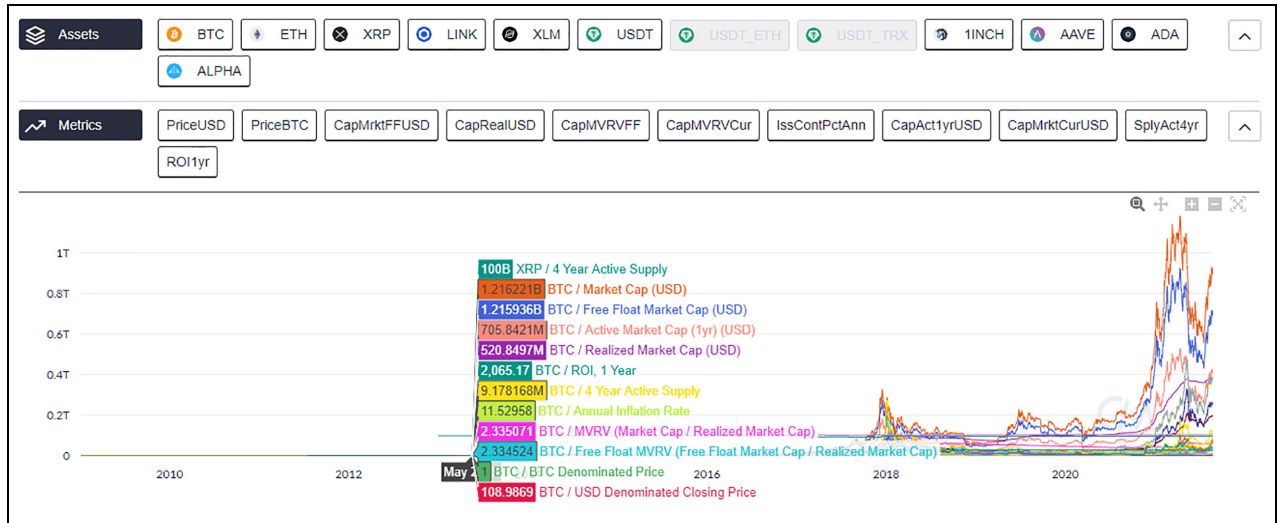


Figure 1. Market capitalization record.³⁰

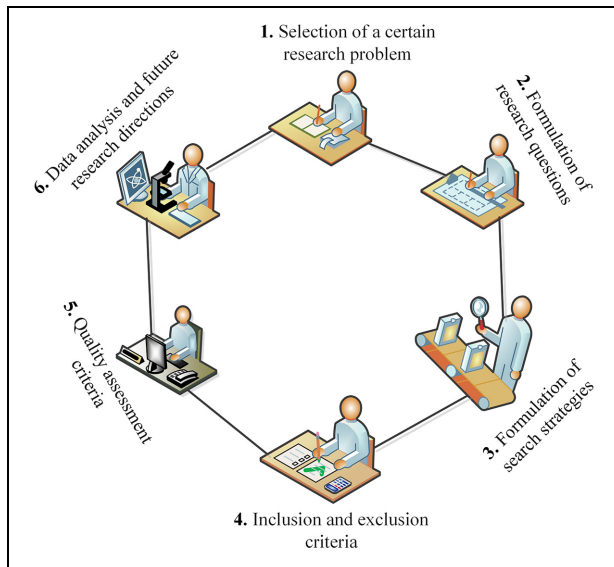


Figure 2. Key steps of an SLR work.

emanating government bailouts of banks. As Tschorsch and Scheuermann,²⁵ and Geiger²⁶ clarified, “Bitcoin is an option in contrast to the current budgetary framework. It expels authority from any single individual or association, and was made in any event incompletely as a reaction to the 2008 GFC,”²⁷ where the poor judgment of a couple of prompted cutbacks, school graduates without openings for work, and home abandonments universally.” With the help of blockchain, total exchange rates are recorded online, and by using a proof of work model (performed using cash excavators), these replacements are totally asserted. Besides, this blockchain-modeling still there is tendency to face two-fold spending issues.^{28,29} Another, innovative idea of cryptocurrency is introduced that uses decentralized mechanism for operational purposes. The overall cryptocurrency market capitalization has

remarkably risen more than four-folds since 2018; exceeds \$30 billion after 2020, as depicted in Figure 1.

From Figure 1, it is depicted that Bitcoin is the most prominent cryptocurrency in terms of market capitalization and transactions (average daily number of transactions over the last 4 years) followed by BTC, ETH, XRP, LINK, XLM, Monero, and LTC. Besides this gigantic market contribution, most of the populations show dubious behavior toward Bitcoin or FinTech applications. The researchers around the world put a significant contribution toward the sentiment analysis of the population toward FinTech. Many research researchers reported case studies^{31,32} to identify population interest, while some researchers^{33,34} used deep learning and other shallow architectures for sentiment analysis purposes. While other reported survey papers^{25,35} for identifying challenges and security risks in the FinTech-driven applications. With passage of time this innovative field get matured and China is the best example, where the FinTech-driven models extensively used compared to United States and United Kingdom.³⁶ Besides this keen interest from the world, the FinTech-driven models are not encouraged in the GCC region, and still they prefer direct financing because money market funds are more popular in this region compared to Japan and Germany etc. Though direct financing is full of fraudulent, corruption, no centralized control mechanism, and many others but still most of the population in this region show a dubious behavior for blockchain, Bitcoin and other FinTech-based applications.

For identifying the core problems that hinders the implementation of FinTech-driven applications in the GCC region, this research work performs a systematic analysis of the extant accumulated from five different peer-reviewed research journals. The systematic literature review (SLR) studies are significantly reported by researchers in diverse domains to get knowledge of new trends and future research direction in the topic of

