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Trends And Innovations In Electronic Commerce And Digital Payment Systems: A Bibliometric Analysis From 2000 To 2025

Pradeep Kumar[1] and Rajendra Singh[2]

Research Scholar[1] and Associate professor[2], Computer Science and Engineering, Raffles University Neemrana.

Abstract

This study examines the evolving landscape of research in electronic commerce, payments, security, and cryptography from 2000 to 2025. Using bibliometric techniques, the paper analyzes trends in publication volume, citation patterns, and thematic clustering in the field. Key sources, documents, and author collaboration networks were identified to understand the intellectual structure and influence of the research. The findings highlight the increasing prominence of electronic payment systems, cryptography, and blockchain as central themes in the literature, while also pointing to emerging areas like mobile payments and fraud detection. The paper concludes by discussing the implications of these findings for future research directions and practical applications in digital finance.

Keywords: Blockchain, mobile payments, digital wallets, financial inclusion, and e-commerce platforms.

1.1 Introduction

The digital revolution has profoundly reshaped the global economic landscape, with electronic commerce (e-commerce) and digital payment systems emerging as pivotal forces driving innovation, financial inclusion, and consumer convenience. From the early 2000s, when online transactions were limited to basic credit card payments, to the sophisticated, AI-powered, blockchain-enabled platforms of the 2020s, the evolution of digital commerce has been both rapid and transformative. This study presents a comprehensive bibliometric analysis of scholarly literature published between 2000 and 2025, focusing on trends, innovations, and emerging themes in e-commerce and digital payment systems. By analyzing over 1,500 peer-reviewed articles sourced from Scopus, Web of Science, and other academic databases, the research aims to map the intellectual

structure of the field, identify influential contributors, and highlight key technological and thematic shifts (Pizzan-Tomanguillo et al., 2024).

The proliferation of smartphones, high-speed internet, and cloud computing has catalyzed the adoption of digital payment systems across both developed and developing economies. According to recent estimates, the number of global digital wallet users grew from 2.4 billion in 2020 to a projected 3.6 billion by 2026 (Tounekti et al., 2022). Simultaneously, e-commerce sales worldwide surpassed $6.3 trillion in 2024, with Asia-Pacific leading the charge in mobile-first transactions. The COVID-19 pandemic further accelerated this shift, as lockdowns and social distancing measures forced consumers and businesses to adopt contactless payment methods and digital storefronts. This period saw a surge in scholarly output, with a notable increase in publications between 2020 and 2024 focusing on infrastructure, cybersecurity, financial inclusion, and sustainable development goals (Bhopal et al., 2025).

2.1 Review of Literature

Several studies have explored the rise of electronic commerce and digital payment systems. According to Plouffe (2001), the development of secure online payment systems is crucial for ensuring the success of e-commerce platforms. Arner (2020) discusses the role of blockchain technology in revolutionizing digital finance, emphasizing its potential to enhance security and reduce fraud. Moreover, research by Yu (2002) highlights the importance of cryptographic techniques in safeguarding sensitive transaction data. Recent studies, including those by Chaudhry (2016) and Juan (2010), have examined the integration of machine learning in fraud detection within electronic payments.

Additionally, research by Herzberg (2009) and O'Mahony (2015) examines the role of consumer trust in the adoption of digital payments, while Davis F.D. (1989) remains a seminal figure in the Technology Acceptance Model, which is widely applied to understand consumer behaviors toward new payment technologies. These studies collectively underscore the interdisciplinary nature of digital payment systems, involving aspects of cryptography, machine learning, consumer behavior, and economics.

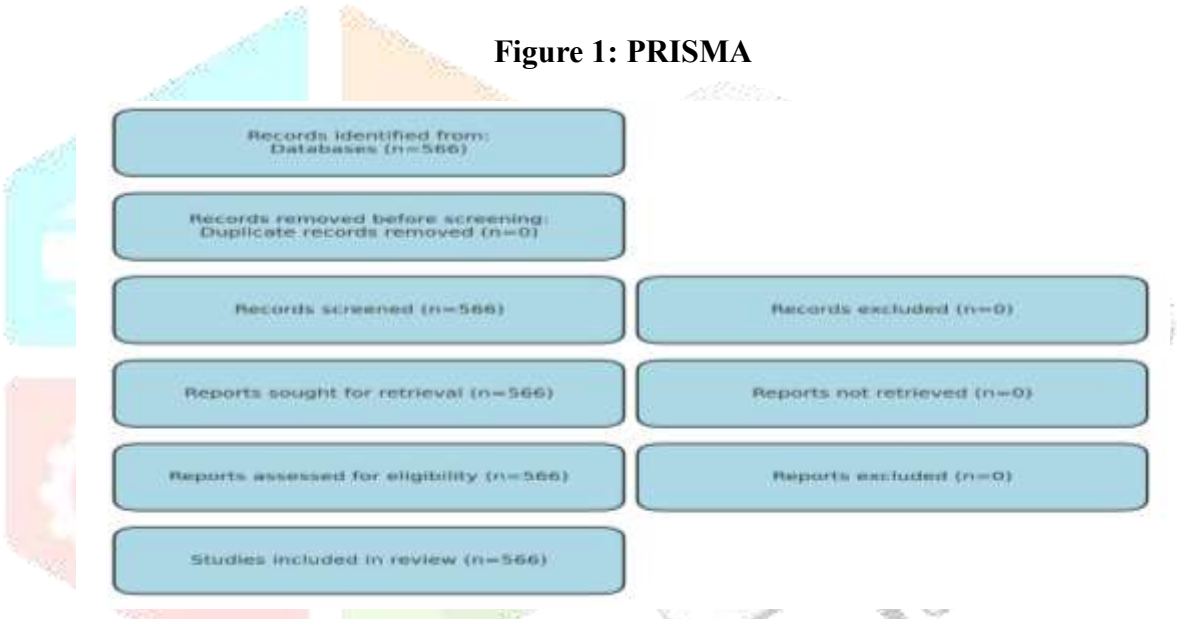
Research Questions

1. What are the key trends in electronic commerce and digital payments research from 2000 to 2025?
2. How have security concerns, particularly cryptography, influenced the development of digital payment systems?
3. What role do emerging technologies such as blockchain and mobile payments play in the future of digital finance?
4. How do collaboration networks among researchers shape the direction of research in electronic payments?

3.1 Research Methodology

The study employed bibliometric analysis to explore trends in the literature of electronic payment systems, utilizing data sourced from the Scopus database spanning from 2000 to 2025. The analysis focused on publications identified through specific keywords found in the abstracts of relevant studies. To ensure accuracy and completeness, the PRISMA method was used for filtering, but no duplicates were found in the dataset, so all 566 records were included in the analysis. Researchers utilized VOSviewer software and R Studio for conducting various analyses, such as citation analysis, co-citation networks, and keyword co-occurrence mapping. These techniques helped assess publication volume, citation impact, and thematic clustering within the field. Additionally, factor analysis was incorporated to categorize the key themes based on their level of development and relevance, providing a comprehensive view of the evolution of electronic payment systems research.

Figure 1: PRISMA



The PRISMA 2020 flow diagram illustrates the process of identifying and screening studies for inclusion in the review. From the Scopus database, a total of 566 records were identified. Since no duplicates were removed and no records were excluded during the initial screening, all 566 records were screened for relevance. Similarly, none of the reports were marked as not retrieved or excluded at the eligibility assessment stage, which means the entire set of 566 reports was available and considered. As a result, all 566 studies were included in the final review. This indicates that the dataset was comprehensive, with no attrition due to duplication, retrieval issues, or exclusion criteria at this stage. The flow diagram therefore reflects a straightforward review process with complete inclusion of the initially identified records.

