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Impact of Blockchain technologies, cryptocurrencies regulation, and ICOs in developing countries. Case applied to Colombia.

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ABSTRACT

In this document, the DELPHI approach is deployed to investigate the impact of blockchain technology, ICOs, and cryptocurrency regulation in Colombia and developing countries. These new technologies have already developed dynamics in recent years, which will be analyzed and discussed through this document to define the role of the State and its companies and investors in the medium and long term concerning adopting these technologies as impact tools.

Similar research by authors in the Colombian context is analyzed, as well as the main applied comparative advantages of blockchain technologies and tokenization focused on companies. These technologies' globalized capacity and peer-to-peer advantages in terms of security, traceability, and speed are essential for an economy that wants to increase its reach and productive capacity.

The Delphi methodology was chosen for this research, given its nature as a systematic and interactive prediction method, in which a group of experts on the subject from different guilds, who were highly informed about the situation of blockchain and cryptocurrencies in developing countries, visualize the needs and outlook.

The thesis results depict that Colombia and developing economies must take an active role in incorporating these technologies. However, future adoptions in large sectors have been slowed due to low institutional efforts, technological educational gap in government institutions, and symptoms of corruption. Furthermore, due to this informal institutional situation, the industry in the country has yet to reach its prime to attract and manage foreign investors or industry developers to increase national offers and generate more users of cryptocurrencies and ICOs.

Experts are not optimistic in the medium term, given the slow legislation process that addresses the regulatory framework for crypto assets in the country. For them, this reduces the advantages of these technologies' potential and scalable benefits in the economic sectors they consider the most fertile for innovations and investment in Colombia: Artistic and cultural activities, finance services, and real estate. Nevertheless, they are convinced that Blockchain, Cryptocurrencies, and Initial Coin Offerings (ICOs) will have an inevitable impact and significant innovative change on the industries regardless of regulation because, in the end, there will be educative cooperation between legislators, regulators, and entrepreneurs to understand, use and create value correctly with this disruptive technology and contribute to the development of the country.

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1. INTRODUCTION

In a world in which data is becoming one of the most valuable assets that an entity can possess, just as innovation and investment have become active subjects of digital globalization in which there are no borders, Blockchain technology, cryptocurrencies, and specifically ICOs, have become vital tools that countries can promote and adopt, both countries with high digital culture and developing countries. Work's thesis is that these technologies can allow a series of unavoidable advantages in the transformation of developing countries like Colombia, helping them to modernize their digital infrastructure to secure digital transactions, provide transparent, verifiable information to create reliable institutions either government projects and accelerate and boost the creation of Small and Medium Enterprises (SMEs).

The present research examines the initial coin offering (ICO) market and its advantages and disadvantages in developing countries like Colombia to bring successful investment, traceability, and growth to successful projects. As ICOs are smart contracts based on blockchain technology designed for entrepreneurs to obtain external financing by issuing tokens without intermediaries (Momtaz, 2020).

The primary feature that could improve a developing country is that, unlike existing mechanisms for early-stage financing, tokens provide investors with quick opportunities due to liquid trading platforms. In addition, Blockchain, as it will be seen later, helps consolidate safe and clear contracts, something that, in a country with high corruption and a growing trend of financial fraud, can significantly help your institutions. Through the DELPHI method and the responses of a group of experts in consensus, added to the appropriate theoretical framework, it will be analyzed how ICOs and Blockchain technology can help Colombia, as a developing country, to progress.

The main objective of this work is to contribute to the increase in literature on Blockchain and ICOs, especially in Latin America and Colombia, to visualize the possible scenarios that will arise in these contexts. Academic literature agrees that technological advances dictate the speed and pace at which societies change (Kleer et al., 2017). Therefore, it would be essential for Colombia to be clear about how these tools can help its population overcome significant disadvantages and consolidate itself as a leading nation in new technologies.

This work is structured as follows. Section 2 provides a theoretical framework that selects some research involved and defines the main concepts on which the research will revolve. Section 3 presents the methodology. Subsequently, the results of the proposed methodology will be presented, and in section 5, conclusions are delivered. These conclusions are framed in the current panorama and experts' expectations regarding crypto assets, blockchain technology, and applied ICOs, as well as the medium and long-term needs of Colombia and developing countries to take advantage of and stimulate their economies.

2. THEORETICAL FRAMEWORK

First, to advance this research, the main terms of reference must be presented to understand better the definition of each one and its phases and divisions. Second, an analysis, given the chosen authors, regarding some of the structural advantages and disadvantages that the implementation of Blockchain and the initial token sales have presented in regions such as Latin America and Colombia, about the competitiveness and liquidity that they contribute to the markets, to predict how it could impact in a country like Colombia over time. Finally, this research will evaluate the complex and multifaceted impact on developing countries of blockchain technologies, cryptocurrency regulation, and Initial Coin Offerings (ICOs).

2.1 BLOCKCHAIN, CRYPTOCURRENCIES, AND ICOs

BLOCKCHAIN TECHNOLOGY

However, to understand better the Initial Coin Offerings (ICOs) term, it is essential first to define Blockchain technology, which can be described as "a simple block of transparent digital information which is highly secured and shareable, but immutable. Transparent digital information means the data exploited is traceable and identifiable". (Peña Gil et al., 2017). In this approach, the Blockchain is transformed into an accounting chain that can be distributed and programmed to record and track anything of value, such as financial transactions, business projects, property titles, redeemable items, etc., safely and quickly.

The same authors describe that the primary purpose of Blockchain is to provide security, and banking transactions are the most suitable candidates to use Blockchain. The ICOs are the issuance of a currency based on Blockchain technology with a series of additions, such as unique information about the base project on which the cryptocurrency is launched, etc... that help to align the interests of various stakeholders (Bellavitis et al., 2021).

In Blockchain technology, blocks are chained together through each block containing the hash digest of the previous block's header, thus forming the blockchain (Yaga et al., 2018). Any changes on the blockchain are easily detected as any modification of the information of previously published blocks would cause all subsequent blocks to have different hashes since they include the previous block's hash (Figure 1 shows this on a generic chain of blocks). Therefore, making it possible to reject this chain of blocks and stay with reliable information.

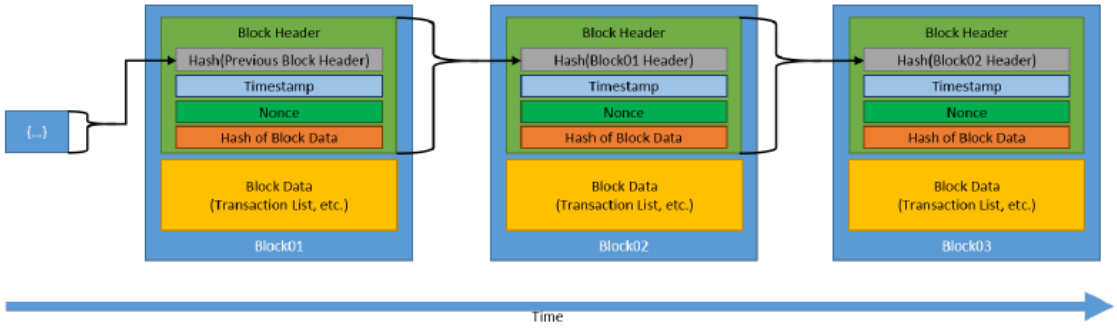

Figure 1. Architecture of a generic chain of blocks (Yaga et al, 2018)

Moreover, it is essential to have clear the differences between public and private blockchains. The author, Bains, defines the difference as a public form envisaged by early developers, so data are distributed widely, and control of that data can be decentralized. Public blockchains are permissionless and decentralized, although there can be public-permissioned blockchains in which certain nodes are given specific rights. On the other hand, a private blockchain, also called permissioned Blockchain, has a single operator or entity that restricts who can access the network and whether they will be able to view and create data on the Blockchain, and usually consists of a small number of entities that give permissions to the use to identifiable participants (Bains, 2022).

CONSENSUS MECHANISMS

Generally, Consensus mechanisms are the complete stack of ideas, protocols, and incentives that enable a distributed set of Miners or Validators to agree on the State of a blockchain. Currently, there are two prominent protocols for consensus in the Blockchain technology ecosystem: Proof-of-Work (PoW) and Proof-of-Stake (PoS). However, there are other Mechanisms of consensus like Proof-of-History (PoH) implemented by Solana Network or Proof-of-Elapsed-Time (PoET), designed by Intel. This research will focus on the Proof-of-Work and Proof-of-Stake to understand the history and the mainstream protocol consensus mechanism used in the industry.

PROOF-OF-WORK (POW)

The Proof of Work (Pow) mechanism consensus was introduced in 1993, but it went largely unused until Satoshi Nakamoto created Bitcoin in 2008 (Nakamoto, 2008). Realizing that this mechanism could be used to reach consensus between many nodes on a network, as this mechanism enables a distributed agreement about the ledger's state using computational power with its one-CPU-one-vote, cryptographic security, and majority decision criteria represented by the longest chain.

Concisely, Proof-of-Work is a protocol that sets difficulty and rules for Miners to create blocks composed for the transaction that occurred within a specific limit of time and go through an intense race of trial and error to find the nonce or missing number that allows the block to be matched with the last block mined and continue building the chain of blocks (Amitai et al., 2022). This is important because the chain's length helps the network follow the correct fork of the blockchain. The more "work" done, the longer the chain, and the higher the block number, the more confident the network can be of the current state.

A Miner needs specialized equipment to do it. Due to the increasing computation needed, mining pools could dominate the mining game, leading to centralization and security risks. Therefore, other consensus mechanisms were introduced, like PROOF-OF-STAKE (POS), where there are validators instead of miners, and users do not “mine” new blocks but instead “mint” or “forge” blocks.

PROOF-OF-STAKE (POS)

This consensus mechanism was introduced in a forum of Bitcoin in 2011 (Bitcoin Forum, 2011) but was first implemented and released by Peercoin in 2012 (Peercoin Foundation, 2023). As years passed, it has been adopted in great projects like Ethereum for being more secure, less energy-intensive, and computational hardware intensive, as well as for being better and more addressable with software, allowing the implementation of new scaling solutions compared to the previous proof-of-work architecture.

This mechanism of consensus allows Validators to coordinate and synchronize with other validators, often called nodes, to create, validate, and propose a new block of transactions only if there is something of value put into the network by their own that will be eliminated if they act dishonestly (Ethereum Foundation, 2023). The time when each block could vary by each implementation, but the most important is that validators are chosen randomly with some minimum desirable criteria for good network and community (Nguyen et al., 2019). There are cases where Stake could be used as a voting process, but these cases could be exposed to centralized practices.

In conclusion, consensus mechanisms are essential in Blockchain technologies because they establish how to create and protect the transaction specifics using computerized hardware and software with determined incentives and cryptographic methods to secure the information for public use. It is crucial to appreciate security contribution being a fundamental part of the advantages of blockchain technology for many situations, such as corruption or low traceability, which are very present in countries with weak institutions, such as Colombia. As defined by current Colombian legislation:

> Permissionless consensus provides a high degree of network security, measured in terms of network hash rate for proof-of-work networks like Ethereum. Through various types of algorithms decentralized consensus beyond the proof of work, network security is generally higher in systems without permission, as they allow more participants of nodes, which in turn increases costs and the difficulty of a "double spending" attack, where a malicious or corrupt actor can master computing power or of the network's voting, either through illegal acts or collusion with other nodes, in order of compromising transactions and records. (MINTIC, 2022)

CRYPTOCURRENCIES

As seen previously, Blockchain technology and, in more general terms, distributed ledger technologies have the potential to disrupt many centralized industries with the wide field of possible applications they offer; these applications or projects are what we call Cryptocurrencies. In this theoretical framework, a summary of cryptocurrencies will also be discussed to understand the reasons for their development and the critical contributions of their conception.