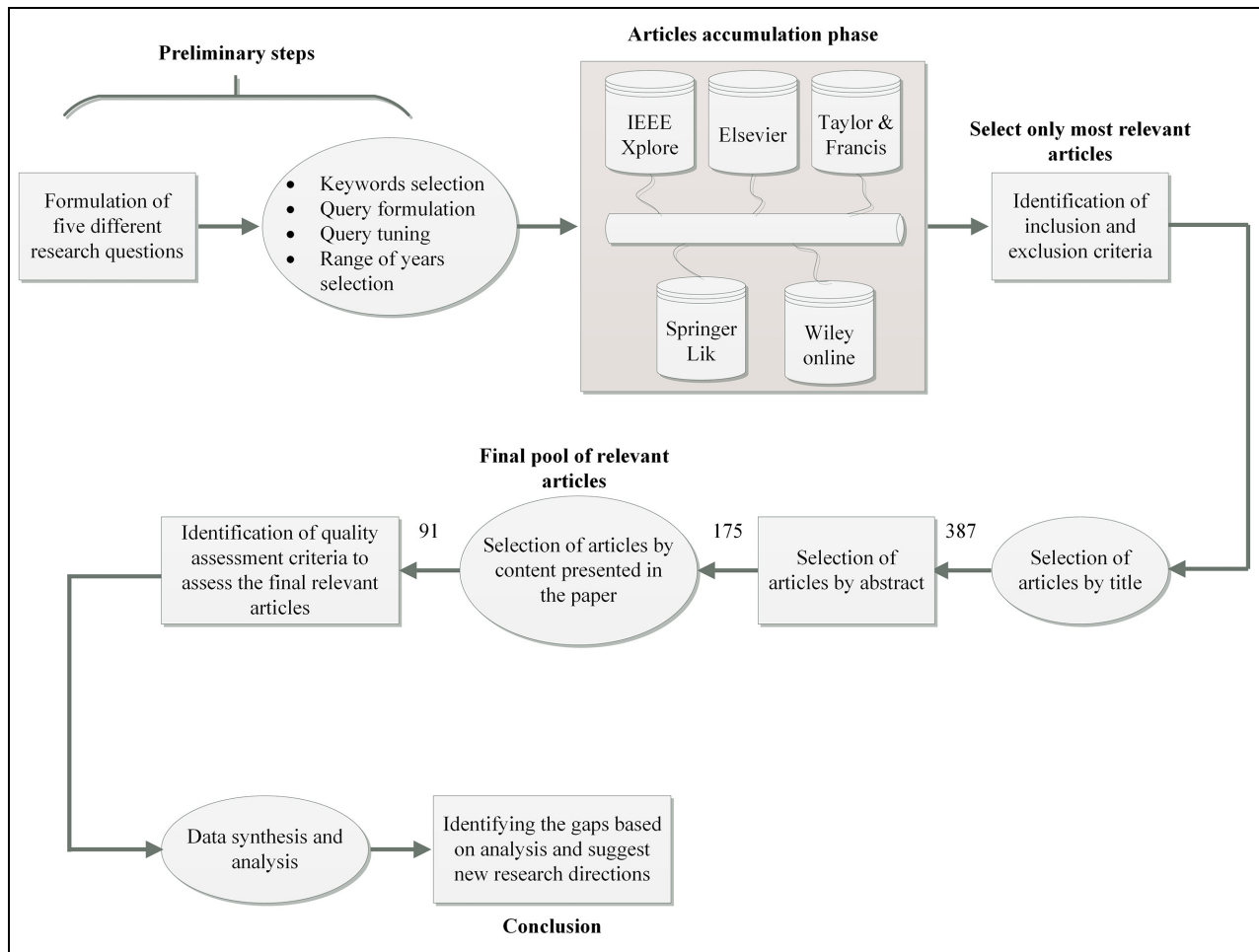


Figure 3. Proposed systematic research protocol.

interest. Key steps of an SLR work are depicted in Figure 2. These steps include identification of a research domain, selection of research questions (in our case, we have formulated five research questions to analysis the proposed research field with different perspectives), identification of search strategies, inclusion and exclusion criteria, and finally the assessment and identifying new gateways for future research directions.

If a systematic research work accurately follows these key steps represented in Figure 2 and ensure the PRISM checklist defined by Moher et al.,³⁷ then the accomplished research work will contain a sound knowledge regarding a certain of interest. Keeping in view the importance of these guidelines the extant in the FinTech domain is assessed and analysis were performed to find the gaps in the available literature and suggested new research directions.

Systematic mapping protocol

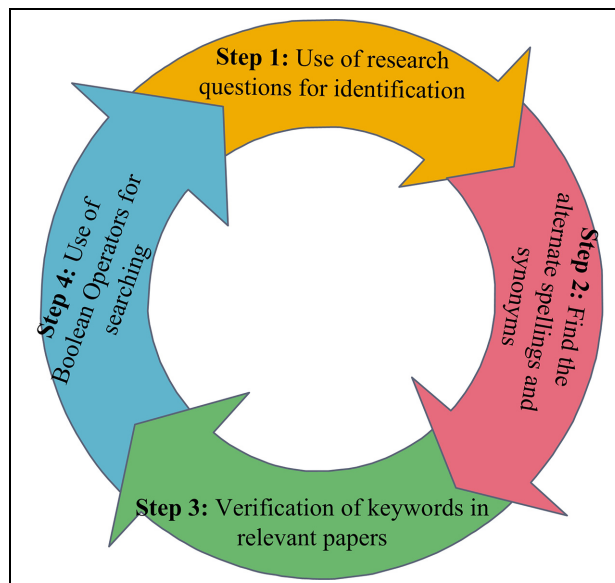
A systematic literature review aims to identify, select and critically assess the extant in order to answer a well formulated research question.³⁸ The systematic research work should follow an audibly determined protocol where the selection criteria is clearly stated earlier to

the systematic mapping. It is an absolute, unequivocal search conducted over multiple online repositories and gray literature that can be cloned and replicated by other researchers.³⁹ It involves formulating a cognoscible search strategy which has a definitive focus or answers a specific research question. The review evaluates the type of information retrieved, applied and published within known timeframes (in our case 2016–2021). The search terms, searching strategies (including repository names, platforms, interval of search), and limits all need to be comprised in the review process. Figure 3 diagrams the systematic mapping protocol used for the proposed SLR work.

From Figure 3 it is evident that the first step in our research work is to formulate the most relevant and well-defined research questions, because this is the key step in any SLR work and acts like a corner stone for the lateral assessment process. For this systematic analysis we proposed five research questions. Based on these research question keywords are identified that helped in formulating the queries to download relevant articles from the targeted libraries (ACM, Springer Link, Elsevier, Taylor & Francis, and Wiley online library). These articles are then scrutinized based on title, abstract, and contents presented in the paper.

Table 1. Research questions.

| No. | Research questions | Descriptions |
|------|---|---|
| RQ1. | How FinTech-driven applications offer improved living styles in developed countries? | This research questions aims to sort the literature to identify the FinTech-based application's masteries by offering improved living styles in terms of security, centralized access, and error-proven systems. |
| RQ2. | What are the key problems that hinders the FinTech in the GCC region? | The prime objective of this research question is to frame the core issues that restricts the FinTech to sprint its wings in the GCC region. |
| RQ3. | Based on the extant, what are different techniques suggested to encourage the GCC population toward the FinTech-based applications? | This research question traces the techniques or models suggested to encourage the GCC-membered countries' population toward FinTech. |
| RQ4. | Using the literature as an evidence, what is level of FinTech implementation in the State of Qatar? | Based on the available knowledge as an evidence, the proposed research questions focuses on outlining the level of implementation and usage of FinTech-driven applications in the State of Qatar. Also, it aims to find the new ways to encourage the FinTech-driven applications in the State of Qatar based on the analysis work. |
| RQ5. | What are the social impacts of FinTech on the GCC region? | The prime motivation behind this research question is to outline the social impacts of FinTech-driven applications on different communities in the GCC member countries. |

**Figure 4.** The search process.

After completing the inclusion and exclusion process a final set of relevant articles is developed for the systematic analysis. It consists of 91 relevant articles. All these steps are discussed in details below.

Preliminary steps

These are the prime steps of any SLR work and considered as the backbone for the systematic mapping work. These steps consist of:

Research questions. For committing this systematic mapping, we couched five different research questions (RQs), depicted in Table 1. These research questions

were framed by keeping the goal in mind to analyze the FinTech domain with different perspectives.

Search strategy. After crafting the research questions, the next step is to define a search strategy for collecting relevant research articles. The search strategy followed for the proposed research work is depicted in Figure 4 below. During the articles accumulation process, all the articles are downloaded from the library using a search query (based on the finalized research keywords). This query was furtherly tuned and refined based on the library requirements and results. In case if more non-relevant articles retrieved then the query was more refined and become more specific to the topic of interest (this not only ensures the accumulation of most relevant articles but it also makes the inclusion/exclusion process more simpler; as there are no more redundant or non-relevant articles to exclude).

