Journal of Theoretical and Applied Information Technology
15th November 2021. Vol.99. No 21

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

THE EFFECTIVENESS FACTORS OF ENTERPRISE ARCHITECTURE INFORMATION SYSTEM IMPLEMENTATION

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ABSTRACT

A research analysis which provides justifiable values from a list of indicators and factors of the effectiveness of the implementation of the Enterprise Architecture Information System (EAIS) in State-Owned Enterprise (SOE) and non-SOE companies which can be validated from a series of validity and reliability test results using quantitative and qualitative method. Variable construction was developed through Systematic Literature Research (SLR) and PRISMA methods. The methodology used using a non-probability method and purposive sampling technique that was verified by using data sampling resulted from survey respondents collected through Momentive online questionnaire. The initial part of this journal describes how key factors before implementing EAIS could influence the effectiveness of EAIS implementation. The result of this study will manifest the relation of each of the factors forming the effectiveness of the EAIS model constitutes the successful EAIS investments at companies depicted in the Smart-PLS hypothesis relationship result and MaxQDA code segment system.

Keywords: *Enterprise Architecture, Information Systems, Effective Implementation, Quantitative, Qualitative*

1. INTRODUCTION

The Enterprise Architecture Information System (EAIS) can be considered as one of the management tools in organizing and achieving the company's strategic goals based on a structured and well-defined vision, mission, and governance under the same understanding by stakeholders. A previous study by Lankhorst [1], defined an Enterprise as a group of organizations having common goals to make a successful implementation of EAIS and has a set of plans to develop a system or more.

The research background is based on the researcher's interest in analyzing the practical benefits of implementing the Enterprise Architecture Information System (EAIS) in State-Owned Enterprises (SOE) and non-SOE companies in Indonesia. The research on factors that support the effectiveness of EAIS in the successful implementation of EAIS is measured by hypothesis using quantitative and qualitative methods. In line with the Indonesian regulation PER-03/MBU/02/2018 for compliance with each company's Information Technology (IT) Strategic Mater Plan, EAIS considered a fundamental requirement for every corporate plan. Most of the SOE companies analyzed in this study already incorporated EAIS in their corporate strategic plan. However, some non-SOE companies in Indonesia still have not considered the importance of EAIS.

This study aims to analyse the factors that influence the implementation of an Enterprise Architecture Information System (EAIS) in SOE and non-SOE companies so companies can implement EAIS in more effective ways for their IT improvement. The scope of the research in this journal shows variables of analyses of the factors that affect the information system in the framework of the Enterprise Architecture (EA) to develop an effective Enterprise Architecture Model which can be implemented in companies, from the stand point of Information System (IS) view. The researcher applied the similar research approach based on Information System Success Factors which was previously was done by other researchers [1], [2].

1.1 Preliminary

The researchers measure factors of EAIS effectiveness using empirical research obtained from a Systematic Literature Research (SLR) method

[12]. EAIS success factors are then categorized and modeled by using a hypothesis based method. The testing made with quantitative and qualitative method. The research model testing was combined with a non-probability survey sampling consisting of various respondents from different SOE and non-SOE companies to necessarily collect supporting data to prove the research result.

1.2 Problem Statement

Therefore, to validate hypothesis, a list of research questionnaires has been prepared for the Survey as follow:

RQ1: How Planning affect EAIS Effectiveness?

RQ2: How Stakeholders affect EAIS Effectiveness?

RQ3: How Organization Effectiveness affect EAIS Effectiveness?

RQ4: How Governance affect EAIS Effectiveness?

RQ5: How Business affect EAIS Effectiveness?

RQ6: How IS affect EAIS Effectiveness?

RQ7: How Technology affect EAIS Effectiveness?

RQ8: How EAIS Effectiveness affect EAIS Implementation Success?

2. LITERATURE REVIEW

2.1 Definitions of Enterprise Architecture

Enterprise Architecture consists of 2 words, Enterprise is defined by Lankhorst [1] as a collection of organizations with the same goals with a unit of information system components designed and structured to support company's business processes to ensure that business processes operate according to predetermined designs. Enterprise is also a set of plans to develop one or more systems [3]. Holistically, Enterprise Architecture is an upgrade of sectors or areas in a company to become integrated as a corporate environment responsible to move and support the delivery of business strategies [4]. According to Kotusev [1], Enterprise Architecture is a company's perspective to collaborate between business and Information Technology to produce an alignment between the two. In addition, Enterprise Architecture is a discipline that helps companies overcome problems occuring due to dynamic and evolving technological changes [2].

2.2 EAIS Supporting Factors

A number of past studies on analysis of EA Critical Success Factors (CSFs) model, which resulted in different points of views, has not been able to prove the applicability of EA Critical Success Factors on the organization operation due to the following challenges: (1) every company requires different analytical models (approaches) to see the right alternative options for solutions; (2) the involvement of Management is not complete from the initial stage to the end of the EAIS implementation assessment; and (3) changes often occurred on the compatibility of supporting tools and may not be in accordance of initial plan or recommendation.

In the past, researchers incorporated the relationship of each of EA CFSs that support the EAIS implementation success factor as dependent variable, which is being studied by the writer. Using EA Framework applied onto a federated structure, the success rate of EA can be calculated based on the followings Architecture components: (1) Architecture Completion evaluates the maturity level of the IT architecture to measure the company's readiness in facing the dynamic change of technology and market; (2) Architecture Use applied onto the use of effectiveness of EA in making every decision done by management and stakeholders; and (3) Architecture Result calculates benefits from the use of EA, in tangible as well as intangible results because not all EA results can always be estimated by EA implementation costs and benefits.

The factors selected for this research were analyzed from the literature collected from various sources.

Planning

With a strategy that supports the company's vision and mission, Quarratuaini [5] said that its strategy has properly been planned because it follows the direction of the corporate plan and goals. This factor is rarely highlighted in previous studies.

Stakeholders

Stakeholders include two indicators, which are Knowledge and Skills, and Users. According to Yan [6], Knowledge and Skills for Users of existing information systems in the company are important to complete their work effectively and efficiently. This factor is exciting to be analyzed because human is the most essensial factor after all.

Organizational Environment

Includes a few indicators such as Communication and Culture, as stated by Nam et al. [7], that a transparent communication from inside and outside the company would build a positive culture in the success of EAIS implementation. In addition, as one of the steps in TOGAF ADM

methods, Change Management must clearly be understood by all relevant parties in companies. TOGAF ADM is the most common EA framework in Indonesia [8] applied by companies.

