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ENTERPRISE ARCHITECTURE AS AN ENABLER OF DIGITAL TRANSFORMATION IN THE GOVERNMENT SECTOR: SUCCESS FACTORS AND MATURITY EVALUATION METHODOLOGY

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ABSTRACT

Enterprise Architecture (EA) plays an important role as an enabler of digital transformation with strategic objectives, especially in digital government initiatives. Despite its potential, EA implementation in the public sector faces challenges such as complex organizational structures, diverse stakeholder interests, and regulatory constraints. This study aims to systematically review the literature to identify critical success factors that influence the success of EA implementation in government and propose a comprehensive maturity evaluation methodology. Using a systematic literature review of 48 studies published between 2018 and 2024, this research identifies key factors such as strategic alignment, governance, human resource capabilities, and stakeholder engagement as critical to achieving effective EA implementation. It also introduces an EA maturity evaluation model designed for the public sector to assess and improve EA practices. The citizen-centric aspect is the novelty of this research where the factors in this aspect characterize the implementation of EA in the digital government sector. The findings provide insights and academic contributions in expanding the study of EA in the public sector as well as providing practical guidance for government agencies to improve their EA maturity so that accelerated digital transformation can be achieved.

KEYWORDS *Enterprise Architecture (EA), Critical Success Factors (CSF), Digital Transformation, Government Sector, EA Maturity Evaluation*

INTRODUCTION

EA has gained significant traction in the government sector as a strategic approach to align IT investments with organizational goals and mission objectives (Arzimi et al., 2021). Implementing EA in government agencies presents unique challenges due to complex organizational structures, diverse stakeholder interests, and regulatory requirements (Othman et al., 2021). Another reason EA received increased attention in government was the criteria for management change

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identified in the United Nations (UN) e-Government Survey policy report and Waseda University's World e-Government Rankings (Wahyuni et al., 2023).

The results of the discovery of critical success factors (CSF) for EA implementation were then presented by presenting an extraction table of the CSF list and its discussion as has been done in previous literature such as (Nikpay et al., 2013). Likewise, the EA maturity measurement model/framework is presented with a table (van Zwienen et al., 2019) to explore the maturity model accompanied by its indicators and then its suitability with the Government sector. However, according to some literature, the implementation of EA in the Government sector often tends not to be as easy and smooth as the implementation in the non-government organization sector. This is due to various factors, challenges and other reasons (Ajer & Olsen, 2019); (Bake & Save, 2016;(Löhe & Legner, 2014); Rouhani, Binti Ahmad, et al., 2019a). Based on this, this study has two main research questions (RQs):

1. What are the critical success factors (CSFs) for the successful implementation of Enterprise Architecture in the public sector?
2. What maturity evaluation methodology is most appropriate for assessing EA implementation in government institutions?

The two RQs aim to explore through secondary research in the form of literature studies on critical success factors (CSFs) and measurement of EA maturity that plays an important role in the implementation of EA, especially in the context of governance. The literature study was carried out by reviewing the publication of scientific articles from journals and proceedings in the last 5 years, namely 2018 to 2024 so that it is relevant to align the development of EA implementation in the current government sector in the future.

Previous studies have highlighted the important role of EA in facilitating digital transformation in the public sector. Janssen and Hjort-Madsen (2007) emphasized that EA can improve interoperability and operational efficiency across government agencies. According to (Langenberg & Wegmann, 2004) proposed an EA maturity model that helps government organizations assess and improve their EA practices. According to (Saha & Jaenisch, 2009) also highlighted the importance of factors such as top management support and stakeholder engagement in the success of EA implementation in the public sector. However, EA implementation in the government sector is often not as easy as in the private sector. Challenges such as resistance to change, lack of skills, and governance complexity often hinder this process (Ajer & Olsen, 2019); (Bakar & Selamat, 2016); (Löhe & Legner, 2014). (Dang & Pekkola, 2020) identified that organizational culture and lack of understanding of the value of EA are significant barriers to EA adoption in the public sector. In addition, Rouhani et al. (2015) emphasized the need for an EA implementation methodology that is tailored to the government context to increase its effectiveness.

This study offers a new contribution in the form of developing an Enterprise Architecture (EA) maturity evaluation methodology tailored for the government sector with an approach that focuses on citizen satisfaction and needs (citizen-centric). While most previous studies emphasize the importance of technical and management factors, this study highlights non-technical aspects, such as stakeholder engagement and human resource capabilities, which are key factors in the government context

The uniqueness of this study also lies in the use of a comprehensive EA maturity evaluation model supported by current literature, namely by integrating various critical success factors (CSFs) that are relevant and specific to the government. By combining elements that are relevant to the context of digital governance and the specific needs of government institutions, this study provides more adaptive and realistic practical guidance for government institutions in achieving optimal digital transformation.

This study aims to identify critical success factors (Critical Success Factors, CSF) that influence the success of Enterprise Architecture (EA) implementation in the government sector. While the benefits of this study are to contribute to the development of theory in the field of Enterprise Architecture, especially in the context of the public sector. The findings regarding critical success factors and EA maturity evaluation models can be a reference for further research related to EA implementation in government.

RESEARCH METHOD

This study adopts the Kitchenham method (Kitchenham et al., 2009) in the field of informatics where the stages in the method consist of search, selection, data extraction, analysis and reporting. The stages of search to data extraction use tools in the form of parsif.al websites and Mendeley and Zotero as literature management. Then, the information extracted from each literature studied is the factors that affect the implementation of EA both from the aspect of success categorized based on the appropriate dimensions. In the analysis stage, this independent study applies qualitative content analysis techniques to process data extracted from the studied literature and other related ones such as regulations, validated news and official reports.