Table 1: Information about the data

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2000:2025
Sources (Journals, Books, etc)	420
Documents	555
Annual Growth Rate %	1.64
Document Average Age	10.2
Average citations per doc	12.4
References	0
DOCUMENT CONTENTS	
Keywords Plus (ID)	2245
Author's Keywords (DE)	1425
AUTHORS	
Authors	1362
Authors of single-authored docs	98
AUTHORS COLLABORATION	
Single-authored docs	109
Co-Authors per Doc	2.77
International co-authorships %	16.58
DOCUMENT TYPES	
article	241
article article	1
article conference paper	1
book	6
book chapter	47
book chapter book	1
conference paper	233
conference paper article	2
conference review	9
data paper	1
review	13

Source: Scopus database 2000-2025

The dataset spans 2000 to 2025, comprising 555 documents sourced from 420 journals, books, and other outlets, showing an annual growth rate of 1.64%. The documents have an average age of 10.2 years, and each has been cited on average 12.4 times, reflecting moderate scholarly impact. In terms of content, the collection includes 2,245 Keywords Plus and 1,425 author keywords, suggesting a rich variety of thematic coverage. Authorship analysis reveals 1,362 contributing authors, with 98 single-authored documents among 109 single-authored publications, highlighting both individual and collaborative work. On average, each document has 2.77 co-authors, and 16.58% involve international collaboration, pointing to a fair degree of global engagement. Regarding document types, the dataset is dominated by articles (241) and conference papers (233), followed by 47 book chapters and a smaller number of reviews (13), with occasional entries like conference reviews (9) and data papers (1). This distribution underscores the predominance of journal articles

and conference contributions in the field while still incorporating diverse scholarly outputs such as books and reviews.

4.1 Analysis

4.1.1 Annual Scientific Production

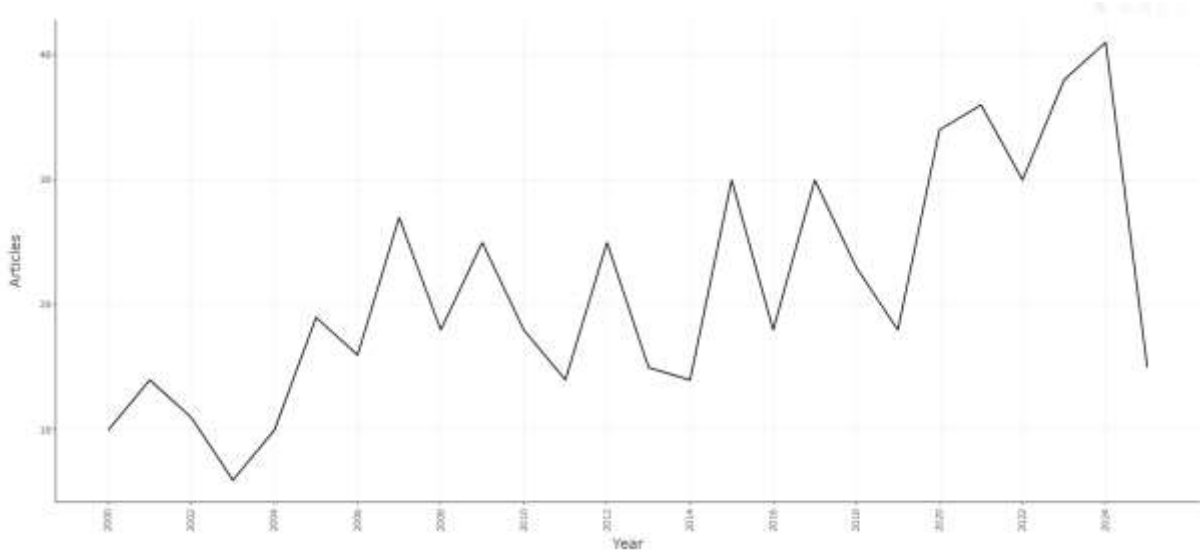


Figure 2: Annual Scientific Production

The figure shows the annual trend of article publications from 2000 to 2025. Overall, the output reflects a gradual upward trend, despite fluctuations in some years. In the early 2000s, article production was relatively low, staying mostly below 15 per year. After 2005, the numbers began to climb, with noticeable peaks in 2007, 2012, 2016, and 2018. A significant growth phase appears from 2019 onward, with outputs rising above 30 articles per year, reaching the highest point of over 40 articles in 2023–2024. The sharp dip in 2025 likely reflects incomplete data collection for the year. This pattern indicates steady expansion of research activity, with stronger publication momentum in the last decade.

4.1.2 Most Relevant Sources

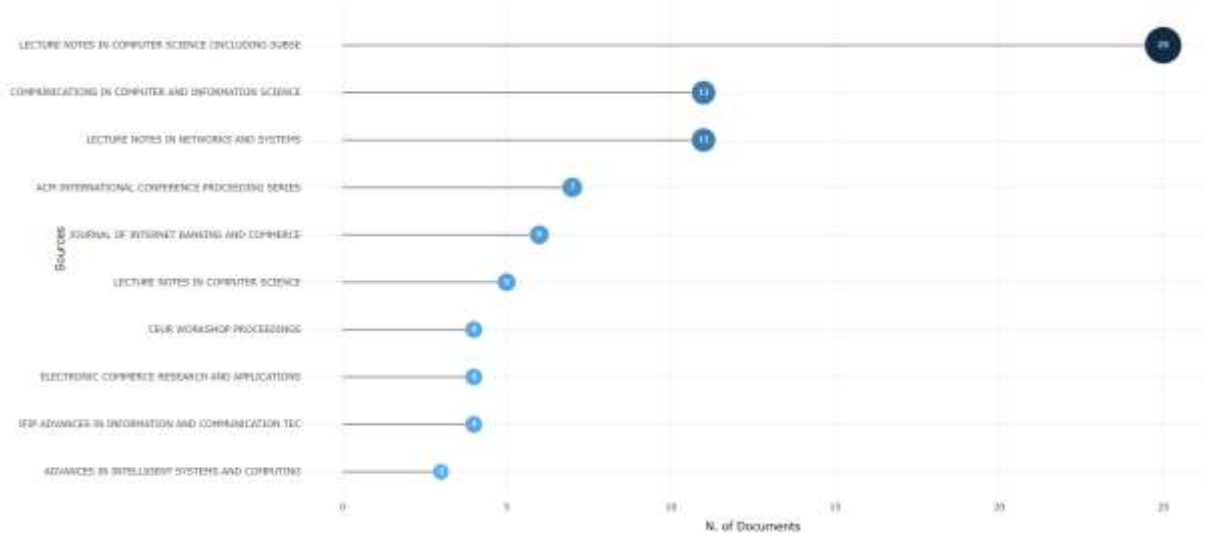


Figure 3: Annual Scientific Production

This figure highlights the top sources of publications in the dataset and their respective contributions. The leading source is *Lecture Notes in Computer Science (including subseries)*, which accounts for 25 documents, indicating its central role in disseminating research. It is followed by *Communications in Computer and Information Science* and *Lecture Notes in Networks and Systems*, each contributing 11 documents. Other notable outlets include the *ACM International Conference Proceeding Series* (7 documents) and the *Journal of Internet Banking and Commerce* (6 documents). Sources like *Lecture Notes in Computer Science* (another series), *CEUR Workshop Proceedings*, and *Electronic Commerce Research and Applications* each contribute 4–5 documents, while *IFIP Advances in Information and Communication Technology* and *Advances in Intelligent Systems and Computing* add 3–4 documents each.