Governance

Architectural principles are design principles that enterprises must be included in EAIS architectural design [9]. A clear organizational structure where the duties and responsibilities of each section and roles are well defined can help increase the Maturity Level of the Organization [10].

Business

Business includes four indicators such as Capabilities, Business Processes, Methodology, and Frameworks, along with Products and Services. The capabilities of the company's products and services will help increase customer confidence to carry out activities with companies whose business processes are simple and easy to understand by all parties, usually in the form of a structured methodology and framework. According to Kotusev [11], Business is the core factor in EAIS.

Information System

Data and Documentation in the context of Information Systems support each other. Data that are integrated both vertically and horizontally can combine the diversity of systems used in the company. The data will be used as a company information system which enterprises can then be compiled in the Documentation for the company's knowledge management [12].

Technology

Innovation is closely related to technological developments [13]. Therefore the company's infrastructure and system security must continually be improved and updated to support the development of technology transformation in EAIS implementation [14]. Technology is a primary enabler factor in the EAIS implementation.

EAIS Effectiveness

As an independent variable whose indicators are taken from the latest research by Rouhani et al. [13], researching the factors that influence effective EA through the regression method. The effectiveness of EAIS can be seen through the following five factors, namely: (1) Binding, (2) Support, (3) Innovative, (4) Adaptiveness, and (3) Alignment. However, only three main factors, Alignment, Binding, and Support, were selected as the indicators in this research model since the other two were already covered as indicators in other factors.

EAIS Implementation Success

The People Process Technology (PPT) framework gives more nuance to the definition of indicators [15]. The successful implementation of EAIS, which researchers consider a general theory, is practical and exciting enough to be further analyzed its relationship to improving the effectiveness of EAIS in an organization as the Enterprise is always expected to be flexible to changes. The summary from keywords finding can be seen in table 1 listed in the form of variables and indicators.

Table 1. List of Indicators and Factors in Summary

Factor #	Factor Name	Indicator #	Indicator Name
X1	Planning	I1	Vision
		I2	Mission
		I3	Strategy
X2	Stakeholders	I4	Knowledge & Skills
		I5	Users
X3	Organization Environment	I6	Communications
		I7	Culture
		I8	Change Management
X4	Governance	I9	Principles
		I10	Maturity Level
X5	Business	I11	Capability
		I12	Business Process
		I13	Methodology & Frameworks
		I14	Product & Services
X6	Information System	I15	Data
		I16	Documentation
X7	Technology	I17	Innovation
		I18	Security
		I19	Infrastructure
M1	EAIS Effectiveness	I20	Alignment
		I21	Binding
		I22	Support
Y1	EAIS Implementation Success	I23	People
		I24	Process

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

2.3 Related Studies

Results of these studies can further be reviewed and summed up with the writer's perception about the factors being analyzed by a number of various researchers of articles or journals about EA Critical Success Factors (CSFs) in the past 5 years such as: Hot-Fit Model according to Sallehudin [16], The frame model for assessing the success rate of EA implementation with 5 categories of factors or constructs by Rouhani et al. [4], EA Implementation Integrated Framework by Nur Azaliah and Selamat [17], The model for the successful implementation of EA based on organizational change is written in a journal by Lee et al. [18], EAM Success Factor Model by Mendling and Recker [19] , Formative CSFs for EA Success Model by Wan et al. [20].

3. METHODOLOGY

The conceptual model design used for this research commences with the development of factors of EAIS comprising details of which factors that have commonly been analyzed by previous researchers to create the most suitable model for this research. Then, the effectiveness of EAIS consists of measurement factors that have been analyzed and validated using empirical research to depend on the validity and reliability of the analyzed data [16]. Next, the People Process Technology (PPT) general framework for all is applied to give more shading to the definition of EAIS implementation success indicators. The writer considers the success of EAIS implementation as a general theory which analyzes the relationships between factors that could validate the EAIS effectiveness in an enterprise facing a flexibility to adopt againt business as well techological changes.

Figure 1: Conceptual Model

3.1 Research Model Development

This research study uses a combination of Systematic Literature Review between two methods between Systematic Literature Review (SLR) [12] and PRISMA workflow [13] formed the hypothesis-based approach model as depicted in Figure 2.

