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DECISION-MAKING FACTORS IN THE ADOPTION OF SMART CONTRACTS IN BRAZILIAN COMPANIES

FATORES DE DECISÃO NA ADOÇÃO DE SMART CONTRACTS EM EMPRESAS BRASILEIRAS

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Abstract

This article seeks to identify the main factors in adopting smart contracts and the way these factors are known and taken into account by Brazilian companies. Thus, we conducted 30 interviews among Brazilian businesses. Results confirmed the existence of an alignment among the perspectives of the characteristics, benefits and adoption factors for smart contracts. Also, it was possible to conclude that the practice of smart contracts is still incipient in Brazil, and the prospects for applying them in companies have been spurred by the health restrictions put in place by the combat against COVID-19.

Keywords: Blockchain. Smart contract. Adoption. Benefits. Barriers

Resumo

Este artigo busca identificar os principais fatores na adoção de contratos inteligentes e a forma como esses fatores são conhecidos e levados em consideração pelas empresas brasileiras. Assim, realizamos 30 entrevistas entre empresas brasileiras. Os resultados confirmaram a existência de um alinhamento entre as perspectivas das características, benefícios e fatores de adoção dos contratos inteligentes. Além disso, foi possível concluir que a prática de contratos inteligentes ainda é incipiente no Brasil, e as perspectivas de aplicá-los nas empresas têm sido estimuladas pelas restrições sanitárias impostas pelo combate ao COVID-19.

Palavras-chave: Blockchain. Smart contract. Adoção. Benefícios. Barreiras.

Introdução

The digital collaboration offered by the internet and the speed of technological change favors business models stored in networks to the extent that the economy has become global due to the participation of users connected to the internet and entrepreneurial activities in the Information Technology (IT) area in the development of new products and solutions for electronic transactions (Labazova, 2019). In this sense, Blockchain technology is understood to be disruptive and capable of making it possible to create new solutions which offer business security and agility, such as smart contracts, for example (Mougayar, 2016; Crosby, Pattanayak, Verma, & Kalyanaraman, 2016). Smart contracts make it possible to automate business logic where assets such as money are conceived of in the form of cryptocurrency which has unprecedented potential (Ante, 2021).

This context has demonstrated the importance of new studies which can help companies reflect about possible reasons that need to be overcome to take advantage of the potential that blockchain technology can offer. Seeking to address this gap, this study's objective is to identify which are the main factors in the adoption of contracts in the opinion of researchers in terms of the way they are known and taken into account by Brazilian companies today.

To accomplish this, we have selected 10 articles through a Systematic Review of the Literature, summarizing the adoption characteristics and factors indicated by researchers. We then conducted 30 interviews (10 business people, 10 IT professionals and 10 digital rights lawyers) to research the level of knowledge of, and adhesion to, smart contracts by Brazilian businesses. The theoretical relevance of this study has been assisted by the situation experienced by the health measures needed to combat the COVID-19 pandemic, which led to exponential growth in the use of IT for communication, which includes the establishment of online contracts due to social isolation. This has increased the frequency of discussions of smart contracts in terms of their speed, safety, economy and legal validity (Bansal, Garg, & Padappayil, 2020). In turn, their practical relevance is based on the contribution of the achieved results in informing the decision making involved in adopting smart contracts.

The sections that follow this brief introduction will present several studies related to the subjects of blockchains and smart contracts. We will then discuss the methodology used in the data collection and analysis, followed by its presentation and a discussion of the results. We will conclude with our final considerations, the limitations of this study, and possible avenues for future research.

Theoretical references

Blockchain technology makes it possible to reach a consensus in a decentralized manner, which is a factor that enhances the potential of its application for the operationalization of smart contracts (Cong & He, 2019; Ølnes, Ubacht & Janssen, 2017). A blockchain acts as a database of rows as if it were the public ledger of all the digital transactions or events which have been executed or shared among the participants. Each transaction in the public ledger is verified by the consensus of most of the system participants (Crosby et al., 2016).

