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From CFOs to crypto: exploratory study unraveling factors in corporate adoption

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Abstract

Cryptocurrency adoption has gained significant attention across various fields owing to its disruptive potential and associated challenges. However, companies' adoption of cryptocurrencies remains relatively low. This study aims to comprehensively examine the factors influencing cryptocurrency adoption, their interrelationships, and their relative importance. To achieve this objective, we employ a Decision-Making Trial and Evaluation Laboratory (DEMATEL) approach coupled with network analysis tools. By adopting a practical approach rather than a purely theoretical one, our unique contribution lies in the valuable insights derived from experienced Chief Financial Officers (CFOs) of various companies with experience in both traditional finance and cryptocurrencies. Furthermore, the unique blend of analytical rigor and industry expertise supports the study's relevance, offering nuanced insights that are not only academically robust but also immediately applicable in the corporate landscape. Our findings highlight the paramount importance of safety in transactions and trust in the chosen platform for companies considering cryptocurrency adoption. Additionally, criteria such as faster transactions without geographical limitations, lower transaction fees, seamless integration with existing systems, and potential cost savings are identified as crucial drivers. Both the DEMATEL approach and network analysis reveal strong interconnections among the criteria, emphasizing their interdependence and, notably, their reliance on transactional safety. Furthermore, our causes and effects analysis indicates that CFOs perceive company-led cryptocurrency adoption to positively impact the broader cryptocurrency market.

Keywords: Cryptocurrency adoption, Factors influencing adoption, Decision-making trial and evaluation laboratory (DEMATEL), Interrelationships, Transactional safety

Introduction

The introduction of the first cryptocurrency, Bitcoin, in 2008 marked the beginning of decentralized currencies (Nakamoto 2008). Cryptocurrencies, digital or virtual currencies utilizing cryptographic techniques, operate on a decentralized peer-to-peer network called a blockchain (Nabilou 2019). This decentralized nature means no central authority governs them, with transactions verified by participants known as miners (Nabilou 2019). Blockchain, the underlying technology, is a distributed ledger recording and verifying transactions across multiple nodes (Pierro 2017). Cryptocurrency transactions involve acquiring digital assets through exchanges or platforms.

Users create accounts, undergo verification, and link payment methods. Exchanges facilitate fiat-to-crypto conversions, enabling users to trade, diversify holdings, and conduct transactions directly between digital wallets (Aspris et al. 2021; Lehar and Parlour 2021). Users can share wallet addresses to receive payments or make transfers, with transactions verified and added to the blockchain through mining (Krause and Tolaymat 2018).

While cryptocurrencies have gained popularity for revolutionizing financial systems by eliminating intermediaries and enhancing security (Campino et al. 2022), concerns about volatility (Liu and Serletis 2019) have led to calls for regulatory measures (Yadav et al. 2022). Individuals' adoption of cryptocurrencies has grown significantly; however, adoption by businesses remains relatively low. Understanding the factors influencing business adoption is crucial to unlock the full potential of these digital assets.

Previous studies mainly focused on understanding the individual perspective for adopting cryptocurrencies, but they lacked an analysis of the differentiated corporate perspective. Furthermore, these studies were mostly based on the Structural Equation Modeling (SEM) methodology, which derived mainly theoretical insights. Conversely, this study builds on the existing literature by delving into the factors that shape companies' adoption of cryptocurrencies. By examining the expertise of Chief Financial Officers (CFOs) from diverse companies and backgrounds, we have analyzed 10 key criteria derived from the literature that have the potential to influence cryptocurrency adoption. Through the application of the Decision-Making Trial and Evaluation Laboratory (DEMATEL) and network analysis methodologies, our primary objective is to classify these criteria and unravel the intricate relationships among them. DEMATEL equips us with the tools to gain deeper insights into the interconnections between these criteria, facilitating a more comprehensive understanding of the factors influencing corporate cryptocurrency adoption and ultimately contributing to the broader discourse on this critical topic. The method supplements qualitative insights with quantitative rigor, affording a meticulous assessment of criteria and their relative significance. Through causal mapping, DEMATEL reveals the intricate web of influences. This method's inherent capacity for prioritization ensures that we focus on the most influential factors, channeling efforts effectively. Ultimately, DEMATEL's holistic approach consolidates all these attributes, fostering a profound understanding of the factors shaping corporate cryptocurrency adoption.

The inclusion of network analysis as a complementary tool to the DEMATEL method is a strategic choice that enhances the robustness and comprehensiveness of our research. Network analysis offers a critical dimension to our study by corroborating the relationships identified within the DEMATEL framework. By attributing centrality measures to each category, we gain valuable insights into the relative importance and influence of these categories within the network. Moreover, network analysis facilitates the visualization of complex numerical. This visual representation not only aids in making these relationships more accessible but also provides a powerful means of communication, allowing us to convey the intricate interplay of factors. To perform this analysis, we used the software R-Studio owing to its dedicated packages, extensive data analysis capabilities, open-source nature, and scripting potential. Additionally, it offers specialized tools tailored for network analysis, making it efficient and effective. The software's

robust data manipulation and statistical functions are crucial for preprocessing and analyzing network data.

The results obtained using the DEMATEL analysis highlight the paramount importance of criteria such as safety in transactions and trust in cryptocurrency platforms, faster transaction capabilities, the ability to conduct corporate transactions without geographic boundaries and with low fees, and potential cost savings and efficiencies. This emphasis aligns with existing literature that underscores the significance of safety, trust, and transaction speed in cryptocurrency adoption (Angerer et al. 2021; Campino et al. 2021; Dabbous et al. 2022). Previously, the adoption of cryptocurrencies was found to have substantial effects on companies, including improvements in transaction safety and trust owing to the incorruptible nature of blockchain technology, as well as the creation of a transparent system that enhances financial integrity (Auer and Claessens 2018; Wen et al. 2023). The adoption of cryptocurrencies also boosts liquidity in the market through faster, borderless, and cost-effective transactions, driving cost savings and operational efficiencies (Arli et al. 2020; Leirvik 2022).

Furthermore, the network analysis conducted reaffirmed the centrality of criteria such as faster transactions, corporate transactions without geographic boundaries, low fees, and potential cost savings and efficiencies, corroborating the DEMATEL findings. Finally, the network analysis underscored the interconnectivity of criteria, demonstrating a single community without distinct clusters, thus validating the high interrelation identified by DEMATEL.

The remainder of this paper is structured as follows. Section "Background" explains essential background concepts necessary for identifying the primary criteria that impact cryptocurrency adoption. Section "Methodology" presents the results of the analysis and discusses their significance. Finally, Section "Results" provides suggestions for future studies and addresses any limitations associated with our approach.

Background

Previous research on cryptocurrency adoption

The number of studies on cryptocurrency adoption has been growing, although it remains in its early stages (Al-Amri et al. 2019). Numerous studies have focused primarily on the adoption of cryptocurrencies from the perspective of individuals (Sousa et al. 2022; Jalan et al. 2023). For instance, Angerer et al. (2021) conducted a systematic literature review on the risks associated with cryptocurrency investments. Their research identified three key avenues of investigation concerning risk. The first avenue explores subjective risk, encompassing social or subjective constructions of human ideas about realities. The second avenue examines the perceived risk related to adopting new technology, an aspect that has been relatively underexplored in the context of cryptocurrency adoption. Finally, the third avenue delves into non-standard financial risks, particularly high market volatility and systemic risks inherent in cryptocurrency investments.

Building upon a similar perspective, Dabbous et al. (2022) investigated the factors influencing individual cryptocurrency adoption in a risky environment in Lebanon, utilizing a Structural Equation Modeling (SEM) approach. Their findings revealed that social influence and technology awareness play a role in reducing perceived risk associated with using cryptocurrencies, while individual risk aversion has the opposite effect.

Interestingly, the existence of regulatory frameworks was found to negatively impact the perception of risk in cryptocurrency adoption. In a similar domain, Quamara and Singh (2022) explored security concerns related to cryptocurrencies, particularly those associated with their completely digital structure and consequent cybersecurity risks. The risks identified by these researchers primarily revolve around the safety of cryptocurrency transactions and investments, highlighting the inherent risks in dealing with these assets. Notably, cybersecurity risks are closely tied to the trustworthiness of the platforms used for transactions (Bucko et al. 2015; Marella et al. 2021; Wen et al. 2023).

García-Monleón et al. (2023) emphasized the significance of financial factors, such as investment opportunities and emotional value in individual cryptocurrency adoption, using an SEM approach. Interestingly, they found that emotional value has a mediating effect through knowledge of cryptocurrencies. Environmental considerations consistently and increasingly play an essential role in diverse sectors (Kou et al. 2024a), particularly in financial investments (Kou et al. 2023). According to García-Monleón et al. (2023), environmental sustainability considerations are fully mediated through financial value, while social sustainability considerations are mediated through both financial and emotional value.

