Proposing Enterprise Architecture for Smart Regencies in Indonesia: A Perspective of Zachman Framework (ZF)

by Aang Kisnu D., Fauzan Masykur, Muhsi, Busro Akramul U., Rofiuddin

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1st Aang Kisnu Darmawan
Department of Information System
Universitas Islam Madura
Pamekasan, Indonesia
ak.darmawan@gmail.com

2nd Fauzan Masykur
Department of Informatics
Universitas Muhammadiyah Ponorogo
Ponorogo, Indonesia
fauzan@umpo.ac.id

3rd Muhsi Muhsi
Department of Information System
Universitas Islam Madura
Pamekasan, Indonesia
muhsiy@gmail.com

4th Busro Akramul Umam
Department of Informatics
Universitas Islam Madura
Pamekasan, Indonesia
busro.umam@gmail.com

5th Rofiuddin Rofiuddin
Department of Informatics
Universitas Islam Madura
Pamekasan, Indonesia
rofiareiv@gmail.com

Abstract— **Enterprise Architecture (EA) has become a necessity for organizations to address their business, data, infrastructure, and information systems. EA deployment in the government sector (e-government) is seen crucial for enhancing the effectiveness of electronic-based service delivery. Unfortunately, there are some crucial challenges to the fundamental requirements of EA in the e-Government sector. There are still partially implemented, lack understanding of technological advances, lack of understanding architectural framework usability, does not have good documentation, and slow service. There is no certainty of normative standardization for operating procedures. Several studies have been conducted to solve these problems. However, its steps are not articulated systematically, nor are the requirements for designing an enterprise architecture for e-government described. This study aims to employ EA for Smart Regency, the unique characteristics of suburban areas in Indonesia. This research conducted Zachman Framework (ZF) as Enterprise Architecture Planning (EAP) methodology. This research has produced the Mapping of EA Model, EA List and Classification of Critical Success Factor, EA Model of Hierarchy Enabling factors, EA Value Chain, and EA Business Process Modeling from Smart Regency Development. This research contributes to exploring and selecting the appropriate e-Government EA framework for Smart Regency service architecture in Indonesia. It helps local government and stakeholders to attend to more crucial factors in developing Smart Regency EA.**

Keywords- enterprise architecture, e-government, smart regency, Zachman framework

I. INTRODUCTION

Enterprise Architecture (EA) was rapidly becoming an essential component for any company that intends to handle their business, data, infrastructure, and information technology needs. It is widely believed that the adoption of EA in the public sector (e-government) is extremely vital for the purpose of enhancing the effectiveness of electronic-based service[1]. Implementation of EA in the government sector could grow significantly rapidly. Unfortunately, some crucial challenges for fundamentally requirement EA in the e-Government sector there are still partially implemented and lack of alignment[2], lack of understanding of technological advances[3], slow service[3], lack of understanding of architectural framework usability[4], there is no certainty of normative standardization for operating procedures[4] and does not have good documentation[5].

Several studies have been conducted to solve these problems includes Enterprise Architecture Digital for Green SPBE[6], Framework for a Long-Term Governmental Enterprise Architecture[4], EAP Method for Public Services Information System Blueprint in Indonesia[7], Planning for EA in E-Government[3], e-Government Ranking by Enterprise Architecture Dimension in Indonesia[8], E-government Architecture Analysis Using the Federal Enterprise Architecture (FEA) Framework[9], Comparative Study of EA in Three Countries Based on the E-Gov Index on the Waseda International E-Gov Rankings[10], Modeling E-Government Interoperability and Integration with TOGAF and SOA[5], Process for selecting the best E-Government EA framework[11], SOA-based service-oriented design for Indonesian e-government[12], Mixed-mode validation of a smart city enterprise architecture framework[13], Qualitative research on digital transformation with business architecture for smarter cities[2], Smart city architecture standardization[14], Bogor's Smart Governance EA[15], and Purwakarta Districts Government E-Government Architectural Planning Using Federal EA Framework[16]. However, it is not presented in a methodical manner with regard to its stages, nor is there an explanation of the components that are necessary for the development of an enterprise architecture for e-government.

This study aims to employ EA for Smart Regency, the unique characteristics of suburban areas in Indonesia. It was motivated by the condition of topographic distribution in Indonesia, which states that regencies (415) are four times the number of cities (93)[17]. However, according to the literature search, few studies still explore elegant regency, especially in EA. This research conducted Zachman Framework (ZF) as Enterprise Architecture Planning(EAP) methodology for deploying Smart Regency EA.

This study contributes to the investigation and selection of an acceptable e-Government EA framework for Indonesia's Smart Regency service architecture. It supports local government and stakeholders in focusing on more critical Smart Regency EA factors.

