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The IT Services Management Architecture Design for Large and Medium-sized Companies based on ITIL 4 and TOGAF Framework

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***Abstract*— The development of information technology occurs rapidly in almost all areas of life. All companies must immediately carry out a business transformation following the development of information technology to survive amid increasingly fierce competition. One of the keys to this business transformation's success is an enterprise architecture that is used as a reference in planning, developing, operating, and monitoring company information technology. Implementation of service management practices in state-owned enterprises needs to be translated into IT Services Management Architecture Design, that match the IT Governance Principles as mandated in PER-03/MBU/02/2018. This research focuses on preparing an enterprise architecture design in IT service management by referring to ITIL 4 best practices. The resulting solution is a target architecture design in the business domain, data, and applications arranged according to the TOGAF framework. It was carried out in four stages: scope identification, which defines practices; preliminary phase, which resulted in 11 architecture principles; architecture vision that produces a value chain for IT service provider organizations; a business architecture which resulted in a business service/function catalog consisting of 13 business functions and 43 business services; and an information system architecture that produces a conceptual data model on the three main priority processes of IT service management and an application use-case diagram that describes the relationship between the four actors (users, service managers, service desks, and support groups) with their roles in applications. The enterprise architecture has been designed following the scope of IT service management practices commonly used as a reference for all large and medium-sized companies.**

***Keywords*— Enterprise architecture; ITIL 4; IT service management; TOGAF.**

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I. INTRODUCTION

Establishing information technology governance is a part of Good Corporate Governance's principles implementation [1]. Information Technology (IT) governance has emerged as a fundamental business imperative, and rightfully because it is key to realizing IT business value [2]. Information technology governance covers strategic and operational policies [2]. Strategic policies reflect the broader strategic guidelines of the institution. Meanwhile, operational policies deal with day-to-day operations [3], which are used in practice to manage IT services [4].

IT planning is part of strategic policies, including the business context, enterprise architecture (vision, business, information, application, and technology architecture), IT program plan, implementation, transition roadmap, sourcing strategy, and IT valuation [1]. The TOGAF standard is a framework for enterprise architecture [5]. It provides a comprehensive approach to the enterprise information technology architecture's design, planning, implementation, and governance [6]. The core content of TOGAF is the TOGAF Architectural Development Method (ADM) which describes methods for developing and managing the life cycle of an enterprise architecture. TOGAF ADM has been widely used in enterprise information system planning in large and medium-sized companies such as colleges [7], state-owned enterprises [8], or manufacturing [9].

IT service management (ITSM) is part of operational policies [1]. The most popular framework for ITSM is the IT Infrastructure Library (ITIL) [10]. ITIL is a documented set of processes designed to define how a company's IT functions can operate. It contains a series of statements describing the procedures, controls, and resources that should be applied to various IT-related processes [11], so organizations can adopt and adapt to environmental conditions and company business needs.

Corporate information technology governance needs to be built by considering the alignment between strategic and operational policies. In this case, it means that business architecture planning, information architecture, application architecture, and technology architecture are needed to manage IT services at each stage. This research answers these needs and will focus on designing the target enterprise architecture according to the TOGAF framework in the IT service management area, which refers to ITIL 4 best practices. The enterprise architecture that will be compiled has adapted to the scope of service management practices that are commonly used to be used as a reference for all large and medium-sized companies. In addition, this research will become an essential reference in enterprise architecture and IT service management, given the limited references available. This research will present some core artifacts as a reference for large and medium-sized companies to implement enterprise architectures in line with IT service management.

Before this research, there have been studies discussing the implementation of ITIL in small and medium-sized enterprises [12]-[14], the ITIL approach to IT Governance [15], the integration between ITIL and TOGAF in the public organization [16], and higher education [17], the integration between IT service management and enterprise architecture/business process [18]-[22], and also the automation of IT service management [23]-[25]. This study will fill in the gaps of previous research, which has not explained the preparation of enterprise architecture based on the phases and common artifacts of the TOGAF Architectural Development Method (ADM), especially in large and medium-sized companies.

II. Material and Method

The research begins with the identification of the scope of service management architecture. Second is the preliminary phase and determination of the architecture vision, followed by the preparation of business architecture and information system (data and application) architecture targets according to service management best practices. The last stage is reporting, where the conclusions are prepared.

The architecture designed in this study is limited to the business, data, and application architectures domain. The technology architecture domain is not included because the technology used by each company will vary. The TOGAF framework is used in defining artifacts or architectural work products [26] in each domain. Meanwhile, the ITIL framework is used to understand the complete picture of information technology service management practices.

