

---

# TOWARDS SUSTAINABILITY OF EA PRACTICES: A SYSTEMATIC REVIEW

Surya Sumarni Hussein<sup>1</sup>, Zuraini Ismail<sup>\*1</sup>, Mohamad Zainuddi Mat Taib<sup>2</sup>

<sup>1</sup>Advanced Informatics School (AIS),  
Universiti Teknologi Malaysia, 54100 Kuala Lumpur  
Malaysia

<sup>2</sup>Malaysian Administrative Modernisation and Management Planning Unit (MAMPU), Prime Minister's Department, Cyberjaya, Selangor. <sup>\*</sup>Corresponding author zurainiismail.kl@utm.my

---

## Abstract

Enterprise Architecture (EA) has been identified as one of the prime initiative to drive the establishment of connected government towards world class public service delivery. However, building upon several public sector agencies that had implemented these initiatives, it was reported as unfavourable in sustaining EA practices. This study aims to i. review and identify related issues ii. Identify factors that influence sustainability of EA practices also iii. Identify elements of EA governance. Through the systematic literature review (SLR) five related issues were discerned, four key factors were established in sustaining EA practices while five elements of EA governance emerged in the construction of EA governance framework.

Keywords: Enterprise Architecture, Enterprise Architecture Governance, sustainability, practices

---

## 1.0 INTRODUCTION

Over the last 40 years, the Malaysian Government IT landscape has changed tremendously. Approximately 77 per cent of Government services are now online[1]. While the Government has reacted positively to this rapid change being the biggest employer in the country, it is still playing catching-up with the demands of its external stakeholders and the world at large. The traditional way of doing work cannot persist, therefore there is a need for immediate revamping of the way how work is done. Those agencies which were able to synchronize their business process with IT infrastructure were able to deliver superb services. Thus, Enterprise Architecture (EA) must be implemented towards a better e-government service delivery. Therefore, the agenda towards establishing a world class public service delivery has continued through various national programs. For instance, under the Entry Point Project (EPP8) of the National Key Economic Area (NKEA) in the Malaysian Economic Transformation Program (ETP), EA has been identified as one of the prime initiative to drive the establishment of connected government in the country[2]. However, the

implementation of EA initiatives is still in its infancy stages among agencies[3]. Studies in Malaysia, found that ten organizations conduct variations of EA, particularly at the planning level[4]. Therefore, The Malaysian Administrative Modernisation and Management Planning Unit (MAMPU) envisioned that the implementation of EAs in silos by individual agencies would restrain any hope of an integrated and connected government system in the future unless efforts are taken to lead this exercise. Thus, Malaysian Government has come out with an initiative called 1 Government Enterprise Architecture or 1GovEA. 1GovEA is a systematic approach in guiding an organization to transform both business and technical aspect. 1GovEA Blueprint consist of framework, methodology and implementation plan to assist the agencies in the public sector to foster EA initiatives for their respective agencies[5]. 1GovEA implementation is important towards better development of Digital Government service delivery through alignment of business strategy and ICT strategy. Through 1GovEA practices, it will support the government via information as references provided by centralised repository of EA. Hence, the initiative of 1GovEA will improve ICT governance for monitoring

and project implementation and to support initiatives of Big Data, Open Data and Green Technology. Besides, this initiative will assist in preventing duplication of ICT application and business process in government agencies [5]. It will also lead to establishment of a single view of the current business and technical environment for agencies. However, building upon several public sector agencies that had implemented these initiatives, it was reported that to sustain the practices of EA is articulated as unfavourable. This study sets to achieve 3 objectives namely i. review and identify related issues ii. identify factors that influence sustainability of EA practices also iii. identify elements of EA governance. The following section describes the review method using SLR while the next section highlights the findings. A discussion follows with the SLR findings based on the synthesis of evidence. Finally, the last section ends with conclusion.

## 2.0 THE REVIEW METHOD

In conducting the literature review, this research follows a systematic literature review (SLR) method [3-4]. The SLR method was conducted in three stages: planning the review, conducting the review and reporting the review. The method is depicted in Figure 1.