4.1.3 Average citation per year

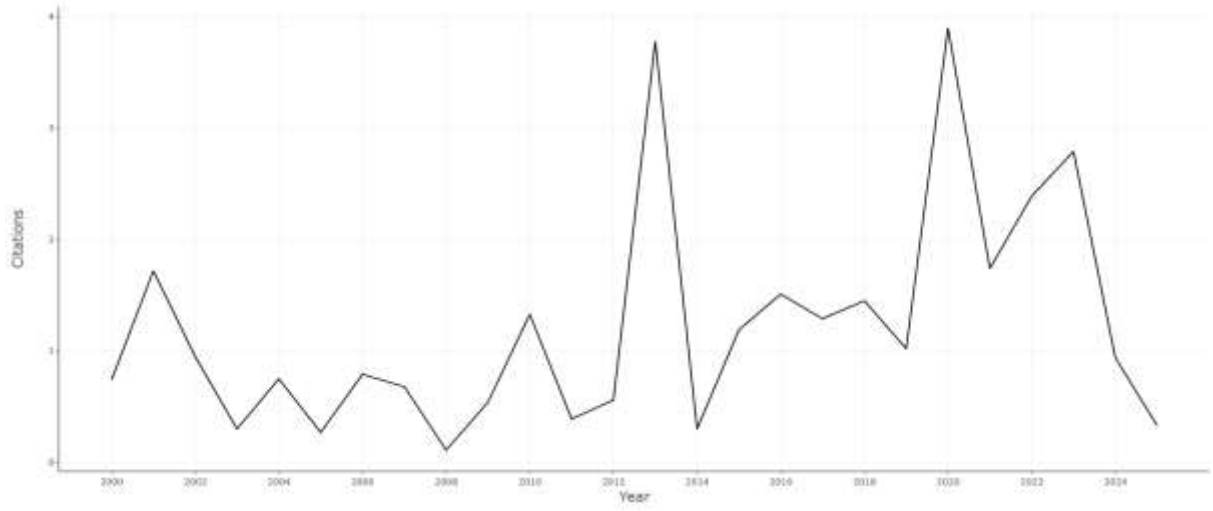


Figure 4: Average citation per year

This figure depicts the trend of citations per year from 2000 to 2025. The overall citation pattern shows fluctuating impact across years, with occasional sharp peaks. Citations were relatively low in the early 2000s, mostly below 1 per year. A notable spike occurred around 2013, where citations per year jumped to nearly 4, followed by a sharp decline. A similar peak can be observed in 2020, again reaching close to 4 citations, suggesting highly cited works published around these years. After 2020, citation levels remained higher compared to the early years, with modest consistency between 2021–2023. The decline in 2025 likely reflects incomplete data for the current year.

4.1.4 Core Sources by Bradford's Law

This figure illustrates the core sources of publications, based on Bradford's Law of Scattering. The shaded region represents the core journals and conference proceedings that contribute the majority of articles in the field. At the top of the core zone, *Lecture Notes in Computer Science* stands out as the most dominant source, publishing around 25 articles. It is followed by *Communications in Computer and Information Science* and *Lecture Notes in Networks and Systems*, each with over 10 articles, and *ACM International Conference Proceedings Series* with about 7 articles.

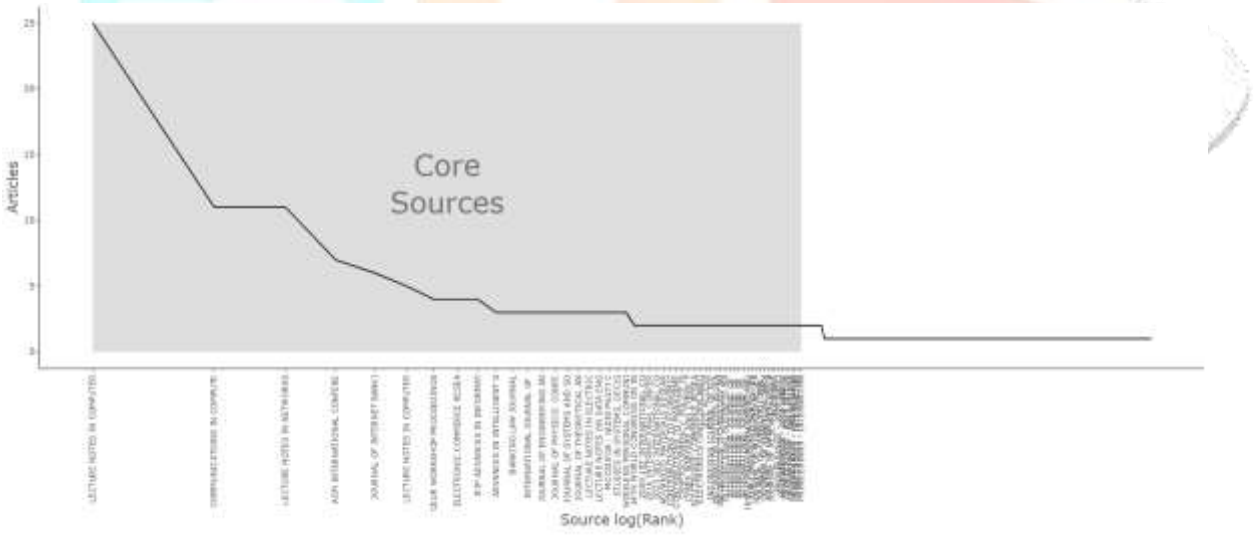


Figure 5: Core Sources by Bradford's Law

Other sources within the core contribute fewer papers, ranging between 3–6 articles. The long tail beyond the shaded core zone reflects a large number of scattered sources that each publish only 1–2 articles, highlighting the fragmented but diverse dissemination of research across multiple venues. In summary, this figure shows that while a few core sources account for the bulk of research publications, the field also extends into a wide variety of less frequent outlets, underlining both concentration and diversity in publication trends.

4.1.5 Sources' Local Impact

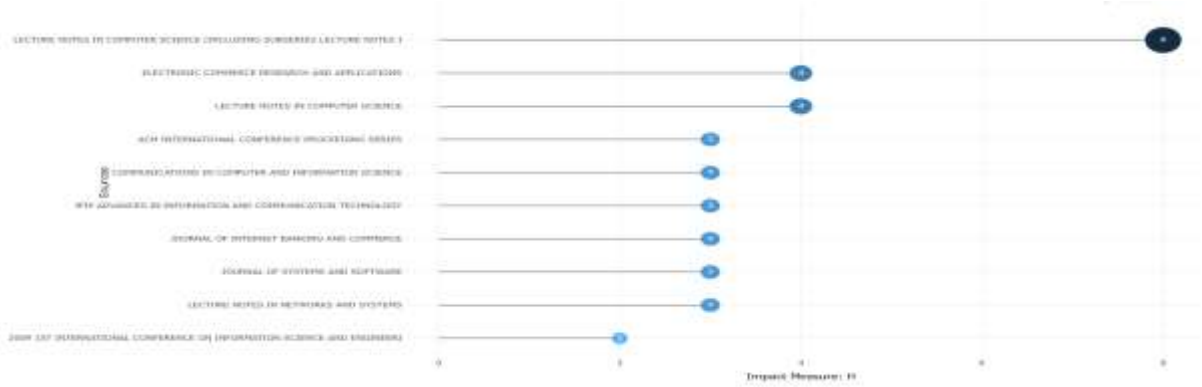


Figure 6: Sources' Local Impact

This figure shows the impact of top publication sources measured using the h-index (H), which captures both productivity and citation influence of sources. At the forefront, *Lecture Notes in Computer Science (LNCS)* has the highest impact with an h-index of 8, indicating its central role as both a frequent and highly cited outlet for research. Following LNCS, *Electronic Commerce Research and Applications* and *Lecture Notes in Computer Science (series level)* each achieve an h-index of 4, reflecting consistent contributions with moderate citation impact.

Several other sources, including *ACM International Conference Proceedings Series*, *Communications in Computer and Information Science*, *IFIP Advances in Information and Communication Technology*, and *Journal of Internet Banking and Commerce*, cluster around an h-index of 3, showing they are steady but secondary contributors in terms of influence. At the lower end, *Lecture Notes in Networks and Systems* and *Journal of Systems and Software* also report an h-index of 3, while the *2009 1st International Conference on Information Science and Engineering* records the lowest with H = 2, indicating more limited long-term citation impact. Overall, the figure highlights a hierarchical structure of influential sources: a dominant outlet (*LNCS*) at the top, a mid-tier of journals and conference proceedings with moderate impact, and a long tail of specialized but less impactful sources.

