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Blockchain technology in the remittance ecosystem: A bibliometric and visualization based analysis

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ABSTRACT

Critical and Emerging Information Technologies (CEITs) greatly influence the current global transforming financial industry and for that matter, blockchain technology is one of the emerging concepts in the financial sector. This technology holds great potential to transform the remittance industry which is an integral part of migration studies in economics. The remittance industry face longstanding challenges like high costs of transaction, slow transaction speeds, limited transparency and financial exclusion, all of which affect the vulnerable populations disproportionately. The study therefore explores the potential solutions in adopting blockchain technology in this industry. This study also examines the bibliometric corpus of research articles on blockchain technology and its role in the remittance industry. Bibliometric analysis is used to study the growing area of research and topics that have been most commonly studied. A total of 109 studies were selected of the time span of 2010- 2024. The VOSviewer software was used to produce the bibliometric results. The findings revealed a deeper understanding of the topic by examining the literature on blockchain technology in the remittance industry, thereby analysing current trends, future research directions, and policy implications. This topic gained popularity in 2017, where a high volume of research was initiated in developed nations such as the United Kingdom and China. The contribution of this study is two-fold, first it aims to contribute in advancing the scholarly understanding and practical pathways for leveraging blockchain technology to achieve financial stability in remittance industry; and secondly, it paves way for future researchers to explore more, thereby leading to ways to achieve the Sustainable Development Goal (SDG) target 10.c, that aims to reduce the transaction costs of remittances by less than 3 percent by 2030.

Keywords: *Bibliometric, remittances, blockchain technology, transaction costs, SDG, VOSviewer, Web of Science, Scopus*

1. Introduction

Remittances represent a key role in the global financial economy, enabling migrants to send money home. But the conventional methods of remitting (formal banking processes, hawala systems[1], etc.) are plagued by inefficiencies, including high transaction costs, lengthy processing times, and regulatory challenges. Blockchain technology[2] holds the potential to transform the remittance industry by offering faster, more secure, and cost-effective means for cross-border remittance (Christodoulou et al., 2024).

For years, remittances have been facilitated by banks, money transfer operators (MTOs) like Western Union and MoneyGram, and informal networks like hawala systems. These traditional methods include various intermediaries, resulting in high transaction costs (6% globally), along with slow processing speed, taking several days to settle (Coutinho et al., 2023). The average global cost of remittance of USD 200 is 6.9% of the transfer. Sustainable Development Goal (SDG) 10.c claims to reduce the cost to less than 3% by the year 2030. Blockchain technology can transform the financial

[1] *The hawala system refers to the method or way for people to transfer money with relative ease. (Faith, 2011)*

[2] *"Blockchain is a Distributed Ledger Technology (DLT) devised to decentralize control and authority." (Coutinho et al., 2023). According to the OECD "Blockchain Primer, a blockchain is a shared ledger of transactions between parties in a network, not controlled by a single central authority."(Prause, 2019)*

angle by reducing these costs of cross-border transactions drastically (Rühmann et al., 2020).

International wire transfers include varied fees, which approximately accumulates to a total of USD 80, varying on factors such as the kind of banks involved, the amount being transferred and the currency conversion rates; moreover, the speed of transfer is usually between three to five business days (Molson, 2018). Even though mobile payment options have been implemented in the remittance industry, the issue of high transaction fees prevails. (Christodoulou et al. 2024)

Intermediaries lead to barriers like transparency, fraud risks, and regulatory system challenges and literature indicates that in developing nations, high costs of remittances disproportionately impact low-income families (Housen et al., 2013). Stringent policies such as Know-Your-Customer (KYC) and Anti-Money Laundering (AML) adds to further delays and operational burdens. Blockchain technology or Distributed ledger technology offers potential solutions to these inefficiencies. The decentralized ledger system eliminates the need for intermediaries, thereby reducing the cost of transactions and also helps improve speed of transactions (Khan et al., 2023).

Blockchain-based cross-border payments can also enable peer-to-peer (P2P) transfers using stable coins and cryptocurrencies, widely used cases of Bitcoin, Ethereum, Ripple (XRP), and Stellar Lumens (XLM) are studied in the previous literature. Additionally, blockchain technology plays a crucial role in achieving Sustainable Development Goals (SDGs), of cost reduction, financial inclusion enhancement and poverty reduction. (Naderi, 2021). Empirical research reveals that blockchain-based transactions can be processed within minutes, as compared to several days in traditional methods of transfers (Ballaschk et al., 2024). Although these 'days' have gradually been converted to several hours of traditional methods, the problem still remains. The United Nations' Sustainable Development Goals (SDG) consist of separate aims and within each goal there are multiple targets. It becomes crucial to understand new and existing literature in any field of study. Given the scenario that almost everything is becoming more integrated with technology, it is essential to understand the convergence of remittances with technology-based systems to achieve efficiency towards reaching the SDGs by 2030.

This study, through bibliometric analysis, therefore explores the potential solutions in adopting blockchain technology in this industry and also examines the bibliometric corpus of research articles on blockchain technology along with its role in the remittance industry. The study empirically attempts to provide a road-map for learning how blockchain plays a role in overcoming the persistent inefficiencies of traditional remittance systems, by reducing costs, accelerating transaction times, and enhancing transparency. By obliterating the need for intermediaries, and by using decentralised ledgers, blockchain-based remittance platforms aim to achieve near-instantaneous financial settlements, and reduce average transaction costs from 6.9% to well below the SDG target of 3% (Rühmann et al., 2020). Ripple and Stellar[3] have significantly enhanced financial inclusion and reduced compliance costs for lower income users (Khan et al., 2023). In order to position blockchain as a transformative force, it is essential to integrate smart contracts[4] and establish balanced regulatory frameworks to achieve faster, cheaper and more secure transactions (Naderi, 2021).