After finalizing the search process (to download relevant articles), the next step is to target the peer-reviewed online repositories to accumulate relevant articles. In our case we selected IEEE Xplore, ScienceDirect, Taylor & Francis, SpringerLink, and Wiley online library as depicted in Figure 5. Based on the RQs, the keywords were identified, and then queries were framed to download articles from the targeted online repositories. The queries were tuned based on the search results and relevant articles. Snowballing⁴⁰ was used to ensure the accumulation of each article. A total of 6824 articles were accumulated during the search process as depicted in Figure 7.

The pool of relevant articles

To develop a final pool of relevant articles, inclusion and exclusion criteria is defined as depicted in Figure 6

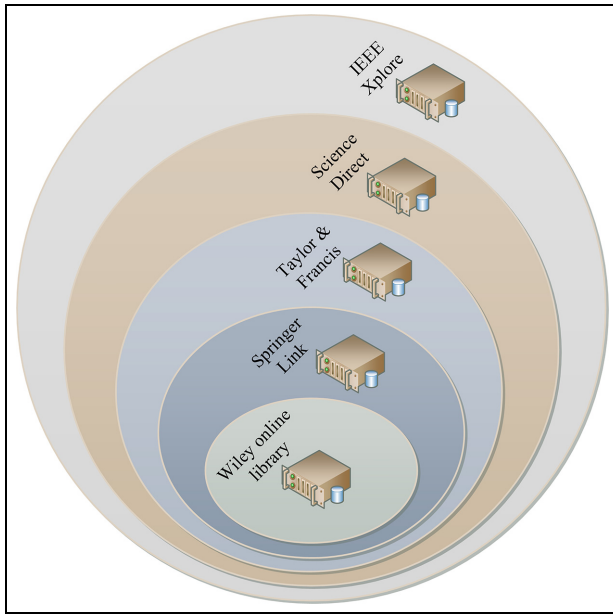


Figure 5. Online databases used for articles accumulation purposes.

below. It is the most hectic job in an SLR work to decide for whether an article should be included in the final pool or not? As this step laterally ensures the quality of a systematic research work. To address this problem, we (the authors) combinedly searched each library and downloaded articles. A manual voting mechanism is followed to validate the relevancy of a certain research article with the selected topic. For the inclusion or exclusion of an article, if more than half were agreed, then that paper was included, otherwise excluded from the final pool of relevant articles.

After searching the libraries and follow the search criteria represented in Figure 6, the number of articles retrieved are depicted in Figure 7 below.

During this initial search process, we retrieved a huge number of articles for each research question.

Still, the prime objective of this step is only to select the most relevant research articles. So, the accumulated themes were further refined and assessed based on the title, abstract, and description (contents) presented in the paper. The corresponding results of this filtering process are depicted in Figure 8. A total of 91 articles were finalized for the assessment and analysis purposes.

The details regarding number of journal articles, conference papers, case studies, and review articles contributed in the final pool is depicted in Table 2.

Quality assessment criteria

After developing a final set of relevant articles, the next important step is to analyze each article against each research question using a certain quality criterion. A grading mechanism is ensued to validate all 91 research articles. The grading mechanism followed for this systematic assessment process is : (1) If an article exactly answers a specific research question, then it is allotted a weighted numerical value of 1, (2) If a certain research article fragmentarily satisfies a research question, then it is allotted a numerical weighted value of 0.5, and (3) If a research papers fails in satisfying a research question then it is assigned a value of 0 (this represents the irrelevancy of an article with that particular research question).

After accomplishing the quality assessment process, the relevancy of each article along with aggregate score (by adding all the grading scores for each article). The underlined results are depicted in Figure 9 below.

The highest aggregate value represents the most relevancy of an article with the selected research domain.

Results and discussions

With the unremitting flux of digital and technological transformation, we are now avouching rampant disruptions in financial and banking sectors that are

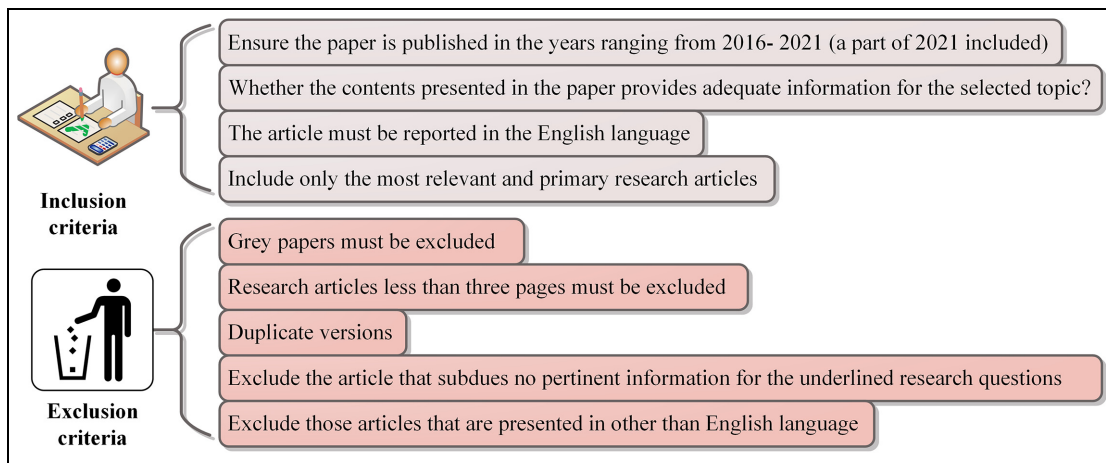


Figure 6. Articles selection criteria during the search process.

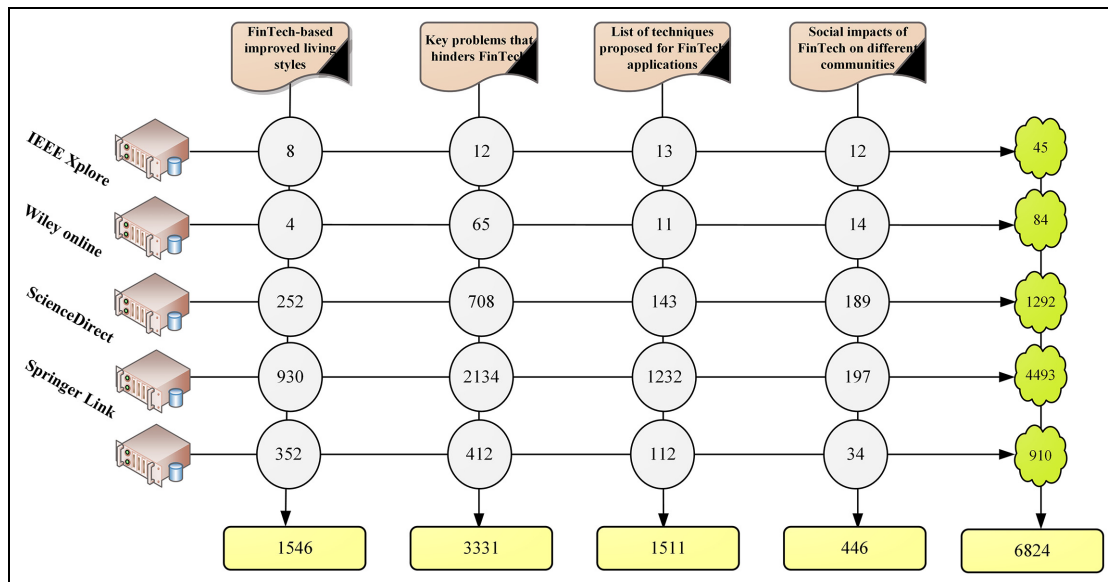


Figure 7. Number of articles retrieved during the initial search process.

