

EVALUATING THE FEASIBILITY OF AI AND BLOCK CHAIN TECHNOLOGY IN PUBLIC SERVICE TRANSACTIONS: A CASE STUDY OF THE UAE

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Abstract

This study aims to evaluate the viability of integrating Artificial Intelligence (AI) and Blockchain technologies into public service transactions in the United Arab Emirates (UAE). The research addresses the challenges, key issues, and impacts of these technologies in public sector organizations. A qualitative methodology was used, utilizing focus group discussions and interviews with leaders. The sample participants were UAE Federal Government officials, Abu Dhabi Local Government officials, Dubai Local Government officials, Ajman Local Government officials, and private sector officials. Thematic analysis, supported by a thematic network method, was applied to structure findings into six crosscutting themes across five stages of technological change (Initial, Developed, Defined, Managed, Optimized) and four dimensions (Strategy, Technology, People, Process). The study observes that despite their potential for powering efficiency and openness, implementation of AI and Blockchain technologies is compromised by different constraints like regulation hurdles, governance, and infrastructural limitations. Their implementation should make it successful with the help of developing integral regimes of regulation appropriate to the technological and legal backdrop of the UAE. Piloted investments will additionally be required in order to evaluate real-life impact as well as identify optimal approaches. Stakeholder acceptance, training of personnel, and systematic knowledge-transfer programs are equally essential to counteract resistance and ensure effective implementation. A well-orchestrated, multi-faceted effort will enable UAE public service agencies to leverage these technologies to improve the delivery of service and spur long-term innovation.

Keywords: Artificial Intelligence, Blockchain, Public services, United Arab Emirates.

INTRODUCTION

In recent years, the intersection of blockchain and Artificial Intelligence (AI) has been a revolutionary power in public service transactions, ushering in unparalleled improvement in efficiency, transparency, and security. The intersection of the two is a game-changing step forward in the delivery and management of public services, particularly at a time of heightened technological innovation and increased demands for digitalization.

AI, as a byproduct of the ability to learn massive volumes of data and produce forward-looking outcomes, has revolutionized several industries via the value addition in decision-making as well as the automatism of mundane tasks (Reyna et al., 2018). AI usage to enhance public services will optimize operation productivity and quality services through thorough analysis of information as well as codes by applying machine learning (Al Shamsi et al., 2021). For

instance, AI in public administration can automate tasks involving resource allocation, fraud detection, and citizen engagement, which can make governance more adaptive and responsive (Khan et al., 2020).

Conversely, blockchain technology offers a decentralized and permanent network of ledgers that is ideal for security and transparency in transactions. In the public sector, the use of blockchain has the potential to enhance the trustworthiness of records, reduce corruption, and restore the trust of stakeholders (Hamza et al., 2021). By offering a guaranteed and transparent way for the administration of transactions and information, blockchain technology promotes the creation of reliable and accountable public service systems (Zhao et al., 2020).

The UAE, as a progressive nation, has been at the forefront in embracing such technologies with the dream of revolutionizing its public service delivery sector. The country's investment and strategic drive in AI and blockchain are indicative of its digitalization ambitions aimed at improving service delivery and governance (Al Shamsi et al., 2021). The purpose of this case study is to look into the feasibility of AI and blockchain technology in UAE public service transactions and their transformation of the tomorrow of public administration, enabling them to be more effective in service and transparency.

LITERATURE REVIEW

In the current years, the combination of blockchain and Artificial Intelligence (AI) has also been a force driving change of revolution in government transactions, ushering an improvement in efficiency, transparency, and security that is unmatched elsewhere. The combined strength of the two technologies is a change in evolutionary leap in providing and delivering government services, particularly on the frontiers of speed in technological advances as well as growing digital innovation requirements.

AI, by virtue of its ability to process large volumes of data and provide expected results, has revolutionized different sectors through enhanced decision-making in addition to the automation of mundane tasks (Reyna et al., 2018). The deployment of AI in the public sector has the potential to enhance organizational efficiency in addition to the provision of quality services through better analysis of data together with machine learning algorithms (Al Shamsi et al., 2021). For instance, public administration AI implementation can assist in automating the task of resource allocation work, fraud detection, and citizen outreach that has the possibility of leading to more responsive and flexible government organizations (Khan et al., 2020).

But blockchain technology offers a decentralized and tamper-evident book system that is security- and transparency-friendly in transactions. Blockchain public service application offers record integrity, reduces corruption, and enables trust between stakeholders (Hamza et al., 2021). Offering a transparent and secure means of handling data and transactions, blockchain technology enables responsible and credible public service systems to be developed (Zhao et al., 2020).

Blockchain technology is applied in the case of a data structure for a linked list in order to preserve the history of transactions as a public ledger in the form of a linear chain of blocks in chronological order (Zheng et al., 2018). Each block possesses a header consisting of various components: a version of the block specifying verification needs, a parent hash pointing towards the previous block, a Merkle tree root hash of transaction roots, a timestamp, a target hashing type (nBits), and a nonce for use in hash calculation (Zheng et al., 2018). Blockchain is an implementation of replicated databases across many nodes that discards central control and enables safe data transfer (Kim, 2018).

It employs asymmetric cryptography to authenticate and secure transactions (Omohundro, 2014). Network participants settle on a consensus protocol to confirm transactions between each other without an intermediary. There are three general types of blockchain systems: public, private, and consortium. Public blockchains are accessible to everyone with open contribution to the consensus, private blockchains are governed and held by a single party with limited contribution to consensus, and consortium blockchains comprise predetermined members of greater than a single party (Buterin, 2015). Blockchain's distributed ledger is an immutably secure, tamper-evident record of transactions visible to and accessible by all members of the network but irreversible upon verification (Bailis et al., 2018). Transactions are collected in blocks sequentially connected by hash values in an append-only data structure (Puthal et al., 2018). This decentralized setup is less expensive and less prone to failure at certain points, yet maintains privacy, security, and data integrity (Scriber, 2018). Recent advances in artificial intelligence (AI) have exploited the limitations of growing amounts of big data and computing capacities, with more focus on data-driven approaches than algorithmic approaches only.

This has enabled AI to handle and comprehend data at a more rapid pace and perform repetitive as well as intricate tasks (Brynjolfsson & Mitchell, 2017). AI has become a generic tool for service innovation across various sectors, employing methodologies such as machine learning (ML), artificial neural networks (ANN), genetic algorithms (GA), multi-agent systems (MAS), and natural language processing (NLP) (Stone et al., 2016). Although all these improvements, the knowledge on the wide implications of AI to the labor market, organizational framework, and society is limited. Technological assimilation does take time to alter production and settle legal and cultural issues. Also, AI sparks ethical questions in terms of privacy of data, decision-making, and whether autonomous systems would take over human employment, thus influencing government administration (Butterworth, 2018).

Liu and Kim (2018) demonstrate the necessity of systematic comprehension of AI uses in the public sector. They, through their work that employed secondary data and content analysis, established eight primary ICTs, such as AI, big data, and IoT, which have been implemented in governance. It did not include thorough descriptions of the effects on governance processes and state-citizen interactions and did not address current advances (Liu & Kim, 2018).

Governments sort their activities along the Classification of Functions of Government (COFOG) categorization, splitting public sector activity into types such as general public service, health, and education (IMF, 2001; IMF, 2014). This offers a method of ascertaining

where AI solutions are in place or under development. AI and blockchain technology are evolving at a very rapid pace, and both are complex with business implications. Blockchain is making transactions automated and decentralized, secure data management possible through the assistance of smart contracts. Blockchain remains misunderstood as fully decentralized and not under any control, as it is developed by core developers (Panarello et al., 2018).