Similarly, employing the same methodological approach, Shahzad et al. (2018) investigated the Chinese market and identified awareness and perceived trustworthiness as crucial factors in Bitcoin adoption. Similarly, Steinmetz et al. (2021) conducted a social-demographic study in the German market and concluded that knowledge is the primary driver of cryptocurrency adoption, mediated by trust. From a macro perspective, the adoption of cryptocurrencies has been associated with low trust in the regional banking system and as a hedge against high inflation (Saiedi et al. 2020)

To the best of our knowledge and based on our extensive research, prior studies on cryptocurrency adoption have predominantly concentrated on individuals rather than companies. These researches have primarily explored the adoption of cryptocurrencies and the factors influencing it from the standpoint of individual investors. However, it is crucial to recognize that the perspectives and objectives of companies may differ from those of individual investors, and that is the contribution of our study. For instance, while investment opportunities in cryptocurrencies may be relevant to both individuals and companies, this factor might hold more significance for individuals and may not carry the same weight for companies. Moreover, the prevailing theoretical approaches in previous studies have largely relied on SEM methodology to draw conclusions.

This research takes a pioneering approach in both areas. First, we exclusively focus on the adoption of cryptocurrencies from the perspective of companies, departing from the prevailing research centered on individuals. This shift in focus allows us to explore the unique considerations and motivations that influence companies' decisions to adopt cryptocurrencies. Second, our study adopts a practical approach, which adds significant value by introducing real-world insights into the academic discussion on the relevant factors influencing cryptocurrency adoption. By incorporating insights from the experiences and practices of real companies, we seek to bridge the gap between theory and practical applications. Through this innovative approach, we aim to contribute a comprehensive understanding of companies' adoption of cryptocurrencies, shedding light on factors that may be distinct from those affecting individual investors. Drawing from

the existing literature, we have identified the most pertinent criteria for companies' adoption of cryptocurrency, which are summarized in Table 1. These criteria primarily encompass the safety and trustworthiness of transactions, as well as their transparent nature. The expeditious processing of transactions is also considered, along with the ability to conduct transactions without geographic limitations, offering cost-efficient payment options to customers and suppliers. Furthermore, the investment opportunities associated with acquiring cryptocurrencies are also considered. The enhancement of liquidity is also deemed important for companies, as it ensures the swift exchange of assets. However, the adoption of cryptocurrencies may also hinge on the feasibility of integrating them into existing systems.

Methodology

This research aims to provide a comprehensive understanding of the interdependencies among various criteria influencing companies' adoption of cryptocurrencies according to the perspective of CFOs. By identifying key factors for effective decision-making, the study utilizes two methods: (1) DEMATEL and (2) network analysis. This section presents a clear overview of the data collection and analysis process, followed by an exploration of the two methods employed. To perform our analysis, we used the software R-Studio because of its dedicated packages, extensive data analysis capabilities, open-source nature, and scripting potential. It offers specialized tools tailored for network analysis, making it efficient and effective. The software's robust data manipulation and statistical functions are crucial for preprocessing and analyzing network data.

Data collection and analysis

We support our results and conclusions based on the opinions provided by the CFOs of different companies. The insight of a CFO holds significant importance for organizations across industries. First and foremost, CFOs possess a deep understanding of financial principles and practices. They have extensive knowledge in areas such as financial analysis, accounting standards, risk management, and financial reporting. Their ability to analyze complex financial information allows them to identify trends, assess potential risks, and make informed recommendations to support strategic decision-making. Furthermore, the CFO's perspective extends beyond financial matters. They possess a

Table 1 Criteria selected for the analysis

ID	Criteria
A	Safety in the transactions and trust in the cryptocurrencies' platforms
B	Completely transparent system where every transaction is recorded
C	Having faster transactions
D	Make corporate transactions without geographic boundaries and with low fees
E	Possibility of paying to customers and suppliers with cryptocurrencies
F	Offer more payment methods than the traditional ones to customers and suppliers
G	Easy integration with existing systems
H	Increase the liquidity of the cryptocurrencies market
I	Potential cost savings and efficiencies
J	Investment opportunities from acquiring cryptocurrencies

These were the criteria selected based on the literature and used in the interviews with the CFOs

holistic view of the organization's operations and strategy as they collaborate with other functional areas, such as operations, marketing, and human resources, to align financial goals with overall business objectives.

This comprehensive insight enables CFOs to contribute to effective decision-making across the organization, not just within the finance department. Moreover, CFOs often serve as key advisors to top management and the board of directors. Their insight is sought in critical areas such as capital allocation, investment decisions, mergers and acquisitions, and cost management. Their strategic guidance helps organizations allocate resources efficiently, optimize capital structures, and mitigate financial risks. Hence, counting on the analysis of different CFOs provides valuable insights to our study, and although the sample size is small, we are still able to extract conclusions owing to their high-ranking position within the companies, which offers them expertise, in-depth understanding and a broad perspective.

We conducted interviews with a group of CFOs to gather insights on the subject matter. After reaching out to several CFOs, we successfully secured interviews with three of them, who accommodated our research within their demanding schedules. These interviews were conducted via scheduled online meetings during March 2023, during which we provided a comprehensive explanation of the research's purpose and obtained their consent to participate. To ensure clarity and transparency, we provided a detailed overview of the interview process and the significance of the selected categories for analysis. Subsequently, we shared response matrices with each of the three CFOs via email and obtained their responses during April 2023.

To ensure their comfort and flexibility, we allowed them to complete the matrices at their own pace without imposing any undue pressure. This approach aims to foster focused reasoning and accommodate their schedules to obtain thoughtful and accurate responses. To maintain the integrity and quality of the data collected, we took extensive measures to ensure that the CFOs fully understood the research process. We provided thorough explanations and addressed any questions they had, ensuring their comprehension and adherence to the research requirements. This attention to detail significantly enhanced the validity and reliability of the data we collected. Throughout the entire process, we guaranteed the total anonymity of the respondents, respecting their privacy and confidentiality.

The three CFOs interviewed were men with varying age intervals: the first aged between 20 and 30 years old, the second aged between 40 and 50 years old, and the third aged between 50 and 60 years old. Each CFO represented a company within a different sector, that is, water, industrial, and construction sectors. These companies' headquarters were located in various European Union countries and catered to different markets. The first respondent represents a large French company, while the second respondent represents a large German company. The last respondent represents a small Portuguese company. The summary of the data on the respondents is presented in Table 2.

Sample consistency

The sample in our study comprises three CFOs. Despite its limited size, this sample remains consistent and offers insights into the extent of cryptocurrency adoption within corporate environments. The DEMATEL method does not inherently require large

Table 2 Respondents identification

ID	Gender	Age	Position	Sector	Headquarters	Size
1	Male	40–50	Chief financial officer	Water	France	Large firm
2	Male	50–60	Chief financial officer	Industrial	Germany	Large firm
3	Male	20–30	Chief financial officer	Construction	Portugal	Small firm

samples, but it focuses instead on expert judgment and is particularly well-suited for scenarios where in-depth insights from a small number of highly knowledgeable participants can be more valuable than large-scale data (Wu and Chang 2015). Furthermore, the use of experts' opinions and valuable insights has been consistently employed in previous studies, yielding convincing results (Kou et al. 2024c).

The role of a CFO in the context of cryptocurrency adoption is highly specialized. It requires a deep understanding of financial operations and strategic decision-making. The three CFOs selected for our study have extensive experience in both traditional finance and the cryptocurrency space, making them well-qualified and highly informed sources of information. Engaging CFOs who possess expertise in both traditional finance and cryptocurrencies is a challenging endeavor, primarily because of their tightly packed schedules, heightened security, confidentiality priorities, constrained availability for external commitments, particularly research-related ones, and the essential requirement to establish trust and foster a strong professional relationship. Therefore, our study is not meant to be a broad, generalized analysis of all CFOs or financial intermediaries. Instead, it focuses on specific insights into the experiences, challenges, and decision-making processes of CFOs involved in cryptocurrency adoption. By providing in-depth interviews with these CFOs, we aim to generate knowledge that can be applicable and valuable to similar contexts, particularly those looking to navigate cryptocurrency adoption in the corporate sector.

This study acknowledges a consequent lack of diversity in the sample owing to its small size. Particularly regarding gender diversity, while we understand and support the importance of diversity in research, the participants were not selected based on gender but on their expertise and experience in the field, as well as on their availability to participate in this study. Furthermore, the gender distribution in the corporate sector, particularly in top leadership roles, is skewed toward men, which influenced our sample selection (Bertrand et al. 2010; Hamplová et al. 2022). Therefore, the sample reflects the current state of the industry, not a bias of the research. Regarding other criteria, our sample provides diverse views on several aspects by representing distinct industries and different company sizes. Furthermore, our sample provides culturally diverse insights as the CFOs represent different European cultures and realities. As the CFOs' cultural backgrounds are diverse, our sample accounts for regional cultural differences in Europe (Kaasa et al. 2014).

