

Review

Customer Due Diligence in the FinTech Era: A Bibliometric Analysis

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Abstract: This study examined the current developments in customer due diligence (CDD) in the financial technology (FinTech) era. The study of anti-money laundering (AML) and combating financing of terrorism (CFT) gained prominence after the 2007–2009 global financial crisis (GFC), in which administrative penalties were issued to financial institutions. Faced with AML regulatory compliance issues, technological solutions were or are still being developed. Thus, several technological innovation developments have shaped the future direction of the CDD aspects in the AML/CFT sphere. A bibliometric review and meta-analysis was employed for the study. The Scopus database was utilised to generate the dataset for the study, while SciVal was applied for research metric analysis. The major findings revealed that the key research themes in this area include anti-money laundering, banks and crime, and cryptocurrency, as well as blockchain and corruption. It was also established that most of the research done in this area is focused on the United Kingdom, the United States, and China. The integration of CDD with FinTech is still an emerging area that requires interdisciplinary collaborations.

Keywords: money laundering; customer due diligence; anti-money laundering; FinTech; bibliometric analysis



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1. Introduction

Financial services provision is a public good that makes any threat not only an economic issue but a national and international security issue (Svitlana et al. 2020; Viritha and Mariappan 2013). In addition, the financial services ecosystem is also evolving due to technological innovations. The emergence of technology has simultaneously affected the way in which banking transactions are conducted and comply with anti-money laundering regulations, among others (Arner et al. 2019). Consequently, opportunities and threats are created in the financial services ecosystem (Milanesi 2022; Lai 2017). Opportunities include more customer-centric products, convenience, and security systems development to curb emerging cyber and information risks (Fulop et al. 2022), while weaknesses include money laundering posing a threat to financial services integrity, cyber security, and national security (Fulop et al. 2022; Svitlana et al. 2020; Cutter 2017). The increased vulnerabilities of the financial sector due to digital innovations can result in financial instability and failure to protect consumers.

A digital economy means digitalisation of most of the activities in an economy. Digital innovations are critical for efficiencies generated by digital economies (Guş and Mangiuc 2022; Pan et al. 2022). It follows that with digital innovations, financial crime has also been digitalised. Hence, the need to devise commensurate money laundering risk mitigation strategies.

Even though digital innovations can assist in accessing reliable information, caution needs to be exercised in complying with data access and confidentiality risks (Fulop et al. 2022; Raweh et al. 2018; Christie 2018). The COVID-19 pandemic brought associated health

challenges in the medical sector (Akram et al. 2021), but in the finance and banking sectors prompted the increased usage and adoption of digital innovations to access services (Sultan and Mohamed 2022; Baicu et al. 2020). For instance, the onboarding process of banking customers shifted to digital from face-to-face (Tsanis and Stouraitis 2022).

Financial institutions face a great challenge in selecting the Fintechs that address their varied regulatory requirements. Tsanis and Stouraitis (2022) revealed that Fintech companies have opined that more regulatory support is still needed in the areas of e-KYC, onboarding, and CDD. This can be attributed to the fact that Fintech companies are unregulated technology-oriented firms, which brings in regulatory arbitrage (Tsanis and Stouraitis 2022; Navaretti et al. 2017).

The financial services sector remains the most vulnerable sector to money laundering, since the sector is expected to curb the flow of illegally earned funds into the formal banking channels (Chitimira and Ncube 2021; Nobanee and Ellili 2018; Al-Nuemat 2014; Araujo 2010). In the era of innovative financial solutions, money launderers continue to refine and develop advanced laundering schemes. Importantly, financial institutions and regulators need to have effective measures in determining banking customer relationships to stifle money-laundering practices.

The 2007–2009 global financial crisis (GFC) exposed regulatory deficiencies of the world's financial system (Butler and Brooks 2018; Arner and Barberis 2015). Arner et al. (2017) claimed that during that crisis period, the BASEL II Capital Accord was proved as a false buffer to security and confidence in the financial system. Likewise, this left economic participants vulnerable and lacking confidence in the financial system. Placing reliance on information technology systems to manage risks is dangerous. Hence, in decision making, a balance needs to be struck between relying on the human factor and technology due to associated risks (Das 2019; Alexandra and Ion 2016). Given increased regulatory oversight post the 2007/2008 GFC, failure to comply with AML/CFT regulations results in regulatory risk both at the institutional and national level.

Globally, AML/CFT efforts are advanced by the Financial Action Task Force (FATF). FATF is an international organisation that specialises in offering guidance in combatting money laundering and terrorism financing (Chitimira and Munedzi 2022; FATF 2012). The countries' AML/CFT regulations adhered to are drawn from the FATF's 40 recommendations and 9 special recommendations on terrorist financing. FATF recommendation 10 specifies the need for customer due diligence (CDD), while recommendation 15 deals with being cognisant of threats arising from new or developing technologies that favour anonymity (FATF 2019). The CDD measures include identification, verification, nature of business relationship, and ongoing monitoring.

Before any bank customer relationship is established, proper background checks need to be conducted (Chitimira and Munedzi 2022; Osifo 2020; Viritha and Mariappan 2013; FATF 2012). These background checks enable financial institutions to validate the information provided and ensure clients are properly risk profiled (Sultan and Mohamed 2022). Failure to risk profile customers can result in financial institutions being used as conduits for money laundering (Beebejaun and Dulloo 2022; Cindori and Petrovic 2018; Esoimeme 2015). Undoubtedly, CDD procedures are pivotal to the overall AML/CFT regulatory framework (Fulop et al. 2022; Johari et al. 2019; Trajkovski and Nanevski 2019; Raweh et al. 2017).