Planning Stage

At the planning stage, it produces the output of research objectives, research questions, protocol for article search criteria, keywords and search strings, article database selection , selection criteria and article quality test as well as data extraction plans. In general, the purpose of the study is to find out the factors that drive the successful implementation of Enterprise Architecture (EA) in the Government sector, in addition, to finding out what the EA maturity evaluation methodologies that have been researched and implemented to date. Based on this objective, the categories of population, interventions, comparisons and results to be sought are formulated, namely the population in the form of government agencies and intervention in the implementation or evaluation of EA maturity. The comparison is not defined because it focuses on finding results in the form of supporting factors for EA implementation but does not limit the inhibiting factors because it is assumed that it can be interpreted as a supporting factor if it is avoided positively.

Therefore, the determination of keywords and search strings refers only to the population, interventions and results sought in the form of related factors that are not limited to technological aspects only, but non-technological factors are

also included. In addition, the keywords used need to be adjusted to the format specified in the database because several databases have different query string formats so that the boolean operator feature is utilized according to the criteria of each database. The query string used for the first research question is "enterprise architecture" AND (implementation OR application OR adoption) AND (government OR state OR public) AND (CSF OR factor OR challenge). Then, the query string for the second research question is "Enterprise Architecture" AND (assessment OR evaluation) AND (maturity OR readiness OR capability OR framework). Furthermore, determining the databases that are the source of the search for scientific articles are 9 databases, namely ACM Digital Library, Emerald Insight, IEEE Xplore, Proquest, Sage Journal, Science Direct, Scopus, SpringerLink, and Taylor & France. The determination of the database is based on the relevance of the field of computer science and information systems according to this research along with the availability of access facilitated by the University of Indonesia campus.

Search and Selection Stage

Article search is carried out on 9 database destinations using keywords that have been determined at the planning stage. Then, select the search results with criteria that are relevant to the research objectives, especially regarding the implementation and evaluation of EA in the Government sector. The criteria are defined as to produce scientific articles in accordance with the inclusion criteria or those that are relevant to the purpose of research and exclusion or that are irrelevant and need to be eliminated. The article selection process at this stage consists of 3 phases, namely initiation, title and abstract selection, and complete text selection. The initiation phase is the process of selecting metadata from search results based on keywords that are input into the database and in accordance with the inclusion criteria presented as features of the database such as the year range, type of publication, language, and contain relevant words in the title and abstract according to the keyword.

Then, after passing the metadata selection phase, then the selection phase of titles and abstracts of the selected literature. The selection criteria at this stage are the suitability of the literature research domain with this research, namely the implementation of EA in government agencies or the measurement of evaluation of both capabilities and maturity.

Table 1. Review Protocol for Article Selection Based on Stages

Phase	Inclusive	Exclusive
Initiation	Search results by keyword	Not suitable for keywords
	Published in the 2018-2024 range	Status in progress or unpublished
Title and Abstract Selection	Discuss EA implementation in the government sector	Does not discuss EA implementation in the government sector
	The article discusses the evaluation of EA maturity	The article does not discuss EA maturity evaluation
Full Text	Full text accessible	Full text is not accessible

Phase	Inclusive	Exclusive
Selection	Discuss the success or failure factors of EA implementation in the government sector	Does not contain success or failure factors for EA implementation in the government sector
	Discuss the parameters of evaluating the maturity of EA implementation in the government sector	Does not discuss the parameters for evaluating the maturity of EA implementation in the government sector
	Available in English	Duplication of the same/different source

Furthermore, the full-text selection phase where the criteria in this phase are English content and have information about the success or failure factors of EA implementation as well as the parameters for evaluating the maturity of the EA in the context of the government sector. The search and selection criteria in these phases are categorized in inclusive and exclusive criteria as shown in table 1.

Table 2. Number of Scientific Article Selection Results Based on Database Sources and Stages

Basis Data	Initiation	Title and Abstract Selection	Full Text Selection	Amount of Duplication
ACM Digital Library	71	13	4	1
Taylor & Francis	98	11	4	-
Emerald Insight	178	9	6	-
Sage Journal	51	8	2	1
IEEE Xplor	13	8	5	1
ProQuest	599	43	17	2
Science Direct	221	21	7	-
SpringerLink	276	17	11	-
Scopus	35	16	5	6
Total	**1542**	**146**	**61**	**48**

The results of the search and selection are limited by the year of publication in the period 2018 to 2024. In this initiation process, 1542 scientific articles were produced that had been filtered according to inclusive criteria, both from keywords and years. The results are collected and managed to facilitate the next stage of selection. In the title and abstract selection stages and the selection stage based on the full text, screening is carried out by taking scientific articles that meet the inclusive criteria, then deleting scientific articles that are included in the exclusive criteria as mentioned in table 1. The selection process for titles and abstracts resulted in 146 scientific articles which were then narrowed down to 61 scientific articles when a full-text selection was carried out. The overall results of the literature selection from 9 databases in the initiation phase to full-text are presented in table 2.

Data Extraction Stages

Before the data extraction stage, all 61 scientific articles were tested for quality according to Kitchenham's guidelines where the quality assessment (QA) criteria focused on the substance of the content rather than the reputation of the conference or journal. This aims to extract the results that contain a list of supporting factors for the implementation and methods of measuring the maturity of EA found by previous research as much as possible, and then used as analysis material in terms of trends and dimensions. This phase is carried out in parallel and in line with the selection phase at the data extraction stage with a cut-off limit of a minimum value of <4.0 where there are several significant criteria that are not met.