AI can be improved in blockchain networks through the utilization of blockchain platforms for machine learning and data handling from various sources like IoT devices and smart cities. There are various opportunities for AI and blockchain integration (Panarello et al., 2018; Salah et al., 2018).

In the public sector, AI and blockchain can be used to enhance decision-making and improve efficiency. Blockchain is best used in digital identity management and secure digital record keeping, but with AI, it can be susceptible to bias and propagate questionable practices, and thus unintentionally propagate bias and encourage problematic practices (Wirtz et al., 2018). Both technologies have common challenges such as security, privacy concerns, scalability, and smart contract vulnerabilities (Salah et al., 2019).

Bettoni et al. (2021) proposed a model of SMEs assessing their AI adoption readiness. The model was created based on carrying out a state-of-the-art review and interviewing SME managers and concludes that there are limitations in existing tools employed by firms to measure AI readiness.

The model has five pillars: Digital and Smart Factory, Data Strategy, Human Resources, Organizational Structure, and Organizational Culture. However, the small sample size (only two interviews) limits the range of opinion in the research. The suitability of the model will vary according to the SME's industry and technological base, and no external validation of the evaluation process is available.

Holmstrom (2022) suggested an AI-readiness framework to assess the readiness of an organization to adopt AI technologies for digital transformation. The framework examines four dimensions: Technologies, Activities, Boundaries, and Goals. Though it employs a scoring system (0-4) to assess readiness, it does not provide explicit information on how these dimensions interact with each other. The framework was piloted in an insurance company workshop, but there is no empirical validation, and concerns are raised about its validity and reliability.

Sanda, Pavlidis, and Polatidis (2022) developed a blockchain readiness assessment framework for the healthcare sector. The framework addresses regulatory readiness through an investigation of blockchain structure, applications, and regulatory issues. It possesses dimensions such as Motivational Readiness, Structural Readiness, Engagement Readiness, and Technological Readiness, and considers significant stakeholders such as regulators and business organizations. The adaptation of the framework for other sectors and its empirical verification are not discussed. The key dimension and stakeholder selection process is also not transparent.

The United Arab Emirates (UAE) is a federation of seven emirates along the east coast of the Arabian Peninsula in Southwestern Asia. The emirates are Abu Dhabi, Dubai, Ajman, Sharjah, Umm al-Qaywayn, Ra's al-Khaymah, and Al-Fujayrah. It has a population of approximately 9,264,000 and a total area of 71,024 square kilometers. The UAE is blessed with natural resources in the form of petroleum and natural gas, which represent about one-tenth of global reserves. The resources are a major contributor to the national budget, while there are other sectors like date farming, cattle rearing, and fishing that propel the economy (Peterson & Crystal, 2023). The UAE is truly working in the direction of technological and digital transformation, reflected through initiatives such as the "UAE Digital Government Strategy 2025" with an aim to infuse digital aspects into master government policies (UAE Government Portal, 2023a).

The UAE is a federal state, where power is shared between a central national government and the individual emirate local governments. The supreme body is the Federal Supreme Council, made up of the leaders of the seven emirates. H.H. Sheikh Mohamed bin Zayed Al Nahyan holds the office of President, while H.H. Sheikh Mohammed bin Rashid Al Maktoum is Vice-President and Prime Minister, as of May 2022. Local governments and the federal government collaborate with other institutions including Executive Councils, Ruler's courts, ministries, and Consultative Councils within the local state (UAE Government Portal, 2023b).

The federal government of the UAE is structured into the five main authorities: The Supreme Council, The President and his deputy, The Council of Ministers, The Federal National Council, and The Federal Judiciary. The exclusive legislative and executive authority over some matters by the federal government involves education, health services, federal passports, immigration, and air traffic control (UAE Government Portal, 2023b).

Aim and Objectives

This study aims to address the following key issues:

1. **Feasibility Analysis:** Assess the practicality of deploying AI and Blockchain technologies within the UAE's public service sector, considering current technological, regulatory, and organizational constraints.
2. **Implementation Challenges:** Identify and analyze the barriers to successful implementation, including technological, regulatory, and operational obstacles.
3. **Impact Assessment:** Evaluate the potential impacts of AI and Blockchain on public service efficiency, transparency, and citizen satisfaction in the UAE context.
4. **Recommendations:** Provide actionable recommendations for policymakers and practitioners on how to overcome identified challenges and leverage these technologies to enhance public service transactions.

Problem Statement

As governments worldwide attempt to foster efficiency, transparency, and security in public service transactions, the integration of emerging technologies like Artificial Intelligence (AI)

and Blockchain is being explored more than ever. In the United Arab Emirates (UAE), a frontrunner in digital transformation initiatives, there is a growing interest in examining how these technologies can be leveraged to improve the provision of public services. Although AI and Blockchain hold huge promise to revolutionize public service transactions, their viability in the UAE's distinctive government and operating contexts remains to be comprehensively examined. AI and Blockchain technologies in public services are typically faced with regulatory compliance, technical integration, and stakeholder acceptance issues in their present applications. Empirical research is also missing that examines how these technologies can be effectively integrated into the UAE's existing public service ecosystem.

Study Questions

1. How do current AI and Blockchain technologies address the key regulatory and technological challenges in UAE public service transactions?
2. What are the measurable impacts of AI and Blockchain implementation on the efficiency and transparency of public service transactions in the UAE?
3. What are the primary factors influencing stakeholder acceptance and resistance to AI and Blockchain technologies in UAE public services?
4. What improvements or adaptations are necessary for AI and Blockchain technologies to better align with the UAE's public service needs and regulatory environment?

METHODOLOGY

The research aimed to gather participants' views on the challenges, key issues, and impacts their organizations face due to advancements in AI and Blockchain technologies. A survey was conducted using a structured questionnaire available online via Google Forms for one month. The questionnaire was divided into four sections: Introduction, Demographic Data, Research Objective Questions, and Project-Related Questions. Participants primarily included professionals from the four main case study organizations.

Focus group sessions were organized with subject matter experts to discuss and define the factors affecting the impact and implementation of AI and Blockchain technologies in the case study organizations. The proposed conceptual framework was presented, which included five stages of change (Initial, Developed, Defined, Managed, Optimized) and four dimensions of change (Strategy, Technology, People, Process). Participants provided insights on each stage and dimension, including challenges, drivers, and barriers to implementing these technologies. Five focus group sessions were held, involving experts from the UAE Federal Government, Abu Dhabi Local Government, Dubai Local Government, Ajman Local Government, and the private sector. These sessions, moderated by the researcher, were conducted in Dubai, Abu Dhabi, and Ajman. Leadership interviews were conducted in two sessions. The first session included seven structured interviews with AI and Blockchain experts from the UAE Federal Government, Abu Dhabi Local Government, Dubai Local Government, Ajman Local Government, and the private sector. The interviews were carried out in open-ended and

sequential fashion. The Leadership Interview Questions Form, organized into five sections, i.e., Introduction, Research Approach, Review of AI and Blockchain Maturity Models, Stages and Dimensions of the Proposed Framework, and Challenges and Suggestions for Improvement, was used. The form asked for extensive insights into the application of AI and Blockchain technologies and obtained suggestions on enhancing adoption among UAE public sector organizations.

Thematic Analysis coupled with subsequent thematic network methodology was applied in qualitative data analysis to understand participants' perceptions and experience regarding AI and Blockchain technologies. Thematic analysis is a systematic way of arranging and interpreting open-end responses to elicit meaningful interpretation, patterns, and information. Braun and Clarke (2008) argue that thematic analysis seeks to identify and examine patterns (themes) across data and report them.