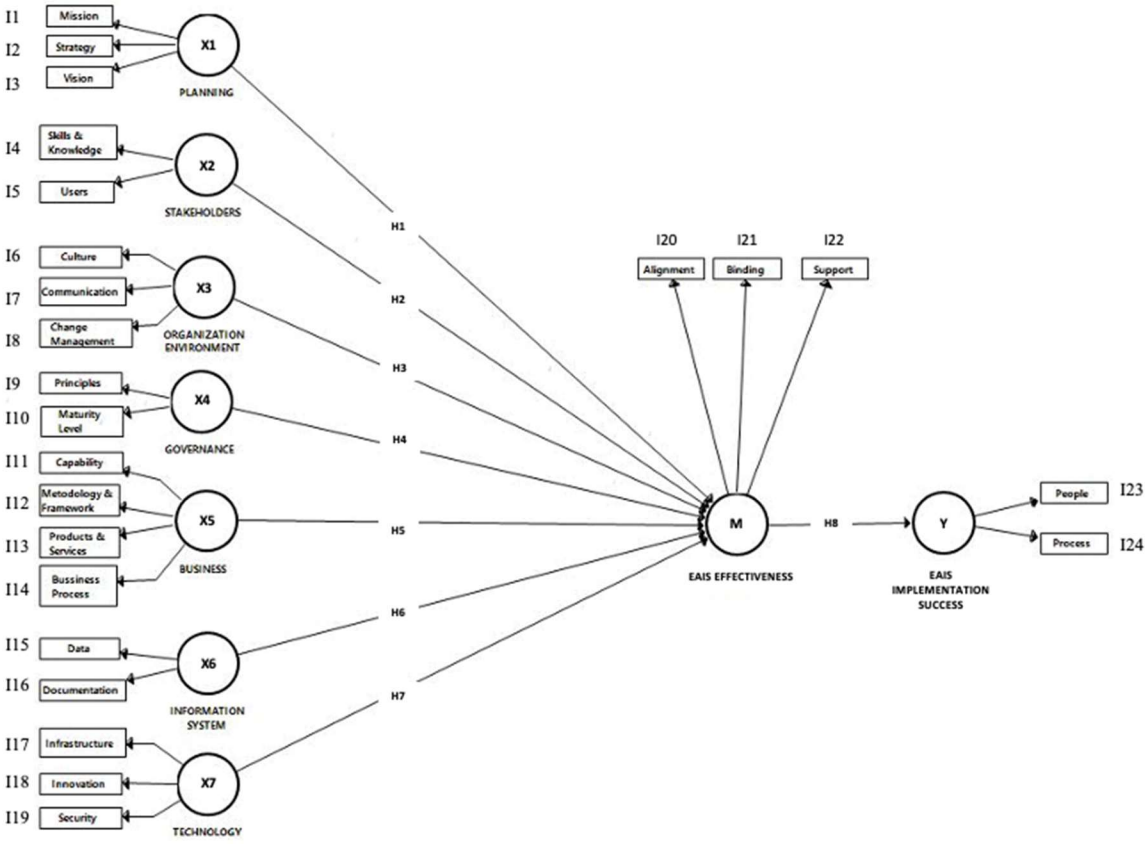


Figure 2: Research Model

3.1.1 Systematic literature review (SLR)

The flowchart shown on Figure 3 reflects the process of the use 108 published literatures to analyze indicators and supporting factors of EAIS. By using 5 selected criterias, the journal data was filtered and reduced to 87 literatures for a better accuracy for the purpose of mapping and development of indicators as well as EAIS supporting factors.

All literatures used in this study are from those published between 2010 and 2020 with most nearest or closest to the current industry condition.

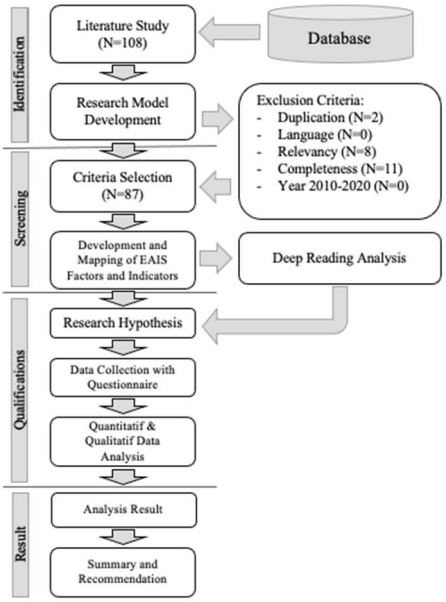


Figure 3. Data collection workflow

3.1.2 Hyphotesis

The 8 hyphotheses from the research model would be assessed with primary and secondary data collections obtained from the results of the on-line *Survey Monkey's* questionnaires based on 5-point likert scale quantitative method using Smart-PLS and qualitative method for open-ended questions analysis using MaxQDA. The study here applied the use of both quantitative and qualitative methods of the implementation of EA at State-Owned and non State-Owned companies.

H1: There is a relationship between Planning and EAIS Effectiveness

The initial stage of EAIS planning emphasizes the process of defining business needs [21] along with its architecture, which consists of defining the architecture of an information system and the required plans and implementation time. The Vision, Mission, and Strategic Objectives of Top Management and stakeholders will be important for binding the commitment in realizing an effective EAIS implementation process.

H2: There is a relationship between Stakeholders and EAIS Effectiveness

The interest of stakeholders will provide full support for understanding the use of EAIS [18], engaging in the implementation and development or improvement of information systems in the organizations.

H3: There is a relationship between Organization Environment and EAIS Effectiveness

Indications of a healthy organizational environment can be seen from the transparent way of communicating between internal and external parties [22], an active work culture between stakeholders and staff, and applying an effective Change Management process.

H4: There is a relationship between Governance and EAIS Effectiveness

Indications of a healthy organizational environment can be seen from the transparent way of communicating between internal and external parties [22], an active work culture between stakeholders and staffs, and applying an effective Change Management process [18], [21].

H5: There is a relationship between Business and EAIS Effectiveness

Business is the most important part in the EAIS framework that is used in processes and procedures to achieve business missions and objectives [23].

H6: There is a relationship between Information System and EAIS Effectiveness

Information systems that are measured efficiently and adaptively for future development provide a good EA implementation effectiveness and can be the basis for developing business in one organization [24].

H7: There is a relationship between Technology and EAIS Effectiveness

Infrastructure, innovation, and security will support innovation that is born from the development of information technology.

H8: There is a relationship between EAIS Implementation Effectiveness and EAIS Implementation Success

EAIS implementation effectiveness can be indicated by several things such as the readiness of an organization to change, the ability to absorb EAIS adoption, governance to implement actionable EAIS initiatives, and most importantly commitment from internal stakeholders such as management and parties. users [13].

4. RESULT AND FINDINGS

4.1 Data Collection

Primary data analysis using non-probability sampling method and purposive sampling was used in the collection of the results through online questionnaires that are distributed to the targeted SOE and non-SOE companies that are the object of this research. Qualified potential respondents should be familiar with the Enterprise Architecture concept, how EA is implemented in their companies, and some background of successful key factors or supports in implementing EA in their respective companies. All respondents are people who understand EA and its application in their respective companies.

Table 2. Summary of survey respondent characteristics

Total valid replies returned	120 respondents
Composition of company types	▪ Private companies (69) ▪ State Owned Enterprise (51)
Background of company's industries	▪ Food and Agriculture (5) ▪ Banking and Insurance (29) ▪ Consultancy Services (9) ▪ Telecommunications and IT-related (26) ▪ Transportation (Air, Sea, Land) (11) ▪ Logistics (8) ▪ Oil and Gas (17) ▪ Health (5) ▪ Retail (5) ▪ Property (5)
Level of position of respondents	▪ Top Management (12) ▪ Middle Management (83) ▪ Non-Management (25)
Office location	▪ Head Quarter (101) ▪ Branch Office (17) ▪ Field (2)
Sexes of respondents	▪ Male respondents (83) ▪ Female respondents (37)
Ages	▪ < 30 (12) ▪ 31-40 (45) ▪ 41-50 (40) ▪ 51-60 (23)
Number of Years in service	▪ < 3 years (35) ▪ 3-5 years (25) ▪ 6-10 years (37) ▪ 11-15 years (10) ▪ > 15 years (13)
Education level	▪ Undergraduate (57) ▪ Graduate (63)

The sampling data collection started from March 30, 2021, and ended April 30, 2021, initially with 156 contacts to reach out to (both by email and calls) and resulted in a total of 138 respondents who answered the survey questionnaire list, and 120 respondents returned completed answers to the entire questionnaire. Profile of the respondents based on their survey questionnaire completion are listed in table 2. These respondents analyzed from different management perspectives, from the top management level view till the middle management and non-management level.