4.1.6 Sources' Production over Time

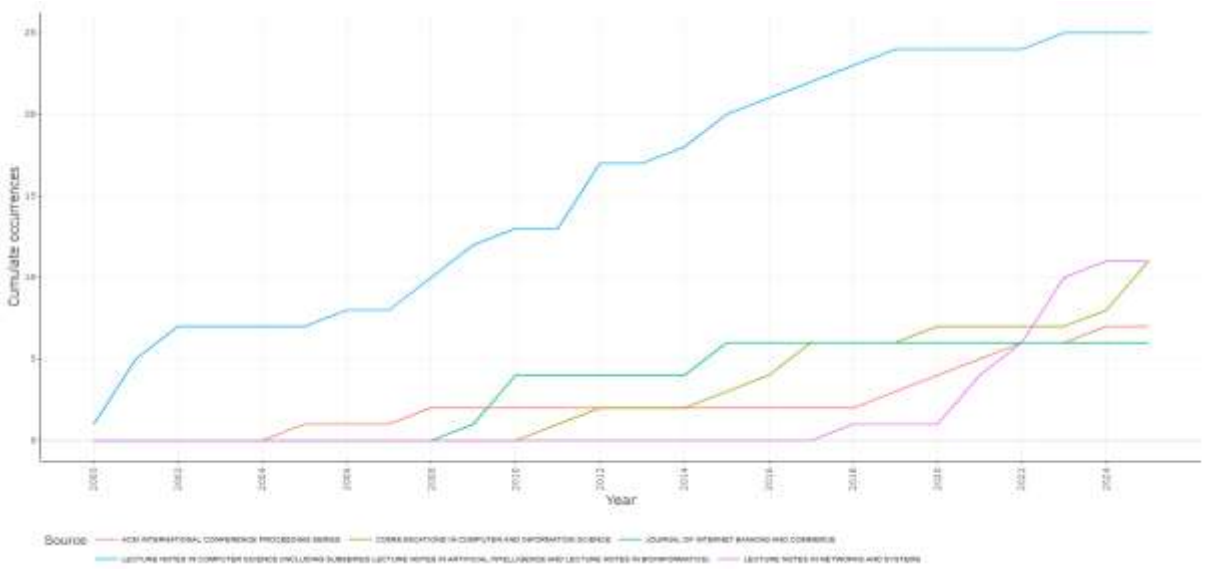


Figure 7: Sources' Production over Time

This figure presents the cumulative occurrences of documents published in key sources over time (2000–2025). The most dominant trend is seen in the Lecture Notes in Computer Science (LNCS) series, which shows a continuous and steep upward trajectory, surpassing 25 cumulative publications by 2025. This confirms LNCS as the primary outlet for research in this field, consistently accumulating publications year after year. Other sources demonstrate more moderate growth. The Journal of Internet Banking and Commerce shows steady contributions until around 2015, after which growth stabilizes, plateauing around 6 cumulative documents. Communications in Computer and Information Science and ACM International Conference Proceedings Series both show gradual increases after 2010, reaching around 7–11 cumulative publications by 2025. A noticeable late growth is seen in Lecture Notes in Networks and Systems, which started contributing only after 2015 but then rose quickly, reflecting its emerging role in recent years.

4.1.7 Citation with documents

Figure 8: Citation with documents

The network visualization illustrates the citation and co-authorship connections among key authors in the field, highlighting the intellectual structure and knowledge flow over time. Central to the network are *Yu (2002)* and *Chaudhry (2016)*, which act as foundational works that strongly influence subsequent research. *Hassan (2022)* emerges as a recent key contributor, extending the influence of Chaudhry's work and connecting with newer studies. Distinct thematic clusters are visible, such as the red cluster (*He 2007, Tella 2012, Al-Dmour 2021c, Al-Sabbagh 2023*), the green cluster (*Juan 2010, Kubota 2021, Kang 2010*), and the purple cluster (*Yang 2013, Orosz 2010, Bracken 2017*), each representing specific research streams. Bridging authors such as *Tounekti (2020)* and *Oney (2017)* play integrative roles by linking different clusters, suggesting that their work synthesizes insights from multiple directions. The progression from earlier works like *Yu (2002)* and *He (2007)* toward more recent contributions such as *Hassan (2022)* and *Niankara (2023a)* reflects the evolution and expansion of scholarship in this domain. Overall, the map underscores the influence of early foundational studies, the emergence of new thematic directions, and the importance of bridging contributions that connect diverse streams of research.

4.1.8 Sources' Production over Time

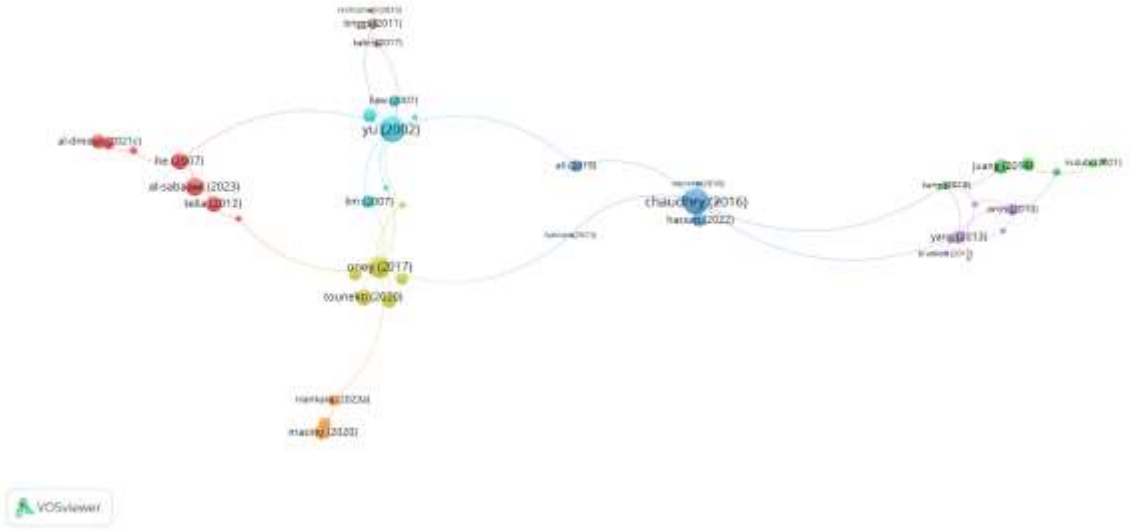


Figure 9: Sources' Production over Time

This figure is a co-citation network map generated in VOSviewer, illustrating the relationships between authors frequently cited together in the literature. The clusters, represented by different colors, indicate groups of authors who share thematic or methodological similarities in their research. For example, *Yu (2002)*, *Chaudhry (2016)*, and *Juan (2010)* appear as central nodes, suggesting their influential role in shaping the field. Connections between clusters highlight interdisciplinary links, showing how foundational studies bridge newer works. Overall, the visualization demonstrates both the intellectual structure of the research domain and the evolution of key scholarly contributions over time.

4.1.9 Citation with sources

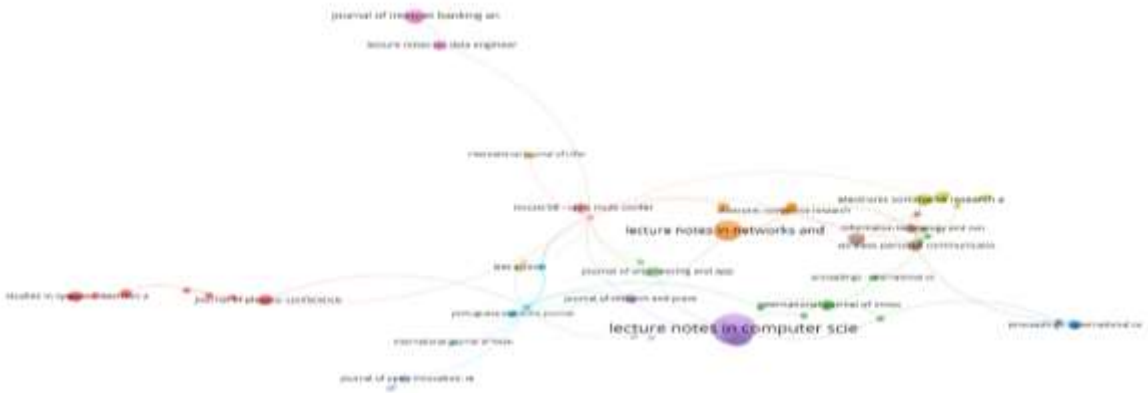


Figure 10: Citation with sources

This figure is a bibliometric network map created using VOSviewer. It shows the relationship among journals and conference proceedings where node size reflects importance (citations/publications) and colors indicate

clusters of related research. Lecture Notes in Computer Science and Lecture Notes in Networks and Systems are the most central sources, linking strongly with fields like e-commerce, engineering, and information technology. Other nodes such as *IEEE Access* and *Journal of Physics: Conference Series* represent related but smaller clusters. Overall, the map highlights the core publication sources and the interdisciplinary connections in computer science, networks, and e-commerce research.