BITCOIN

Satoshi Nakamoto, a pseudonymous person or group, released in December 2008 the first cryptocurrency, Bitcoin (BTC). In his white paper, he (or they) proposed a purely peer-to-peer version of electronic cash that allows online payments to be sent directly from one party to another without going through a third party known as a financial institution (Nakamoto, 2008), Figure 2 shows an example of a simple transaction using blockchain and Bitcoin (BTC).

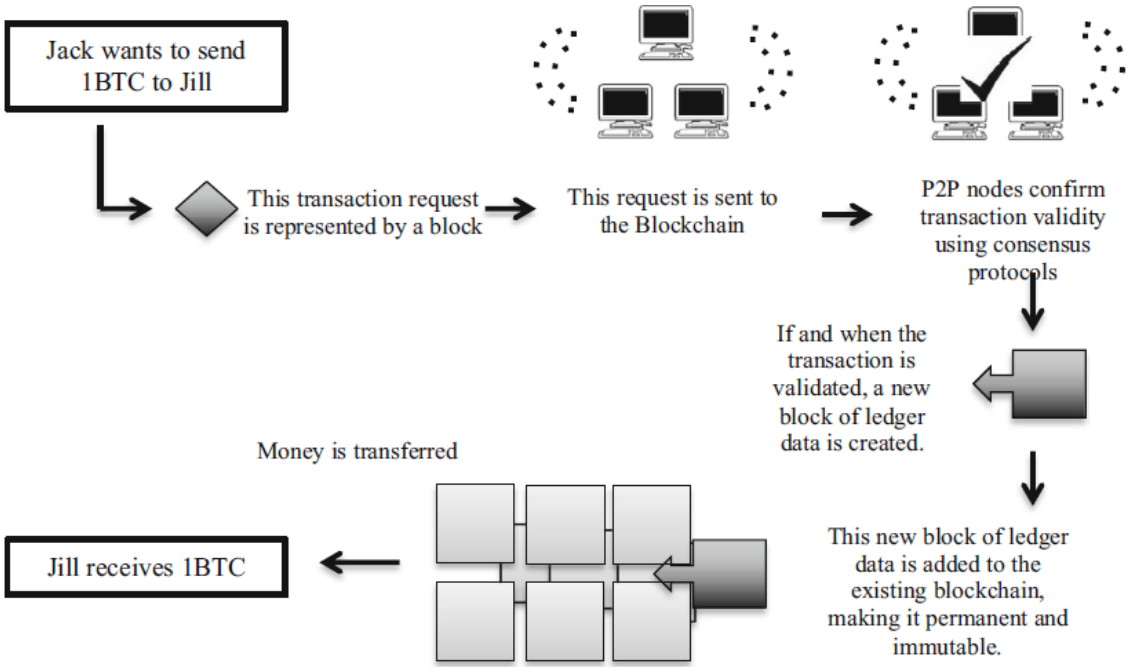

Figure 2. Simple transaction using Blockchain and Bitcoin (Kher et al., 2020)

Regarding its price action, Bitcoin has reached a stunning all-time high (ATH) price of ≈$69.000 per coin and a market capitalization of $1.28 trillion in November 2021 (Globaldata.com, 2023). This is impressive for an asset that started being valued at pennies of a dollar 13 years before and used to buy pizzas.

This cryptocurrency has been standing for providing access to many financial services for the unbanked and underbanked populations, allowing them to send and receive money, access credit, and participate in the global economy regardless of a third intermediary part. Also, the "peer-to-peer" idea could help speed up many transactions in a trust scenario. At this point, there is no doubt that cryptocurrencies have become an essential part of the global economy and, day by day, are starting to develop their institutions. Simplifying day-to-day actions with secure technology is an essential contribution to human exchange relationships. It is clear that Blockchain and cryptocurrencies have the potential to increase financial inclusion in developing countries (Tapscott & Tapscott, 2017).

One of the most important things to consider about cryptocurrencies is that it is not about only Bitcoin anymore; to that end, the Cryptocurrency market is highly diverse. As a clear example, we have Ethereum, an open-source platform to write computer code that stores and automates digital databases using smart contracts. (Ethereum Foundation, 2020).

ETHEREUM

Since 2018, Ether (ETH) has been ranked the second largest Crypto by market cap, and as of October 2023, it has reached around $200 Billion in total value (Coinmarketcap, 2023). This dominance has been granted by the different uses allowed beyond financial utilities. Since its launch in 2014, this cryptocurrency was introduced to be used as a "resource" that allows the development and execution of a new revolutionary blockchain innovation called "smart contracts."

Ethereum Foundation, headquartered in Switzerland, is a non-profit organization that supports this crypto and defines Ethereum as a worldwide system, an open-source platform to write computer code that stores and automates digital databases using smart contracts. (Ethereum Foundation, 2020). These smart contracts built on Ethereum could only be created and managed using a newly introduced programming language called "Solidity," a new programming language designed by Gavin Wood Solidity Co-founder with Vitalik Buterin and developed by Christian Reitwiessner, Alex Beregszaszi, and several former Ethereum core contributors.

SMART CONTRACTS, TOKENS, AND INITIAL COIN OFFERINGS (ICOS)

Smart contracts were a novel innovation of blockchain technology introduced by Ethereum, where they are automated and programable codes being ruled by a set of standards and requirements built in a digital virtual machine called Ethereum Virtual Machine (The Solidity Authors, 2016). Due to being hosted in a digital environment, they can be tailored to interact in specific ways, allowing the recreation of real-world actions and events, but now powered by algorithms that allow automation and high-speed executions and cryptography that allows

data privacy and security. In this order, the leading term of this research is the Initial Coin Offerings (ICOs) or token sales. ICOs are smart contracts based on distributed ledger technology (DLT or blockchain) designed to raise external finance by issuing coins or tokens (Figure 3).

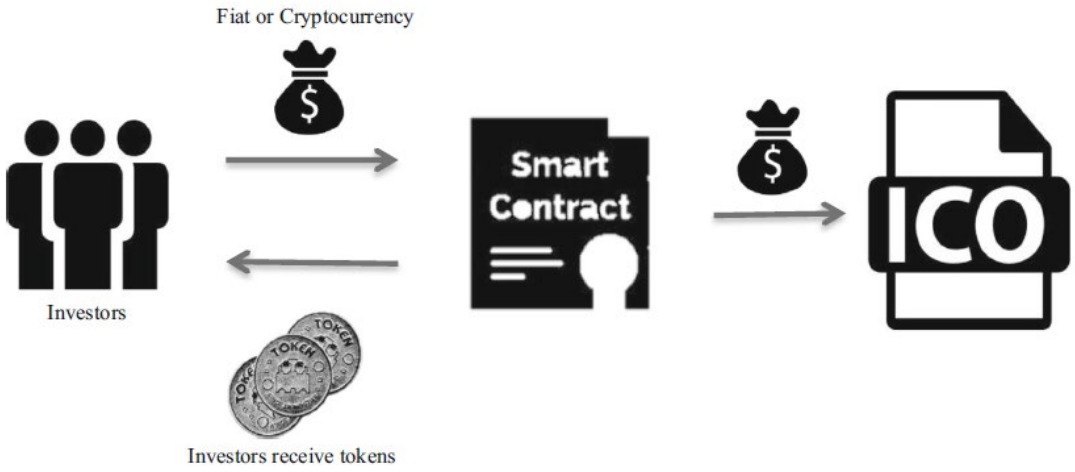

Figure 3. The ICO process and generation of tokens (Kher et al., 2020)

As Paul P. Momtaz from the University of California (UCLA) told us, ICOs are "smart contracts are computer protocols that automatize value-exchange transactions between the entrepreneur and investors, potentially creating perfect disintermediation" (Montaz, 2020). Also, this author said that ICOs are also attractive for innovators because they help gauge consumer demand from future users and the firm's market value at an early stage.

This is one of the most critical aspects for a developing nation; the ability to support innovative projects and make them competitive through investment is critical to having greater economic strength and participation in international markets. Paul P. Momtaz also said that ICOs "help innovators to improve platform features. From the user's and investors' perspective, ICOs may help redistribute platform gains to platform developers and users instead of financial intermediaries in most conventional financing methods". (Montaz, 2020)

It is essential to mention that there are public ICOs and private ICOs, and experts conclude that the advantage of these contract forms is that they facilitate the capital-raising process and create direct connections between the company and investors. In addition, the interests of both parties are aligned since the beginning of the commercial relationship.

2.2 BLOCKCHAIN AND ICOs: USES CASES AND RISKS FOR A DEVELOPING COUNTRY

Consequently, Blockchain efficiencies are being recognized by many companies of all sizes worldwide, and now they want to harness this concept to power their existing systems. This is due to its many applications in a wide variety of fields like banking, asset and finance management, cryptocurrencies, agriculture, polls, SCM (Supply Chain Management), healthcare, and many others. In Colombia, the discussion rounds through many points, as the use of Blockchain in Colombia regarding the circulation of intellectual property will increase the level of its protection by transferring and giving legal force to some existing mechanisms to guarantee the reliability of the information in Blockchain records (Gómez Molina, 2022) until Blockchain in forward contracts, that are mainly one of the cores of the agriculture exports in Colombia.

The author Llanos Quiñones et al. (2020) said: "Experts establish that the main characteristics of smart contracts are: greater agility, precision, does not need intermediaries, has lower costs, is automatic, facilitates interoperability between different services, generates security and trust, in addition to having an immutable history on values, services, operations or adjustments." (Llanos Quiñones et al., 2020; p:41) As seen, secure technologies such as Blockchain can be beneficial to provide further guarantees to their institutions and that all stakeholders have greater confidence, both in their innovation creations and in the security of the traceability of their investment in validation processes, with national authorities.

On the other hand, Blockchain faces significant scalability, speed, and transaction issues, which results in higher costs and processing times. This is one of the most significant disadvantages of Blockchain that academic literature agrees on, pointing to the energy consumption of its early technologies due to the high computational requirements needed to validate transactions.

Another note about this new technology is that the content cannot be modified; therefore, it requires expertise to avoid errors that could affect real situations. In developing countries like Colombia, with such a high information gap, it may be a problem to adopt technology in this way, so it is an opportunity for the government to deepen education in this medium with a view to the long term. Colombia occupies position number 64 in the ranking of the most digitized countries, which is a patron; also, we have ciphers showing Internet penetration in developing countries at 35%. (HAP Gil, 2017) In these two main aspects, capacity to use and Blockchain infrastructure development, the most significant challenges a developing country like Colombia must face to take advantage of all the potential opportunities that experts will point out in this research.

Leaving the concept of Blockchain behind and returning to the work's central concept, ICOs, which have all the advantages of Blockchain technology, offer their issuers a series of advantages that explain their development among them. This is important because this research focuses on how ICOs can help a developing company encourage specific industries and attract national and international investment. One of the most significant incentives for using ICOs in developing countries is their ease of raising investment and ability to create secure digital and automated agreements between SMEs and investors. To deepen and broaden the main advantages of ICOs for SMEs in raising investment, let us review the work *The Dawn of the ICO: Implications for the Colombian Market* by the Colombian academic Daniel Echavarría Wattenberg:

> "(i) the number of investors accessed through this means, (ii) the ability to access investors alternative to traditional ones, (iii) the flexibility of offering a product tailored to the issuer, (iv) the elimination or reduction of traditional intermediation costs, (v) the creation of a liquid secondary market for ICOs and, finally, (vi) regulatory arbitrations, under which the issuer has lower information and corporate governance burdens about traditional financing mechanisms" (Echavarría, 2020; p:168)

The **low issuance cost and high release velocity**, driven by the automated and programmed solutions innovations called **Smart contracts,** are considered one of the essential benefits of financing through Initial Coin Offerings (ICOs). The only costs involved in early token sales were the technical costs of setting up the infrastructure and developing the protocol, plus exchange platform fees for converting tokens, as advisors were rarely involved. (OECD, 2023; p:20). Also, there are some costs related to Marketing and Community Management, but these often go down always that the products or services delivered are tailored for the users and solve a lack in their daily lives (Zhang et al., 2022). In some cases, there is a critical engagement created by preferences or just community beliefs that gather in their likes, as in the cases of Dogecoin in 2016 and ShibaInu in 2020. In short, creating a currency through these technologies provides even more than the possibility of being an exchange of capital.