4.2 Research Model Evaluation

The results of the questionnaire data analyzed for their relationships value with the Smart-PLS 3 tools [25]. Structural Equation Modelling (SEM) data analysis technique used for measuring conceptual model between latent variables from each indicator construct the variables. The strength of using this SEM-PLS method lies in the variables path analysis explanation for more than one dependent variable. The observed variable in this research model named latent variable both for independent variable and dependent variable. All direct observed variable named indicators.

4.3 Measurement Model Evaluation

The measurement model evaluation of validity test measured by outer loading values and average variance extracted (AVE). The Convergent Validity Test is carried out using the outer loading value of each indicator. This research indicator is said to be in a good category if the outer loading value is ≥ 0.7, but outer loading value between 0.4 – 0.7 is still acceptable as long as the AVE value ≥ 0.5 [26].

Table 3. Average Variable Extracted (AVE)

Variables	AVE
Planning	0.769
Stakeholders	0.804
Organization Environment	0.688
Governance	0.808
Business	0.599
Information System	0.842
Technology	0.720
EAIS Effectiveness	0.835
EAIS Implementation Success	0.836

All the independent variables shows the result for AVE value ≥ 0.5 which means all the factors selected for this research is valid.

Discriminant Validity Test is used to prove that each question formed from latent indicators or variables analyzed is not mixed up with questions from other latent variables. Since the research model being analyzed uses mediation or intervening variables, it is recommended to use the HTMT method because this technique will explain the relationship between indicators and latent variables better than the Fornell-Larcker criterion [27].

Table 4. HTMT Confidence Level

Variables	Original (O)	Mean (M)	2.5%	97.5%
Planning	0.909	0.908	0.871	0.937
Stakeholders	0.891	0.889	0.813	0.950
Organization Environment	0.868	0.867	0.821	0.906
Governance	0.894	0.891	0.817	0.948
Business	0.854	0.853	0.819	0.890
Information System	0.914	0.914	0.881	0.943
Technology	0.884	0.883	0.837	0.920
EAIS Effectiveness	0.938	0.937	0.905	0.958
EAIS Implementation Success	0.910	0.909	0.869	0.945

HTMT is commonly used to analyze complex models with mediating effect. Since all the HTMT value using resampling of 5000 subsamples in significance level 0.05 are ≤ 0.9, mean all the latent variables are valid.

Table 5. Cronbach α, rho A

Variables	α	rho_A	CR
Planning	0.847	0.859	0.909
Stakeholders	0.762	0.813	0.891
Organization Environment	0.772	0.802	0.868
Governance	0.762	0.767	0.894
Business	0.767	0.814	0.854
Information System	0.813	0.813	0.914
Technology	0.803	0.842	0.884
EAIS Effectiveness	0.901	0.905	0.938
EAIS Implementation Success	0.804	0.817	0.910

From table 5, we can see that all latent variables shown considered reliable as all the CR value is ≥ 0.6 and all the Cronbach's Alpha value ≥ 0.7, meaning all the latent variables are reliable.

Composite Reliability (CR) test is used to see the level of stability of the indicators from the analyzed data. The data can be said to be Reliable and Stable if it can still give the same results eventhough used repeatedly [28]. The CR value can be seen from 3 kinds of values from upper till lower approach: (1) Composite Reliability (CR); (2) Cronbach's Alpha; and (3) rho A.

4.4 Structural Model Evaluation

Structural model evaluation explains the prediction relationship from each latent variable used such as R2 test, f2 test, and path coefficient from hypothesis testing.

Coefficient determination (R-Square) is used to measure how much the endogenous variables (influenced) in the structural model are affected by exogenous variables (which influence). The higher the R-Square value, the better the prediction model of the proposed research model. The R-Square adjusted value normally selected for a complex model which normally involves mediating variable. The R-Square adjusted value for EAIS Effectiveness is 0.754, and the R-Square adjusted value for EAIS Implementation Success is 0.747 meaning the proposed model is in a good category for prediction. The result of R-Square adjusted ≥ 0.67 indicates that the research model formed is in the good category [26].

Table 6. f^2 values

Variables	EAIS Effectiveness	EAIS Implementation Success
Planning	0.081	
Stakeholders	0.119	
Organization Environment	0.036	
Governance	0.000	
Business	0.034	
Information System	0.099	
Technology	0.025	
EAIS Effectiveness		2.979

The F-test normally uses to see whether all the independent variables included in the model have a joint effect on the dependent variables. The result of F-Square ± 0.35 indicates the effect size is strong. If the result of F-Square ± 0.35 indicates the effect size is medium, and if the result of F-Square ± 0.02 indicates the effect size is weak category [25]. EAIS Effectiveness as mediating variable constructed from all the independent variables has the strongest effect to influence EAIS Implementation Success whereas the f^2 value for EAIS Effectiveness is 2.979 far above all the other independent variables.

4.5 Quantitative Result

The researchers used the quantitative method to justify each hypothesis findings, which answering each research question. The result from Smart-PLS calculation for each test can be depicted in table 12. The hypothesis being tested uses 120 samples of data that represent SOE and non-SOE companies in Indonesia, from different management levels.

Hypothesis 1: There is a relationship between Planning and EAIS Effectiveness

An analysis of two-tailed hypothesis testing to test hypothesis 1 support the relationship between planning and EAIS effectiveness. This result shows in p-value < 0.05 means planning affecting EAIS effectiveness positively. If the corporate strategy aligned with the business and IT process binding, this will impact the EAIS effectiveness. T-statistic value for this independent variable is the highest, which is > 1.96 with a 5% significance level, showing that planning should be carefully prepared from the early stage to extend the EAIS effectiveness throughout the implementation journey because this is the most significant factor among others.

Hypothesis 2: There is a relationship between Stakeholders and EAIS Effectiveness

An analysis of two-tailed hypothesis testing to test hypothesis 2 doesn't support the relationship between stakeholders and EAIS effectiveness. This result shows in p-value > 0.05, a little bit more than the standard value compared to other non-supporting path analyses, which means stakeholders not really affecting EAIS effectiveness positively. Even though the user's skills and knowledge improved, the EAIS effectiveness will still not impacted by their improvement. T-statistic value for this independent variable is only a little bit < 1.96 with a 5% significance level, showing that the stakeholders might impact the EAIS effectiveness if only the other relationship analyzed directly to the EAIS implementation success which aligned with the people indicators supported by management commitment.

Hypothesis 3: There is a relationship between Organization Environment and EAIS Effectiveness

An analysis of two-tailed hypothesis testing to test hypothesis 3 doesn't support the relationship between organization environment and EAIS effectiveness. This result shows in p-value > 0.05, the second-highest value from the most non-supporting path analysis means organization environment not affecting EAIS effectiveness positively. Whatever the company culture type in an organization, the EAIS effectiveness will not be impacted. T-statistic value for this independent variable is < 1.96 with a 5% significance level and the lowest, showing that the organization environment not significantly impact the EAIS effectiveness.