In sum, our study contributes to the scientific cryptocurrency literature by providing in-depth insights into the challenges and factors influencing corporate adoption of cryptocurrencies, as seen through the eyes of experienced CFOs. These insights, even from a small sample, can help inform future research and decision-making in this rapidly evolving field.

DEMATEL

This research has followed the approach used by Shieh et al. (2010) and Kou et al. (2024b) for the application of a DEMATEL method. DEMATEL is a multi-criteria decision-making technique that involves creating a cause-and-effect network of interrelated factors and analyzing their relationships to determine their relative importance. It is used to identify and prioritize the factors affecting a decision or problem and determine the causal relationships among these factors. The DEMATEL process begins with the identification of the problem or decision to be made and defining the factors that contribute to it, in our case, the adoption of cryptocurrencies by companies and the factors that contribute to this adoption. These factors are then grouped into categories, and a matrix is created to show the relationships between the factors. This matrix is then transformed into a digraph or network diagram that shows the causal relationships between the factors. Next, the digraph is analyzed to determine the relative importance of each factor and identify the key drivers of the problem. The results are then used to develop a strategy or action plan to address the problem or make the decision.

In this research, we have chosen to utilize the opinions of finance experts to develop our DEMATEL analysis. The approach of integrating experts' perspectives (i.e., individuals with the required expertise and adequate professional experience related to the research) with DEMATEL analysis was previously employed by Kou et al. (2024d). Accordingly, our research methodology is inspired by these prior methodological insights. Therefore, based on the literature, we first selected the most important categories that influence the adoption of cryptocurrencies. Subsequently, the matrices were produced, and the data was analyzed. According to Shieh et al. (2010), there are four main steps to conduct a correct DEMATEL analysis. We followed the approach proposed and previously tested, which is summarized in Table 3.

Network analysis

The network analysis methodology focuses on studying and analyzing the relationships and connections between entities or actors within a system. These entities can vary depending on the context of the study. The primary goal of network analysis is to

Table 3 DEMATEL method summary

Step	Description	Method
1	Calculate the average matrix which is based on the experts' opinions (0-3) about the influence of each category on the other.	$A = a_{ij} = \frac{1}{H}\sum_{k=1}^{H} x_{ij}^{k}$
2	Calculate the normalized initial direct-relation matrix by normalizing each coordinate of the average matrix by the maximum value of the average matrix.	$S = \frac{1}{\max_{1\le i\le n}\sum_{j=1}^{n} a_{ij}}$
3	Calculate the total relation matrix. From this matrix is possible to derive the total effects given and received by each factor as $(r_i + c_j)$ indicating their importance. Furthermore, we can calculate the net effect of each factor to the system as causes and effects identified in the research as $(r_i - c_j)$.	$T = D(I - D)^{-1}$
4	Define the threshold value to build the final diagram. As T matrix provides information on the interactions among effects we can disregard from our final analysis negligible effects. The threshold is defined by averaging the T matrix and the diagram obtained by $(r_i + c_j, r_i - c_j)$.	$\overline{T}$

Notation: i and j are factors; k is the number of respondents; H is each respondent; x_{ij} is the degree to which the respondent believes factor i affects factor j; D is the normalized matrix; I is the identity matrix; c is the sum of columns; r is the sum of rows

understand the structure, patterns, and dynamics of relationships within a network. In network analysis, entities are represented as nodes or vertices, while the relationships between them are depicted as edges or links. By examining the connections and interactions between nodes, network analysis uncovers valuable insights into the overall structure and functioning of the network. In this research, each criterion represents a node, and their connections represent the undirected edges.

Our main objective in using network analysis techniques is to understand the relationship connections among each criterion. Using centrality measures, we can measure and visualize the importance of each criterion and the way they are connected. This allows a further understanding of the insights provided by the CFOs as well as a complementary analysis to DEMATEL. For this study, we used three centrality measures: (1) degree of centrality, which quantifies the centrality of a node based on the number of direct connections it has with other nodes in the network. Nodes with a higher degree of centrality are considered more influential or essential within the network. Degree centrality is calculated by counting the number of edges connected to a node. (2) Eigenvector centrality. This measure considers not only the number of connections a node has but also the centrality of its neighboring nodes. It assigns a score to each node based on its own centrality and the centrality of its neighbors. In essence, nodes with high eigenvector centrality are well-connected to other influential nodes in the network. Eigenvector centrality is calculated iteratively using an eigenvector equation that incorporates the centrality scores of neighboring nodes. (3) Betweenness centrality. It measures the extent to which a node lies on the shortest paths between other nodes in the network. It quantifies the control or influence that a node has over the flow of information or resources within the network such that nodes with high betweenness centrality act as bridges or intermediaries, facilitating communication and information transfer between other nodes. Betweenness centrality is calculated by determining the proportion of shortest paths that pass through a particular node.

Finally, we used Louvain clustering—a widely used algorithm in network analysis for detecting communities or clusters. It is a hierarchical and modularity-based approach that aims to identify groups of nodes that are more densely connected within themselves than with nodes in other groups. The Louvain clustering algorithm follows a two-step optimization process that continues to iterate, optimizing modularity at both the node and community levels. The first step is modularity optimization. The algorithm starts by assigning each node to its own separate community. It then iteratively evaluates the modularity of the network, which quantifies the quality of the division of nodes into communities. Modularity measures the density of edges within communities compared to the expected density in a random network. The algorithm seeks to maximize the modularity by optimizing the community assignments. The second step is agglomeration and merger. Here, the algorithm aggregates nodes into supra-nodes based on their community assignments from the previous step. The resulting network consists of these supra-nodes, where each one represents a community. The algorithm then repeats the modularity optimization process on this coarser-grained network, treating the supra-nodes as individual nodes. This step helps to identify higher-level communities or clusters within the network.

Network analysis and its visualization techniques explored in our research in Figs. 3 and 4 were previously used in finance for different purposes. These techniques find their primary applications in analyzing systemic risk (Kuzubaş et al. 2014; Chan-Lau 2018) and studying financial market networks (Battiston et al. 2012). The centrality measures previously discussed serve as the foundation for network analysis visualization techniques, facilitating a lucid comprehension of our research outcomes. The incorporation of network analysis methods into the DEMATEL approach represents an innovative solution with dual objectives: (1) to offer a visual representation of our research findings and (2) to validate the DEMATEL results by attributing centrality values to identified categories. In this study, the application of network analysis techniques not only offers a convenient visual representation of the coefficients derived from DEMATEL but also corroborates the analysis by aligning the centrality measures with our earlier DEMATEL findings.

Results

DEMATEL

We have applied DEMATEL as the first step in our analysis. Building on this technique, we were able to distinguish the criteria defined between causes and effects, as well as their importance to the respondents. Furthermore, we managed to determine the relationships and their strength among the different criteria. The matrices used in the DEMATEL technique should always be read row-wise, and consequently, they should not be symmetric.

Causes and effects

Identifying the causes and effects using a DEMATEL technique reacquires the definition of the total relationship matrix T, depicted in Table 4. This matrix attributes the normalized weights to each interaction between criteria and allows the sum by row and column of the weights per criterion represented ad Ri and Ci, respectively.

Matrix T allows the definition of causes and effects, provided by $Ri - Ci$, and the relative importance of each criterion, provided by $Ri + Ci$, as summarized in Table 5.