II. LITERATURE REVIEW

A. Development of Indonesia's Smart Regency

Smart Regency is a concept for applying ICT in Indonesia's suburbs. Indeed, Smart Regency is less prevalent than Smart City. Several studies, including the adaption of user-centered cognitive walkthroughs for gauging user experience, have investigated Smart Regency[18], Implementation and adaption of MECUE for User Experience[19], [20], Community participation for intelligent individual development[21], investigation of usability aspects using SUS adaption[22], knowledge Management System[23], Deployment of tourism promotion policies[24], Numerous smart city implementation applications in Blora[25], Public service on Smart Netizens[22], identification of essential criteria using a balanced scorecard, and fuzzy topsis[26], Quality analysis of e-Service[27], holistic value and social viewpoint on the citizen[28], traffic application of fuzzy mamdani[29], implementation of the Smart Governance idea[30], examination of TRUTAUT success factors[31], Intention of Indonesians to Continue Using Mobile Applications[32], Identification of Service Maturity Levels[33], Investigate Intelligent Sustainable Adoption Factors[34], E-Service Quality Evaluation[35], A Model for Smart Villages in Rural Communities[36], Community Preparedness Metric[37], Understanding Via Intelligent Economy[38], Intelligent Destination Management[39], The notion of a smart community and the expansion of tourism[40], Synergistic and concurrent bureaucracy reform[41], Integration of E-Government Based on SOA[42], Smart Village Building for Smart City and Smart Regency Enhancement[43], and Design of Information Systems for Intelligent Small and Medium-Sized Enterprises[44].

B. Zachman Enterprise Architecture Framework(ZF)

In 1987, the first edition of the Zachman Framework was published[45], followed by a revised version in 1993 and 1999[46]. Zachman defines architecture as a collection of relevant design artifacts or descriptive representations that explain an entity that will be built in accordance with quality standards and maintained over its expected lifetime (change). Many organizations from all walks of life have embraced Zachman's framework[47]. A more comprehensive perspective of EA encompasses the model used to describe items in their current state and the future as business plans and requirements change them. It is difficult for many businesses to use the Zachman Framework for model building for practical purposes[48]. His paradigm is based on the idea that only by manipulating representations of these things can we manage complex object modifications[49]. Using this framework, a company can categorize the various models it may need and describe them in context and relevance[50].

C. Smart Regency Service in the Districts of Madura Island

The Pamekasan Smart and Sym mobile applications have initiated several Smart Regency development initiatives on Madura Island. Another study was conducted in connection with the establishment of Smart Regency Services on Madura Island, which looked at how to improve user interface and usability using Webqual 4.0[51], Hien's Framework for Information System Quality Testing[52], quality assurance in e-services research[27] and Adoption of smart mobile applications with the TOE framework[53].

III. METHODOLOGY

The method used in research is the development of Zachman's Framework. Zachman Framework is a set of work based on the thought to classify and organize company representation in developing the next system[54]. The stages of EAP development can be seen in the following figure :
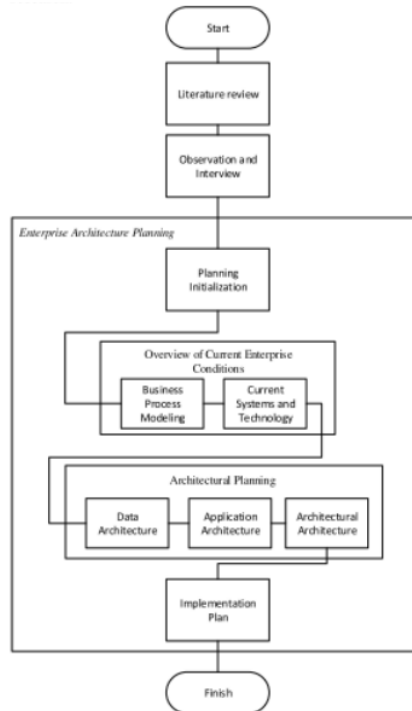

Fig. 1. Research Stages Framework[55]

The following explanation of the stages of EAP in research as follows[55]:

1. *Literature Study.*
   At this stage, it is necessary to search for materials or literature to support and expand upon the theory and initial discussion of the topics chosen.
2. *Data Collection*
   Two events were used to collect data, as described below:
   a. *Observation*: Observation is the direct observation of the research location to see activities, things, or documents that can be used to prepare for research. Observations were made in Pamekasan and Sumenep Regency.
   b. *Interview:* Conduct interviews with IT-related district officials or employees, or research-related parties.