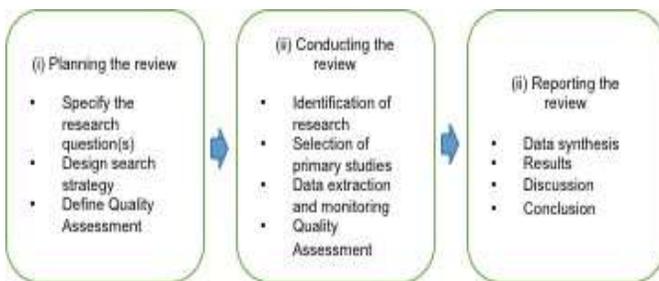


Figure 1 SLR phases and stages

### 2.1 SLR Research Questions

The formulation of research question(s) comprised of five major components such as population, intervention, comparison and outcomes model and context [8]. Table 1 shows the criteria and scope of research question.

Table 1 Criteria and scope of research question

Criteria	Scope
Population	All organisations that have established EA.
Intervention	EA Governance, issues and elements
Comparison	Public and private sector organisation
Outcomes	Elements, issues for EA Governance Framework deployment

Criteria	Scope
Context	Reviewed of any studies of EA Governance Framework and deployment issues

Based on the criteria and scope of the research question in Table 1, the SLR questions are:

RQ1: What are the issues in sustaining EA practices in an organization?

RQ2: What are the factors that influence sustainability of EA practices?

RQ3: What are the governance's elements in existing EA framework?

### 2.2 Data Sources

Databases used as sources of data are ACM Digital Library, IEEEExplore, Emerald, ScienceDirect, SpringerLink, Scopus, and Google Scholar as sources of data. The selected online databases library was chosen based on their "Enterprise Architecture" studies indexes.

### 2.3 Search Strategy

The initial search strings are Enterprise Architecture, Enterprise Architecture Governance, Framework, Model, Implementation, Practice and Sustainability. The following steps were used to build the search strings:

- (i) Source of major terms from the research questions.
- (ii) Identification of synonyms for major terms.
- (iii) Identification of keywords in relevant papers or books.
- (iv) Usage of the Boolean OR and Boolean AND to allow synonyms and world class variants of each keywords

### 2.4 Study Selection

For the selection of study, the source of papers being selected were rank from highest to lowest priority: journals, conferences or proceedings, technical reports, thesis reports, books and magazine articles.

### 2.5 Inclusion and Exclusion Criteria

The articles reviewed were peer-reviewed articles in English on EA governance framework studies published between January 1, 2005 and December 15, 2015. Articles on the following subtopics were included in the search:

- (v) Purposes and aims to foster EA governance framework.

- (vi) Strategies and methodologies for development. Status or level of implementation.
- (vii) Issues and obstacles in implementation.
- (viii) EA governance in ensuring the sustainability of e-government services.
- (ix) Consequences of having EA governance including outputs and benefits.
- (x) Include study published within the period of 2005 to 2015.
- (xi) Articles on the following topics were excluded:
  - a. Non-research articles with no supporting evidence.
  - b. Articles that only described tools only.
  - c. Articles that is not written in English.
  - d. Articles that did not match the inclusion criteria.

### 2.5 Data Extraction and Study Quality Assessment

Quality assessment study checklist was used to ensure the data extraction meets the quality criteria. According to the SLR guidelines, which were proposed by Kitchenham and Charters[7], the general questions asked to measure the quality of the selected studies are shown in Table 2 below.

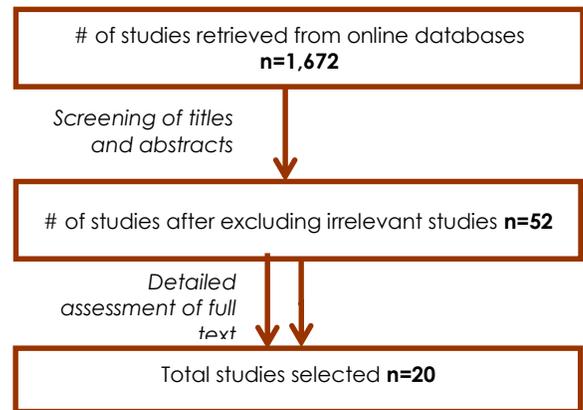
**Table 2** Quality assessment study checklist

No	Questions	Answer
SQ1	Are the aims of the research clearly stated?	Yes/No
SQ2	Is the research design clearly specified?	Yes/No /Partially
SQ3	Do the data collection being carried out accordingly?	Yes/No /Partially
SQ4	Does the researcher(s) display(s) enough data to support their understandings and conclusions?	Yes/No /Partially
SQ5	Is the method of analysis appropriate?	Yes/No /Partially

The study checklist used three scale which are coded accordingly: Yes = 1 point, No = 0 point, and Partially = 0.5 point. From the item checklist, the sum of quality score for each article was measured between 0 (very poor) and 5 (very good).