Table 4 Total relationship matrix

	A	B	C	D	E	F	G	H	I	J	Ri
A	0.669	0.710	0.725	0.726	0.630	0.614	0.654	0.641	0.678	0.592	**6.640**
B	0.708	0.564	0.646	0.661	0.555	0.556	0.594	0.609	0.629	0.579	**6.101**
C	0.816	0.760	0.652	0.763	0.678	0.630	0.673	0.704	0.712	0.654	**7.039**
D	0.823	0.739	0.755	0.647	0.685	0.624	0.667	0.683	0.706	0.632	**6.959**
E	0.725	0.660	0.676	0.677	0.518	0.555	0.623	0.623	0.644	0.562	**6.263**
F	0.720	0.670	0.657	0.658	0.594	0.486	0.605	0.634	0.640	0.559	**6.223**
G	0.770	0.690	0.678	0.678	0.612	0.584	0.544	0.668	0.645	0.577	**6.447**
H	0.626	0.581	0.596	0.582	0.541	0.515	0.565	0.485	0.554	0.537	**5.581**
I	0.809	0.753	0.755	0.756	0.670	0.624	0.667	0.683	0.611	0.633	**6.962**
J	0.618	0.575	0.577	0.577	0.508	0.469	0.517	0.560	0.535	0.426	**5.360**
Ci	**7.283**	**6.702**	**6.719**	**6.726**	**5.988**	**5.656**	**6.108**	**6.289**	**6.353**	**5.751**	

Bold indicates identify the final values

Table 5 Causes and effects table

Criteria	Ri	Ci	Ri+Ci	Ri-Ci	Identity
A	**6.640**	**7.283**	13.923	**−0.644**	Effect
B	**6.101**	**6.702**	**12.803**	**−0.601**	Effect
C	**7.039**	**6.719**	13.758	**0.320**	Cause
D	**6.959**	**6.726**	13.685	**0.233**	Cause
E	**6.263**	**5.988**	**12.251**	**0.276**	Cause
F	**6.223**	**5.656**	**11.878**	**0.567**	Cause
G	**6.447**	**6.108**	**12.554**	**0.339**	Cause
H	**5.581**	**6.289**	**11.870**	**−0.708**	Effect
I	**6.962**	**6.353**	13.315	**0.608**	Cause
J	**5.360**	**5.751**	**11.111**	**−0.390**	Effect

The causes and effects table is based on the total relationship matrix and defines cases/effects and their relative weight. These data will be used in the posterior steps of the analysis

Bold indicates indentify the highest values in that given context

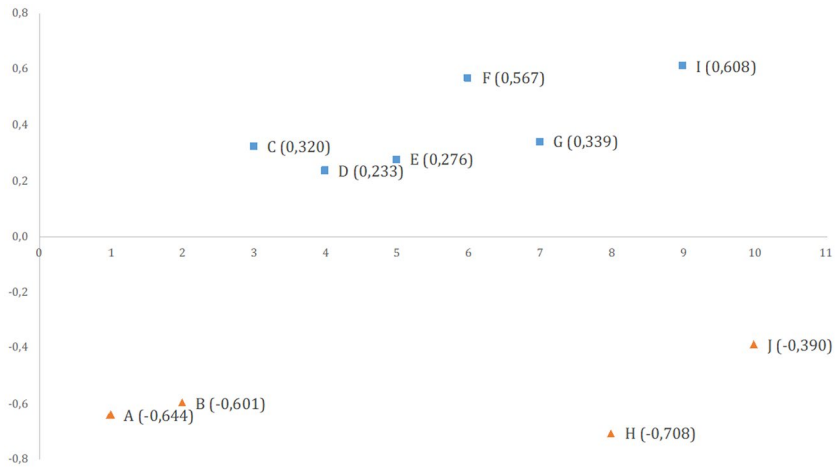

Fig. 1 Causes and effects graph. Note: the graphs identifies visually each cause and effect based on the causes and effects table

In DEMATEL, causes are the factors that are the drivers affecting the decision at hand. The causes identified were the following: (C) having faster transactions; (D) make corporate transactions without geographic boundaries and with low fees; (E) possibility of paying customers and suppliers cryptocurrencies; (F) offer more payment methods than the traditional ones to customers and suppliers; (G) easy integration with existing systems; (I) potential cost savings and efficiencies. Regarding effects, they are the outcomes or consequences of a decision. Effects are typically the criteria or variables that are of interest and are influenced by the causes in the decision-making process. The effects identified were the following: (A) safety in the transactions and trust in the cryptocurrencies' platforms; (B) completely transparent system where every transaction is recorded (H) increase the liquidity of the cryptocurrency market; (J) investment opportunities from acquiring cryptocurrencies. Figure 1 allows the spatial visualization of the criteria distribution and the identification of causes and effects, indicating a clear distinction between them as per $Ri - Ci$.

Following a prioritized criteria analysis based on $Ri + Ci$, it is possible to obtain the importance of each criterion according to their relative weight. Therefore, it is possible to establish a hierarchy of importance among criteria, and our results identify four main criteria with weights above 13. According to the respondents, the most crucial criterion is the effect (A) safety in the transactions and trust in the cryptocurrencies' platforms. The causes (C) having faster transactions and (D) make corporate transactions without geographic boundaries and with low fees are the second and third most important criteria. Finally, the respondents identified the cause (I) potential cost savings and efficiencies as one of the most important.

Relationships

Our analysis helps to provide insights into the complex relationships between causes and effects and assists in understanding the dynamics and interdependencies within a system. Therefore, based on matrix T, we have built the relationship matrix R depicted in Table 6. This matrix identifies the relationships among criteria, in other words, which criteria are connected. The relationships in Matrix R were obtained by eliminating the relationships below the minimum weight threshold defined as $\overline{R}$. Our criteria are strongly interconnected, revealing several relationships among them. Our results show an average of 4.7 relations, a maximum of 8 relations, and a minimum of 0 relations per criterion. We were able to identify the following relationships per criterion: (A) -> B, C, D, G, H, I; (B) -> A, C, D; (C) -> A, B, D, E, G, H, I, J; (D) -> A, B, C, E, G, H, I; (E) -> A, B, C, D, I; (F) -> A, B, C, D, I; (G) -> A, B, C, D, H, I; (I) -> A, B, C, D, E, G, H.

To assess the strength of each relationship, we have created thresholds to define weak, medium, and strong relationships. The thresholds are based on matrix R and provide the relationship strength matrix S depicted in Table 7. We have defined as weak the relationships in which weight is comprised between $min(R)$ and $mean(R)$, as medium the relationships in which weight is comprised between $mean(R)$ and $\frac{max(R)+mean(R)}{2}$, and strong relationships in which weight is comprised between $\frac{max(R)+mean(R)}{2}$ and $max(R)$. As expected, the relationships' strengths vary widely depending on the criteria. The strongest relationships are between the criteria (C) -> A, D; (D) -> A; (G) -> A; (I) -> A. This analysis identifies a clear pattern of a strong impact of several criteria on Criterion A.

Table 6 Relationship matrix

	A	B	C	D	E	F	G	H	I	J
A		0.710	0.725	0.726			0.654	0.641	0.678	
B	0.708		0.646	0.661						
C	0.816	0.760		0.763	0.676		0.673	0.704	0.712	0.654
D	0.823	0.739	0.755		0.685		0.667	0.683	0.706	
E	0.725	0.660	0.676	0.677					0.644	
F	0.720	0.670	0.657	0.658					0.640	
G	0.770	0.690	0.678	0.678				0.668	0.645	
H										
I	0.809	0.753	0.755	0.756	0.670		0.667	0.683		
J										

The relationship matrix should be analyzed horizontally, and the relationships between the criterion and their strength should be identified based on the total relationship matrix

Table 7 Relationship strength matrix

	A	B	C	D	E	F	G	H	I	J
A		Medium	Medium	Medium			Weak	Weak	Weak	
B	Medium		Weak	Weak						
C	Strong	Medium		Strong	Weak		Weak	Medium	Medium	Weak
D	Strong	Medium	Medium		Weak		Weak	Weak	Medium	
E	Medium	Weak	Weak	Weak					Weak	
F	Medium	Weak	Weak	Weak					Weak	
G	Strong	Weak	Weak	Weak				Weak	Weak	
H										
I	Strong	Medium	Medium	Medium	Weak		Weak	Weak		
J										

Qualitative matrix based on the relationship matrix

Network analysis

We conducted a comprehensive network analysis to explore the relationships among criteria in our study. By employing centrality measures, we determined the significance of each criterion within the network, allowing us to identify the most influential criteria. Furthermore, we applied the Louvain clustering algorithm to detect communities or clusters of criteria based on their similarity levels. This enabled us to group related criteria together and gain insights into the underlying patterns and structures within the network.

Centrality of criteria

The three measures of centrality used were degree centrality, eigenvector centrality, and betweenness centrality. These measures show low correlation levels except for the correlation between eigenvector and degree centrality, as per Fig. 2. This leads to the conclusion that nodes that are well connected (i.e., high degree centrality) are also likely to be connected to other highly influential nodes (i.e., high eigenvector centrality). This suggests that these nodes not only have many direct connections but are also connected to other influential nodes in the network, reinforcing the importance of those criteria. Conversely, the lack of correlation between betweenness centrality and both eigenvector centrality and degree centrality suggests that nodes with high betweenness centrality (i.e., the extent to which a node lies on the shortest paths between other pairs of nodes) may not necessarily have high overall influence or many direct connections.

The full results of the centrality measures are summarized in Table 8, showing that the three measures used confirm Criterion C as the most central. The three measures are also in accordance with the four most central criteria, namely, A, C, D, and I. This analysis confirms the conclusions of the prioritized criteria analysis in DEMATEL, where the same criteria were defined as the most important according to the CFOs' answers.