Hypothesis 4: There is a relationship between Governance and EAIS Effectiveness

An analysis of two-tailed hypothesis testing to test hypothesis 4 doesn't support the relationship between governance and EAIS effectiveness. This result shows in p-value > 0.05, the second rank position after the weakest of non-supporting path analysis, means governance not affecting EAIS effectiveness positively. But the maturity level of the organization might able to impact the EAIS effectiveness if the company grows to become more mature in the organization. T-statistic value for this independent variable is < 1.96 with a 5% significance level, but almost reach the standard t-value so this shows that the governance can negatively impact the EAIS effectiveness. Although insignificant.

Hypothesis 5: There is a relationship between Business and EAIS Effectiveness

An analysis of two-tailed hypothesis testing to test hypothesis 5 support the relationship between business and EAIS effectiveness. This result shows in p-value < 0.05 means business affecting EAIS effectiveness positively, second after most important after planning. If the business is managed positively, this will positively impact the EAIS effectiveness too. T-statistic value for this independent variable is the second highest, which is > 1.96 with a 5% significance level, showing that business process should be managed with a proper methodology and frameworks to improve products and services capability.

Hypothesis 6: There is a relationship between Information System and EAIS Effectiveness

An analysis of two-tailed hypothesis testing to test hypothesis 6 support the relationship between information system and EAIS effectiveness. This result shows in p-value < 0.05 as the third position most important factor to support EAIS effectiveness. Data integration which is managed well in proper documentation can be used as a knowledge management system in the organization, this will impact the EAIS effectiveness positively. T-statistic value for this independent variable is the highest, which is > 1.96 with a 5% significance level, showing that the information system should be managed as the most important asset for the company.

Hypothesis 7: There is a relationship between Technology and EAIS Effectiveness

An analysis of two-tailed hypothesis testing to test hypothesis 7 doesn't support the relationship between technology and EAIS effectiveness. This result shows in p-value > 0.05, the strongest non-supporting path analysis means governance really not affecting EAIS effectiveness positively. Whatever the technology used by a company, the EAIS effectiveness will not be impacted. T-statistic value for this independent variable is < 1.96 with a 5% significance level, showing that technology does not significantly impact the EAIS effectiveness. Infrastructure and security aspects should be prepared carefully before the company thinks about innovation.

Hypothesis 8: There is a relationship between EAIS Implementation Effectiveness and EAIS Implementation Success

An analysis of two-tailed hypothesis testing to test hypothesis 8 support the relationship between information system and EAIS effectiveness. The p-value and t-statistic value show the highest rank for both tests, which means that this relationship is the most important path to support EAIS effectiveness. Alignment between business and IT bind in a good strategy from plans until EAIS implementation supported by management will create success.

From the calculated path coefficient, T-Stats, and P-Values for all factors, the hypothesis path stakeholders, organization environment, governance, and technology are not supported. So, the final research model only supports the relationship between EAIS Effectiveness with three analyzed factors Planning, Business, and Information System by orders as shown in Fig. 5. This result is significant at the p-level 0.05 where the correlation between X variables and mediating variable was tested.

Table 7. Research Model Final Results after resampling 5000 subsamples

ID	Hypothesis	Path Coef.	T-Stats	P-Values	Result
H1	Planning affects EAIS Effectiveness	0,224	2,821	0,005	Accepted
H2	Stakeholders affects EAIS Effectiveness	0,191	1,837	0,066	Rejected
H3	Organization Environment affects EAIS Effectiveness	0,012	0,122	0,903	Rejected
H4	Governance affects EAIS Effectiveness	-0,124	1,822	0,068	Rejected
H5	Business affect EAIS Effectiveness	0,331	2,724	0,006	Accepted
H6	Information System affects EAIS Effectiveness	0,219	2,625	0,009	Accepted
H7	Technology affects EAIS Effectiveness	0,115	1,583	0,113	Rejected
H8	EAIS Effectiveness affects EAIS Implementation Success	0,865	28,611	0,000	Accepted

4.6 Qualitative Result

The researchers used the qualitative method using deductive coding in MaxQDA to explore findings from the participant's pain point of view related to the factors and indicators analysed in this study. The researchers categorized each wording text analysis in the questionnaire's open-ended responses by code segment analysis from the variables and indicators analyzed in the research model.

4.6.1 Planning

When asked to provide the feedback on how one of 3 indicators, Vision, Mission, and Strategy, would be or has been carried out in the EAIS implementation, the majority of respondents provided almost the same answer that EAIS would or has not able to be carried out in their companies due to various reasons, such as (1) Top Management's inability to apply most proper or applicable company's strategies, (2) frequent change of Top Management level, (3) budgetary constraints to execute annual plans, (4) outdated technology which caused them to divert their focus on other agendas rather than having to invest in a huge amount, and (5) competencies and updated knowledge at stakeholders level to prepare and compete in the markets.

4.6.2 Stakeholders

Stakeholders could play an important role in support achieving the company's success and there are two indicators that could give a sign of that success are competencies of the Stakeholder's Skills & Knowledge, and User's role to proactively be involved in new knowledge update to update their skills. Almost every respondent provided with the same answer that the right competencies would be the main critical aspect required, followed by User's lack of knowledge of market trends need to be improved accordingly.

4.6.3 Organization Environment

One of the key factors to make the EAIS implementation successful with three indicators in regards to the company environment are culture, communication, and change management. When asked about providing feedback on how important it would be to have synchronization between the culture and communication, almost every respondent explained that their companies have already built some establishment for the communication channel, starting from daily morning discussions within teams, regular daily update meetings, weekly meetings, and periodical town hall have been held. However, lacking transparency seems to be the main problem to solve in these meetings for effective results. Very few respondents provided the information that their companies have not optimized the efforts to develop a good and proper communication tool in their internal communication. As of change management, nearly 70% of the total respondents think that regulation and policy support EAIS effectiveness through change management of their internal policy through the top-down approach, while only a few of the respondents think that EAIS effectiveness triggered by external policy, such as POJK, government regulation, etc.