2. Literature review and theoretical framework

Integrating any new force into an already existing system or replacing in the system is what really goes behind policy implications and executions. The same scenario applies for when any new technology is introduced in any established setup. For that matter, our study's theoretical backing is based on the Technology Acceptance Model (TAM) given by Davis in 1985 and advanced in 1989. TAM's focus on individual perceptions makes it suitable for

[3] *Ripple and Stellar are the two most prominent stablecoin and cryptocurrency networks.*

[4] *"A smart contract is an electronic transaction protocol intended to digitally facilitate, verify, or enforce the negotiation and execution of the terms of an underlying legal contract designed to fulfil common contractual conditions comprising payments, legal obligations, and enforcement without third parties."*

studying the adoption of financial technologies and since blockchain technology has surfaced as a transformative force in the financial industry. SWIFT[5], a traditional remittance system faced its competitor Ripple, a blockchain-based alternative cross-border payment system, which leverages distributed ledger technology for fast and cost-effective transactions (Qiu et al., 2019). A comparative analysis between the two suggests that SWIFT benefits from economies of scale in the short run, whereas blockchain-based solutions are expected to disrupt the industry in the long run because of its efficiency, security and reduced dependence on intermediaries.

Zhang et al., (2020) focuses on the integration of blockchain with financial market operations and highlights regulatory barriers as well as scalability issues. Their study also identifies multiple potentials of blockchain like enhancing data processing, credit assessment and cross-border transactions. Cryptocurrencies like Bitcoin adoption are appealing to experts due to their low transaction fees and financial inclusivity (Parino et al., 2018). Hashemi Joo et al., (2020) highlights the vital role of cryptocurrency as the initial successful application of blockchain technology in financial markets. Walton & Johnston (2018) evaluate Bitcoin adoption in South Africa emphasizing that both the enablers and barriers affect cryptocurrency usage. They also highlight the reduction in remittance transaction costs despite ongoing issues of volatility.

From a sectoral landscape, Peters & Panayi (2016) reveal the broader implications for banking ledgers smart contracts and remittances using blockchain technology. They position the technology as a tool for automating financial processes while maintaining its transactional integrity. Rosner & Kang, (2016) discuss that even though Ripple's payment protocol enhances efficiency in cross-border transactions regulators must develop new oversight mechanisms to address the emerging risks associated with it. Papadaki & Karamitsos, (2021) further support this argument in the Middle East and North Africa (MENA) region where unskilled labor is a contributing barrier.

Davis (1985) defines TAM's central paradigms are 'perceived usefulness' (the extent to which a person believes that using the system will enhance their job performance) and 'perceived ease of use' (the extent to which a person believes that using the system will be effortless). Hence, in the context of remittances, it becomes crucial to understand user behavior where technology is involved. Jegerson et al. (2024) examine consumer innovation's role in cryptocurrency adoption for remittances in the United Arab Emirates and highlight that while consumer innovation fosters adoption, widespread acceptance is hindered by perceived risks.

This section of literature review broadly covers all aspects of blockchain adoption and its potential to revolutionize the remittance system and financial markets. However, issues like regulation, scalability and user adoption issues remain key challenges that pave the way for future research and policy development. The TAM model addresses both traditional technology adoption factors and blockchain-specific concerns. Research by Albayati et al. (2020) and Gan & Lau (2024) demonstrates that trust and risk perceptions are crucial moderating factors in the adoption of blockchain financial services. By understanding TAM, our research aims to evaluate not only the efficiency and cost-effectiveness of digital innovations but also the behavioral dimensions influencing their adoption in the remittance landscape

3. Research methodology

3.1 Conceptual framework

The authors tried to capture the essence of this study through a diagram (Figure I). This diagram presents a conceptual framework integration blockchain technology and remittance industry which ultimately leads to the outcome of Sustainable Development Goal 10.c.

[5] *Society for Worldwide Interbank Financial Telecommunication (Seth, 2025)*

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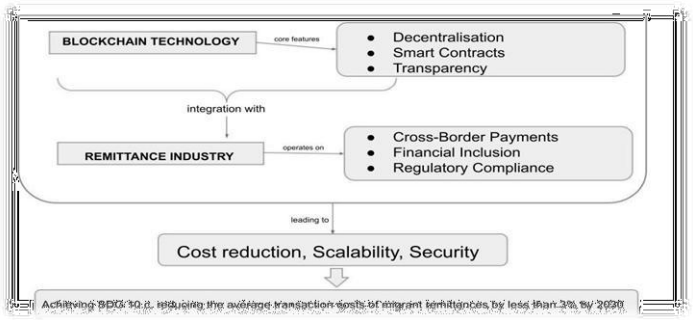
Figure I: Diagram depicting the conceptual Framework



Source: Authors' creation

The dimension containing blockchain technology and remittance industry when put together leads to cost reduction, scalability and security. The blockchain technology in the figure indicates its core functions alongside in the figure comprising of decentralization, innovative smart contracts and transparency. The remittance industry operates on the principles of financial inclusion and regulatory compliance. This combined framework results in cost reduction by eliminating intermediaries, reducing fees and lowering operational costs. It also aims to facilitate secure transactions along with handling large volumes of remittances efficiently to ensure scalability and security. The entire goal of the framework, as well as the study, is to reduce transaction costs by less than 3 percent by 2030 (SDG 10.c).

To understand the possibilities of what the existing literature suggests, and how effective the aforementioned solutions provided via research are, this study provides a complete picture of the extant literature on blockchain technology in the remittance industry by conducting a bibliometric analysis. Precisely, the three vital research questions addressed here are-

RQ1: What is the existing condition of research on blockchain technology in the remittance industry?

RQ2: What are the core themes that emerge from the present literature on blockchain in remittances?

RQ3: How can the ongoing literature on blockchain technology and remittance industry together be advanced?

