Blockchain-integrated Enterprise Architecture for Vaccine Distribution Systems: Application of the Australian Government Architecture Framework – A Case Study

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Abstract

The paper demonstrates how the Federal Government can adopt an enterprise architecture (EA) framework to support the integration of blockchain technology for vaccine rollout processes, using the case of vaccine distribution in Australia. Although the Australian Government has put substantial effort into designing the vaccine rollout program, the evidence of cold chain breaches in the past indicates possibilities of ineffectiveness. Therefore, increased transparency through blockchain technology integration seems to be a promising solution. The EA framework recommended for the Australian Government in this context is the Australian Government Architecture (AGA) Framework which is adapted from the Federal Enterprise Architecture Framework (FEAF). The AGA outweighs other frameworks in several dimensions including the specific design for unifying information and policies among federal government agencies, as well as the focus on the process, speed, and safety of vaccine distribution. The application of the five reference models from the AGA to the enterprise architecture will enable the government to address specific blockchain integration requirements. With the support of a suitable EA, the blockchain-embedded system is expected to facilitate three merits to the Australian Government: boost citizen's trust in safe vaccine delivery, reduce the risks of fraud, and strengthen traceability. Although this report only demonstrates one design tailored to EA for the Australian Government, the outcome of this paper aims to inspire other government agencies to follow the approach to practically select and apply a proper EA framework for designing architecture that supports the blockchain-based transparent vaccine dissemination process.

1. Introduction

After the outbreak of COVID-19, the invention of an effective vaccine against the virus has gained more and more attention (e.g. Le et al., 2020; Pernenkil & Lewis, 2020). Yet, the reliability of the coronavirus vaccine would not solely be the convincing solution to the current pandemic if the government cannot ensure that the vaccine is distributed and delivered safely to the public (Schwartz, 2020). A transparent and credible vaccine dissemination process is required, and blockchain seems to be a promising facilitator to such an aspiration, as the technology allows all participants within the network to receive real-time information regarding the flow of the vaccine in a synchronised manner (Nakamoto, 2008; Qiu & Zhu, 2021; Yong et al., 2020). As the information is encrypted and stored in every ledger within the distributed network, hacking and data breaches can be mitigated (Ramirez Lopez & Beltrán Álvarez, 2020). Nevertheless, integrating a blockchain system into an existing IT infrastructure requires the government to prepare for a suitable EA to support the technology-specific features (Gong, Yang, & Shi, 2020). Therefore, this is the avenue where EA comes to play.

EA is widely deemed as a management practice to align technological infrastructure and IT systems with the business processes within an organisation (Langenberg & Wegmann, 2004). It is typically used as a guideline for organisations to capture the most value from such IT systems (Tamm, Seddon, Shanks, & Reynolds, 2011). EA practice is adopted in government globally to set strategic objectives and govern changes from as-is state to the desired target state (e.g. Paul & Paul, 2012; Valtonen, Korhonen, Rekonen, & Leppanen, 2010). Nevertheless, EA for government is typically more complex than for a single organisation as there are multi-connected systems operating in several government agencies (Seppanen, Heikkila, & Liimatainen, 2009). Although prior research has investigated several areas of the government EA application, such as factors contributing to effective government EA implementation (Lee, Oh, & Nam, 2016; Ojo, Janowski, & Estevez, 2012; Shaanika & Iyamu, 2015) and government EA to support big data and cloud computing (Lnenicka & Komarkova, 2019; Lnenicka, Machova, Komarkova, & Pasler, 2017), the study that addresses the government EA for blockchain technology is scarce.

Motivated by the importance of blockchain for vaccine distribution and the shortage of literature regarding the EA for blockchain, we propose the following research question:

"How can the government adopt an enterprise architecture framework to support the integration of blockchain technology for vaccine distribution?"

Initially, the paper outlines a case study of the vaccine rollout plan in Australia. The possible issues in the plan are then analysed, followed by the evaluation of blockchain capabilities and specific features for designing EA. In Section 5, a few EA frameworks are examined, and the Australian Government Architecture (AGA) Framework is chosen. Following that, Section 6 demonstrates the application of the five reference models in the AGA to specifically design EA for blockchain-based vaccine distribution in Australia. The paper concludes with the expected merits of a blockchain-integrated vaccine rollout system.

2. Analysis of the Australian Government Vaccine Distribution Plan

We analysed the Australian Government case for their substantial effort in the vaccine distribution plan. The plan incorporates aspects of managing logistics, distribution and storage, along with monitoring the visibility of the vaccines (Department of Health, 2020). The selected logistics and distribution operation providers, DHL and Linfox, will collaborate with the Australian Department of Health (DoH) to develop a distribution network that will also include all remote areas (Department of Health, 2020). The widely spread cold chain network will enable the government to cover and reach most of the population for immunisation. The distribution providers will also be responsible for vaccine tracking and management throughout the supply, from production to administration locations, as well as for reporting crucial temperature details or any cold-chain breach (Department of Health, 2020). Considering the high vulnerability of cold chain breaches attributing to the specific cold chain requirements of the vaccines, for example, -70 degrees for Pfizer vaccine, and the high temperature in Australia, it is highly imperative to ensure a rigorous cold chain and its visibility across the distribution network.

