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The Role of Blockchain in E-Governance and Decision-Making in Project and Program Management

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Abstract

This paper discusses the impact of e-governance powered by blockchain in the project and program management industry. With the rise in technological innovations, many countries have turned to e-governance for efficiency in service delivery, transparency, and decision-making. E-governance backed by blockchain technology entails improving the public services provision by implementing structures of information and communication technologies. There are many challenges with the traditional project management approach that causes organizations and its stakeholders' cost and time. Thus, the introduction of blockchain has given many organizations a new approach to adopt in order to eliminate the challenges associated with the typical project management approach. In spite of the cutting-edge technology of blockchain and its broad applications in program management and e-governance, there are still many challenges that restrain its adoption on a broader scale. The research discusses the challenges of the blockchain deployment in the program management field and e-governance in private and government sectors and it highlights the efforts put by both sectors to make use of the technology. Also, the research covers the opportunities and the advantages of a blockchain adoption in various segments. The paper uses various case studies in the UAE, in both private and government sectors, and a qualitative research approach was implemented. The case studies were on government entities such as Smart Dubai and the Ministry of Health Prevention and also private entities like DP World and Emirates NBD. The paper concludes with recommendations and solutions on how to maximize the benefit of blockchain in the program management industry and how it is improving the decision-making process.

Keywords

Project Management, Program Management, Blockchain, E-Governance,

Decision Making

1. Introduction

PMI defines program management as coordinated management of related projects to obtain and maximize the benefits of managing the package as a whole and delivering the desired outcomes [1]. E-governance is the use of Information and Communication Technology (ICT) to provide, facilitate, and deliver efficient communication transactions and exchange of information between program stakeholders. Governance is a key element that is involved in the program management process and helps to achieve the strategic objectives of the organization. Program governance is a framework of authority, responsibility, and accountability that defines and controls the outputs and the outcomes of projects/programs.

Organizations put huge efforts into setting an efficient framework that defines accountability and responsibility to ensure that the framework eases the decision-making process throughout the program life cycle [2]. In addition to defining roles and responsibilities, the framework helps in deploying and optimizing the right individual in each role within the organization as it sets the required knowledge and level of expertise for each role. Due to the complexity of the programs and hurdles of achieving the desired outcomes, whether from setting an efficient governance framework or deploying the right individuals that help achieve strategic goals and objectives, organizations are keen to adopt blockchain technology to govern their programs to the maximum effect. Blockchain technology has had a massive impact on e-governance, especially in enhancing decision-making. E-governance pertains to the use of the ICT to perform several functions within the programs of the organization. Since decision-making is crucial throughout the program life cycle, it is very important to ensure that there is a framework that supports each and every decision taken by the program team.

Problem Statement

The emergence of technology has introduced many of its applications in different fields. Due to the variations of governing program management in many governmental and private sectors, it became pivotal to embrace the blockchain technology that helps set an efficient governance framework for program management across different sectors and helps ease the decision-making process. Despite the need for this disruption in the program management industry, there are many entities that are reluctant to adopt blockchain technology in program management governance, whether it's due to a lack of understanding of this technology or reluctance to evolve. Many programs are delivered without achieving the objectives of the organization, causing an abundance of arguments and discrepancies among the stakeholders, which adversely impacts the program

outcome.

2. Research Method

The research intends to highlight and explain the role of governance and the associated challenges in program management fields. Moreover, it highlights the technological and innovative solutions for governance challenges introduced by blockchain. Data was collected from educational institutions, libraries, academic journal websites, PwC, LinkedIn, and government websites.

Research Aim and Objectives

The aim of the research is to address the existing challenges of blockchain adoption in the program management field and to highlight the importance of blockchain technology in program management governance and how it helps the decision-making process across various disciplines. Also, the research highlights the foreseeable future for blockchain technology in program management applications and the role of government and private sectors in that.

Research Questions

- What is e-governance in program management and how does it add value to the program?
- How does blockchain support e-governance and decision-making in program management?

Research Strategy

The research discusses the governance role and impact on the decision-making process in program management, and it also highlights the cutting-edge technology that blockchain assists in governance. The data related to blockchain solutions were provided and discussed based on a quantitative and qualitative approach. The quantitative data was collected from reliable resources and the qualitative data was obtained from interviews with a subject matter expert.

Research Approach

Two methods were used in this paper to satisfy the objectives: primary qualitative and secondary quantitative. The primary qualitative method is presented in the form of semi-structure interviews to highlight the role of blockchain in program governance. The secondary quantitative approach is presented via document analysis.

Semi-Structure Interview

The semi-structure interview is one of the tools used to gather different kinds of data and get subject-related questions answered. Historically, the semi-structure interview was called "elite interviewing" and it developed throughout the decades. The semi-structure interview refers to open-ended questions often followed by "why" or "how" questions [3]. The semi-structure interviews are well suited for a number of multiple tasks and open-ended questions type of interviews. This type of interview focuses on individual thoughts on a specific subject, and that is why we have chosen this type in our research. We wanted to obtain different thoughts about how blockchain supports decision-making and gover-

nance in program management across different governmental and private sectors. Also, it gives the interviewees the freedom to answer the questions and elaborate on their own thoughts for different subjects.

Document Analysis

There are multiple resources used effectively in this research, such as academic journals, reports, previous papers, and official government publications with regard to governance and blockchain. All these tools are part of the document analysis that has been used in the paper.

Data Collection

Data about e-governance and blockchain was collected from reliable resources such as academic journals, previous papers by various scholars, reports by reliable corporations like PwC, and also all data regarding the application of blockchain in e-governance in public and private projects were collected from government-published reports.