Finally, the author Kevin Werbach writes about cryptocurrencies and Blockchain in developing countries such as India, Kenya, and others in East Africa, stating that these states are discovering plenty of blockchain applications, the decentralized ledger technology that promises a secure, peer-to-peer mechanism for verifying information. He said, "Even as blockchain technology has made inroads into developing countries like India, inadequate digital infrastructure and relatively low financial literacy may be obstacles. However, even more than those, outdated laws and rules are proving to be the biggest impediments to achieving Blockchain's full potential". (Werbach, 2018).

With the current introduction of blockchain technology, cryptocurrencies, and ICOs, it is observed that the final result often depends on the context's ability to adapt innovations. Therefore, in the next chapter, the legal framework in Colombia will be analyzed, and how challenges and opportunities arise in the current situation.

2.3 COLOMBIA'S REGULATORY FRAMEWORK

First, it must be stated that the Central authorities not only solve the problem of trust in certifying value transactions but also offer essential supervision of the process, such as safeguarding that information asymmetry is kept at reasonable levels between parties engaging in contracts. The financial world is always, both in taxes and incentives, a primary importance for Central authorities. Blockchain technologies, as we could see before, and cryptocurrencies are designed for peer-to-peer interactions, simplifying many operations in many sectors of the economy. Although there are many cases where even state authorities find themselves in situations of corruption, there is no doubt that appropriate legislation is critical to avoiding bad practices with new technologies. The authors Elisa Ughetto and Daniel Levis explained that:

> Letting people directly exchange value between themselves or allowing companies to raise capital easily can boost financial efficiency but also provide room for fraud and ambiguous behaviors. Today, companies that are interested in raising capital both through innovative tools such as crowdfunding or through traditional entities such as public financial markets must disclose relevant information and usually go through a **deep process of due diligence** (Ughetto, Levis D, 2021; p:17)

There are all kinds of cases regarding legislation on cryptocurrencies and their implications on productive projects. However, both regulatory authorities acknowledged the innovative potential of ICOs and refrained from outright banning them. In contrast, other countries, such as Singapore and Switzerland, implemented accommodating regulatory frameworks to attract ICOs and blockchain ventures to leverage their vast innovative potential (Howell et al., 2020). Otherwise, the Chinese Banking Regulatory Committee, led by the People's Bank of China, immediately banned all initial crypto-asset offerings. Chinese law will track and prosecute any attempt at "illegal fundraising," the name given to any action where a person or business acquires or absorbs funds without the permission of the Financial Administration Department of the Council of China.

In Colombia, As the main note of the regulatory case, the Plenary of the Chamber of Representatives of Colombia is in the process of approving Bill 139 of 2021, by which "Cryptoasset Exchange Platforms (PIC) that offer exchange services for these virtual assets are recognized, a framework is created regulatory and other provisions are issued." This project was presented by representatives Mauricio Andrés Toro Orjuela and Rodrigo Arturo Rojas Lara. It mainly seeks to recognize crypto-asset exchange platforms and establish guidelines for their surveillance and control to prevent fraud or other risks. However, this bill has been shelved in mid-2023 until 2024. The author Daniel Echavarría told us about the arrival of cryptocurrencies in Colombia:

> "Virtual currencies have already generated negative noise in the national territory. The media pick up warnings from the *Superfinanciera*, which "asks citizens not to fall into pyramids that have ventured into the bitcoin business "26. This same idea is supported by Jhonatan Higuera, coordinator of the Financial Market Analysis Unit of the Faculty of Economic Sciences of the National University, who points out that "the first approach of people with the issues of virtual currencies in the country has been, in large part, by the scandals of pyramid or fraudulent schemes" (Echavarria, 2020; p:25)

In turn, the Colombia Vice Minister of Digital Transformation, Iván Durán, highlighted the benefits that this technology generates for public entities, such as "audibility, traceability and immutability in data; a series of characteristics that allow us to be an increasingly "transparent and able to guarantee the security of information." For the Colombian State, the primary applicability of blockchain and crypto assets is security, ensuring that these technologies are incorporated into its banking and real estate system.

Despite these advances, Colombian law still defines crypto assets as "virtual assets that can be used as a means of exchange for goods and services. They are not considered legal tender, nor currencies, nor titles representing legal tender" in the present project of law. Regarding this situation, it is worth clarifying that the bill is currently ostracized, and until 2024, it will be taken up again on government agendas. Blockchain technologies, cryptocurrency

regulation, and Initial Coin Offerings (ICOs) have complex and multifaceted impacts on developing countries. Here are some key points to consider (Gutmann & Schückes, 2020):

- **Financial Inclusion:** Blockchain and cryptocurrencies can potentially increase financial inclusion in developing countries. They provide access to financial services for the unbanked and underbanked populations, allowing them to send and receive money, access credit, and participate in the global economy.

- **Remittances:** Cryptocurrencies can significantly reduce cross-border remittances' costs and time. This is particularly important for developing countries where remittances from migrant workers are a crucial source of income.

- **Fraud Prevention:** Blockchain technology can create transparent and tamper-proof systems, reducing fraud and corruption in developing countries, especially in areas like land registry, supply chain management, and government procurement.

- **Access to Capital:** ICOs and tokenization have provided a new way to raise capital for startups and projects in developing countries. This can foster entrepreneurship and innovation, although it also comes with risks of scams and regulatory challenges.

3. METHODOLOGY

This research will use the DELPHI method, whose quantitative and qualitative approach will give an estimated forecast about the Impact of Blockchain technologies, cryptocurrency regulation, and ICOs in developing countries., especially the Colombian economy.

In this case, the Delphi method, derived from the Greek oracle Delphos, is a method of prediction based on a panel of experts in two or three surveys and is carried by its opinions and answers to a series of questions. In this method, experts must evaluate projections and assess the societal impact of the main topic and the probability that they will occur in a specific time horizon. The Delphi forecasting method uses expert judgments, especially on technology or social processes, considering responses to a questionnaire to examine the likely directions of development of specific technologies and the impact of these possible scenarios.

In this method, to ideally interpret the results, a systematic process must be carried out with the selection of the participants based entirely on their status as experts, considering that the population consulted is too minimal to be representative of the total population. For this reason, the results obtained are exclusively qualitative regarding the consensus achieved or the discrepancies in the opinions of those consulted. The four main objectives of the DELPHI method are:

1. Obtain greater intersubjective and prospective knowledge about the chosen topic.
2. Analyze the desires and preferences of characteristic segments or groups in the thematic areas of the research.
3. Promote a structured debate process by visualizing points of dissent among expert panel members.
4. Promote currents of opinion among decision-makers.

For this research, 2033 is chosen as a time horizon for generating the scenarios, to the expectation of how Latin American countries, mainly Colombia, will adapt to these new technologies. Experts assumed a period like this as the recommended period for a Delphi study since a superior period would have become unmanageable to provide relevant advice for strategic development, and less would be non-predictable and approachable. Based on the explanatory scheme of the research (von der Gracht & Darkow, 2010), Figure 4 depicts the phases of the Delphi Model that will be applied to achieve conclusions on the future scenarios of ICOs and their blockchain technology in Colombia as a developing country:

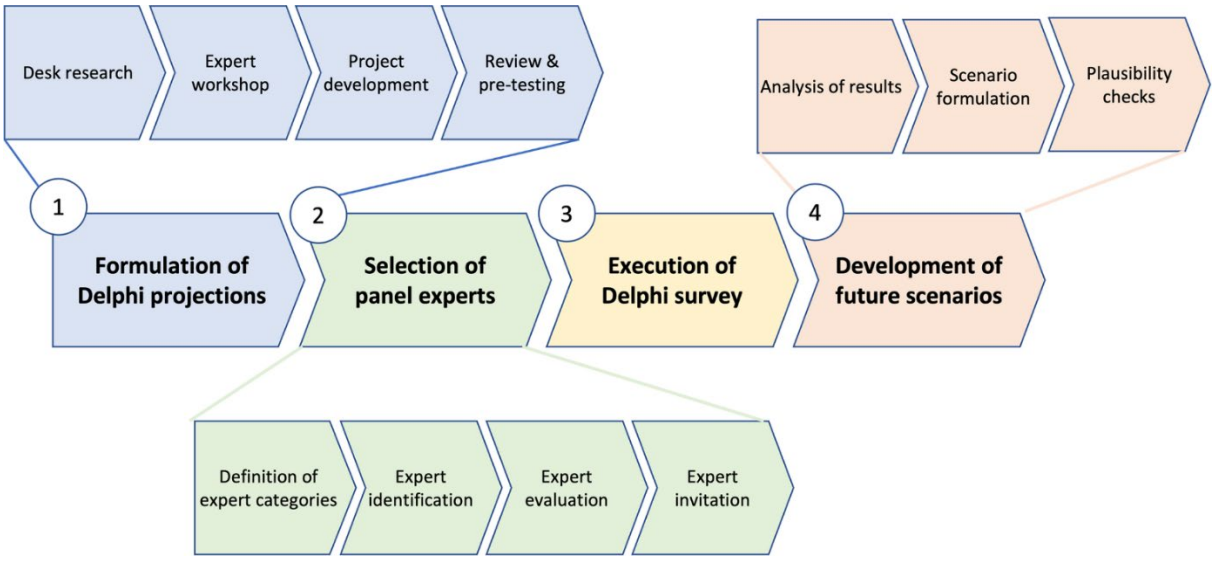

Figure 4. Four Steps Delphi procedure by Heiko and Darkow (2010)
(https://journals.plos.org/plosone/article/figure?id=10.1371/journal.pone.0258995.g001)

Gathering information from experts to formulate Delphi projections is extremely important. However, due to the inconveniences that come with assembling a panel of experts, a hybrid mechanism is deployed. In this hybrid system, the steps are slightly modified, and the first round of formulations includes projections based on existing literature and some open questions made to gain more information from experts and further convert them into projections for the second survey.

This dynamic system will allow to glimpse the future perspectives in various productive sectors. Therefore, for the first round, a total of 15 statements were formulated, including 9 projections and 6 open questions, with space for additional comments by the experts (Table 1). Then, the answers to the 6 open questions were converted into projections for the second survey based on experts' opinions (easily allowing to then reach a consensus on the second survey), with the idea of covering possible scenarios left behind.