Various innovative country collaboration initiatives have been pursued (Matsuo and Staines 2020). For instance, Canada has the Jasper project (Aaron et al. 2017); Nigeria has a bank verification number for each bank account holder being advanced by the Central Bank of Nigeria (Anichebe 2020); the United States of America (USA) has an innovative pilot anti-money laundering (AML) programme (Federal Reserve System 2018); and Singapore uses the My Info project's Know Your Customer (KYC) utility for banks (MAS 2017).

IMF (2015) argued that fighting money laundering is a complex process that demands a lot of resources. Furthermore, Suntura (2020) opined that the greatest challenge in fighting

the money-laundering process architecture is the creation of strong and robust customer identification systems.

This study scientifically examined the current developments regarding customer due diligence as part of mitigating money-laundering risk over a period of time. Further, the study analyses the emerging authors, countries of study, source documents and emerging future directions for research in this realm. The study of anti-money laundering gained prominence after the 2007–2009 GFC, in which administrative penalties were issued to large financial institutions such as Standard Chartered Bank, Credit Suisse—Switzerland, HSBC (Katz 2019), and BNP Paribas of France (Justice Department 2014). Combined with technological innovations during the same period, a lot of developments have happened that are shaping the future direction of CDD in the AML/CFT sphere.

A bibliometric review of documents based on the subject query (Financial AND Technology) AND (Anti-Money AND Laundering) AND (Customer AND Due AND Diligence) AND (Regulations) were reviewed. Section 2 reviews the related literature of the study. The research methodology adopted for the study is described in Section 3. This is followed by a discussion and presentation of results in Section 4. Finally, Section 5 concludes the article and suggests areas for future research.

2. Theoretical Literature Review

The advent of technology has led to a cumulative change in the banking landscape through innovative solutions, with mixed results (Lai 2017; Alexandra and Ion 2016). Ultimately, the information communication and technology (ICT) industry continues to integrate with the banking sector. To broaden and have a greater understanding of this integration, two theories were identified, namely crying wolf, and technology acceptance and hype cycle. Firstly, the crying wolf theory is briefly discussed.

2.1. Crying Wolf

Takáts (2007) advanced the crying wolf theory to explain the enforcement of anti-money laundering regulations by regulators on banks. This theory was developed from the agency problem (Masciandaro 1999) and the latter (Masciandaro and Filotti 2001). Crying wolf is also described as excessive reporting, which dilutes information value. Instead, the crying wolf opts for optimal AML reporting rather than excessive reporting of useless information (Mathuva et al. 2020; Takats 2011). Indeed, Gara and Pauselli (2020) concurred with Takáts (2007) that excessive regulatory reporting negatively affects effectiveness in fighting money laundering. The crying wolf theory is based on five economic building blocks, which are: information, reporting, fines, monitoring, and investigations.

An agency relationship exists between banks and governments or customers. These relationships are associated with information asymmetries. Similarly, Stein (2002) argued that communication between two parties is coarse, and naturally the information presented is admittedly not always accurate due to agency problems between two parties (Naheem 2020; Panda and Leepsa 2017; Takats 2011; Pellegrina and Masciandaro 2009; Masciandaro 1999). With the agency problems, agency costs are incurred (Naheem 2020; Panda and Leepsa 2017). Banks incur agency costs such as additional reporting and monitoring, which can result in regulatory penalties for AML violations. In this case, KCB Bank of Kenya and Standard Chartered Bank United were penalised USD 1.4 million and USD 1.1 billion for the AML violations of inadequate CDD procedures (Financial Conduct Authority 2018; Central Bank of Kenya 2018).

A bank–customer transaction has the potential of being a money-laundering transaction. Banking transactions done through intermediaries such as local transfers, cash or electronic deposits, and money transfers pose a money-laundering threat (Reuter and Truman 2004). Equally important, Trajkovski and Nanevski (2019) discovered that 5% of bank customers facilitate money-laundering transactions using bank accounts. Uncertainties associated with customer transactions makes banks' decision-making processes difficult (Bello and

Harvey 2017). Thus, proper customer risk profiling using innovative digital technologies aids in reducing decision-making uncertainties.

2.2. Technology Acceptance and Hype Cycle

The technology acceptance model, in conjunction with the hype cycle model, helps to show and provide an understanding of the effect of digital innovations in the AML/CFT sphere over time. The integration of these two models was advanced by Betts-LaCroix (2010). The integrated model shows the different levels of technology acceptance by stakeholders over a time period. Furthermore, stakeholders' technology expectations are non-linear, but exist in the form of a cycle (Shuler 2012). The stakeholders include but are not limited to consumers, regulators, supervisors, government, financial institutions, non-financial institutions, fintech firms, and investors.

This theory can signify how launderers respond by developing advanced mechanisms to counter measures taken by banks and regulators, resulting in a game in which they aim to outpace each other. Critically, the theories were designed and developed when the banking systems technologies were not integrated (card, internet, and mobile), though current and future banking systems have integrated systems (Lai 2017). As such, the theories, when applied, show current and future developments in having integrated digital innovations subject to emerging money-laundering risks.