Informal Discussion

Conducting interviews with subject matter experts is very vital for understanding the application of e-governance and blockchain in the program management industry. Experts or consultants always contribute toward designing the right strategies for government entities and private corporations that are keen to adopt blockchain technology in their programs. The outcome of the interviews with the experts provides a clear picture of how blockchain supports program governance and decision-making and will provide resolutions for all uncertainties regarding governance integration with the cutting-edge technology of blockchain.

Research Framework

Question List

To cover and highlight the main objectives of the research there were multiple questions that had to be answered by the experts in the field of program management and blockchain technology. The question style was open-ended questions, which the interviewees had the flexibility to answer freely without any limitations. The questions are as follows:

1) How has implemented blockchain technology improved the organization management to govern their programs?

2) How does blockchain technology improve program performance and governance?

3) How does blockchain technology help to drive the decisions and translate them into practice to meet the organization's strategic objectives?

4) How does blockchain technology improve managing their stakeholders and how is trust affected?

5) What are the barriers that impact the use of blockchain technology as an effective tool in program governance?

6) What are the opportunities that are using blockchain technology have created in program management?

7) How do government entities foresee the adoption of blockchain in program management governance?

8) What are the key factors that help speed up the adoption of blockchain in program management governance across government entities?

9) Is there any governmental framework that urges entities to use the blockchain in program management governance, e.g. the framework set by the Ministry of Artificial Intelligence?

10) How does the application of blockchain in program governance support PPP (public private partnership)?

Ethics

We are committed to the interviewees' request to keep their names confidential, and we are committed to citing all the confidential data that is presented in this paper. We confirm that the interviewees were not under any pressure to answer any question, and they had the flexibility to reject answering any question they didn't wish to answer.

3. Literature Review

3.1. Governance and Decision-Making in Program Management

Governance plays a vital role in program management as it is associated with improving projects/program performance. It is mainly linked to the program performance because it is linked to the decision-making. The decision-making takes place throughout different stages of the program life cycle. Setting up an efficient governance framework will help in managing the program efficiently. Despite all the efforts that have been utilized by many organizations to ease the decision-making mechanism, there is no sound and the solid mechanism that organizations can refer to [4].

Governance is challenging because of the intensive coordination between different stakeholders involved. In any program-level projects, there are many individuals involved and there are an enormous number of interfaces between different departments and stakeholders. Setting up a clear framework and roles and responsibilities system has made the governance less challenging as each individual and each department followed their own scope of work. Also, the authority and responsibility of each individual within the program team needs to be well-defined in order to reduce governance challenge. In addition to that, the framework has all the tools, processes, policies, and procedures that need to be undertaken by each project team throughout the program life cycle: reporting, communication protocol, change orders and variations.

3.2. Decision-Making in the Blockchain System and Its Characteristics

Blockchain is a disruptive technology that comes with various real-life applications. Blockchain technology has numerous characteristics that enhance the decision-making process in managing multiple programs. The first trait is ensuring

decentralization, where all the nodes share obligations and freedom [5]. This helps the workflow and the interdependencies to be analyzed and processed automatically as all projects/program information will be captured and analyzed. Blockchain technology also gives space for reviewing and traceability as it ensures storage of data is in nodes while encrypted [6]. This provides clear transparency to the program team as they will be able to view the progress of each milestone in the program. In addition, the KPI for each task will be tracked and assessed. The stakeholders cannot hide the information following the nature of the system. The element uses cryptocurrency to ensure zero modification and damaging of the information blocks. The same can be implemented in program governance in any industry as the info cannot be hidden, hacked, or lost.

3.3. Benefits of Blockchain on E-Governance

As stated above, e-governance pertains to the comprehensive use of IT to perform various program functions. There are various advantages of adopting blockchain technology in program governance. The first benefit is restoring the distrust that has existed between program stakeholders [7]. The constant growing distrust among program stakeholders is unhealthy as it will restrain their efficiency and will adversely impact the desired outcomes [8]. Blockchain technology has features that can solve the problem leading to the restoration of trust among different stakeholders [9].

Security is one of the key elements that needs to be a top priority in any organization. Protecting data from cyberattacks is crucial to ensure the continuity of the functions within the organization.

3.4. Sectors of E-Governance Where Blockchain Is Applicable

The blockchain concept revolves around a ledger technology allowing people to transact safely in an automated form. The technology has been applied in contemporary cities' ecosystems [10]. Among the sectors that blockchain technology has revolutionized include healthcare, energy trading, real estate, and supply chain [11]. The healthcare system is complex, and its sustainability has been tested during the Covid-19 era. However, countries that had already implemented the system could maneuver through the situation.

The technology has also positively impacted the energy trading platforms by ensuring transparency and efficiency [12]. This includes options contracts for commodities as the prices will be monitored by market players and based on the market trends, decisions can be made more easily. Furthermore, smart transportation has become popular, especially in smart cities, thereby easing the shortcomings of the sector [13]. At the governmental level, the data analysis of the population will help governments/organizations to decide whether or not to improve or expand the transit system and also will help them decide whether or not to deploy more technological solutions for the transportation system.

3.5. Blockchain and E-Governance

3.5.1. Governance in Program Management in Pre-Blockchain Era

Governance in project/program management consists of all the key elements that determine the success of a program. Governance is always formed with the organization's needs and objectives. There are eight elements that decide how a program governance framework is created, implemented, monitored and controlled. According to PMI, program governance can be defined as an "oversight function that's aligned with the organization's governance model and encompasses the project life cycle". The eight key elements that influence the effectiveness of the project fall under two main categories; the alignment with the organization's governance and monitoring and controlling of the governance plan.