	PROJECTIONS
ID	ADOPTION
1	By 2033 blockchain technology will play a decisive role in Latin America and Colombia's economic and environmental development
2	By 2033, blockchain technology will allow the creation of companies and formal jobs, and therefore better living conditions for developing countries' population
3	By 2033, the level of security and transparency be increased to prevent and/or reduce financial fraud with the implementation of blockchain technology, cryptocurrencies, and ICOs
4	By 2033, what are the 3 economic sectors that you think ICOs will have the greatest potential to generate innovation and investment?
5	Based on your expertise and knowledge, leave us a reflection on why it was your previous choice?
	INNOVATION
6	By 2033, in Colombia and Latin America, the use of Blockchain technology, crypto, and tokenization will become widespread and counted as a source of receipt of Foreign Direct Investment (FDI)
7	By 2033, Colombia will have created a financing channel for SMEs through cryptocurrencies, allowing efficiency, effectiveness, and security for investors and entrepreneurs.
8	By 2033, companies and individuals will face greater dangers of financial scams and fraud due to a lack of knowledge about the implementation of blockchain, cryptocurrencies, or tokenization.
9	What products or services do you think implementing Blockchain technology, cryptocurrencies or ICOs would bring the greatest benefit to companies, governments, or society in Latin America and/or Colombia?
10	What blockchain technology innovation will bring the most benefits to Latin American and/or Colombian companies, governments, and society?
	REGULATORY FRAMEWORK
11	By 2033, Crypto Asset Bills beneficial to blockchain technology, cryptocurrencies, and tokenization will be passed (although Crypto Asset Bill 139 of 2021 was passed in November 2022, this bill has been shelved)
12	By 2033, there will be an adequate regulatory framework that allows the government to implement blockchain technology in its processes, such as decision-making or fund management.
13	By 2033, there will still be obstacles to achieving a defined regulatory framework in Latin America and Colombia
14	Considering that this year the regulatory framework for Crypto assets in Colombia was postponed, what would be the main reason or what should happen to have priority on the agenda of the country's legislation in the following years?
15	Do you think that in order to accelerate the adoption of blockchain technology and ICOs, it is necessary to have greater support from the State, both in terms of tax deductions and subsidies?

Table 1. Initial projections.

For the application of the DELPHI model, 20 experts were carefully selected to achieve consistent results. However, as depicted in Table 2, 18 answered the first survey and 16 the second, leading to a 20% decrease concerning the initial invitations.

	Invited	First survey	Second Survey
Number of experts	20	18	16
Percentage	100%	90%	80%

Table 2. Experts' dropouts.

Experts have mostly recognized figures in Colombia's blockchain and cryptocurrency landscape. However, experts from other Latin-American countries (and one from the USA to get an external perspective), were also included (Figure 5), taking into consideration their knowledge and experience on the topic and their willingness to participate, the Ethereum Foundation served as a link to reach the experts.

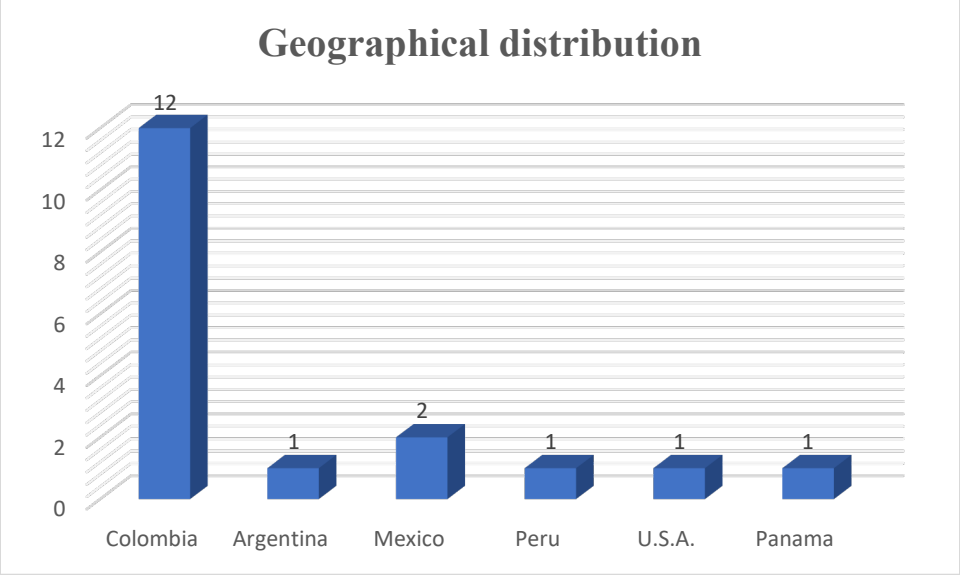

Figure 5. Experts' geographical distribution.

The profiles (Depicted in Figure 6) range from academics of the phenomenon to businesspeople and active participants in Colombian regulations.

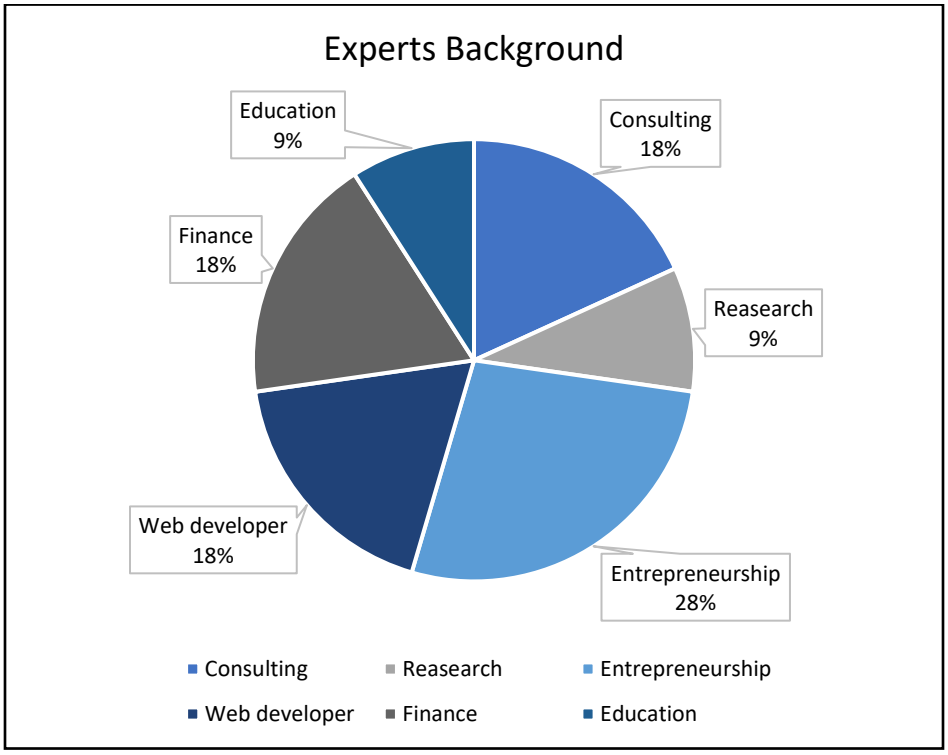

Figure 6. Experts' identification by Background.

These experts have chosen to adapt better to the context in which new technologies are found because they have not always been received with the necessary expectations and have often adapted negative variables to their purpose. Additional information on experts is presented in Appendix C.

Experts were evaluated mainly in the regulatory part of the State, taxation, innovation, and entrepreneurship. During this process, experts were asked to rate the social impact (from 1 to 5) and the likelihood that a particular projection will occur, starting from impossible to unlikely, equally likely, likely, and certain. Then, results were expressed in probability terms from 0% to 100%, as shown in Table 3.

ID	Likelihood	Probability
1	Impossible	**0**
2	Unlikely	**0.25**
3	Equally likely	**0.5**
4	Likely	**0.75**
5	Certain	**1**

Table 3. Scale deployed to evaluate projections likelihood.

Then, consensus was analyzed in terms of the interquartile range (IQR), which measures the dispersion of the central half of the data. It is the range for the middle 50% of the sample, the IQR assesses the variability in which most of your values lie. Larger values indicate that the central part of your data was more spread out, which would indicate that experts on the topic have a very broad context on the possible evolution of Blockchain technology, cryptocurrencies, and ICOs in that statement. Conversely, smaller values indicate that the mean values are more clustered, which would indicate a consensus and prediction, the goal of the Delphi method.

The session was developed considering different levels of consensus based on different IQR values (presented in Table 4) looking for cases with minimum variability, allowing both to identify outliers and to test data without heterogeneity. There is also a certain similarity and a high probability that the statements proposed by this research take place in the long term, which would mean favorable results for the implementation of Blockchain technologies. This research will take values below or equal to 0.15 IQR as High Consensus, 0.16 to 0.3 as Moderate Consensus, and greater than 0.3 as No Consensus. Then, only projections that did not reach consensus on the first survey were included in the next iteration, and experts were asked on the second survey to reconsider the likelihood of occurrence of these projections.

IQR for Consensus	Consensus Level
X <= 0.15	High Consensus
0.15 < X <= 0.3	Moderate Consensus
> 0.3	No Consensus

Table 4. Scheme for consensus levels.

4. RESULTS

With the DELPHI methodology deployed, a series of predictions and questions were asked in two iterations (to get quantitative and qualitative data), and with the primary objective of visualizing in the medium and long term the opinion of a group of experts on blockchain technology, ICOs, and cryptocurrencies in developing countries, specifically Colombia. The result was quite positive, where the experts were optimistic regarding the evolution of technologies but with ambivalent opinions for the Colombian case, given that the evidence shows that little progress has been made in the essential tools to understand and apply these technologies to particular contexts, as well as the knowledge gap in the country do not seem to show solutions soon.

First iteration: The first prediction group regarding the role of the adoption of blockchain technology, ICOs, and cryptocurrencies in developing countries, shows that experts reached a moderate consensus (IQR 0.25) on projections No. 1, 2, and 3 (Figure 7). This leads to blockchain technology having a high probability to play a decisive role in Latin America and Colombia's economic and environmental development by 2033.

The comments were affirmative in approximately 90% of the panel of experts, all agreeing that these technologies solve fundamental problems of reliability and corruption in developing countries. According to experts, the main argument for not believing in adopting technologies is "because it is an infrastructure technology that requires a very large learning curve.". Experts also agreed with a high probability that by 2033, the level of security and transparency will be increased to prevent and/or reduce financial fraud with the implementation of blockchain technology, cryptocurrencies, and tokenization, also having the greatest impact (median of 5 points)

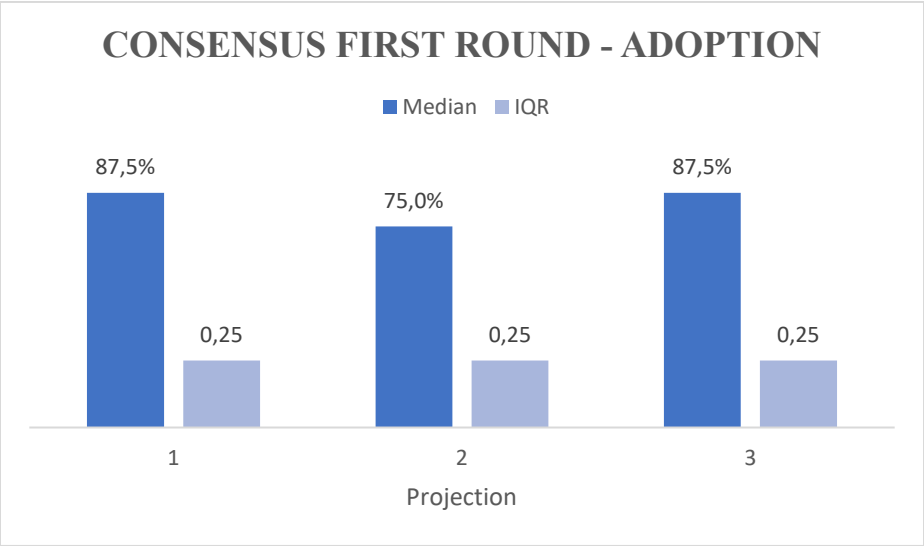

Figure 7. Experts defining the adoption of Blockchain, Cryptocurrencies, and ICOs in Latin America and Colombia.

Some of the following questions are mainly about formality and transparency and their adaptability to the current dynamics of entrepreneurship and governance in Colombia and Latin America. At these points, there is no doubt that agility in payments, the formalization of work, and the creation of new exchange channels will be the main advantage of cryptocurrencies and blockchain technology.