Smart contract definitions

The term and the concept of smart contracts were introduced by Nicholas Szabo in 1994 who defined them as a computerized transactional protocol which executes the terms of a contract (Luciano, 2018; Sheikh, Azmathullah, & Rizwan, 2019). To Ante (2021) smart contracts are scripts created in a decentralized manner in blockchains or similar infrastructure which permits the transparent execution of predefined processes. To Sheikh et al. (2019) smart contracts are self-executing computer programs that use blockchain technology, which in turn is an instrument which offers security and reduced costs compared to traditional contracts. These authors affirm that smart contracts should be mandatory for

common contractual conditions such as payments, confidentiality, and even financial applications, which would exclude the need for intermediaries between the contract's parties.

Smart Contracts: Benefits and Barriers to Adoption

Lamb (2018) points out that there are many reasons to not adopt a smart contract in a precipitate manner without considering the potential disadvantages and barriers to the adoption of this technology. In the first place, she argues that the reduction in costs may be overestimated, because smart contracts may not be less expensive than regular contracts, because the costs of the infrastructure necessary for its implementation are still quite high. Secondly, there is a significant scarcity of trained professionals which needs to be overcome before smart contracts become a reality. Writing secure and protected smart contracts can be extremely difficult due to the variety of business logic as well as the vulnerabilities and limitations of the platform (Singh, Parizi, Zhang, Choo, & Dehghantanha, 2020).

Labazova (2019, p. 9) states that the conformity of blockchains with current regulations is a major barrier. Data standards to deal with blockchains have yet to be proposed. "I think that governments and regulators in general are quite behind in terms of data about blockchains and economies oriented toward the data market." Schechtman (2019) states that given the current state of things, there are two large potential barriers to the widespread implementation of smart contracts. The first barrier is represented by the need to adopt blockchain platforms as a form of currency which is necessary for the automated nature of smart contracts to occur. The second barrier is the public nature of the process which could expose negotiations that people would rather keep secret.

Methodological procedures

In the panorama described in the previous section, this study is based on the analysis of data collected in a way that makes it possible to verify the degree of adhesion between the theory related to smart contracts identified in our review and its practical application as reflected in our field interviews. We consider this study to be an applied qualitative investigation with exploratory objectives.

Systematic Literature Review

We have performed a systematic review of the literature to identify the main characteristics and adoption factors for smart contracts in the opinion of researchers in this area. We opted to search Google Scholar for the words "smart contracts" in any place within texts, restricted the publications to those since 2018, and excluded citations and patents, and searched for review articles in any language, classifying them by relevance. This search yielded more than 3,800 publications. Then we added the condition of searching for "smart contracts" AND "adoption", and this time the search resulted in 3,010 publications. To increase the accuracy of the process, we altered the string search to be "smart contracts adoption" OR "smart contract adoption" located anywhere in the text, while maintaining the same initial parameters in Google Scholar, and this search resulted in 32 publications. The articles were analyzed and the protocol of the criteria presented in Table 1 was applied which ended up selecting 10 articles for this study.

Inclusion criteria	Exclusion criteria
Recent studies (since 2018) which address two of the subjects necessary for this study: 1) The concept and characteristics of smart contracts. 2) The criteria and benefits associated with the adoption of smart contracts.	Studies written in various idioms of English and Portuguese. Grey Literature (results which have not been peer reviewed or approved by an editorial board). Studies that do not answer any of the research questions described in the inclusion criteria.

Table 1 – Defined Criteria for Inclusion and Exclusion.
Source: The Authors.

According to Jacsó (2005) the importance of the Google Scholar database is not only its volume of articles from various academic sources, but also the research filter tools that this database offers. To this author, these tools increase the efficiency of research work by searching for data of interest in the text, abstracts and titles of these works. Since this is a study interested in works published in distinct areas, including Business, Administration, Engineering, Computation Sciences and Social Sciences, the Google Scholar database is attractive because it is not segmented by area, which is useful when we are seeking inter- and multi-disciplinarity. Table 2 summarizes the filter process for the selected works using the sequence of strings adopted in our systematic review of the literature.

