Leveraging Blockchain technology to accelerate financial and nonfinancial inclusion and empowerment in developing countries

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Abstract:

Introduction/purpose: Blockchain is a technology that first came into existence to optimize the cryptocurrency area by forming a decentralized network for online transactions and managing investors' data. With the advent of technology, new ideas have started taking shape in experts' minds regarding the potential of this technology if it were to be used in areas other than just cryptocurrency – mainly Bitcoin. Some of its potential features include security, distributed data, maintaining data integrity, anonymity, and the lack of need for third-party involvement. This research has analyzed the use of Blockchain technology in Pakistan, including its awareness amongst technical experts and the public. The focus areas are using Blockchain technology in hospitals as well as for voting, political documents, financial ledgers, and contracts. The research aimed to investigate which field is most appropriate to use Blockchain technology according to the general public belief.

Methods: A detailed survey has been carried out collecting answers from the public, and gathering expert opinions on the topic. The TOPSIS approach was then applied to determine which fields are the most favored.

Results: The results favored the use of Blockchain technology in the areas of political documentation. Based on the conducted study, there are recommendations and important insights provided from experts to facilitate the improvement of the system in Pakistan.

Conclusion: In conclusion, this study sets out to understand public and expert perspectives on using Blockchain technology in other sectors of the country. As a result of this research work, it is concluded that government/political documentation presents an exciting market for implementing this technology.

Keywords: cryptocurrency, bitcoin, blockchain, business innovation, computational trust, MCDM.

Introduction

Blockchain technology is at its infant stage and focuses on building a decentralized database connected in a string of scattered blocks, each connected to its consecutive block by a hash number and carrying information in bits and pieces. These blocks are scattered all over the Internet. The winning quality of blockchain technology is that, in order to alter information in one block, every consecutive block will have to be altered, which means umpteen blocks getting changed, which is virtually impossible for anyone to do so. This makes the information stored in blockchains unalterable and impossible to tamper with.

Blockchain technology was mainly used in cryptocurrency where this innovative technology handled cyber-currency like Bitcoin. As more and more people started focusing on working on blockchain technology, it became apparent that Blockchain is a revolution waiting to happen. With its unparalleled features, blockchain technology can expand out of the cryptocurrency area and improve other sectors of the cyber world, such as contracts, online voting, digital healthcare systems, etc.

This kind of change needs to be brought about in every sector of the world, and organizations smart enough to recognize this gem for what it is rapidly started working on taking on this new technology to help improve their systems. Blockchain technology aims to eliminate all third-party control from data by creating a decentralized environment that handles and holds all the transaction information and other data.

Work has been done on blockchain technology outside Pakistan on a large scale. Blockchain has been studied, and its uses have been analyzed for the healthcare center as well as for digital voting and contractual deals in the case of smart contracts. The work is still mostly in its theoretical phase and is far from becoming a norm, but it has started. Many different businesses and companies are looking at it as a means to innovate and modernize their business practices in whatever field they are. The benefit of this technology dramatically outweighs the difficulties in perfecting it and integrating it into everyday life. In the long run, everyone perceives only its help, which is why it catches this much attention.

In Pakistan, there is a lack of general awareness about blockchain technology, however. The only area looking at using this technology in Pakistan seems to be the financial sector, and even there it is in its infancy. Blockchain technology with its numerous applications needs to be recognized and appreciated by different sectors and organizations of the country as they will become imperative in improving many services and systems that right now are not handled as appropriately as they could be

by the introduction of blockchain technology. Technical research and advent are not the only practices essential to practically implementing blockchain technology. The technology's current real-life implications and feasibility are also required to be studied. A couple of techniques have been used worldwide to conduct a feasibility study, recognize blockchain technology's impact factors, etc. A lot of different angles have been applied to look at it. TOPSIS is one of the first and foremost techniques experts used to assess the pros of blockchain technology over the other more conventional methods. Such MCDM approaches started eliminating other measures and techniques in favor of blockchain technology as research progressed on the topic. Considering numerous highlighted factors, they proved beneficial in most areas under discussion.

This sort of research added to the importance of blockchain technology and emphasized its importance worldwide. It gave the world confidence to work further on the technology by proving that it is the right direction to move in and needs to be built on more. Had it been the other way around, and Blockchain was proved useless and costly instead of beneficial, the research would have stopped as it would have been considered redundant and in vain to go with the technology if there was no feasible use in the real world.

Looking at the direction the world is taking on blockchain technology, there is a need to work on it in Pakistan and provide practical motivation that the technology needs for its implementation in Pakistan. In addition, the more valuable it proves to be, the more motivated experts will be to use it in multiple sectors and departments. There are challenges that need to be addressed at the national level related to blockchain technology. The first and foremost of these challenges is the lack of awareness among the general public about this technology. Blockchain technology, however, has features that can change how different sectors of the country work.