Also, this conversation can be easily linked to the open question 4 ("By 2033, what are the three economic sectors that you believe ICOs will have the greatest potential to generate innovation and investment?"), in which experts depict what they see in the future as the sectors that will benefit the most from ICOs and blockchain technology in the Colombian context. As can be seen in Figure 8, almost 50% of the answers determine that "Financial and insurance activities" will be the first economic sector to adopt and see their practices improved with these technologies in the coming years. It is essential to highlight that 40% of experts also think that "Artistic, entertainment and recreational activities" and "Real estate

activities" will be others of those favored sectors, as having direct investment and sales contact through cryptocurrencies will be easier.

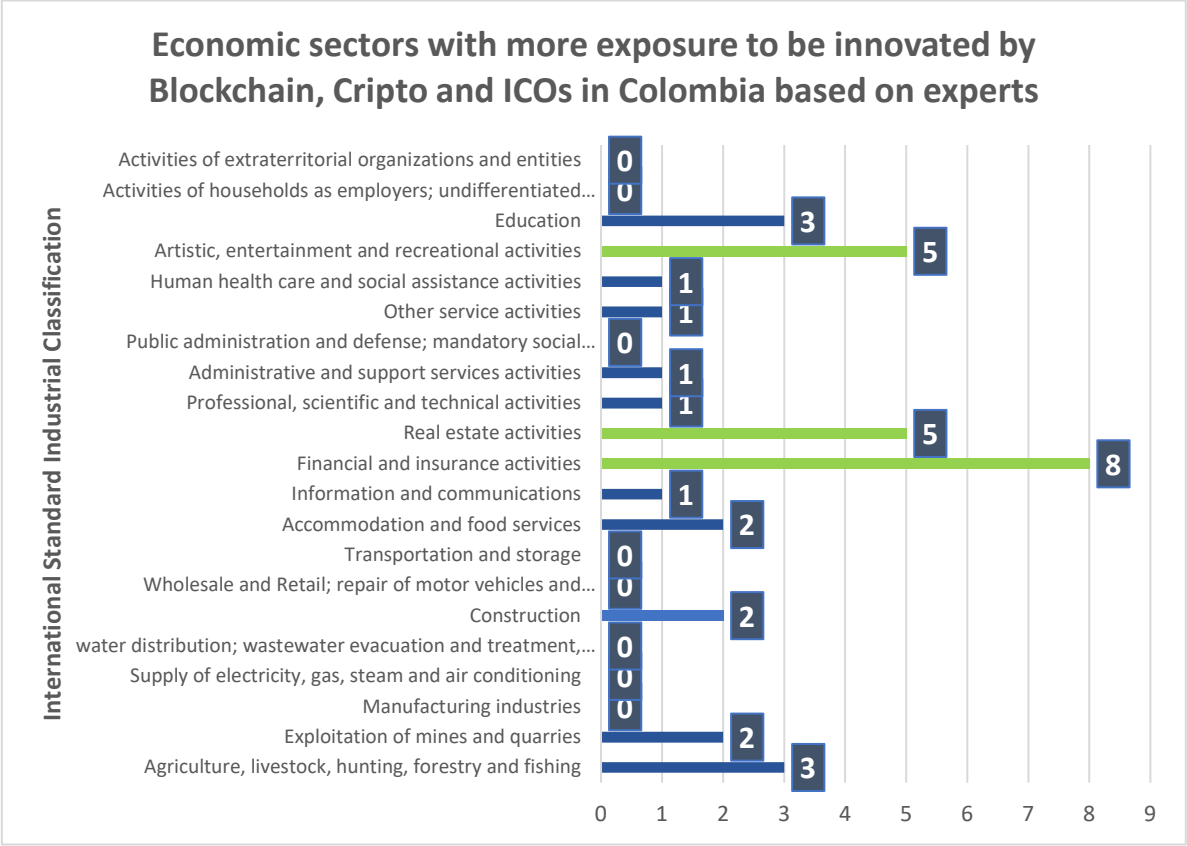

Figure 8. Economic Sectors with more exposure to be innovated by Blockchain, Crypto, and ICOs in Colombia based on experts.

At this point, it is important to analyze that ICOs in developing countries should be used primarily as a tool so that the investment arrives more quickly and efficiently.

Institutions, generally in these types of countries, instead of expediting and attracting foreign investors, make their entry difficult with unnecessary barriers; ICOs could easily surpass that experience. In many sectors, cryptocurrencies can significantly reduce the cost and time associated with cross-border remittances. This is particularly important for developing countries where remittances from migrant workers are a crucial source of income. Colombia and Latin America depend largely on remittances and foreign investments, so the

consolidation, with government support, of collection channels would be a step forward for better conditions.

The following group of predictions were presented to determine what experts thought about disruptions that could happen when implementing Blockchain, cryptocurrencies, or ICOs and the possible dangers for individuals and companies, reaching a moderate consensus (IQR 0.25) for projection 8 (Figure 9). Regarding this point, the panel of experts was divided. Most of the arguments against the implementation of new technologies by central governments have to do with low initial security, which can pervert the entire platform, and changes in the rules of the game due to the governmental volatility that is currently managed in a highly divided society, and, finally, the loss of autonomy of technologies and ICOs themselves.

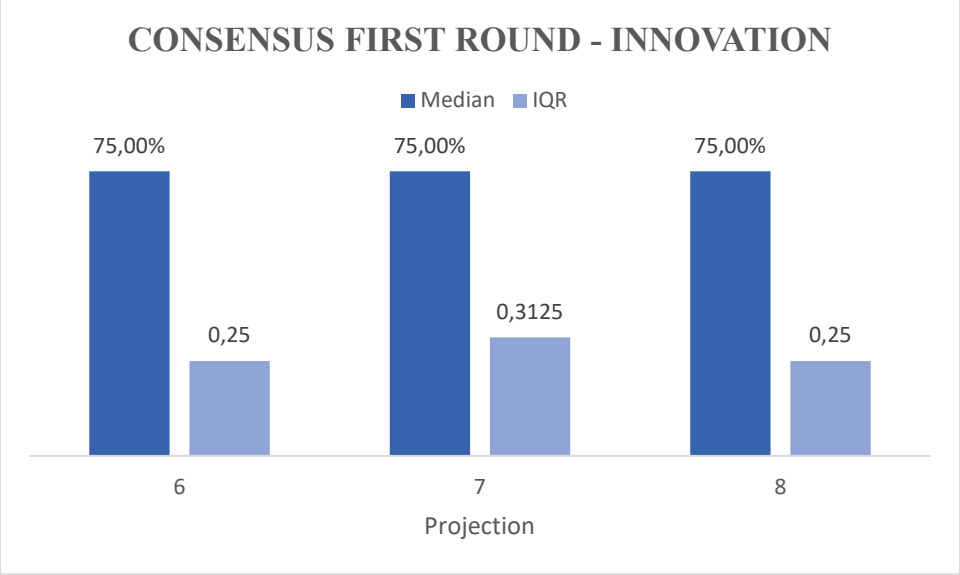

Figure 9. Experts defining Innovation for Blockchain, Crypto, and ICOS in Latin America and Colombia.

There is no doubt that for these sectors mentioned above, which represent the actual progress of a nation in terms of macroeconomic impact, a series of critical measures are required. During the interview methodology, the panel of experts reached a moderate consensus (IQR 0.25) on the use of Blockchain technology, crypto, and tokenization becoming widespread and counted as a source of receipt of Foreign Direct Investment (FDI) for Colombia and Latin America

Moreover, through questions 9 and 10, the experts answered the most critical points for Colombia to channel Foreign Direct Investment (FDI) through the crypto asset markets. The answers show us various options, from the private to the public sector. Using tokens as a risk estimate, added to ICOs, for ideal peer-to-peer communication is one of the most repetitive responses. For this, it is concluded that the Colombian Central Government must adopt regulations that protect investors from scams, given that ICOs, as we analyzed in the theoretical framework, are subject to fraudulent operations and have a history with a high negative connotation in the country.

Another of the operations that are mentioned to be able to channel this investment and make the nation more attractive in international markets is the creation of a secondary market to trade these digital financial assets, such as ICOs, with the opportunity for monitoring guaranteed by state authorities, that are validated and aware of the main mechanisms of cryptocurrencies. The main disadvantages that experts argue in the interview are the fear of using cryptocurrencies in the country, the lack of regulation, the delay in state regulation projects, and the low transparency of traceability. Almost 60% of them mention this point as the main barrier to the success of an increase in foreign direct investment (FDI) in our country through these channels, which have a very high value in streamlining processes.

Investments through ICOs would be available to everyone, eliminating bureaucratic and payment barriers that occur in the traditional stock market. Current modalities, such as forward contracts, could be highly incentivized through capitalization channels with blockchain technology. These contracts are mainly used in the country's agricultural development (Colombia has 17% of its workforce in the agricultural Market, which is poorly developed, and 26.5% of its population lives in rural areas).

It is important to remember that tokenization generates liquidity for illiquid assets, and blockchain technology ensures traceability that cannot be altered through corrupt practices. One of the interviewees also tells us that operations such as REPOS (An operation where an asset is sold in exchange for a sum of money, with the agreement to repurchase it later) would be simplified and could be easier for the authorities, both in the transfer of titles and assets.

Research continues with questions about the applicability of new technologies, using the Delphi method if investment could be channeled for SMEs. The general responses for the probability of occurrence were highly varied for projection No. 7. “By 2033, Colombia will have created a financing channel for SMEs through cryptocurrencies, allowing efficiency, effectiveness, and security for investors and entrepreneurs.” Thus, not reach a consensus (IQR 0.3125) even though it has the most impact according to the experts (5 points). However, in the additional commentaries, it was seen that the innovation of using ICOs and cryptocurrency wallets will formally allow for micro-investments to stand out.

Now, regarding regulations, there was no consensus among those surveyed (IQR 0.5 and 0.315), about a series of regulations adopted in the short and medium term protecting this type of investment (Figure 10). They also point out that the possibility of money laundering through this methodology, a widespread practice in the country, given its characteristics, would highly discredit the entire cryptocurrency market in the face of state authorities and SME stakeholders.

Developing countries often lack clear and comprehensive regulations for cryptocurrencies and ICOs. This can lead to uncertainty for businesses and investors and may hinder adoption. There is no doubt that one of the main results of this research is that it would be a tremendous competitive advantage for a developing nation to be able to obtain national and international resources but also something significant: they will maintain corporate governance by not falling into dissolution in very early stages due to lack of working capital.

Experts explained that the possibility of each company issuing tokens could be vital to increasing their ability to do business, even though tokens, in Colombia, currently do not represent ownership of companies but rather give participation in governance in the company for most of the cases. Blockchain technology can create transparent and tamper-proof systems, which could be very attractive to secure institutions in legal disputes regarding business participation.

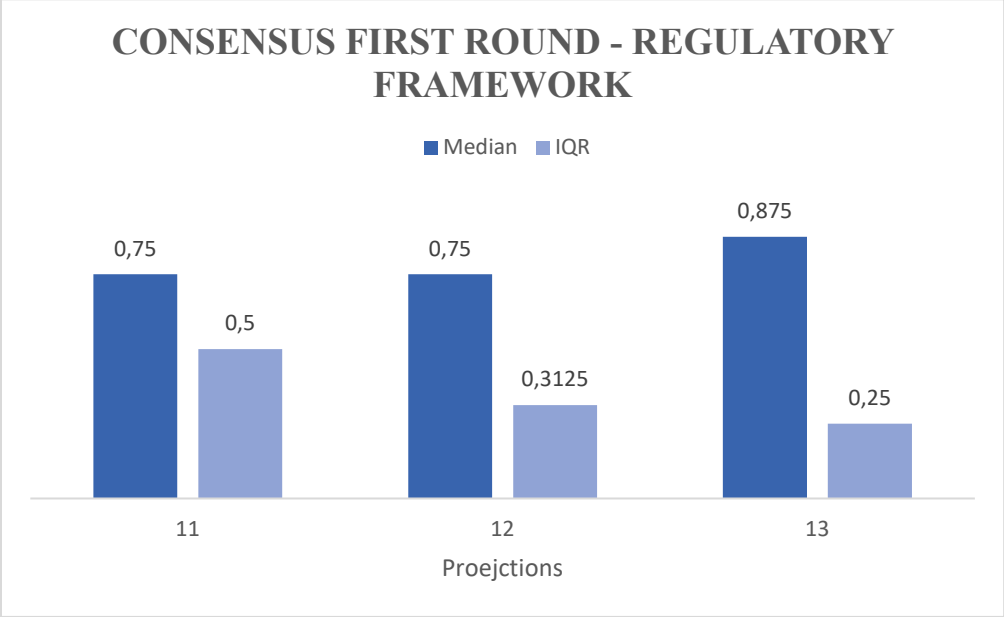

Figure 10.Experts defining Regulatory Framework for Blockchain, Crypto, and ICOs in Latin America and Colombia.