We address RQ1 by using bibliographic coupling (refer to section 5.1) and co-word analysis (refer to section 4.3) in order to objectively analyze and organize fragmented literature on the topic (Caviggioli & Ughetto, 2019; Khanra et al., 2020). For RQ2, we conduct bibliographic coupling and thematic analysis of the clustered leading articles to map the emergent themes in the blockchain technology in remittance industry literature. In response to RQ3, we offer a roadmap for the future potential gaps and areas where literature is yet to be explored. This study endeavors to consolidate and explain blockchain literature in remittances.

3.2 Data sources and search strategy

Two widely trusted databases by researchers were used to conduct our study. The SCOPUS database, exploited largely by social science peer-reviewed research, is considered the largest interdisciplinary database. (Donthu et al., 2021) and is frequently employed for quantitative analysis (Donthu et al., 2021; Durán-Sánchez et al., 2019). We conducted an extensive literature search using the Social Sciences Citation Index (SSCI) or Science Citation Index Expanded (SCI-EXPANDED) on the Web of Science database. While Scopus contributes to wider disciplinary breadth, Web of Science ensures in-depth coverage of core economic and finance journals thus using both databases removes the biases that individual platforms may cause. Both databases are included to conduct the analysis to ensure validity and comprehensiveness of the study (Mongeon & Paul-Hus, 2016). A thorough list of various articles in CSV format was prepared and processed to provide the requisite structure and format for analysis in the VOSviewer software version 1.6.20, developed by Leiden University, Netherlands, to generate network maps (Zyoud, 2024). VOSviewer is a free and open-source

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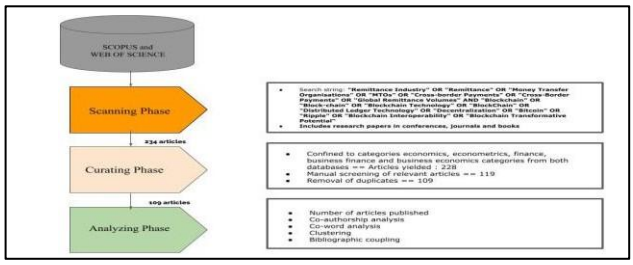
software tool for creating and visualizing bibliometric networks.

3.3 Research method

3.3.1 Bibliometric analysis

Bibliometric analysis includes quantitative techniques, like co-citation analysis, co-word analysis, etc., on the shortlisted data (Broadus, 1987). This method is widely used by researchers to identify and map out the key authors, organizations and countries who have contributed a major portion to the existing literature on the subject matter. (Xu et al., 2018).

Figure II: Bibliometric analysis using Khanra et al. (2020)'s comprehensive bibliometric protocol



Furthermore, it contributes to the knowledge structure of the topic (Caviggioli & Ughetto, 2019), as well as defines the scope of the research topic by suggesting related future research fields (Fahimnia et al., 2015; Khanra et al., 2020). Additionally, this methodology is employed to analyze and record a source of metadata and knowledge diffusion (Ellegaard & Wallin, 2015). Khanra et al. (2020)'s comprehensive bibliometric protocol is adapted, consisting of three stages carried out to scan, curate, and analyze the results. (Refer Figure II)

3.3.2(a) Scanning Phase

The data was collected using keywords relevant to the literature of our research topic. A keyword is a specific search string that is used to get datasets related to any given topic of concern (Setiawan et al., 2024). The literature search was done on January 7, 2025, covering the period from 2010 to 2024. The search terms were "blockchain technology" and "remittances" combined with the Boolean operators "AND" and "OR". The "AND" operator was applied to titles, abstracts, and keywords of documents to ensure relevance (Farid et al., 2016). While the "OR" included synonyms for a more comprehensive dataset. The final form of the search string was:

For SCOPUS Database, we started with a core concept combination yielding nine records ("Remittance Industry" AND Blockchain OR Block-chain). Then, we included synonym expansion ("Remittance Industry" OR "Remittance") AND ("Blockchain" OR "Block-chain"), which also included generic remittance studies, and increased the count to 81—further adding payee terminology, resulting in a marginal increase of 82 records ("Remittance Industry" OR "Remittance" OR "Money Transfer Operators" OR MTOs) AND (Blockchain OR "Block-chain"). We then incorporated wider payment language [… OR "Cross-border Payments"], giving 153 results. Finally, including Global flow perspective and cryptocurrency platforms [… OR "Global Remittance Volumes" AND … OR "Bitcoin" OR "Ripple", leading to a final expansion of 196 records from the SCOPUS database

The final search string for SCOPUS includes following: ("Remittance Industry" OR "Remittance" OR "Money Transfer Operators " OR "MTOs" OR "Cross-border Payments" OR "Cross-Border Payments" OR "Global Remittance Volumes") AND ("Blockchain" OR "Block-chain" OR "Blockchain Technology" OR "BlockChain" OR "Distributed Ledger Technology" OR "Decentralization" OR "Bitcoin" OR "Ripple" OR "Blockchain Interoperability" OR "Blockchain Transformative Potential")

For Web of Science Database, the final search string used in the study was: ("Remittance Industry" OR Remittance OR "Money Transfer Operators" OR MTOs OR "Cross-border Payments" OR "Cross-Border Payments" OR "Global Remittance Volumes" AND (Blockchain OR Block-chain OR "Blockchain Technology" OR BlockChain OR "Distributed Ledger Technology" OR

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Decentralization OR Bitcoin OR Ripple), it retrieved 1419 results. The authors attempted to maintain a similar syntax for both databases to minimize any potential bias (Bramer et al., 2017)

3.3.2 (b) Curating Phase

The scanning phase results were diligently refined by implementing a few boundary conditions (Tandon et al., 2020). The disciplines were restricted to economics, econometrics, and finance in Scopus and Economics, Business Finance, and Business Economics in Web of Science, the publication years were restricted to 2010-2024, and for Web of Science, the Research category was restricted to Business Economics Fand category restriction was set to "Article," which resulted in 228 articles for both the databases. After removal of duplicates, a total of 218 articles were curated. Lastly, the authors manually read the abstracts of 218 articles, and based on their significance to our research question, we finalized the sample to 109 articles. No significant disagreements existed between the authors during the course of study. In cases where interpretative differences arose, we deferred to authors with domain expertise in the subject.

