Evaluating the Influence of EA Capabilities on Digital Transformation in the Ministry of Finance of Indonesia

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Abstract. Enterprise Architecture (EA) has been adopted by the Ministry of Finance (MoF) of Indonesia since 2018 as a strategic methodology to achieve the MoF's organizational goals more effectively and efficiently by defining, mapping, aligning and integrating business domains, data, applications and technology. EA's role in digital transformation is listed in the MoF's EA Vision, namely as an orchestrator who accelerates and harmonizes digital transformation in the MoF and focuses on outcomes. However, a number of stakeholders considered that the value provided by EA to support the MoF's digital transformation was considered not optimal. This is allegedly caused by the insufficient maturity level of the MoF's EA capability. The purpose of this paper is to analyze the perceptions of the MoF's EA Team on the maturity of EA capabilities and their influence on the MoF's digital transformation. The methodology used in analyzing this effect is the Partial Least Square Structural Equation Model (PLS-SEM). The research findings demonstrate that the MoF's EA capabilities, categorized into enabler capability and utilization capability, have a significant positive influence on the digital transformation within the MoF.

1 Introduction

1.1 Background

The concept of Enterprise Architecture (EA) encompasses comprehensive aspects of the business domain and information & communication technology (ICT) dating back to IBM's Business System Planning (BSP) concept in 1975 [1]. EA brings several advantages to organizations, including improved alignment between business and ICT, enhanced communication quality between top-down, and business and ICT levels, streamlined strategy-to-delivery through projects, reduced ICT costs, increased ICT flexibility, and a focus on stakeholder/client orientation [2].

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EA has gained widespread popularity across diverse sectors, including the government [3,4], and the MoF is no exception. The MoF's EA initiative was initiated to address challenges identified in the MoF's Information and Communication Technology Strategic Plan (Renstra ICT) 2014-2025, such as the lack of an approved end-state architecture leading to silos among echelon I units, high system maintenance costs, and suboptimal sustainability of automation projects [2].

However, the value of EA in supporting the MoF's digital transformation was deemed suboptimal. Stakeholders suspected this was due to the insufficient maturity level of the MoF's EA capability. According to the Evaluation Report on the Implementation of the MoF's 2022 EA Capability Assessment, the benefit capability value was only 1.33 on a scale of 5, and the enabler capability value in the same year was only 2.2 on a scale of 5 [5].

1.2 Objective

The objective of this study is to examine the MoF's EA Team's perception of EA capability maturity and its impact on the MoF's digital transformation. The analysis is conducted using the PLS-SEM methodology. This study aims to offer insights into EA management within the MoF and serve as a guide for EA management in other governmental entities. Furthermore, it is anticipated to contribute to the advancement of knowledge concerning EA implementation in the government sector.

2 Literature Study

2.1 Enterprise Architecture and Digital Transformation

The EA framework serves as a structure for content or process, which can be utilized as a tool to organize thoughts, ensuring they are consistent and comprehensive [6]. The most popular EA frameworks today are The Open Group Architecture Framework (TOGAF), Zachman, Federated Enterprise Architecture Framework (FEAF), and Gartner [7]. TOGAF is recognized as the most widely adopted framework among organizations. This is attributed to its comprehensive and open guidelines, the availability of numerous training institutions, and the existence of a certification program. TOGAF plays a crucial role as a reference in the establishment of the MoF's EA framework.

The MoF's EA framework serves as a guide for the MoF's EA Team in developing and managing EA which comprises eight components: EA vision, EA principles, EA references, EA domains, EA methodology, EA tools, EA capabilities, and EA governance [8]. The components are modeled as depicted in Fig 1 to enhance comprehension.

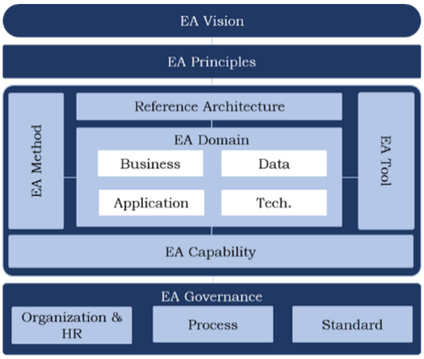

Fig. 1. MoF’s EA Framework

The primary focus of the study revolves around the EA Capability. Numerous organizations have attempted to establish EA, only to witness its failure within a few years. This phenomenon transpired due to the organizations' incapacity to proficiently assimilate the EA process with other management procedures within their organizational structure. [9]. As a result, it is crucial for organizations to prepare their EA capabilities before initiating an EA project, as the Preliminary Phase of the TOGAF Architecture Development Method (ADM) [6].