Along with the cold chain management by the distribution partners, the "point in time" visibility of the vaccines across the cold chain will be monitored by an IT solution implemented by Accenture (Department of Health 2020). The IT solution will also provide visibility of the vaccine receipt by the health centres, patients and for monitoring the after-effects of the vaccine (Department of Health, 2020). These contracts together will probably allow the government and the stakeholders to monitor and ensure compliance throughout the manufacturing to delivery process.

Furthermore, the government will provide governance guidelines for the medical centres along with specialised training to the immunisation workforce for ensuring constant compliance in the safety and integrity of the vaccines (Australian Government, 2020b). The governance guidelines will allow the government to streamline the immunisation workforce with the digital supply chain. The guidelines will also enforce a reporting mechanism to report cases of cold-chain breach, vaccine security at storage locations, and for managing stock and waste (Australian Government, 2020b).

Although the government vaccine rollout plan seems to be robust and promising, the incorporation of a manual reporting mechanism develops suspicion on the effectiveness of the digital supply chain in tracking breaches at storage locations. Moreover, although the government has announced visibility through a digital supply chain, the specifications of its effectiveness in identifying and reporting cold chain breaches has not been elaborated.

3. Possible Issues in Australian Government Vaccine Distribution

Australia has experienced several cold chain issues in the past. Firstly, there has been a lack of transparency in reporting the actual causes and the number of cold chain breaches. For instance, Woodley (2019) reported a statistic that there were over 12000 cases of cold chain breach in Australia over the five years before 2019, the reasons of which remained unclarified by the government. It also mentioned that some territories even refused to report the statistics, making the actual numbers unclear.

There is also evidence of lack of data integration across authorities. For instance, Woodley (2019) indicated discrepancies in the data provided by the states and the DoH about the percentage of discarded vaccines due to cold chain breaches.

Furthermore, the issue of inefficient storage management is reflected in an incident reported in Haydar (2019) where expired or inappropriately stored vaccines in a Sydney clinic led to the re-vaccination of around 3000 patients who were vaccinated at said clinic, while also underlining the inefficient record-keeping in retrieving patient information.

Considering the massive scale of COVID-19 vaccine distribution and the offshore administration of the Pfizer vaccine (Tsirtsakis, 2021), the aforementioned issues call for a nation-wide integrated and transparent system that can monitor and track the entire cold chain to ensure compliance in the safety and integrity of the vaccines. Moreover, the current strategy of managing and reporting cold chain breaches at storage locations (Australian Government, 2020b) requires a manual engagement and could be vulnerable to compliance issues. Therefore, end-to-end transparency is essential to ensure the tracking of possible breaches.

4. Blockchain Application for Vaccine Distribution Process

Blockchain was originally coined as a distributed infrastructure containing a number of blocks that contains a duplicated set of encrypted digital information (Nakamoto, 2008). The technology is capable of allowing participants to share and receive information with all parties within the network in a synchronised fashion (Crosby, Pattanayak, Verma, & Kalyanaraman, 2016). The data stored in the ledgers are also encrypted and only accessible by authorised parties (Nofer, Gomber, Hinz, & Schiereck, 2017). With such exceptional attributes of blockchain, several information system experts believe that the application of blockchain can help increase the transparency and security strength in a vaccine distribution process (e.g. Antal, Cioara, Antal, & Anghel, 2021; Ramirez Lopez & Beltrán Álvarez, 2020; Yong et al., 2020).

To briefly describe mechanisms of the blockchain-based vaccine system, Yong et al. (2020) comprehensively explained that there are three interrelated chains consisting of a number of blocks, in which each chain stores different types of information. Specifically, the Good Manufacturing Practice (GMP) chain can be used to store batch production records and batch packing records, the Release chain can be used to keep information associated with testing processes such as spot sampling, seal sampling and inspection, and the Inoculation chain can be used to record information related to the recipient of the vaccine, the medical professional and the vaccination centre. In one block of each chain, the transaction related to vaccine activities uploaded by different entities is recorded. Each transaction consists of timestamp, sender, recipient, and the data pertinent to the transaction (Yong et al., 2020). All of this information is also monitored by the smart contract in which it automatically queries vaccine records and detects expired vaccines (Grishchenko, Maffei, & Schneidewind, 2018). With all of this mechanism, a blockchain-integrated system can help address the issues of vaccine expiration and vaccine record fraud (Yong et al., 2020).

Nevertheless, to achieve such a scheme, there are multiple features of blockchain implicitly suggested in prior literature that should be taken into consideration when designing EA, including but not limited to distributed network infrastructure, database interoperability design, security management, the flow of data, and specific agreement and standards (Ramirez Lopez & Beltrán Álvarez, 2020; Yong et al., 2020). Therefore, there is a need for the government to choose an EA framework that provides the structure that allows the incorporation of these aforementioned blockchain features.