Table 3. List of Scientific Article Quality Test Questions

Checklist	QA Questions
C1	What research methods are used: Experiments, Quasi-Experiments, Lessons learned, Case studies, Opinion surveys, Tertiary studies, Others
C2	Is there a clear statement of the purpose of the research?
C3	Is there an adequate description of the context in which the research or observation is conducted?
C4	Is there a clear statement about the findings?
C5	Does the study mention CSF/CFF in the implementation of EA in the Government sector?
C6	Does the study address maturity in EA in the Government sector?

This study refers to 6 quality test criteria that are adjusted to the research objectives and mapped in the trends and dimensions of previous research. The criteria are the research method, research objectives, research context, research findings, discussion of factors supporting the implementation of EA, and discussion of maturity or capability of EA according to Kitchenham's guidelines in information systems research presented in table 3.

In line with this phase, data extraction is also carried out to answer research questions (RQ) described in Chapter 1. Beyond the quality test criteria and RQ, there are several data that need to be extracted as follows:

1. Year of publication
2. Article type (journal/conference)
3. Country of origin
4. The government that is the context of the research

After that, to answer RQ1, it is necessary to extract what determinants affect the success of EA implementation in the Government sector. The data collected is a mention or discussion of interventions carried out in implementing EA in the government sector.

For the RQ2 answer, which is a maturity measurement model to evaluate EA implementation in the government sector, extraction was carried out on the methods and instruments to measure the maturity and capabilities of EA implementation that are known, such as Capability Maturity Model Integration (CMMI) and Control Objectives for Information and Related Technologies

(COBIT) and its modifications. Then, it is followed by a more in-depth extraction accompanied by analysis for the constructs measured in the method or instrument.

Qualitative Data Analysis Procedure

The results of extraction from selected scientific articles are analyzed by a qualitative method, namely coding refers to the qualitative content analysis (QCA) process. The content analysis was carried out systematically by classifying the results of previous data extraction based on the codification framework (Schreier, 2012). However, the adjustment of the QCA process is made to be more relevant because this research is carried out singly so that the potential for bias in the determination of codification is inevitable and it is necessary to evaluate the consignment and test of pilots in the future. However, to minimize this potential, the codification process is carried out by referring to previous studies to become a framework of categories and codes that have been defined which can be in the form of trends, dimensions and other criteria. The codification can also increase and decrease for adjustment in answering the research RQ referring to the provisional coding technique and 1 literature can produce more than 1 code (Saldaña, 2013). In addition, self-report data collection techniques in the form of questionnaires, think-aloud protocols and interviews as well as information system data are also used to analyze the components of measuring the maturity of EA implementation. The results of the coding are analyzed and presented in visualizations that provide information about the trends in the emergence of literature from year to year, the concept of each category of factors or instruments that affect the success and maturity of EA implementation in the Government sector.

RESULT AND DISCUSSION

This systematic literature review tries to find literature published in the 2013-2024 period.

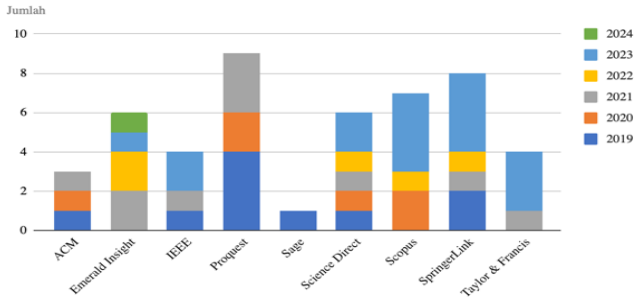

Figure 1 Literature Demographics Based on Sources and Year of Publication

However, after passing the selection stage, the publication year of the selected literature is in the range of 2014-2024. The largest number of publications is in 2023 with a total of 26 literature or 23.85% of the total selected literature. In general, it can be seen in figure 2 with the details of the numbers presented in the following table 3.

Table 4. Article Selection Protocol Based on Stages

Article Source	Year and Number of Publications						Total per source
	2019	2020	2021	2022	2023	2024	

Article Source	Year and Number of Publications						Total per source
	2019	2020	2021	2022	2023	2024	
ACM	1	1	1				3
Emerald Insight			2	2	1	1	6
IEEE	1		1		2		4
Proquest	4	2	3				9
Sage	1						1
Science Direct	1	1	1	1	2		6
Scopus		2		1	4		7
SpringerLink	2		1	1	4		8
Taylor & Francis			1		3		4
Total per year	**10**	**6**	**10**	**5**	**16**	**1**	**48**

In 2019 there were 10 scientific articles where the most sources came from Proquest, namely 4 scientific articles. Then, in 2020, there were 6 scientific articles from 4 sources, namely ACM, Proquest, Science Direct and Scopus. In 2021, the number of extracted articles is the same as the number in 2019, namely 10 scientific articles with the most source origins, namely proquest as many as 3 scientific articles.