- The alignment with an organization's governance means that the project environment is fully understood, which ensures the right fit of the established governance. The alignment is crucial prior to the kickoff of the program when defining the project governance framework, roles & responsibilities and stakeholder engagement plan.
- Monitoring and controlling governance plan takes place during the program life cycle. In this phase the program manager will ensure that the governance framework is monitored and controlled through adequate meetings, proper reporting, active risk trackers and issue management.

The ultimate goals and objectives of many projects and programs have not been achieved due to a lack of governance and difficulties in defining what governance is and how to monitor and control it.

Figure 1 highlights the main elements of governance. The mentioned components have added significant value to the success of projects when applied [14].

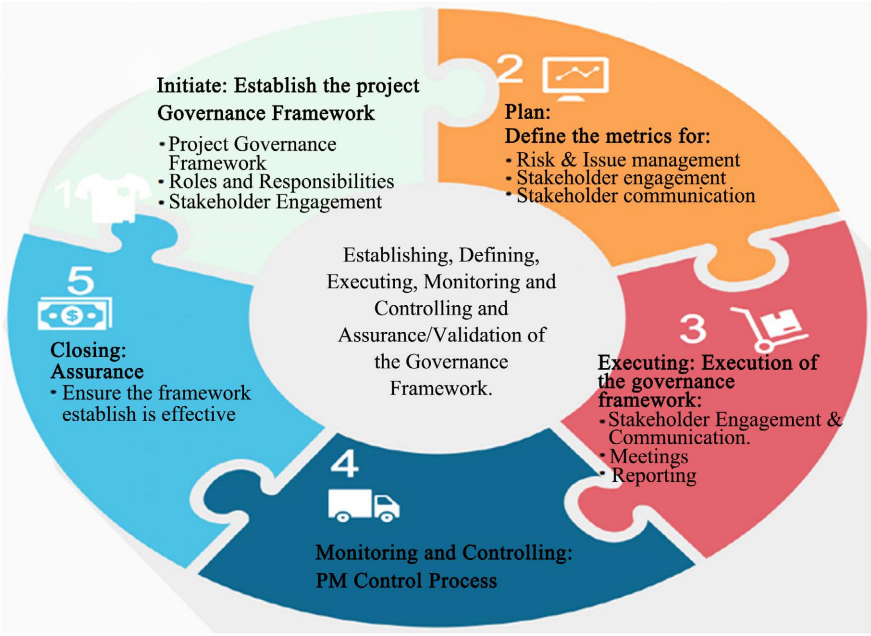

Figure 1. Governance main elements [14].

- Governance model: selecting the right model is key for ensuring the success of the program. Defining a compatible governance model aligning the organization's needs will help to achieve the desired missions required for the program with regards to baseline, cost, time, risk and stakeholder engagement and expectations.
- Accountability and responsibility: assigning roles and responsibilities is very critical to any project or program as everyone will be aware of what is expected from them to look after and deliver.
- Stakeholder Engagement: Stakeholder's needs and expectations are very important for the program team as their unacceptance of the program deliverables will have a significant impact on the success of the program.
- Stakeholder communication: After the identification of all stakeholders in the program, a clear communication plan needs to be established to depict how and when the deliverables and milestones will be conveyed to the stakeholders throughout the program life cycle.
- Risk and issue management: risks will always be associated with projects and programs, but the main concept of risk is how to deal with them once occurred. Risks can be expected at any stage of the program but setting a plan for how to deal with different types of risks at early stages will provide extra resilience to the program team to react accordingly.
- Assurances: this is the blueprint that ensures that all risks are managed effectively and also it ensures setting program performance KPIs.
- Project management control process: This task is vital as it will oversee all program deliverables status and gives the right window to intervene. This task is activated throughout the full program life cycle.

Challenges of Traditional Governance

Despite the attention and efforts exerted by the program management industry on governance and its importance to the success of the program, there are still challenges associated with its efficient application. The blueprint for the key governance elements was effectively designed to implement, but during the execution some of those elements can be found very tough to implement. Stakeholder engagement and communication plan is one of the toughest tasks to execute as it relies on other parties' expectations and needs.

Sometimes governance teams come from an operational oriented industry which is totally different from the project and program management industry, so having governance members from operations will create some sort of uncertainty that they need to deal with and that may jeopardize achieving the overall objectives [15].

3.5.2. Governance in Program Management in Post-Blockchain Era

E-governance

Electronic governance is the implementation of ICT in the project or program governance, which will result in better governance through simple process creation and efficient communication with various stakeholders [16]. In program

management, the uses of e-governance focus on decision-making, management, services, and transactions.

Decision-making

The electronic governance will bring all stakeholders and connect them via online portals, which provides clearer and stronger accessibility to the information. As a result, more transparency is created and efficient decision-making will take place among the stakeholders.

Management

Electronic governance helps in managing program and project teams efficiently as the execution will be monitored through various online channels. This helps in creating more transparency and efficient governance for large projects.

Services

Conducting services online is one of the main features e-governance provides. Accessibility to the online platforms will result in better delivery of different kinds of services to the stakeholders.

Transactions

The application of the internet eases the transactions between firms and individuals. Using online payment channels to perform transactions has helped companies to reduce cost compared to traditional transactions and also it increases the marginal profit due to the high level of exposure. (Figure 2)

Blockchain and E-governance

Blockchain brings an innovative and disruptive solution that helps in shifting the focus from a centralized system to distributed system that is efficient and transparent to all participants in the system. Furthermore, it stores data and executes any required process on a decentralized basis. The blockchain helps multiple participants to transact and interact with each other even if they are not well known to each other. Those participants can be individuals, firms and corporations, or governments.

Figure 2. E-governance matrix [16].

The technology of blockchain has provided various solutions for the common issues associated with e-governance. Trust and transparency, efficiency, availability, and data security are the main features that blockchain facilitates with regard to e-governance [16].