5. EA Framework Selection

In the context of Australia's COVID-19 vaccine rollout, integration of systems and technology is extremely important to carry the task. It involves multiple government agencies (e.g. National Immunisation Program (NIP), Australian Technical Advisory Group on Immunisation (ATAGI), Therapeutic Goods Administration (TGA), Office of Gene Technology Regulator (OGTR)). As argued previously, the task is susceptible to problems related to security, which can be mitigated by the application of a blockchain-based distribution system. However, deploying that initiative requires alignment of IT systems of all agencies taking part in the task. An EA framework can guide this alignment process to bind particular, shared, and whole tasks of those agencies (Australian Government Information Management Office, 2011a)

EA for government institutions is different from corporate institutions due to the nature of government agencies, in which they are diverse yet bounded into one governmental structure (Isomäki & Liimatainen, 2008; Weerakkody, Janssen, & Hjort-Madsen, 2007). As such, EA should provide interoperability and resource sharing that eventually support the delivery of individual and shared services to the public (Australian Government Information Management Office, 2011b; Hjort-Madsen, 2006). While different agencies might use separate frameworks to develop EA, it is imperative to aim for unification of language and concepts in EA development, without overriding the current frameworks that have been used across different agencies (Australian Government Information Management Office, 2011b)

Several alternatives of EA frameworks are available to guide the development of EA practices in government. However, we argue that most of them are less appropriate to government agencies, particularly in the context of vaccine rollout. The Open Group Architecture Framework (TOGAF™) is well understood as a comprehensive architectural framework that aligns IT and business through the design, plan, implementation, and governance of IT systems (Josey, 2016). However, limited practical templates/tools of how to actually architect the enterprise becomes the disadvantage of TOGAF (Kotusev, 2016). This is particularly critical when we consider the vaccine rollout context that requires immediate development of EA initiative. In a similar vein, the Zachman Enterprise Architecture Framework (ZEAF™), while enabling multiple stakeholder views in the EA development (Zachman, 1987), has low interoperability which is actually critical for the EA of government institutions (Australian Government Information Management Office, 2011b; Hjort-Madsen, 2006). Alteration after the implementation in ZEAF is challenging due to its document-heavy and process-heavy nature (Lu, Wang, Wang, Wang, & Yuan, 2020). Another option is the Federal Enterprise Architecture Framework (FEAF), which was specifically designed to enable the unification of information and policies among federal government agencies (Adenuga & Kekwaletswe, 2012). This is suitable to be applied in Australia which also adopts the federal government system. Although it has a limited focus on leveraging technology to increase business value (Ji & Xia, 2007), we argue that it would not affect the ability of the government to achieve the main goal of vaccine rollout, which is to deliver it fast and safely rather than achieving business-related metrics such as cost and profit. Therefore, with those pros and cons, we argue that FEAF is a potential and appropriate framework to embed the blockchain-based distribution system in the context of vaccine rollout by the Australian Government. Table 1 summarises the comparison of positive and negative points for TOGAF, ZEAF, and FEAF in the context of Australia's vaccine rollout.

In the context of Australia, the Australian Government developed the Australian Government Architecture (AGA) Framework in 2011, which was heavily influenced by the development of FEAF (Australian Government

Information Management Office, 2011a). In that sense, AGA takes the advantages of FEAF as well as increased fitness of the framework for the Australian context. The scope of AGA is also extensive and holistic, covering all services performed independently or collaboratively by Australian Government agencies, Australian jurisdictions, and private business (Australian Government Information Management Office, 2011a). Therefore, we propose the AGA framework as the main EA framework to be used by the Australian Government to embed blockchain-based technology into government agencies taking part in the COVID-19 vaccine rollout, ensuring the safe and secure delivery of vaccines.

Table 1. *Summary of positive and negative points for TOGAF, ZEAF, and FEAF in Australia's vaccine rollout context*

Framework	Positive Point	Negative Point	Contextual Justification
TOGAF	Comprehensive architectural framework that aligns IT and business through the design, plan, implementation, and governance of IT systems (Josey 2016).	limited practical template/tools of how actually architecting enterprise IT system (Kotusev 2016).	**Negative point outweighs the positive point.** The context of vaccine rollout put pressure in the time needed to embed blockchain-based system. Therefore, the presence of practical template/tools of how actually architecting enterprise system that aligns IT and business process will be very helpful.
ZEAF	Enable multiple stakeholders view in the EA development (Zachman 1999).	Low interoperability. Alteration after the implementation of enterprise architecture is challenging due to document and process heavy (Lu et al. 2020).	**Negative point outweighs the positive point.** In the context of vaccine rollout, multiple government institutions and systems need to liaise. Therefore, high interoperability is required.
FEAF	Specifically designed to enable unification of information and policies among federal government (Adenuga & Kekwaletswe 2012).	Limited focus on leveraging technology to increase business value (Ji & Xia 2007).	**Positive point outweighs the negative point.** Australia adopts federal government system. Vaccine rollout, specifically in Australia, is a task that demand highly coordinated action among 6 states and 2 territories. Also, it does not focus on business related metric such as cost and profit. It focuses on the quality of the process, the speed, and safety.

6. The application of the AGA framework for a blockchain-embedded EA

This section specifies how the DoH in collaboration with ATAGI, TGA, OGTR, and NIP (Australian Government, 2020a) can adopt the AGA framework to support the integration of blockchain technology and ensure the security of vaccine distribution processes. AGA comprises five reference models as shown in Figure 1 (Australian Government Information Management Office, 2011b).