Themes may be identified through deductive or inductive reasoning. Deductive or top-down approach identifies themes from data content, while deductive or top-down approach uses pre-conceived themes based on existing theories. A deductive approach was used here as the research was trying to seek answers to some research questions. The semantic themes were analyzed using only surface meanings of the data.

Thematic analysis is aided by thematic network analysis, in which themes are categorized under three: Basic Themes, Organizing Themes, and Global Themes. Basic themes are of lowest order and have very little context in themselves. Organizing themes combine similar basic themes to form more meaningful observations. Global themes are of highest order, summarizing and encapsulating the overall findings of the analysis.

Thematic analysis combined with thematic networks has been used in various studies. For example, Jung et al. (2022) explored user experiences with kitchen appliances using thematic analysis to identify key themes related to usability, affect, and user value. Similarly, Heimbirger et al. (2018) investigated academics' experiences with recorded audio feedback in higher education, identifying themes related to dialogue diversification and load reduction. These studies utilized thematic networks to represent and organize the themes, providing detailed insights into user experiences and challenges.

DATA ANALYSIS AND PRESENTATION

For this study, data collected from all case studies via interviews & focus group sessions was amalgamated to investigate different case studies collectively and put the analysis into common frames which provide broader & generic information. However, for each case entities' particular challenges or its capacity in terms of various dimensions & factors of maturity model can be analysed at later stage by leveraging maturity model.

The amalgamated / combined dataset was analysed by following six main stages of thematic network which include 1) coding dataset, 2) identifying themes, 3) constructing thematic networks, 4) Describing & exploring thematic networks, 5) summarizing thematic networks, and 6) interpreting patterns / drawing final conclusions. The analysis resulted in 6 global

themes/networks which are illustrated following the last three stages of thematic network analysis which includes describing each thematic network, summarizing all thematic networks & interpreting patterns. Each of these networks is represented and described as follows:

Network of Main Drivers behind AI & BC Deployment/implementation

The thematic network for global theme titled as “Main Drivers behind AI & BC Deployment/implementation” has been illustrated in the figure 1.



Figure 1: Main Drivers behind AI & BC Deployment

This network is composed of 8 organizing themes which have been composed of 39 basic themes. The code cloud represented in figure 2, illustrates the codes and their frequency throughout the global theme. The solidness of colour of code and the font size of the code

corresponds to its frequency, meaning that for higher frequency, colour of code will be denser with larger font size. For example, the code “Cost-Saving”, is appearing larger in font and the colour is dense, meaning that this code has appeared very frequently as compared to “job-creation” code, which is appearing very light in colour and also have smaller font size as compared to cost-saving code.



Figure 2: Code cloud of Main Drivers behind AI & BC Deployment

Participants from interviews and focus groups agreed that AI and Blockchain (BC) technologies can significantly enhance data management by providing immutable transaction records, identity verification, and effective data analysis. They further stated that these technologies would be capable of optimizing operations, resource planning, and decision-making, and delivering better business performance by reducing errors, preventing fraud, and establishing trust.

Besides, BC and AI technologies are seen as key drivers in economization by improving productivity, reducing the labor cost, and higher economic growth through automation and innovation. The technologies are also expected to transform public services in the UAE by providing quicker, more precise, and citizen-centered services, in addition to transparency and accountability. Finally, the participants highlighted the UAE's vision of emerging as a world leader in BC and AI with potential benefits being job creation, increased marketing, and infrastructure enhancement. These technologies are pivotal in driving innovation and transforming the UAE into a competitive and innovative platform.

Main Challenges behind AI & BC Implementation in UAE Public Sector

The "Main Challenges in Implementing AI & Blockchain" network discusses the main obstacles to the adoption of these technologies in the UAE public sector. It is a big and

complicated network of 7 organizing themes and 27 basic themes. Two of the primary organizing themes, "Internal Barriers" and "External Barriers," are sub-networks of the overall "Main Challenges" network. These sub-networks explore the internal and external obstacles that organizations encounter when integrating AI and Blockchain technologies. These challenges are discussed in detail in the following section. The network is depicted in Figure 3.

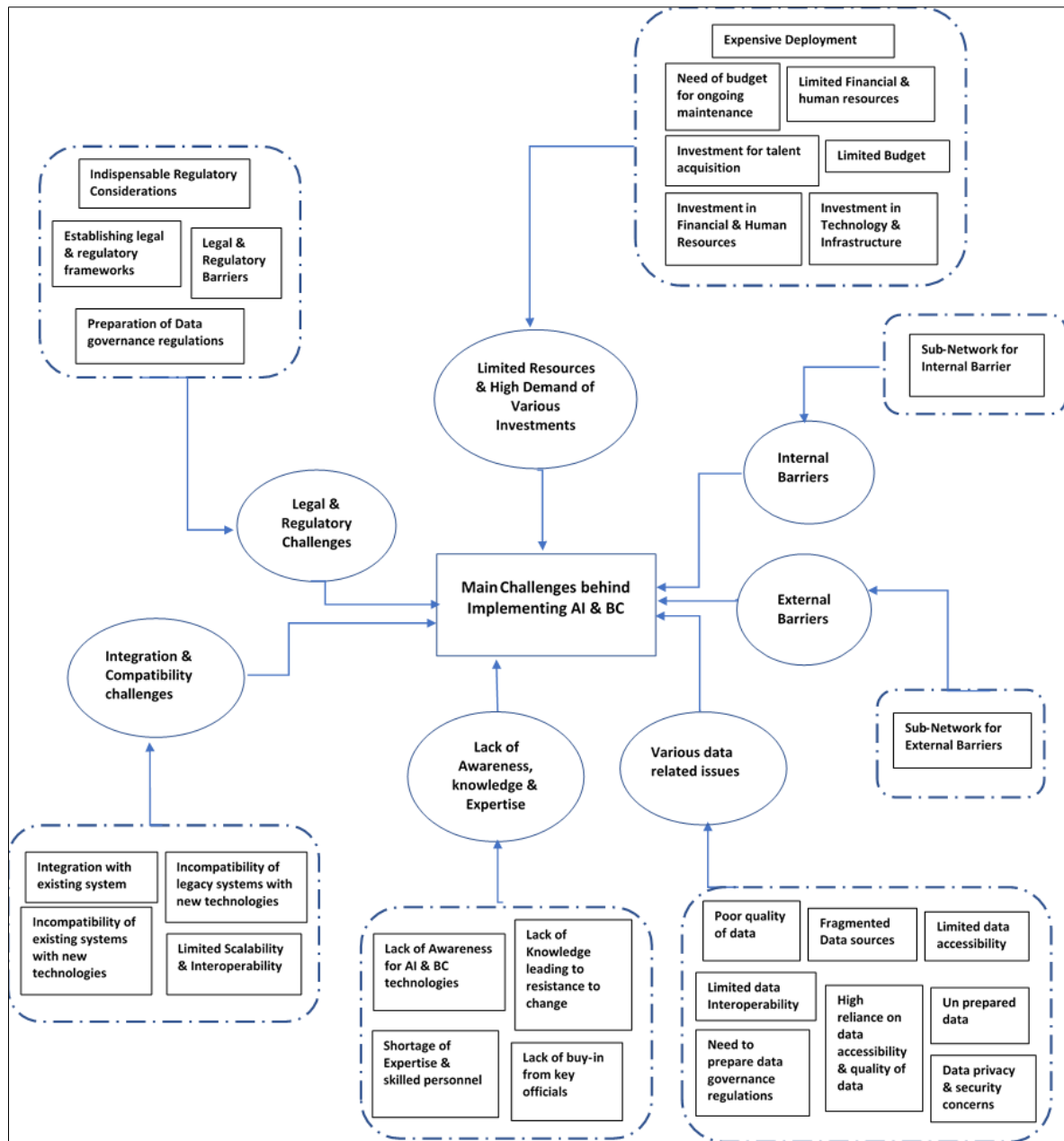


Figure 3: Main Challenges behind Implementing AI & BC

The figure 4, represents the cloud of codes according to their occurrence frequency in a whole dataset. Higher the frequency of code is, larger is font size of code with dense colour.