3. *Planning Initiation.*
   The form of identification of the rules referred to as Smart Regency is related to enterprise architecture planning.
2. *Overview of Current Conditions.*
   It was done based on ongoing enterprise analysis.
   a. Business Process Modeling.
      Make a list of the company's current business processes and describe making a business model from scratch by the company's organizational structure.
   b. Current Systems and Technology.
      Identify and document the needs of the system and technology
3. *Analysis of Current Review Results*
   Analyze the current state of the enterprise by using a SWOT (Strength, Weakness, Opportunities, Threat) analysis and reviewing the results of the company's condition for enterprise change.
4. *Architectural Model Design*
   We are reviewing and planning the right enterprise for the company to use in the future according to the situation and condition of the company.
   a. *Data Architecture*
      Identifying and designing architectures according to the needs of data entities of the company's business processes and describing inter-entity relations using CDM (Conceptual Data Model) and PDM (Physical Data Model)
   b. *Application Architecture*
      Identify and register applications that can be used during business processes.
   c. *Architectural Architecture*

Perform the definition of technology used in running applications that have been planned.
5. *Implementation Plan*
   Plan a variety of architectures that are designed according to the needs used by the company.

IV. RESULT AND DISCUSSION

A. *Proposed Enterprise Architecture Model of Smart Regency with the Zachman Framework(ZF)*

The following is given a smart regency model design submitted after going through the design with the Zachman Framework method. Table 1 presents a proposed Smart Regency architecture framework, including additional lines representing the architectural collaboration model for system development. This describes very interesting challenges, such as how we must first raise the Government's Vision to build ICT services in the Smart Regency concept. The architecture framework in table 1 illustrates that each government agency or institution and all stakeholders must coordinate and collaborate well so that each of the interests and needs of the Smart Regency development can be properly accommodated. This table describes 2 data and information artifacts by a systematic and structured framework. This makes the relationships between the components in the framework, which are the building blocks of the smart regency, well mapped. Thus it can represent the relationship between stakeholders' perspectives and stakeholders with the processes and data needed to support their interests. The results of Zachman's ontology column mapping are presented in table 1.

B. *Proposed List and Classification of Critical Success Factor(CSF) of Smart Regency*

Table 2 was presented the Critical Success Factor proposed by the author, which is the basis for building smart regency architecture.

TABLE I. PROPOSED ENTERPRISE ARCHITECTURE MODEL OF SMART REGENCY WITH THE ZACHMAN FRAMEWORK

	What	**How**	**Where**	**Who**	**When**	**Why**
Scope	List of data related to the Smart Regency	Business model processes related to Smart Regency	Location of the Smart Regency business model process	People who are connected and involved in the Smart Regency business model process	All events that occur in the Smart Regency business process	Vision and mission possessed in making the Smart Regency model
Enterprise Model	S_1: What S_2: What S_N: What	S_1: How S_2: How S_N: How	S_1: Where S_2: Where S_N: Where	S_1: Who S_2: Who S_N: Who	S_1: When S_2: When S_N: When	S_1: Why S_2: Why S_N: Why
System Model	Logical Data Model	Architectural Application	Distribution System Architecture	Human Interface Architecture	Process Structure	Rule Model Smart Regency
Technology Model	Physical Data Model	System Design	Architectural Architecture	Presentation Architecture	Control Structure	Rule Design
Components	Data Definition	Architecture Program	Network Architecture	Securities Architecture	Definition of Timing	Rule Definition
Generic	Data	Function	Network	Organization	Schedule	Strategy

TABLE II. PROPOSED ENTERPRISE ARCHITECTURE MODEL OF SMART REGENCY WITH THE ZACHMAN FRAMEWORK

Technology Factors (TF)	ICT Infrastructure	**Procedure & Bureaucracy Factors (PBF)**	Alignment of Organizational Goals and ICT Direction
	System Quality		Simply change Factors And conditions
	Service Reliability		E-Leadership & Engagement
	System Accessibility		Government Regulation and Policy
Employment & Competencies Factors (ECF)	Expertise and Knowledge	**Information Factors (IF)**	Usefullness
	Regular and Conditional Exercise		Ease of Use
	ICT Literacy		Social Contentment and Intent for Using
	Service Innovation		Confidentiality and Safety

| IT Governance & Management Factors (ITGMF)	Vision & Top Management Support	Objective & Value Factors (OVB)	Trust & Responsibility
	Blueprint & Masterplan		Appreciation
	Inspection & Assessment		Compassion & Commitment
	Organizational Hierarchy		Public Engagement
	Project Management		
	Relationship Management with Citizens		
	G2G Relationship		
Supporting Factors (SF)		Financial Consistency	
		Stability Government	
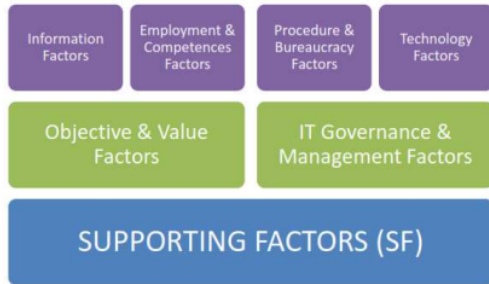
Fig. 2. Proposed Model of Hierarchy Enabling factor on Smart Regency