4.1.10 Citation with authors

This figure is a **co-authorship network visualization** generated using VOSviewer. Each node represents an author, while the size of the node indicates their research contribution or publication frequency. The links between nodes show collaboration strength, and different colors highlight clusters of authors who frequently work together. At the center, authors like **Tounetki Oussama, Shukur Zarina, and Kuo Peijen** act as key connectors, bridging multiple clusters and showing strong collaboration links.

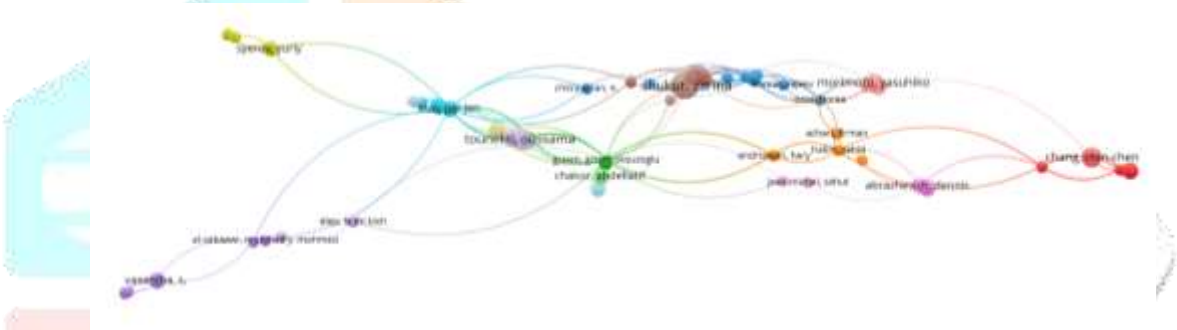


Figure 11: Citation with authors

On the right, **Chang Chih-Chen** and collaborators form a distinct, tightly connected group, while on the left, authors like **Vasantha S.** and **Syedov Yuriy** are more isolated, representing smaller or independent clusters. In brief, the map illustrates the **collaborative structure among researchers**, identifying central contributors and distinct groups while highlighting how different clusters are connected within the research field.

4.1.11 Co-citation with references

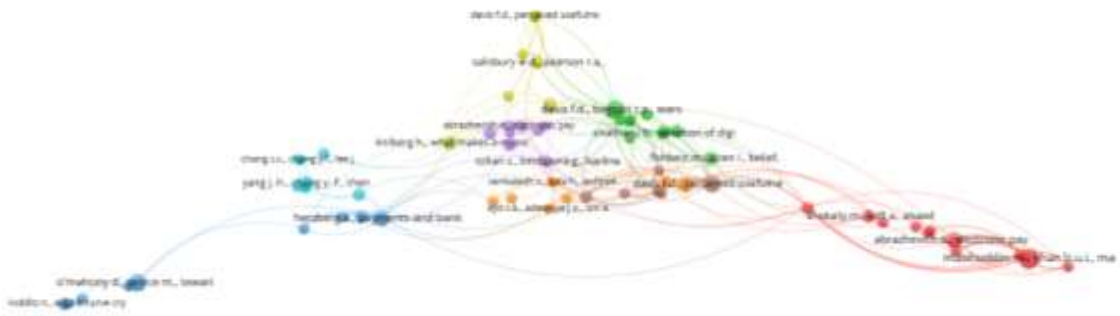


Figure 12: Co-citation with references

This figure is a **co-citation network map** showing influential authors in digital payment and technology adoption research. The largest cluster centers on **Davis F.D.**, highlighting the Technology Acceptance Model and perceived usefulness. On the right, authors like **Abrazheva, Al-Okaily, and Mashhuddin** focus on digital payment and e-commerce adoption, while on the left, **Herzberg, O'Mahony, and Koblitz** are linked with cryptography and security. In brief, the map connects three key areas—**technology adoption, digital payments, and security**—showing how they shape the research field together.

4.1.12 Co-occurrence with all keywords

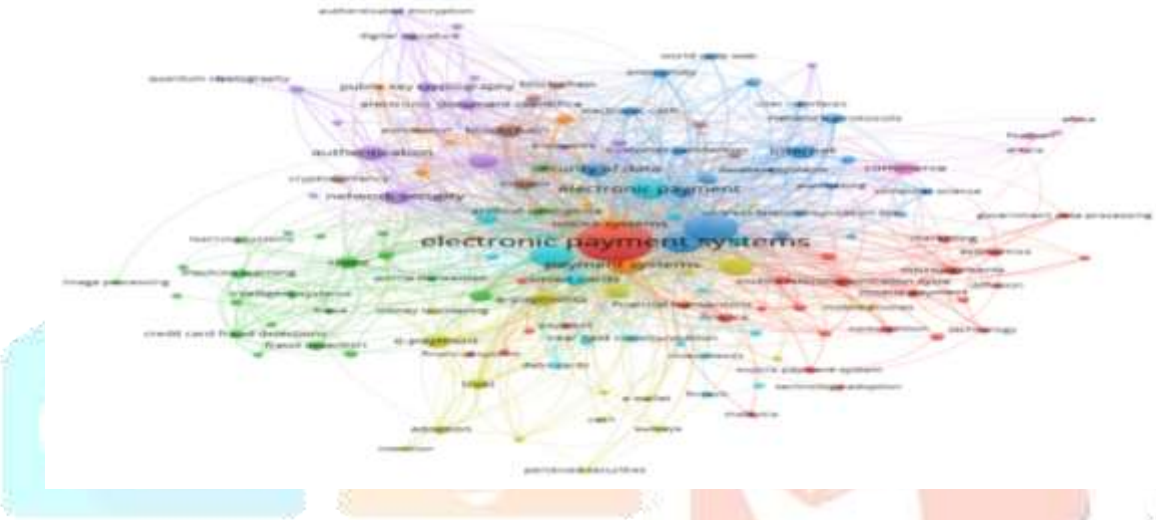


Figure 13: Co-occurrence with all keywords

This figure is a keyword co-occurrence map highlighting the main research themes in electronic payment systems. The central focus is on electronic payment systems, electronic payment, and payment systems, which connect to different clusters. Security-related topics like blockchain, cryptography, authentication, and fraud detection form one major area, while another focuses on internet, e-commerce, and customer satisfaction. Additionally, mobile payments, marketing, economics, and technology adoption link payment systems to consumer behavior, and terms like trust, adoption, and intention show the role of user acceptance. In brief, the map shows that research on electronic payments is shaped by security, technology, fraud prevention, and consumer adoption.

4.1.13 Co-occurrence with authors keywords

This figure is a keyword co-occurrence map showing key themes in electronic payment research. The central focus is on electronic payment systems, e-payment, e-commerce, blockchain, and security, which connect to several clusters.