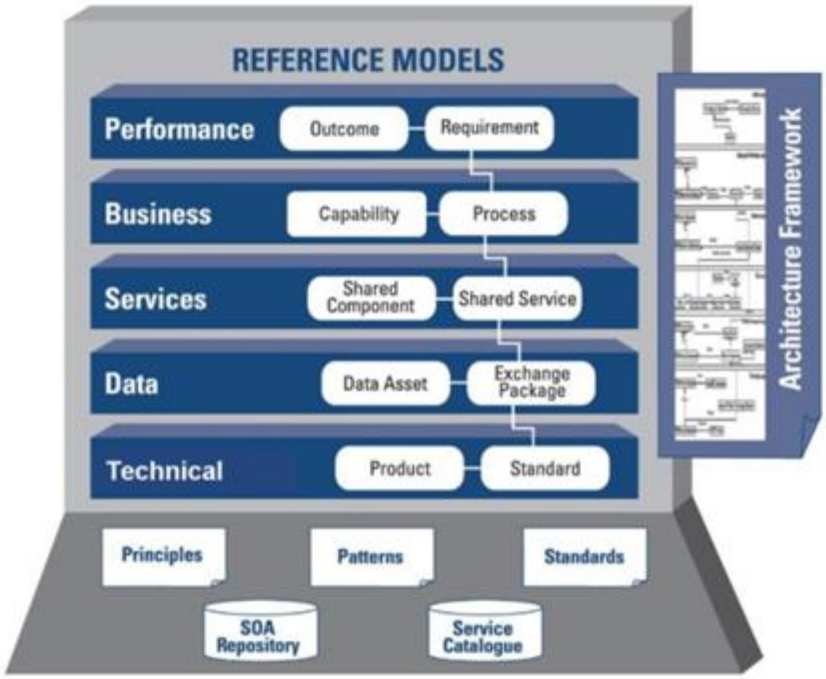

Figure 1. *Five Reference Models of the AGA framework (Australian Government Information Management Office, 2011a)*

6.1 Performance Reference Model (PRM)

PRM is an outcome-focused measurement framework that supports the government agencies to design and implement effective business measurement systems and performance-based architecture. It comprises five measurement domains and fourteen domain sub-types, as shown in Figure 2. Each subtype comprises the sub-type attributes which are used as the criteria (measurement grouping) for aggregating the measurement indicators within the same business theme for both quantitative (i.e. costs, time, and capacity) and qualitative indicators (i.e. compliance alignment and consistency), as illustrated in Figure 3 (Australian Government Information Management Office, 2011b).

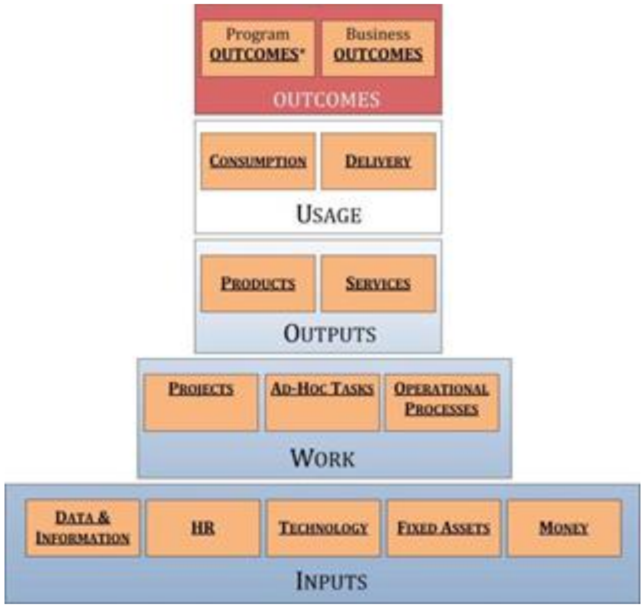

Figure 2. *Five measurement domains and fourteen domain subtypes of PRM (Australian Government Information Management Office, 2011b)*

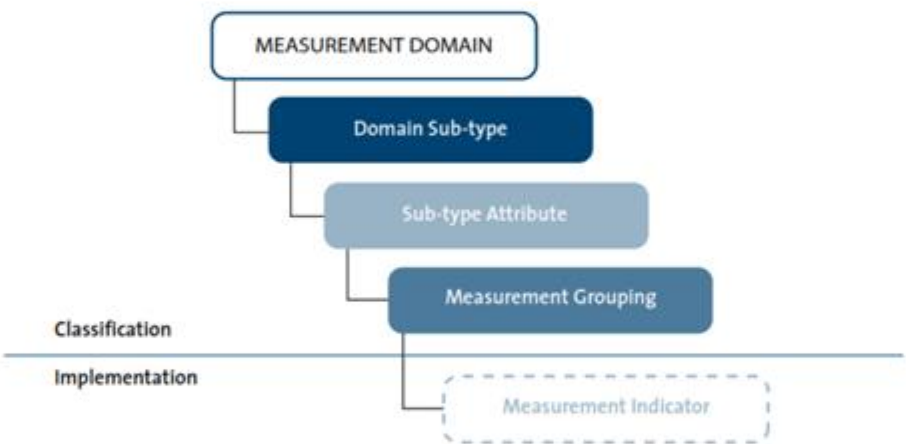

Figure 3. *The PRM Structure (Australian Government Information Management Office, 2011a)*