On the other hand, with a view to the local government's implementation of Blockchain, cryptocurrencies, or ICOs, and the dangers that there would be for companies and people, the majority of the experts consulted agree that that the lack of education about the management would generate chaos in the early implementation, either of blockchain mechanisms to ensure investment and capital for the country, or in a possible creation of a Central Bank Digital Currency (CBDC).

Advantages that the literature consulted coincide in praising, such as that Blockchain technology can be used to create transparent and tamper-proof systems, reducing fraud and corruption in developing countries, especially in areas like land registry, supply chain management, and government procurement, are unreal in the current context of discredit and lack of knowledge in the nation according to experts. Creating a CBDC with capricious rules that depend on a government in power is complicated. As evidence, the significant changes made in the country's fiscal frameworks during the last century are cited, where the rules of the game for capital markets have been changed on multiple occasions without fundamental solutions. With such a history, instability is expected to highly affect the international perception of the country and its markets.

Furthermore, the group of experts was asked, By 2033, there will still be obstacles to achieving a defined regulatory framework in Latin America and Colombia, this was the only projection from the regulatory framework that reached consensus (IQR 0.25), and they concluded that a large number of the nation's problems have caused other issues to prevail in the legislation, as well as the general lack of knowledge that prevents reaching a consensus that makes it easier to take measures to take advantage of the advantages of blockchain technologies, ICOs, and cryptocurrencies. Ideas such as that the restriction protects the user, being a field where innovation must be allowed, is at least a contradiction in the government's perspective.

Furthermore, experts also agree that the emergence of substitute platforms to manage funds, such as exchanges and other digital wallets, has been seen as a threat to the country's banking hegemony, which is one of the most stable and privileged sectors. In the discussion panel, it is pointed out that the view of emerging nations should be the case of Europe with the approval of the MICA law. The legislation is expected to clearly understand the benefits of implementing this type of technology and, consequently, its products, such as Cryptocurrencies or ICOs. The fact that these technologies are new to the country's application has led to the search for the most suitable actors to adopt them, even when their nature is to eliminate intermediaries in transactions.

Finally, the discussion closed with questions No. 14 and 15, with the primary considerations to accelerate the adoption of blockchain technology and ICOs, in which the experts were asked to indicate whether it is necessary to have more significant support from the State regarding tax deductions and subsidies. 22% of the experts agreed that the State must take measures if it wants to attract foreign players to develop the industry, given that the technological entrepreneurship ecosystem in the country, despite cases of success, still required a lot of support and tax exemptions to generate much employment in a significant way and be considered a spearhead for the next decade.

The national cryptocurrency industry, which generally applies blockchain technology, does not have enough power to achieve a complete offer for users. If this industry could be better positioned, better knowledge objectives could be achieved for a large part of the population, and the attention of regulatory entities at the national level would be attracted.

Accordingly, with the end of the first session, only projections that did not reach consensus are considered for the execution of the second round of surveys of the Delphi method. In this second round, experts are asked to reevaluate the projections that did not reach consensus on the first round and new projections based on their answers to the open questions, results are presented in Table 5.

As expected from the answers to question number 4 of the first survey, experts agreed with a high consensus (IQR 0.125) projection 5, that by 2023, the financial sector, real estate, and arts/entertainment activities will be the sectors with the greatest scope for positive innovations with the adaptation of blockchain technologies, having a significant social impact. One of the experts explained that he chose the three industries "due to the restrictions they normally have in the markets and the high participation costs for those who want to enter. ICOs make available to anyone the possibility of investing in these sectors quickly, safely, and with potentially interesting returns".

No.	Projection	Impact	First Round Probability		Second Round Probability		Consensus
		Median	Median	IQR	Median	IQR	
ADOPTION							
1	By 2033, blockchain technology, cryptocurrencies, and tokenization will play a decisive role in the economic and environmental development of Latin America and Colombia	4	0,88	0,25	-	-	Moderate
2	By 2033, blockchain technology, cryptocurrencies, and tokenization will allow the creation of companies and formal jobs, and therefore better living conditions for the population of developing countries.	4	0,75	0,25	-	-	Moderate
3	By 2033, the level of security and transparency will be increased to prevent and/or reduce financial fraud with the implementation of blockchain technology, cryptocurrencies, and tokenization.	5	0,88	0,25	-	-	Moderate
4	By 2033, financing mechanisms, tokenized with blockchain, will allow the raising of funds for non-profit social and ecological projects, also taking advantage of the growing interest of the international community to support these initiatives.	5	-	-	1,00	0,25	Moderate
5	By 2023, the financial sector, real estate, and arts/entertainment activities will be the sectors with the greatest scope for positive innovations with the adaptation of blockchain technologies.	4	-	-	0,75	0,125	High
6	By 2023, blockchain technology, cryptocurrencies, and tokenization will eliminate the growing fraud in financial operations that occurs in the banking sector of Colombia and Latin America, when used for transactions and investments by natural persons.	4	-	-	0,75	0,5	No Consensus
INNOVATION							
7	By 2033, in Colombia and Latin America, the use of Blockchain technology, crypto, and tokenization will become widespread and counted as a source of receipt of Foreign Direct Investment (FDI)	4	0,75	0,25	-	-	Moderate
8	By 2033, Colombia will have created a financing channel for SMEs through cryptocurrencies, allowing efficiency, effectiveness, and security for investors and entrepreneurs.	5	0,75	0,3125	0,75	0,25	Moderate
9	By 2033, companies and individuals will face greater dangers of financial scams and fraud due to a lack of knowledge about the implementation of blockchain, cryptocurrencies, or tokenization.	4	0,75	0,25	-	-	Moderate
10	By 2033, the Colombian State will implement education on cryptocurrencies and blockchain technology in schools, to encourage their use and prevent fraud caused by misinformation.	3	-	-	0,63	0,5	No Consensus
11	By 2033, cryptocurrencies will gain greater acceptance as a payment method, but FIAT currencies will remain the dominant means of payment.	4	-	-	0,75	0,213	Moderate
REGULATORY FRAMEWORK							
12	By 2033, Crypto Asset Bills beneficial to blockchain technology, cryptocurrencies, and tokenization will be passed (although Crypto Asset Bill 139 of 2021 was passed in November 2022, this bill has been shelved).	5	0,75	0,5	0,75	0,5	No Consensus
13	By 2033, there will be an adequate regulatory framework that allows the government to implement blockchain technology in its processes, such as decision-making or fund management.	4	0,75	0,3125	0,75	0,5	No Consensus
14	By 2033, there will still be obstacles to achieving a defined regulatory framework in Latin America and Colombia	4	0,88	0,25	-	-	Moderate
15	By 2033, due to regulations, cryptocurrency-based capital must be fully disclosed in people's financial statements.	4	-	-	0,88	0,25	Moderate
16	By 2033, tokenization will allow sectors of the population without large capital investments to participate in minority investments in national SMEs, through clear legislation.	4	-	-	0,75	0,25	Moderate

Table 5. Second Round Results.

Blockchain technology, cryptocurrencies, and tokenization are expected to play a relevant role in Latin America in terms of job creation, contribution to GDP, and further development of the cryptocurrency cluster. With greater formalization in its mechanisms and greater incentives towards consolidation as a national industry, the experts agree that this possibility will be likely fulfilled. Also, the chance to bring better living conditions for the population of developing countries is understood as progress in the development of a market of cryptocurrencies with economic possibilities due to exchange and innovations in this field of the technological sector.

There was a significant consensus on almost all the ADOPTION slices of the affirmations, having almost all the projections and IQR equal or lower than 0.3, which is classified in the research as moderate agreement of the panel of experts. Experts did not reach a consensus (IQR 0.5) on whether the increase in the use of blockchain in the prevention of computer fraud would continue (projection 6) even though they consider it likely to happen. It is noteworthy that the banking sector in Colombia has used this as the main application of new technologies, without getting much involved in tokenization and cryptocurrencies. This prediction is important because fraud in computer transactions is at a growing rate in Colombia. Furthermore, in the Colombian population, as our theoretical framework showed, there is little sense of trust in traditional information media, so it is an open field for cryptocurrencies and transactions with blockchain technology to occupy a more important place in the coming years.

To the statement "By 2033, financing mechanisms, tokenized with blockchain, will allow the raising of funds for non-profit social and ecological projects, also taking advantage of the growing interest of the international community to support these initiatives", it was found that the group of experts expect this to happen with a 100% probability, and a high consensus. This point is interesting because as analyzed previously, social initiatives and work with vulnerable populations can be highly positively influenced in their ability to acquire resources from international stakeholders, taking advantage of the advantages of ICOs in overcoming national borders and streamlining procedures. such as taxation and state bureaucracy.

Moreover, questions about innovation had a moderate consensus (IQR from 0.16 to 0.3) in almost all their results. One of the statements that did not reach consensus (IQR 0.5) was "By 2033, the Colombian State will implement education on cryptocurrencies and blockchain technology in schools, to encourage their use and prevent fraud caused by misinformation.", also having a low likelihood of 0.625. In an ideal scenario, this statement should be possible, given that it is necessary for the evolution of the union in Colombia, but experts are not so optimistic and believe that the tendency of public education, 10 years from now, to leave an aside from blockchain technologies, tokenization and ICOs, it will not be reversed. Experts see that the Colombian people will only become more permeated as private initiatives evolve. Being the premise that is least likely to happen of all the predictive research, even if it is seen, a priori, as one of the most necessary.

Another result of this second session is the moderate consensus (0,213 IQR) that despite the expected growth in the use of cryptocurrencies, FIAT transactions will continue to be the majority in the country as the dominant payment method. On the other hand, regarding the use of tokenization in private companies, for the distribution of annual dividends, or the collection of foreign direct investment (FDI), a moderate consensus was found, with optimistic views of it happening.

It is evident that by 2033, the best prospects for progress are projected in private companies regarding the issue of the adoption of blockchain technology and the creation of ICOs. SMEs would be, according to predictions, one of the most favored sectors, allowing efficiency, effectiveness, and security for investors and entrepreneurs. In all the statements of INNOVATION was a moderate consensus among the panel of experts, except for the question we analyzed about education with a guideline that comes from the state, to avoid fraud and encourage the adoption of the use of cryptocurrencies.

Finally, the second session ended by asking about the regulatory framework and tax part. The statement "By 2033, due to regulations, cryptocurrency-based capital must be fully disclosed in people's financial statements", this being an initiative that started to be applied this year by the Colombian State, in a step for the regularization of these assets in the country, it shows that experts are optimistic. Despite the nature of cryptocurrencies, which are prone to tax evasion, the experts are optimistic and achieve a moderate consensus (IQR 0.213) that the Colombian State will achieve important advances in this field; and, that blockchain technology will continue to be incorporated in the Colombian State, such as in the legalization of land and identity control, with a 85% of probability to happen.