In 2010, the Open Group published the World-class EA Capability Model, which can serve as a reference for organizations in managing their Enterprise Architecture (EA). Within this model, As shown in Fig 2, there are three distinct capability groups, namely: 1) general business capabilities, 2) foundation architecture capabilities, and 3) the utilization of EA at the strategic, program, project, and contractor management levels [9].

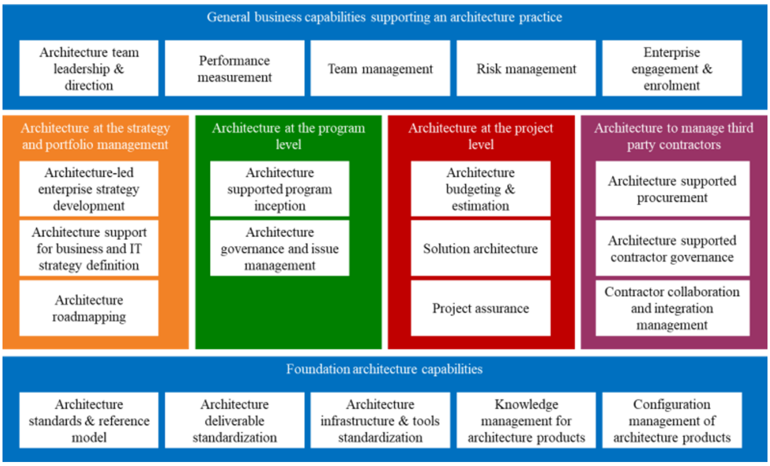

Fig. 2. World-class EA Capability Model

MoF's EA capability adapts the world-class EA capability model with some adjustments. As shown in Fig 3, the MoF's EA is categorized into two groups: the enabler capability group and the utilization capability group. The enabler capability group encompasses organizational and human resource capabilities, standards, methodologies, architectural references, and architectural knowledge management. On the other hand, the utilization capability group comprises EA utilization capabilities for strategies, programs, and projects [8].

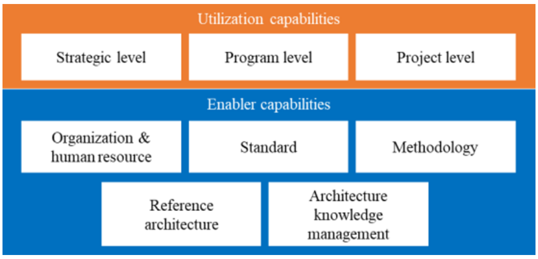

Fig. 3. MoF's EA Capability Model

In this study there were a number of adjustments to the EA capabilities of the MoF which were used as indicators for independent latent variables. This takes into account the urgency, similarity, and report of the 2022 MoF's EA capability assessment [5]. On the other hand, digital transformation functions as a dependent variable which has indicators covering the perspectives of stakeholders, organizations, employees and a culture of innovation.

2.2 Hypothesis Development

In the following Table 9, a list of latent variables and their indicators is presented along with the corresponding references cited.