The visualizations of both degree centrality and eigenvector centrality networks are depicted in Fig. 3. As anticipated, these centrality measures exhibit a strong correlation, leading to similar outcomes regarding the centrality rankings of the criteria. In the graphs, the size of each edge corresponds to the centrality level assigned by each measure, while the thickness of the edge represents the strength of the relationship, ranging

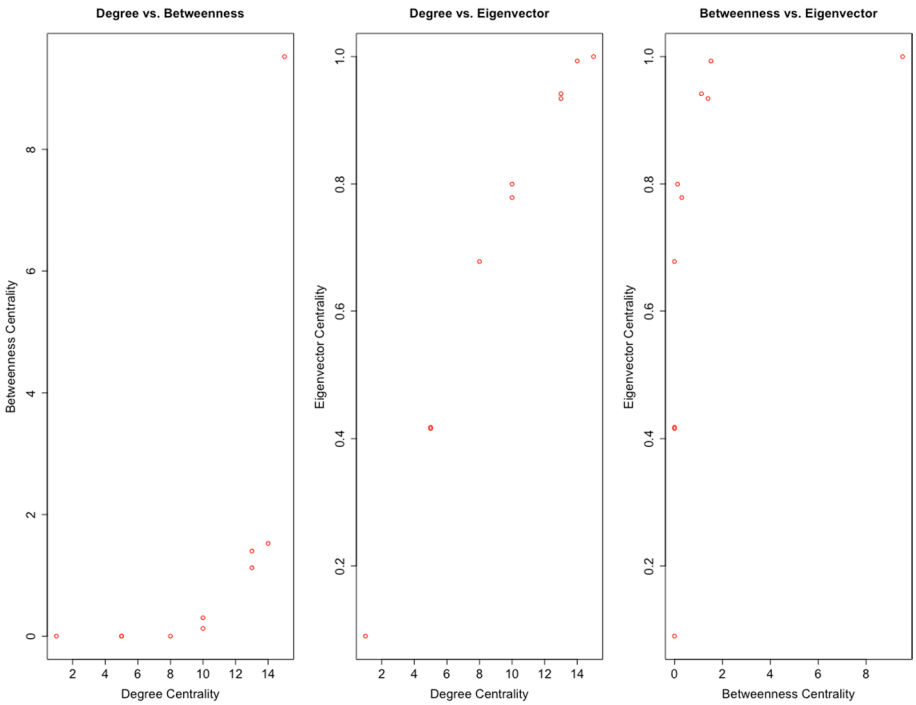

Fig. 2 Correlation between centrality measures

Table 8 Centrality measures output

Criteria	Degree	Eigenvector	Betweenness
A	**13**	**0.942**	**1.123**
B	10	0.778	0.303
C	**15**	**1.000**	**9.525**
D	**14**	**0.993**	**1.525**
E	8	0.678	0.000
F	5	0.416	0.000
G	10	0.800	0.125
H	5	0.418	0.000
I	**13**	**0.934**	**1.400**
J	1	0.089	0.000
Maximum	C	C	C

Summary table of the results obtained in the network analysis

Bold indicates indentify the highest values in that given context

from 1 to 3. These visual representations provide a comprehensive understanding of the criteria's centrality within the network.

The degree centrality graph reveals that Criteria A, C, D, and I are the most central nodes in the network. These criteria exhibit the highest number of connections and play crucial roles in maintaining the network's overall connectivity. Their centrality suggests that they are influential over other criteria in the graph. Following the highly central criteria, we find Criteria B, E, and G, which exhibit a relatively lower degree centrality. Although these nodes have fewer connections compared to the previous group, they still hold a moderate level of centrality within the graph. Their position suggests that they

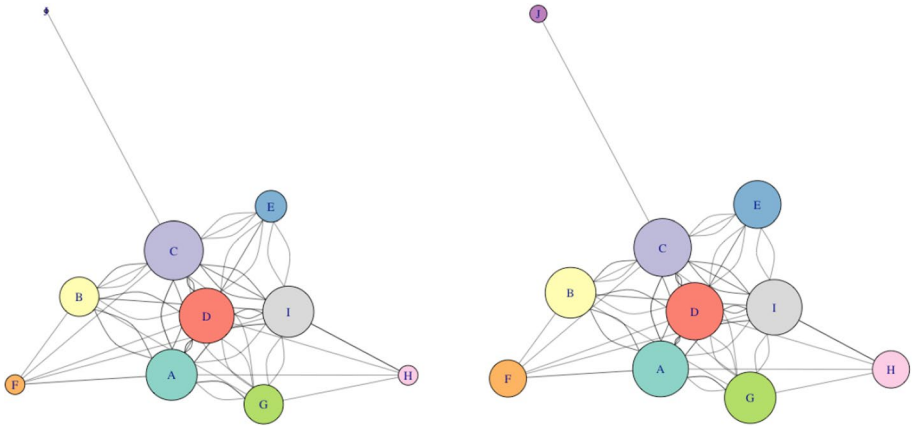

Fig. 3 Degree centrality and eigenvector centrality visualization

play intermediary roles, connecting the highly central nodes to other parts of the network. Criteria H and F occupy the next tier in terms of degree centrality. These nodes have even fewer connections, indicating that they are less central within the graph. While they may not exert as much influence as the previous groups, they still contribute to the network's overall structure and connectivity. Criterion J emerges as the least central node according to the degree centrality. It possesses only one edge, forming a connection with Criterion C. This limited number of connections signifies its peripheral position within the network. Consequently, criterion J holds less influence over other criteria compared to its counterparts.

Eigenvector centrality is a different measure that considers both the number and quality of connections. Although the weights associated with each connection are not explicitly specified, the eigenvector centrality graph yields centrality rankings similar to those of the degree centrality graph. Criteria A, C, D, and I, which were identified as the most central in terms of degree centrality, continue to hold their positions in the eigenvector centrality graph. This indicates that these nodes not only have a high number of connections but are also connected to other influential nodes, emphasizing their overall importance and influence within the network. Similarly, Criteria B, E, and G, along with H and F, maintain their respective centrality rankings in the eigenvector centrality graph. Although the weights assigned to their connections may vary, these criteria exhibit a similar level of centrality as observed in the degree centrality graph. Criterion J, with only one connection to Criterion C, also remains the least central node according to eigenvector centrality. Despite potential variations in weights, the limited number and quality of its connections contribute to its peripheral position within the network.

Unlike degree centrality and eigenvector centrality, which focus on the connection of nodes, betweenness centrality quantifies the extent to which a node lies on the shortest paths between other nodes within a network. This measure attributes weight to the criterion with the shortest path to others (i.e., directly connected) and penalizes the criterion with the longest path (i.e., indirectly connected to others via another or several criteria). The betweenness centrality Fig. 4 unveils a centrality distribution that shows that Criterion C stands out as the most central node, significantly surpassing all other measures in terms of betweenness centrality. Its position suggests that Criterion C holds

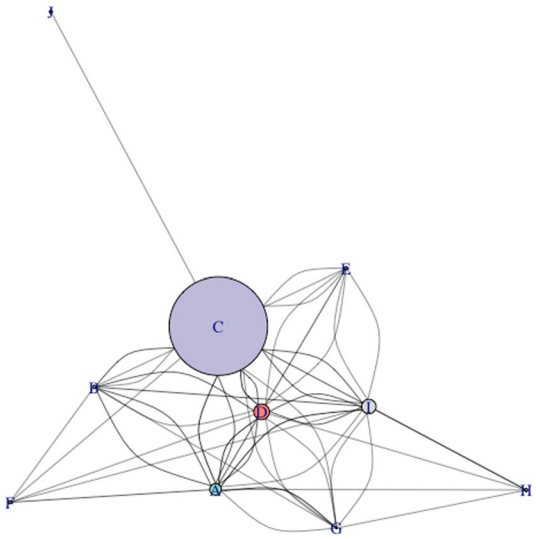

Fig. 4 Betweenness centrality visualization

a pivotal role within the network, acting as a critical connector between various nodes and serving as a bridge for information flow. Criteria A, D, and I follow in the centrality rankings, albeit with notably lower betweenness centrality values compared to Criterion C. Although these measures are considered relatively central within the network, their centrality levels remain considerably lower than that of Criterion C. This implies that while A, D, and I contribute to connectivity, their roles are comparatively less influential than Criterion C. Moreover, the remaining measures in the graph exhibit very low levels of betweenness centrality, suggesting limited involvement in the network's shortest paths.

Community detection

Similarly to the previous analysis, Fig. 5 utilizes degree centrality to distribute nodes and represents the strength of relationships through the thickness of the edges. Furthermore, community detection using the Louvain cluster algorithm has been applied to identify distinct communities within the network. However, the result of this analysis is the detection of only one community encompassing all the criteria. This outcome suggests a high degree of interconnectedness and similarity between the criteria, reinforcing the notion of a cohesive network structure already conveyed in DEMATEL's matrix *R*.