III. Results and Discussion

A. Scope Identification

ITIL management practices consist of several kinds of practices, which are general management practices, service management practices, and technical management practices [27]. The architectural design will focus on service management practices as mandated in PER-03/MBU/02/2018 regarding guidelines for BUMN information technology management [28]. The service management architecture designed in this research is the target architecture in the business, data, and application domains. The alignment between them allows a coherent blueprint of the organization, which is then used to govern its processes and systems [29].

B. Preliminary Phase

The preliminary phase is the initial stage of preparation before analysis and design. At this stage, the principle catalog is established by classifying it to the impacted architecture domain (business, data, application, technology). Some principles can represent multiple domains at once.

TABLE I
Principle Catalog

No	Domain	Architecture Principle	IT Governance Principles	ITIL Management Practices
1.	Business	Customers have a single point of contact	Management: Adopt digital transformation (5.1.1b)	• Service Desk
2.	Business Application	Routine work is automated	Management: Adopt digital transformation (5.1.1b)	• Monitoring and Event Management • Service Desk • Service Request Management
3.	Business Application Technology	The main business processes are not disrupted by the implementation of changes	Management: Adopt digital transformation (5.1.1b)	• Change Control
4.	Business Data Application Technology	IT components controlled The business and IT components have a clear owner	Management: Sharing IT capacity (5.1.1a) Data and Information: User that generates data as data owner (5.1.2b)	• Service Configuration Management • Risk Management • Monitoring and Event Management • Service Catalogue Management • Service Configuration Management
5.	Data	Sensitive data is exchanged securely	Data and Information: Main users of data and information (5.1.2a)	• Information Security Management
6.	Application	The application has a general appearance	Management: Adopt digital transformation (5.1.1b)	• Service Design
		Standard application development	Management: Adopt digital transformation (5.1.1b)	• Business Analysis • Change Control • Release Management • Deployment Management
7.	Application Technology	The application depends on one-stack technology	Technology: Good interoperability (5.1.3)	• IT Asset Management
		Scalable IT system capacity	Management: Sharing IT capacity (5.1.1a)	• Capacity and Performance Management
		Standardized and reusable IT systems	Management: Sharing IT capacity (5.1.1a)	• IT Asset Management
		IT system available anytime and anywhere	Management: Adopt digital transformation (5.1.1b)	• Availability Management

The principle catalog refers to the architectural principles [30], resulting from combining, abstracting, and formulating based on architectural practices in the real world. The principle catalog in Table 1 contains architecture principles following the IT Governance Principles set by the Ministry of BUMN [28] and ITIL management practices [31].

C. Architecture Vision

The architecture vision is drawn up in a high-level model of the candidate building blocks. Building blocks represent reusable components of enterprise capabilities that can be combined with other building blocks to produce architectures and solutions [32]. According to the IT service management value chain, the building blocks will be represented by organizational units that carry out activities.

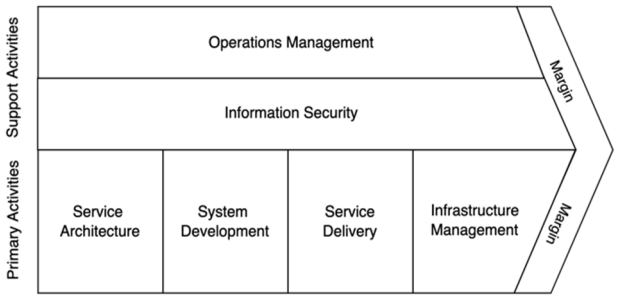

Fig. 1 IT Service Management Value Chain for Medium-Large Companies.

D. Business Architecture

In this phase, business services are mapped to business functions which in Table 1 were previously identified as ITIL management practices. The business services/business functions are then linked to the organizational unit relevant to that function, see Table 2.