For inclusion and exclusion criteria the results only from 2010-2024 were included in the study, whereas publication types were not an exclusion criterion in this review, to encompass the breadth of published literature in order to provide a landscape of the research agenda. However, no gray literature was included in our study as it is not bound by the same publishing conventions as white literature (Adams et al., 2017)

Donthu et al. (2021) propose analyzing at least 100 papers for a comprehensive yet manageable bibliometric study. With 109 papers, this study gathers meaningful insights despite limited academic exploration. The manual shortlisting of documents ensured the relevance and significant contribution to the analyzed study.

3.3.2 (c) Analyzing Phase

Between the period of 2010 and 2024, a total of 109 papers were analyzed, which contributed to blockchain-based technology in the remittance industry topic. In recent years, there has been an upsurge in academia's interest in this topic. The publications for the area have increased drastically post 2017. (Refer to Figure III). Table I shows the 10 most top prominent authors and countries by the volume of their publications.

Table I: Top 10 most prominent authors and countries by volume of publications

Top 10 Authors			
Based on number of contributions		**Bibliographic coupling**	
Authors	**Articles**	**Authors**	**Total link strength**
Alonso Alvarez, Raul	2	Alonso Alvarez, Raul	116
Burganov R.T.	2	De La Fuente, David	116
De La Fuente, David	2	Fernandez-Vazquez, Simon	116
Duan, Tingting	2	Innet, Supachate	114
Fernandez-Vazquez, Simon	2	Jegerson, Devid	254
Jegerson, Devid	2	Khan, Mehmood	254
Khan, Mehmood	2	Meijueiro, Luis	116
Meijueiro, Luis	2	Mertzanis, Charilaos	254
Mertzanis, Charilaos	2	Rosillo, Rafael	116
Rosillo, Rafael	2	Sethaput, Vijak	114
Top 10 Countries*			
Based on number of contributions		**Bibliographic coupling**	
Countries	**Articles**	**Countries**	**Total link strength**
China	26	China	123
Germany	5	Germany	56
India	12	India	102
South Korea	6	South Korea	153
United Kingdom	7	United Kingdom	58
United States	11	United States	288

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Source: Compiled by Authors

*There are only six countries appearing in the analysis, due to the dominance of research output from a few key countries.

4. Research Methodology and Analysis

Bibliometric analysis helps determine various key elements of publications, authors, keywords, citations, documents, and countries to determine research area and domain related to blockchain technology and remittances. A summary of the analyzed data is provided in table II to ensure methodological transparency, reliability and completeness of the bibliometric study. The time frame from 2010 to 2024 offers comprehensiveness of the study. For an interdisciplinary research, 96 sources are included in the study comprising journals, books, conference proceedings, etc. The breadth of topics is reflected in the author keywords count and index keyword count of 164 and 48 respectively.

Table II: A summary of the analyzed data

Description	**Results**
Timespan	2010-2024
Sources (journals, books, etc.)	96
Documents	109
Document Types	
Articles	50
Conference papers	43
Book chapters	10
Review	5
Editorial	1
Document Contents	
Index keywords	48
Author's keywords	164

Source: Compiled by authors from WoS, SCOPUS database & VOSviewer.

4.1 Evaluation of the number of articles published

The analysis covers 2010 to 2024 and involves 109 shortlisted papers, primarily from 2015-2024. Blockchain technology's impact on remittances is a relatively new research area but is evolving. Figure III depicts a graphical representation of year-by-year publications. For the initial two years, from 2015-2017, the publications were low with only one paper in the year 2015 and 2017 each, and five in 2016, depicting an initial research phase. In the later years, 2018- 2021, publications grew significantly, rising to eight in 2018 and fourteen in 2019, stabilizing at approximately thirteen to fourteen papers per year, thus reflecting increasing recognition of blockchain's potential for remittances. In the years 2022 to 2024, the post-COVID times, publications peaked at sixteen in 2022 and eighteen in both 2023 and 2024 each, suggesting that blockchain's role in cross-border payments had recognized potential in academia, probably after digitalization took a major shift globally due to the pandemic. The stabilization at eighteen papers indicates research maturity focusing towards practical applicability and efficiency. Since bitcoin's public launch in 2009, the concept of blockchain has evolved and gained academic interest in 2015. Blockchain as a disruptive force in remittances was first highlighted by Peters & Panayi (2016).

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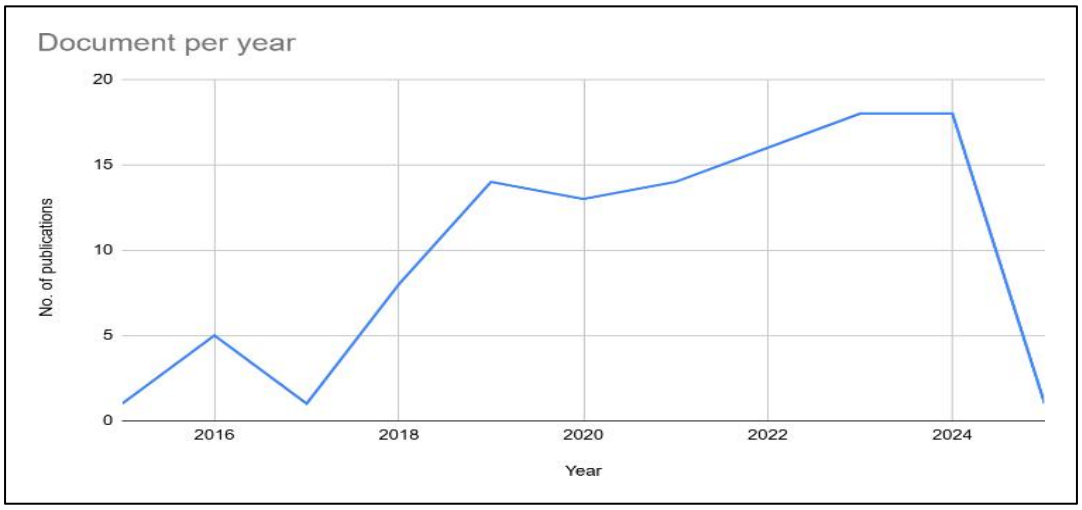
Figure III: Publication trend