For example, considering the additional investment in IT infrastructure to create the distributed-ledger network to secure the vaccine safety, technology (domain subtype) under the inputs (measurement domain) will be measured in costs, availability, and reliability (measurement attributes). Under the cost attribute, hardware/software/licensing acquisition cost and operation costs will be measured (measurement indicators). All key measurement indicators recommended are listed in Figure 4. The DoH can use these indicators to evaluate the feasibility of the investment in blockchain technology, improve efficiency and effectiveness in business operation, and increase transparency in operation and reporting (Australian Government Information Management Office, 2011a).

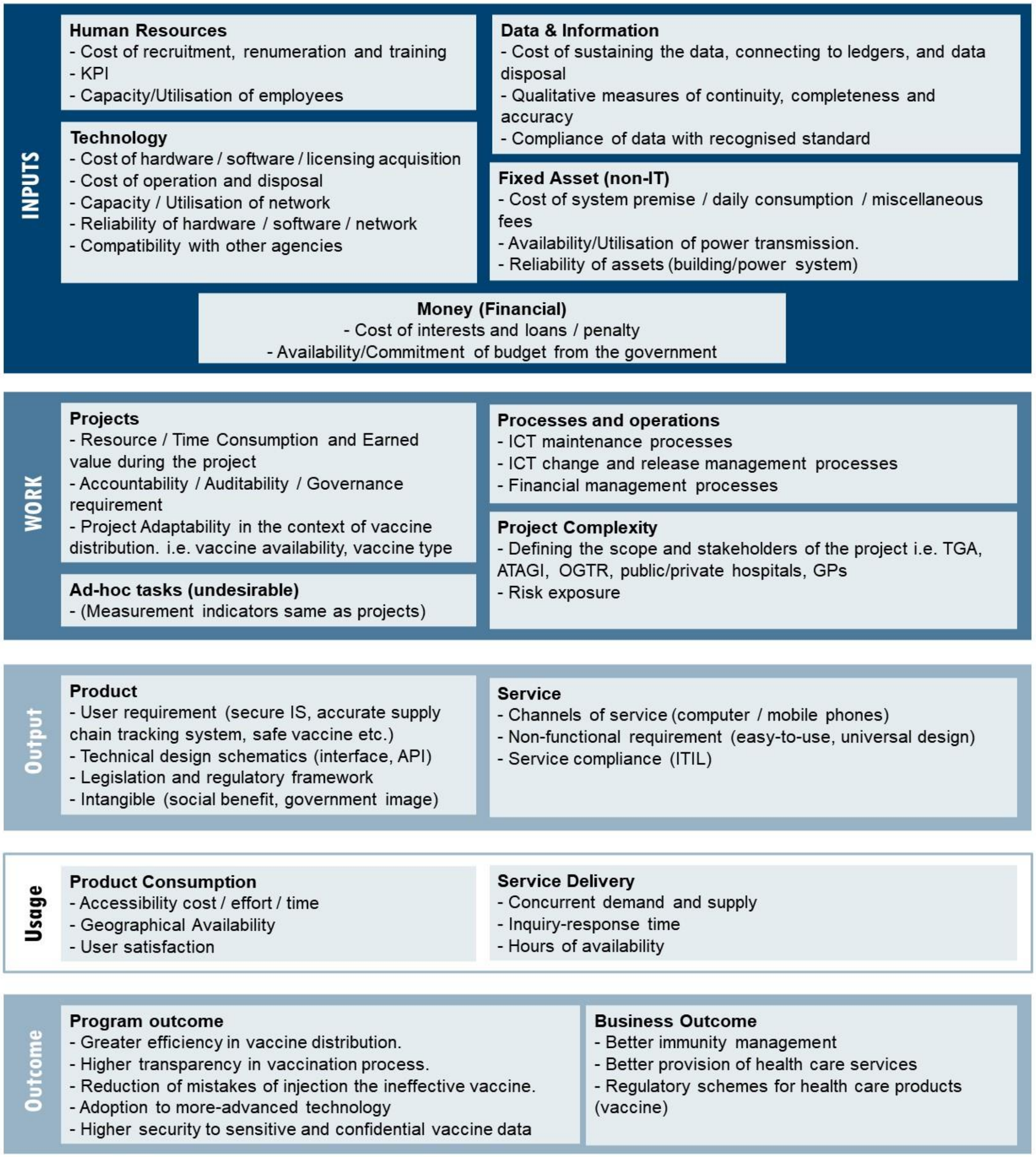

Figure 4. *The PRM Structure of the DoH in adopting blockchain technology for vaccine distribution context (based on Australian Government Information Management Office, 2011b)*

6.2 Business Reference Model (BRM)

BRM provides a framework to illustrate a functional view of a business. This view covers how the business operations are required to deliver the services for the citizens, third parties and other government agencies. The BRM structure is tiered in a hierarchy representing the business functions of the government as shown in Figure 5. There are four business areas/themes (Management of the Government Resources, Services Support, Service Paths, and

Services for Citizens). Each area is broken down into a line of businesses (LoB). Each LoB is composed of business subfunctions which are the smallest unit of work (Australian Government Information Management Office, 2011b).