Figure 4: Code cloud of Main Challenges behind Implementing AI & BC

The main challenges in implementing AI and Blockchain (BC) in the UAE public sector include limited resources and high demand for investments, as discussed by most focus groups and interviewees. The development and deployment of AI and BC solutions require significant financial, technological, and human resources, which may strain budgets and resources, especially given competing priorities. Additionally, there is a shortage of skilled professionals, necessitating investment in training and development.

Legal and regulatory challenges are also significant, with AI and BC technologies needing to comply with existing frameworks and address data protection, intellectual property, and cybersecurity concerns. The integration of AI and BC with existing systems presents compatibility issues, especially with legacy systems, making the process complex and time-consuming. It leads to a lack of knowledge and experience among major stakeholders, hence less investment and support in these technologies. Moreover, data issues such as low-quality data, faulty sources, and data privacy also pose difficulties that require stringent data governance models for effective adoption.

In addition to the fundamental challenges, the Internal Barriers network, as shown in Figure 5, highlights the internal barriers that organizations encounter in adopting, deploying, or implementing AI and Blockchain technologies and their related solutions. The network has three organizing themes, which are further divided into 12 basic themes.

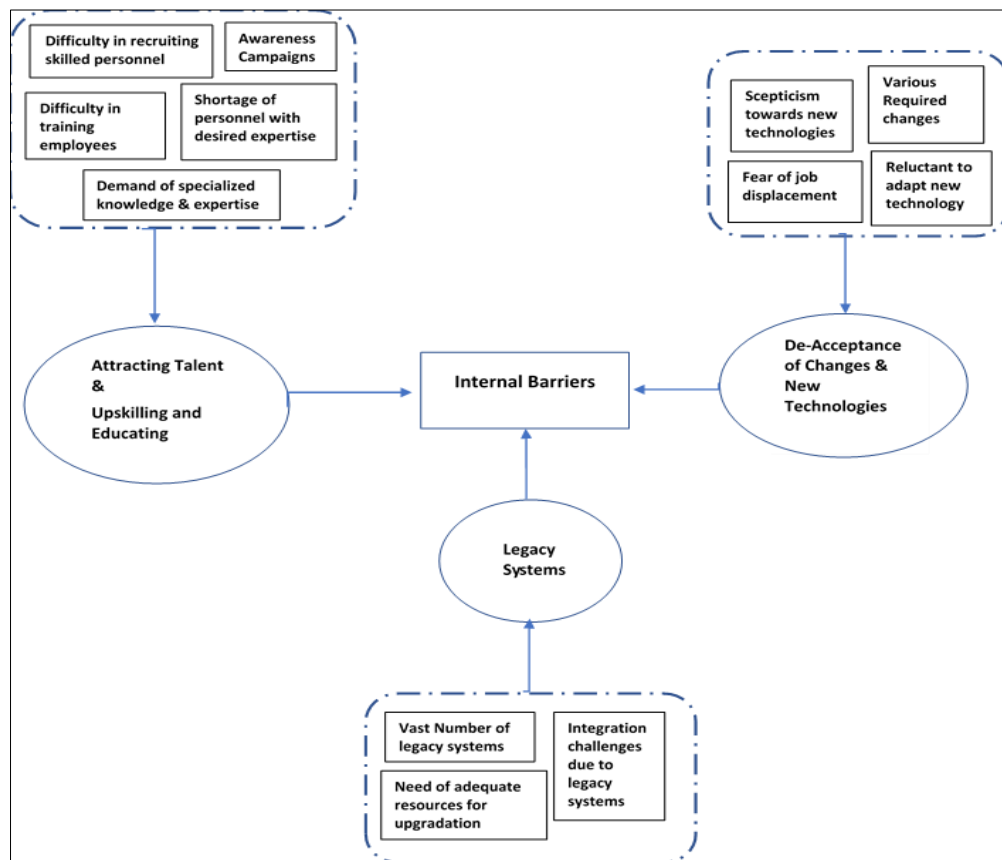


Figure 5: Internal barriers

The majority of the interviewees and focus groups discussed the topic "Attracting Talent & Upskilling and Educating." All participants highlighted that the effective adoption of AI and Blockchain technologies requires a highly skilled workforce, but since there is a shortage of such talent, attracting, recruiting, and retaining talent is challenging. Retaining employees, particularly skilled employees, is extremely challenging, as they can relocate elsewhere in search of more appealing opportunities. To combat this hurdle, organizations have to invest in the upskilling and reskilling of their existing workforce through workshops and collaboration with universities. However, insufficient funds, time, along with a deficiency of interest on the part of the employees, could hamper such efforts. In addition, creating awareness among opinion leaders or key stakeholders about AI and Blockchain benefits is imperative for securing their buy-in. The topic of "De-Acceptance of Changes & New Technologies," brought up by most focus groups and interviewees, highlights that the adoption of AI and blockchain technologies within organizations typically necessitates significant process, operational, and employee skill set changes.

Resistance to such changes is inevitable, particularly due to a lack of experience and fear of job loss among stakeholders and employees, which creates reluctance in the adoption of new technologies. Effective change management policies and awareness programs need to be

adopted to clear such hurdles. The topic of "Legacy Systems," which was also widely discussed, emphasizes the challenge of integrating AI and blockchain technologies into the UAE public sector's outdated IT infrastructure and databases. The majority of legacy systems are incompatible with new technologies, requiring significant modifications or redesigning, potentially causing compatibility, interoperability, and resource allocation issues. Their replacement or upgrade demands significant time, technical resources, and expertise.

External Barriers to AI & Blockchain Adoption, Deployment, and Implementation

The External Barriers Network outlines the challenges organizations encounter from external sources when integrating AI and Blockchain technologies into their operations. This network consists of five organizing themes and 19 basic themes, as illustrated in figure 5.10, with the corresponding code Cloud shown in figure 6.