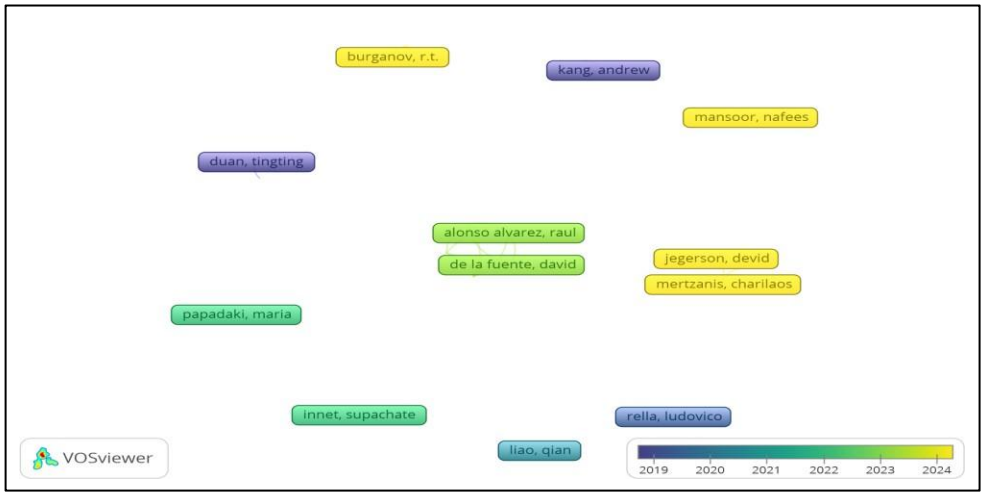
Source: Compiled by authors from WoS and SCOPUS database.

4.2 Co-authorship analysis

4.2.1 On authors

Figure IV shows co-authorship analysis, meaning collaborative networks among researchers in the blockchain and remittance industry. The nodes represent authors, and links indicate co-authored publications. Collaborations from the Western regions of Spain, such as Alonso Alvarez, Raul and De la Fuente, David (Alonso Alvarez R., CTIC Centro Tecnológico, Gijón, Spain; De La Fuente D., Business Management Department, University of Oviedo, Spain) indicate strong research clusters whereas isolated authors indicate solo research efforts. This topic being new in the research world, gives scope for future collaboration and more work for the enhancement of knowledge exchange.

Figure IV: Co-authorship analysis on authors



Source: VOSviewer

4.2.2 On countries

Figure V maps international collaborations in blockchain remittance research. Countries like China and the UK have larger nodes, indicating higher publication volumes and collaborations. Strongest links exist between developed economies (refer Table III), showing research concentration in these nations.

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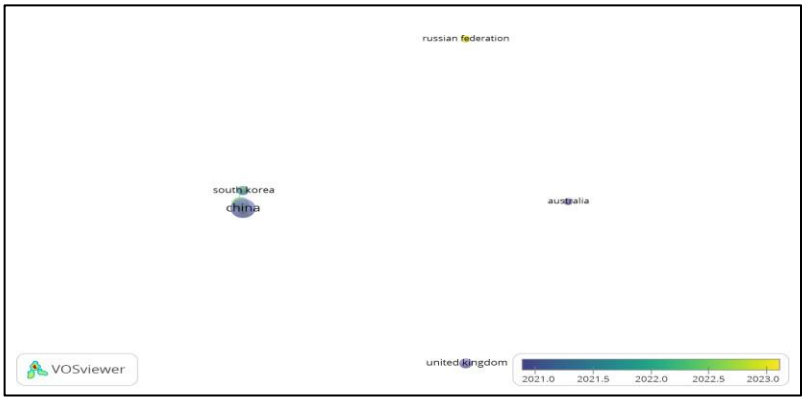
Figure V: Co-authorship analysis on countries



Source: VOSviewer

According to Van Eck et al., (2023), total link strength in VOSviewer measures co-authorship intensity. The United States leads in collaboration, followed by China and Germany. India and South Korea show growing but limited collaboration, while the UK lacks co-authorship ties, indicating independent research efforts.

Table III: Co-authorship analysis of countries, representing total link strength

Co-authorship analysis	
On countries	
Country	**Total link strength**
United States	5
China	3
Germany	2
India	1
South Korea	1
United Kingdom	0

Source: Compiled by authors from VOSviewer

4.3 Co-word analysis

Using both authors' keywords and index keywords, Co-word analysis is conducted which helps to attain an intellectual understanding of the topic. (Eck & Waltman, 2014; Fahimnia et al., 2015). Our sample of 109 documents on blockchain technology and its relation to remittance industry, authors' keywords and indexed keywords extracted from all papers add up to 325 and 484 respectively.