Discussion

The research results were drawn following the interview of three CFOs of different companies with different backgrounds. They were asked to fill out a matrix, which is the basis for the DEMATEL approach followed. Having selected 10 criteria, each respondent made 90 links between criteria, which makes a total of 270 links.

The DEMATEL analysis shows primarily the importance of the criteria (A) safety in the transactions and trust in the cryptocurrency platforms, (C) having faster transactions, (D) make corporate transactions without geographic boundaries and with low fees, and (I) potential cost savings and efficiencies. The CFOs are mainly interested in

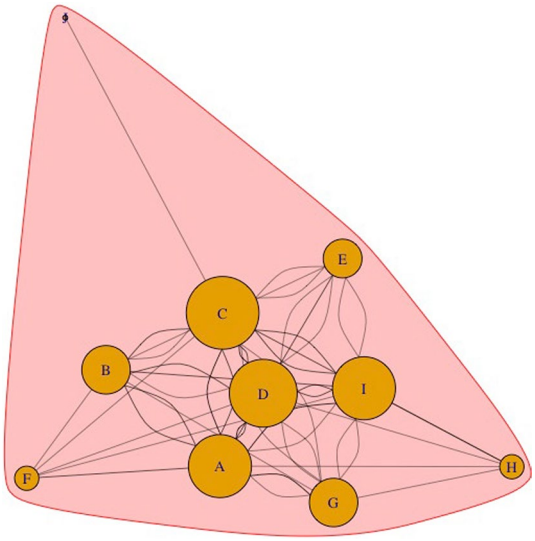

Fig. 5 Community detection visualization. Note: the community detection was obtained using the Louvain cluster algorithm based on the degree centrality

the assurance of safety in the transactions and trust in the cryptocurrency platforms (Angerer et al. 2021; Dabbous et al. 2022). The objective of achieving faster transactions than the ones performed via fiat currencies is also crucial for companies adopting cryptocurrencies. As the companies represented in our sample perform business abroad in their home countries, the CFOs reveal interest in performing transactions without geographic boundaries and with low fees, which lead to cost savings and efficiencies (Campino et al. 2021; Singh 2023). In summary, the hierarchy revealed by our analysis demonstrates the importance of faster transactions if they are considered safe and trustworthy while performing more efficient transactions, leading to savings.

Companies' adoption of cryptocurrencies profoundly affects their operations (Alzahrani and Daim 2019). One of the significant effects is the improvement in safety in transactions and trust in cryptocurrency platforms (Wen et al. 2023). This effect is caused by the incorruptible nature of blockchain technology, which ensures the security and immutability of transaction records (Quamara and Singh 2022).

Another effect of cryptocurrency adoption is the creation of a completely transparent system where every transaction is recorded. This transparency ensures that all transactions are traceable and verifiable, thereby enhancing integrity and accountability in financial transactions (Auer and Claessens 2018). Companies' adoption of cryptocurrencies also leads to increased liquidity in the cryptocurrency market (Leirvik 2022). This effect is driven by causes such as faster transactions facilitated by cryptocurrencies. With cryptocurrencies, companies can conduct swift and borderless transactions, eliminating geographic boundaries and reducing processing time compared to traditional financial systems (Arli et al. 2020).

Additionally, the lower fees associated with cryptocurrency transactions contribute to improved liquidity, as businesses can transact more efficiently and at reduced costs (Singh 2023). Furthermore, the adoption of cryptocurrencies offers companies potential cost savings and efficiencies. Causes contributing to this effect include the

possibility of paying customers and suppliers with cryptocurrencies (Alzahrani and Daim 2019).

By utilizing cryptocurrencies, companies can eliminate intermediaries and associated transaction fees, leading to cost reductions. Moreover, offering more payment methods than traditional options to customers and suppliers expands transaction opportunities and enhances operational efficiencies. Additionally, the easy integration of cryptocurrencies with existing systems enables seamless financial processes, further driving cost savings and operational efficiencies (Chan et al. 2019).

Finally, the adoption of cryptocurrencies presents investment opportunities (García-Monleón et al. 2023) not only for companies but also for individuals, as their wider adoption contributes to their establishment. On a broader perspective, considering the causes and effects identified by the analysis, we conclude that the CFOs believe that the adoption of cryptocurrencies by companies has an improvement effect on the cryptocurrency market as all the causes identified can be considered internal to the company and the effects external to the company and related with the macro-environment of the cryptocurrencies' market.

When examining the robust relationships between the criteria, it becomes evident that the primary concern of CFOs is the safety of transactions and trust in the platform (Shahzad et al. 2018; Steinmetz et al. 2021). Factors such as faster transactions without geographic constraints and with low fees, easy integration into existing systems, and potential cost savings are all strongly correlated with ensuring safety.

It is crucial to recognize that when companies consider adopting cryptocurrencies, they can potentially reap several advantages; however, these advantages are contingent upon the perceived safety and trustworthiness of the transactions (Shahzad et al. 2018). Therefore, for the widespread adoption of cryptocurrencies by companies, transactions must provide a level of safety that is convenient for businesses, and exchange platforms must inspire trust and offer guarantees to users (Marella et al. 2021).

As previously explored, the concept of faster transactions emerges as the primary driver for companies to adopt cryptocurrencies. This factor is also closely linked to the ability to perform transactions without geographic constraints and with low fees. International transfers tend to be more complex and typically involve third-party intermediaries, which inevitably increase costs. Hence, companies desire to conduct such transactions faster and more efficiently (Suratkar et al. 2020). It is important to note that the prospect of offering more payment methods than traditional ones to customers and suppliers does not currently serve as a significant driver for the adoption of cryptocurrencies. This is primarily owing to the current lower demand for these solutions (Jonker 2019), as companies place greater emphasis on achieving efficiencies in their operations.

Concerning the network analysis performed, we start by confirming a correlation between the measures of degree centrality and eigenvector centrality in our sample. This shows convincing proof that the highly connected criteria are also linked to other criteria with high levels of centrality. However, concerning betweenness centrality, we confirm that nodes on the shortest paths between other pairs of nodes are not central to the network.

This analysis confirms the importance of the centrality of the same criteria already highlighted by the DEMATEL analysis. Therefore, the network analysis confirms the

strong centrality of (C) having faster transactions, (D) make corporate transactions without geographic boundaries and with low fees, (I) potential cost savings and efficiencies, and (A) safety in the transaction and trust in the cryptocurrencies' platforms. This is because of their high level of relationships, mainly among them, and also with other criteria. However, all the centrality measures highlight (C) having faster transactions as the most central measure instead of (A) safety in the transactions and trust in the cryptocurrencies' platforms, as this criterion has the highest number of relationships and has the highest strength.

This result enhances the DEMATEL analysis by providing further validation that the adoption of cryptocurrencies is primarily influenced by two crucial factors: transaction speed and security. This analysis confirms the existence of only one community of criteria after the application of the Louvain clustering algorithm, concluding that they are interconnected and there are no clusters concerning levels of similarity. This conclusion also confirms the high interconnection of criteria revealed by the DEMATEL analysis.

Finally, our analysis reveals a noteworthy trend among companies, emphasizing the utilization of cryptocurrencies for transactional purposes rather than exploring their potential for investment opportunities and financing. The findings underscore a predominant emphasis on criteria such as (A) safety in the transactions and trust in the cryptocurrencies' platforms, (C) having faster transactions, (D) make corporate transactions without geographic boundaries and with low fees, and (I) potential cost savings and efficiencies. Conversely, criteria like (J) investment opportunities from acquiring cryptocurrencies receive comparatively lower scores, akin to (H) increase the liquidity of the cryptocurrency market.

Consequently, our results indicate that companies are primarily preoccupied with the safety of the instrument and optimizing its use to achieve cost savings and operational efficiencies, particularly in the context of faster and international transactions. Notably, considerations for increased liquidity in the market or seizing investment opportunities stemming from cryptocurrencies are not at the forefront of our respondents' priorities, as their primary focus lies elsewhere.

Conclusion

The objective of this research is to provide a comprehensive understanding of the interconnected relationships among various factors influencing companies' acceptance of cryptocurrencies. To achieve this, the criteria affecting companies' adoption of cryptocurrencies were derived from existing literature.

Subsequently, a DEMATEL analysis and network analysis were performed based on the insights obtained from three CFOs. Particularly, the DEMATEL method is a powerful decision-making technique used to analyze complex relationships and interdependencies among elements within a system or problem. It involves a structured approach to identify and assess the mutual influences between various factors, variables, or components through pairwise comparisons provided by experts or stakeholders. By creating a cause-and-effect network, the method helps distinguish between influential and influenced elements, revealing the direct and indirect relationships within the system and allowing its adaptation to traditional network

analysis. DEMATEL also aids in understanding the underlying structure of the problem, identifying key drivers, and prioritizing actions for effective decision-making and problem-solving.