A practical knowledge gap exists in that the integrative disciplines of this study are still being researched and developed. In integrating the AML and digital innovation, the theories of two different disciplines were considered. For instance, AML theories and ICT theories. The adopted CDD practices are still being researched on.

3. Research Methodology

In the analysis by Grant (2015), it was recommended that bibliometric data should be normalised to minimise misinterpretation of findings. Thus, the citation patterns should be normalised by field of research and publication year. The literature review helped in identifying search words used in the search query.

A document search was conducted on the Scopus database, which is the most effective search engine on any subject (Tober 2011). Scopus is highly structured, which ensures that the search is precise and producing highly reliable results (Vignieri 2020; Griffiths 2014). In searching for the appropriate documents, careful considerations need to be noted regarding the words used in the search query. For instance, fintech and financial technology produce different results. Also, using abbreviations and full names yields different results, for example, CDD and customer due diligence.

Initially, the search query (anti-money AND laundering) AND (customer AND due AND diligence) AND (fintech) was used. However, with limited documents produced, we opted for another search query (financial AND technology) AND (anti-money AND laundering) AND (customer AND due AND diligence) AND (regulations). As shown in Table 1, the adopted search query resulted in 78 documents from the 558,298 documents. The query was further refined by limiting the documents to English language, so that greater focus was on the research area.

Table 1. Search Query Results.

Search Query	Results (Documents)
Financial Technology	558,298
Anti-Money Laundering	1325
Customer Due Diligence	93
Regulations	78

Source: Authors' own compilation.

4. Data Presentation and Analysis

The section presents and analyses the data based on the scholarly demographics, top five scholarly outputs, and keyphrase analysis. Firstly, the scholarly demographics are presented.

4.1. Assessing Scholarly Data Demographics

Due to increased scholarly outputs, identifying the quality outputs is crucial and vital to the stakeholders (Salim 2017). Stakeholders include researchers, research funders, and institutions of higher learning, among others. Furthermore, relying on one metric can lead to misleading conclusions, hence the need for multiple metrics (Salim 2017; Ronald and Fredd 2013). Over the study period from 2012 to 2021, a total of 1649 scholarly outputs were produced, as shown in Table 2. These were produced in the form of journals, articles, and books. The field-weighted citation impact score of 0.55 was attained. This means that scholarly output is being cited less than the global average of 1, which can be attributed to the subject gaining the attention of a few scholars, given the technical nature of the study area.

Table 2. Scholarly Characteristics.

Scholarly Metrics	Information
Study period	2012 to 2021
Scholarly output	1649
Field weight citation impact	0.55
International collaboration	164
Views count	41,235
Citation count	5375
Topic Prominence Percentile	92.7

Authors' own compilation.

International collaboration measures co-authorship networks, which results in information and knowledge-sharing platforms for the researchers (Abbasi et al. 2011). The findings revealed a score of 164, indicating sharing of information and knowledge is still an emerging development in the field of integrating technological innovations in performing the CDD procedures. These findings concur with the impact score of 0.55 discussed in the previous paragraph.

Citation count measures the impact of published papers (Salim 2017). The study revealed view counts of 41,235 and citation count of 5375, which reveal that over the 10-year period, citation was still low, which can be attributed to the interdisciplinary nature of the study. This concurs with the earlier findings on international collaborations and scholarly output.

4.2. Top Five Scholarly Output Analyses

This section presents and analyses the scholarly output based on the top five scholarly outputs. These include countries, publications, authors, and institutions. Firstly, the documents by year are presented.

4.2.1. Scholarly Publications by Year

Figure 1 shows the documents published and categorised to year of publication. The findings reveal an upward and downward trend over the period, with the time period from 2018 to 2020 recording an increasing trend to a high of 15 in 2020. The trend indicates the emergence of financial innovations that gained prominence after the 2007–2009 global financial crisis and resultant regulatory penalties, with the highest penalty of USD 8.9 billion imposed on any financial institution to date going to BNP Paribas of France in 2014.

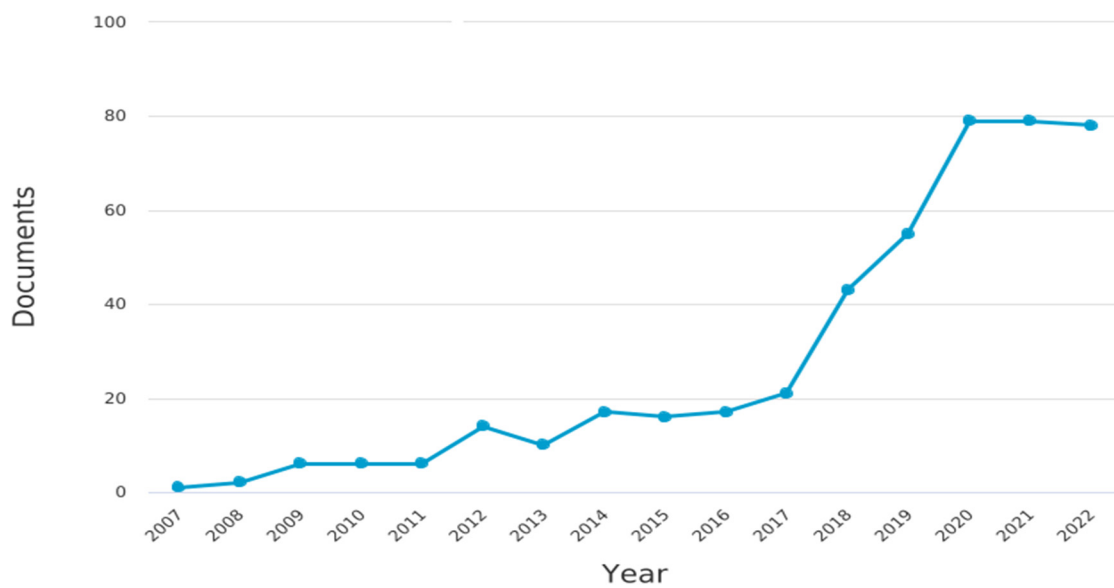


Figure 1. Document publications from 2007 to 2022.