Table IV: Co-word analysis

Co-word Analysis			
Author Keywords		**Index Keywords**	
Keywords	**Total link strength**	**Keywords**	**Total link strength**
Blockchain	51	Blockchain	173
Bitcoin	24	Block-chain	145
Cross-border payments	23	Cross-border	129
Remittances	22	Electronic money	48
Blockchain technology	8	Bitcoin	31
Cryptocurrencies	17	Electronic commerce	48
Cryptocurrency	13	International trade	43
Remittance	11	Payment systems	44
Financial inclusion	13	Distributed ledger	40
Ripple	12	E-commerces	42

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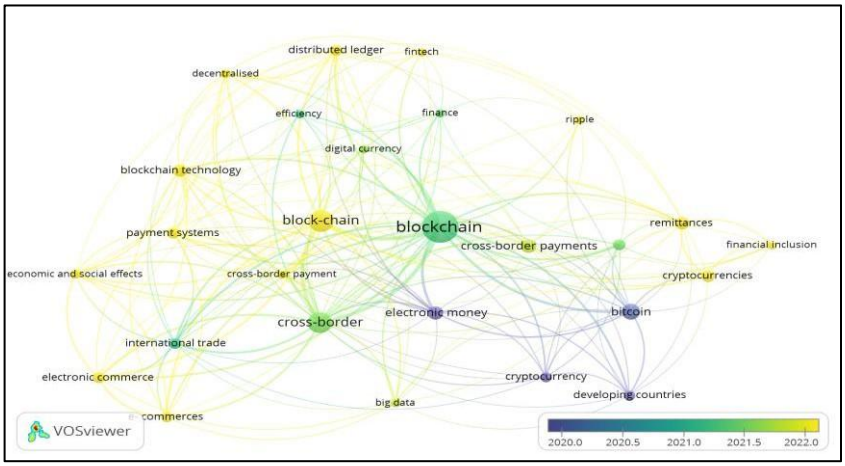
Source: Compiled by authors from VOSviewer

Of these, the top author and index keywords were mapped appertaining to the number of co-occurrences. Blockchain, bitcoin, and cross-border payments were the top three author keywords. (Refer to Table IV). Blockchain, block-chain, and cross border were indexed as the top three keywords from the research articles. (Table IV). An analysis of keywords from both the tables suggests that authors asserted the importance of types of blockchain technology, i.e. bitcoin whereas indexers drew more upon the idea as a whole making both the terms "blockchain" and "block-chain" relevant to the search engines.

The following bibliometric cluster (ref. Figure VI), containing all keywords or co-word analysis clustering, shows semantic relationships between keywords. There exists a strong link between "Blockchain" and "Remittances", which is ultimately the focal point of the current study, confirming the core research focus. Keywords such as regulation, adoption barriers, and technology acceptance form a separate but interconnected cluster, highlighting the importance of policy studies. Moreover, the observation also includes the presence of "machine learning" and "artificial intelligence," indicating a growing interest in AI-driven remittance solutions.

Figure VI: All keywords (Co-word analysis)



Source: VOSviewer

5. Clustering

Clustering is considered a key bibliometric mechanism to ascertain thematic clusters. We elicit thematic clusters through the bibliographic coupling of research documents, which further highlight core themes that enhance the intellectual capital of the research topic. This technique, as stated by Dhontu et al. (2021), "periodical or the present thematic development," focuses on the common citations among current publications. This study employs bibliographic coupling, which helps identify future research directions based on current and emerging trends in the given topic (Van Raan, 2005).

5.1 Bibliographic coupling of the Research Articles

Referencing patterns enables the researchers to comprehend and map the intellectual resemblance in a research work, which further helps in tracing emergent themes and potential future research of a topic (Kessler, 1963). Two documents would emphasize and elaborate on the shared literature only when they are both commonly cited by a third article. Bibliographic coupling is generalized as a science mapping technique enabling researchers to unravel the broad spectrum of themes of a given topic.

Previous bibliometric studies use a minimum threshold to reduce noise and enhance the robustness of the analytical network (Van Eck & Waltman, 2010). For our analysis we considered articles with minimum five citations, yielding a result of 51 articles. The threshold was important to ensure and uphold the research quality of the documents. Overall, the bibliographic coupling of documents resulted in six major clusters. Cluster 1 (9 items,

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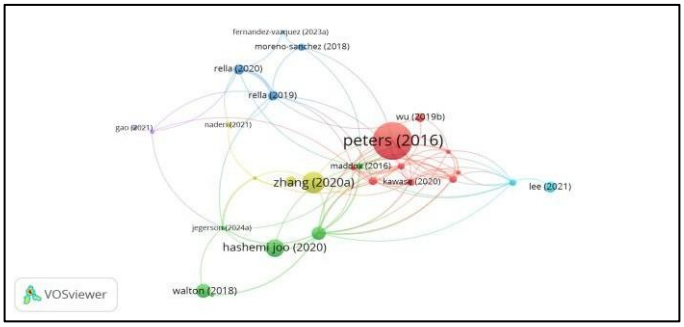
red), cluster 2 (6 items, green), cluster 3 (4 items, blue), cluster 4 (4 items, yellow), cluster 5 (2 items, purple), and cluster 6 (2 items, cyan) (See figure VII)

Figure VII: obtained from bibliographic coupling: Cluster 1 (Red), cluster 2 (Green), cluster 3 (Blue), cluster 4 (Yellow), cluster 5 (Purple), and cluster 6 (Cyan)



Source: VOSviewer

5.2 Thematic assessment of the clusters: Understanding the literature

5.2.1 Cluster 1 (Red): Blockchain technology's transformative impact on remittance industry

The key areas in this cluster of papers emphasize the cost reduction, transaction speed, decentralisation, mining efficiency and financial inclusion of blockchain applications in the remittance sector. Two broad sub-groups are categorised in this cluster. First sub-group argues that blockchain technology can significantly reduce costs and replace the conventional methods of remittance transfers. Ekbote et al., (2017) proposed a peer-to-peer remittance system, using CUDA-based GPU mining which reduces the costs by eliminating intermediaries, addressing the "how" part of the study. RemBit which is a blockchain-based remittance solution for Ethiopia was introduced by Ricci & Mammanco (2019) to help reduce reliance upon informal channels and increase the speed of cross-border transactions. Evidence that blockchain technology can lower fees in comparison to conventional methods to enhance transaction security and enable 24/7 money transfers is suggested by Sood & Simon (2019).