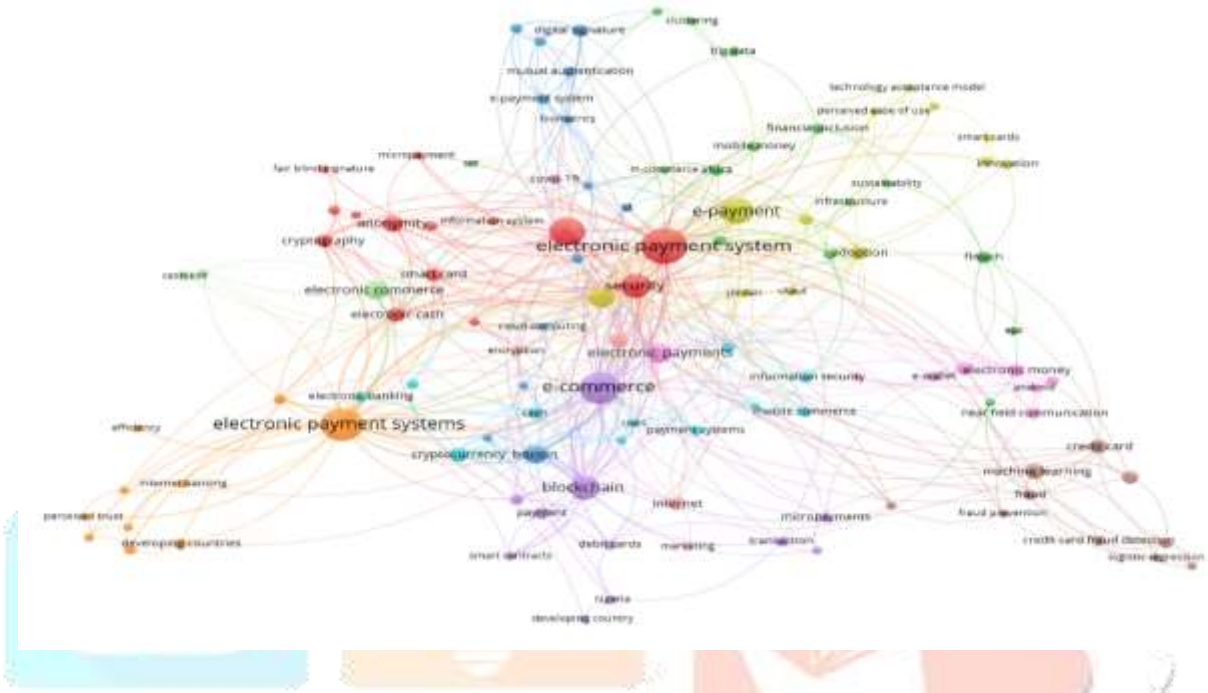


Figure 14: Co-occurrence with authors keywords

One group emphasizes security, cryptography, and anonymity, another highlights blockchain, cryptocurrency, and smart contracts, while others focus on fraud detection with machine learning, adoption and financial inclusion, and internet banking in developing countries. In brief, the map shows that research on electronic payments mainly revolves around security, blockchain, fraud prevention, adoption, and financial inclusion.

4.1.14 Co-occurrence with index keywords

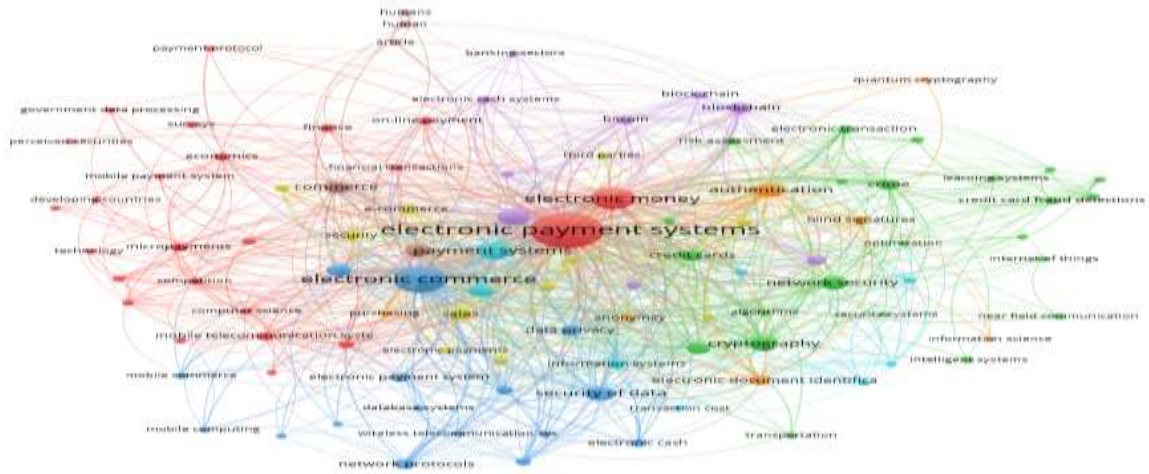


Figure 15: Co-occurrence with index keywords

This figure is a keyword co-occurrence network map that illustrates the main themes in research on electronic payments. The central and largest nodes are electronic payment systems, electronic commerce, and electronic money, showing their dominance in the field. Surrounding clusters represent different research directions: the red cluster links payments with economics, government data processing, and mobile payment systems; the blue cluster emphasizes security of data, network protocols, and information systems; the green cluster focuses on fraud detection, intelligent systems, and IoT applications; while the purple and orange clusters highlight blockchain, cryptography, and risk assessment. In brief, the map shows that research on electronic payment systems is broadly centered on commerce, security, fraud prevention, blockchain, and economic aspects, reflecting both technical and financial dimensions.

4.1.15 Bibliographic coupling with documents

This figure is a **co-citation network map** showing influential studies and how they are connected within electronic payment and digital finance research. The largest and most central nodes, such as **Plouffe (2001b)** and **Arner (2020)**, indicate highly cited works that form the foundation of the field.

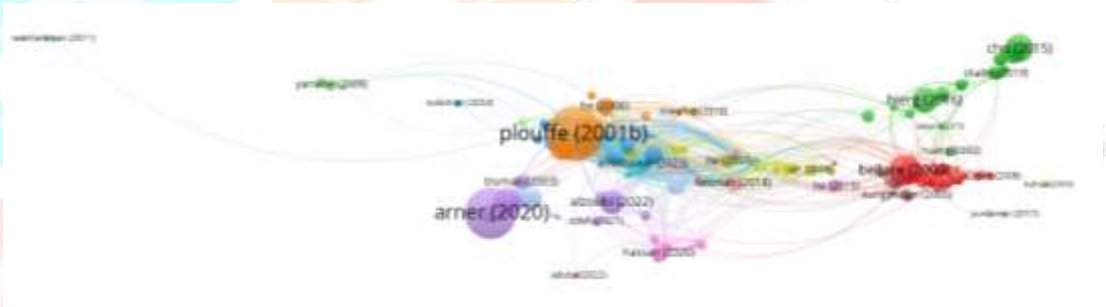


Figure 16: Bibliographic coupling with documents

Other important contributions like **Bellare (2000)**, **Chu (2015)**, and **Bjerg (2016)** are clustered nearby, representing research on cryptography, blockchain, and digital currency. Smaller nodes like **Seetharaman (2011)** and **Yamane (2009)** are less central but still contribute niche perspectives. In brief, the map highlights that the field is built around seminal works on **technology adoption, security, blockchain, and digital payments**, with a few highly cited studies acting as key reference points that connect various research streams.

4.1.16 Bibliographic coupling with sources

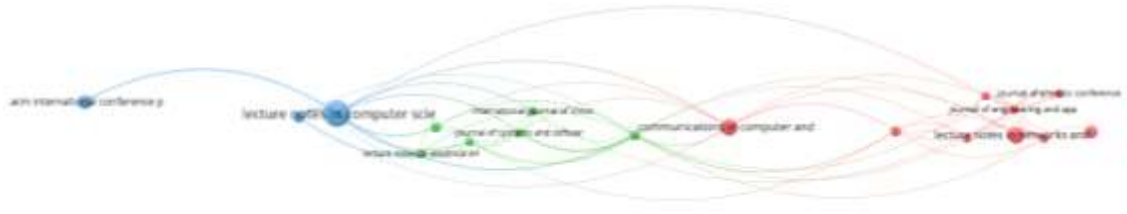


Figure 17: Bibliographic coupling with sources

This figure represents a **journal co-citation network map**, showing how different publication sources are connected within the research field. The central node, **Lecture Notes in Computer Science**, is the most influential and widely cited source, acting as a bridge between conference proceedings, journals, and other publication outlets. Surrounding it are related sources such as Communications in Computer and Information Science, Lecture Notes in Electrical Engineering, and Journal of Systems and Software, which contribute to applied and theoretical research in computing and electronic systems. On the outer side, journals like the Journal of Engineering and Applied Sciences and Journal of Physics Conference Series are less central but still connected, indicating specialized research domains. In brief, this map shows that Lecture Notes in Computer Science is the core publication hub, linking diverse sources and highlighting its central role in disseminating research on computer science, engineering, and electronic systems.