Search string (anywhere in the text)	**Results**
"Smart contracts"	+ 3,800
"Smart contracts" AND "adoption"	+ 3,010
"Smart contracts adoption*" OR* "Smart contract adoption*"*	32
Selected articles	10

Table 2 – Search Strings
Source: The Authors based on a systematic review of the literature.

Table 3 presents the 10 works selected in our systematic review of the literature, which served as our base for elaborating and conducting our interviews.

1	(Badi, Ochieng, Nasaj, & Papadaki, 2021). This study seeks to identify the factors that influence the adoption of smart contracts in the construction sector in the United Kingdom. It uses a deductive approach based on a questionnaire using the technology-organization-environment (TOE) model. The results suggest that four factors have a significant influence on the adoption of smart contracts: supply chain pressure, competitive pressure, support from upper management, and the possibility to monitor it.
2	(Gurgun & Koc, 2021). This study seeks to evaluate the administrative risks of adopting smart contracts in construction projects. A bibliographic search sought to specify the administrative risks of smart contracts. The results show that (1) changes in regulations; (2) a lack of a driving force; (3) work that was not taken into account in planning; (4) deficiencies of current legal arrangements; and (5) a lack of a dispute resolution mechanism are the main risks in the adoption of intelligent contracts in construction projects.
3	(Drummer & Neumann, 2020). This article analyzes the challenges that have contributed to the slow adoption of smart contracts when there are discrepancies between the legal requisites and IT resources. This work combines academic sources and interviews with 30 IT specialists from the legal domain and private industry. The results show the deficiencies of smart contracts on three distinct levels: (1) how smart contracts can cause conflicts with existing laws; (2) how smart contracts are intrinsically limited to the level of individual contracts; and (3) how they are impeded by their current technical design.
4	(Guo, He, Chen, & Huang, 2021) Smart contracts can be applied to the auto-execution of the green energy financing process and the distribution of subsidies. Auto-execution for smart contracts helps mitigate potential risks of renegotiation among the various parties. Competition by quantity is significantly mitigated by smart contracts which are dependent on contingencies under heterogeneous market conditions.
5	(Malan & Steyn, 2019). The implementation of blockchains in the loan market through smart contracts makes it possible to reduce manual labor and the workload of back offices, and also remove corporate reconciliations and actions. This article examines the unified theory of acceptance and the use of the technological model to instill trust and encourage the adoption of the technological model.
6	(Arias-Barrera, 2020). The extension and the success of the implementation of smart contracts for financial derivatives depends on technical and sociological factors. On one hand, they discuss the technical capacity of smart contracts to facilitate the negotiation and execution of transactions, as well as their impact in terms of efficiency and transparency. On the other hand, it explores whether the power relationships between the interested parties influence the content, design and implementation of smart contracts.
7	(Schechtman, 2019). The way that mergers and acquisitions occur may also be altered by smart contracts and blockchains. This article seeks to analyze how these technologies could be adopted and help the practices of business operations.

8	(Ullah & Al-Turjman, 2021). This study explores the literature about smart contracts and blockchains in smart homes. Based on the literature, ten key aspects are highlighted for smart homes which are grouped into six items for the adoption of smart contracts in intelligent real estate.
9	(Sheikh, Azmathullah, & Rizwan, 2019). This paper seeks to understand smart contracts and their benefits as compared to traditional contracts and also offers a technical explanation about their execution and implementation.
10	(Luciano, 2018). This article presents smart contracts with the purpose of automating contract management within the natural gas commercialization process. The data collection of adoption factors was performed through documental research of the literature concerning smart contracts, blockchains and the current natural gas market in Brazil.