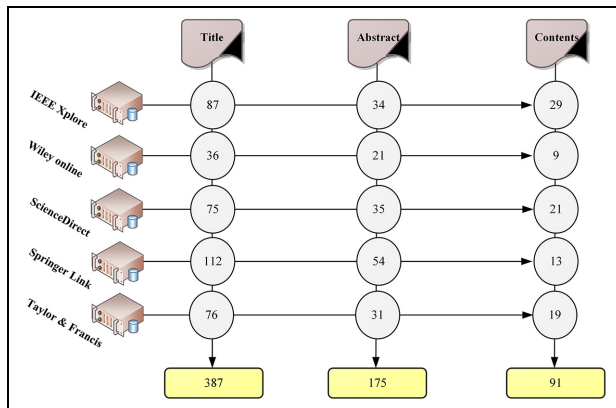


Figure 8. Contribution of research articles in the final pool.

considered the most aching sectors nowadays. Especially with the emergence of FinTech, a fat umbrella term that portrays disruptive technologies in the financial services sector. Globally, total investments in the FinTech have grown exponentially from \$1.8 billion in 2010 to \$19 billion in 2015.^{119,120} Keeping in view the interest of business tycoons in the FinTech-driven applications, the researchers paid a significant attention toward the development of smart FinTech-based applications. This section of the paper aims to analyze the published research work by identifying the gaps in the literature and bridge these gaps by suggesting new gateways for future research directions.

How FinTech-driven applications offer improved living styles in developed countries?

After scrutinizing the extant it was concluded that the countries that cognate with the advents in the information system and FinTech-driven applications were

nowadays considered as the developed countries in the world like United States of America, China, United Kingdom, and a few others. In contrast, the countries they tried to adapt these technologies, but face challenges are nowadays listed as the developing countries such as India, Pakistan, Iran, etc. Laterally the countries shown less interest or left far behind from the aforementioned categories are listed in underdeveloped countries such as South Sudan, Central African Republic, and many others. Gearing these smart financial applications, the developed countries have mostly the non-cash communities and an easy access interface for the poor people to start new business startups, etc. Some of the improved living styles that were recorded in the published research work are depicted in Table 3.

After assessing the final relevant articles, it was concluded that FinTech-driven applications have staged an improved living styles for its users with the help of Blockchain assisted smart solutions. These smart solutions ensure integrity of sensitive information, frugality of new knowledge, women empowerment, easier transaction and mobile payment interface, borrowing money from banks for cars, homes, and other basic needs.

What are the key problems that hinders the FinTech in the GCC region?

Based on the IMF reports the GCC member countries (including six countries named Bahrain, Kuwait, Oman, Kingdom of Saudi Arabia (KSA), United Arab Emirates (UAE), and the State of Qatar) are listed in developing countries list.^{121,122} After thoroughly analyzing the extant, it was concluded that some of the GCC member countries like Turkey, KSA, UAE, Bahrain and the State of Qatar have reported significant work and encouraged FinTech-based revolution

Table 2. Evolution of final pool.

| Online databases | Conference papers | Journal articles | Case studies | Review/Survey papers |
|----------------------|---|---|---|--|
| IEEE Xplore | Mehrotra, ³² Duque et al., ³³ Warjiono et al., ³⁴ Woo Young and Soo Dong, ⁴¹ Fernando et al., ⁴² Mei et al., ⁴³ Pantelieieva et al., ⁴⁴ Seara et al., ⁴⁵ Xiang et al., ⁴⁶ Itkin et al., ⁴⁷ Kalra, ⁴⁸ Siek and Sutanto, ⁴⁹ Ahmed and Kumar, ⁵⁰ Arora and Kaur, ^{51,52} Caragea et al., ⁵³ Jonny and Kriswanto, ⁵⁴ Legowo et al., ⁵⁵ Rangkuti et al., ⁵⁶ and Kumar, ⁵⁷ Selim, ⁵⁸ Yohanes et al. ⁵⁹ | Sinha, ⁶⁰ Xiang et al. ⁶¹ | Mehrotra, ³² Rangkuti et al., ⁵⁶ Nomakuchi ⁶² | Almuhammadi, ⁹ Mehrban et al., ³⁵ Fernando et al., ⁶³ Paul and Sadath ⁶⁴ |
| Elsevier | | Anagnostopoulos, ⁶⁵ Buchak et al., ⁶⁶ Acar and Citak, ⁶⁷ Jünger and Mietzner, ⁶⁸ Bollaert et al., ⁶⁹ Carlini et al., ⁷⁰ Chen et al., ⁷¹ Jiao et al., ⁷² Laidroo et al., ⁷³ Lee et al., ⁷⁴ Zhang et al., ⁷⁵ Davis et al., ⁸³ Gozman et al., ⁸⁴ Bernards, ⁸⁵ Boratyńska, ⁸⁶ Demir et al., ⁸⁷ Friedline et al., ⁸⁸ Laidroo and Avarmaa, ⁸⁹ Palladino, ⁹⁰ Brown and Piroška, ⁹¹ Kanga et al., ⁹² Kong and Loubere, ⁹³ Wang et al., ⁹⁴ Yao and Song ⁹⁵ | Muthukannan et al., ³¹ Leong et al., ⁷⁶ Sheng ⁷⁷ | Degerli, ¹⁰ Banna et al., ¹⁷ Lee and Shin, ⁷⁸ Dranev et al., ⁷⁹ Thakor, ⁸⁰ Boot et al., ⁸¹ Wang et al. ⁸² |
| Taylor & Francis | | Yoon and Jun, ¹⁰⁰ Chan and Ji, ¹⁰¹ Zhang et al., ¹⁰² Zhang et al., ¹⁰³ Lagna and Ravishankar ¹⁰⁴ | Fosso Wamba et al., ¹ Chen ³⁶ , Bu et al. ⁹⁶ | Mention ⁹⁷ , Panos and Wilson, ⁹⁸ Hua and Huang ⁹⁹ |
| Wiley online library | | Belouafi, ⁶ Chinnasamy et al., ⁷ Griffiths, ¹⁰⁹ Imerman and Fabozzi, ¹¹⁰ Mitra and Karathanasopoulos, ¹¹¹ Awotunde et al., ¹¹² Miwa and Matsui, ¹¹³ Mohamed et al. ¹¹⁴ | Friedline and Chen, ¹⁰⁵ Flögel and Beckamp ¹⁰⁶ | Das, ¹⁰⁷ Yao and Song ¹⁰⁸ |
| Springer Link | Bashayreh and Wadi ⁸ | | Anand and Mantrala ¹¹⁵ | Li et al., ¹¹⁶ Puschmann, ¹¹⁷ Haddad and Hornuf ¹¹⁸ |

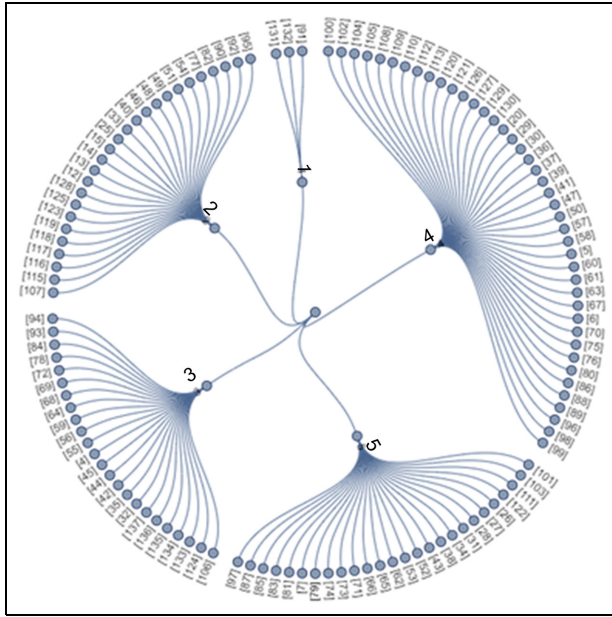


Figure 9. Relevancy of each article with the proposed research problem.

in their financial and banking sectors but still there is a lot of work to do to track the FinTech and meet with the digital revolution. A survey report¹²³ aired in 2017 has shown the level of regulation activity in the middle east including GCC region. Figure 10 represents the GCC member countries regulation report.