This research has studied some of these sectors – other than the financial sector – wherein data and information have been collected to understand the feasibility and demand of the public as to which sector they think needs blockchain technology the most at this point. Furthermore, the paper discusses the importance of introducing blockchain technology in this sector and recommends how to start implementing blockchain technology in different sectors in Pakistan. The rest of the article is organized as follows. Section 2 introduces the background of Blockchain and Bitcoin. Moreover, this study also examines the challenges and technical limitations of Blockchain technology, previous literature on TOPSIS and its applications, and the unique ways it identifies its application in this work. Section 3 describes the applied research

methodology and collects relevant research papers. Section 4 presents the results of the gathered articles and extracted data. Moreover, it also presents the analysis derived from the previously obtained results. Section 5 concludes the paper, followed by references.

Literature review

There has been research conducted on the usage of Blockchain technology. Still, as this technology is in its infancy, research is very scarce and only focuses on a few topics to give a bigger picture of what is happening with the technology. Speaking of Pakistan in particular, there is virtually no research on the importance, usage, and potential of Blockchain technology, which needs to be remedied immediately. There are a lot of questions that need to be answered about Blockchain technology. As yet, the primary use of Blockchain technology in Pakistan is in the financial sector which is introducing Blockchain technology to improve organizational methods, as it will be discussed further on.

Blockchain technology can also help improve many other nonfinancial systems in Pakistan. This research has studied some systems, such as hospitals (health care), voting, political documents, financial ledgers, and smart contracts. A few of these areas have been studied under the lens of Blockchain technology in some areas of the world, but seldom in Pakistan. The paper intends to assess what the people of Pakistan feel is the most feasible area to apply Blockchain technology in and which can benefit the most from its characteristic features.

In Pakistan, as mentioned above, Blockchain is only applied in the financial sector, and that started only very recently. According to a DAWN News article (DAWN, 2017), The State Bank of Pakistan (SBP) was talking about adopting Blockchain technology in all their transactions as that is what the world is moving towards. This article talks about moving to match the advent of technology in the world. SBP's Executive Director-Banking Supervision Group says that the world is moving towards adopting new technologies and that the country should also use this technology as its trades can significantly benefit from them and that they are open to other banks joining them in the interest of using new technology. It also talked about cybercrimes and mobile banking explaining how advanced technology and new techniques are essential to combat these issues and run things more smoothly.

Other than that, in Pakistan, Blockchain has been used in nonfinancial sectors in several places. It is a start, but at the very least, it has started. A paper written by Linn and Koo discusses how healthcare and information

technology are moving towards each other to increase productivity and convenience for patients, their next of kin, and healthcare staff. This paper discusses "a Blockchain-based access-control manager to health records" (Kuo et al, 2017), which has the potential to deal with "interoperability challenges" present in the healthcare system which will allow all stakeholders to access medical records and manage them securely and incorruptibly. Another study focused on Comparing Market Performance of Metaverse Crypto Assets. This sort of use of Blockchain technology is highly beneficial. It could also bring about a positive change in Pakistan's healthcare system if Pakistani hospitals started using it regularly.

Digital Voting with the Use of Blockchain Technology by Barnes, Brake, and Perry is a report written to analyze the problems with the current voting system and to propose a solution to that problem in the form of a digital voting system using Blockchain technology. Hsiao et al (2017) stated that, with the advent of technology, there must be an online voting system free of corruption, like the rigging of the results. Security of these online votes was the biggest concern and one of the unsolvable problems, but not anymore. According to this paper, the one foolproof way of minimizing security risks and issues is by using Blockchain technology in the online voting system. Another study mentioned that sustainable digitalization is a growing trend in which digital technology is used to promote environmental, social, and economic sustainability.

Blockchain has also been studied as a potential technology for smart contracts, which will eliminate third-party interference in contracts and make contracts more secure. Smart contracts are said to be computer agents as they form contracts based on the time of user's actions and Blockchain technology has emerged to be one of the best ways to keep track of these contracts as discussed in a paper "Blockchain and smart contracts" (Panisi, 2017). It is a difficult concept to brag – the integration of Blockchain in the world of contracts – but change is always the hardest to grasp and is always needed to be discussed, to adapt and improve for the sake of progress. According to this paper, the jury is still out on how much Blockchain can be trusted as it is a theoretical concept but there is no experience to ensure complete trust in the technology by using it as a basis for smart contracts. There is still a great debate going on about the usage of Blockchain technology as the right medium for smart contracts or not. Ledgers are directly connected to accounting and this is another area where Blockchain has the most chance of being used and will be greatly advantageous if done so. As discussed in the paper of Wang & Kogan (2018), modern-day accounts are based on a double-entry system which was introduced in the Renaissance period. It is, however, very difficult to

manually do this as it requires a lot of labor. By using Blockchain, it is easier to prove the integrity of electronic files. The hash string attached to each block is the fingerprint that needs to be presented and matched in case of any need of proof against the file. Blockchain technology can provide different ways to document the data otherwise being managed manually and leads to a more secure way of keeping the integrity of these ledgers intact.