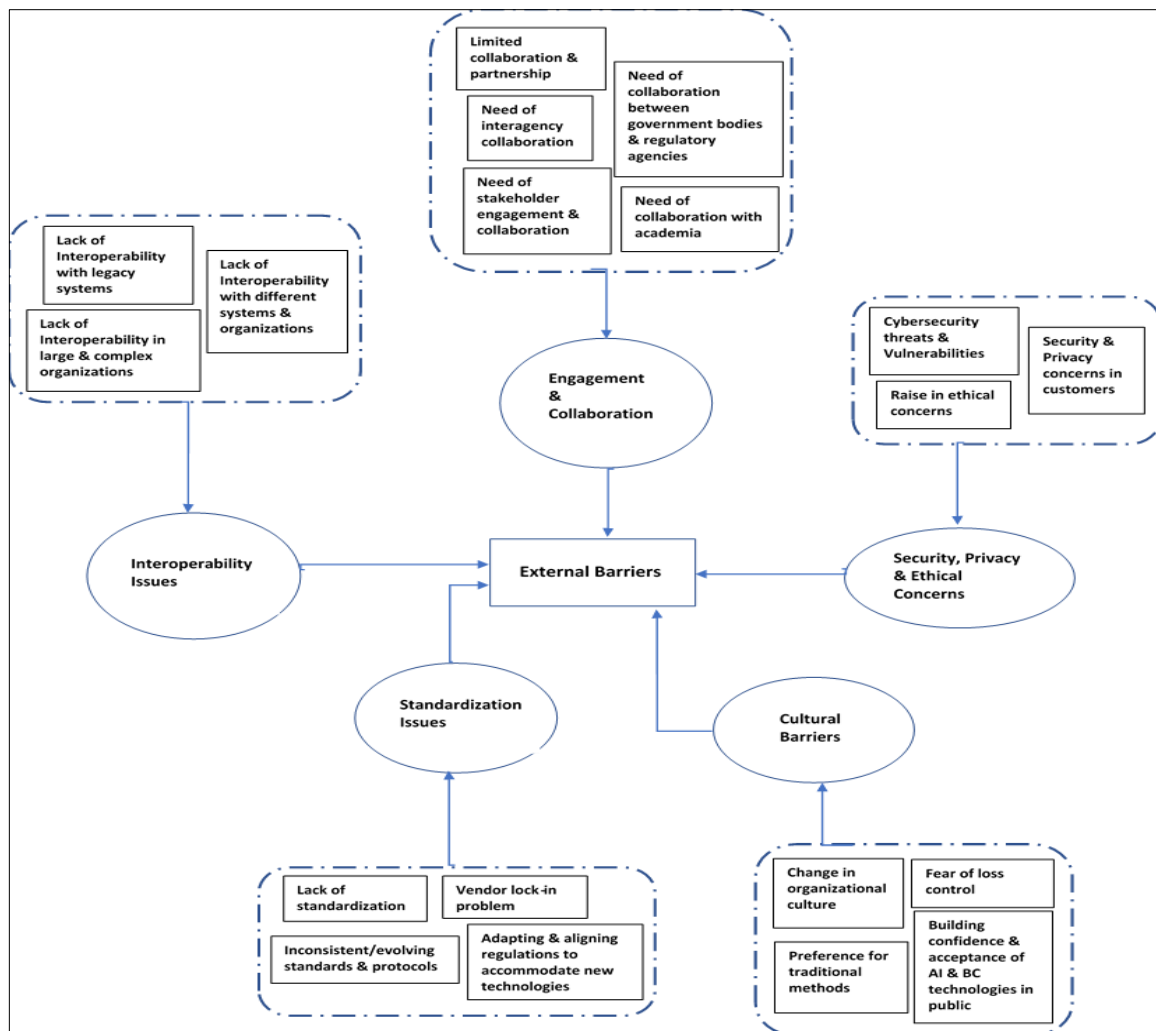


Figure 6: External barriers

The organizing theme of Engagement & Collaboration was highlighted by all focus groups and two interviewees as crucial for the successful implementation of AI and Blockchain technologies in the UAE public sector. Participants emphasized the importance of collaboration between different agencies, departments, and both public and private sectors. However, achieving this level of coordination is challenging. There exists a strong imperative for engagement with powerful stakeholders including regulators, technology suppliers, and industry associations, as they play a significant role in the adoption process.

Members said that AI and Blockchain adoption has a tendency to involve numerous government agencies and stakeholders, which makes collaboration, coordination, and goal alignment between departments difficult. It is essential to have clear governance structures, communication channels, and coordination processes for successful implementation.

Also, the government officials and experts in the law must come together to create appropriate legal and regulatory standards for these technologies. However, there is always a general challenge in the public sector with minimal collaboration and partnership, thus slowing down the implementation process. Single organization efforts to implement AI and Blockchain technologies can be more challenging without general collaboration and shared best practices.



Figure 7: Code cloud of External barriers

The theme of Security, Privacy & Ethical Issues was prioritized by 4 out of 5 focus groups and 6 out of 7 interviewees. They discussed that the use of AI and blockchain technologies in the public sector is majorly concerned with data security and privacy issues due to citizens' sensitive data. These issues can lead to the resistance of the adoption of these technologies. Robust security measures are necessary to protect against unauthorized access, data loss, and misuse, so privacy and security are both critical and problematic.

Ethical concerns, including fairness, bias, transparency, and accountability in AI systems and blockchain networks, were also highlighted. Governance frameworks and ethical principles to address the issues were stressed by stakeholders. In addition, unless controlled, these technologies are exposed to cybersecurity breaches, so cybersecurity considerations are relevant.

The Cultural Barriers topic, posed by 4 of the 7 interviewees and by both of the focus groups, highlighted cultural factors such as resistance to organizational culture change, loss fear of process and data control, and desire to make use of established practices.

Employees can favor familiar, paper-based processes, preventing the adoption of AI and blockchain technologies. Building trust and acceptance among citizens and stakeholders and establishing the trust in these technologies is most important, but building public trust in UAE public sector organizations remains a primary challenge. The theme of Standardization Issues, cited by all focus groups and 4 of the 7 participants, emphasized the value of standardized protocols and frameworks to enable open communication and interoperability.

Lack of standardization and changing legal and regulatory frameworks for AI and blockchain technologies were quoted as major issues. These bring uncertainty and could potentially hinder adoption. The threat of vendor lock-in, where entities are trapped into employing specific technology vendors, was also highlighted, focusing on the importance of maintaining vendor neutrality.

Finally, the Interoperability Challenges theme, referred to by 4 out of 5 groups and 6 out of 7 interviewees, was regarding difficulties in bringing AI and blockchain solutions into existing systems and processes. It is crucial to facilitate interoperability between systems, departments, agencies, and technologies but particularly difficult in large and complex organizations. The presence of legacy systems in the UAE public sector makes it even more complex and requires careful planning, coordination, and investment

Evaluation Network for the Provisional Model of AI & Blockchain Implementation and impact in UAE Public Sector

Participants were asked to provide their perspectives on the proposed "provisional model/conceptual framework" designed to evaluate the implementation and impact of AI and blockchain technologies in the UAE public sector. This framework, depicted in Figure 8, includes five horizontal stages of change: Initial, Repeatable/Developed, Defined, Managed, and Optimized, and four vertical dimensions of change: Strategy, Technology, People, and Process.

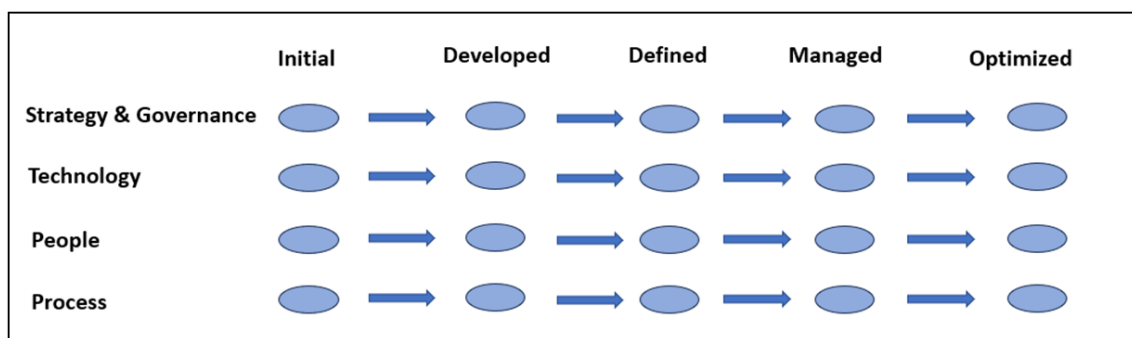


Figure 8: Provisional Model

The feedback from participants on this provisional model has been summarized and is presented in the "Evaluation of Provisional Framework's Network." This network consists of two organizing themes and 11 basic themes, as illustrated in Figure 9, with the associated code cloud shown in Figure 9.