Data Security

Cybersecurity is one of the challenges that governments and corporations face against cyberattacks. Blockchain has been designed to encrypt data that is exchanged between parties. Also, it provides an extra layer of security for the data as it facilitates digital certification and signature for each and every transaction. (Figure 3)

Blockchain and Purchase Management

Procurement and purchase order management is an essential process in the program management cycle; ensuring the delivery note adherence and invoices are important to ensure that the vendors are getting paid on time. In prior years, this process was managed and operated manually, causing a high level of inefficiencies. Usually, due to the inefficiencies, suppliers don't get paid on time and

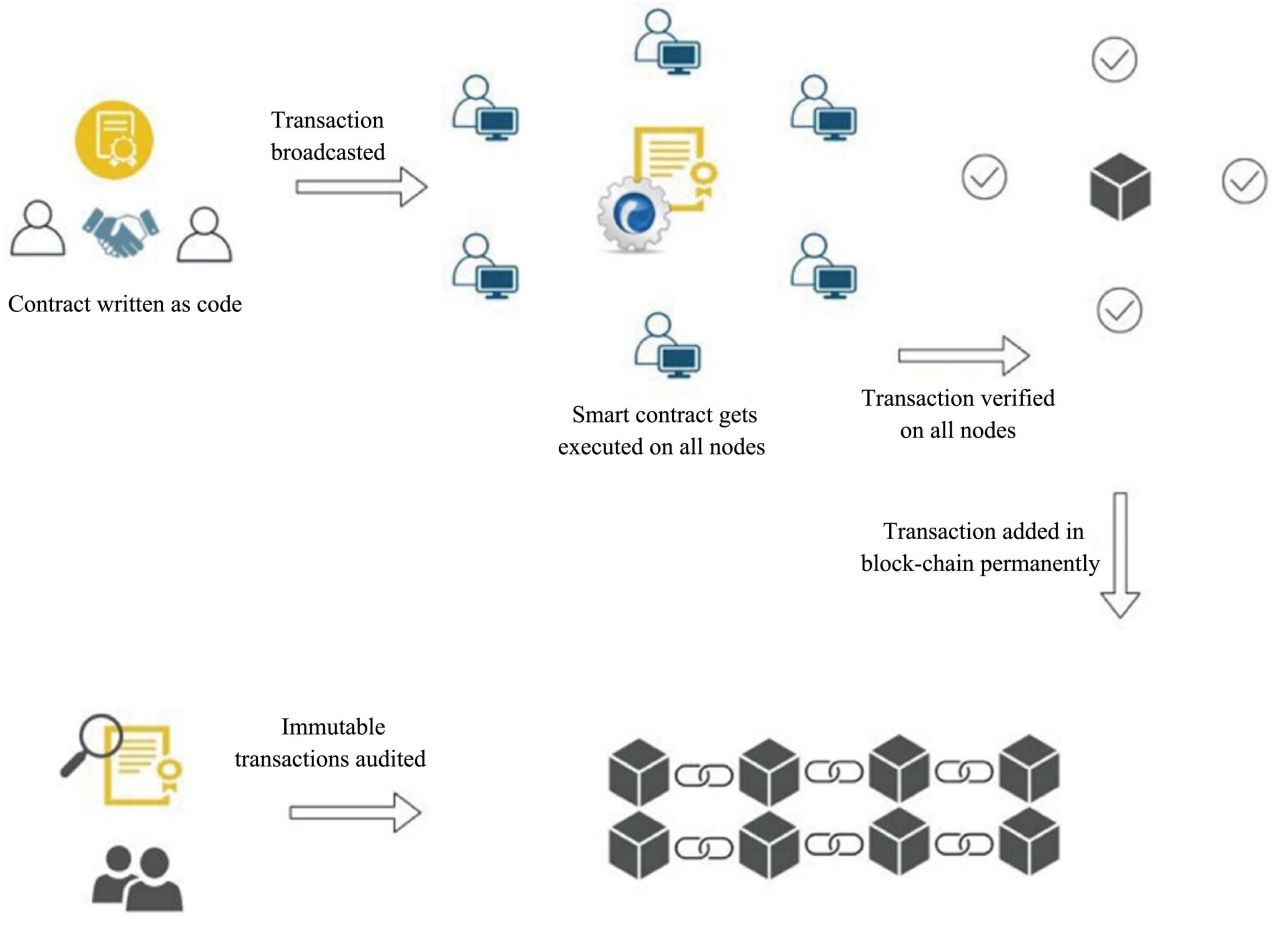

Figure 3. E-governance through blockchain [16].

that jeopardizes their cash flow. Blockchain technology replaces all the manual processes with distributed digitalized form and enhances the overall process and releases the certified payment on time [17]. Also, it processes the correct decision-making related to the right products purchased and it creates undisrupted communication channels with all stakeholders involved.

Blockchain and Finance Management

The financial aspect in program management is very important to align with the established governance by organizations. Overdue payments cause huge difficulties for companies, making it difficult for them to survive. Blockchain enhances all financial transactions as it provides an instant payment protocol. Cryptocurrencies such as Bitcoin and Ethereum can be used as an alternative types of currencies that are safe, instant, and have lower fees.

Blockchain and Contract Administration

Contract administration is very critical at the initial stage of any project or program as it has more risks due to the uncertainty. Stakeholders spend tremendous amounts of time on contract planning to ensure the feasibility and smooth implementation throughout the program lifecycle. Blockchain via smart contracts resolves the concerns attributed to contract administration and planning. Smart contracts are computer-programmed contracts that process if/then scenarios automatically. Those contracts function with the support of the data stored in the blockchain. For example, the old traditional bidding systems for the contracts will be adjusted and powered by smart contracts in a way that ensures price competitiveness, accountability and a payment rewarding system in relation to work performed.