### 3.0 FINDINGS

Figure 2 illustrates the summary of the stages of study selection in this SLR guidelines[7]. Using the search item defined, 1672 studies being identified. Consequently, only 52 relevant studies were selected based on the screening of contents of the frameworks. Next, the relevant studies will be synthesis after being filtered according to the inclusion and exclusion criteria. All possible duplicates and similarity of the frameworks are excluded too. Finally, only 20 studies were selected and believed capable of providing answers to the formulated research questions.



**Figure 2** Findings from primary studies procedures

### 3.1 Quality of Factors

Table 3 indicates the quality scores of 20 identified articles. Eight (40%) are of good quality while six (30%) studies were rated as very good quality. Four (20%) studies as fair, two (10%) as poor however no study was found to of very poor quality. Therefore, all 20 selected articles were included for further analysis.

**Table 3** Quality Scores

Quality Scale	Very poor (>=1)	Poor (>=2)	Fair (>=3)	Good (>=4)	Very Good (=5)	Total
Number of studies	0	2	4	8	6	20
Percentage (%)	0	10	20	40	30	100

### 4.0 DISCUSSION

In this section, the study results are based on the research questions developed.

#### 4.1 Issues in sustaining EA practices in an organization

According to literature, there is issue regarding sustainability of EA practices in both private and government sectors. The complexity of the organizations leads to this [9]. EA approaches receive major criticisms due to frequent changes in processes landscape, practices and procedures of government and governance that leads the difficulty in fitting them in stages-of-growth model [10].

There are various challenges in planning the execution of EA implementation. Among them are creating awareness, getting recognition and acceptance, political barriers, getting support from the top management, conducting training, culture cultivation, data control and cooperation from users

[11]–[13]. Apart from that, the effective use of EA faced obstacles due to the lack of understanding on how decisions are made, what processes are being implemented and what the desired outcomes[14]. It was noted that in order for EA to succeed, stakeholders should be made to understand and be clear of EA practices. Ultimately, the critical part is the formation of shared vision, communication among stakeholders, and unclear evaluation of the impact. Architects are primarily in charge of developing these building blocks. Clear roles between project managers, project architects and intended users is crucial that may lead to good governance. Good communications with rampant feedbacks, and mutual understanding lead towards effective use of EA [14].

Governance is a complex, dynamic system involving multiple disciplines and multiple stakeholders[15]. A major challenge when proposing a governance model for EA governance is the different perspectives being identified from various stakeholders. Thus, these perspectives need to be assessed via a stakeholder analysis. This includes stakeholder identification and application scenarios that are to be mapped to the model. It seems that the challenge is typically the lack of competency and stakeholders' readiness to explicitly describe their requirements and application scenarios[16]. Lack of governance also may cause substantial risks and can create inconsistencies among agencies, which are usually not acclaimed by the decision makers[10-11]. In comparison to business and ICT governance which are already established and matured in form of reference models, EA governance is still in their early stage[19]. Hence, there is a need for a clear definition of EA governance that reflect revolutionary EA in strategic manner currently downplayed by IT governance [20].

## 4.2 Factors that influence sustainability of EA practices

SLR research question 2 seeks to understand how governance affects sustainability of EA practices in an organization. Four factors were identified as exhibited in Table 4.

**Table 4** Factors influencing sustainability EA practices

Key Factors	Authors
Detailed, formal description of a process	[21]
Sufficient resources, top management support and acceptance	[22], [21], [23]
Strategic and standardized governance	[22], [21], [24], [23]
Learning, support, collaborate	[25], [26]

## 4.3 Elements of governances in existing EA framework

EA governance can assist in decision making of management[27]. Based on the SLR conducted, there are many approaches in adopting governance in implementing EA in an organization. Each approach consists of elements that build up the governance framework. Table 5 lists the EA governance elements based on authors' works from the year 2005 to 2014. Emphasis had been given to 'Structures' as it act as a backbone for communication and interaction on EA among stakeholders [28]. 'Structures' integrate EA function into the overall organizational towards effectiveness[29]. All the elements recorded in Table 5 will be considered for the proposed EA governance framework.