It is important to mention that projections 12 and 13 did not reach a consensus among experts, indicating that experts on the topic have a very broad opinion on the possible evolution of Blockchain technology, cryptocurrencies, and ICOs regarding an adequate regulatory framework that allows the government to implement these technologies in its processes, such as decision-making or fund management.

To sum up, the results of the first and second sessions show a range of common opinions and points of agreement among the panel of experts, even when there is disagreement on the possible evolution of the role that the State has in favoring changes concerning adoption. of blockchain technology, cryptocurrencies, and the incorporation of ICOs as an engine of progress. Mostly, it is expected that the potential possibilities will be consolidated, given that SMEs, foreign direct investment, and financial security would find new technologies a very useful tool.

5. CONCLUSION

In summary, the impact of blockchain technologies, cryptocurrency regulation, and ICOs in developing countries is mixed. While they offer opportunities for financial inclusion, innovation, and transparency, they also pose risks related to regulation, financial stability, fraud, and security. To harness the potential benefits, developing countries must carefully balance innovation with effective regulation and consumer protection measures. Additionally, international collaboration and capacity building can play a crucial role in helping these countries navigate the challenges and opportunities presented by Blockchain and cryptocurrencies, as well as getting national companies and citizens involved in these new technologies.

The expectation regarding the future of blockchain technology, ICOs, and cryptocurrencies in Colombia is not very optimistic, mainly for two reasons: the risk of fraud, which has not found any support from the central government so far, and the high digital divide that would prevent a large part of the population from taking benefit of the advantages of these technological innovations. Also, with the panel of experts selected through the application of the DELPHI methodology, we discovered that, as indicated by Echavarría (2020), the cryptocurrencies and ICO market is highly discredited because, upon its arrival in the last decade, it was the victim of several fraudulent operations, taking advantage of the population's lack of knowledge about these topics.

Despite this, there is no doubt that in a market with the characteristics of Colombia, replicable to many developing countries, these technologies should ensure advantages in terms of investment (where currently it does not have any established micro-investment mechanism), to be able to give greater possibilities, agility, and guarantees for foreign and national users of modalities such as ICO and tokenization (Gutmann & Schückes, 2020). This can modernize essential sectors such as agriculture, real estate, and entertainment, where red tape and corruption are an impediment and a solid disincentive to development.

Concerning the initial thesis, it is evident that developing nations have great difficulty adapting to new technologies, which is why they perpetuate their dynamics of backwardness and fail to consolidate valuable tools, such as Blockchain technology, ICOs, and cryptocurrencies, accentuating their risks and hindering their virtues. Colombian laws still do not have clear terms, either for foreign developers who stimulate local markets or for its state apparatus, which, despite various approaches, has not yet used the security and traceability benefits of Blockchain technology in legalizations or transactions.

Also, it is evident during the second session of the Delphi Method, the conclusion that there are actions that could help the country improve its cryptocurrency and blockchain technology ecosystem, but the experts are not optimistic, as seen in the results. There is a generalized context that many measures are necessary but are not entirely likely to happen, especially due to the indifference of the public sector to educating the population more and establishing stronger institutions, which, paradoxically, would contribute to the regularization and tax control of cryptocurrencies. It is important that this happened, because figures such as minority investments, which help SMEs in the United States acquire funds and could be made with tokenization, but the lack of education prevents a greater impact in the country. An example of this is that experts during this session do not see it as entirely likely that Colombia will use blockchain technology to guarantee the protection of personal data and digital identity, as well as streamline its procedures through this technology in user validation. Many of these innovations, which are necessary, should be implemented within ten years.

Colombia, as agreed by the panel of experts consulted for this research, must adopt a more active role to legitimize and encourage the population's participation in the positive alternatives offered by these new technologies. Additionally, in its government operations, by adopting Blockchain technology, it would be able to overcome many current problems in matters of legality and traceability, especially in processes such as the allocation of land and the development of more remarkable institutions to provide guarantees to investors and entrepreneurs.

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APPENDICES:

APPENDIX A Form Questionary - First round:

Language	English
Title	**Impact and Future of Blockchain, Crypto, and Initial Coin Offerings (ICOs) in Latin America and Colombia**
INTRODUCTION	**This form is only for educational and research purposes to find results for a thesis for a master's in engineering and management within the Department of Management and Production Engineering of the Politecnico di Torino in Italy.** **Please note that your answers:** **They will not have commercial purposes.** **They will not be collected for public disclosure.** **It will not be shared with third parties for any purpose other than research.**

TEMATICA	PREGUNTA	SUBTITIULO	TIPO	RESPUESTA	DIAGRAM
General Information	Full Name	Optional	Na	Free Answer	NA
	Country of Residence		NA	Free Answer	NA
	Company, community, or institution where you are currently and dedicate most of your time and effort		NA	Free Answer	NA
	Define your position or Professional Profile	Example: CFO of Blockchain Colombia and Professor at the Ades University.	NA	Free Answer	NA
	Since what year have you been involved in the blockchain ecosystem?	Write only the number. Example: 2015	Quantitative	Number	Chart
	URL of your main social network that can reference your achievements and activities.	We suggest X(Twitter) and/or LinkedIn, however, you can leave your personal website or whatever you want.	URL	Free Answer	NA

TEMATICA	PREGUNTA	SUBTITIULO	TIPO	RESPUESTA	DIAGRAM
ADOPTION	By 2033 blockchain technology will play a decisive role in Latin America and Colombia's economic and environmental development.	Why? / Example: Yes, because.... / Probability (0, 0.25, 0.5, 0.75, 1). Impact (1 to 5)	Quantitative + Qualitative	YES/NO + Explanation	Chart
	By 2033, blockchain technology will allow the creation of companies and formal jobs, and therefore better living conditions for developing countries' population	Why? / Example: Yes, because.... / Probability (0, 0.25, 0.5, 0.75, 1). Impact (1 to 5)	Quantitative + Qualitative	YES/NO + Explanation	Chart
	By 2033, the level of security and transparency be increased to prevent and/or reduce financial fraud with the implementation of blockchain technology, cryptocurrencies, and ICOs	Why? / Example: Yes, because.... / Probability (0, 0.25, 0.5, 0.75, 1). Impact (1 to 5)	Quantitative + Qualitative	YES/NO + Explanation	Chart
	By 2033, what are the 3 economic sectors that you think ICOs will have the greatest potential to generate innovation and investment?	Below are the main sections of the International Standard Industrial Classification of All Economic Activities.	Quantitative	Selected Choice	Conclusion
	Based on your expertise and knowledge, leave us a reflection on why it was your previous choice.	No Subtitle	Qualitative	Free Answer	Conclusion
INNOVATION	By 2033, in Colombia and Latin America, the use of Blockchain technology, crypto, and tokenization will become widespread and counted as a source of receipt of Foreign Direct Investment (FDI)	Why? / Example: Yes, because.... / Probability (0, 0.25, 0.5, 0.75, 1). Impact (1 to 5)	Quantitative + Qualitative	CIIU	Chart

TEMATICA	PREGUNTA	SUBTITIULO	TIPO	RESPUESTA	DIAGRAM
	By 2033, Colombia will have created a financing channel for SMEs through cryptocurrencies, allowing efficiency, effectiveness, and security for investors and entrepreneurs.	Why? / Example: Yes, because.... / Probability (0, 0.25, 0.5, 0.75, 1). Impact (1 to 5)	Quantitative + Qualitative	YES/NO + Explanation	Chart
	By 2033, companies and individuals will face greater dangers of financial scams and fraud due to a lack of knowledge about the implementation of blockchain, cryptocurrencies, or tokenization.	Why? / Example: Yes, because.... / Probability (0, 0.25, 0.5, 0.75, 1). Impact (1 to 5)	Quantitative + Qualitative	YES/NO + Explanation	Chart
	What are the products or services that you think the implementation of Blockchain technology, cryptocurrencies, or ICOs would bring the greatest benefit to companies, governments, or society in Latin America and/or Colombia?	It is a free response, and consider that you are going to lead this type of products and services that use blockchain	Qualitative	Free Answer	Conclusion
	What is the innovation of blockchain technology that will bring the most benefits to Latin American and/or Colombian companies, governments, and society?	Indicate the technology and leave a brief reflection on why you chose it.	Qualitative	Free Answer	Conclusion
REGULATORY FRAMEWORK	By 2033, Crypto Asset Bills beneficial to blockchain technology, cryptocurrencies, and tokenization will be passed (although Crypto Asset Bill 139 of 2021 was passed in November 2022, this bill has been shelved)	Why? / Example: Yes, because.... / Probability (0, 0.25, 0.5, 0.75, 1). Impact (1 to 5)	Quantitative + Qualitative	YES/NO + Explanation	Chart

TEMATICA	PREGUNTA	SUBTITIULO	TIPO	RESPUESTA	DIAGRAM
	By 2033, there will be an adequate regulatory framework that allows the government to implement blockchain technology in its processes, such as decision-making or fund management.	Why? / Example: Yes, because.... / Probability (0, 0.25, 0.5, 0.75, 1). Impact (1 to 5)	Quantitative + Qualitative	YES/NO + Explanation	Chart
	By 2033, there will still be obstacles to achieving a defined regulatory framework in Latin America and Colombia	Why? / Example: Yes, because.... / Probability (0, 0.25, 0.5, 0.75, 1). Impact (1 to 5)	Quantitative + Qualitative	YES/NO + Explanation	Chart
	Considering that this year the regulatory framework for crypto assets in Colombia was postponed, what would be the main reason or what should happen to have priority on the agenda of the country's legislation in the following years?	No Subtitle	Qualitative	Free Answer	Conclusion
	Do you think that in order to accelerate the adoption of blockchain technology and ICOs, it is necessary to have greater support from the State, both in terms of tax deductions and subsidies?	YES/NO, why? / Example: Yes, because...	Quantitative + Qualitative	YES/NO + Explanation	Conclusion

APPENDIX B Form Questionary - Second round

Google Form	https://forms.gle/HdQtZN4izQjEkvnU
Language	English
TITULO	**Impact and Future of Blockchain, Crypto, and Tokenization in Latin America and Colombia - Second Phase**
INTRO	**This form is only for educational and research purposes to find results for a thesis for a master's in engineering and management within the Department of Management and Production Engineering of the Politecnico di Torino in Italy.** **Please note that your answers** **They will not have commercial purposes.** **They will not be collected for public disclosure.** **It will not be shared with third parties for any purpose other than research.**

ID	ENGLISH	Probability
1	Impossible	**0**
2	Unlikely	**0,25**
3	Equally likely	**0,5**
4	Likely	**0,75**
5	Certain	**1**

IQR for Consensus	Consensus Level
0,15	High Consensus
0.16-0.3	Consensus Moderate
More than 0.3	No Consensus

TOPIC	Number of Projections
ADOPTION	6
INNOVATION	5
REGULATORY FRAMEWORK	5
TOTAL	**16**

TOPIC	QUESTION	SUBTITLE	TYPE	ANSWER	DIAGRAM
GENERAL INFORMATION	Country of residence	Country Name	NA	Free Answer	NA
	Company, community, or institution where you are currently and dedicate most of your time and effort	No subtitle	NA	Free Answer	NA
	Define the industry you are working on	Based on CIIU	NA	Free Answer	NA
	Define your position or Professional Profile	Example: CFO of Blockchain Colombia and Professor at the Andes University.	NA	Free Answer	NA
	In which industry could you identify your activity?	Below are the main sections of the International Standard Industrial Classification (ISIC) of all economic activities. You can mark a maximum of 3 and a minimum of 1.	Multiple Selection	Free Answer	Chart
	What is the country or countries where your activities are focused?	Select Maximum 3 and Minimum 1	Multiple Selection	Free Answer	Chart
	Since what year have you been involved in the blockchain ecosystem?	Write only the number. Example: 2015	Quantitative	Number	Chart
ADOPTION	By 2033, blockchain technology, cryptocurrencies, and tokenization will play a decisive role in the economic and environmental development of Latin America and Colombia	If you want to express indeterminate or indefinite, mark 3.	Quantitative	1 Impossible (0) 2 Unlikely (0.25) 3 Equally Likely (0.5) 4 Likely (0.75) 5 Certain (1)	Chart
	By 2033, blockchain technology, cryptocurrencies, and tokenization will allow the creation of companies and formal jobs, and therefore better living conditions for the population of developing countries.				