Challenges

Like the introduction of any new disruptive technology, the applications of blockchain have some challenges that need to be considered and addressed. All those challenges were theoretically and empirically identified when the technology was implemented across multiple disciplines. The concerns center around getting the right deployment of blockchain in different governance models and their alignment with different regulations and legislations. Also, it is important to note that there is a lack of education amongst stakeholders, whether government entities or private companies. The gap of knowledge is big between private and government entities, so it is very important to bridge the gap by bringing both parties together through seminars, workshops, and conferences and intensifying the collaboration for both in the upcoming programs. Also, it is important for governments and stakeholders to be open and resilient to changing their standards and regulations over time [18].

4. Case Studies

Estonia

Estonia is one of the pioneering governments that tested blockchain when it was introduced in 2008. The implementation of blockchain took place in 2012 when the government urged all its sectors to maximize the benefits of the use of

blockchain in their operations and management. Due to the efficiency and the correct use of the blockchain, Estonian e-governance structure became one of the most efficient and resilient structures and assisted the Estonian government in achieving their objectives in their programs [19]. One of the largest programs was to support all the services offered by the government by using blockchain. The government of Estonia powered their services with a blockchain infrastructure in a way that secured and encrypted end users' data. For example, for any application to any of the services provided by the government, the users just need to insert their ID and the applications will be processed based on the blockchain technology that would utilize the database for all verifications and process the required actions. Financial services and public services as well as medical services were processed efficiently for the applicants. As a result, the Estonian government accomplished many benefits and advantages whether financially or strategically from implementing blockchain.

UAE

The United Arab Emirates is one of the first countries to consider blockchain in their strategic initiatives and plans. The Emirates Blockchain Strategy 2021 intends to process 50% of government transactions through the blockchain platform, saving around 11 billion dirhams from those transactions [20]. Those initiatives were collaboratively brought up by government entities and private sectors. The government has created the regulatory framework through the Ministry of Artificial Intelligence that enables both government entities and private companies or startups to follow and adhere to [21]. The framework focuses on four main pillars: residence happiness, global entrepreneurship, government efficiency, and advanced legislations. The below picture depicts the disciplines and fields where blockchain deployment was applied. (**Figure 4**)

The case studies present the deployment of blockchain in program management and how it helps organizations achieve their strategic objectives and goals. Also, it is important to note that the program management and the deployment of blockchain were tested and experimented with through pilot projects in future labs and government innovation hubs. The outcome of the experiments and the deployment will be further applied in a broader scheme.

Public Sectors

When the concept of blockchain was introduced, many governments took steps ahead and embraced the new technology. Later, they built their own strategies and amended their regulations to adapt to the new technology. As a result, a

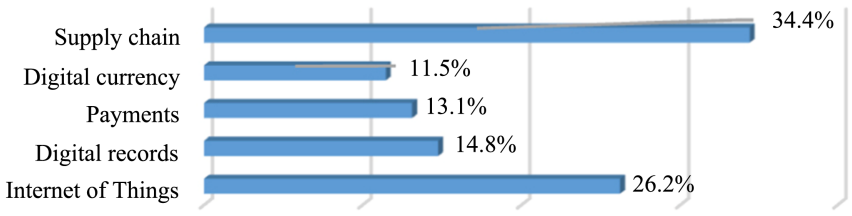

Figure 4. Blockchain fields deployment [20].

huge transformation happened in those governments towards efficiency and competitiveness. Moreover, knowledge and expertise were gained which have put those governments on the radar for benchmarking as they succeeded in adopting blockchain in program governance.

Smart Dubai

Smart Dubai is a government entity in Dubai that is responsible for transforming the Emirate of Dubai into one of the smartest cities in the world, supported by strong infrastructure. Furthermore, Smart Dubai supports the collaboration between the public and private sectors as well as academia to design and implement the framework for any innovation and technological initiatives.

Smart Dubai launched their centralized payment system in 2003, known as Dubai Pay. The centralized payment gateway involved more than 40 entities, enabling them to process their payments online. In 2018, the total amount of transactions was more than 10 million applications valued at around 16 billion dirhams. Despite the fact that the system was considered a smart system as all transactions were processed online, there was a huge problem with payment reconciliation. Each entity was recording all the figures in their bookkeeping trackers manually, consuming extra time and incurring extra costs.

The introduction of the blockchain has given Smart Dubai the task of resolving the payment reconciliation issue as it is a lengthy and costly process that each and every entity struggles with. The program development by Smart Dubai was to address payment reconciliation by enabling instant payment reconciliation for all entities, dispute and claims resolution, automating and enhancing the financial process and providing transparency for the financial records.

Smart Dubai has successfully completed the payment reconciliation program development alongside other stakeholders like Dubai Electricity and Water Authority (DEWA), Emirates NBD, Knowledge & Human Development Authority (KHDA) and Avanza (blockchain solution provider) in a timely manner, achieving all set objectives and goals. After the completion of the project, Smart Dubai handed over the system to the Department of Finance in order to ensure that all involved stakeholders and users had a clear understanding of the services provided in the new payment system. The blockchain was used to manage the delivery outcomes and e-governance and decision-making were achieved during the development phase, so the product was developed and tested by the program management team and then it was launched for official use.

Abu Dhabi Digital Authority

Abu Dhabi Digital Authority is the responsible party for shifting the digital transformation of Abu Dhabi entities and it is the legislative body that issues new rules and regulations for the development of any new technology within the emirate. The intention of the Authority is to build a secure data exchange platform supported by blockchain for Abu Dhabi entities and external organizations. The blockchain platform was developed to connect multiple blockchain systems together to ease all the communications between the stakeholders. This will minimize the complexity of each blockchain system and will promote inte-

roperability and set the basis for all blockchain projects that will happen in the future.