Table 3 – Works Selected in the Systematic Review of the Literature
Source: The Authors.

Interviews

To delve deeper into the theoretical definitions and the practical results obtained from the articles selected through the systematic review of the literature, we realized interviews utilizing semi-structured questionnaires as displayed in Table 4. These were applied to business people, IT professionals, and lawyers specializing in digital rights who were selected based on ease of access. The selection of IT professionals is justified based on our interest in technical views of smart contracts, while business people and lawyers were selected intentionally to give us a business perspective of the adoption of technology in this study.

Question	Objective	Justification
1. What is your profession and your personal or professional experience with blockchain technologies and smart contracts? How do you conceive of, or understand, these technologies?	Verify the technical knowledge and the proximity of the profession of the interviewee and his or her professional experience with the investigated technologies.	Smart contracts involve a set of specific technical knowledge, and understanding how the respondent comprehends these technologies is fundamental to achieve our proposed objectives.
2. In your opinion, how long will it take for smart contract technology to be adopted by organizations?	Identify the perception of the scope of the implementation of smart contracts in daily life.	The envisaged scope of the implementation of this technology will corroborate the probability of greater adhesion.
3. Which areas or types of organizations do you consider to be potential users of smart contracts? Why?	To verify which areas or types of companies will be selected as potential users of smart contracts.	To identify whether the companies selected by the interviewees (business people, IT specialists, and lawyers) have the same characteristics.
4. In your opinion what are the benefits of a company's adopting smart contracts?	Corroborating or deconstructing the benefits cited in our systematic review of the literature.	Confronting the opinions of researched authors with specialists who have practical experience with the studied technological advances.
5. In your opinion, what factors can be considered barriers or facilitators of a company adopting smart contracts?	Corroborating or deconstructing the factors in the systematic review of the literature that encourage or present obstacles.	Considering that this study is above all studying the adoption of smart contracts, this research is fundamental.
6. Do you believe the Brazilian legal scenario is ready to, or able to, absorb company negotiations intermediated by smart contacts?	To verify whether Brazilian laws present obstacles to the adoption of smart contracts.	Is there concern about a probable incomprehension of electronic clauses in the courts? The challenge is to make the codes of smart contracts intelligible to people who are not computer programmers (BASHIR, 2017).
7. Do you know companies that have already adopted smart contracts in their routines? If so, what was the decision-making process like in the adoption of this technology?	Mapping companies that eventually use these studied technologies to validate or reject the information from the systematic review of the literature.	To indicate paths for new companies which are adopting this technology.

Table 4 – Script for Interviewing Business People, IT Specialists and Lawyers
Source: The Authors

The semi-structured interviews occurred during the second bimester of 2022. Each interview lasted on average of 32 minutes and involved 30 individuals: 10 IT business people, 10 IT professionals, and 10 lawyers specializing in digital law. The number of participants was selected to meet the saturation criteria recommended by Bauer and Gaskell (2008). The sessions were realized through videoconferences recorded for subsequent transcription, and the questionnaire in Text Table 4 was used to assist researchers in conducting these interviews. The treatment of the data was performed through the use of content analysis of the transcriptions as indicated by Bardin (2011). All of the ethics committee's recommendations were respected. Text Table 5 presents information about the activities of the business people, IT professionals, and lawyers who accepted our invitation to be interviewed.