4.6.4 Governance

In the Governance factor, building or maintaining a good corporate governance culture in companies is still somewhat a problem, as addressed by all respondents. Common feedbacks given were being disciplined with timing at work, be administratively disciplined with documentation, proactively communicate to others for two-way communication, and be consistent to earn integrity from others. In regards to the maturity level of companies, most of the respondents work for companies with an acceptable level of maturity levels which are levels 3 and 4 with several common reasons addressed: (1) Constant improvements in applying business processes matching to other units; (2) Plan vs actual not happening; (3) Readiness and acceptance of impacted individuals for a change in the organization structure; (4) The higher the maturity level is, the companies should be leaner and move towards digitization; (5) ISO standardization would be a goal to reach for companies.

4.6.5 Business

Act as a supporting factor in the successful implementation of EAIS with indicators such as capability, business process, methodology and framework, and product and services. A series of questions were answered by respondents. 18% responded that product and or services would be the key factor to make a company competitive in the market, whereas others provided numerous answers (large networking, innovation, collaboration, quality advantage being offered, market penetration, good supply chain management, competitiveness against private sectors, strong logistics, market trends followers, and strong sales and marketing). 67% claimed that business processes are running well at an acceptable level and 33% believed that business processes at their companies are not updated or not integrated. 37% of them did not disclose any answer with either unknown due to confidentiality or

respondents are not in the best knowledge to reply. The others mentioned ITIL, COBIT, ISO, TOGAF, Zachman, ITSM, agile, and PCS DSS. Still, around Business factor, all 100% of respondents provided with at least one answer: airport operation control center, CMS, connectivity business, customer portal, customer touchpoints, QRIS payment, eProcurement, internet banking, IT Helpdesk system, production and monitoring dashboard, freight, and container services, Vendor management system dan iProc (e-procurement) services, Mobile Application and digital payment, and many others.

4.6.6 Information System

Respondents were asked about which of the two indicators under Information System can still be optimized to make information system effective (more effective) in their companies. Using two indicators, Data, and documentation, the following reasons were provided by respondents: data for monetization, manual processes need application (automation), data needs to be integrated, documentation needs to be maintained.

4.6.7 Technology

Almost every business process can be automatedand integrated with each other. Respondents were asked to provide an overview of industry trends which related to their respective companies and 100% responded with the followings: Competitive, Data Connectivity, Digital Banking, AI, open bank API, marketplace, trend technology updates, online services, digitalization in the airline's industry, blockchain, online payments, cloud computing. Between indicators of security and infrastructure, respondents provided opinions of which should be optimized in their companies: 60% security and 40% infrastructure.

4.6.8 EAIS Effectiveness

There are three variables that support EAIS Effectiveness. The selected indicators are alignment, binding, and support. Through the survey response, respondents described alignment as the synchronization between business and IT processes, which all have confirmed that alignment has taken place at their companies with various examples of involvement of multi-business users in data integration by utilizing technology to run their business processes. Regulatory compliance assured being placed in the system as a basis to run their business processes. Secondly, the Binding variable has been in line with corporate strategy along with the adaptiveness of technology to meet the most suitable market's technology trends. Lastly, Support has become an important element that connects employees' willingness to support, the strategy provided by Top Management, and the information system that also supports the integration of various business processes.

4.6.9 EAIS Implementation Success

In the end, EAIS implementation success is a dependant variable that was driven from the supporting factors of EAIS which formed the EAIS effectiveness. There are two out of three indicators selected as construction that play a major role in the making of the EAIS implementation success, namely People and Process. From People's perspectives, the majority of respondents have provided their views that top management support is a very important requirement in supporting the EAIS implementation success from planning up to the post-implementation stage. This shows a commitment to support and update the stakeholder's skills and knowledge to develop maturity level. Another thing is Process, as an important indicator in realizing the EAIS implementation success. The process has an effective role by integrating business processes between different units and driving materialize process automation by using the available technology as an enabler of process efficiency.

The result of the code segment made in MaxQDA can be seen where most of the word counts shows in the form of Code Segment Map. The indicators and variables words hit depicted in Figure 4. The Code System Relationship can be seen from the numbers of each word counts in each respondents survey collected or by Code System Corellation Map in Figure 5.

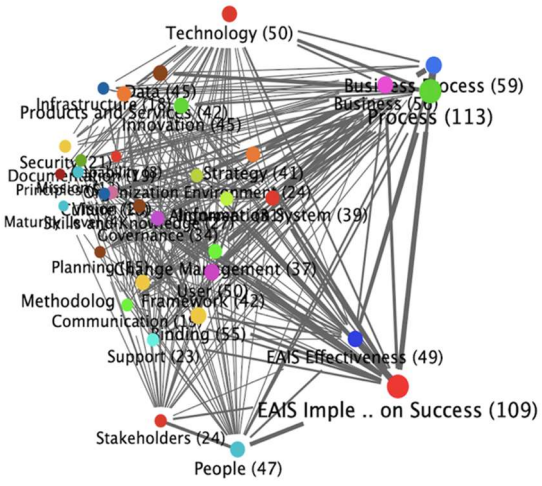
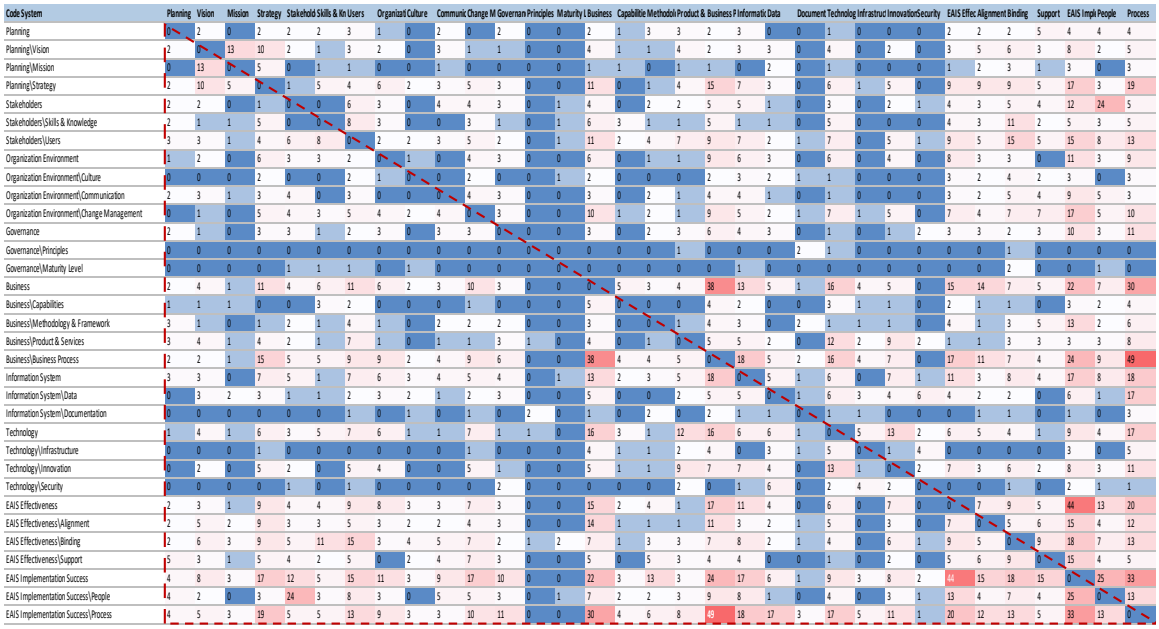