4.2.2. H-Index

The H-graph developed by Hirsch displays and compares the impact of scholarly outputs. In this study, the h-index of 14 means that out of the 78 published documents, 14 were cited 14 times. This is depicted in Figure 2.

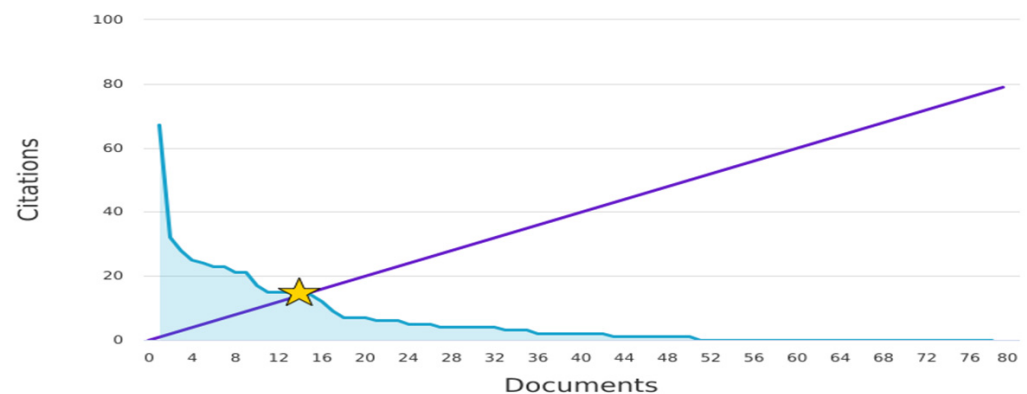


Figure 2. Documents h-index graph showing an h-index of 14.

4.2.3. Top Five Authors Scholarly Analysis

The top five authors on the subjects anti-money laundering, crime, and financial crimes are shown in Figure 3. Teichmann is the first with 36 documents, followed by Naheem with 20 documents; Unger with 17 documents; Ferweda with 14 documents; and Masciandaro with 12 documents. Notably, Teichmann had more scholarly output in 2020, while Unger had the highest in 2013. Observably, Unger is one of the early authors on the subject. The increase in the scholarly output from 2016 can be attributed to financial innovations and the subject gaining attention due to AML/CFT regulatory actions. The next section analyses the top five scholarly outputs, firstly Teichmann.

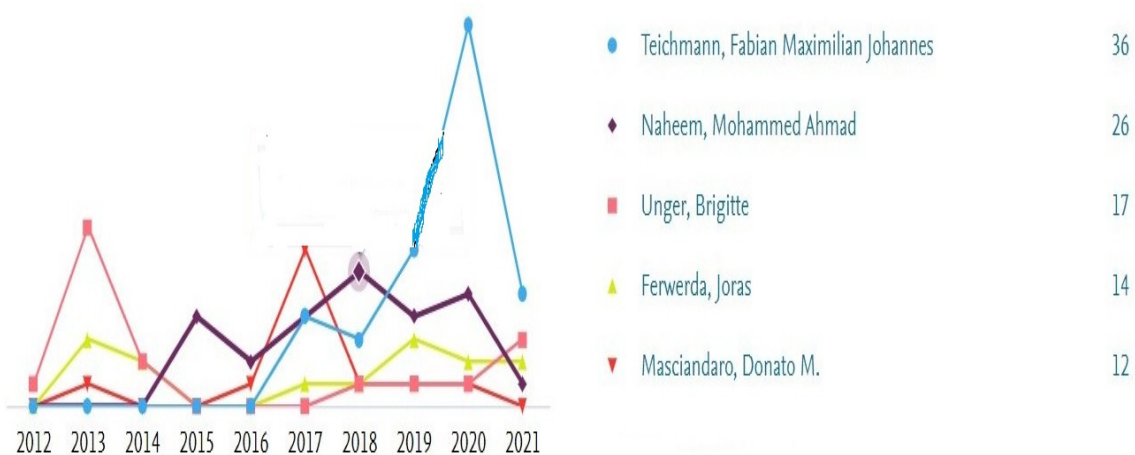


Figure 3. Top five author's scholarly output, 2012 to 2021.

Teichmann, the most prolific author, produced 36 publications, which were classified under anti-money laundering, crime, and financial crimes. This concurs with Figure 3, which shows the highest number of publications in 2020. Another nine articles were published under the classifications of firms, bribes, and anti-corruption measures. Notably, the topic field-weighted citation impacts are all below 1, which indicates the emerging and interdisciplinary nature of the subject. This information is presented in Table 3.

Table 3. Scholarly Contribution of Teichmann, 2017–2021.