We conducted a comprehensive research study centered around a practical approach, leveraging valuable insights from three experienced CFOs regarding their firsthand financial experiences and their companies' potential adoption of cryptocurrencies. By grounding our research in real-world perspectives, we aimed to bridge the gap between academic discussions and the evolving field of cryptocurrencies. Our primary contribution lies in offering fresh insights from industry practitioners, shedding light on the emerging topic of cryptocurrencies and their adoption by companies. This approach enriches the academic discourse and facilitates a more nuanced understanding of the subject.

To identify the key factors influencing companies' adoption of cryptocurrency, we analyzed responses from our respondents and applied both DEMATEL and network analysis techniques. As a result, we pinpointed the most crucial factors in line with the literature: (A) safety in the transactions and trust in the cryptocurrency platforms (Angerer et al. 2021; Dabbous et al. 2022; Quamara and Singh 2022; Wen et al. 2023), (C) having faster transactions (Arli et al. 2020), (D) make corporate transactions without geographic boundaries and with low fees (Campino et al. 2021; Singh 2023), and (I) potential cost savings and efficiencies (Suratkar et al. 2020; Campino et al. 2021). Furthermore, the DEMATEL analysis helped us highlight the causes of cryptocurrency adoption in line with the literature as: (C) having faster transactions; (D) make corporate transactions without geographic boundaries and with low fees; (E) possibility of paying customers and suppliers cryptocurrencies (Alzahrani and Daim 2019); (F) offer more payment methods than the traditional ones to customers and suppliers (Jonker 2019); (G) easy integration with existing systems (Chan et al. 2019); (I) potential cost savings and efficiencies. The analysis allowed the identification of effects as well: (A) safety in the transactions and trust in the cryptocurrencies' platforms; (B) completely transparent system where every transaction is recorded (Auer and Claessens 2018); (H) increase the liquidity of the cryptocurrency market (Leirvik 2022); (J) investment opportunities from acquiring cryptocurrencies (García-Monleón et al. 2023). We were also able to identify the following relationships per criterion, which vary according to their strength: (A) -> B, C, D, G, H, I; (B) -> A, C, D; (C) -> A, B, D, E, G, H, I, J; (D) -> A, B, C, E, G, H, I; (E) -> A, B, C, D, I; (F) -> A, B, C, D, I; (G) -> A, B, C, D, H, I; (I) -> A, B, C, D, E, G, H.

Used jointly with the DEMATEL analysis, the network analysis further supported the interconnections between the selected criteria, validated through the Louvain algorithm, which allowed us to detect a single community within the data, showing convincing proof of the strong connections between criteria. Additionally, the network analysis highlighted lower degrees of centrality for criteria (J) investment opportunities from acquiring cryptocurrencies, (F) offer more payment methods than the traditional ones to customers and suppliers, and (H) increase the liquidity of the cryptocurrency market, regardless of the centrality measurement employed. Network analysis and its associated visualization methods have traditionally been employed in finance for various purposes. These techniques are primarily used to assess systemic

risk (Kuzubaş et al. 2014; Chan-Lau 2018) and explore financial market networks (Battiston et al. 2012). The centrality measures form the basis for visualizing network analysis, which enhances our understanding of research outcomes.

Our research findings present significant conclusions regarding the motivations behind companies adopting crypto assets, and the methodology employed in this study introduces a novel approach to this subject matter. The methodology allows real-world motivations and arguments to be made in the academic field, building on an emergent topic. Therefore, our study offers several implications for practitioners, academics, and policymakers. For practitioners, particularly CFOs and financial professionals, the research offers actionable insights into the factors driving companies' adoption of cryptocurrency. Understanding the criteria influencing adoption allows practitioners to evaluate the potential benefits and risks associated with integrating cryptocurrencies into corporate operations. Moreover, the emphasis on real-world perspectives, drawn from experienced CFOs, links practitioners and academics, bringing a different perspective to the discussion about cryptocurrency adoption.

In the academic sphere, the research contributes to the advancement of knowledge by building on previous literature and enriching scholarly discussions on cryptocurrency adoption, particularly by including the corporate perspective on the topic. By employing methodologies such as DEMATEL and network analysis, the study provides a framework capable of including practitioners' perspectives and collecting insights directly from experienced professionals. Academics can build upon these methodologies to conduct further research and explore new dimensions of cryptocurrency adoption dynamics.

From a policymaker's perspective, this study offers valuable insights into the implications of cryptocurrency adoption for regulatory frameworks. By understanding the motivations and concerns driving companies' adoption of cryptocurrency, policymakers can tailor regulatory interventions to mitigate potential risks.

Future recommendations

Future studies would benefit from implementing our methodology on a broader sample of experts rather than solely focusing on high-ranking managers. While our research leveraged the extensive expertise and knowledge of the managers involved, it would be valuable to explore the perspectives and reasoning of a more diverse range of experts. This approach would help validate and solidify the insights obtained from high-ranking managers.

We recommend applying this methodology to a more diverse sample, encompassing various markets and industries, to facilitate analysis by clusters. By doing so, crucial conclusions can be drawn, shedding light on potential variations in perceptions across different countries or other relevant factors such as demographics or sectors. This approach would provide clarity on whether the decision to adopt cryptocurrencies differs based on sector, as certain industries may exhibit a greater inclination towards embracing disruptive technologies like cryptocurrencies. By expanding the participant pool and incorporating a wider range of perspectives, future studies can enhance the comprehensiveness and generalization of their findings. A multi-dimensional analysis considering various factors and contexts would contribute to a more nuanced understanding of the factors influencing cryptocurrency adoption, enabling researchers and

industry professionals to make more informed decisions and strategies. We would also recommend the application of our methodology to a case study of a company that has already adopted cryptocurrencies.

Our research approach holds significant value as it brings real-world examples and insights to enrich the academic discussion, thereby enabling us to identify the causes and effects of companies adopting cryptocurrencies. Through this approach, we were also able to determine the strength of these relationships and their centrality within the context of adoption. It is important to note that while our study successfully identified these critical factors, our primary aim was not to construct a theoretical or econometric model using the obtained results. Instead, we propose that future studies build upon our findings by developing such models. For instance, employing SEM (Jegerson et al. 2023) methodology or econometric techniques in future research could help construct theoretical models that validate the significance of the identified categories in cryptocurrency adoption by companies. Moreover, exploring machine learning techniques based on neural network approaches can potentially yield a reliable model for predicting and analyzing cryptocurrency adoption. These advanced models can provide valuable insights and understanding, offering a novel and promising perspective on the subject matter.

Limitations

Our study has some limitations which can be addressed by future studies. First, the research is based on the opinions and insights of only three CFOs from different companies and backgrounds. This limited sample size may not fully represent the diverse perspectives and experiences of companies considering cryptocurrency adoption.

Second, the opinions and perspectives of the interviewed CFOs may be influenced by their individual backgrounds, experiences, and biases. This could introduce a certain level of subjectivity and limit the objectivity of the findings. Third, the study focuses on a specific set of criteria derived from existing literature and the opinions of the interviewed CFOs. Other relevant factors influencing cryptocurrency adoption may have been overlooked or not included in the analysis. Therefore, the findings may not capture the full range of factors impacting companies' acceptance of cryptocurrencies.

Fourth, the study does not explore potential variations in cryptocurrency adoption across different cultures or industries. Factors such as cultural norms, regulatory environments, or industry-specific requirements can influence the adoption decisions differently. Therefore, the findings may not fully capture the nuanced dynamics and variations in cryptocurrency acceptance. Finally, the study primarily provides a snapshot of the current perspectives and priorities of the CFOs interviewed. It does not account for potential changes in attitudes or market conditions over time. A longitudinal analysis would offer a more comprehensive understanding of the evolving nature of companies' adoption of cryptocurrency.

Abbreviations

CFO	Chief financial officer
DEMATEL	Decision-making trial and evaluation laboratory
SEM	Structural equation modeling

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Author contributions
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Availability of data and materials
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Declarations

Competing interests
The author declare that he has no competing interests.