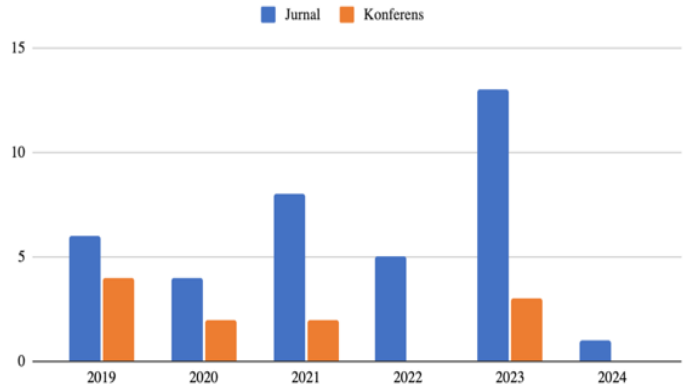

Figure 2. Comparison of the Number of Journals and Conferences of Selection Results

All of these scientific articles that are the subject of literature review consist of scientific articles with journals and conferences. Referring to chart 6, the scientific articles in the type of journals that became literature in this study were dominated by journals both from 2019 to 2024, namely around 77% or 37 scientific articles came from journals and the rest, 23% or 11 scientific articles came from conferences.

Table 5. Details of the Number of Literature in Journals and Conferences Based on the Year of Publication

Year of Publication	Article Type		Total Amount
	Journal	Conference	
2019	6	4	10
2020	4	2	6
2021	8	2	10
2022	5		5
2023	13	3	16
2024	1		1
Total	**37**	**11**	**48**

From the 48 scientific articles, mixed and combined methodologies dominated as much as 43% or as many as 21 articles, while the others were in the

form of qualitative as many as 12 articles, quantitative as many as 7 articles, systematic literature review as many as 5 articles, and case studies as many as 3 articles.

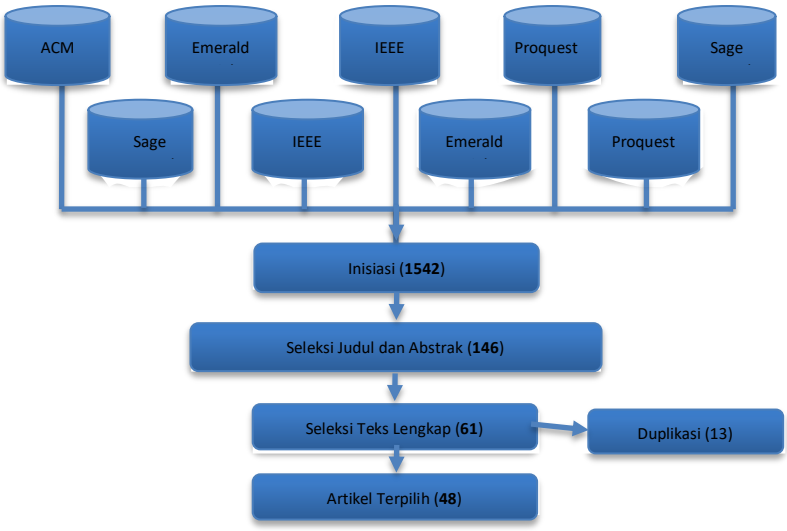

Figure 3. Sources and Search Results of Systematic Literature Studies

Several theories emerged in the discussion used by previous research related to EA in the Government sector such as the concept of agility, service-oriented architecture (SOA), DeLone and McLean Information System success model, technology acceptance model (TAM), Innovations Diffusion, Reference Model for Information Assurance & Security (RMIAS), TOGAF (The Open Group Architecture Framework), Zachman Framework, Citizen-Centricity, design science research (DSR), The Architecture Tradeoff Analysis Method (ATAM) and stakeholder management theory.

Table 6. List of Countries that are the Research Context

Context of the country studied	Number of studies	Article
Czech Republic	1	(Rod & Vomlel, 2023)
Egypt	1	(Banaeianjahromi & Smolander, 2019)
Finlandia	1	(Lnenicka & Komarkova, 2019)
Finland	4	((Dang, 2021); Lnenicka & Komarkova, 2019; Puspita et al., 2023; Rachmaniah et al., 2022)
Australia	4	(Grigoreva & Sorensen, 2020; (Kotusev, 2019); Yablonsky, 2021)
Iran	1	(Banaeianjahromi & Smolander, 2019)
Malaysia	5	(Ahmad et al., 2022; Kurnia et al., 2021; Lnenicka & Komarkova, 2019; Othman et al., 2020; Sumarni Hussein et al., 2019)
Netherland	3	(Al-Kharusi et al., 2021; Kotusev, 2019; Lnenicka & Komarkova, 2019)
Norway	3	(Ajer et al., 2023; Ajer & Olsen, 2019; Lnenicka & Komarkova, 2019)
Syria	1	(Banaeianjahromi & Smolander, 2019)
United States	4	(Al-Kharusi et al., 2021; (Anthony Jnr et al., 2021); Kotusev & Alwadain, 2023; Sundberg et al., 2023)

From the results of the extraction, there are around 11 countries that are said to be the context of research related to the implementation of EA in the digital government sector, namely, the Czech Republic, Egypt, Finland, Indonesia, Australia, Iran, Malaysia, the Netherlands, Norway, Syria, and the United States. The rest, is not mentioned or is not specific because it is discussed at the same time as the non-government sector. However, Malaysia became the most discussed country, followed by the United States, Australia and Indonesia. It can be concluded that the issue of EA implementation is not only rampant in developing countries, but also an important issue in the government sector in developed countries.