Some of the key problems that hinders the FinTech to open its headwings with full capacity in the GCC region are listed below.

- **Uncertainty** – The GCC region has found historically slow in acclimating international standards or accept technological changes to legal systems. Mostly this region leave many uncertainties regarding the implementation of rights and obligations.
- **Language barrier** – Multiple financial investors face difficulties in collecting the suitable people to ease their introduction to markets in the GCC region due to language barriers and limited resources. Mostly, this major problem causes many firms to struggle in the market.
- **Hedge to foreign investors** – Some jurisdictions in the State of Qatar and United Arab Emirates, give permission to a non-national (or non-GCC) shareholder to hold only 49% of a company. Consequently, the investors hesitates in investing capital with an unknown local partner.
- **Elevated risk and sensitivities** – Globally cyber-attacks are considered as the key problem to be handled carefully especially in the financial sector. Because if not handled carefully, it must leads to reputational harms and other significant disruptions. From regional instability to

geographic proximities this problem is extremely sensed in this region (GCC countries), and the news reports have kindled business across this region as endangered. Furthermore, the privacy laws most oftenly meant to defend national security and can be restricted in scope in certain jurisdictions. Moreover, terrorist funding is another big problem in this region, and some jurisdictions to address this may inadvertently hinders the emergence of FinTech-driven applications.

- **Unexploited IP regime** – IP protection laws are defined for the GCC region; and brand rights are well recognized. Now this is possible to get patents that can cover the GCC region in whole. However, enforcing these laws and regulations the regime remains nascent in terms of copyright issues, industrial design and patents equated with some other jurisdictions. Consequently, the FinTech entrepreneurs can be dubious to invest capital for the development of the GCC region.
- **Biddability costs** – A huge amount is required for local operations including KYC/CDD checks and mitigating biddability risks.

These are some of the prime reasons that restricts the FinTech to open its wings with full strength in the GCC region. If these problems are addressed on priority basis then FinTech can be emerged in this region with full hype. Resultantly, the living styles of the population living in this region will be enhanced.

Based on the extant, what are different techniques suggested to encourage the GCC population toward the FinTech-based applications?

From the literature it was concluded that numerous models and techniques were adapted to develop smart FinTech applications by using mathematical and analytical applications. Some of the researchers performed case studies to inform people about FinTech applications and flaws in the traditional business models. While some researchers inspired from the extensive applications of machine learning techniques in diverse domains (healthcare,¹²⁴ internet security,^{125–127} text recognition domain,^{128–130} and many others) suggested machine learning models during the development of FinTech-driven applications to analyze the sentiments of the population regarding FinTech applications. List of other models and other techniques suggested are depicted in Table 4 below.

From the above discussion presented in Table 4 it is concluded that the researchers paid a significant attention toward the machine learning models to analyze the behavior of multiple user regarding FinTech applications. Though a lot of work has been reported from the developed countries but comparatively there is no significant work reported from the GCC member countries.

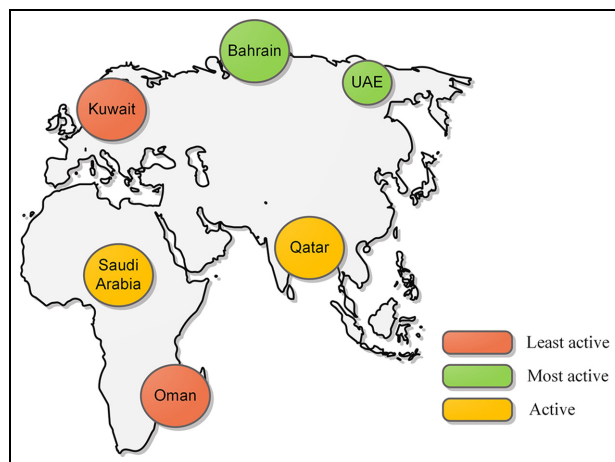
Table 3. Different living styles improved by FinTech-driven applications.

| No. | Facilities | Description | Paper ids |
|-----|---------------------------------|---|---|
| 1. | Digital wallet | A digital wallet or shortly e-wallet is considered as a software-driven application capable of storing payments information and passwords of a certain user for other payment mechanisms and websites. With the help of an e-wallet, users can buy stuffs quickly and in timely manner with near-field information technology. They facilitate in creating stronger passwords without worrying about misuse or can be remembered for later purposes. e-wallets can also be used in combination with mobile payment applications that allows the customers to pay for purchased goods from his/her smartphone devices. | Fosso Wamba et al., ¹ Almuhammadi, ⁹ Ahmed and Kumar, ⁵⁰ Jiao et al., ⁷² Laidroo et al. ⁷³ |
| 2. | e-commerce | E-commerce is the process of selling and buying of services and goods, or sending funds or data, primarily using an internet connection. These transactions can be in the form of business-to-business (B2B), business-to-consumer (B2C), consumer-to-consumer or consumer-to-business. | Jiao et al., ⁷² Laidroo et al., ⁷³ Puschmann, ¹¹⁷ Haddad and Hornuf ¹¹⁸ |
| 3. | P2P lending | In the age of information systems and technological revolution the credit markets are also termed as P2P (peer-to-peer) mechanism. While some researchers have surveyed diverse P2P lending mechanism. | Fosso Wamba et al., ¹ Pantelieieva et al., ⁴⁴ Xiang et al., ⁴⁶ Siek and Sutanto, ⁴⁹ Bollaert et al., ⁶⁹ Jiao et al., ⁷² Laidroo et al., ⁷³ Thakor, ⁸⁰ Boot et al., ⁸¹ Puschmann, ¹¹⁷ Haddad and Hornuf ¹¹⁸ |
| 4. | Mobile payments | A mobile payment mechanism allows the customers to pay for purchased goods from his/her smartphone devices. It is a presentative FinTech service, and there are a number of payment methods in operation such as Samsung Pay, Apple Pay. | Fosso Wamba et al., ¹ Almuhammadi, ⁹ Woo Young and Soo Dong, ⁴¹ Pantelieieva et al., ⁴⁴ Laidroo et al., ⁷³ Puschmann, ¹¹⁷ Haddad and Hornuf ¹¹⁸ |
| 5. | Banks efficiency | Selecting China's banks as evidence the authors in these research articles outlined the implications of FinTech development. The coinages in the FinTech applications has not only enhanced the cost efficiency of banks, but also enhanced the technology used by banks. | Nomakuchi, ⁶² Lee et al., ⁷⁴ Sheng, ⁷⁷ Wang et al. ⁸² |
| 6. | Optimum daily life requirements | In this research work the authors used the data of Alibaba's ant financial official website with the help of Ant Forest model. They found that Ant Forest with the use of FinTech can play significant roles for acquiring sustainable development goals, grazing from land restoration, carbon emission reduction, optimum health services, poverty reduction, and many others. | Zhang et al., ⁷⁵ , Kong and Loubere ⁹³ |
| 7. | Crowdfunding | Crowdfunding is the commitment of financing an endeavor (project) by elevating small amounts of money from a huge number of users, over the Internet. Crowdfunding is a model of crowdsourcing and substitute to finance. Globally, a huge amount of \$34 billion was recorded with crowdfunding in 2015. | Fosso Wamba et al., ¹ Xiang et al., ⁴⁶ Griffiths ¹⁰⁹ |
| 8. | Vehicle loan | The authors has developed an augmented banking mechanism by using smart IoT systems. Furthermore, a case study was performed for developing smart IoT-based smart vehicle loans has also been presented. | Arora and Kaur ⁵¹ |
| 9. | Sensitive problems | In this research article the author surveyed the FinTech-driven application for different types of sensitive problems. These sensitive problems include security, privacy, threats, and cyber-attacks. At the end it was concluded that FinTech uses different cloud computing, Big Data analytics, and Blockchain-based optimum solutions to ensure no occurrence of these sensitive problems. | Mehrban et al., ³⁵ Yohanes et al., ⁵⁹ Paul and Sadath, ⁶⁴ Davis et al., ⁸³ Bernards, ⁸⁵ Miwa and Matsui ¹¹³ |