	Business People: Business Characteristics
B1	Company that owns a digital social network concerned with fashion that's planning to migrate its functions to a blockchain network.
B2	Company that owns a network platform for autonomous professionals. The platform connects service providers with those in need of their services.
B3	Company that captures and processes aerial data via drones for the mining, renewable energy, and AEC (Architecture, Engineering and Construction) segments.
B4	Company that owns a platform that analyzes educational data and delivers it in real time to teachers to accompany the development of their students.
B5	Company that develops physical robots which are sold and rented for use as retail attendants for events and also as service providers in hospitals.
B6	Company that owns a digital platform that offers an innovative service model for low-cost accounting with a high degree of client involvement.
B7	Company that develops technology to improve processes in soccer clubs, evaluating young athletes, preparing and instructing them for opportunities in this sport.
B8	Company that offers technological solutions and treatments in the area of work security engineering.
B9	Company that develops E-commerce technology that enables online sales through various digital channels.
B10	Company that develops a platform focused on protecting authorial rights and the management of these rights through proofs of digital authenticity.
	IT Professionals: Qualifications Summary
T1	IT Infrastructure Analyst, works with the configuration, maintenance, and migration of servers; support and development; application updates; verification and configuration of backup routines.
T2	Project Manager, Systems Analyst, Java, XML, SOAP, IBM WebSphere Message Broker and Message Queue, SVN, Maven, and TDD Programmer.
T3	Information security consultant; Vulnerability and critical system analyst; IT management and governance; CPTE/Mile2 Course Instructor; Linux network administrator; and C/C++ Programmer.
T4	Systems Analyst who implements printing and invoice management systems, and also develops Java based systems.
T5	Customer engineer with more than 13 years of experience in IT and more than 4 years performing maintenance for Bradesco, AT&T, Cisco, and BT, among other companies and data centers.
T6	Systems Analyst who performs maintenance and configures automated banking systems and servers.
T7	MCP Microsoft Certified Professional Managing and Maintaining a Windows Server Environment. FFS Maintenance management.
T8	PhD in Mechanical Engineering; Received international award for best researcher in the Mechanical Engineering area on a doctoral level in 2013/2014 and the inventor of various technologies.
T9	Software Engineer, Data Analyzer and Technologist in Industrial Automation.

T10	Electronic Technology Specialist. Works on the maintenance of automated medical commercial equipment and servers.
	Lawyers: Qualifications Summary
L1	Lawyer with a graduate degree in Civil Law and Processes and Digital Law. Works in private law with an emphasis on digital, robotic, civil and corporate law. Professor in graduate school and extension schools.
L2	Lawyer who works in private law with an emphasis on digital, corporate and retirement law.
L3	Lawyer with a graduate degree in Digital Law. Works in private law with an emphasis on digital, robotic, civil and corporate law.
L4	Lawyer who works in Private Law with an emphasis on digital, corporate and tax law.
L5	Lawyer who works in Private Law with an emphasis on digital, corporate and civil law. University Professor in Law.
L6	Lawyer with a graduate degree in Civil Law and Processes. Works in Private Law with an emphasis on digital, civil and corporate law.
L7	Lawyer with a graduate degree in Digital Law. Works in Private Law with an emphasis on digital and corporate law. Professor in graduate school and extension schools.
L8	Lawyer working in Private Law with an emphasis on digital, corporate and electoral law. CEO of a startup which is developing a digital platform.
L9	Lawyer working in Private Law with an emphasis on digital, corporate and labor law.
L10	Lawyer working in Private Law with an emphasis on digital and corporate law as well as compliance to, and the adjustments needed for, the General Data Protection Law.

Text Table 5 – Qualifications of the Interviewees
Source: The Authors.

Results obtained

Our integral analysis of the 10 selected articles resulted in 13 categories which form two distinct groups. Text Table 6 presents the groups and categories obtained through our systematic review of the literature and the articles which cite them, as well as the number of interviewees who mentioned each individual category during their interviews.