Figure 4. Code Segment Map

Journal of Theoretical and Applied Information Technology
15th November 2021. Vol.99. No 21

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195



Code System	Planning	Vision	Mission	Strategy	Stakehold	Skills & Kn	Users	Organizati	Culture	Communic	Change M	Governan	Principles	Maturity L	Business	Capabilitie	Methodolo	Product &	Business P	Informatic	Data	Document	Technolog	Infrastruc	Innovation	Security	EAIS Effec	Alignment	Binding	Support	EAIS Impl	People	Process
Planning	0	2	0	2	2	2	3	1	0	2	0	2	0	0	2	1	3	3	2	3	0	0	1	0	0	0	2	2	2	5	4	4	4
Planning\Vision	2	0	13	10	2	1	3	2	0	3	1	1	0	0	4	1	1	4	2	3	3	0	4	0	2	0	3	5	6	3	8	2	5
Planning\Mission	0	13	0	5	0	1	1	0	0	1	0	0	0	0	1	1	0	1	1	0	2	0	1	0	0	0	1	2	3	1	3	0	3
Planning\Strategy	2	10	5	0	1	5	4	6	2	3	5	3	0	0	11	0	1	4	15	7	3	0	6	1	5	0	9	9	9	5	17	3	19
Stakeholders	2	2	0	1	0	0	6	3	0	4	4	3	0	1	4	0	2	2	5	5	1	0	3	0	2	1	4	3	5	4	12	24	5
Stakeholders\Skills & Knowledge	2	1	1	5	0	0	8	3	0	0	3	1	0	1	6	3	1	1	5	1	1	0	5	0	0	0	4	3	11	2	5	3	5
Stakeholders\Users	3	3	1	4	6	8	0	2	2	3	5	2	0	1	11	2	4	7	9	7	2	1	7	0	5	1	9	5	15	5	15	8	13
Organization Environment	1	2	0	6	3	3	2	0	1	0	4	3	0	0	6	0	1	1	9	6	3	0	6	0	4	0	8	3	3	0	11	3	9
Organization Environment\Culture	0	0	0	2	0	0	2	1	0	2	0	0	1	2	0	0	0	0	2	3	2	1	1	0	0	0	3	2	4	2	3	0	3
Organization Environment\Communication	2	3	1	3	4	0	3	0	0	0	4	3	0	0	3	0	2	1	4	4	1	0	1	0	0	0	3	2	5	4	9	5	3
Organization Environment\Change Management	0	1	0	5	4	3	5	4	2	4	0	3	0	0	10	1	2	1	9	5	2	1	7	1	5	0	7	4	7	7	17	5	10
Governance	2	1	0	3	3	1	2	3	0	3	3	0	0	0	3	0	2	3	6	4	3	0	1	0	1	0	2	3	3	2	3	10	3	11
Governance\Principles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	1	0	0	0	0	0	0	1	0	0	0
Governance\Maturity Level	0	0	0	0	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	1	0
Business	2	4	1	11	4	6	11	6	2	3	10	3	0	0	0	5	3	4	38	13	5	1	16	4	5	0	15	14	7	5	22	7	30
Business\Capabilities	1	1	1	0	0	3	2	0	0	0	1	0	0	0	5	0	0	0	4	2	0	0	3	1	1	0	2	1	1	0	3	2	4
Business\Methodology & Framework	3	1	0	1	2	1	4	1	0	2	2	2	0	0	3	0	0	1	4	3	0	2	1	1	1	0	4	1	3	5	13	2	6
Business\Product & Services	3	4	1	4	2	1	7	1	0	1	1	3	1	0	4	0	1	0	5	5	2	0	12	2	9	2	1	1	3	3	3	3	8
Business\Business Process	2	2	1	15	5	5	9	9	2	4	9	6	0	0	38	4	4	5	0	18	5	2	16	4	7	0	17	11	7	4	24	9	49
Information System	3	3	0	7	5	1	7	6	3	4	5	4	0	1	13	2	3	5	18	0	5	1	6	0	7	1	11	3	8	4	17	8	18
Information System\Data	0	3	2	3	1	1	2	3	2	1	2	3	0	0	5	0	0	2	5	5	0	1	6	3	4	6	4	2	2	0	6	1	17
Information System\Documentation	0	0	0	0	0	0	1	0	1	0	1	0	2	0	1	0	2	0	2	1	1	0	1	1	0	0	0	1	1	0	1	0	3
Technology	1	4	1	6	3	5	7	6	1	1	7	1	1	0	16	3	1	12	16	6	6	1	0	5	13	2	6	5	4	1	9	4	17
Technology\Infrastructure	0	0	0	1	0	0	0	0	0	0	1	0	0	0	4	1	1	2	4	0	3	1	5	0	1	4	0	0	0	0	3	0	5
Technology\Innovation	0	2	0	5	2	0	5	4	0	0	5	1	0	0	5	1	1	9	7	7	4	0	13	1	0	2	7	3	6	2	8	3	11
Technology\Security	0	0	0	0	1	0	1	0	0	0	0	2	0	0	0	0	0	2	0	1	6	0	2	4	2	0	0	0	1	0	2	1	1
EAIS Effectiveness	2	3	1	9	4	4	9	8	3	3	7	3	0	0	15	2	4	1	17	11	4	0	6	0	7	0	0	0	7	9	5	44	13	20
EAIS Effectiveness\Alignment	2	5	2	9	3	3	5	3	2	2	4	3	0	0	14	1	1	1	11	3	2	1	5	0	3	0	7	0	5	6	15	4	12
EAIS Effectiveness\Binding	2	6	3	9	5	11	15	3	4	5	7	2	1	2	7	1	3	3	7	8	2	1	4	0	6	1	9	5	0	9	18	7	13
EAIS Effectiveness\Support	5	3	1	5	4	2	5	0	2	4	7	3	0	0	5	0	5	3	4	4	0	0	1	0	2	0	5	6	9	0	15	4	5
EAIS Implementation Success	4	8	3	17	12	5	15	11	3	9	17	10	0	0	22	3	13	3	24	17	6	1	9	3	8	2	44	15	18	15	0	25	33
EAIS Implementation Success\People	4	2	0	3	24	3	8	3	0	5	5	3	0	1	7	2	2	3	9	8	1	0	4	0	3	1	13	4	7	4	25	0	13
EAIS Implementation Success\Process	4	5	3	19	5	5	13	9	3	3	10	11	0	0	30	4	6	8	49	18	17	3	17	5	11	1	20	12	13	5	33	13	0