TOPIC	QUESTION	SUBTITLE	TYPE	ANSWER	DIAGRAM
	By 2033, the level of security and transparency will be increased to prevent and/or reduce financial fraud with the implementation of blockchain technology, cryptocurrencies, and tokenization.				
	By 2033, financing mechanisms, tokenized with blockchain, will allow the raising of funds for non-profit social and ecological projects, also taking advantage of the growing interest of the international community to support these initiatives.				
	By 2023, the financial sector, real estate, and arts/entertainment activities will be the sectors with the greatest scope for positive innovations with the adaptation of blockchain technologies.				
	By 2023, blockchain technology, cryptocurrencies, and tokenization will eliminate the growing fraud in financial operations that occurs in the banking sector of Colombia and Latin America, when used for transactions and investments by natural persons.				
INNOVATION	By 2033, in Colombia and Latin America, the use of Blockchain technology, crypto, and tokenization will become widespread and counted as a source of receipt of Foreign Direct Investment (FDI)	If you want to express indeterminate or indefinite, mark 3.	Quantitative	1 Impossible (0) 2 Unlikely (0.25) 3 Equally Likely (0.5) 4 Likely (0.75) 5 Certain (1)	Chart
	By 2033, Colombia will have created a financing channel for SMEs through cryptocurrencies, allowing efficiency, effectiveness, and security for investors and entrepreneurs.				

TOPIC	QUESTION	SUBTITLE	TYPE	ANSWER	DIAGRAM
	By 2033, companies and individuals will face greater dangers of financial scams and fraud due to a lack of knowledge about the implementation of blockchain, cryptocurrencies, or tokenization.				
	By 2033, the Colombian State will implement education on cryptocurrencies and blockchain technology in schools, to encourage their use and prevent fraud caused by misinformation.				
	By 2033, cryptocurrencies will gain greater acceptance as a payment method, but FIAT currencies will remain the dominant means of payment.				
REGULATORY FRAMEWORK	By 2033, Crypto Asset Bills beneficial to blockchain technology, cryptocurrencies, and tokenization will be passed (although Crypto Asset Bill 139 of 2021 was passed in November 2022, this bill has been shelved).	If you want to express indeterminate or indefinite, mark 3.	Quantitative	1 Impossible (0) 2 Unlikely (0.25) 3 Equally Likely (0.5) 4 Likely (0.75) 5 Certain (1)	Chart
	By 2033, there will be an adequate regulatory framework that allows the government to implement blockchain technology in its processes, such as decision-making or fund management.				
	By 2033, there will still be obstacles to achieving a defined regulatory framework in Latin America and Colombia				
	By 2033, due to regulations, cryptocurrency-based capital must be fully disclosed in people's financial statements.				

TOPIC	QUESTION	SUBTITLE	TYPE	ANSWER	DIAGRAM
	By 2033, tokenization will allow sectors of the population without large capital investments to participate in minority investments in national SMEs, through clear legislation.				

APPENDIX C – EXPERTS

Country of Residence	Company, community, or institution where you are currently and where you dedicate most of your time and effort	Define your position or Professional Profile	In which industries do you identify your activity?	What is the country or countries where your activities are focused?	Since what year have you been involved in the blockchain ecosystem?
Colombia	Ethcali	Blockchain Researcher & Consultant	Other service activities	Colombia	2017
Colombia	Giveth	Software Engineer / Web3 Developer	Information & Communications, Professional, Scientific & Technical Activities	Colombia, worldwide	2019
Colombia	Echotech	VEO	Professional, scientific, and technical activities	Colombia, USA	2017
Colombia	Margenes Labs	Blockchain Consultant and Project Manager	Financial and insurance activities, Administrative and support services activities, and other service activities	Colombia, USA	2016
Mexico	Bielo Media	Manager	Arts, Entertainment & Recreation Activities	Colombia, Argentina, Brazil	2021
Peru	ETH Kipu	Education Coordinator	Professional, scientific, and technical activities, Education	Colombia, Argentina, Perú	2013
Colombia	Monetta	Co-founder and VP of Commercial	Information & Communications, Financial & Insurance Activities	Colombia, USA	2018
Colombia	BloeX	Product Leader	Information & Communications, Professional, Scientific & Technical Activities	Colombia	2018
Colombia	Spyral Labs	CEO	Information & Communications, Professional, Scientific & Technical Activities	Colombia	2021
Argentina	Worldcoin	Expansion Manager	Other service activities	Argentina, México, Chile	2011
Mexico	Bitcuners	Founding Member	Information and communications	México	2013

Country of Residence	Company, community, or institution where you are currently and where you dedicate most of your time and effort	Define your position or Professional Profile	In which industries do you identify your activity?	What is the country or countries where your activities are focused?	Since what year have you been involved in the blockchain ecosystem?
Colombia	Amaris Consulting	Head Of CoE Artificial Intelligence & Blockchain	Professional, scientific, and technical activities, and Other service activities	Colombia	2016
Colombia	Anzi Finance	Product Manager.	Financial and insurance activities	Colombia, España	2016
Colombia	Optimism - Gravity DAO - Ethereum Colombia	Web3 Protocol Governance and Conflict Management	Professional, scientific, and technical activities, Administrative and support services activities, Education, Activities of offshore organizations and entities	Colombia, USA, España	2016
Colombia	Jerónimo Martins	HEAD OF NEW BUSINESS	Wholesale and retail trade; Repair of motor vehicles and motorcycles	Colombia	2014
USA	Safe Ecosystem Grants Council (Formerly Gnosis Safe)	Researcher and product consultant	Information and communications, Financial and insurance activities, Professional, scientific and technical activities	Worldwide	2015
Colombia	Colombia Compra Eficiente	Lawyer	Public Administration	Colombia	2016
Panama	Kraemer & Kraemer	Web3 Consultant	Financial and insurance activities	Panama and Colombia	2014

APPENDIX D – EXPERT ANSWERS:

First Session Answers

https://docs.google.com/spreadsheets/d/1oeZcl0jRYHT-UtfRHed8j7iftrpjhnM5cJCvWMXkWyE/edit?resourcekey#gid=431359

Second Session Answers

https://docs.google.com/spreadsheets/d/1wDG8jFHnIsBHwknqZJLv3ijdjGy6qxMuK-RasN4k3jc/edit#gid=547071

APPENDIX E – CONCLUSIONS BY ADOPTION

By 2033, what are the 3 economic sectors that you think ICOs will have the greatest potential to generate innovation and investment?	Based on your expertise and knowledge, leave us a reflection on why it was your previous choice.
Most of the responses cover multiple economic sectors, especially in Finance, Real Estate, Construction, Entertainment, Agriculture, and Education. There is no clear trend towards a specific sector, as each response mentions a different mix of economic activities.	There is a strong emphasis on the financial sector, DeFi, and ICOs as areas of greater impact. Tokenization is seen as relevant in real estate and equity. It is mentioned that DeFi is already proving to be convenient, especially in the context of information and ownership. Some responses suggest that the question is vague or that there is no specific sector that will not be impacted. One response considers that ICOs will not have a significant impact on any sector.

APPENDIX F – CONCLUSIONS BY INNOVATION

What are the products or services that you think the implementation of Blockchain technology, cryptocurrencies, or ICOs would bring the greatest benefit to companies, governments, or society in Latin America and/or Colombia?	What is the innovation of blockchain technology that will bring the most benefits to Latin American and/or Colombian companies, governments, and society?
It highlights the importance of understanding an entire digital asset economy with new frontiers and digitalization. Emphasis is placed on the relevance of smart contracts and more efficient means of payment (attestations). The focus on start-ups and the repetition of elements already mentioned are mentioned. It highlights the importance of digital identity, private over public networks protected by ZK, and the tokenization of RWA. The importance of global treasury management for companies with multiple locations is identified. The importance of traceability in the public budget and executors is highlighted. It focuses on payments and transfers as crucial elements. The importance is mentioned in sectors such as insurance, health, tourism, and applications with many-to-many reconciliations. The importance of non-stock markets and the simplification of operations such as REPOS and guarantees in agricultural transactions are highlighted. It focuses on Embedded DeFi and offering financial services on marketplaces by leveraging global liquidity. The importance of alternative financing with tokenized assets is highlighted, especially in liquid assets or the securitization of illiquid assets backed by a supervised institution.	The idea is put forward that blockchain would decrease corruption and tax evasion. It highlights the importance of a framework of clear rules and constant communication with governments to develop and innovate with new technologies. The existence of risks associated with blockchain and crypto is recognized, but the importance of regulation is emphasized. Digital security and self-custody are seen as key elements, along with tax adjustments for companies that handle large cash capitals. The presence of systemic risks is mentioned in all processes, not exclusive to the blockchain. It warns about the chaos that could arise through the use of ICOs if they are not promoted with good practices. The ease of investment is seen as a reason to be careful where you invest your money. The risk of CBDCs is noted from the perspective of centralization and censorship. The possibility of dangers is raised in wanting to create CBDCs with capricious rules, but also the absence of dangers if there is traceability of public money audited by the population.

APPENDIX G – CONCLUSIONS BY REGULATORY FRAMEWORK

Considering that this year the regulatory framework for cryptoassets in Colombia was postponed, what would be the main reason or what should happen to have priority on the agenda of the country's legislation in the following years?	Do you think that in order to accelerate the adoption of blockchain technology and ICOs, it is necessary to have greater support from the State, both in terms of tax deductions and subsidies?
The responses show that the reasons for prioritizing the regulation of crypto assets in Colombia range from boosting entrepreneurship and investment to promoting blockchain innovation and autonomy. Each opinion reflects a different perspective on what is needed to advance this field in the country. Opinions vary widely on whether there are significant obstacles to achieving a defined regulatory framework in Latin America and Colombia for these technologies. Some believe that a lack of interest and management is the main problem, while others point to factors such as the threat to the establishment and lack of knowledge as major challenges Moreover, A diversity of opinions is reflected regarding the need for a regulatory framework for blockchain technology, cryptocurrencies, and ICOs. Some argue that regulation provides confidence and security and sets necessary limits for its development. Others argue that regulation should wait until the technology is fully understood so as not to limit its innovative potential. In short, while some see regulation as essential, others believe it must be carefully balanced so as not to stifle the disruptive innovation of these technologies	It highlights the importance of getting more data on how blockchain is used to inform regulation rules. The power of the banking sector is mentioned as an influential factor in Colombia. The need for clear legislation is emphasized, concerning the MICA law in Europe. There is an expectation that BTC's price will surpass 60K. It is suggested that robust regulation could have a positive impact on a bull market. There is a critical perspective towards the legislative agenda in Colombia, describing it as a media game. It is observed how other countries are moving forward in the adoption of crypto with clear regulations. The lack of knowledge on the subject on the part of one of the participants is pointed out. Opinions on crypto asset regulation vary, with some highlighting its importance for mass adoption and consumer protection, while others are skeptical about its feasibility. Regulation is seen as necessary to establish clear rules and reduce risks, but its focus on user protection rather than favoring traditional players is crucial. The market can also influence regulation in search of safe and clear standards.