As mentioned above, the goal of the program was to build a platform that would allow government stakeholders to exchange data and information with other government entities and private corporations, enable them to make transactions efficiently and enhance government services. The project was developed through a government sandbox which is the trial lab for new technologies. Prior to the development phase, awareness sessions about blockchain were conducted for the teams and the implementation of the project used a top-down approach.

There were many challenges associated with the development, such as a low level of clarity on the standards and interoperability. Integrating unified standards in the blockchain is very challenging as each entity has its own standards and regulations that may conflict with other stakeholders' standards. Designing the right governance model for the blockchain to link all stakeholders together without having a conflict is still under research and development.

Ministry of Health and Prevention

The Ministry of Health is responsible for providing healthcare services for all the citizens of the UAE. In order for the ministry to uplift their services to all, they have adopted innovative technologies as part of their improvement strategies. Illegal organ donation is one of the challenges that the healthcare community faces as it is very difficult to secure and ensure the registries. Therefore, the Ministry of Health has developed a project to avoid illegal organ donation in the UAE. The project was developed in partnership with Dhonor Healthtech to develop an organ registry platform using blockchain. Due to the complexity of the program development, it was decided to break down the program into three phases. Each phase has its own processes and systems. It was crucial to bring all stakeholders together during the development stage and ensure their buy-in was obtained. The program was managed and developed via blockchain, smoothly meeting all the objectives of the organization and its stakeholders.

Private Sectors

Emirates NBD

Emirates NBD is one of the leading banks in the UAE and worldwide. They have branches in Saudi Arabia, Egypt, India, Singapore, China and Turkey. The bank has established a Future Lab where they develop all their innovative digital projects. The Future Lab works collaboratively with regulators, clients, and governments to accelerate the delivery of their projects.

Emirates NBD developed a program to reduce cheque fraud using blockchain technology. The development of the program started in early 2017 with banking consultants and the Central Bank of the UAE. Blockchain was utilized to achieve efficiency and transparency during the development phase.

DP World

DP World is a leading supply chain company specializing in cargo logistics and port terminal operations. The company's portfolio consists of more than 150 operations across 46 countries. The challenges with supply chain and logis-

tics have been on the radar for a decade and due to the complexity of management and operations there were no huge shifts to the supply chain ecosystem. The inefficiencies were always part of the challenges that supply chain firms face. DP World, as a leader in the supply chain industry, has taken part in exploring and identify technological solutions that will disrupt the industry and will add significant value to all market players. Building a logistics trade platform powered by blockchain that will ease the exchange of data and automate all processes and smart contracts was the main target for DP World to develop.

The project or program development is intended to build a permissioned blockchain platform that assists cargo owners in their trades by enhancing the flow of data and process integration. The ultimate goals of building the platform were to ascertain trust among the traders, reduce logistics lead time, and enable digitization and data-driven decision-making.

The DP World has developed the program collaboratively with cargo owners, financial institutions and other entities. At the outset, the development was in pilot mode to ensure the efficiency of the product, and after that, it went live for official use. There were challenges due to unconventional project management requirements whether in the approval process or roles and responsibilities for each party. Therefore, DP World conducted several workshops with all stakeholders prior to the program development to try to avoid some of the clashes that might occur during the development phase. They used blockchain for traceability, transparency, and data-driven decision-making.

Challenging Factors

The World Economic Forum has conducted a survey in collaboration with Dubai Future Foundation to capture different thoughts and views about the challenges of blockchain implementation across different fields. The survey involved around 100 stakeholders from government and private entities. The main purpose of the survey was to get feedback on how stakeholders perceive blockchain implementation across different programs. The picture below illustrates the outcome of the survey.

As illustrated, more than 50% of government entities believe that a lack of awareness of blockchain deployment restrains many entities from deployment. Similarly, the majority of private sector entities and service providers think that lack of awareness among stakeholders and unclear regulatory framework are the challenges that affect the implementation of blockchain, whether in program management and development or other disciplines. (**Figure 5**)

Critical Success Factors

The conducted survey presented other success from the implementation of blockchain, as depicted in **Figure 6** below.

Government entities think that continuous communication and alignment with other entities and stakeholders and defining scope, expectations, and responsibilities will urge other entities to use blockchain and will urge them to deploy it in their program management. The corporate sector and service providers