Critical Success Factors for EA Implementation in the Digital Government Sector (RQ1)

This section is focused on answering the first question (Q1), which is what are the determining factors for the successful implementation of EA in the digital government sector. In this section, the determinants of the successful implementation of EA in the digital government sector are presented with a classification based on the findings of codification in each scientific article. The factors are classified according to the similarity of activities and the purpose of the application of these factors, namely achieving the optimal level of maturity. The success factors are strategy and planning, organizational governance, human resource capabilities, processes and approaches, communication and collaboration, citizen's centric, and technology as presented in table 7.

Figure 4. Summary of EA Success Factors based on the Literature

The factors are classified according to the similarity of activities and the purpose of the application of these factors, namely achieving the optimal level of maturity. The success factors are strategy and planning, organizational governance, human resource capabilities, processes and approaches, communication and collaboration, citizen's centric, and technology as presented in table 7.

Table 7. EA Implementation Maturity Model/Framework

Aspects	Success Factors	Scientific Article Reference	Number of Scientific Articles
Strategy and Planning	Vision, mission and achievement values	(Adhi et al., 2019), (Aliee et al., 2019), (Anthony Jnr et al., 2023), (Gong & Janssen, 2020), (Alwadain, 2020), (Kotusev et al., 2022)	6

Aspects	Success Factors	Scientific Article Reference	Number of Scientific Articles
	(VMN)		
	EA Alignment with VMN	(Nehemia-Maletzky et al., 2018), (Lnenicka & Komarkova, 2019), (Bastidas et al., 2023), (Pavleska et al., 2019), (Yablonsky, 2021), (Nehemia-Maletzky et al., 2018), (Gong & Janssen, 2020), (Bhatia et al., 2023), (Kotusev & Alwadain, 2024), (Samsudin & Hadiana, 2019), (Haki et al., 2021), (Beese et al., 2023), (Rod & Vomlel, 2023), (Dang, 2021), (Van De Wetering et al., 2023), (Puspita et al., 2023), (Daoudi et al., 2023), (Ahmad et al., 2022)	17
	EA implementation strategy and roadmap	(Kotusev, 2019), (Beese et al., 2023), (Othman et al., 2020), (Van De Wetering et al., 2023), (Kurnia et al., 2021), (Daoudi et al., 2023)	6
	Budget effectiveness	(Lnenicka & Komarkova, 2019), (Alwadain, 2020)	2
Organizational Governance	Complexity of organizational profiles	(Nakakawa et al., 2021), (Gong & Janssen, 2020), (Kotusev & Alwadain, 2023), (Daoudi et al., 2023)	4
	EA organizer structure	(Lnenicka & Komarkova, 2019), (Yablonsky, 2021), (Al-Kharusi et al., 2021), (Kotusev, 2019), (Rachmaniah et al., 2022), (Ajer & Olsen, 2019), (Kotusev & Alwadain, 2023), (Alwadain, 2020), (Haki et al., 2021), (Kotusev et al., 2022), (Othman et al., 2020), (Rod & Vomlel, 2023), (Dang, 2021), (Ajer et al., 2023), (Daoudi et al., 2023), (Ahmad et al., 2022)	15
	Organizational and political culture	(Gong & Janssen, 2020), (Sundberg et al., 2023), (Othman et al., 2020), (Dang, 2021), (Daoudi et al., 2023), (Gong & Janssen, 2020), (Ahmad et al., 2022)	6
	EA Management	(Dang, 2021), (Al-Kharusi et al., 2021), (Kotusev, 2019), (Banaeianjahromi & Smolander, 2019), (Ajer & Olsen, 2019), (Kurnia et al., 2021), (Jonnagaddala et al., 2020), (Sundberg et al., 2023)	8
	Change Management	(Jonnagaddala et al., 2020), (Pavleska et al., 2019), (Al-Kharusi et al., 2021), (Van De Wetering, 2022), (Rod & Vomlel, 2023),	5
	Conflict management	(Dang, 2021), (Kurnia et al., 2021)	2
Human Resource Capability	Competent team	(Yablonsky, 2021), (Gong & Janssen, 2020), (Al-Kharusi et al., 2021), (Rachmaniah et al., 2022), (Alwadain, 2020)	5
	Training and competency	(Jonnagaddala et al., 2020), (Pavleska et al., 2019), (Nehemia-Maletzky et al., 2018),	11