**Table 5** EA governance elements with supported authors

Elements	Authors
Structures	[9], [12], [14], [19], [20], [22], [30], [31], [32], [33], [34]
Processes	[9], [14], [16], [20], [28], [35], [36]
Roles and Responsibilities	[9], [16], [30]
Standard, Policies and Principles	[16], [30], [33]
Others (Organisation, Measurements, Tools, maintenance, communication, investment, resources)	[14], [20], [30], [31], [35]

## 5.0 CONCLUSION

This ongoing study, had successfully identified five related issues. They are i. complexity of organizations ii. attaining support from top management iii. lack of understanding of EA processes iv. different stakeholders' perspectives and v. lack of governance. The review indicates that there is limited research on factors that influence the sustainability of EA practices suggesting more work to be done on this issue. Secondly, four key factors were established in sustaining EA practices namely i. detailed description

of a process ii. top management support and acceptance with sufficient resources iii. strategic and standardized governance and iv. support towards learning and collaboration. Third, five elements of EA governance emerged in the construction of EA governance framework. The elements are i. structures, ii. processes, iii. roles and responsibilities, iv. standards, v. policies and principles.

With such a paucity of research in EA therefore this study would provide some insights toward sustainability of EA implementations and its practices. This would advocate as an initial effort towards a more

conclusive EA governance adoption for the Malaysian setting. Notwithstanding the issues involved, along with recognising the sustainable factors had aligned the determinants of governances' elements. Hence, leads to the construction of EA governance framework. EA experts of selected Malaysian government agencies will assist in evaluating the proposed EA governance framework. A Delphi methodology will be employed in the data collection phase.

## Acknowledgement

The research is supported by UTM research grant Q.130000.2538.11H82 and Ministry of Education Malaysia.