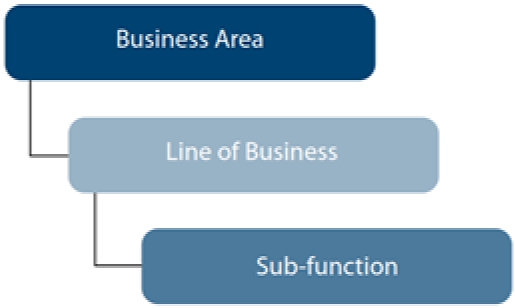

Figure 5. *The BRM Structure (Australian Government Information Management Office, 2011a)*

In this context, the DoH has to prepare the Management of the Government Resources and execute the Services Support and Service Paths to provide Services for Citizens. For example, adopting blockchain requires a group of experts to set the requirements and manage the information system to support blockchain technology. The following subfunctions need to be done:

- **Recruitment** of experts: a subfunction in the human resource management which is a LoB under the Management of Government Resources
- **Budget formation** to support those experts**:** a subfunction in the planning and budgeting which is a LoB under Services Support
- **Knowledge presentation** to other employees: a subfunction under the information and knowledge exchange which is a LoB under Service Paths

Apart from the subfunctions mentioned above, the other subfunctions in Figure 6 are required for providing support to subfunctions under Services for Citizens including customer protection, public health service and information security.

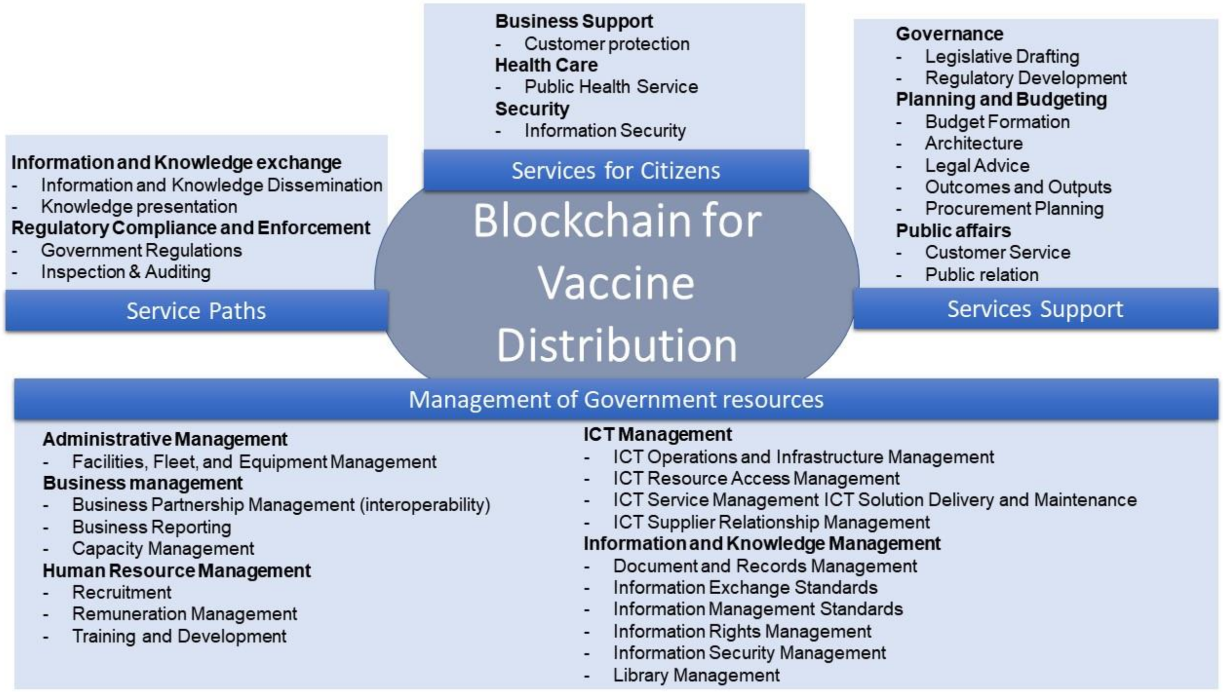

Figure 6. *The BRM Structure of the DoH in adopting blockchain technology for vaccine distribution context (based on Australian Government Information Management Office, 2011b)*

6.3 Service Reference Model (SRM)

SRM provides a model for categorising services regarding the business and performance objectives for an organisation. The model outlines the structure of services in three layers: Service Domain, Service Type, and Service Components (Australian Government Information Management Office, 2011b), as presented in Figure 7.