Aspects	Success Factors	Scientific Article Reference	Number of Scientific Articles
	development	(Adhi et al., 2019), (Kotusev, 2019), (Guo et al., 2019), (Van De Wetering, 2022), (Ajer & Olsen, 2019), (Kotusev et al., 2022), (Van De Wetering et al., 2023), (Ajer et al., 2023)	
	Knowledge of EA	(Grigoreva & Sorensen, 2020), (Jonnagaddala et al., 2020), (Gong & Janssen, 2020), (Van De Wetering, 2022), (Ajer & Olsen, 2019), (Othman et al., 2020), (Rod & Vomlel, 2023)	7
	Experience in the EA field	(Jonnagaddala et al., 2020), (Sumarni Hussein et al., 2019), (Grigoreva & Sorensen, 2020), (Othman et al., 2020)	4
	Experts from multidisciplinary	(Pavleska et al., 2019), (Van De Wetering, 2022), (Singh et al., 2024), (Kohansal et al., 2021), (Dang, 2021), (Banaeianjahromi & Smolander, 2019)	6
Process and Approach	Comprehensive framework	(Adhi et al., 2019), (Kotusev, 2019), (Rachmaniah et al., 2022), (Bhatia et al., 2023), (Alwadain, 2020), (Dang, 2021), (Banaeianjahromi & Smolander, 2019)	7
	iterative development	(Yablonsky, 2021), (Ajer & Olsen, 2019), (Puspita et al., 2023)	3
	methodological orientations	(Kaddoumi & Watfa, 2022), (Grigoreva & Sorensen, 2020), (Gong & Janssen, 2020), (Singh et al., 2024), (Rachmaniah et al., 2022), (Kotusev & Alwadain, 2023), (Banaeianjahromi & Smolander, 2019),	7
	Tools used	(Gong & Janssen, 2020), (Kotusev, 2019), (Alwadain, 2020), (Banaeianjahromi & Smolander, 2019)	4
	Agility	(Kaddoumi & Watfa, 2022), (Van De Wetering, 2022),	2
	Documentation	(Sumarni Hussein et al., 2019), (Gong & Janssen, 2020), (Kotusev & Alwadain, 2023)	3
Communication and Collaboration	Effective communication	(Gong & Janssen, 2020), (Alwadain, 2020), (Anthony Jnr et al., 2023), (Sumarni Hussein et al., 2019), (Yablonsky, 2021), (Nehemia-Maletzky et al., 2018), (Gong & Janssen, 2020), (Al-Kharusi et al., 2021), (Sundberg et al., 2023), (Kotusev et al., 2022), (Othman et al., 2020), (Kurnia et al., 2021), (Banaeianjahromi & Smolander, 2019), (Ahmad et al., 2022)	13
	Stakeholder Engagement	(Yablonsky, 2021), (Bastidas et al., 2023), (Pavleska et al., 2019), (Grigoreva & Sorensen, 2020), (Nehemia-Maletzky et al., 2018), (Gong & Janssen, 2020), (Adhi et al., 2019), (Jnr & Petersen, 2023), (Sundberg et al., 2023), (Kotusev, 2019), , (Kohansal et al., 2022), (Kotusev & Alwadain, 2023),	24

Aspects	Success Factors	Scientific Article Reference	Number of Scientific Articles
		(Haki et al., 2021), (Kotusev et al., 2022), (Beese et al., 2023), (Rod & Vomlel, 2023), (Dang, 2021), (Ajer et al., 2023), (Kurnia et al., 2021), (Puspita et al., 2023), (Daoudi et al., 2023), (Ahmad et al., 2022)	
	Leadership commitment and support	(Lnenicka & Komarkova, 2019), (Sumarni Hussein et al., 2019), (Nehemia-Maletzky et al., 2018), (Gong & Janssen, 2020), (Al-Kharusi et al., 2021), (Kohansal et al., 2022), (Rachmaniah et al., 2022), (Ajer & Olsen, 2019), (Alwadain, 2020), (Haki et al., 2021), (Othman et al., 2020), (Rod & Vomlel, 2023), (Ajer et al., 2023), (Kurnia et al., 2021), (Banaeianjahromi & Smolander, 2019), (Daoudi et al., 2023),	16
	Feedback	(Lnenicka & Komarkova, 2019), (Kotusev & Alwadain, 2023), (Haki & Legner, 2021), (Beese et al., 2023)	4
Citizen's Centric	Public satisfaction value	(Jnr & Petersen, 2023), (Sundberg et al., 2023)	2
	Alignment of priorities	(Bastidas et al., 2023)	1
	Quality of service benefits	(Singh et al., 2024)	1
Technology	Standarisasi	(Jonnagaddala et al., 2020), (Lnenicka & Komarkova, 2019), (Bastidas et al., 2023), (Pavleska et al., 2019), (Al-Kharusi et al., 2021), (Haki et al., 2021)	6
	Integration	(Jonnagaddala et al., 2020), (Lnenicka & Komarkova, 2019), (Bastidas et al., 2023), (Pavleska et al., 2019), (Adhi et al., 2019), (Sundberg et al., 2023), (Choudhuri et al., 2023), (Bhatia et al., 2023), (Alwadain, 2020), (Haki et al., 2021), (Beese et al., 2023), (Rod & Vomlel, 2023)	12
	Interoperability	(Jonnagaddala et al., 2020), (Lnenicka & Komarkova, 2019), (Bastidas et al., 2023), (Pavleska et al., 2019),	4
	Flexibility	(Yablonsky, 2021), (Haki et al., 2021), (Beese et al., 2023), (Van De Wetering et al., 2023), (Puspita et al., 2023)	5
	Service-oriented architecture (SOA)	(Pavleska et al., 2019), (Lnenicka & Komarkova, 2019), (Puspita et al., 2023)	3
	Quality of artifacts	(Anthony Jnr et al., 2023), (Beese et al., 2023), (Othman et al., 2020)	3
	Complexity of	(Othman et al., 2020)	1