## References

- [1] J. P. Menteri, "Economic Transformation Programme, Annual Report 2014," p. 44, 2010.
- [2] Economic Transformation Programme: A Roadmap For Malaysia., "Performance Management and Delivery Unit (PEMANDU)," *ETP Handb.*, pp. 513–550, 2010.
- [3] P. Public and S. Digital, "THE MALAYSIAN PUBLIC SECTOR ICT," no. July, 2011.
- [4] S. S. Kamaruddin and S. Abdullah, "FACTORS CONTRIBUTING TO ENTERPRISE INFORMATION ARCHITECTURE (EIA) PRACTICE IN MALAYSIAN," pp. 1–5, 2007.
- [5] E. Architecture and E. Architecture, "Blueprint for 1 Government Enterprise Architecture (1GovEA)."
- [6] C. Okoli and K. Schabram, "Working Papers on Information Systems A Guide to Conducting a Systematic Literature Review of Information Systems Research," *Work. Pap. Inf. Syst.*, vol. 10, no. 26, pp. 1–51, 2010.
- [7] B. Kitchenham and S. Charters, "Guidelines for performing Systematic Literature Reviews in Software Engineering," *Engineering*, vol. 2, p. 1051, 2007.
- [8] H. Petticrew, M., & Roberts, *Systematic Reviews in the Social Sciences: A Practical Guide*, vol. 11, no. 3, 2006.
- [9] B. Van Der Raadt, M. Bonnet, S. Schouten, and H. Van Vliet, "The relation between EA effectiveness and stakeholder satisfaction," *J. Syst. Softw.*, vol. 83, no. 10, pp. 1954–1969, 2010.
- [10] D. Maheshwari, M. Janssen, and A. F. van Veenstra, "A multi-level framework for measuring and benchmarking public service organizations: connecting stages-of-growth models and enterprise architecture," *Proc. 5th Int. Conf. Theory Pract. Electron. Gov.*, pp. 73–80, 2011.
- [11] S. Buckl and C. M. Schweda, "On the State-of-the-Art in Enterprise Architecture Management Literature," *Language (Baltim.)*, p. 144, 2011.
- [12] B. Jahani, S. R. S. Javadein, and H. A. Jafari, "Measurement of enterprise architecture readiness within organizations," *Bus. Strateg. Ser.*, vol. 11, no. 3, pp. 177–191, 2010.
- [13] J. Götze, P. E. Christiansen, R. K. Mortensen, and S. Paszkowski, "Cross-National Interoperability and Enterprise Architecture," *Informatica*, vol. 20, no. 3, pp. 369–396, 2009.
- [14] M. Janssen, "Sociopolitical Aspects of Interoperability and Enterprise Architecture in E-Government," *Soc. Sci. Comput. Rev.*, vol. 30, no. 1, pp. 24–36, 2012.
- [15] E. Lewis and G. Millar, "The Viable Governance Model-A Theoretical Model for the Governance of IT," pp. 1–10, 2009.
- [16] K. Brandis, S. Dzombeta, and K. Haufe, "Towards a framework for governance architecture management in cloud environments: A semantic perspective," *Futur. Gener. Comput. Syst.*, vol. 32, no. 1, pp. 274–281, Mar. 2014.
- [17] S. Bente, U. Bombosch, and S. Langade, "Collaborative Enterprise Architecture," *Collab. Enterp. Archit.*, pp. 39–104, 2012.
- [18] S. Newell, "Magnitude of Innovation Change : Adaptation and Reinvention in Enterprise Architecture Implementation," no. AUGUST, 2015.
- [19] R. Winter and J. Schelp, "Enterprise architecture governance: the need for a business-to-IT approach," *Proc. 2008 ACM Symp. ....*, pp. 548–552, 2008.
- [20] J. L. Janne J. Korhonen, Kari Hiekkanen, "EA and IT Governance – A Systemic Approach," *Architecture*, 2006.
- [21] R. Fischer, S. Aier, and R. Winter, "A Federated Approach to Enterprise Architecture Model Maintenance.," *Enterp. Model. ....*, p. 14, 2007.
- [22] F. Radeke, "Toward Understanding Enterprise Architecture Management 's Role in Strategic Change : Antecedents , Outcomes," 2011.
- [23] P. Saha, *Advances in Government Enterprise Architecture*, vol. Hershey, P. 2009.
- [24] D. Simon, K. Fischbach, and D. Schoder, "Enterprise architecture management and its role in corporate strategic management," *Inf. Syst. E-bus. Manag.*, vol. 12, no. 1, pp. 5–42, 2014.
- [25] S. Bente, U. Bombosch, and S. Langade, "Chapter 3 - What Enterprise Architects Do: Core Activities of {EA}," *Collab. Enterp. Archit.*, pp. 39–104, 2012.
- [26] N. A. A. Bakar, "Influence Factors in Government Enterprise Architecture Establishment Process : A Preliminary Findings," no. June, pp. 1–6, 2013.
- [27] J. Schekkerman, *Trends in Enterprise Architecture*, vol. 2009, no. December, 2005.
- [28] R. Klischewski, "From e-Government Strategy to Services: Challenges of Inter-organizational IT Governance in Egypt," *8th Int. Conf. Theory Pract. Electron. Gov. (ICEGOV 2014)*, pp. 190–199, 2014.
- [29] B. Van Der Raadt and H. Van Vliet, "Designing the enterprise architecture function," *Qual. Softw. Archit. Model. Archit.*, pp. 103–118, 2008.
- [30] S. Aziz, T. Obitz, R. Modi, and S. Sarkar, "Enterprise Architecture: A Governance Framework Part I: Embedding Architecture into the Organization," *Infosys*, no. September, pp. 1–10, 2005.
- [31] C. Becker, J. Barateiro, G. Antunes, J. Borbinha, and R. Vieira, "On the Relevance of Enterprise Architecture and IT Governance for Digital Preservation," in *Springer*, 2011, pp. 332–344.
- [32] J. Bartenschlager and M. Goeken, "(POP-013) [S62] IT strategy Implementation Framework-Bridging Enterprise Architecture and IT Governance.," *Am. Conf. Inf. Syst. 2010 Proc.*, p. 10, 2010.
- [33] H. J. Scholl, H. Kubicek, and R. Cimander, "Interoperability, enterprise architectures, and IT governance in government," *Lect. Notes Comput. Sci. (including Subser. Lect. Notes Artif. Intell. Lect. Notes Bioinformatics)*, vol. 6846, pp. 345–354, 2011.
- [34] A. Ojo, T. Janowski, and E. Estevez, "Improving Government Enterprise Architecture practice - Maturity factor analysis," *Proc. Annu. Hawaii Int. Conf. Syst. Sci.*, pp. 4260–4269, 2011.
- [35] I. Hanschke, *Strategic IT Management*. 2010.
- [36] C. Schmidt and P. Buxmann, "Outcomes and success factors of enterprise IT architecture management: empirical insight from the international financial services industry," *Eur. J. Inf. Syst.*, vol. 20, no. 2, pp. 168–185, 2011.