(continued)

Table 3. Continued

| No. | Facilities | Description | Paper ids |
|-----|-------------------|--|--|
| 10. | New knowledge | The FinTech applications has provided an opportunity for the academics and industry professionals to get new insights about diverse fields. | Mitra and Karathanasopoulos ¹¹¹ |
| 11. | Women empowerment | In this research article the authors concluded by performing case studies about FinTech. They resulted that the FinTech-driven applications have improved the standard of livings especially for women to do banking and financial activities from home. | Mohamed et al. ¹¹⁴ |

**Figure 10.** Level of FinTech regulation in GCC region.

Using the literature as an evidence, what is level of FinTech implementation in the State of Qatar?

After analyzing the literature it was concluded that United Arab Emirates,¹³¹ Turkey,^{10,132} Saudi Arabia,¹³³ and the State of Qatar^{134–136} has shown a keen interest in adopting FinTech-driven applications in high regulation sectors including banking and financial sectors. This keen interest in adopting the new technologies has strengthen the abilities of these countries to face the hard challenges of Covid-19 pandemics compared to other GCC member countries. Although Kingdom of Bahrain has also shown interest by encouraging its population especially women to follow FinTech-driven applications.^{50,114}

From the extant it is concluded that a lot of research work must be carried on from this region (GCC) by introducing a Blockchain driven, and venture capitalist facilitated ecosystem. This research work will help in: (1) creation of new markets and new startups; (2) improved deliverables costs; (3) better processes; (4) commercial evaluation of trades and professions; (5) innovative workflows; (6) smart revenue and regulation scheme; (7) skill evaluation of an institution per unit area; (8) reduction in the OPEX and CAPEX of state development bodies; and (9) achievement of new

knowledge regarding blockchain and crowdfunding-based FinTech applications.

What are the social impacts of FinTech on the GCC region?

After boning the reported research work in the FinTech domain, it was concluded that the countries that cultivates smart applications especially the FinTech-driven applications in their business and financial sectors, they provided an easy interface for serving both the poor and rich communities. Assisting the poor community by providing an easy access to borrow money for their basic needs including education, new business startup, or building homes etc. On the other hand, profiting the richer community by providing a safe and secure model where they can invest, can authenticate, availability of error proven systems etc. Also these FinTech driven applications ensures no provides high facilities to its customers and poor communities by restricting corruption and illegal fees by providing non-cash community,³ smart intelligent interface using advanced artificial intelligence and machine learning models,^{137,138} presenting globalized economy, providing a centralized controlling mechanism where the customers can have access from everywhere and every time. A huge number of social impacts that influences our lives are depicted in Figure 10 below. Sci2 Tool¹³⁹ is used to sketch the Figure 11.

On the other hand the GCC member countries (Yemen, Syria, and others) that do not follow or show interest (due to unstable environment or some other reasons) in adapting these FinTech based applications (in their high regulation sectors including banks and financial organizations) are extensively influenced from corruption, instability, money laundering, imbalance transfer of money in different hands, no centralized control, no authentication and integral interface, cash oriented exchange services (that are full of fraudulent, black money, fake currency notes etc.), poverty, voracity, and many others.

In order to control these key problems in the GCC member countries a significant attention is required from both the research communities and financial organizations. The research community must work on

Table 4. List of techniques suggested to encourage the population toward FinTech.

| No. | Techniques uses | Description | Paper ids |
|-----|-------------------------------------|---|---|
| 1. | Shadow banks | Since 2007–2015, an exponential growth recorded for shadow banking among online “FinTech” lenders. The authors analyzed the two forces, regulatory differences and technological advantages, contributed to this growth. In contrast to other shadow banks, FinTech loaners serve more creditworthy borrowers and contributing more in the re-financing markets. | Buchak et al., ⁶⁶ Wang et al., ⁹⁴ Chan and Ji ¹⁰¹ |
| 2. | Ecosystem | In this study work, the authors introduced a historical view of FinTech and outlined the ecosystem of the FinTech domain. They outlined multiple FinTech business models and various types of investment. This article flush light on the use of real time decision for FinTech investment. While the researchers from India performed simulations on complex adaptive systems (CASs) model to evaluate the advent of a worldwide self-sustained ecosystem: The “FinTech Valley” in Vizag, India. | Muthukannan et al., ³¹ Lee and Shin, ⁷⁸ Imerman and Fabozzi ¹¹⁰ |
| 3. | AI and ML-based models | In this research article the authors reviewed the effects of FinTech emergence versus the more liberal environment in the finance industry. For identifying the sentiments of its customer diverse artificial intelligence (AI) and machine learning (ML) based models are suggested. These techniques include hidden Markov models, support vector machine, Naive Bayes classifier, deep learning based regression and classification models, and many others. | Chinnasamy et al., ⁷ Duque et al., ³³ Warjiyono et al., ³⁴ Mei et al., ⁴³ Seara et al., ⁴⁵ Caragea et al., ⁵³ Selim, ⁵⁸ Anagnostopoulos, ⁶⁵ Jünger and Mietzner, ⁶⁸ Boot et al., ⁸¹ Laidroo and Avarmaa, ⁸⁹ Palladino, ⁹⁰ Yao and Song, ⁹⁵ Mention, ⁹⁷ Panos and Wilson, ⁹⁸ Yoon and Jun, ¹⁰⁰ Das, ¹⁰⁷ Awotunde et al., ¹¹² |
| 4. | Case studies | In these research articles the authors performed case studies to evaluate the introduction of a FinTech company in China that suggests microloans for the students of colleges. While the researchers from India performed simulations on CASs model to evaluate the advent of a worldwide self-sustained ecosystem. | Belouafi, ⁶ Bashayreh and Wadi, ⁸ Banna et al., ¹⁷ Muthukannan et al., ³¹ Mehrotra, ³² Chen, ³⁶ Kalra, ⁴⁸ Arora and Kaur, ⁵¹ Rangkuti et al., ⁵⁶ Chen et al., ⁷¹ Leong et al., ⁷⁶ Friedline et al., ⁸⁸ Bu et al., ⁹⁶ Zhang et al., ¹⁰³ Flögel and Beckamp, ¹⁰⁶ Yao and Song, ¹⁰⁸ Mohamed et al., ¹¹⁴ Anand and Mantrala ¹¹⁵ |
| 5. | POC-based processing model | In this research paper the authors presented an integration process for different financial sectors by embedding the business experience of Kuveyt Turk Participation Bank in Turkey. In this integration process all the employees’ experience, customer feedbacks, demands of different departments, online databases were included. They divided this integration process into seven phases and developed a proof of concept (POC) processing model for the integration process. | Acar and Çıtak, ⁶⁷ Zhang et al. ¹⁰² |
| 6. | FinTech M&A and FTF | After observing the significance of FinTech business firms in the current mergers and acquisitions (M&A) and FinTech firms (FTF) from an investor point of view, this paper investigates the post-acquisition capabilities of the acquirer firms calculated using abnormal returns. They also studied its (M&A and FTF) influence on stock-returns. | Carlini et al., ⁷⁰ Chen et al., ⁷¹ Dranev et al. ⁷⁹ Lagna and Ravishankar, ¹⁰⁴ Li et al. ¹¹⁶ |
| 7. | P2P lending mechanism | In the age of information systems and technological revolution the credit markets are also termed as P2P (peer-to-peer) mechanism. While some researchers have surveyed diverse P2P lending mechanism. | Xiang et al., ⁴⁶ Siek and Sutanto, ⁴⁹ Bollaert et al., ⁶⁹ Thakor, ⁸⁰ Boot et al. ⁸¹ |
| 8. | Blockchain-assisted smart solutions | To develop a secure and accurate FinTech-driven applications the researchers suggested Blockchain-assisted smart solutions. This integration of Blockchain-assisted technique injected a new strength to FinTech applications to dart its headwings. | Fosso Wamba et al., ¹ Thakor ⁸⁰ |