Figure 5. Code System Correlation Map

A Process on EAIS Implementation Success of Business Processes on Business factors has a high correlation. This is indicated by the highest number 49 in the correlation. This means that the existing Business Process in the company is the most important thing to support the EAIS Implementation Success Process. EAIS effectiveness has a high correlation with EAIS Implementation Success. This is indicated by the number 44 in the correlation. This means that the success of EAIS implementation will not be created if it is not supported by effective EAIS Supporting Factors. Business Process on the Business factor has a high correlation with a correlation number of 38, which means that the company's business processes are the most important thing to support the company's business. A Process on the EAIS Implementation Success has a high correlation with a correlation number of 33, which means that all existing processes in the company are very important to support the Successful Implementation of EAIS. A Process on the EAIS Implementation Success on Business factors has a high correlation with a correlation number of 30. This shows that Business Process is the most important thing in the Successful Process of EAIS Implementation. People on the EAIS Implementation Success compare with the EAIS Implementation Success have a high correlation with a correlation number of 25, which means that Business Process is one of the other most important indicators in supporting the Success of EAIS Implementation is People in the company.

All of the correlation results above prove the harmony between the relationships between quantitative and qualitative research results obtained, where Process and People in an organization strongly support the success of EAIS implementation. This supports the results of hypothesis testing between variable relationships where the Information System generated from a company's Business Process has a very positive influence on supporting the success of EAIS implementation.

5. DISCUSSION

The analysis of eight factors for EAIS implementation success in Table 7 concluded that Planning, Business, and Information System factors support EAIS Effectivities significantly in a positive direction and mediating EAIS Implementation Success in accordance. However, we found out that several factors such as stakeholders, organization environment, governance, and technology were rejected because they did not affect the EAIS Effectiveness significantly in a positive direction. While Governance affecting the EAIS Effectiveness insignificant, but if governance in an organization changed, the EAIS effectiveness will also respond in a negative direction.

Meanwhile, the qualitative results show us the Business Process holds the most important aspect in

the responses for EAIS Effectiveness for EAIS Implementation Success. This means that Business holds both same result in becoming the most important factor from quantitative and qualitative method result. In addition to that, the Planning for EAIS Effectiveness should consider the involvement of People and Process from pre-implementation of EAIS process.

Another critical factor highlighted in this research was the authorities' government laws and regulations, which behave as external factors for consideration in the public sector stated by Nur Azaliah and Selamat [17]. In Indonesia, these external factors are crucial to support the successful implementation of EAIS for SOE and non-SOE companies. This is almost the same as Lee et al. [18] had described in this study before.

The main stakeholders who are often encountered in the discussion of the results of this study are the management and implementation teams, who regulate and implement organizational governance.

In addition, there is one main factor discussed by Wan et al. [20] in their previous studies, which turned out to be a factor supporting the effectiveness of the main EAIS in this study. Planning turned out to be a forming or formative factor in previous studies. This factor is often forgotten because many previous studies only pay attention to the implementation process phase but failed to pay attention to Planning before implementation.

Business Processes and Data in the form of Information Systems are the two main supporting factors: new findings, rarely discussed as supporting factors for successful EA implementation.

The factors supporting the effectiveness of the EAIS being studied in this research model are almost all aligned and similar to the CSF from previous related studies. However, the three main factors found as a result of this research are still rarely studied by previous researchers, namely Planning, Business, and Information Systems.

The implementation of EAIS Strategic Planning at the beginning of the implementation and improvements to the company's Business Processes and Data Documentation are likely to increase EAIS implementation's success effectively.

6. CONCLUSION

The research model sets out in this study to test the relation of nine variables: Planning, Stakeholders, Organization Environment, Governance, Business, Information Systems, Technology, and EAIS effectiveness gathered from the early literature review towards EAIS implementation success SOE and non-SOE companies. The research tests the linkages between the attributes constructed from the model capabilities using a quantitative method using Smart-PLS and a qualitative method using Max-QDA.

Based on the quantitative results of the hypothesis testing conducted, of all eight hypotheses, four factors influence the success of EAIS implementation, namely Business, Planning, and Information Systems mediated through EAIS Effectiveness for EAIS Implementation Success. All the hypotheses H1, H5, dan H6 support the relationship to EAIS effectiveness and positively impact the EAIS Effectiveness. The T-test with a significance level of 5% indicates that the company should carefully prepare planning early to extend the business process efficiency, which is managed with a proper methodology and frameworks for information system management as the essential asset for the company. The EAIS effectiveness impact to EAIS implementation success gained through the following factors will improve products and services capability throughout the implementation journey, starting from planning until successful EAIS implementation so that hypothesis H8 can be accepted. The other four factors that do not affect the success of EAIS implementation are Stakeholders, Organization, Governance, and Technology. Skills and knowledge of Stakeholders do not significantly impact the EAIS effectiveness, so hypothesis H2 was rejected. Organization Environment, such as the company's culture, does not positively impact EAIS Effectiveness, so Hypothesis H3 was rejected. The company's Governance, such as its communication between its internals and externals, also does not positively affect EAIS Effectiveness, so the hypothesis H4 was rejected. And lastly, the Technology security, infrastructure, or innovation of a company does not positively impact the EAIS effectiveness, so hypothesis H7 was also rejected.

In line with the quantitative results, the Business Process stands out as the critical factor in this research which comes after Planning to provide better Information Systems for successful EAIS implementation.

The limitation in this study lies in the sampling method where the researcher uses the non-probability sampling purposive method. The survey conducted by the researcher was targeted to the audience who are familiar with or have knowledge about the terminology of Enterprise Architecture Information System (EAIS) and how it was or will be implemented at their companies. The number of targeted participants who answered to this research

can still be improved, and without the COVID19 pandemic condition, the time and effort placed to do the research would have been much less. An efficient approach can be improved to increase the number of respondents without constraints such as onsite interviews and meetings for research purpose introduction.

In future research, we can add more participants from other divisions in the company, and we can also add more business sector perspective to get more holistic view.

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