Subject Area	Number of Publications	Topic Field-Weighted Citation Impact
Anti-Money Laundering, Crime, and Financial Crimes	36	0.61
Firms, Bribes, Anti-corruption Measures	9	0.96
Bitcoin, Ethereum, Internet of Things	3	2.55
Exchange Rates, Prices, Bitcoin	3	3.19

One of the articles classified under bitcoin, ethereum, and Internet of Things, with the title “Financing terrorism through cryptocurrencies—a danger for Europe?”, is an example of an interdisciplinary article that can reveal wrong information. The article had a TFWCI of 2.06, reflecting a highly cited article with a 106% generated impact in the field of study.

Over the period from 2017 to 2021, Naheem contributed articles in the 3 subject areas—anti-money laundering, bitcoin, and Salafis. As shown in Table 4, more contributions have been in the anti-money laundering subject area, which has a TFCI score of 0.61, indicating that impact is still low. However, one scholarly output in the bitcoin subject area had a TFCI score of 2.55, showing 155% impact within the academic and research field. This indicates that bitcoin is an emerging area with a lot of ongoing research.

Table 4. Scholarly Contribution of Naheem, 2017–2021.

Subject Area	Number of Publications	Topic Field-Weighted Citation Impact
Anti-Money Laundering, Crime, and Financial Crimes	20	0.61
Bitcoin, Ethereum, Internet of Things	1	2.55
Salafis; Wahhabism; Kuwait	1	0.75

Of the scholarly output exhibited in Table 5, Naheem had 5 articles published in journals, the majority of which were published in the Journal of Money Laundering Control. The most citations were recorded in 2017 with 19 apiece for the two articles. Naheem contributed to evolution game theory, which is one of the theories used in advancing the subject of money laundering. In 2019, Naheem concurred with Masciandaro (1999) on the need for active cooperation among the stakeholders in fighting money laundering. This remained key for addressing money laundering issues. Further, Naheem (2020) proffered to make use of big data to assist in minimizing money laundering effects.

Table 5. Naheem’s journals main citations.

Document Title	Source Document	Year	Citations
Illicit financial flows: HSBC case study	Journal of Money Laundering Control	2017	19
Money laundering and illicit flows from China—the real estate problem	Journal of Money Laundering Control	2017	19
China’s dirty laundry—international organizations posing a risk to China’s AML systems	Journal of Money Laundering Control	2018	18
Legitimacy of the Summer 2017 GCC crisis and Qatar’s AML framework	Journal of Money Laundering Control	2017	16
Suspicious alerts in money laundering—the Crédit Agricole case	Journal of Financial Crime	2017	16

Table 6 shows the scholarly contributions based on the subject areas. Unger was one of the top five authors, with publications that covered various disciplines including AML (6), firm and book–tax differences (2), and pension (2).

Table 6. Scholarly contributions of Unger, 2017–2021.

Subject Area	Number of Publications	Topic Field-Weighted Citation Impact
Anti-Money Laundering, Crime, and Financial Crimes	6	0.61
Firm; Book–Tax Differences; Profit Shifting	2	0.79
Pension Reform; Non-state Actors; Legitimation	2	0.6

Table 7 shows the publications by Unger. The studies were published in journals and book chapters. The majority of the publications had 8 citations. Most of the publications were collaborations with the top authors. For instance, Unger and Ferwerda in 2021 co-authored book chapter entitled “How big are illicit financial flows? The hot phase of IFF estimations”. Collaborations enhance quality of the research and contributing to knowledge sharing.

Table 7. Journal citations.

Document Title	Source Document	Year	Citations
How Big are Illicit Financial Flows? The Hot Phase of IFF Estimations	Book Chapter—How big are illicit financial flows? The hot phase of IFF estimations	2021	1
Estimating money laundering flows with a gravity model-based simulation	Scientific Reports, 2020	2020	8
A microeconomic foundation for optimal money laundering policies	International Review of Law and Economics, 2019	2019	8
Strategies to avoid blacklisting: The case of statistics on money laundering	PLoS ONE, 2018	2018	6

Table 8 shows the scholarly contributions by Ferwerda during the period from 2017 to 2021, with 13 publications recorded. The highest number of publications were recorded under anti-money laundering, with 9, yielding a TFWCI score of 0.61, while one was classified under crime prevention, with a TFWCI score of 1.48 and 48% impact within the interested community.

Table 8. Scholarly contributions of Ferwerda, 2017–2021.

Subject Area	Number of Publications	Topic Field-Weighted Citation Impact
Anti-Money Laundering, Crime, and Financial Crimes	9	0.61
Firm; Book-tax Differences; Profit Shifting	2	0.79
Crime Prevention; Burglary; Environmental Design	1	1.48
Firm; Bribes; Anti-corruption Measures	1	0.96

Table 9 shows the scholarly output of 32 articles. Of these published articles, the highest number of citations recorded was 8, in 2019 and 2020.

Table 9. Ferwerda’s journals and citations from 2017 to 2021.

Document Title	Source Document	Year	Citations
A microeconomic foundation for optimal money laundering policies	International Review of Law and Economics	2019	8
Estimating money laundering flows with a gravity model-based simulation	Scientific Reports	2020	8
Strategies to avoid blacklisting: The case of statistics on money laundering	PLoS ONE	2018	6
Learning from Money Laundering National Risk Assessments: The Case of Italy and Switzerland	European Journal on Criminal Policy and Research	2019	5
Estimating Money Laundering Risks: An Application to Business Sectors in the Netherlands	European Journal on Criminal Policy and Research	2019	4

Masciandaro’s scholarly output shows the three subject areas: anti-money laundering, central banking, and economics, as shown in Table 10, though more output was under anti-money laundering, crime, and financial crimes. Evidently, in 2009, Masciandaro collaborated with Pellegrina to further develop the initial crying wolf theory players by adding another player supervisory authority in the form of the financial intelligence unit (ref crying wolf theory).