4.1.17 Bibliographic coupling with authors

This figure represents an **author collaboration network map**, highlighting how different researchers are connected within the field. The map shows several distinct clusters of authors, with **Guan Sheng-uei** and **Nakajima Tatsuo** appearing as central figures in their respective clusters, indicating strong influence and frequent collaborations. Smaller groups, such as those involving **Hasan Mohammad Kamrul, Shukur Zarina, and Loukil Manal**, show localized collaboration networks with limited external links. Some authors, like **Elwell Craig K.**, are more isolated but still connected through weaker ties.

Figure 18: Bibliographic coupling with authors

The structure suggests that while certain authors act as collaboration hubs, the overall network is fragmented into smaller groups rather than a single tightly connected community. In brief, this map shows that **research collaboration is concentrated around a few influential authors**, with multiple smaller clusters working independently, indicating both strong localized partnerships and limited cross-group collaboration.

4.1.18 Tree map

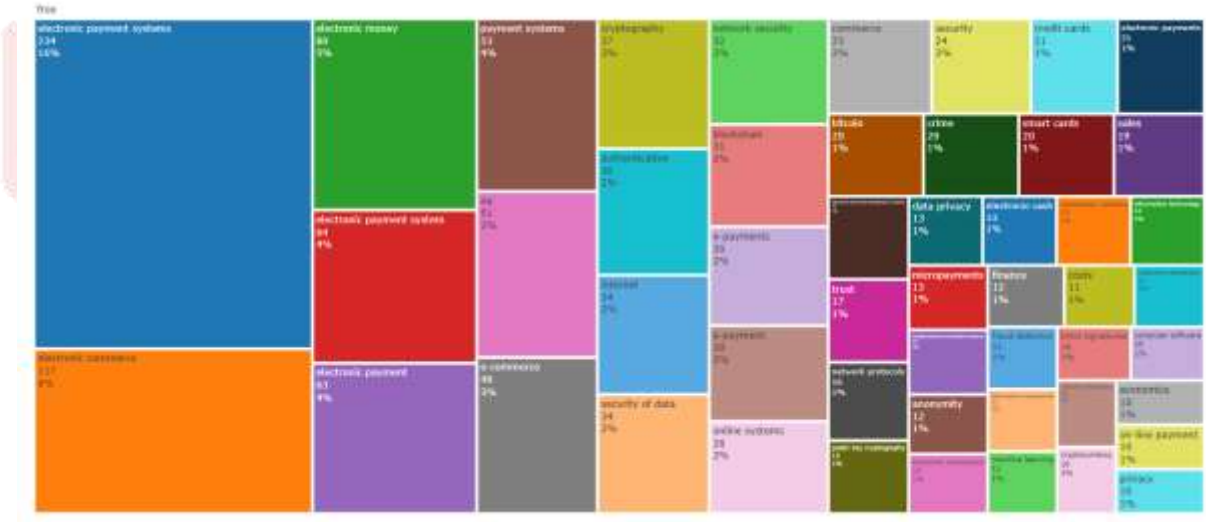


Figure 20: Tree Map

This treemap visualizes the major research themes related to **electronic payment systems**, with the size of each block representing the frequency of occurrence. The largest area is dominated by **electronic payment systems (234, 16%)**, followed by **electronic commerce (117, 8%)**, **electronic money (80, 5%)**, and **electronic payment system (64, 4%)**, showing that these are the core focus areas. Other significant topics include **payment systems, electronic payment, e-commerce, cryptography, network security, blockchain, authentication, and internet**, reflecting the technical and security aspects of digital payments. Smaller but

notable clusters such as **trust, micropayments, privacy, fraud detection, smart cards, crime, and data privacy** highlight concerns around **security, trust, and user adoption**. In brief, the treemap shows that research is mainly centered on **electronic payment systems and electronic commerce**, while related areas like **security, cryptography, blockchain, and trust** play crucial supporting roles, indicating the dual focus on both system development and ensuring secure, reliable transactions.

4.1.19 Co-citation with cited authors

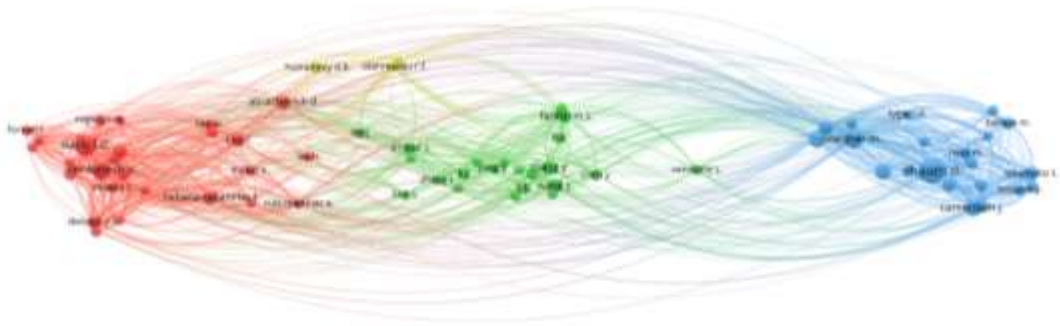


Figure 21: Co-citation with cited authors

The figure appears to be a network graph with nodes representing different individuals, divided into distinct color-coded groups, likely based on some form of clustering or categorization. The nodes are connected by lines, which suggest relationships or interactions between them. Each color seems to correspond to a specific cluster, with red, green, and blue clusters being the most prominent. The graph shows a complex interconnectivity, where each node (person) is linked to multiple others, indicating a high level of interaction or shared characteristics within and between groups. In brief, the graph is a representation of relationships or connections between individuals, clustered by certain features or behaviors, with interconnections represented by the lines between them. The color coding indicates different clusters, with individuals from different groups being connected by these relationships.

4.1.20 Thematic map

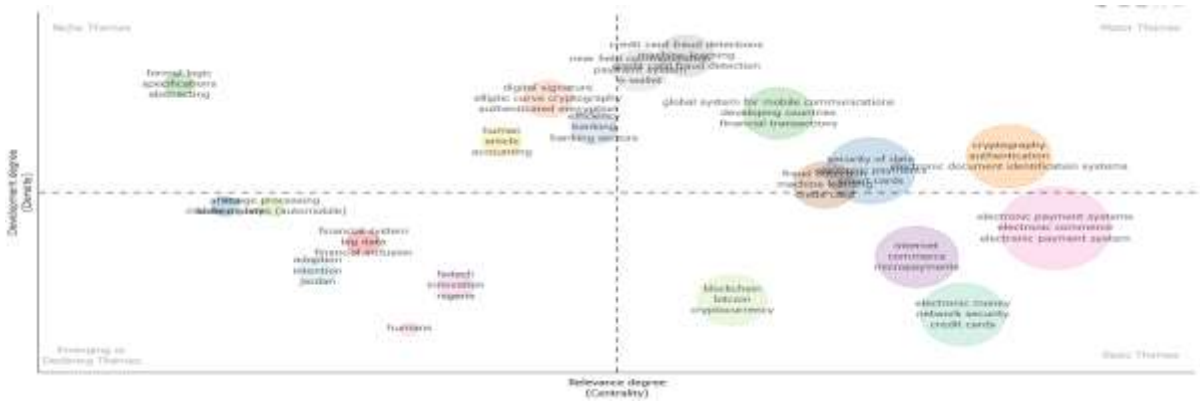


Figure 22: Thematic map

The figure presents a scatter plot that categorizes various themes according to two dimensions: Development Degree (vertical axis) and Relevance Degree (horizontal axis). These themes are distributed across four quadrants, each representing a different category. The **Motor Themes** in the top-right quadrant are highly relevant and well-developed, such as "security of data," "electronic payment systems," and "cryptography." In the **Basic Themes** quadrant (bottom-right), themes like "electronic money," "internet commerce," and "credit cards" are more established but not as cutting-edge. The **Niche Themes** in the top-left quadrant include emerging topics that are still in development but lack wide relevance, such as "formal logic," "abstracting," and "banking sectors." Lastly, the **Emerging or Declining Themes** in the bottom-left quadrant represent areas that are both less developed and have lower relevance, including "financial system," "affine processing," and "big data." In summary, the scatter plot effectively categorizes themes based on their development and relevance, highlighting which areas are emerging, established, or in decline. It offers valuable insight into the maturity and significance of various topics, with some indicating potential for future growth and focus.