"Computing Ledgers and the Political Ontology of the Blockchain" is a paper by Velasco (2017) which discusses the political forms that Blockchain technology can switch on and how it will benefit the integrity of political documents. This paper discusses the ontology of Blockchain in favor of political documents and the importance of keeping them secure and incorruptible. The paper recognizes that there will be an absence of necessary authority figures in the digitalization of ledgers and political documents, but that is what Blockchain is all about, removing authority from a central point and distributing responsibility over the whole network in a dynamic form of environment. Another study conducted by Ul Haq et al (2023) discussed the concept of Blockchain and its application. A lot needs to be considered when discussing Blockchain technology and its usage in different sectors. A study conducted by Arsyad et al (2022) proposed a farm transaction model by demonstrating a flow of farm transaction simulation implicated by Modular Block Chain. These precious few pieces of research are just the start of what would later become an essential and integral part of the technical world. Taking this research and all this material into account, a survey was conducted keeping the Pakistani populace in mind and collecting data from them to analyze how well they will be able to adjust to this very new technology and where they feel like it is needed the most, given its many advantageous features. In this article, a solid foundation has been built to analyze the significance of introducing Blockchain technology in Pakistan.

The Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), developed by Hwang et al (1993), is a method to assess the capabilities of alternatives through the similitude with the ideal solution. As indicated by this procedure, the best option would be one nearest to the positive-ideal solution and most distant from the negative-ideal solution. The positive-ideal solution amplifies the advantage criteria and limits the cost criteria. The negative perfect arrangement augments the cost criteria and specifies the advantage criteria. In outline, the positive-ideal solution is made out of every single best value achievable of the criteria, and the negative-ideal solution comprises all the most exceedingly bad values attainable of the criteria.

The MCDM strategies manage the way toward settling on a choice within the sight of numerous criteria or objectives (Sahoo & Goswami, 2023). Puška et al. (2023) carried out a study based on the MCDM approach to find the index of economic freedom in Balkans countries. A study carried out th Fuzzy Analytic Hierarchal Process for a sustainable public transport system. Another study used the m-polar fuzzy set theory for the selection of non-traditional machining processes. TOPSIS is generally utilized to take care of issues having various criteria. Multi-criteria decision-making strategies have been widely used in multiple application zones. Liu et al (2010) connected AHP and TOPSIS MCDM strategies for security appraisal communication networks of power control systems. C. T. Chen (2002) connected the MCDM method to deal with issues of project selection. Angelou & Economides (2008) additionally connected MCDM strategies to allot ranks to a portfolio of ICT foundation ventures. F. Trojan & D. C. Morais (Trojan & Morais, 2012) presented the idea of cooperative choice to organize options for the upkeep of water appropriation systems.

Similarly, recent research implemented the use of the novel fuzzy decision making model to identify right policies for renewable energy transition. Another study was carried out by Dagistanli on the financial performance evaluation of energy companies. A similar application of MCDM can also be found in the "Examining the Impact of Product Innovation and Pricing Capability on the International Performance of Exporting Companies" (Rezazadeh et al, 2023). Tešić & Marinković (2023) applied an aplication of fermatean fuzzy weight operators and the MCDM model DIBR-DIBR II-NWBM-BM for the efficiency-based selection of a complex combat system. The multiple options above showcase the use of TOPSIS in multi-criteria decision making as a very accurate and precise way of prioritizing and ranking numerous alternatives given specific criteria for each alternative. TOPSIS uniquely suits this research into the use of Blockchain technology in sectors, other than financial, of Pakistan's economy.

Methodology

The problem at hand was tackled using the Multi-Criteria Decision-Making technique called TOPSIS. This method revolves around using multiple criteria to rate and analyze the data using weights assigned to those criteria to evaluate the solution, which would be the best alternative for implementing Block Chain Technology in Pakistan in this case. TOPSIS was chosen among various alternative methods mainly because TOPSIS

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makes a focused analysis on the criteria allotted, which is necessary while assigning weights to the criteria upon which eventually is concluded to a final solution. TOPSIS has been a prevalent method used to solve similar problems and has been around since 1981. Some researchers have combined AHP and TOPSIS for their methodology and used the combination to study power control systems. In contrast, others have used it alone to find the best alternatives for project implementation solutions, as discussed in more detail in the literature review above. This research paper uses the TOPSIS technique independently to best correspond to the public view with strict criteria and dimensions, making it the most suitable to be applied. The methodology has been divided into four main sectors: Survey Development and Analysis, Weight Calculation and Assignment, TOPSIS Implementation, and finally, Analysis and Conclusion. The process started with a thorough insight into the literature review of the technology that is under study, and five alternatives for the implementation of the technology were discovered, namely:

1. Hospitals,
2. Voting,
3. Political Documents,
4. Financial Ledgers, and
5. Contracts.

After discovering these options, experts in computer science and big data were contacted and asked to provide insight into what they thought were the criteria to be allotted to rank the data to be collected. The results from these experts classified the criteria into four main categories and were assigned weights according to the importance each expert assigned. They were:

1. Security,
2. Distributed,
3. Open Source, and
4. Implementation Cost.

After the methodology parameters were calculated, a survey was created for the general audience of Pakistan. It asked them to rank the importance of each criterion set as to which they thought would be most feasible and necessary to be implemented in Pakistan. The survey output data collected would qualify as the data required to evaluate the most viable solution through the TOPSIS method. After the collection of data, TOPSIS is applied in the manner of the following steps:

Step 1

The first step is to standardize the Decision Matrix. It is done by taking the square root of the sum of the elements of each row and dividing each element of the row with it. The formula

$$y_{ij} = \frac{x_{ij}}{\sum x_{ij}^2}$$

helps to attain the values where y is the output element, and x is the original element. The data is then normalized by dividing each matrix element by its consequent standardized value.