TABLE II
BUSINESS SERVICE/FUNCTION CATALOG

Unit	Business Function	Business Service
Information Security	Information security management	• Security Controls Design • Security Testing • Security Review • Security Warranty
System Development	Release management	• Release Planning • Release Controlling • Release Support
Service Delivery	Service level management (SLM)	• Service Portfolio Planning • Service Offering Planning • Service Performance and Trends Monitoring • Service Performance and Trends Reporting
	Change control	• Change Scheduling • Change Assessment • Change Authorization • Change implementation
	Incident management	• Incident Diagnosis • **Incident and Problem Resolution** • Incident Escalation
	Service Request Management	• Requirement Collection • **Request Fulfillment**
	Problem management	• Problem Identification • Incident Repetition Prevention
Service Architecture	Service financial Management	• Funding planning • Investment evaluation and prioritization • Financial control • Service billing and reporting
	Capacity and performance management	• Service performance, capacity, and scalability design • Service performance and capacity information • Component and services performance management • Capacity management reporting
	Availability management	• Availability design • Availability controls testing • Availability measurement
	Service continuity management	• Continuity planning and forecasting • Continuity plan monitoring and improvement • Continuity design and testing
Infrastructure management	Service configuration management	• Configuration Identification • Configuration Control • Configuration Verification and Audit
Operations Management	IT Asset Management	• IT Asset Register Maintenance • IT Asset Control • IT Asset Reporting • IT Asset Audit

Based on the catalog in Table 2, several business services are selected (marked in bold) to define the service value stream that applies to these business services, as shown in Table 3 and Table 4.

TABLE III
SERVICE VALUE STREAM: FULFILLMENT OF USER DEVICE REQUESTS

Value Chain Activity/ SVS Component	Practices	Roles	Activities
Demand		User	1. Users need devices to support their work
Engage	Service Request Management, Service Desk	User, Service Desk Agent	2. The user enters the self-service portal and accesses the device provisioning request in the service catalog, and selects as needed 3. Service Desk Agent logs service requests as a starting point
Obtain/build	Service Request Management, Supplier Management	Service Desk Analyst, Procurement Officer	4. Service requests are handled by the Service Desk Analyst, then if the Service Desk Analyst has approved, it will be continued with the procurement of equipment by the Procurement Officer
Deliver and Support	Service Configuration Management	First/ second line technician	5. First/second line technician will configure device according to policy
Value		User	6. The user's device request has been fulfilled

TABLE IV
SERVICE VALUE STREAM: IT INCIDENT RESOLUTION

Value Chain Activity/ SVS Component	Practices	Roles	Activities
Demand		User, Service Desk agent	1. Users contact Service Desk Agents to report IT-related issues
Engage	Service Desk	Service Desk Agent, First Line Technician	2. Service Desk Agent records ticket as incident 3. If it cannot be resolved by the service desk agent, it will be assigned to the appropriate Resolver Team (First Line Technician)
Engage	Incident Management	First Line Technician, User	4. The Resolver Team (First Line Technician) receives incident tickets and contacts the user to collect further information, conduct investigations, and carry out diagnostic actions
Deliver and Support, Engage	Incident Management	First Line Technician, Major Incident Team	5. Resolver Team (First Line Technician) identify incident's handling and resolved it 6. If it cannot be resolved then escalate to Major Incident Team
Value		User	7. Service returns to normal and tickets are settled

The service management process flow in the two sample service value streams above will be described further in the Process Flow Diagram. Process flow diagrams are made to detail how business processes work [33]. The swim lane technique is used to represent the ownership and realization of the process steps. There are at least nineteen roles involved in these processes, as shown in Table 5.

TABLE V
DEFINITION OF EACH ROLE

No	Role	Definition
1	Sponsor	A person who authorizes budget for service consumption. It can also be used to describe an organization or individual that provides financial or other support for an initiative.
2	Customer	A person who defines the requirements for service and takes responsibility for the outcomes of service consumption
3	Business Relationship Manager	A role responsible for maintaining good relationships with one or more customers.
4	Finance manager	A role responsible for supporting an organization's strategies and plans for service management by ensuring that the organization's financial resources and investments are being used effectively.
5	Portfolio Manager	A role responsible for creating and managing investment allocations for private clients. Some portfolio managers work with individuals and groups, while others focus their attention on institutional or corporate investors.
6	Service Level Manager	A role responsible for setting clear business-based targets for service performance so that the delivery of a service can be properly assessed, monitored, and managed against targets.
7	Project Manager	A role responsible for planning and overseeing projects within an organization, from the initial ideation through to completion.
8	Change Manager	A role responsible for ensuring that risks are properly assessed, authorizing changes to proceed, and managing change schedule to maximize the number of successful service and product changes.
9	Service Desk Manager	A role responsible for managing daily operations of the service desk, managing the service desk team, representing the team to other stakeholders, and helping to ensure that the service desk is constantly developing and improving
10	Measurement and Reporting Analyst	A role responsible for helping drive critical business decisions by analyzing metrics and designing reports.
11	Continuous Improvement Manager	A role responsible for monitoring and improving organizational processes to make them as efficient as possible. Also mapping out all workflows, removing waste and low-value activities, and recommend solutions
12	Release Manager	A role responsible for the release management lifecycle, focusing on coordinating various aspects of production and projects into one integrated solution.
13	Deployment Manager	A role responsible for oversees the release of updates to technical systems
14	User	A person who uses services.
15	Service Desk Agent	A role responsible for supporting customers with IT-related problems, functioning as the first point of contact between users and the company
16	Service Desk Analyst	A role responsible for providing technical support to users, responding to incoming requests for IT support, and resolving network, hardware, and software issues with computers.
17	Procurement Officer	A role responsible for evaluating suppliers, products, and services, negotiating contracts, and ensuring that approved purchases are cost-efficient and of high quality.
18	First Line Technician	A role responsible for handling support of service requests which relate to all technology including workstations, servers, printers, networks, and vendor-specific hardware and software.