Other authors in this cluster discuss the transformative role of blockchain technology in banking operations. Peters & Panayi (2016) discuss smart contracts and automated banking ledgers with an emphasis on advancement of blockchain's potential to create self-executing agreements, reduce banking inefficiencies and bridge financial gaps. Wu & Duan (2019) explore blockchain's transformative role in commercial banking focussing on improvements in bill processing, asset securitization and cross-border payments. Rosati & Čuk (2019) contribute to this discussion by examining blockchain adoption across financial services and identify payments, ledning, trading and compliance as key areas of transformation.

Han et al., (2018) introduced Jupiter in the compelling structure of blockchain studies. Jupiter addresses the storage limitations in decentralised networks and adding to this Kawase & Kasahara (2020) analyze the transaction-confirmation times to use Bitcoin to demonstrate the role of congestion and prioritization in payment mechanisms.

5.2.2 Cluster 2 (Green): Role of Bitcoin and cryptocurrencies in cross-border remittances, capital flows, and financial adoption

The six studies in cluster 2 explore the economic, technical and behavioural dimensions of the adoption of cryptocurrency in cross-border payments, highlighting some of the key elements like cost efficiency, financial inclusion, regulatory challenges and user perceptions.

Highlighting a major gap in the literature Maddox et al., (2016) shows the pseudo-anonymity risks associated with Bitcoin transactions, revealing that a key challenge of regulatory oversight in mainstream adoption of Bitcoin remittance remain prevalent. They emphasize that the technology adoption is driven not just by financial necessity but also by a

counter-cultural rejection of traditional banking systems. Parino et al., (2018) analyse the socioeconomic factor behind Bitcoin adoption by making use of variables such as GDP per capita, trade freedom and internet penetration as key predictors of cryptocurrency usage for cross-border payments. By using Bitcoin transaction data, they developed a gravity model of international trade, reinforcing the argument that in emerging markets cryptocurrencies work as a parallel financial system. A similar study by Walton & Johnston (2018) investigates Bitcoin adoption in South Africa using key predictors such as perceived benefits, financial literacy and ease of use of Bitcoin technology and found that Bitcoin reduces transaction costs and improves accessibility for cross-border remittances. Hashemi Joo et al., (2020) position cryptocurrency as first successful blockchain application in finance an highlight its ability to reduce transaction costs and improve financial accessibility. Their study also emphasis that cryptocurrency holds the power to fuel global money transfer networks. Bitcoin and other cryptocurrencies are proposed as alternatives to traditional remittance transactions. Graf von Luckner et al., (2023) empirically prove that Bitcoin serves as a tool for capital mobility and remittance transfers using evidence from Venezuela and Argentina.

5.2.3 Cluster 3 (Blue): Role of blockchain in remittances and Financial Infrastructure

The four papers in cluster 3 by Moreno-Sanchez et al., (2018), Rella (2019), Rella (2020) and Fernandez-Vazquez et al., (2021) are interconnected through their focus on blockchain applications in remittances and financial infrastructures. Their collective emphasis on Ripple, CRP, correspondent banking, decentralization, financial inclusion and remittance formalisation explains the thematic analysis in this cluster.

Moreno-Sanchez et al., (2018) discuss the IOU-based settlement system and how it differs from traditional cryptocurrencies. Rella (2019) further provides an analysis of how Ripple is helping to reshape the correspondent banking models and concludes that its application is more aligned with financial market needs as compared to financial inclusion goals. Further adding to the study in 2020, Rella developed a particular case of Ripple, where it is found to be promoting its role in shaping money infrastructures in current financial institutions. Fernandez-Vazquez et al., (2021) conduct a comparative comprehensive analysis of Bitcoin, Ethereum and Ripple suggesting that Ripple's fast processing speed and scalability makes it the most suitable blockchain technology for remittance transactions.

5.2.4 Cluster 4 (Yellow): Blockchain driven financial inclusion and financial system efficiency

This cluster represents regulatory and technical adoption challenges in the blockchain based payment systems even after the new technology offers potential to change cross-border transaction dynamics. Mansoor et al., (2024) and Naderi (2021) focus on regulatory uncertainty whereas Zhang et al., (2020) and Zhou et al., (2022) focus on scalability and computational overhead in blockchain networks. Overall this cluster emphasis on the application of blockchain technology and its financial inclusion.

Mansoor et al. (2024) apply the Unified Theory of Acceptance and Use of Technology (UTAUT) model to analyze the behavioral factors affecting blockchain adoption in the remittance services of Pakistani banks. They empirically analyze that trust, transparency and performance expectancy significantly influence bankers' willingness to adopt blockchain based remittance solutions. Naderi (2021) explores the role of blockchain technology in reducing poverty through reducing remittance costs. Both these studies highlight that the cost of remittances remains significantly above the UN Sustainable Development Goal (SDG) target of 3% making blockchain a viable solution.

Zhang et al. (2020) take a broader outlook by analyzing blockchain's role in reframing financial credit systems and improving efficiency in transactions. Moreover, Zhou et al. (2022) focus on distributed network optimization for mainly cross-border transitions, using a statistical sequence model for blockchain network access and transaction retrieval efficiency. The thematic overlap of these studies lies in the improvement of financial transactions through automated processing and adaptive scheduling.

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5.2.5 Cluster 5 (Purple): Blockchain enables international transactions

Coutinho et al., (2023) critically examines the high transaction costs of remittance industry and acts as a major impediment to growth of cross-border financial transactions. They state that Ripple and Stellar aim to create alternative cross-border payment solutions but their degree of decentralisation is questionable. They introduce Layer Onex which is considered a novel blockchain framework that aims to provide truly decentralised, cost saving remittance services with the help of low-computational transaction validators. They also propose the idea of a universal blockchain wallet to facilitate interoperability among different networks.

Gao (2021) on the other hand focuses on the blockchain technology role in cross-border e-commerce and the importance of payment security, logistics efficiency and trustworthiness for a broader area of international trade. The study focuses on commodity information quality, logistics service quantity and payment security and evaluates the influence of these factors on the decisions of consumer purchase in foreign trade.