Step 2

After the Standardized Decision Matrix, the normalized decision matrix needs to be constructed. This is done by multiplying the assigned weights with each element in the row of the subsequent criteria. The following formula

$$y_{ij} = x_{ij} \times w_j$$

helps to attain these values where y represents the output element, x is the original element, and w is the weight. The weighted standardized decision matrix is thus created.

Step 3

This step works towards finding the Ideal and the Negative Ideal solutions for the data. The Ideal solution is given by

$$A^* = \{y_1^*, \dots, y_n^*\} \; where$$
$$y_j^* = \{\max(y_{ij}) \; if \; j \in J\} \; ; \; \{\min(y_{ij}) \; if \; j \in J'$$

The Negative Ideal solution is given by
$$A' = \{y_1', \dots, y_n'\} \quad where \; y_j' = \{\max(y_{ij}) \; if \; j \in J\} \; ; \; \{\min(y_{ij}) \; if \; j \in J'$$

Step 4

Now that the Ideal and Negative Ideal solutions have been calculated, the next step involves calculating the separation measures for each option in this problem. Essentially, the separation from the ideal alternative is given by

$$S_{i*} = \left[\sum (y_j^* - y_{ij})^2\right]^{1/2}$$

and consequently, the negative ideal alternative is given by

$$S_i' = \left[\sum (y_j' - y_{ij})^2\right]^{1/2} \quad \text{where i goes from zero to m.}$$

Step 5

The last step is to find the relative closeness of all the options to the Ideal Solution. This is done by using the formula

$$C_i^* = \frac{s_i'}{(S_i^* + s_i')}.$$

The resultant value that is closest to 1 is the option that is selected. Consequently, the desired results are generated by the application of TOPSIS. After this, the data analysis is done, and the reasons for the results attained are considered. From the said analysis, a conclusion is drawn, and a suggestion regarding the output of the analysis is illustrated. The structure of the methodology is summarized in Figure 1.
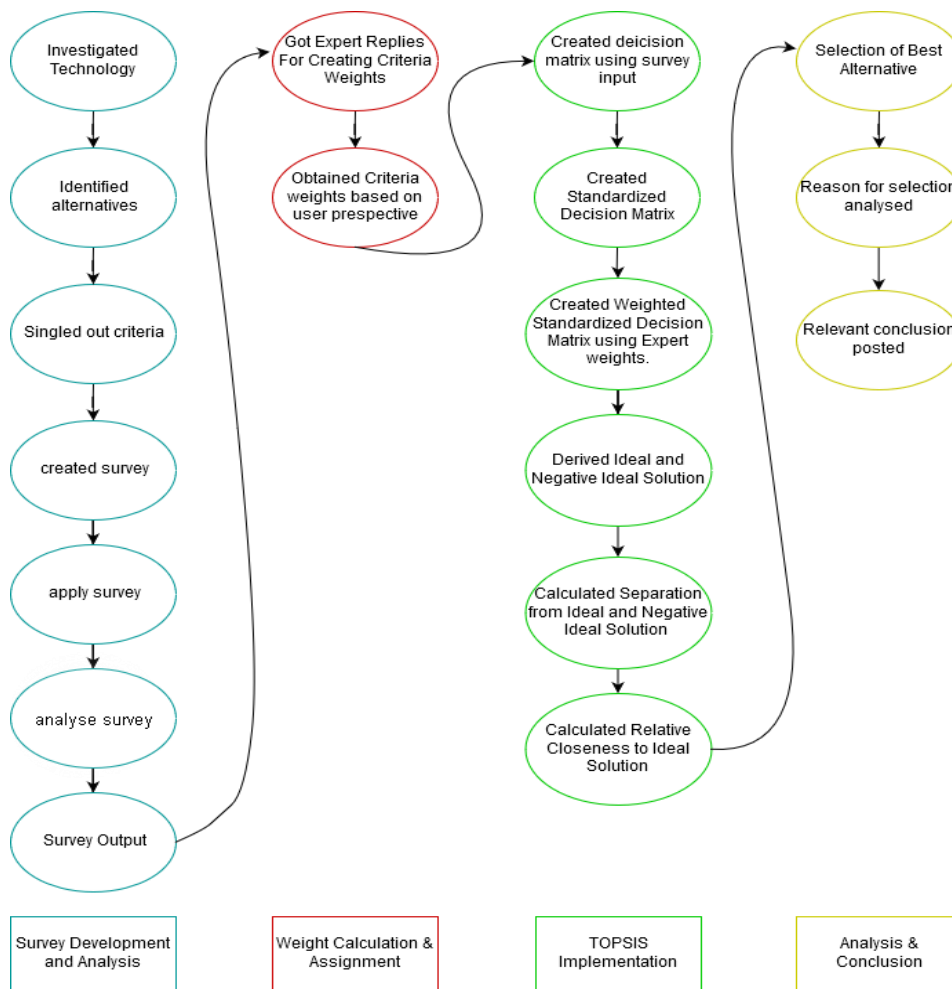

Figure 1 – Flow chart for the methodology

Discussion and results

The foremost output received in the methodology was the experts' opinions. They were asked to draw up five criteria, which would then be assigned weights by taking the average rating they would assign each criterion. The result would give the desired weight assignment and the criteria to take forward into the research. The criteria and weights from the experts are summarized in Table 1.