Aspects	Success Factors	Scientific Article Reference	Number of Scientific Articles
	Technology		
	Dynamic adaptation	(Bastidas et al., 2023), (Yablonsky, 2021), (Van De Wetering, 2022), (Rachmaniah et al., 2022), (Van De Wetering et al., 2023), (Kurnia et al., 2021), Kaddoumi & Watfa, 2022)	7
	Security Coverage	(Pavleska et al., 2019), (Sumarni Hussein et al., 2019), (Bhatia et al., 2023),	3
Regulation	Policies/regulations	(Nakakawa et al., 2021), (Sumarni Hussein et al., 2019), (Kohansal et al., 2022), (Othman et al., 2020), (Dang, 2021)	5
	Compliance	(Lnenicka & Komarkova, 2019), (Pavleska et al., 2019), (Haki et al., 2021), (Beese et al., 2023), (Puspita et al., 2023), (Ahmad et al., 2022)	6
	Guide	(Singh et al., 2024), (Kohansal et al., 2022), (Daoudi et al., 2023)	3
Monitoring and Improvement	Evaluate benefits and impacts	(Pavleska et al., 2019), (Gong & Janssen, 2020), (Jnr & Petersen, 2023), (Guo et al., 2019), (Kotusev & Alwadain, 2023), (Beese et al., 2023), (Daoudi et al., 2023), (Ahmad et al., 2022)	8
	Periodic monitoring	(Pavleska et al., 2019), (Yablonsky, 2021), (Nehemia-Maletzky et al., 2018), (Kotusev, 2019), (Kohansal et al., 2022), (Bhatia et al., 2023), (Kotusev & Alwadain, 2023), (Haki et al., 2021), (Rod & Vomlel, 2023), (Ajer et al., 2023), (Daoudi et al., 2023)	11
	Continuous development and innovation	(Lnenicka & Komarkova, 2019), (Kaddoumi & Watfa, 2022), (Nakakawa et al., 2021), (Pavleska et al., 2019), (Nehemia-Maletzky et al., 2018), (Adhi et al., 2019), (Kotusev, 2019), (Van De Wetering, 2022), (Bhatia et al., 2023), (Kotusev & Alwadain, 2023), (Kotusev & Alwadain, 2023), (Haki et al., 2021), (Kotusev et al., 2022), (Beese et al., 2023), (Rod & Vomlel, 2023), (Kurnia et al., 2021), (Puspita et al., 2023)	17

Maturity Evaluation Methodology for Government EAs

This section discusses the answer to the second question (Q2), which is what are the maturity measurement models for evaluating EA implementation in the government sector. In this section, the model for measuring the maturity of EA implementation in the digital government sector is presented by presenting the definition and concept of the maturity level of the model. As presented in table 5, the results of the analysis of 48 studies found that there are 8 models or frameworks that are called and discussed in relation to the measurement of EA maturity in the government sector, namely Enterprise Architecture Agility Index (EAAI), Enterprise Architecture Maturity Model (EAMM), Federal Enterprise

Architecture Framework (FEAF), The Open Group Architecture Framework (TOGAF) Maturity Model, Capability Maturity Model Capability Maturity Model Integration (CMMI), Business Capability Models (BCM) Capability Maturity Model in Enterprise, Enterprise Architecture Management Maturity (EAMM).

Table 8. EA Implementation Maturity Model/Framework

Model/Framework	Order of Maturity Levels	Reference
Enterprise Architecture Agility Index (EAAI)	M (Motivated, partially motivated, unmotivated) E (Ready, half ready, not ready) B (Able, partially capable, difficulty)	(Kaddoumi & Watfa, 2022), (sundberg et al., 2023), (Kohansal, et al., 2022),
Enterprise Architecture Maturity Model (EAMM)	*(1) ad-hoc.* Organizations adopt EA practices but are not structured where processes and documentation are not formal. (2) Undefined. Organizations have structured documentation and processes even though there are still many inconsistencies. (3) Applied. EA implementation and documentation are done formally. EA is integrated into daily operations and there is a clear understanding of EA's contribution and role in supporting business objectives (4) Managed. The implementation of EA is integrated with business strategy and has evaluated EA contributions with metrics and measurement tools. (5) Optimized. Organizations proactively seek innovation and improvement in EA practices and changes to EA that are adaptive and responsive to the business and IT environment	(Lnenicka & Komarkova, 2019), (Anthony Jnr et al., 2023)
Federal Enterprise Architecture Framework (FEAF) *Maturity Model*	(1) *ad-hoc-applicable but not existing.* The EA implementation process is informal and uncoordinated. (2) *not documented, but existing informally*). The EA implementation process has been undertaken without clear guidance, but lacks formal processes and documentation. (3) *plan available*. Plans are in place to guide the implementation of the architecture, but implementation has not yet begun. (4) *implementation at preliminary stage*.	(Lnenicka & Komarkova, 2019), (Grigoreva & Sorensen, 2020), (Proper et al, 2023), (Ahmad et al., 2022)

Model/Framework	Order of Maturity Levels	Reference
	EA implementation has begun. Some architectural elements have been implemented, but they have not been fully integrated. (5) *implementation in advanced stage*. Many architectural elements have been implemented and are well integrated in the organization's operations. (6) *fully functional/acquired*. The EA is fully functional. Architectural processes and practices are well-managed and support business objectives. (7) *monitored and evaluated*. EAs are regularly monitored and evaluated to ensure their effectiveness and relevance. and continuous improvement based on feedback and evaluation.	
The Open Group Architecture Framework (TOGAF) *Capability Maturity Model*	(1) EA implementation is ad-hoc and unstructured. (2) defined. The implementation of EA at this level is not consistent across the organization because there is no widely and formally applied standard. (3) Integrated. EA has been integrated with business and IT and there is added value from EA in supporting the organization's goals. (4) managed. EAs have been managed with performance metrics and indicators, and the organization has clear policies and procedures for managing the architecture, and a focus on continuous improvement. (5) optimal (*optimizing*). The organization proactively adapts to a strong culture of continuous improvement and innovation.	(Lnenicka & Komarkova, 2019), (Grigoreva & Sorensen, 2020)
Capability Maturity Model Integration (CMMI)	(1) *Initial*. At this level, the process is unstructured and ad-hoc. (2) managed, the process is managed and documented, but it is still partial. Organizations have used data to manage performance and ensure that processes can be used repeatedly. (3) defined, The process has been thoroughly defined and documented and made into a standard/procedure	(Lnenicka & Komarkova, 2019), (Kotusev & Alwadain, 2023)