Table 10. Scholarly contribution of Masciandaro, 2017–2021.

Subject Area	Number of Publications	Topic Field-Weighted Citation Impact
Anti-Money Laundering, Crime, and Financial Crimes	10	0.61
Central Bank, Monetary Policy, Bank of England	3	0.65
Welfare Cost of Inflation, Medium of Exchange, Inflation	2	0.52

Table 10 shows the outputs of the authors and the number of citations in the publications. The study published in 2019 had the highest number of citations, at 25, when

compared with the others. Notably, most of the studies were conducted through collaborations. Also, Masciandaro produced a book and contributed a book chapter. This further indicates scholarly output diversity.

4.2.4. Documents by Sources

Figure 4 shows the top five scholarly output publishers. The highest output was by the Journal of Money Laundering Control, which published 254 articles over the period. This was followed by the Journal of Financial Crime with 62 articles, the Research Handbook of Money Laundering with 18 articles, Crime, Law, and Social Change with 17 articles, and Advances in Intelligent Systems and Computing with 13 articles.



Figure 4. Top five Scopus sources, 2012 to 2021.

The Journal of Money Laundering Control seems to be the main journal used over the period 2012 to 2021. This could be attributed to the journal publishers, who are the primary authors on AML/CFT issues. Notably, the articles are being published in journals that do not solely focus on AML/CFT issues. For instance, the Journal of Crime, Law and Social Change and the Journal of Advances in Intelligent Systems and Computing. This supports the view that AML/CFT is an interdisciplinary subject, as it involves ICT and criminology subjects. Also, the classification of articles based on subject area can be conducted incorrectly, though addressing the same subject area of AML/CFT.

4.2.5. Top Five Documents by Country/Territory

Of the scholarly output, Figure 5 reveals the source countries. During the period 2012 to 2021, the United Kingdom is the main country with 254 documents, followed by the United States with 154 documents, China with 103 documents, Russia with 73 documents, and the Netherlands with 72 documents. The findings reveal that most of the research focus is done in Europe. This justifies the notion that developed countries allocate more resources towards research. Thus, this can explain the research findings on international collaborations of 164, in Table 2, in that collaborations are happening among the developed countries.

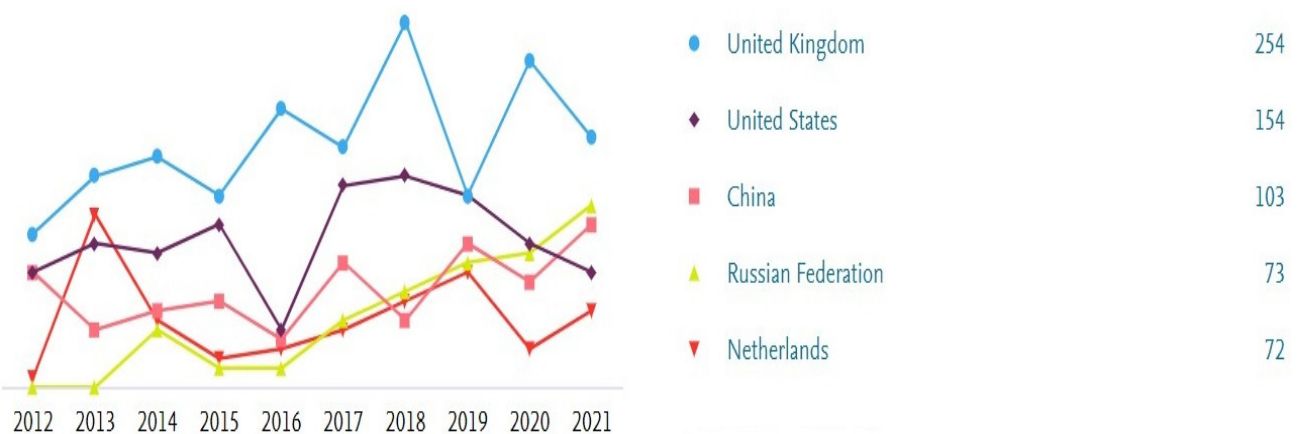


Figure 5. Five most active countries.

4.2.6. Top 5 Institutions' Scholarly Output

Of the scholarly output published and produced over the study period, Utrecht University had the most publications, with 32, followed by the Universiti Teknologi MARA with 20 articles, and the University of the West of England with 17. As shown in Figure 6, most studies were published in 2013 by Utrecht university, with 13 articles. This indicates that studies are being conducted in developed countries.