Table 1 – The results from the experts & averaged weights

Name	Security	Distributed	Open Source	Implementation Cost
Ghulam Abbas	6	7.4	5	3.4
Hussain Ali	7.8	9.2	7.4	8
Daniyal Ahmed	8.6	8	6.4	5.8
Saif Bilal	8.6	8	5.8	4.8
Laila Khalid	8.8	8.2	6.4	7.2
Weights	7.96	8.16	6.2	5.84

It can be seen from the data collected from the experts that the highest weightage has been assigned to the Distributed category, which shows that the experts feel that the distribution of data in the implementation of Blockchain technology is of paramount importance. It is further seen that with a weight of 8.16, the experts believe that overall data should be distributed among the masses rather than being centrally controlled, hinting at the urge for transparency in the system that Blockchain technology would provide. Security got the second rank out of the four with a weight of 7.96, showing that while considering the implementation of the said technology, security is a very, if not the most, important while considering the option. Being Open Source got the third nod from the experts with a weight of 6.2, showcasing that the system's availability carries meaning and should be available as open source if implemented. The implementation cost of the system came in last with a weight of 5.84, signifying that the cost of the system is the least of the worries where its implementation is concerned. As mentioned earlier, a more detailed view of the expert can be seen in Figure 2.

Since the criteria have been defined and the weights assigned, the data from the general public was gathered through a survey, and a total of 150 responses were collected. Considering the public opinion as a deciding factor to determine which sector should have Blockchain technology implemented, these responses were the decision makers in this study. The data was then used for analysis, and TOPSIS was applied to it, thus achieving the results in Table 2 below.
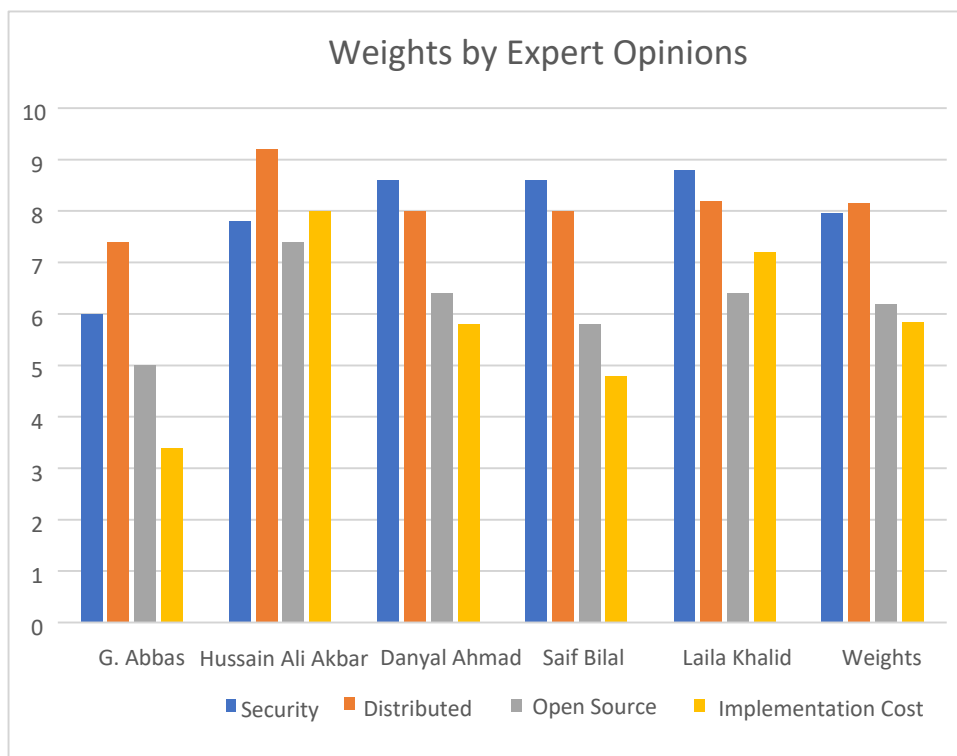
Weights by Expert Opinions

Figure 2 – Graphical representation of experts' weights

Table 2 – Relative Closeness to the Ideal Solution

	Hospital	Voting	Political Docs	Financial Ledgers	Contracts
Si*	0.651	0.803	0.365	0.588	0.504
Si'	0.630	0.279	0.759	0.561	0.568
Si*+Si'	1.281	1.082	1.124	1.149	1.072
Si'/(Si*+Si')	0.492	0.258	0.675	0.488	0.530