Model/Framework	Order of Maturity Levels	Reference
	that is integrated across all organizational units. (4) The process has been quantitatively managed using metrics and quantitative analysis. The results of the analysis are used for performance measurement and continuous improvement. (5) Optimizing which focuses on continuous improvement and innovation to improve processes and adopt new technologies.	
Business Capability Models (BCM)	BCM Consists of levels: (1) No ability (2) Isolated capabilities (3) Service capabilities (4) Strategic capabilities (5) Discriminating ability	(Kotusev & Alwadain, 2023) 14/11/24 13.24.00
Capability Maturity Model in Enterprise	*The First School of Thought* . (1) No capability. There are only limited activities. (2) General abilities. There is a business process but EA has not supported the business strategy. *The Second School of Thought* (1) Methodical. There is a conceptual representation of EA as an artifact but it does not focus on capabilities to support business strategy. (2) Innovative. There is creative planning related to capabilities that function on organizational performance. *The Third School of Thought* (1) Strategic. The existence of strategic capabilities that are in accordance with the organizational ecosystem. (2) Adapt. Identification of benefits, challenges and support to improve capabilities (1) Productive. There is integration, flexibility and relevance in various organizational ecosystems to the level of the international community.	(Aliee et al., 2019)

Model/Framework	Order of Maturity Levels	Reference
Enterprise Architecture Management Maturity (EAMM)	(1) initial. there is already an EAM process, but it is not organized (2) over-the-earth (3) defined, EAM practices have been formally documented and have standards. (4) managed, EAM processes are managed with systematic performance measurement and analysis (5) optimized, the organization focuses on innovation and continuous improvement in EAM practices and is optimized to achieve competitive advantage.	(Al-Kharusi et al., 2021), (Banaeianjahromi & Smolander, 2019), (Haki et al., 2021), Kotusev et al., 2023)

From the overall systematic literature review of the 48 articles, the author concludes that there are nine general steps of the methodology for evaluating the maturity of EA implementation in the context of the government sector:

1. Definition of purpose and scope. Organizations need to define maturity evaluation objectives, such as improving efficiency, effectiveness, or alignment with government strategy, as well as the scope of the evaluation, such as the units or departments that are planned to be evaluated.
2. Selection of maturity models. Organizations need to choose a maturity model that is relevant to the vision, mission, functional values, structure, and governance of the organization or modify an existing maturity model. For example, the FEAF Maturity Model CMMI (Capability Maturity Model Integration). This is because the selected model will be a frame of reference for the implementation of the evaluation, such as what aspects or factors are considered relevant to be assessed to describe the maturity of the implementation.
3. Data collection. Organizations can collect data through a variety of methods that suit the character of stakeholders, such as surveys to get input from various parties regarding EA practices anonymously, interviews to dig up detailed information from stakeholders, including IT architects, IT managers, and end users, or documentation to review EA-related documents, such as architectural plans, policies, and procedures.
4. Data analysis. Data analysis is carried out based on a reference framework to identify aspects/factors that are strengths, weaknesses, and areas for improvement.
5. Maturity assessment. The maturity level mapping of the EA is based on an analysis of the aspects/factors that are the strengths, weaknesses, and areas for improvement into the relevant maturity level (e.g., from level 0 to level 5).
6. Preparation of recommendations. Recommendations can include policy development, upskilling, or the implementation of new tools and technologies.
7. Preparation of reports. Reports can be in the form of summaries of findings, analyses, and recommendations, where this report can be supporting documentation in subsequent assessments. The report is then submitted to stakeholders for feedback and support.

8. Implementation of the action plan. Organizations plan and execute strategies to improve EA maturity based on recommendations, feedback, and support provided from stakeholders.
9. Continuous monitoring and evaluation. Regular and periodic monitoring and evaluation are carried out through the identification of challenges, benefits, and impacts related to the implementation of EA assessment for progress in improving EA maturity.

These measures are expected to provide a systematic approach to evaluating and improving the maturity of EAs in the government sector. In addition, organizations can systematically evaluate their strengths and weaknesses in implementing EA, prioritizing areas for development, and tracking their progress to achieve a higher level of maturity in EA practice.

CONCLUSION

Here are some points that can be concluded from this study: Several studies have discussed the implementation of Enterprise Architecture (EA), but the focus on the government sector is still limited, while the implementation of EA in this sector is increasing. The literature related to success factors and measurement of EA maturity is less specific about the scope of digital governance. There are 48 articles from 1542 publications related to the implementation of EA in the government sector between 2018 2024. The majority of articles came from journals (77%) and conferences (23%), with the peak of publication in 2023. Dominant topics include agility, SOA, TAM, and TOGAF. The study covered 11 countries, with a focus on Malaysia, the United States, Australia, and Indonesia, showing that EA is important in both developing and developed countries. The study presents a list of success factors and evaluation models of EA maturity in the government sector. EA's success factors in the government sector include strategy, governance, HR capabilities, processes, communications, citizen centric, technology, regulation, and continuous monitoring. There are eight models or frameworks discussed related to measuring EA maturity in government, such as EAAI, EAMM, FEAF, TOGAF, CMMI, BCM, and EAMM. EA maturity evaluation involves nine general steps, including goal definition, model selection, data collection, analysis, assessment, recommendation, reporting, implementation, and monitoring.

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