Table 1. Latent Variables and Indicators

No	Latent Variable	Code	Indicator	Question	Reference
1	Enabler Capability	EC01	Organization	EA organization is optimal in supporting EA tasks and functions (authority, composition, and so on)	[8–13]
2	Enabler Capability	EC02	Architect	The architect has sufficient competence to carry out his role	[8,9,11,13]
3	Enabler Capability	EC03	Leadership	Leaders in the EA organization are intense/engaged in directing and coordinating EA tasks and functions	[8–11,13]
4	Enabler Capability	EC04	Standard, methodology, reference	There are standards, EA methodologies, architectural references that assist architects in developing and utilizing architectures	[8–11,13]
5	Enabler Capability	EC05	Knowledge management	There is a knowledge management program related to the MoF's EA which is adequate for architects, leaders and employees in general	[8,9,13]
6	Utilization Capability	UC01	Strategic level	EA is used to support organizational strategies	[8,9,14]
7	Utilization Capability	UC02	Program level	EA is used in organizational programs	[8,9]
8	Utilization Capability	UC03	Project level	EA is utilized in organizational projects	[8,9]
9	Digital Transformation	DT01	User experiece of product and service	Digital transformation encourages increased user experience on Ministry products and services	[15–21]
10	Digital Transformation	DT02	Operational process	Digital transformation encourages more effective and efficient operational processes	[18–23]
11	Digital Transformation	DT03	Working model	Digital transformation encourages the improvement of the quality of working models that are flexible, productive, collaborative and enjoyable	[15,17–19,21,24]
12	Digital Transformation	DT04	Organizational creativity and innovation	Digital transformation encourages increased organizational creativity and innovation	[15,16,18–25]

In the earlier section, the list of latent variables and their corresponding indicators was provided. Enabler capability has five indicators, utilization capability has three indicators and digital transformation has four indicators. Drawing on this information, the proposed PLS-SEM model in this study is as shown in the following figure:

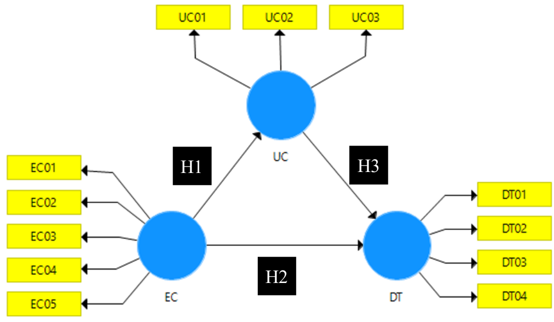

Fig. 4. Proposed PLS-SEM Model

As seen in Fig 4, the hypothesis formulated for this study are as follows:

1. H1: Enabler capability (EC) has a positive influence on utilization capability (UC)
2. H2: Enabler capability (EC) has a positive influence on digital transformation (DT)
3. H3: Utilization capability (UC) has a positive influence on digital transformation (DT)

The aforementioned hypothesis will undergo examination through the methodology that will be explicated in the subsequent section.

3 Data Collection

The study data was collected by administering an online questionnaire to the MoF's EA Team during the period from March 20, 2023, to March 28, 2023. The questionnaire was developed using Microsoft Form and shared through the WhatsApp Group "MoF's EA Team." The questions were designed to represent each variable as indicators using a Likert scale, encompassing response options ranging from 1 as "strongly disagree" to 5 as "strongly agree".

A total of 107 architects from the MoF participated in the study, consisting of 71.02% men and 28.97% women. Regarding age distribution, respondents fell into the following categories: 30-39 years old (62.62%), 40-49 years old (21.50%), 20-29 years old (13.08%), and 50-59 years old (1.867%). In terms of educational background, the majority of respondents held bachelor (55.14%), followed by postgraduate (36.51%), undergraduate (8.41%), and doctoral (0.93%). As for their job positions, respondents were primarily composed of those in the staff level (55.14%), followed by echelon IV (37.38%) and echelon III (7.48%).

4 Methodology

Subsequently, the acquired data and the constructed model were analyzed using the PLS-SEM methodology. As illustrated in Fig 3, PLS-SEM comprises two key phases: 1) evaluation of the Measurement Model, and 2) evaluation of the Structural Model. In the Measurement Model evaluation phase, the correlation between latent variables and their indicators is examined. Meanwhile, during the Structural Model evaluation phase, the associations between the specified latent variables are investigated [26].