The resultant data in Table 2 shows that the highest relative closeness to the ideal solution is taken by Political Documents, with 0.68, which is the best option according to this method. The second-best alternative is Contracts with a mild closeness of 0.53. This shows that Political Documents is the best option by a considerate amount. The results in the chronological order are:

1. Political Documents,
2. Contracts,
3. Hospitals,
4. Financial Ledgers, and
5. Voting.
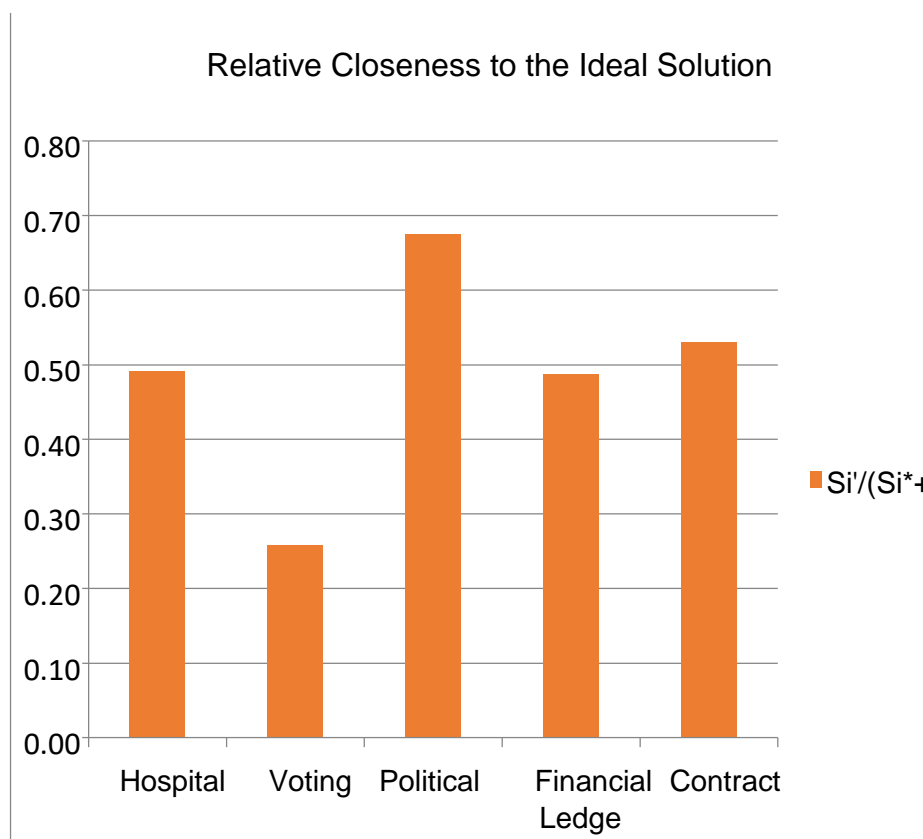
The results can further be summed up in Figure 3.

Figure 3 – Graphical representation of relative closeness to the ideal solution

The study's significant findings, as it can be seen in Figure 4, state that the public perspective, weighed by experts' opinions, dictates that one of the most favorable areas for the expansion of Blockchain technology is political documentation held by the government political parties. These documents include but are not limited to laws, codes, rules and regulations, census publications, etc., which are only a small portion of the government's collection. The findings suggest that the integral features of Blockchain technology apply the most to the implementation of a database containing these documents. The reason for the results, as mentioned earlier, is apparent. As it can be seen in the results, the features such as being 'open-source' and 'distributed' were the highest in the Political Documentation group. This shows that experts and the general populace agree that these documents should be available to everyone and be completely transparent, as well as be hosted within a distributed network, which would make it near impossible for these documents to be tampered with or modified for the needs or benefit of a particular group.
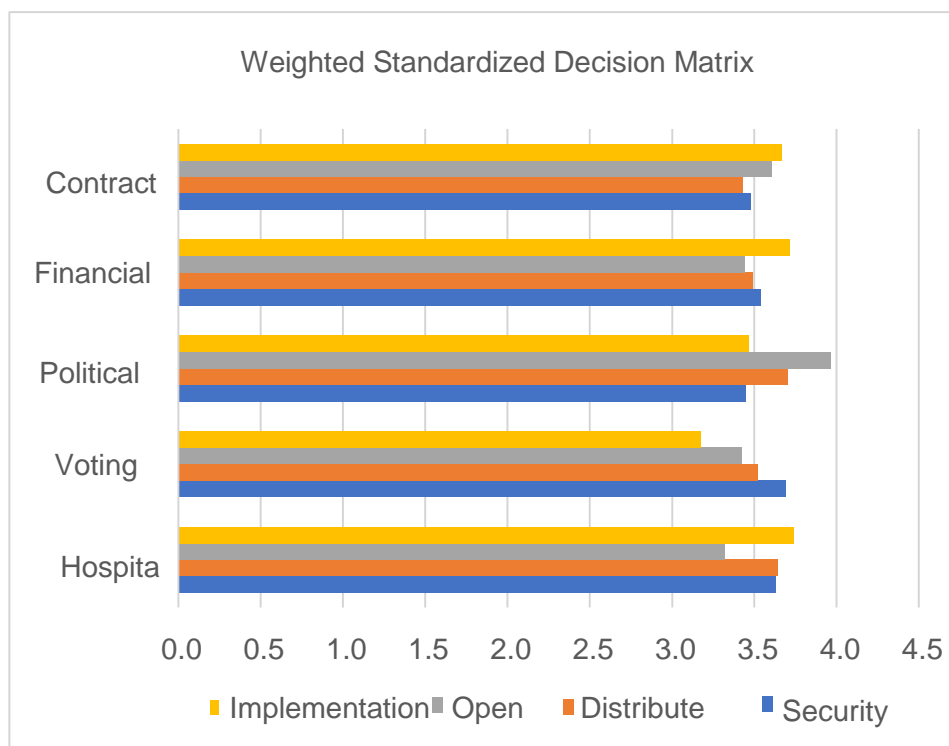