19	Second Line Technician	A role responsible for handling incoming technical support incidents, requests, and changes, Management of personal call queue, ensuring calls are closed in a timely fashion, providing updates and ensure ongoing customer communication is maintained, Resolution of calls ranging from simple password resets to complex server queries
20	Major Incident Team	A role responsible for developing an initiative-taking incident response plan, testing for and resolving system vulnerabilities, maintaining strong security best practices, and providing support for all incident handling measures.

The process flow diagram in Fig. 2 begins with the User and continues with other activities involving Service Desk Agents, Service Desk Analysts, Procurement Officers, and First/Second Line Technicians. Service request records will be forwarded to the Service Desk Analyst for approval. If "Yes" then proceed to procurement but if "No" then return to the beginning to make a request again, then end with the device configuration activity by the Technician.

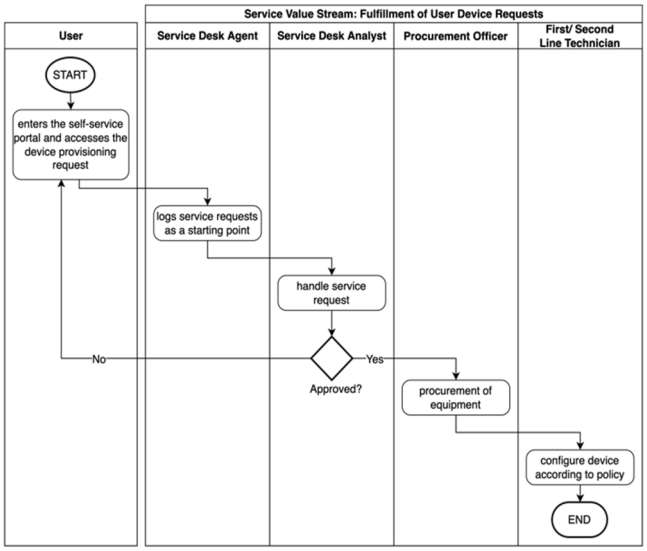

Fig. 2 Process flow diagram for fulfilling user device requests involving five roles.

The process flow diagram in Fig. 3 begins with the User and continues with other activities involving the Service Desk Agent, First Line Technician, and the Major Incident Team. IT-related issue reports will be forwarded to the Service Desk Analyst to check the completion status. If "Yes" then the activity ends but if "No" the Service Desk Analyst will assign it to the Resolver Team, initiated by the First Line Technician and if needed will be escalated to the Major Incident Team.