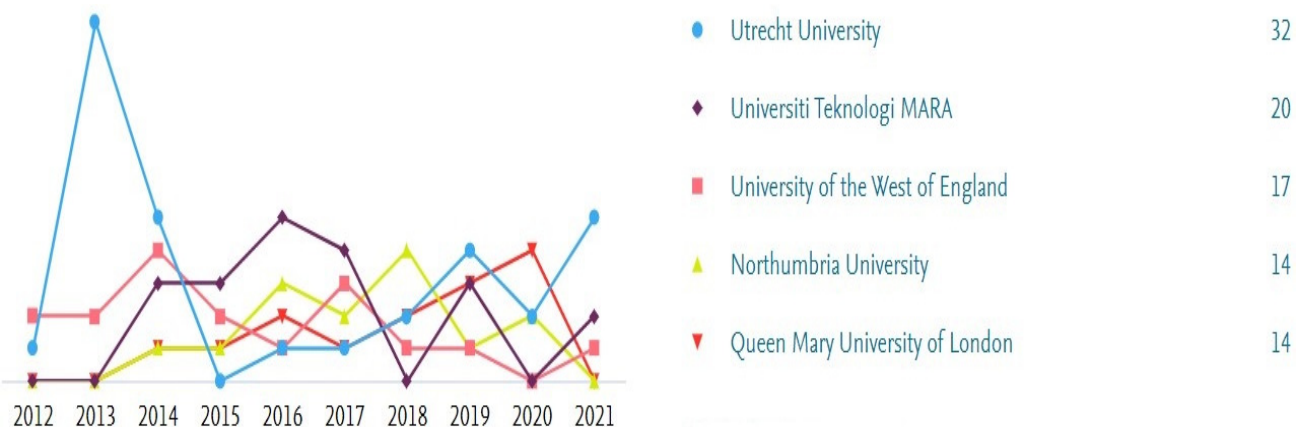


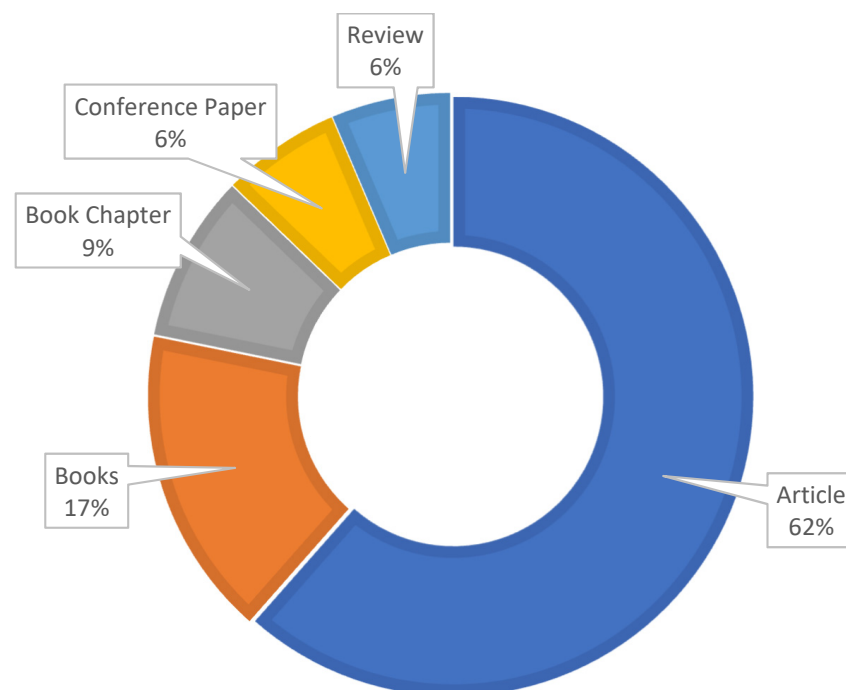
Figure 6. Top five institutions by scholarly output, 2012 to 2021.

4.2.7. Scholarly Output Publication Source

Scholarly output is being published in a number of sources, depending on various factors. The findings in Figure 7 revealed that 62% were published in articles with others, book chapters, conference papers, and books with others. These findings concur with Figure 3 shows top five scholarly outputs. For instance, Naheem (refer to Table 5) and Masciandaro (refer to Table 11) used mainly journals, though Masciandaro also published a book (refer to Table 11) and book chapter (refer to Table 11).

Table 11. Masciandaro—scholarly output and citations, 2017 to 2022.

Document Title	Source Document	Year	Citations
Cryptocurrency or usury? Crime and alternative money laundering techniques	European Journal of Law and Economics	2019	25
Global financial crime: Terrorism, money laundering and offshore centres	Book—Global Financial Crime: Terrorism, Money Laundering and Offshore Centres	2017	14
Drug trafficking, money laundering and the business cycle: Does secular stagnation include crime?	Metroeconomica	2017	7
Bank secrecy in offshore centres and capital flows: Does blacklisting matter?	Review of Financial Economics	2017	7
Combating black money: International co-operation and the G8	Book Chapter—New Perspectives on Global Governance: Why America Needs the G8	2017	3

**Figure 7.** Publication source distribution.

4.2.8. Documents by Subject Area

The subject area shows the interdisciplinary nature of the subject. Figure 8 shows that social sciences comprised 44%, economics 23%, and computer science 12%. The subject of customer due diligence in the FinTech era encompasses a number of disciplines, especially customer identification and verification that require incorporation of technology and the algorithms that can be used to track customer bank transaction activities and notify of any abnormalities.