(continued)

Table 4. Continued

| No. | Techniques uses | Description | Paper ids |
|-----|----------------------------------|--|--|
| 9. | FinFI | FinTech transformations are quickly innovating the worldwide finance sectors and alleviating the financial inclusion enterprises of microfinance institutions (MFIs). However, no significant evidences were confirmed that reflects the influence of FinTech-assisted financial inclusion (FinFI) on the risk-assuming sentiments of Sub-Saharan African MFIs. | Banna et al. ¹⁷ |
| 10. | Digital wallet | A digital wallet or shortly e-wallet is considered as a software-driven application capable of storing payments information and passwords of a certain user for other payment mechanisms and websites. With the help of an e-wallet, users can buy stuffs quickly and in timely manner with near-field information technology. They facilitates in creating stronger passwords without worrying about misuse or can be remembered for later purposes. e-wallets can also be used in combination with mobile payment applications that allows the customers to pay for purchased goods from his/her smartphone devices. | Almuhammadi, ⁹ Ahmed and Kumar, ⁵⁰ Jiao et al., ⁷² Laidroo et al. ⁷³ |
| 11. | Mobile payments | The mobile payment applications allow the customers to pay for purchased goods from his/her smartphone devices. | Almuhammadi, ⁹ Woo Young and Soo Dong, ⁴¹ Pantieleieiva et al., ⁴⁴ Laidroo et al. ⁷³ |
| 12. | stochastic metafrontier approach | Selecting China's banks as an evidence the authors in these research articles outlined the implications of FinTech development. The coinages in the FinTech applications has not only enhanced the cost efficiency of banks, but also enhanced the technology used by banks. | Lee et al., ⁷⁴ Sheng, ⁷⁷ Wang et al. ⁸² |
| 13. | Ant Forest model | In this research work the authors used the data of Alibaba's ant financial official website, as well as remote sensing data, to evaluate how the Ant Forest contributes to land restoration and its socio-economic effects. They concluded that Ant Forest can play significant roles for acquiring justifiable development goals, grazing from health improvements, land restoration, and many others. | Zhang et al., ⁷⁵ Kong and Loubere ⁹³ |
| 14. | Technology acceptance model | In this research work the authors proposed technology acceptance model (TAM) to test the applicability of financial instruments via pilot studies with the help of 133 different communities as prime contributors. This is a quantitative research work simulated using smart pls v3.0 dataset. | Fernando et al., ⁴² Fernando et al. ⁶³ |
| 15. | crowdfunding | Crowdfunding is the commitment of financing an endeavor (project) by elevating small amounts of money from a huge number of users, over the Internet. Crowdfunding is a model of crowdsourcing and substitute to finance. Globally, a huge amount of \$34 billion was recorded with crowdfunding in 2015. | Xiang et al., ⁴⁶ Griffiths ¹⁰⁹ |
| 16. | Structural Equation Model | The research work has proposed the use of the quantitative method for identifying the influence of FinTech over different communities. Structural Equation Model (SEM) is performed using smart pls v2.0 for analysis and assessment process. | Jonny and Kriswanto, ⁵⁴ Fernando et al. ⁶³ |
| 17. | User-Assisted Log Analysis | In this paper, the authors presented the use of semi-automatic assessment of the sentiment of clearing and settlement system by utilizing its history for identifying and recognizing errors. | Itkin et al. ⁴⁷ |
| 18. | Augmented banking | This paper has used a cloud centric smart IoT-based design for banking and financial organizations. Additionally, a case study is processed to check the requests for vehicle loans. | Arora and Kaur ⁵¹ |

(continued)

Table 4. Continued

| No. | Techniques uses | Description | Paper ids |
|-----|---|--|--|
| 19. | interpretive-exploratory paradigm | This study work has proposed a descriptive-qualitative research design assisted by interpretive-exploratory paradigm. Simulational data was obtained through secondary data from multiple research journals, articles, and government agencies. | Arora and Kaur ⁵² |
| 20. | RERT | In this paper the authors used annotated dataset for training deep learning models, specifically RNN and CNN networks in combination with BERT transformers. They validated their model on a comparatively comprising 25,580 FinTech patent applications presented in the European and US Patent Offices during 2000–2017. | Caragea et al. ⁵³ |
| 21. | Exploratory Sequential Mixed Method (ESMM) approach | This article presents ESMM technique inspired from a mixedmethod technique. The underlined results show that FinTech has significantly encouraged by financial gurus. In Indonesia, the FinTech has a significant role in sustainable development projects including Financial as well as Banking sectors. | Legowo et al. ⁵⁵ |
| 22. | SOE SMEs | In these research articles a detailed model of Chinese small and medium-sized hi-tech enterprises (SMEs) is presented, and it was found that state-owned enterprises (SOEs) and family firms and financially constrained firms are comparatively low and more probable to adapt FinTech investments. | Xiang et al., ⁶¹ Hua and Huang ⁹⁹ |
| 23. | UTAUT model | This research article evaluated an application Member XYZ based on Unified Theory of Acceptance and Use of Technology (UTAUT) architecture. This article has proposed analytical approaches and processed the data using SmartPLS. | Yohanes et al. ⁵⁹ |
| 24. | SWIFT's Innoribe competition | A cluster based mechanism is used to enhance the appreciation of the global FinTech chorography. It solely depends upon the evaluation of start-ups that contributed in SWIFT's Innoribe competition. | Gozman et al. ⁸⁴ |
| 25. | DIPLOM model | This research work has proposed a model of digital shifts and elements of ecosystems theory and integrating them to solve FinTech problems. For this theory development corporate diplomacy is used based on the DIPLOM model. | Boratyńska ⁸⁶ |
| 26. | quantile regression approach | These research article has investigated the companionship among FinTech, financial inclusion and income inequality for a group of 140 countries with the help of Global Findex waves of survey data for 2011, 2014, and 2017. | Demir et al., ⁸⁷ Kanga et al. ⁹² |
| 27. | Regulatory Sandbox | In these research studies regulatory sandbox is proposed for discourses of resolution and solvability. These researchers considered FinTech as a socio-technical development model for the integration of these discourses. | Brown and Piroška, ⁹¹ Friedline and Chen ¹⁰⁵ |

identifying the easiest ways by selecting venue for workshop or case studies to encourage people to participate and encourage them toward the FinTech-driven applications to improve their living styles. While the financial sectors do invest on these poor communities to assist them by providing an easy access to borrow money for their basic needs.