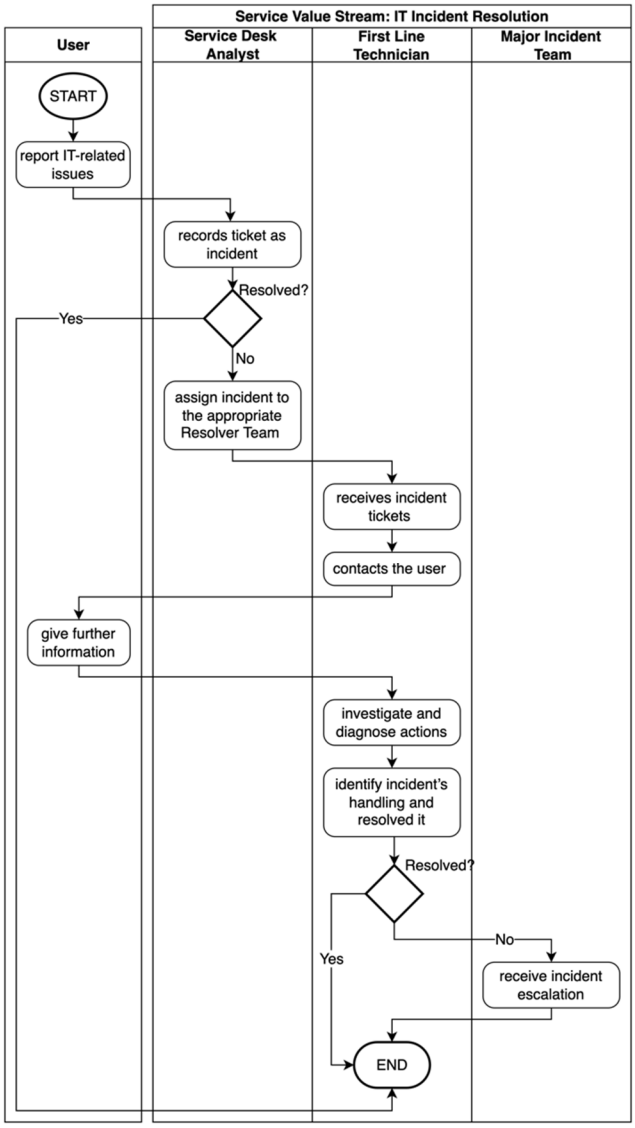

Fig. 3 Process Flow Diagram for IT Incident Resolution involving four roles.

E. Information System Architecture – Data Architecture

The data architecture is represented by a conceptual data model describing how data entities relate. There are at least two kinds of relationships: one-to-many and many-to-many. One-to-many means that a record in the first entity is related to more than one record from the second entity, and many-to-many means that each record in the first entity can have many relationships with every record in the second entity.

The conceptual data model is prepared by referring to the IT enablement conceptual model previously initiated [34] and adapting it to the service management scope in Table 2. In Fig. 4 we can see that there is a close relationship between service management practices. For example, a problem can be related to many incidents, and each incident can be related to many configuration items. Each configuration item can consist of many measurements and agreements.