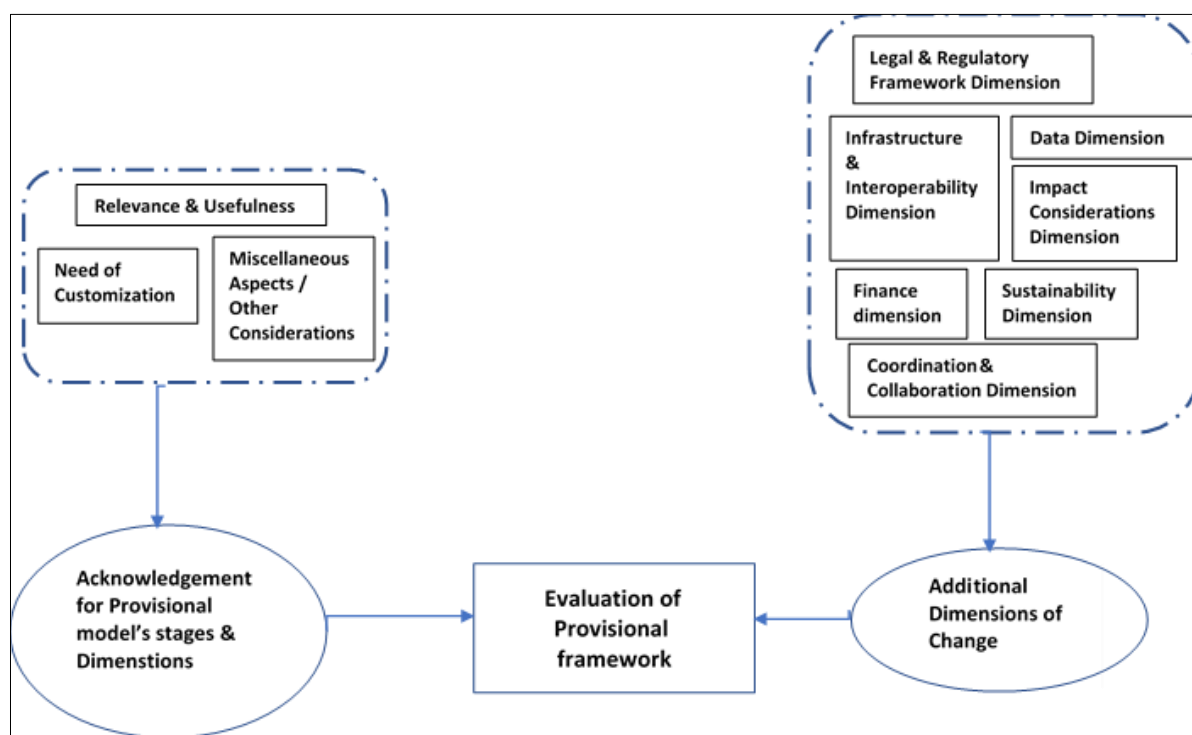


Figure 9: Evaluation of Provisional framework

The organizing theme "Acknowledgement for Provisional Model's Stages & Dimensions" was addressed by all interviewees. They acknowledged that the proposed conceptual framework's stages and dimensions are essential, appropriate, relevant, and useful for evaluating the implementation and impact of AI and blockchain technologies. Each stage of change—Initial, Repeatable/Developed, Defined, Managed, optimized—represents a specific level of maturity

In addition, interviewees emphasized the need to take into consideration other aspects such as ongoing observation, stages prioritization, adaptation levels, specific circumstances, and company attributes. As the implementation of these technologies is incremental and their impact is dependent on factors like adoption levels, quality of data, and regulatory controls, the framework may need to be contextualized based on the use case of application and scenario. According to one of the interviewees, "Generally, while these stages and dimensions can provide a useful framework, the individual stages and descriptions will perhaps need to be adapted and fitted to the particular context and challenge that the UAE public sector is working within in terms of deploying AI and blockchain technologies."



Figure 10: Code cloud of Evaluation of Provisional framework

The organizational theme "Additional Dimensions of Change" was discussed by all the interviewees, who pointed out that depending on some goals, implementation environments, and application scenarios, other important dimensions should be considered. In the words of one interviewee, "It is important to determine the right dimensions of change applicable to the particular implementation and its effect.". Therefore, it is advisable to consult specialists in the area or conduct research to identify any other elements of change in regard to particular use cases." Although the dimensions of the temporary model are well-suited, dimensions like

infrastructure & interoperability, ethical or social implications, governance, and regulation would enhance the model to be holistic.

Finances and sustainability are critical in successful adoption of such technologies, making them compulsory elements to factor in. Integration of AI and blockchain also leads to legal and ethical issues, particularly concerning data security and regulation compliance, making legal & regulatory and data domains compulsory to consider. Among the interviewees highlighted, "The policy and regulatory environment has an enormous potential to impact the adoption and deployment of AI/Blockchain technologies in the public sector. Therefore, it needs to be evaluated as to whether there is compatibility of these technologies with present policies and regulations and whether changes are required."

The other considerations are ethical, environmental, societal, and cultural impacts, which can be addressed through impact considerations dimensions. The technologies require advanced technological infrastructure and system interoperability, so infrastructure & interoperability dimensions need to be taken into account as well. Coordination and collaboration between various stakeholders, including academia, technology vendors, and government officials, are necessary for proper implementation, hence coordination/collaboration dimensions are required.

One of the interviewees opined, "Implementation of AI/Blockchain technologies in the public sector is successful only if there is an engagement and coordination of multiple stakeholders. It is thus critical to assess the extent of stakeholder engagement and coordination in the implementation."

Network of Ways & Means to Improve the Adoption, Implementation, and Deployment of AI & Blockchain Technologies

In the adoption network for enhancing the adoption, implementation, and deployment of AI and Blockchain technologies, the institution representatives shared their perspectives and suggestions after gaining experience. There are six organizing themes and 25 basic themes in this adoption network, as shown in Figure 11. Setting the Ground: Discussed by all focus groups (5/7) and most interviewees (6/7), this theme emphasizes the need to prepare the environment for successful technology adoption. The main steps are:

1. **Regulatory Frameworks:** Create comprehensive frameworks that operate in harmony with UAE laws, fostering responsible deployment and addressing legal, ethical, and privacy concerns. The frameworks should protect citizens' rights and manage biases.
2. **Data Governance:** Put in place robust data governance mechanisms to foster data quality, availability, accessibility, integrity, security, and privacy.
 - Participant Quote: "Developing an integrated governance framework can help ensure that AI and Blockchain solutions are used responsibly, ethically, and transparently. This can involve developing clearly defined guidelines and standards for data privacy, security, and ethical use, and developing mechanisms for oversight, accountability, and risk management..."

3. **Objective Definition:** Clearly define implementation objectives, required resources, project priorities, timelines, and expected outcomes to tailor solutions to project needs and facilitate effective monitoring and evaluation.
4. **Infrastructure Modernization:** Upgrade IT infrastructure by developing data centers and cloud-based platforms to support AI and Blockchain applications.
5. **Knowledge Sharing:** Create platforms, forums, and communities of practice where AI and Blockchain experts and organizations can exchange knowledge, share success stories, and offer lessons learned.
 - Participant Quote: “Establishing platforms or forums for sharing best practices, success stories, and lessons learned can accelerate the adoption and implementation of AI and Blockchain solutions.”