C. Value Chain Analysis

Value Chain Analysis identifies the main activities and supporting activities carried out in making Smart Regency artifacts. The author's observations can be described as Value Chain activities that exist in the preparation of the Smart Regency, were presented in figure 3

D. Main & Supporting Business Process Modeling

Business Process Modeling is a strategy for formalizing the phases of a business process, as well as the people, organizations, and systems responsible for these processes, as well as the data connected with each step. In building smart architecture, we described it in two domains: main business process activities and supporting domain activities. The main and supporting activities are presented in Figures 4 and 5.
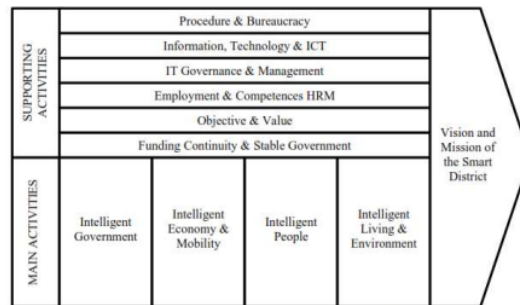

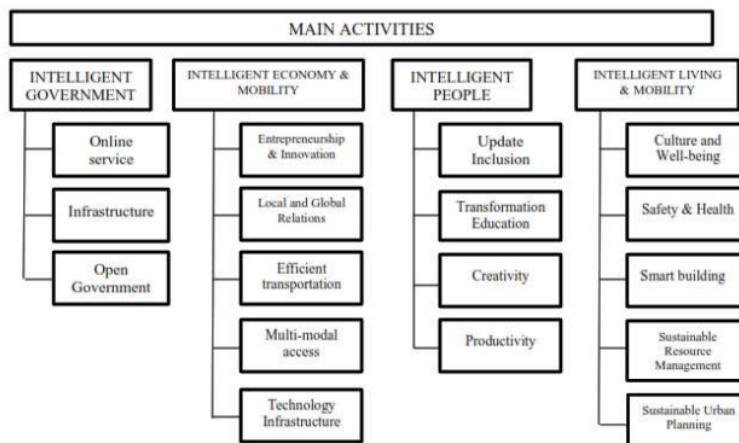Fig. 3. Proposed Value Chain of Smart Regency Development

Fig. 4. Proposed Main Business Process Modelling Activities of Smart Regency
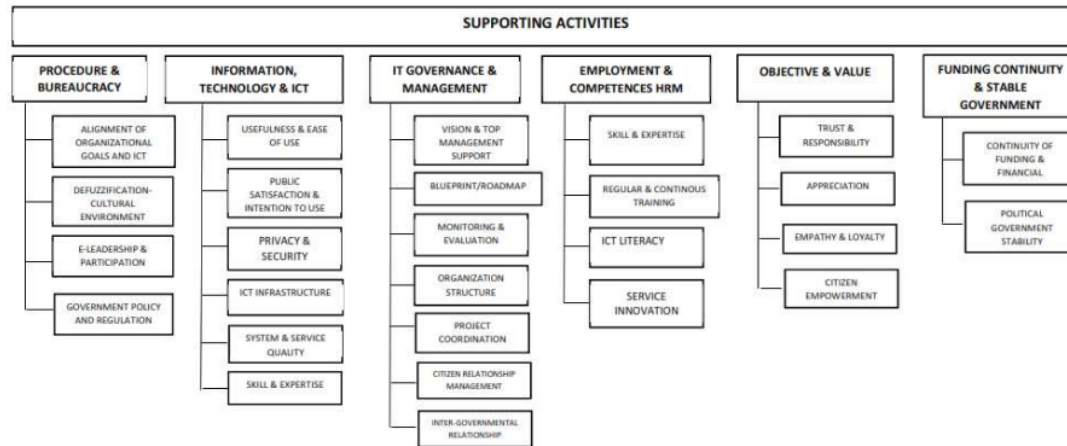
Fig. 5. Proposed Supporting Business Process Modeling Activities of Smart Regency

V. CONCLUSIONS AND FUTURE RESEARCH

This research has produced the Mapping Enterprise Architecture Model, List, and Classification of Critical Success Factor, Model of Hierarchy Enabling factors, Value Chain, and Business Process Modeling from Smart Regency Development. The results of architectural design that have been done are expected to be the basis and foothold in research into the development of information systems architecture for the subsequent development of smart regencies.

In developing this smart regency architecture model, it is expected to accommodate all the needs of stakeholders so that all the needs of the smart regency development can be modeled properly. Following on from this research, it is necessary to design Data Architecture Modeling, Information Systems Architecture Modeling, Architectural Architecture Modeling, and Application Portfolio of smart modeling so that it is expected to produce a more detailed and accurate system architecture design.

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