Future research directions

After polishing this systematic analysis, some future research directions are endorsed in this SLR work. These new research directions will cheer no heterogeneity

among payment schemes in different payment processes, meliorates the financial inclusion of previously excluded market segments, present the strategic capabilities for a firm to occupy a market niche in financial sector, make the poor community in the GCC region able to borrow money for their basic needs (education, cars, safe resident environment, new business startup etc.). Some of the few research directions are depicted in Table 5.

Conclusion

The emergence of FinTech is deliberated as a new paragon for providing potent financial services by

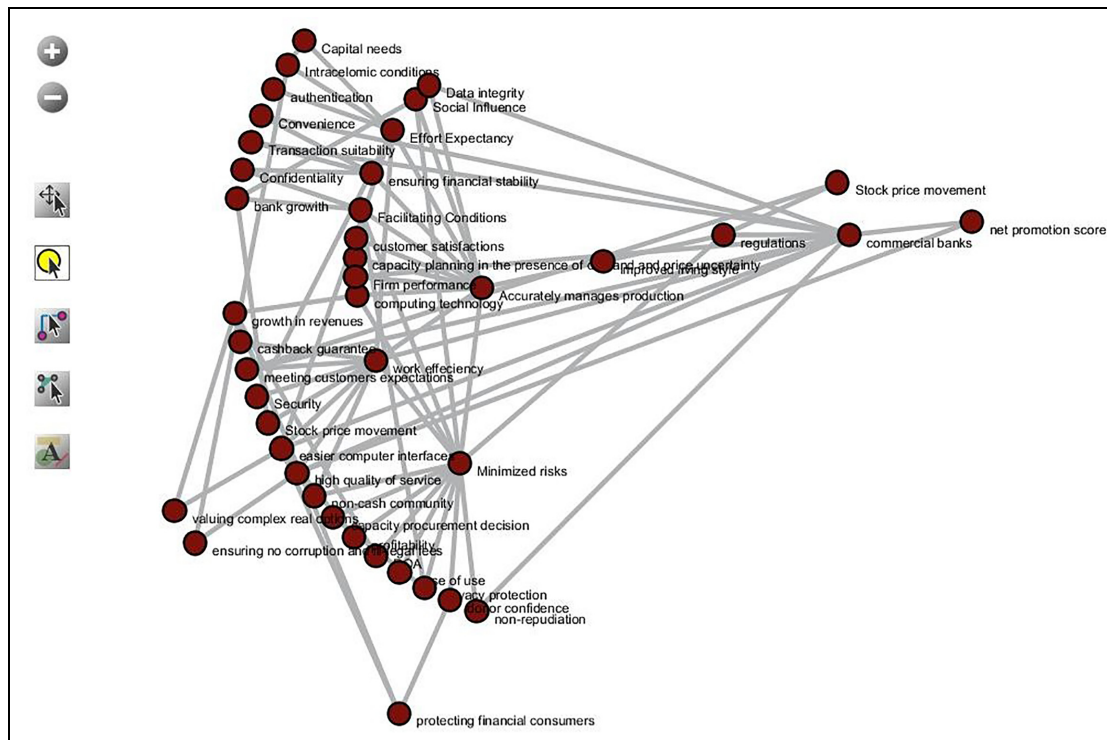


Figure 11. Social impacts of FinTech applications.

Table 5. Future research directions.

| S.No | Research direction | Description |
|------|--|--|
| 1. | Advanced hybrid deep learning models | Some researchers like Warjijono et al. ³⁴ and Seara et al. ⁴⁵ have proposed SVEM, particle Swarm methods, and machine learning techniques for sentiment analysis of FinTech users. But all these models are binary classifiers and shows poor performance in case of multi-class problems (for calculating behavior of people from different multiple aspects). ^{128,140} Advanced hybrid machine learning architectures for cognitive computing are considered as the future toolbox for the data-driven analysis of FinTech data. |
| 2. | Case studies | For retrieving the information in third world countries for identifying the barriers that restrict poor people from borrowing money from their basic needs including education, new business startups etc. And also, a comprehensive is required using case studies to identify the key doubts in customer's mind for availing FinTech services. |
| 3. | Cluster-based techniques | Cluster-based mechanisms should be considered for FinTech data organization purposes to improve FinTech data timely-access and easy-management capabilities. Promoting research in these areas will be crucial for future innovations in the proposed FinTech domain. |
| 4. | Comparatively large amount of data selection | Some researchers in the extant concluded for a limited number of data such as ^{116,141} only selected 47 incumbent US retail banks for the analysis purposes. A comparatively larger dataset must be selected for the optimum investigations and customer's sentiment analysis purposes. |
| 5. | Arranging a workshop | For future theoretical studies and awareness purposes an arrangement of workshops is required to evaluate, how the researchers can implement an integrated theory of financial intermediation capable of accommodating new elements, such as P2P lending and shadow banking, while capturing their economic functions, as well as traditional banking. |
| 6. | Effective monetary policies | In this modern technological age, it is believed that the digitization of money is likely to dominate in the near future, but there is a little knowledge about how the advent of FinTech affected the transmission of pecuniary policy, in addition to the information content of key monetary indicators. To address this issue an effective classical monetary policy is a worthy question for future investigations. |
| 7. | Achieve high financial regulations | After analyzing the literature, it was observed that the extant is almost silent for the new challenges that were arise in the financial regulations after the emergence of the FinTech. |
| 8. | Optimum decision model | After analyzing the literature, it was concluded that a worthy challenge that nowadays facing in the FinTech-driven models is, to make an optimum decision in balancing the desire by encouraging new business structures to intensify competition and present optimum customer services in the organization, while defending both consumers and the systems from excessively risky behavior and potential disruption. |

integrating smart IoT devices. Payment is an imitable FinTech service, and there exists innumerable payment stratagem in operation. However, there exists a potent variegation among payment strategies in the form of payment processes, transaction settlement schemes, and software agent deployments. Accordingly, for any two different payment strategies a payment cannot be established. The gamut of doable financial stability risks graveled by FinTech, which claims a systematic analysis by entities presenting financial stability, is deceived. The demand for presenting a reliable level of information security of financial intermediation, taking into account a digitalization on the basis of new information and communication technologies and information communication systems, is substantiated. To address these problems, a systematic monitoring work is performed, where a total of 91 most relevant research articles analyzed based on five different research questions. The findings of this research work will not only help the state development bodies by encouraging its stakeholders to use FinTech-driven applications in banking, markets, etc. but it will also help the people in maintaining great connections with the Ministries of Foreign Affairs, Economic Affairs, the Dutch regulators, the Dutch Central Bank (DNB), as well as the Authority on Financial Markets (AFM). This systematic mapping offers new research directions for the research community to explore in the near future.

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