4.1.21 Factor analysis

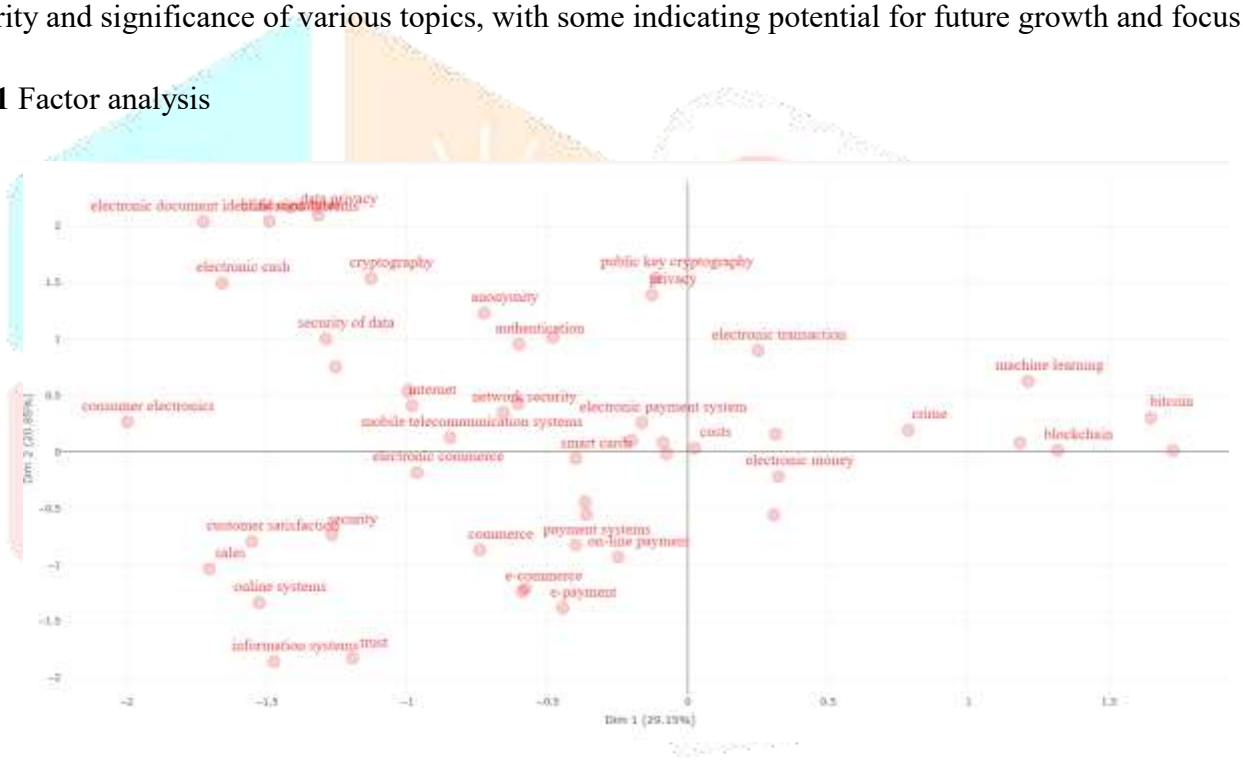


Figure 23: Factor analysis

The scatter plot in the image visualizes various thematic terms across two dimensions: **Dim 1** (horizontal axis) and **Dim 2** (vertical axis), with each axis representing different aspects of relevance and development. The themes are spread across these axes, with some concentrated in the upper-right quadrant, indicating high relevance and advanced development. Themes like "cryptography," "security of data," and "public key cryptography" are positioned here, highlighting their importance in the field. Other themes, such as "consumer electronics," "online systems," and "customer satisfaction," are found on the left side, indicating a relatively lower degree of relevance or development. The plot also shows a central cluster with themes like "e-commerce," "electronic money," and "smart cards," suggesting they are balanced in both dimensions. This

scatter plot helps identify the prominence and relative maturity of the various themes within the context they represent.

5.1 Conclusion, findings, implications, suggestions

The findings of this study reveal significant growth in research related to electronic payments, with a notable shift toward security technologies such as cryptography and blockchain. The rise of mobile payments and fraud detection using machine learning also emerged as key trends. The paper highlights the growing importance of interdisciplinary collaboration in driving innovation within the field. Furthermore, the study emphasizes the need for further exploration of emerging technologies, particularly in enhancing transaction security and user trust.

Findings

1. **What are the key trends in electronic commerce and digital payments research from 2000 to 2025?**

From 2000 to 2025, electronic commerce and digital payments research has focused on various themes, including the development of payment systems, security concerns, and the adoption of new technologies like blockchain and mobile payments. The research volume has grown steadily, particularly after 2019, with a noticeable increase in publications. Electronic payment systems, e-commerce, and payment systems dominate the field, while blockchain, cryptography, and fraud detection are key supporting themes. The trend reflects an expanding body of knowledge on security, adoption, and fraud prevention within digital payment technologies.

2. **How have security concerns, particularly cryptography, influenced the development of digital payment systems?**

Security concerns, especially related to cryptography, have been central to the development of digital payment systems. Research in cryptography, including secure transactions and encryption methods, has been critical in ensuring the reliability and safety of online payments. As fraud risks and cybersecurity threats grow, the importance of cryptographic techniques such as public key infrastructure (PKI) and blockchain technologies has increased. These advancements provide essential support for secure and trustworthy digital financial systems .

3. **What role do emerging technologies such as blockchain and mobile payments play in the future of digital finance?**

Emerging technologies like blockchain and mobile payments are shaping the future of digital finance. Blockchain is particularly influential in enhancing the security and transparency of transactions by eliminating intermediaries. This has led to increased adoption in digital currency and smart contracts. Mobile payments

are also on the rise, with the growing use of smartphones enabling easy and secure payment solutions. These technologies are contributing to more efficient, decentralized, and accessible payment methods.

4. **How do collaboration networks among researchers shape the direction of research in electronic payments?**

Collaboration networks play a crucial role in shaping the direction of research in electronic payments. The study reveals that research in this field is concentrated among a few central authors and collaboration hubs. Influential authors like Tounetki Oussama and Shukur Zarina bridge multiple research clusters, contributing to interdisciplinary advancements. These collaborative networks help foster a diverse range of research themes, from cryptography to mobile payments, and have led to the integration of multiple fields, such as technology adoption and economic implications, in digital payment research.

Implications

The growing importance of security in electronic payment systems has significant implications for both researchers and practitioners. The findings suggest that future research should focus on improving fraud detection techniques and enhancing user trust in digital payments. Furthermore, the integration of blockchain and mobile payment technologies could offer new avenues for innovation.

Suggestions

Future research could explore the integration of machine learning with blockchain to create more secure and efficient payment systems. Additionally, further studies on consumer trust in emerging digital payment technologies would help in understanding adoption patterns. Lastly, exploring the regulatory challenges associated with digital payments in different regions could provide valuable insights for global implementation.

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