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References

Al-Amri R, Zakaria NH, Habbal A, Hassan S (2019) Cryptocurrency adoption: current stage, opportunities, and open challenges. Int J Adv Comput Res 78:789. https://doi.org/10.19101/IJACR.PID43
Alzahrani S, Daim TU (2019) Analysis of the cryptocurrency adoption decision: literature review. In: 2019 Portland international conference on management of engineering and technology (PICMET). https://doi.org/10.23919/PICMET.2019.8893819
Angerer M, Hoffmann CP, Neitzert F, Kraus S (2021) Objective and subjective risks of investing into cryptocurrencies. Financ Res Lett 40:101737. https://doi.org/10.1016/j.frl.2020.101737
Arli D, Esch PV, Bakpayev M, Laurence A (2020) Do consumers really trust cryptocurrencies? Mark Intell Plan. https://doi.org/10.1108/MIP-01-2020-0036
Aspris A, Foley S, Svec J, Wang L (2021) Decentralized exchanges: the "wild west" of cryptocurrency trading. Int Rev Financ Anal. https://doi.org/10.1016/j.irfa.2021.101845
Auer R, Claessens S (2018) Regulating cryptocurrencies: assessing market reactions. BIS quarterly review Sept 2018. https://ssrn.com/abstract=3288097
Battiston S, Puliga M, Kaushik R, Tasca P, Caldarelli G (2012) DebtRank: too central to fail? Financial networks, the FED and systemic risk. Sci Rep. https://doi.org/10.1038/srep00541
Bertrand M, Goldin C, Katz LF (2010) Dynamics of the gender gap for young professionals in the financial and corporate sectors. Am Econ Assoc 2(3):228–255. https://doi.org/10.1257/app.2.3.228
Bucko J, Palová D, Vejacka M (2015) Security and trust in cryptocurrencies. In: CEFE 2015—central European conference in finance and economics
Campino J, Brochado A, Rosa Á (2021) Initial coin offerings (ICOs): the importance of human capital. J Bus Econ. https://doi.org/10.1007/s11573-021-01037-w
Campino J, Brochado A, Rosa Á (2022) Initial coin offerings (ICOs): why do they succeed? Financ Innov. https://doi.org/10.1186/s40854-021-00317-2
Chan KC, Zhou X, Gururajan R, Zhou X, Ally M, Gardiner M (2019) Integration of blockchains with management information systems. In: 2019 international conference on mechatronics, robotics and systems engineering (MoRSE). https://doi.org/10.1109/MoRSE48060.2019.8998694
Chan-Lau JA (2018) Systemic centrality and systemic communities in financial networks. Quant Financ Econ 2(2):468–496. https://doi.org/10.2139/ssrn.3422808
Dabbous A, Sayegh MM, Barakat KA (2022) Understanding the adoption of cryptocurrencies for financial transactions within a high-risk context. J Risk Financ 23(4):349–367. https://doi.org/10.1108/jrf-10-2021-0169
García-Monleón F, Erdmann A, Arilla R (2023) A value-based approach to the adoption of cryptocurrencies. J Innov Knowl 8(2):100342. https://doi.org/10.1016/j.jik.2023.100342
Hamplová E, Janeček V, Lefley F (2022) Board gender diversity and women in leadership positions–are quotas the solution? Corp Commun Int J 27(4):742–759
Jalan A, Matkovskyy R, Urquhart A, Yarovaya L (2023) The role of interpersonal trust in cryptocurrency adoption. J Int Financ Mark Inst Money. https://doi.org/10.1016/j.intfin.2022.101715
Jegerson D, Khan M, Mertzanis C (2023) Adoption of cryptocurrencies for remittances in the UAE: the mediation effect of consumer innovation. Eur J Innov Manag. https://doi.org/10.1108/ejim-09-2022-0538
Jonker N (2019) What drives the adoption of crypto-payments by online retailers? Electron Commer Res Appl. https://doi.org/10.1016/j.elerap.2019.100848
Kaasa A, Vadi M, Varblane U (2014) Regional cultural differences within European countries: evidence from multi-country surveys. Manag Int Rev 54:825–852. https://doi.org/10.1007/s11575-014-0223-6
Kou G, Pamucar D, Dinçer H, Yüksel S (2023) From risks to rewards: A comprehensive guide to sustainable investment decisions in renewable energy using a hybrid facial expression-based fuzzy decision-making approach. Appl Soft Comput. https://doi.org/10.1016/j.asoc.2023.110365

Kou G, Pamucar D, Yüksel S, Dinçer H, Deveci M, Umar M (2024) Evaluation of multidimensional carbon neutrality policies in transportation using a novel quantum picture fuzzy rough modeling. IEEE Trans Eng Manag 71:445. https://doi.org/10.1109/TEM.2024.3374385
Kou G, Dinçer H, Yüksel S (2024) Pattern recognition of financial innovation life cycle for renewable energy investments with integer code series and multiple technology S-curves based on Q-ROF DEMATEL. Financ Innov. https://doi.org/10.1186/s40854-024-00616-4
Kou G, Dinçer H, Yüksel S, Alotaibi FS (2024) Imputed expert decision recommendation system for QFD-based omnichannel strategy selection for financial services. Int J Inf Technol Decis Mak. https://doi.org/10.1142/S0219622023300033
Kou G, Pamucar D, Dinçer H, Deveci M, Yüksel S, Umar M (2024) Perception and expression-based dual expert decision-making approach to information sciences with integrated quantum fuzzy modelling for renewable energy project selection. Inf Sci. https://doi.org/10.1016/j.ins.2023.120073
Krause MJ, Tolaymat T (2018) Quantification of energy and carbon costs for mining cryptocurrencies. Nat Sustain. https://doi.org/10.1038/s41893-018-0152-7
Kuzubaş TU, Ömercikoğlu I, Saltoğlu B (2014) Network centrality measures and systemic risk: an application to the Turkish financial crisis. Phys A 405:203–2015. https://doi.org/10.1016/j.physa.2014.03.006
Lehar A, Parlour CA (2021) Decentralized exchanges, SSRN.https://doi.org/10.2139/ssrn.3905316
Leirvik T (2022) Cryptocurrency returns and the volatility of liquidity. Financ Res Lett. https://doi.org/10.1016/j.frl.2021.102031
Liu J, Serletis A (2019) Volatility in the cryptocurrency market. Open Econ Rev. https://doi.org/10.1007/s11079-019-09547-5
Marella V, Roshan Kokabha M, Merikivi J, Tuunainen V (2021) Rebuilding trust in cryptocurrency exchanges after cyber-attacks. In: Proceedings of the 54th Hawaii international conference on system sciences. https://hdl.handle.net/10125/71304
Nabilou H (2019) How to regulate bitcoin? Decentralized regulation for a decentralized cryptocurrency. Int J Law Inf Technol 27(3):266–291. https://doi.org/10.1093/ijlit/eaz008
Nakamoto S (2008) Bitcoin: a peer-to-peer electronic cash system. https://bitcoin.org/bitcoin.pdf
Pierro MD (2017) What is the blockchain? Comput Sci Eng. https://doi.org/10.1109/MCSE.2017.3421554
Quamara S, Singh AK (2022) A systematic survey on security concerns in cryptocurrencies: state-of-the-art and perspectives. Comput Secur 113:102548. https://doi.org/10.1016/j.cose.2021.102548
Saiedi E, Broström A, Ruiz F (2020) Global drivers of cryptocurrency infrastructure adoption. Small Bus Econ. https://doi.org/10.1007/s11187-019-00309-8
Shahzad F, Xiu G, Wang J, Shahbaz M (2018) An empirical investigation on the adoption of cryptocurrencies among the people of mainland China. Technol Soc 55:33–40. https://doi.org/10.1016/j.techsoc.2018.05.006
Shieh J-I, Wu H-H, Huang K-K (2010) A DEMATEL method in identifying key success factors of hospital service quality. Knowl Based Syst 23(3):277–282
Singh O (2023) What are crypto payment gateways and how do they work? Retrieved from Cointelegraph: https://cointelegraph.com/news/what-are-crypto-payment-gateways-and-how-do-they-work
Sousa A, Calçada E, Rodrigues P, Borges AP (2022) Cryptocurrency adoption: a systematic literature review and bibliometric analysis. EuroMed J Bus. https://doi.org/10.1108/EMJB-01-2022-0003
Steinmetz F, Von Meduna M, Ante L, Fiedler I (2021) Ownership, uses and perceptions of cryptocurrency: results from a population survey. Technol Forecast Soc Chang 173:121073. https://doi.org/10.1016/j.techfore.2021.121073
Suratkar S, Shirole M, Bhirud S (2020) Cryptocurrency wallet: a review. In: 2020 4th international conference on computer, communication and signal processing (ICCCSP). https://doi.org/10.1109/ICCCSP49186.2020.9315193
Wen T, Xiao Y, Wang A, Wang H (2023) A novel hybrid feature fusion model for detecting phishing scam on Ethereum using deep neural network. Expert Syst Appl 211:118463. https://doi.org/10.1016/j.eswa.2022.118463
Wu H-H, Chang S-Y (2015) A case study of using DEMATEL method to identify critical factors in green supply chain management. Appl Math Comput 256(1):394–403. https://doi.org/10.1016/j.amc.2015.01.041
Yadav SP, Agrawal KK, Bhati BS, Al-Turjman F, Mostarda L (2022) Blockchain-based cryptocurrency regulation: an overview. Comput Econ. https://doi.org/10.1007/s10614-020-10050-0

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