Figure 4 – Graphical representation of the weighted standardized decision matrix

These findings are significant as they indicate a shift in the public thinking towards the political scene within the country, with a greater demand for transparency of official documentation within the higher echelon of the government, and thus also indicate a better attitude towards the investment in technologies that cater to these specific needs such as Blockchain technology. Due to the fresh nature of the market, this allows a vastly diverse and superior investment opportunity for companies, which would also positively affect the country's economy. Transparency in the democratic process of the government shows a favorable movement towards a more stable democratic establishment within the government, which would lead to a more stable economy and a more stable currency, which also provides ground for more investment from outside sources.

An alternative explanation for the results may also be the current political scene within the government. Incidents such as the Panama Leaks of documents have led to more public outcry about the transparency of documents in possession of different government bodies and the accountability of the said government for better accessibility to these documents.

The study, though, acknowledges its limitations, as firstly, though quite large in relative size to the country's population, the sample size of both the general populace and the pool of experts is relatively small and may not cater to the opinions and ideology of the entire country. However, it does show noticeable trends and reveals meaningful information about the general mood within the country. The study also does not consider many other features of Blockchain technology. However, as mentioned earlier, it acknowledges the lack of public knowledge of the technology as it is still in its infancy.

Conclusions

The objective of this research is to examine the application of Blockchain technology in various sectors beyond finance within Pakistan. Being a developing nation, Pakistan presents an expansive and unexplored market for the emerging potential of this technology. Given its relatively recent and complex nature, Blockchain technology faces a lack of awareness and understanding among the general population in Pakistan. Consequently, the implementation of this technology across different sectors in the country is becoming progressively challenging.

The impact of this technology is extensive and crucial; however, there has not been any research exploring its application beyond the cryptocurrency realm in the dynamic shifts of the country's economy. This

study seeks to anticipate the trajectory of Blockchain technology in the nation, opening up a novel market for its utilization. This is accomplished by gauging public perceptions of the technology's attributes and incorporating expert opinions on the subject.

In conclusion, this study sets out to understand the public and expert perspectives on using Blockchain technology in other sectors of the country. It was achieved by applying the Multi-Criteria Decision-Making process known as The Technique for Order of Preference by Similarity to Ideal Solution, otherwise known as TOPSIS, by using responses from the general public and weighing them by expert opinions. As a result of this research work, it is concluded that government/political documentation presents an exciting market for implementing this technology.

These results are attributed to the ongoing political scene in the country, where heavy political competition between the major parties has recently resulted in many accusations against one another. Also, in the near past, there was a court case against the nation's prime minister regarding the proper disclosure of documents regarding assets held abroad, which resulted in his being removed from his office. These current happenings seem to have influenced a lot the public opinion on the use of Blockchain technology in Pakistan as a means of greater transparency towards their political representatives. It also predicted a shift towards a more transparent, democratic, and stable government, leading to an increasingly challenging economy for third-party investment. While this research work has its limitations, there are other features of the technology and other sectors in which it can be utilized effectively.

Furthermore, smart contracts are a booming industry and are in high demand as a secure means of agreement. Third-party investment in such technologies would lead to further research and development that would help the economy as a whole. Smart contracts would provide a very secure and legally enforceable method of making contracts between parties, which would increase the incentive for numerous and more extensive contracts and take away from the general public fear of entrepreneurship, leading to a healthier attitude towards further investment from the local population into the economy.

The study can be further extended by applying other decision-making techniques to evaluate different aspects of the Blockchain technology. It is recommended that Blockchain technology be investigated further in relation to government and political documentation applications. Applying a more secure yet open-source platform for distributing government policies and agreements would allow easier access to it for a wider population.