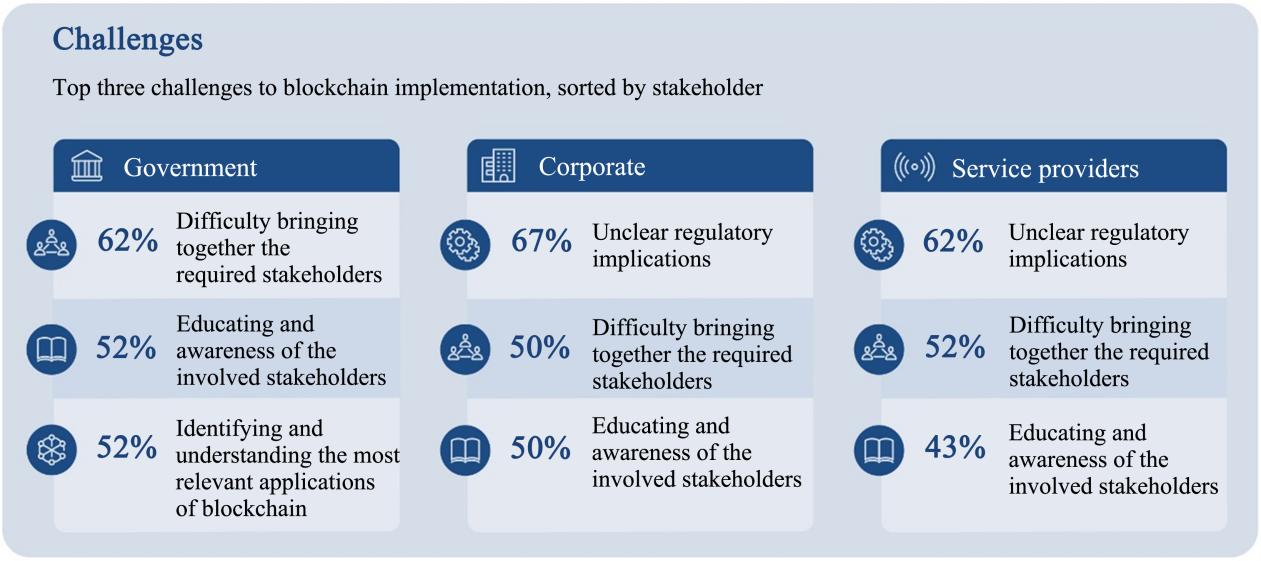

Figure 5. Blockchain deployment challenges [21].

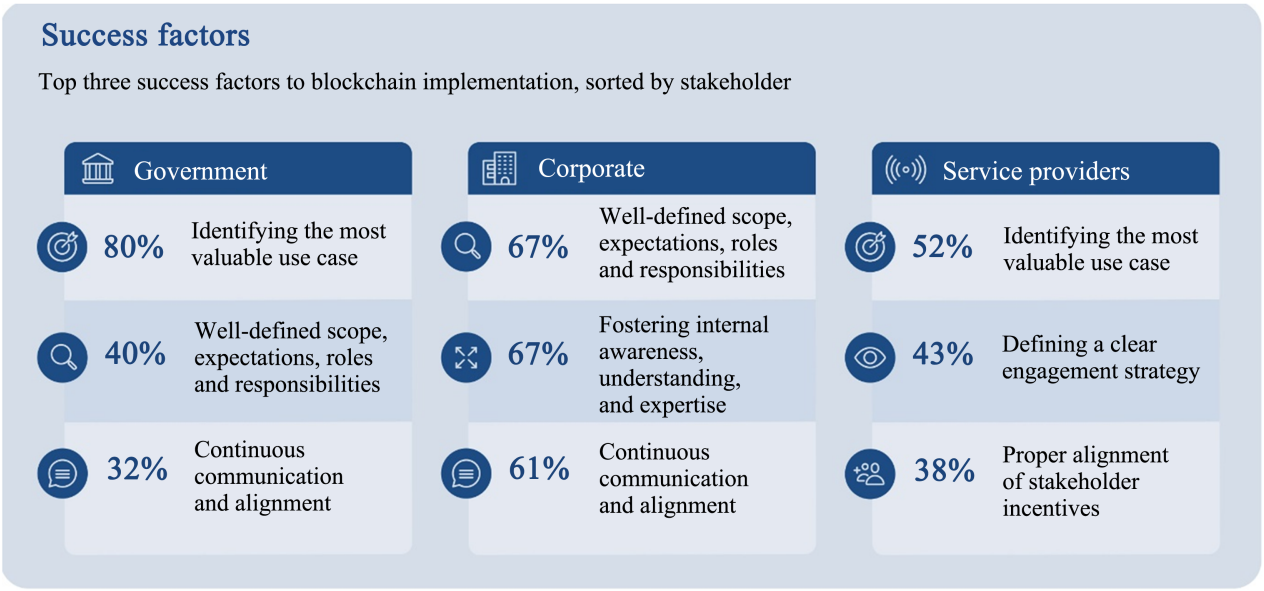

Figure 6. Success factors of blockchain deployment [21].

assume that establishing a clear scope and fostering awareness and engagement strategy will urge companies to consider blockchain in their program management and strategies to meet the desired goals and objectives.

5. Research and Findings

5.1. Interviews

The qualitative data analysis was conducted by interviewing various experts in the field of project management and technology and blockchain. The interviewees represent government entities, private corporations, and consultants. Experts with multidisciplinary functions were interviewed to answer the questions

related to e-governance and blockchain to provide their feedback on that matter. This feedback is vital to study and consider as they have already witnessed the technological emergence of blockchain, and they were part of the workshops conducted by the government with regard to blockchain applications. Also, they were involved in pilot projects that were conducted in various private sector companies across the UAE. Therefore, the feedback from the experts will provide a real added value to the idea of blockchain application in governance and decision-making, relaying both the advantages and the challenges. The interviewees that represent government entities argued that blockchain facilitated the decision-making and supported e-governance within program management activities. They stated that the management ecosystem has become efficient and more resilient. They added that transparency is one of the key elements that blockchain provides and ultimately promotes trust and agreement between program stakeholders. Moreover, the representatives of the private corporate entities have ascertained that blockchain applications in program governance have improved the transparency amongst the teams and have increased productivity and delivery.

The subject matter experts highlighted that the design of the blockchain model would assist in translating the decision-making into real practice in order to meet the strategic objectives of the organizations. The blockchain uses smart contracts to get rid of all bottlenecks as they are designed to handle multiple roles and action them simultaneously. All interviewees agreed that a higher degree of awareness is highly recommended for the ecosystem to mature. They all urged the continuation of workshops, sessions, and conferences with the involvement of governments, privates sectors and academia will boost the implementation of blockchain in program management.