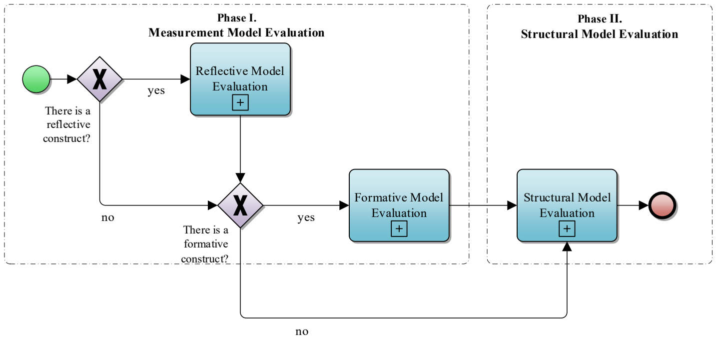

Fig. 5. Systematic Evaluation of PLS-SEM

In this research, SmartPLS was employed as the tool of choice. SmartPLS is a renowned software application widely used for Partial Least Squares Structural Equation Modeling (PLS-SEM).. Originated by Ringle, Wende, and Will in 2005, this software has gained widespread popularity, not only because of its free availability to academics and researchers, but also because of its easy-to-use interface and powerful reporting features [27].

5 Results And Discussion

5.1 Descriptive Analysis

Based on the responses provided, the indicators for the latent variable "Enabler Capabilities" show that Leadership (3.359) has the smallest value, followed by Organization (3621), and Architect (3.641). For the latent variable "Utilization Capabilities," the indicator values are relatively similar, with the smallest being strategic level (3.650), followed by program level (3.757), and project level (3.835). Meanwhile, in the latent variable "Digital Transformation," the indicator values are quite evenly distributed, with the lowest value being "Organizational creativity and innovation" (4.291) and the highest value being "Operational process" (4.408). The data dispersion, as measured by standard deviation, appears to be quite diverse across each indicator. The highest standard deviations are observed for Leadership (0.984) and Strategic level (0.942), indicating that the data distribution for these two indicators is the most spread out.

Table 2. Descriptive Analysis

No	Code	Indicator	Average	Standard Deviation
1	EC01	Organization	3.621	0.860
2	EC02	Architect	3.641	0.811
3	EC03	Leadership	3.359	0.984
4	EC04	Standard. Methodolog, reference	4.408	0.582
5	EC05	Knowledge management	4.049	0.768
6	UC01	Strategic level	3.650	0.942
7	UC02	Program level	3.757	0.875
8	UC03	Project level	3.835	0.789
9	DT01	User experiece of product and service	4.330	0.629
10	DT02	Operational process	4.408	0.565
11	DT03	Working model	4.340	0.567

12	DT04	Organizational creativity and innovation	4.291	0.585

5.2 Evaluation of Measurement Model

As stated in the methodology section, the first step in PLS-SEM is the evaluation of the measurement model. The purpose of this evaluation is to empirically assess the reliability and validity of the relationship between constructs (latent variables) and their indicators.

5.2.1 Internal Consistency Reliability and Convergence Validity

Internal consistency reliability is assessed using Cronbach's α and composite reliability [28]. Both measures range from 0 to 1, with higher values indicating greater reliability. The Cronbach's α values for the latent variables EC, UC, and DT were 0.767, 0.899, and 0.884, respectively, indicating high reliability of the latent variables and their indicators (values > 0.7). This aligns with the respective composite reliability values of 0.84, 0.937, and 0.92 as shown in table 3.

Most indicators exhibited high outer loading values. Only indicators EC04 and EC05 had values below 0.7, specifically 0.587 and 0.639, respectively. However, these values are still above 0.4, suggesting their presence when considering the AVE value and composite reliability. The calculated AVE and composite reliability values are 0.512 and 0.84, respectively, indicating that the EC04 and EC05 indicators can be retained.

Table 3. Indeks Reliability and Convergence Validity

Latent Variable	Indicator Variable	Outer Loadings	Cronbach's α	Composite Reliability	AVE
Enabler Capabilities (EC)	EC01	0.798	0.767	0.840	0.512
	EC02	0.704			
	EC03	0.833			
	EC04	0.587			
	EC05	0.639			
Utilization Capabilities (UC)	UC01	0.927	0.899	0.937	0.833
	UC02	0.933			
	UC03	0.877			
Digital Transformation (DT)	DT01	0.852	0.884	0.920	0.742
	DT02	0.877			
	DT03	0.892			
	DT04	0.823			

5.2.2 Discriminant Validity

The evaluation of discriminant validity involves assessing whether a reflective indicator effectively measures its corresponding latent variable by comparing its correlation values with other latent variables [28]. Various methods can be used to analyze discriminant validity, including the Fornell-Larcker Criterion and Heterotrait-Monotrait (HTMT) ratio. Table 4 demonstrates that the Fornell-Larcker Criterion values in cells with the same column and row are higher compared to others. For instance, the value for cell EC-EC (0.718) exceeds that of EC-UC (0.587) and EC-DT (0.487).