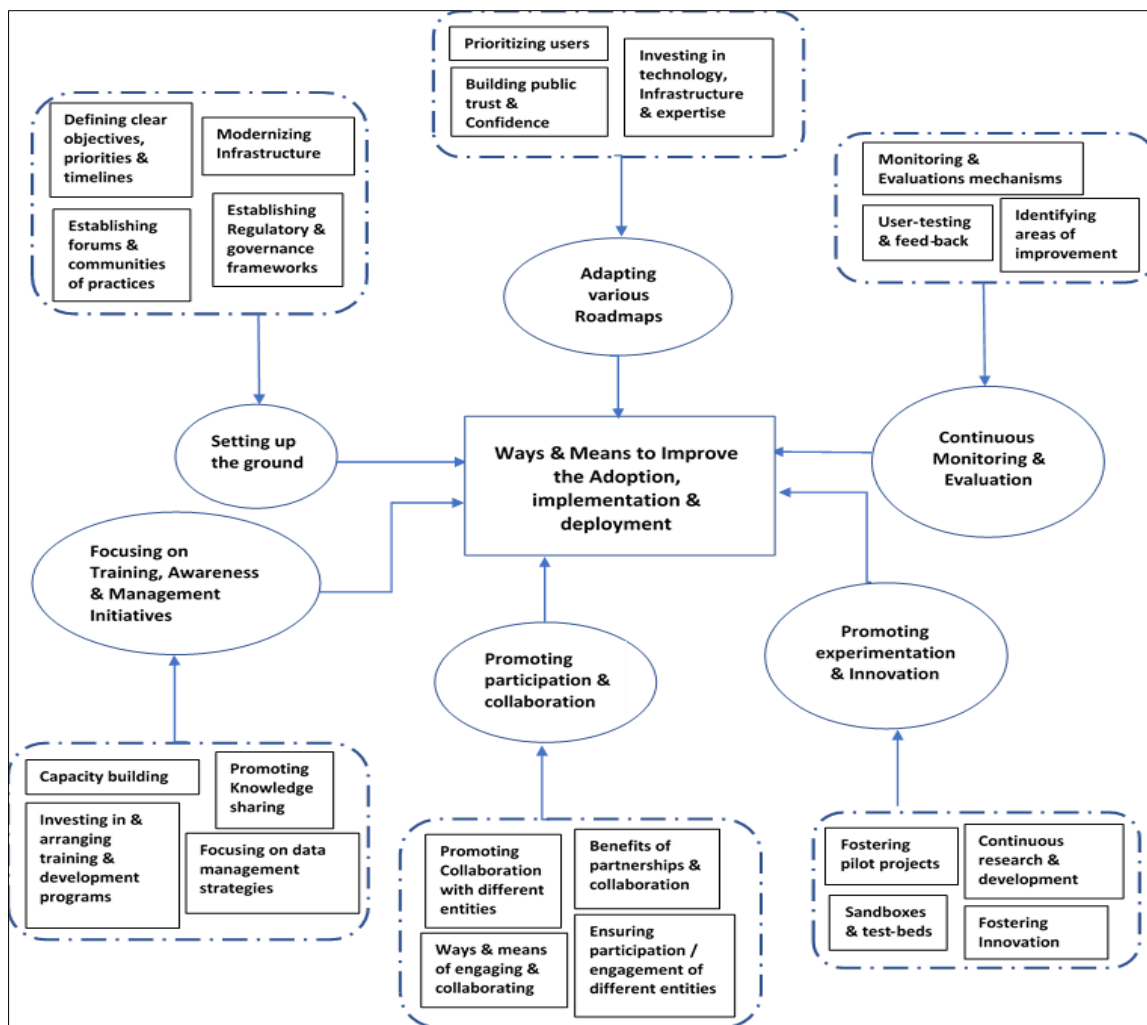


Figure 11: Ways & Means to Improve the Adoption, implementation & deployment

The *code cloud* representing the codes of this network, is give in figure 12 where the intensity & font of the code corresponds to its frequency of occurrence in whole dataset.



Figure 12: Code cloud of Ways & Means to Improve the Adoption, implementation & deployment

The organizing theme "Adapting Various Roadmaps" was discussed by all focus groups (5/5) and most interviewees (5/7). Participants emphasized the importance of several strategies to enhance the adoption and deployment of AI and Blockchain technologies. Key recommendations include:

1. Investments in Infrastructure and Expertise: Significant investments are needed in both technological infrastructure and expertise development programs. Upgrading the UAE public sector's infrastructure and developing specialized skills are crucial for accelerating adoption.
2. User-Centric Approach: The implementation should prioritize users by adopting a user-centric design approach. Engaging stakeholders and end-users during the design and development phases helps create solutions that meet their needs and expectations.
 - Participant Quote: "AI and blockchain solutions should be designed with the user in mind, and should prioritize user experience, accessibility, and usability."

3. Addressing Concerns: Building trust and addressing concerns related to data privacy, security, and ethical issues is essential for gaining public confidence and fostering adoption.
 - Participant Quote: “Building trust and addressing concerns related to data privacy, security, and ethical implications can foster public support and acceptance of these technologies.”
4. Ongoing Monitoring and Evaluation: Monitoring and evaluation should be conducted regularly to ensure that technologies address evolving needs in the public sector. This includes using feedback loops, updating regulating systems, and reassessing performance metrics.
 - Participant Quote: "Set precise metrics and key performance indicators to gauge the impact and return on investment of AI & blockchain initiatives. Track and assess the results on a routine basis to ascertain areas to optimize and enhance".
5. Encouraging Experimentation and Innovation: Encouraging a culture of innovation by means of pilot projects and controlled experimentation can assist in solving problems on a smaller scale before wide-scale deployment. Encouraging ongoing learning and risk-taking among AI and Blockchain experts is also crucial.
 - Participant Quote: “Conducting pilot projects and proof of concepts can provide valuable insights and practical experience before scaling up.”
6. Ostering Participation and Collaboration: It is necessary to create partnerships with suppliers of technology, consultants, research institutions, and regulatory bodies. Such alliances can attract resources, know-how, as well as solve problems like the lack of specialists.
 - Participant Quote: "Collaboration with private sector, start-ups, and research institutions can bring in expertise, innovation, and resources to spur the uptake of AI & blockchain technologies”.
7. Training, Awareness, and Management Programmes: Shortfalls in knowledge and skills must be removed with training and awareness programmes. The programmes must cover technical as well as non-technical areas of knowledge of the technologies to ensure an efficient workforce and a knowledge-sharing culture.
 - Participant Quote: "Building the necessary skills and competency in public sector organizations is central to the effective adoption of AI & blockchain solutions. Investment in training programs, workshops, and other capacity development schemes can help build a competent workforce to effectively make use of and implement these technologies."

Network of AI & Blockchain Training & Awareness Initiatives at different stages

The AI & Blockchain Training & Awareness Initiatives network shows how training and awareness activities evolve in five stages of change: initial, developed, defined, managed, and optimized, as seen in figure.