	Concept and characteristics						Criteria for, and the benefits of, adoption						
	Rapid and efficient processes	Self-executing	Execution using blockchains	Security	No third parties are needed	Automation	Decentralization	Reduction in operating costs	Increased agility in processes	Legal viability	Agility/Performance	Reduction in costs compared to traditional contracts.	Immutability
BADI et al., 2021.	√		√					√	√		√	√	
GURGUN; KOC, 2021.		√		√		√				√			√
DRUMMER; NEUMANN, 2020.	√		√	√	√			√		√	√	√	√
GUO et al., 2021		√					√		√				
MALAN; STEYN, 2019.	√		√			√		√	√		√	√	
ARIAS-BARRERA, 2020.	√	√				√	√		√		√		
SCHECHTMAN, 2019.		√	√	√	√		√						√
ULLAH; AL-TURJMAN, 2021.	√		√				√						
SHEIKH; AZMATHULLAH; RIZWAN, 2019.			√	√	√			√				√	√
LUCIANO, 2018.		√		√		√							√
INTERVIEWEES*	13	13	7	6	6	11	6	10	12	23	12	11	0
Business People	3	6	2	2	2	1		7	2	7	8	8	-
IT Professionals	3	4	5	4	1	7	2	2	5	7	-	2	-
Lawyers	7	3	-	-	3	3	2	1	5	9	4	1	-

Text Table 6 – Results Obtained through the Systematic Review of the Literature and the Interviews.
Source: The Authors.
*Refers to the total number of interviewees who mentioned the term during their interviews.

Concept and characteristics of smart contracts

The concept and characteristics of smart contracts found in the systematic review of the literature were points in common with the interviews. We observed that the interviewees also mentioned the smart contracts characteristics observed in the literature review. For example, 13 interviewees (3B, 3T, 7L) mentioned that smart contracts are digital programs that offer more speed and efficiency in terms of processes, which is related to positive aspects of smart contracts like auto-execution (Guo et al., 2021) and manual labor reduction (Malan & Stein, 2019). Thus, this efficiency aspect of smart contracts is related to the possibility that this technology reduces the costs compared to traditional contracts (Sheikh et al., 2019; Arias-Barrera, 2020) and was mentioned in three ways in the interviews. First, 13 interviewees (6B, 4T, 3L) mentioned the self-executable characteristic of the smart contract. Second, 11 (1B, 7T, 3L)

interviewees mentioned the automated nature of contractual clauses, and third, 6 (2B, 1T, 3L) interviewees mentioned that smart contracts don't need a third party to intermediate.
Another aspect mentioned by 7 of the interviewees (2B, 5T) was the possibility of the smart contracts being executed through blockchain, in the same way, Ante (2020) and Sheikh et al. (2019) affirmed. Besides, Sheikh et al. (2019) link the blockchain aspect of smart contracts to security, and it was observed in 6 (2B, 4T) interviewees who related a security raise to the digital execution of the smart contract. Given these scenarios, we can observe that the main aspects related to smart contracts in the interviews were security and efficiency. It is in keeping with our field research, validating the understanding that these are the main factors that make up the characteristics of smart contracts.

Benefits of the adoption of smart contracts

Regarding the benefits indicated for the adoption of smart contracts, we observed that they are aligned with the characteristics observed in item 4.1. For example, efficiency aspects related to agility were observed when 12 interviewees (2B, 5T, 5L) recognized that smart contracts increased agility and the velocity of contractual processes, and 4 (1B, 3T) noted the practicality of its decentralization. And efficiency aspects related to costs were observed when 10 (7B, 2T, 1L) interviewees mentioned operational costs as smart contract benefits, and 11 (8B, 2T, 1L) mentioned the difference in cost between smart and traditional contracts. These characteristics of smart contracts are aligned with the literature when Sheikh et al. (2019) mention aspects like cost reduction in an organization adopting smart contracts, and Ante (2020) and Malan and Steyn (2019) mention efficiency in processes and decentralization. Also, 4 interviewees (2T, 2L) mentioned the security that smart contracts offer at a comparatively low price as a benefit. This mix of cost-benefit and the security aspect of smart contracts was mentioned in the literature review (SHEIKH et al., 2019). Thus, we observed that the interviewees mentioned specific aspects of the benefits of smart contracts and aligned them to those in a broad way in the literature. They are related to agility and cost reduction, followed by security.