Cluster 5 elucidates that blockchain's decentralisation can eliminate inefficiencies associated with traditional financial intermediaries, thus providing a cheaper, faster and more transparent network of transactions. While Coutinho et al., (2023) emphasizes on financial inclusion, Gao (2021) focuses on consumer trust in blockchain based payment systems globally.

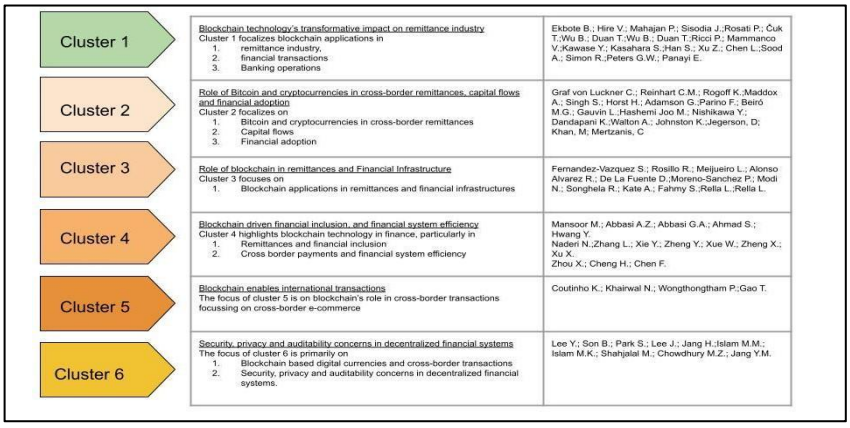
5.2.6 Cluster 6 (Cyan): Security, privacy, and auditability concerns in decentralized financial systems

The papers by Lee et al., (2021) and Islam et al., (2023) focus on the inefficiencies present in the existing interbank payment systems and digital currencies. These inefficiencies include high transaction costs, transparency challenges and lack of regulatory framework. Their work focuses on Central Bank Digital Currency (CBDCs) and their security and privacy risks. They also propose a taxonomy that bifurcates these challenges into identity management, transaction privacy, consensus mechanisms and auditability.

Islam et al., (2023) propose a cross-border payment system using a permissioned blockchain model to enhance auditability and privacy. Their paper introduces a cryptocurrency-based model in place of intermediary-heavy correspondent banking model, which are governed by various financial authorities and are energy efficient proof-of-authority (PoA). Their analysis leverages "Dynamic Decentralized identifiers" (DIDs) which guarantees user privacy along with maintaining regulatory compliance which is further identified as a key theme in Lee et al., (2021).

While Islam et al., (2023 takes a broader approach by analysing cryptocurrency Lee et al., (2021) focusses on CBDC- related security concerns and both studies contribute to the solutions of inefficiencies in the traditional financial network of remittances (ref. Figure VIII for all six clusters).

Figure VIII: Clustering



Source: Compiled by authors

6. Discussion, Policy Implications and Concluding Remarks

This study gives strong evidence of cost and speed reductions in the transaction times of sending cross-border funds using the blockchain technology. Ripple constantly emerged as the most efficient channel for remittance transfers and innovative cryptocurrency adoption techniques gives future scope to solve the scalability issues. In order to endure safe regulatory environments, as discussed as an emerging theme in cluster six, it becomes crucial to gradually experiment stringent policies which help shape stakeholder confidence without exposing them to risks. The Bitcoin law which was enacted between 2021 and 2025 aimed to lower fees for money transfers across borders and increase financial inclusion. This led to the idea of making blockchain technology a legal tender but due to volatility issues and technological transfer gaps it was considered a tedious task. Integration of blockchain technology into existing digital payment platforms makes it more user friendly rather than substituting the technology altogether. This implication is supported by the pilot integration of blockchain into Unified Information System (UPI) to France and Nepal for cross-border transactions. Bitso has achieved more than $3.3 billion transfers with almost 1% costs over and above as compared to the traditional venders charging 6-8% in the United States-Mexico corridor. This specially implies that for established and huge corridors it becomes important for policymakers and industry stakeholders to prioritize partnerships and regulatory frameworks. It becomes all the more necessary to formulate clear policies and guidelines on data retention for authorities and to respect user privacy. The case of Singapore provides a strong basis for the same. Its data-driven remittance platforms on blockchain technology remain transparent to authorities and ensure user safety and privacy. This can also be supported by third-party audits and access provisions to mitigate money laundering risks and preserve the inherent benefits of privacy of customers.

Previous literature on similar topic provided a wider scope to study, but our study also provides specific research gaps which individually can develop into new studies in varied fields. For example, infrastructural gaps remain a primary challenge in the adoption of blockchain technology in the remittance industry, and it also received criticism from the multilateral institutions such as the IMF. The co-authorship analysis in our paper highlights that the strongest links exist between the developed economies and research is required in developing nations. It is further suggested that more collaboration among academicians and practitioners is suggested for the enhancement of knowledge gap and multi-disciplinary approach to view the topic.

The two important limitations of the integration of blockchain technology into remittance industry are regulatory uncertainty and scalability issues. For instance, Ripple's consensus raises concerns about centralization and suggests not all blockchains are truly decentralized. Also, there exists infrastructural components of blockchain-based payment systems, regulatory limitations as well as regulatory concerns in the revolutionary potential of blockchain in the remittance industry. The industry experts and policymakers may look into promising trust and transparency in the process and models which are efficient, as proposed by Zhou et al., (2022). Comparative evaluation to determine actual savings, transaction efficiency and adoption barriers across different corridors will enhance a stronger approach to achieve the target threshold of less than 3% of transaction costs of remittances by 2030.

In all, the blockchain-integrated remittances can drive financial inclusion by reducing costs and improving transaction speeds for migrant workers. This specific social impact aligns with the Sustainable Development Goal 10.c i.e. to facilitate orderly, safe and responsible migration through well planned migration policies.

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