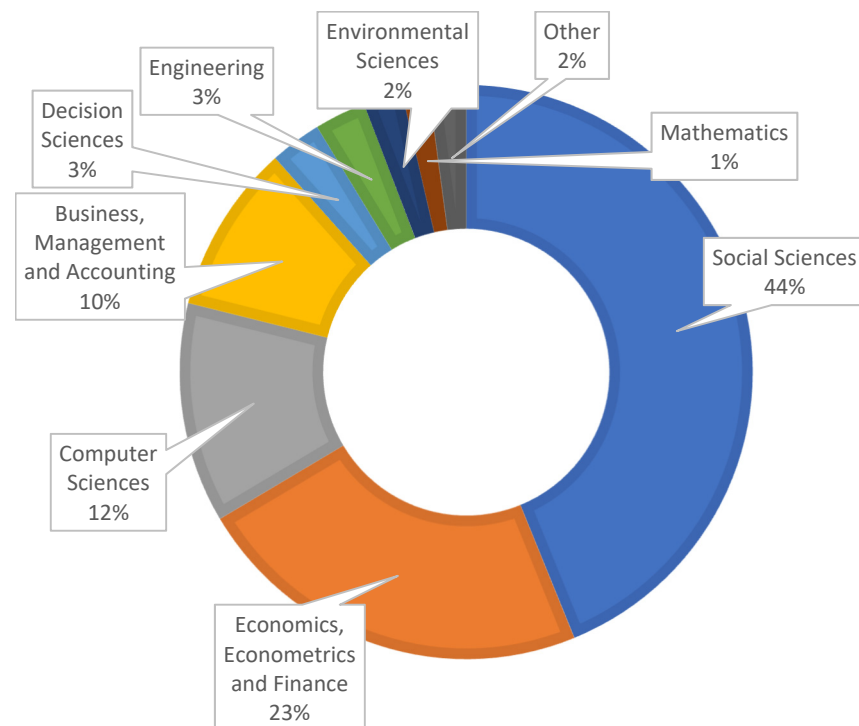


Figure 8. Documents by area of subject.

4.3. Keyphrase Analysis

Based on the anti-money laundering, crime, and financial crime subject, Figure 9 shows the heat map of the keyphrases or keywords commonly used. These keywords show the relevance and growth over the period from 2012 to 2021. This information reveals the impact and how the subject area is evolving.



Figure 9. Map of keywords.

Table 12 shows the relevance of keywords. It shows that anti-money laundering had strong relevance, as evidenced by the score of 1, while banks and crime were moderately weak, as evidenced by scores of 0.25 and 0.27, respectively. The keyphrases laundering and law had a score of 0.23, which is weak. Aside from anti-money laundering, the other scores were less than 0.2, which indicate the growing relevance of the subject.

Table 12. Top ten relevance keyphrases, 2017 to 2021.

Keyphrase	Relevance
Anti-money laundering	1.00
Crime	0.27
Banks	0.25
Laundering	0.23
Law	0.23
Financing of Terrorism	0.23
Terrorism	0.2
Corruption	0.18
Fraud	0.17
Banking	0.17

Table 13 shows the growth of the keywords in the subject area from 2012 to 2021. Cryptocurrency recorded the highest growth of 1100%, followed by blockchain with 500%, and corruption with 328.6%. Others that recorded above 100% growth were big data (150%), artificial intelligence (150%), compliance (130.8%), regulatory (120%), financing of terrorism (120%), banking sector (116.7%), and legislation (100%).

Table 13. Top ten growth keyphrases, 2017 to 2021.

Keyphrase	Growth
Cryptocurrency	1100%
Blockchain	500%
Corruption	328.6%
Big data	150%
Artificial Intelligence	150%
Regulatory	120%
Compliance	130.8%
Risk	131.6
Banking sector	116.7%
Legislation	100%
Banking	81.9%

The growth percentages show that the AML/CFT subject area is being integrated with technological innovations. Notably, regulation, compliance, and legislation recorded growth, which is an indicator of the regulations being adjusted accordingly. This concurs with the Hype cycle/TAM theory, which found that any new technological innovations follow an S shape. All these developments into the financial services sector and associated sectors to be proactive and not reactive in reducing emerging money laundering risks.

5. Conclusions

This study examined the current developments in customer due diligence (CDD) during the FinTech era. The study of anti-money laundering and combating financing of terrorism (AML/CFT) gained prominence after the 2007–2009 global financial crises (GFC),

in which administrative penalties were issued to financial institutions. Faced with AML regulatory compliance issues, technological solutions were or are still being developed. Thus, several technological innovation developments have shaped the future direction of the CDD in the AML/CFT sphere. A document search was conducted on Scopus using a well-defined subject query (financial AND technology) AND (anti-money AND laundering) AND (customer AND due AND diligence) AND (regulations). The adopted search query resulted in 78 documents from a total of 558,298 documents. Analysis and creation of bibliometric science maps was conducted using Scopus and SciVal.

The major findings revealed that the main research themes centered on anti-money laundering, banks and crime, and cryptocurrency, as well blockchain and corruption. Further, sharing of information and knowledge is still an emerging development in the field of integrating technological innovations in performing the CDD procedures. Most of the research has been conducted in countries such as the United Kingdom, the United States and China. The most prominent authors on the subject were Teichmann, Naheem, Unger, Ferwerda, and Masciandaro.

Based on the findings, the integration of CDD with FinTech is still an emerging area that requires interdisciplinary collaborations. Collaborations help in sharing information and knowledge about the subject. Suffice to say that the research in this realm is still concentrated in the developed world. Areas of further study include incorporation of technological innovations in performing AML/CFT functions and interdisciplinary collaborations. For future research, there is a need to devise integrative theories that capture the digitalisation of activities with other disciplines. The new norm is being shaped by technology-driven solutions to problems. Due to digital innovations, the financial sector remains vulnerable, which can result in financial instability and failure to protect consumers.

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