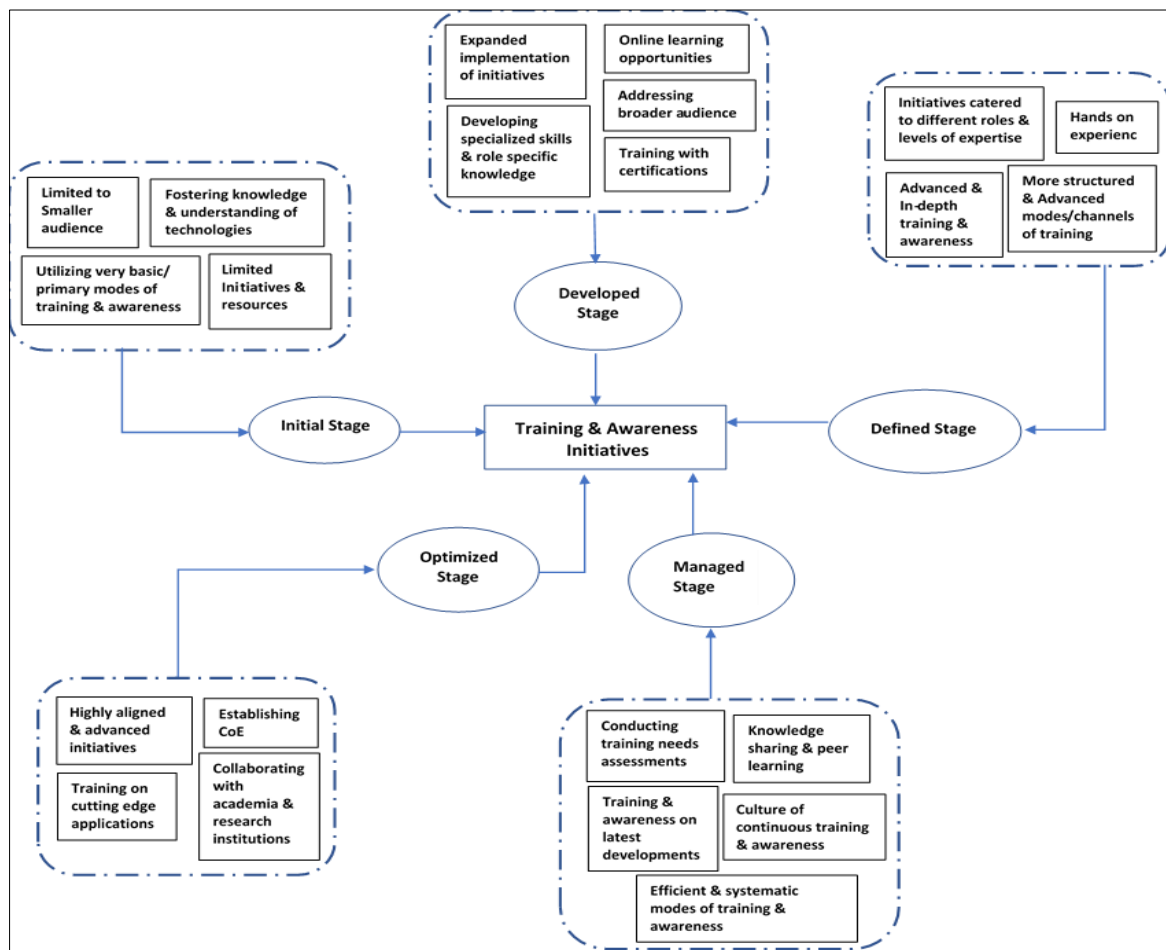


Figure 12: Network of Training & Awareness Initiatives

During the initial stage, training and awareness are aimed at exposing the target group to the basics of AI and Blockchain technologies. Minimal efforts are involved in developing the foundation knowledge in this stage using straightforward approaches such as awareness campaigns, workshops, and seminars. The audience here is usually limited and comprises key stakeholders and technical teams directly involved in the first stages of implementation.

As the technologies reach the developed stage, training and awareness initiatives become more formalized and universal. Organizations begin to invest in upskilling employees to benefit from best practices and manage these technologies effectively. Awareness initiatives spread to the stage of case studies, real-life implementations, and success stories, and training extends to people in general, encompassing all the teams and departments that are engaged in the implementation process. Such partnerships can be done with institutions of learning so as to provide specialized training and certification programs, which can be provided in online and offline platforms. In the established phase, training programs are more incorporated into organizational culture and tailored to meet the specific needs of various roles in the

organization. This phase includes advanced training providing in-depth knowledge and hands-on experience with tools, algorithms, and techniques for AI and Blockchain. More structured and sophisticated types of training, such as newsletters, internal knowledge platforms, and conferences, are used to enable ongoing learning. As the company moves into the managed state, focus shifts to continuous training and awareness, putting industry domain knowledge, technology innovation, and regulatory compliance first. Continuous needs analysis for training occurs to diagnose skill gaps and enhance programs. Training grows more formalized and collaborative, leveraging knowledge sharing systems and communities of practice to facilitate peer learning and continuing professional development. Finally, training and awareness initiatives at the best level are highly specialized with the emphasis on building innovation. Specialized Centers of Excellence (CoE) are established to support ongoing development, mentorship, and research. Academic institution and industry network collaborations are enhanced to promote innovation and stay up-to-date with the latest technological advancements. Training is focused on future technologies and sophisticated applications so that the workforce is skilled and well-equipped to tackle future challenges.

CONCLUSION

The networks shown above show a holistic view of how various dimensions and phases affect the adoption, implementation, and deployment of Blockchain and AI technologies. These findings emphasize the character of a multi-faceted approach to incorporate the technologies appropriately into organizations and governments. Secondly, the other dimensions of change indicate the need to be mindful of a wide range of factors beyond the fundamental dimensions of technology adoption. As reiterated by our interviewees, there is the need to confront infrastructure, governance, legal and ethical concerns, as well as coordination among stakeholders when attempting to establish a flexible and overarching network for AI and Blockchain solutions. The broader vision here is so that technological rollouts are not only effective but sustainable and regulation-compliant as well. On the question of technologies for supporting adoption, implementation, and deployment, the networks handle root causes such as establishing regulatory environments, development of infrastructure, and collaboration. Well-established correct goals, effective administration, and enabling platforms for information exchange are requirements for successful integration of technologies. Monitoring and evaluation are also requirements in assessing domains where change needs to be initiated and that the technologies align with evolving requirements and legislation.

The training and awareness programs at various levels of change highlight the incremental and methodical approach towards gaining expertise. From familiarization to higher-level training and continuous learning, every level has its own important part to play in creating an expert human resource pool that is capable of using AI and Blockchain technologies to their best. At every level, the focus is from general knowledge to specialized competencies, promoting a culture of innovation and agility. In order to render both Blockchain and AI technologies more effective in public services, complete regulatory frameworks should be established to deal with technological, as well as legal, challenges. This entails formulating strict data privacy, security, and compliance regulations for the UAE ecosystem. Formulating such regulations will mitigate

risks associated with these technologies, facilitate their ethical use, and provide a suitable environment to implement them in public services. Second, UAE government public service agencies must invest in case studies and pilot projects to quantify the impacts of AI and Blockchain technologies in real-life situations. The pilots must gauge the improvement in efficiency, transparency, and overall service delivery. Evaluations of the outcomes of the pilots will enable agencies to establish best practices and make informed decisions for large-scale adoption. Another critical suggestion is priority education and outreach to the stakeholders. With all the stakeholders, i.e., government, service providers, and public, well informed regarding the benefits and limitations of AI and Blockchain technologies, the adoption process will be smoother. Awareness campaigns and training programs will assist in coping with resistance and a better understanding of these technologies. Lastly, Blockchain and AI solutions shall have to be customized for the UAE's specific requirements as well as regulation. This will involve technology solution customization to address local challenges, such as peculiar regulatory requirements or unique public service demands. Solution design with assistance from technology developers will optimize their performance and render them more responsive to the UAE's public sector programs.

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