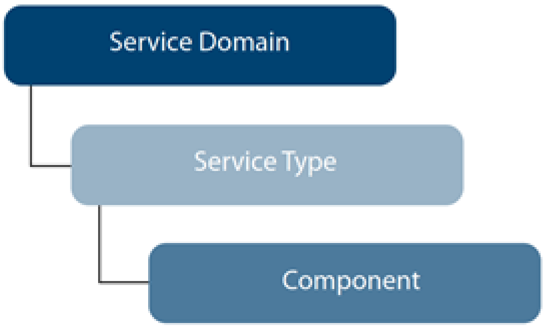

Figure 7. *The SRM Structure (Australian Government Information Management Office, 2011a)*

With the SRM, the DoH can identify the opportunities for re-use and sharing of Service Components and capabilities in different business functions. Since the use of the SRM requires detailed information about the government services which are rarely publicly published, only the security management (Service Type) under support services (Service Domain) will be discussed as it is the most relevant to the blockchain capability.

As shown in Figure 8, key service components relevant to blockchain are listed. Each service component can be reused for different processes while adopting blockchain. For example, the access control (Service Component) to the information block must be differently allowed based on the user types. The DoH employees will be able to access the process information of vaccine distribution through the distribution centres whereas the citizens can be allowed to view only the information of vaccine, its delivery status, and incident reports, if any. Some algorithms and process flows of the access control component can be reused and managed to optimise the capability of resources.

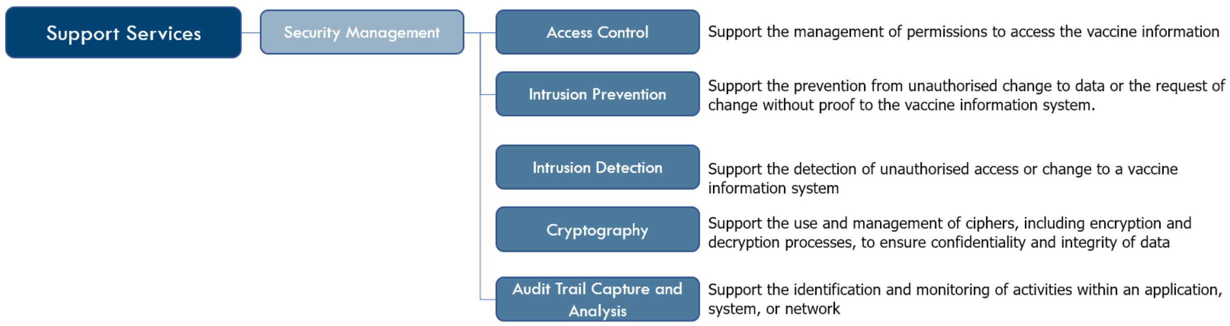

Figure 8. *The SRM Structure (Security Management) for the DoH (based on Australian Government Information Management Office, 2011b)*

6.4 Data Reference Model (DRM)

The DRM is a standards-based framework which provides flexibility and information sharing across an organisation. It provides values for an organisation's data architecture by outlining the three key components: Data Description, Data Context, and Data Sharing as illustrated in Figure 9. These components increase the consistency and the compatibility of data and information between the cross-agency data architectures (Australian Government Information Management Office, 2011a).

In this context, the Data Context area defines the information of vaccines that should be included in the blocks, establishes the data governance, and ensures that the data taxonomies can support the other AGA reference models. The Data Description area manages the uniformity of metadata in the blocks. After the Data Description and the Data Context has been formulated, the Data Sharing area will establish the data sharing architecture for the data exchange and data access for users.

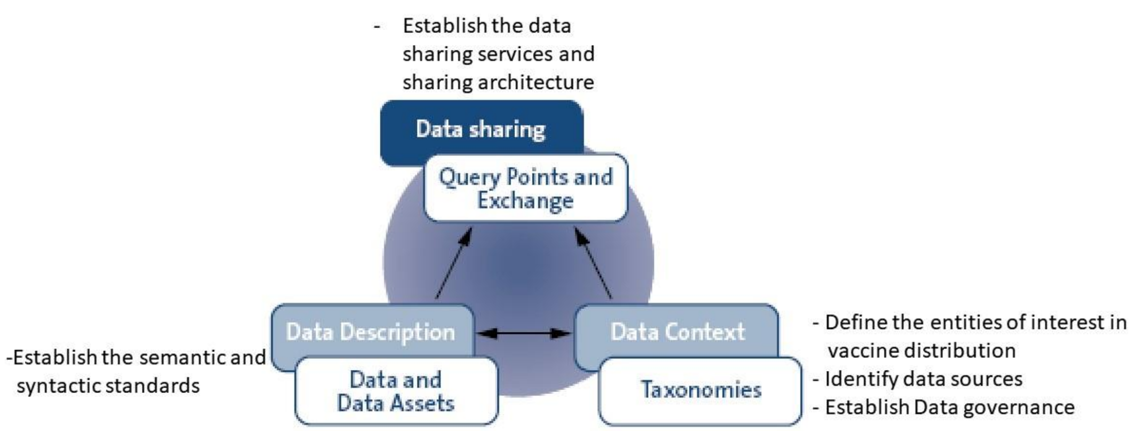

Figure 9. *The DRM Structure of the DoH in adopting blockchain technology for vaccine distribution context (based on Australian Government Information Management Office, 2011b)*

6.5 Technical Reference Model (TRM)

TRM is a framework for categorising relevant standards and technologies and establishing software and hardware inventories. The framework can be used as a guideline for estimating the capacity of the systems, identifying gaps between the baseline architecture and the target architecture, and reducing redundancy of technology components (Australian Government Information Management Office, 2011a). The DoH can use the TRM for establishing the additional technical requirements to support the other four reference models and prepare for further technical updates.