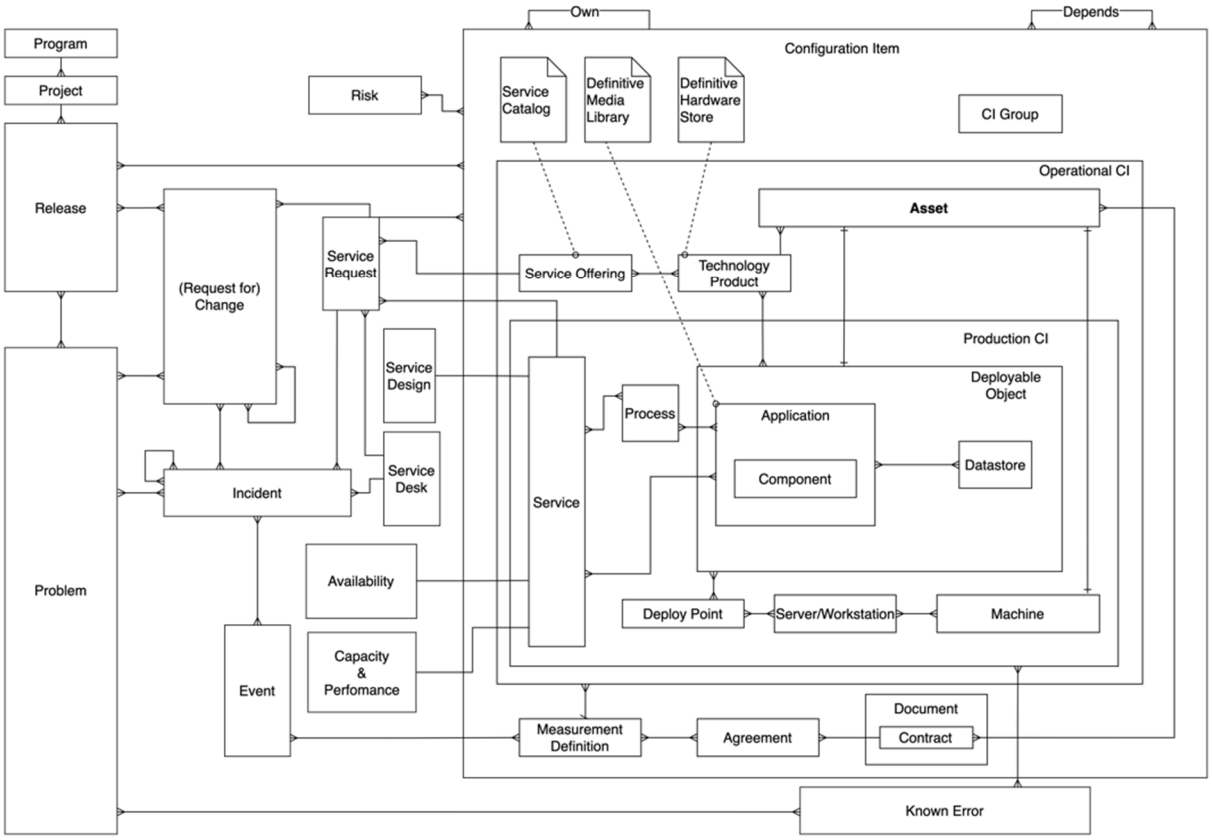

Fig. 4 Conceptual Data Model that describes the relationship between data entities in service management processes

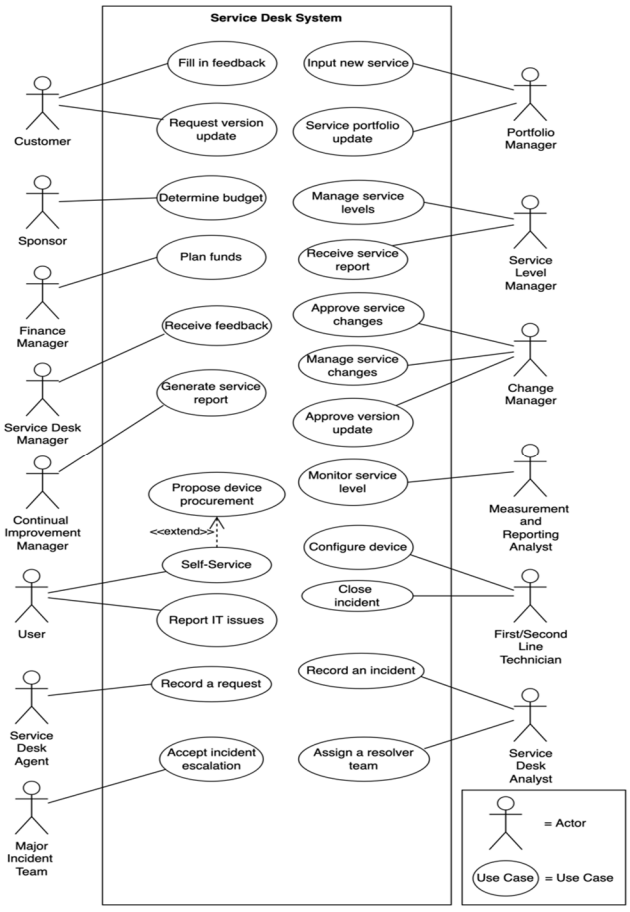

Fig. 5 Application Use-Case Diagram that illustrates the relationship between actors and use-cases

F. Information System Architecture – Application Architecture

An application use-case diagram represents the application architecture. This diagram aims to help describe and validate the relationships between actors and their roles in the application. The types of relationships used, as shown in Fig. 5 include association and extending relationships. Association means a relationship exists between the actor and the use case while extending means expanding the use case if any terms or conditions are met.

The use case diagram in Fig. 5 is based on the process flow in five service value streams, including fulfillment of user device requests and IT incident resolution (see Tables 3 and 4), new service identification and provision, service level target achievement, and major application change. The use case is taken from the actor's activity which is also the functionality of the Service Desk system. The resulting use case diagram consists of 14 actors and 23 use cases.

IV. CONCLUSION

This research resulted in artifacts that can be used as a reference for large and medium-sized companies to implement enterprise architectures in line with IT service management. The preliminary phase produces 11 architectural principles following PER-03/MBU/02/2018 and ITIL management practices. The architectural vision resulted in the value chain of the IT service provider organization consisting of six units: four in main activities and two in support activities. The business architecture produces a service/business function catalog derived from the unit and

consists of 13 business functions and 43 business services. The data architecture is represented by a conceptual data model that describes the data requirements for service management practices. The application architecture is illustrated by a use case diagram that illustrates the relationship between the fourteen actors and those given in the application.

This research has limitations, including only referring to regulations intended for state-owned enterprises. It is assumed that all state-owned companies as objects of implementing regulations are classified as large and medium-sized. Future researchers can consider more regulations and best practices in architectural design and elaborate on other business services and process flows.

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