Adjustment of the Brazilian legal scenario to smart contracts

Most interviewees, 7 business people, 7 IT professionals, and 9 lawyers, viewed this subject with skepticism. They stated that they do not consider the Brazilian justice system ready to handle the functioning of smart contracts. And this skepticism is related to corruption, a lack of facilitating legal mechanisms, a lack of preparation, the slow pace of operations, the absence of legislation that contemplates this technology, resistance from the operators of law, and the instability of the Brazilian legal system. Although the legal aspect was observed in the literature review, the main difference mentioned is the problem related to the lack of legal mechanisms, while in the literature, we observed conflicts between the existing law (Drummer & Neumann, 2020; Labazova, 2019) or shortcomings of current legal arrangement (Gurgun & Koc, 2021) and the practice.
On the other hand, seven interviewees, including three business people, stated that they did not perceive implications that would challenge the judiciary because this is a universal technology that is independent of where it is used, and three technology professionals and one lawyer said they were hopeful that Brazil would be able to handle the intricacies of smart contracts judicially without any impediments. These perceptions can be related to the fact that the interviewees related to the business scenario perceived the practical aspects of the technology. The situation is similar to that of Drummer and Neumann (2020) since the authors also related practical perceptions to private industry interviewees and legal perceptions to legal domain interviewees.
Given this overall scenario, we note that the greatest skepticism is directed at the possibility of using smart contracts in Brazilian protection legislation. Also, we observed that different actors' perceptions in this smart contract scenario could be different due to their expertise.

Factors considered to be barriers or facilitators of their adoption

All of the interviewees were able to contribute to this subject. The barriers to adopting smart contracts were related to internal and external organizational aspects. On internal aspects, we observed the user factor, which is related to the lack of knowledge or fear and the lack of willingness on the part of people to change and adhere to the use of smart contracts. And second, the organizational structure factor is related to the technology usability and politics, the lack of trust in the technology, and the cultural aspect. As we observed in the literature review, the user factor can raise issues due to the lack of knowledge and specialists on the theme and the costs related to systems implementation (Lamb, 2018).
And on external factors, we observed the legislation and the lack of traceability of the technology. Thus, the issues related to conflicts in current law were raised in previous studies and their alerts on regulations conformity on smart contracts and possible conflicts (Drummer & Neumann, 2020; Labazova, 2019). Also, Schechtman (2019) alerted on the possibility of smart contracts being exposed due to their public nature.
Also, we raised the facilitating factors listed by the interviewees regarding the adoption of smart contracts, and we observed that the COVID-19 pandemic was mentioned. And again, we observed that the facilitating factor was mainly related to positive aspects like trust, agility, and facilities offered by the technology, but also the process's transparency and security.

Estimated time for adhesion to smart contracts on a national level

We found conflicting opinions among the three groups of interviewees. Four business people and 8 lawyers considered adhesion to smart contracts to be distant, while 6 IT professionals believe this adhesion will occur soon. This temporality aspect of the adoption of smart contracts was observed in the literature review (Drummer & Neumann, 2020) and was linked to conflicts between legal requisites and IT resources. Conversely, here we observe that Brazilian IT professionals believe the organizations are near to having or already have the conditions to adopt smart contracts. In contrast, lawyers observed a lack of legal and practical conditions.
It should be noted that this was the question that required the most reflection from the interviewees, and all of them indicated how difficult it is to estimate the period of time that will pass before this technology becomes commonplace. That being so, this is a subject of controversy and produced much doubt among all the interviewees. It also should be noted that the COVID-19 pandemic was mentioned as a factor that would reduce the estimated time necessary for adhesion to smart contracts nationally.