7. Benefits of blockchain-embedded government architecture

With the proposed guidance based on the AGA Framework that facilitates the integration of a blockchain-based monitoring system, the Australian Government can expect the following three benefits from the technology integration.

7.1 Increase confidence in safe vaccine delivery process

As blockchain allows every authorised participant to see the real-time, updated information stored in the system (Pilkington, 2016), the execution of such a blockchain-embedded system can leverage the transparency of vaccine information regarding its storage, handling, and transporting to the Australian population, which enhances their trust in the safety of the government vaccine distribution process. Moreover, as explicitly stated in the Australian COVID-19 vaccination policy (Australian Government, 2020a), each COVID-19 vaccine needs to have its own administration requirement. The visibility of such information, enabled by blockchain, will help vaccine recipients ensure that their received vaccine has been treated properly along its journey.

7.2 Develop immunity to fraudulent incidents

As data recorded in the blockchain ledger is encrypted and only authorised entities are allowed to access it (Nofer et al., 2017), the vaccine information input by the Australian Government, States and Territories cannot be tampered with. Also, since data is stored in multiple ledgers within a blockchain network and the data can be changed only if all relevant parties agree, manipulation or hacking all ledgers at the same time is unlikely to occur (Tapscott & Tapscott, 2016). Therefore, it is reasonable to expect a dramatic decrease in the chances of a fraudulent incident during the trip of vaccine products from the suppliers' factory to the Australian citizens.

7.3 Enhance traceability when there is an issue

In the case of any adverse event reported by a vaccine recipient, health professionals, or any relevant stakeholders in the vaccine dissemination process, the information in the blockchain system will allow the TGA to trace back into the provenance of the problem (Aste, Tasca, & Di Matteo, 2017). For instance, if an end consumer receives the wrong dose of a vaccine, the TGA can trace back the flow of that vaccine dose from the vaccine suppliers to health clinics and health professionals. The TGA can then investigate the vaccine-related activities in each stage and analyse the underlying causes of the problem.

8. Conclusion

This study acts as the first of its kind to demonstrate how the government can adopt the EA framework to support the integration of blockchain technology for the vaccine rollout process through the case study of vaccine distribution in Australia. Although the Australian Government has put substantial effort into designing the vaccine dissemination program, there are still possibilities of cold chain issues, which have happened multiple times in the past (Woodley, 2019). An increase in transparency through blockchain technology integration seems to be a promising solution (Qiu & Zhu, 2021; Yong et al., 2020).

In doing so, the Australian Government needs to prepare and adapt its EA to fit with specific features of the blockchain system. The recommended EA framework for the Australian Government in this context is the AGA, as it shows advantages over other frameworks in several dimensions. With the application of the five reference models from the AGA Framework, the adapted EA can help governmental agencies ensure that all important aspects of the integrated blockchain system are well addressed. In essence, the blockchain-integrated vaccine distribution system will help the Australian Government increase the citizen's confidence in the safety of vaccine delivery, decrease chances of fraudulent incidents, and enhance traceability.

Although this report only shows one tailored design EA for the Australian Government, other government entities can also follow the procedural approach outlined in this paper. To this end, this paper not only highlights the importance of EA in the blockchain-integrated system, but also demonstrates the application of an EA framework to a specific context of vaccine distribution, which could be used as a guideline for government agencies to practically design EA for a transparent vaccine rollout program.

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Appendix: Key stakeholders of Australia's Vaccine distribution process

Based on Australian Government (2020a) and the Department of Health (2020), The key stakeholders of the vaccine distribution process in Australia can be listed as follows:

Key Stakeholders	Responsibilities
Australian Government	To procure and safely transport vaccines in collaboration with Vaccine Manufacturers, Logistics, Distribution, and Technology partners.
Australian Government Department of Health (DoH)	To monitor and ensure safe implementation of vaccine rollout process on behalf of Australian Government.
National Immunisation Program	To ensure maximum immunisation coverage.
Australian Technical Advisory Group on Immunisation (ATAGI)	To provide scientific and evidence-based guidance for the vaccine rollout process.
Therapeutic Goods Administration (TGA)	To assess and license specific vaccines to be safely used in the program.
Office of Gene Technology Regulator (OGTR)	To assess and license specific vaccines with genetically modified organisms to be safely used in the program.
Australian Immunisation Register (AIR)	To monitor and measure immunisation coverage and provide Immunisation History Statement of individuals.
Vaccine Manufacturers § Pfizer (BioNTech) § Oxford (AstraZeneca) § Novavax (NVX-CoV2373)	To supply the contracted number of vaccine doses as per Australian Government guidelines.
Distribution and Logistics Partners § DHL Supply Chain § Linfox	To create and facilitate a national distribution network.
Technology Partner – Accenture	To provide IT solutions for visibility across the supply chain.

State and Territory Government	To ensure training of the immunisation workforce and enforcing clinical governance.
Storage and Administration Sites	To ensure compliance in safety and integrity of the vaccine cold chain.