The interviewees confirmed that there is a huge potential for improvement in the blockchain implementation in program e-governance in the upcoming years. They believe there are certain factors that influence the implementation of blockchain such as: regulation and legislations, awareness, and the collaboration between government and private sectors.

In the UAE, the partnership between the private and government sectors has increased the adoption of blockchain. Furthermore, the collaboration helped establishing the regulatory framework led by the Ministry of Artificial Intelligence.

5.2. Analysis

E-governance powered by blockchain has many advantages and a few challenges that need to be tackled. As identified and captured by the case studies and the interviews, establishing the right governance model will help the efficient deployment of the blockchain in program management. In the program management industry, decision-making is crucial for the program team during the program life cycle. Sometimes, the uncertainty of information jeopardizes the progress of the program as many stakeholders will be reluctant to take any decisions that they foresee as uncertain or ambiguous.

Challenges will be always be associated with the emergence of new technologies. Through the case studies, it is clear that there were some challenges that impacted the full deployment of blockchain in program management. Technical challenges were observed since the deployment of the blockchain by the entities and were addressed by technical experts such as cybersecurity and data protection. The strategic challenges are the main ones that affect the efficient deployment of the blockchain to facilitate program governance. Strategic challenges are related to the governance model, awareness, stakeholders' collaborations and program management style and approach. Also, it is clear that government and private entities that adopted blockchain to facilitate their governance achieved the desired goals and outcomes despite the challenges. For example, the decision-making was smooth and fast due to the high level of transparency and data was fully secured and encrypted, avoiding cyber-attacks.

We can conclude from the interviews that the continuous collaboration between the private and government sectors is very crucial to bridge the gap and tackle the mutual challenges. In addition, conducting several workshops between both sectors will urge more organizations to deploy the blockchain technology in their program governance and achieve their strategic objectives. Organizations need to be resilient and flexible to change their policies, governance and management approach to cope with the advancement of technology.

6. Limitations

There were certain limitations associated with this paper as the implementation of blockchain is immature in many fields. First, the concept of program management mentioned in this paper considers different attributes of program management style and is not peculiar to traditional program management. Second, the deployment of blockchain and its impact on governance and decision-making was tested throughout the established future labs and accelerator hubs during the development of the program/project, whether as a service or product. Lastly, due to the immaturity of the ecosystem, there was a limited amount of data to analyze blockchain and its deployment in program management governance, so the main focus of data analysis was based on qualitative data.

7. Recommendations and Solutions

The solutions were derived and extracted based on the quantitative and qualitative research analysis. The quantitative data has given clear data supported by real-life applications such as case studies and figures on the deployment of blockchain in program governance. At the same time, the qualitative approach has provided comprehensive information about the blockchain deployment by representatives from both sectors. Also, it gives the subject matter experts the freedom to discuss the matter and highlights other points that are not captured in other sources.

The application of blockchain in program management will increase in the coming years due to the achieved advantages. Despite all the benefits achieved

by blockchain adoption, there are still many challenges that affect the full-fledged adoption of the technology in program management and governance. Some of the challenges can be tackled in the short term and some require further study and analysis in order for them to resolve in the medium and long term (Blockchain Guide, 2020). The major challenges of blockchain deployment revolve around assigning the right applications for blockchain across different disciplines, lack of awareness about blockchain and its application in program management, and selecting the right governance model that suits all stakeholders involved. It is highly recommended that the partnership between private and government sectors continues to elevate the degree of awareness and discuss the mutual interests of all. Also, creating an attractive ecosystem to attract experts and technology companies in the field of blockchain and program governance is recommended to overcome the obstacles. Moreover, governments need to create an efficient platform and framework for the private sector to take the lead in developing an efficient blockchain model that aligns with the program governance for all.

8. Conclusion

This paper details the existing challenges of blockchain deployment across different program management disciplines. It is clear that blockchain is a cutting-edge technology that has various uses and applications across different sectors. In the program management field, blockchain technology plays an important role in promoting program governance. Despite all the efforts exerted by governments and private sector entities, there are still challenges with blockchain deployment. Some of the challenges are valid as different stakeholders have their own governance models and policies, and it is very difficult to change them as they are linked to the organization's objectives. Blockchain can facilitate decision-making, but to a certain extent only. The knowledge of the program management team will evolve with time as well as the organization's objectives. As a result, a high level of resilience and acceptance to change will be achieved and a unified governance model for all market players and stakeholders can be established. The research suggests the continuous collaboration between academia and private companies to develop further studies and empirical experiments that can tackle the existing challenges. We believe that decision-making and e-governance backed by blockchain adoption will spread across different segments and will help the program team to maximize the use of the data analysis developed by blockchain. The initiatives set by government entities will create the channel for private entities to get involved in the development of the ecosystem as well as academia. However, highlighting the benefits of the blockchain application will be the driving point for further development and deployment. The maturity of the ecosystem will attract the talents to address all the technical challenges and will help governments to set the required legislations and regulations.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendix

Interview Questions

1) How has implementing blockchain technology improved the organization's management to govern their programs?

2) How has blockchain technology improved the program's performance & governance?

3) How has blockchain technology helped to drive the decisions and translate them into practice to meet the organizations strategic objectives?

4) How does blockchain technology improve managing their stakeholders and how is trust affected?

5) What are the barriers that impact the using of blockchain technology as an effective tool in program governance?

6) What are the opportunities created using blockchain technology in program management?

7) How do government entities foresee the adoption of blockchain in program management governance?

8) What are the key factors that help speed up the adoption of blockchain in program management governance across the government entities?

9) Is there any governmental framework that urge entities to use the blockchain in program management governance e.g., framework set by the Ministry of Artificial Intelligence?

10) How does the application of blockchain in program governance support PPP (public private partnership)?