Areas or companies that are potential users of smart contracts

The questions related to the areas or companies which are potential users of smart contracts are relevant since the literature review pointed out different possibilities, like business sector and business operations (Schechtman, 2019; Sheikh et al., 2019), supply chain management (BADI et al., 2022), construction projects (Gurgun & Koc, 2021), loan market (Malan & Steyn, 2019), smart homes (Ullah & Al-Turjman, 2021), and energy sector as natural gas (Luciano, 2018) and green energy (Guo et al., 2021). Thus, we observed that interviewees suggested the adoption of smart contracts broadly. So, 6 IT professionals and 7 lawyers affirmed that every type of company is a potential user, 2 IT professionals affirmed that any area or company could adopt smart contracts, especially e-commerce companies and hospitals, and two business people stated that any company that provides services would be a good candidate for them.
Conversely, 2 business people, 4 IT professionals, and 1 lawyer indicated insurance companies, service sector companies, companies related to finance or fintech, marketplaces, and internet commerce companies. Also, 2 lawyers and 3 technology professionals indicated that potential users would be large firms.

This analysis was essential to show that interviewees in this case also specify some companies to adopt smart contracts. Still, in some cases, interviewees believe any organization or sector can adopt the technology. And this is different from the cases raised in the literature review.

Knowledge of companies that have already adopted smart contracts

Of the 30 interviewees, 12 (4B, 4T, 4L) did not know of any companies that have adopted smart contracts in Brazil; 18 of the rest said they knew of Brazilian companies that use smart contracts in their processes.

Considerations and conclusions

The content analysis of the interviews with business people, IT professionals, and lawyers demonstrated that the understanding of, and adhesion to, smart contracts by companies is still developing in Brazil. However, to conclude this study, we can present three main contributions, one theoretical and two practical. The first contribution is theoretical and is related to the literature review we developed. The studies showed that the adoption of smart contracts is beyond the blockchain, pointing out benefits and barriers that must be explored. However, studies mainly explored northern global realities, with only one article exploring the Brazilian context and limited to a documental analysis.

The first practical contribution is related to the interdisciplinarity aspect, which the organizations must observe since different specialists in different areas can perceive smart contracts' positive and negative aspects. Also, since many internal factors like organizational structure and culture, employees' knowledge, fear, and willingness, and many external factors, especially the legal environment, are related to the adoption of smart contracts, this showed us the importance of multidisciplinary teams evolved in this process and decision. This aspect is important because it supports the validity of dealings related to smart contracts mentioned by the interviewees and corroborated by the literature (Mwashuma, 2018; Gilcrest & Carvalho, 2018).

And the second practical contribution we propose is related to the mistakes or misconceptions related to smart contract adoption. Although the majority of characteristics pointed out by the interviewees are related to the benefits of smart contracts like efficiency, cost reduction, and security, the literature review showed that these aspects could be blurred by the high costs related to the infrastructure necessary for its implementation, and the significant scarcity of trained professionals (Lamb, 2018). Also, the vulnerability of the smart contracts related to their implementation complexity can compromise the security aspect (Singh et al., 2020; Schechtman, 2019).

We cannot ignore that the field interviews were realized after the COVID-19 pandemic, and smart contracts would have been an ally to all sectors of society in facing the challenges of the pandemic. Thus, most interviewees pointed to smart contracts as capable of helping overcome the business repercussions caused by social isolation. Some participants even mentioned the COVID-19 pandemic as having accelerated the adoption of countless technologies and that this movement should be replicated in digital media contracts. Also, besides the many doubts and controversies raised by the technology, most interviewees affirmed that companies use smart contracts in some processes.

Considered to be a fertile instrument favoring reflection, this article raises new questions, which will lead to recent studies and research in the sense of seeking new elements to build on the work we have presented here.

Despite the interesting results we have obtained, this study has a few limitations that reduce the scope of its conclusions. The main ones have to do with the selection of the interviewees. When the process is based on convenience of access, we cannot affirm that the interviewees are part of the same population (from a statistical point of view) as those who were not interviewed, which impedes the realization of inferences. Even so, the authors do not believe there is a significant reason for possible differences between our sample and the population, given that the number of participants was determined using the saturation criterion recommended by Bauer and Gaskell (2008).

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