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Aprovechar la tecnología Blockchain para acelerar la inclusión y el empoderamiento financiero y no financiero en los países en desarrollo

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Resumen:

Introducción/objetivo: Blockchain es una tecnología que surgió por primera vez para optimizar el área de las criptomonedas mediante la formación de una red descentralizada para transacciones en línea y la gestión de datos de los inversionistas. Con la llegada de la tecnología, han comenzado a tomar forma en las mentes de los expertos nuevas ideas sobre el potencial de esta tecnología si se utilizara en áreas distintas a las criptomonedas, principalmente Bitcoin. Algunas de sus características potenciales incluyen seguridad, datos distribuidos, mantenimiento de la integridad de los datos, anonimato y la falta de necesidad de participación de terceros. Esta investigación ha analizado el uso de la tecnología Blockchain en Pakistán, incluido su conocimiento entre los expertos técnicos y el público. Las áreas

de enfoque son el uso de la tecnología Blockchain en hospitales, así como para votaciones, documentos políticos, libros financieros y contratos. La investigación tuvo como objetivo investigar qué campo es más apropiado para utilizar la tecnología Blockchain según la creencia del público general.

Métodos: Se ha llevado a cabo una encuesta detallada recogiendo respuestas del público y recabando opiniones de expertos sobre el tema. Luego se aplicó el enfoque TOPSIS para determinar qué campos son los más favorecidos.

Resultados: Los resultados favorecieron el uso de la tecnología Blockchain en las áreas de documentación política. Según el estudio realizado, los expertos proporcionan recomendaciones y conocimientos importantes para facilitar la mejora del sistema en Pakistán.

Conclusión: En conclusión, este estudio se propone comprender las perspectivas del público y de los expertos sobre el uso de la tecnología Blockchain en otros sectores del país. Como resultado de este trabajo de investigación, se concluye que la documentación gubernamental/política presenta un mercado interesante para implementar esta tecnología.

Palabras claves: criptomoneda, bitcoin, blockchain, innovación empresarial, confianza computacional, MCDM.

Использование технологии блокчейн для ускорения финансовой и нефинансовой инклюзии и расширения прав и возможностей в развивающихся странах

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Резюме:

Введение/цель: Блокчейн - это технология, созданная для оптимизации сферы криптовалют путем формирования децентрализованной сети для онлайн-транзакций и управления данными инвесторов. С появлением этой технологии эксперты поняли насколько велик ее потенциал и стали развивать новые идеи относительно ее использования в других областях, а не только в области криптовалюты (в основном биткоин). Преимущества технологии блокчейн заключаются в безопасности, распределении данных, сохранении целостности данных, анонимности, а также в отсутствии необходимости привлекать посредников. В данном исследовании анализируется использование технологии блокчейн в Пакистане, а также уровень осведомленности технических экспертов и широкой

общественности о возможностях технологии блокчейна. Акцент делается на использовании технологии блокчейна в больницах, голосовании, политических документах, финансовых регистрах и контрактах. Цель исследования заключается в выявлении наиболее подходящей области для использования технологии блокчейн, по мнению общественности.

Методы: Был проведен подробный опрос среди населения, а также были собраны мнения экспертов по данной теме. Затем был применен подход TOPSIS для определения наиболее предпочтительных областей.

Результаты: По результатам опроса общественности применение технологии блокчейн предпочтительно в сфере политической документации. В то время как рекомендации и важные наблюдения экспертов, основанные на проведенном исследовании, будут способствовать совершенствованию системы в Пакистане.

Выводы: Целью данного исследования является определение мнения как экспертов, так и широкой общественности относительно использования технологии блокчейн в разных секторах экономики страны. На основании исследования сделан вывод, что государственные/политические документы являются главной областью для применения блокчейн технологии.

Ключевые слова: криптовалюта, биткоин, блокчейн, бизнес инновации, информационное доверие, MCDM.

Коришћење блокчејн технологије за убрзавање финансијске и нефинансијске инклузије и њен значај за земље у развоју

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Сажетак:

Увод/циљ: Блокчејн је технологија створена да оптимизује област криптовалута путем формирања децентрализоване мреже за онлајн трансакције и управљање подацима инвеститора. Уочивши њен потенцијал, стручњаци су почели да уобличавају нове идеје у вези с њеним коришћењем, не само код криптовалута (углавном биткоина) већ и у осталим областима. Нека од њених потенцијалних својстава су: сигурност, дистрибуирани подаци, одржавање интегритета података, анонимност, као и одсуство потребе за укључивањем посредника. Ово истраживање анализира

коришћење блокчејн технологије у Пакистану, као и сазнања која о њој имају стручњаци и шира јавност. Тежиште је на коришћењу блокчејн технологије у болницама, при гласању, изради политичких докумената, финансијских књига и уговора. Циљ је да се истражи која област је најпогоднија за коришћење блокчејн технологије, по мишљењу шире јавности.

Методе: Спроведена је исцрпна анкета међу општом популацијом, а прикупљена су и мишљења стручњака о овој теми. Затим је примењен приступ TOPSIS како би се утврдило које су области најпожељније.

Резултати: Резултати показују да је примена блокчејн технологије најпожељнија у области политичке документације. На основу спроведеног истраживања, препоруке и важна запажања стручњака олакшаће побољшање система у Пакистану.

Закључак: Ова студија има за циљ да утврди какво је мишљење и стручњака и шире јавности у вези с коришћењем блокчејн технологије и у осталим областима у земљи. Закључује се да државна/политичка документација представља главну област за примену ове технологије.

Кључне речи: криптовалута, биткоин, блокчејн, пословне иновације, информатичко поверење, MCDM.