Table 4. Fornell-Larcker Criterion and HTMT

Latent Variable	Fornell-Larcker Criterion	HTMT

	EC	**UC**	**DT**	**EC**	**UC**	**DT**
EC	0.718					
UC	0.587	0.913		0.668		
DT	0.487	0.408	0.861	0.549	0.454	

The HTMT ratio is a measure that quantifies the between-trait correlations in relation to the within-trait correlation, serving as a tool for assessing discriminant validity. An HTMT value exceeding 0.9 indicates a deficiency in discriminant validity [28]. The HTMT values obtained in this study are as follows: EC-UC (0.668), EC-DT (0.549), and UC-DT (0.454). These HTMT values below 0.9 are consistent with the Fornell-Larcker Criterion, indicating that discriminant validity between the latent variables and their indicators is valid.

5.3 Evaluation of Structural Model

The purpose of assessing the Structural Model is to evaluate the magnitude and statistical significance of the path coefficient between the constructs (latent variables) that represent the study hypothesis [26,28].

5.3.1 Collinearity Assessment

In this stage, there are no collinearity problems observed in the constructed model. This is evident from the Inner Variance Inflation Factor (VIF) value, which is lower than 5 [28] as indicated in Table 8. Consequently, the designed model does not have collinearity issues.

Table 5. Inner VIF Values

	EC	**UC**	**DT**
EC		1	1.526
UC			1.526
DT			

5.3.2 Path Coefficient

The path coefficient ranges from -1 to 1, where a value closer to 1 indicates a stronger positive relationship, a value closer to -1 indicates a stronger negative relationship, and a value closer to 0 suggests a weaker relationship [26]. According to the path coefficient calculations presented in Table 8, the most robust relationships are observed in the following order: EC → UC (0.587), EC → DT (0.377), and UC → DT (0.187).

The P-Value results align with the path coefficient findings, indicating consistency. With a significance level of 0.1 (confidence level of 0.9), it can be inferred that EC → UC (0.000), EC → DT (0.000), and UC → DT (0.077) have a statistically significant positive relationship. Therefore, H1, H2, and H3 are supported and confirmed.

Table 6. Statistic Test Result

Hypothesis	**Relationship**	**Path Coefficients**	**P-Value**	**Result (significant level 0.1)**
H1	EC → UC	0.587	0.000	Positive Significant
H2	EC → DT	0.377	0.000	Positive Significant
H3	UC → DT	0.187	0.077	Positive Significant

6 Conclusion

Leadership holds paramount significance in diverse aspects, not merely completing tasks but accomplishing them effectively [29]. However, in this study, the lowest indicator score relates to EA capability, specifically leadership/EC03, with a value of 3.359 (rated on a 1-5 ordinal scale). Other indicators, such as Organization/EC01 (3.621), Architect/EC02 (3.641), Strategic level/UC01 (3.650), Program level/UC02 (3.757), and Project level/UC03 (3.835), also exhibit relatively lower scores below 4. Addressing these indicators is essential for the MoF to enhance its EA and optimize its benefits.

In evaluating the measurement model, two indicators, EC4 (0.587) and EC5 (0.639), have outer loading values below 0.7. Although they could be considered for removal to improve AVE and composite reliability, the AVE (0.512) and composite reliability (0.84) values for the latent variable "enabler capability" already surpass the threshold. The remaining indicators exceed the threshold, indicating their good reliability and validity. The evaluation of the structural model confirmed the formulated hypothesis, with H1 (EC → UC), H2 (EC → DT), and H3 demonstrating a significant positive effect at a 90% confidence level or P-Value < 0.1.

This quantitative study successfully explored the influence of MoF's EA capabilities on its digital transformation. Further research opportunities lie in employing a mixed-method approach, integrating qualitative methods to generate more holistic, complementary, and credible insights [30]. This approach should encompass the expectations of the MoF's EA Team regarding leadership, the structure of the EA Team, architect's competencies, and other capabilities supporting the digital transformation of the MoF.

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