

READINESS ASSESSMENT MODEL IN SUPPORTING
ENTERPRISE ARCHITECTURE ESTABLISHMENT
FOR MALAYSIAN PUBLIC SECTOR

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DEDICATION

This thesis is dedicated to my late father, who taught me that the best kind of knowledge to have, is that which is learned for its own sake. It is also dedicated to my mother, who taught me that even the largest task can be accomplished if it is done one step at a time.

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ABSTRACT

Enterprise Architecture (EA) is a strategic approach designed to align business strategy with ICT initiatives which has become part of the digital government transformation programme in most countries. The Malaysian Public Sector (MPS) has embraced EA as one of the pillars in their digital transformation initiative. However, findings from Malaysian Administrative Modernisation and Management Planning Unit (MAMPU) in 2016 revealed that EA establishment in MPS is still at its infancy level due to the lack of EA readiness. Similarly, public sectors in other countries such as Indonesia, Vietnam and Oman are also struggling to resolve this issue. Until June 2020, only six (6) agencies in MPS have established EA compared to 25 agencies targeted by MAMPU. Thus, to address this issue, this research proposes an EA Readiness Assessment Model (EARAM) with the aim to assess readiness of MPS, support decision-making process, and plan strategies for EA establishment. This research has four (4) objectives. The first objective is the identification of EA readiness factors followed by the second objective which is the development of EARAM. The third objective is to validate the developed EARAM, while the fourth objective involved evaluation of EARAM. A sequential exploratory mixed method research design was employed to achieve these four (4) objectives. To achieve the first and second objectives, this research used a systematic review (SR) and interview with five (5) EA experts; while the third objective involved three rounds of modified Delphi technique with 13 EA experts. Finally, for the fourth objective, the researcher adopted a multiple case study method whereby three (3) agencies in MPS that are in the EA establishment stage were selected. The EARAM was formulated based on several inputs from SR, interview findings, as well as Information Technology and Information System (IT/IS) Readiness Maturity model. The overall results of three (3) cycles of Delphi technique yielded the conclusion that 45 statements of elements, factors and items in the questionnaires received high consensus of importance in which their Inter Quartile Range (IQR) is between zero (0), and one (1) and median is more than four (4). Results from the Delphi analysis validated four (4) major elements of EARAM, namely 1) Catalyst Enabler, 2) People, 3) Process and 4) Technology along with 14 factors and 45 items. The EA Readiness Assessment Tool (EARAT) is developed by incorporating EARAM validated elements and factors to provide practitioners with an automated tool to assess the EA readiness level of their organisation. The results of EARAT's evaluation from three (3) agencies in MPS indicated a high level of agreement (with a median score of more than 4.00) that EARAT provides useful and quality information, supports decision making, as well as provides ease of use and user satisfaction to support EA establishment in MPS. In conclusion, this research contributed to the development of EARAM to assess readiness in MPS, supports decision-making process, and plan strategies for EA establishment. This research is also in line with EA Body of Knowledge (EABOK) related to the areas of Organisational Scope and Structure of EA, specifically focusing on the sub-areas of Organisational Need and Drivers.

ABSTRAK

Seni Bina Perusahaan (EA) adalah pendekatan strategik yang dirancang untuk menyelaraskan strategi perniagaan dengan inisiatif ICT yang telah menjadi sebahagian daripada program transformasi kerajaan digital di kebanyakan negara. Sektor Awam Malaysia (MPS) telah menerima EA sebagai salah satu teras dalam inisiatif transformasi digital mereka. Walau bagaimanapun, penemuan dari Unit Pemodenan Tadbiran dan Perancangan Pengurusan Malaysia (MAMPU) pada tahun 2016 menunjukkan bahawa penubuhan EA di MPS masih di peringkat awal kerana kurangnya kesediaan EA. Begitu juga sektor awam di negara lain seperti Indonesia, Vietnam dan Oman yang bergelut dalam menyelesaikan isu ini. Sehingga Jun 2020, hanya enam (6) agensi di MPS yang telah membangunkan EA berbanding 25 agensi yang disasarkan oleh MAMPU. Oleh itu, bagi menangani masalah ini, kajian ini mencadangkan Model Penilaian Kesediaan EA (EARAM) yang bertujuan untuk menilai kesediaan MPS, membantu dalam proses membuat keputusan, dan merangka pelan strategi untuk pembangunan EA. Kajian ini mempunyai empat (4) objektif. Objektif pertama adalah untuk mengenal pasti faktor kesediaan EA diikuti dengan objektif kedua iaitu pembangunan EARAM. Objektif ketiga adalah untuk mengesahkan EARAM yang dibangunkan, manakala objektif keempat melibatkan penilaian EARAM. Reka bentuk penyelidikan kaedah eksploratif bercampur secara berturutan digunakan untuk mencapai empat (4) objektif ini. Untuk mencapai objektif pertama dan kedua, kajian ini menggunakan kaedah sorotan bersistematik (SR) dan temu bual dengan lima (5) pakar EA; manakala objektif ketiga melibatkan tiga pusingan teknik Delphi yang diubah suai melibatkan 13 pakar EA. Akhirnya, bagi objektif keempat, penyelidik menggunakan kaedah kajian kes melibatkan tiga (3) agensi di MPS yang berada di peringkat pembangunan EA. EARAM dirumuskan berdasarkan beberapa input dari SR, penemuan temu bual, serta model Kematangan Kesediaan Teknologi Maklumat dan Sistem Maklumat (IT/IS). Hasil keseluruhan dari tiga (3) kitaran teknik Delphi menghasilkan kesimpulan bahawa 45 pernyataan elemen, faktor dan item dalam soal selidik mendapat konsensus kepentingan yang tinggi bagi Julat Antara Kuartil (IQR) berada antara sifar (0), dan satu (1) serta median lebih daripada empat (4). Keputusan daripada analisis Delphi mengesahkan empat (4) elemen utama EARAM, iaitu 1) pemangkin pemboleh ubah, 2) manusia, 3) proses dan 4) teknologi bersama dengan 14 faktor dan 45 item. Alat Penilaian Kesediaan EA (EARAT) dibangunkan dengan memasukkan elemen dan faktor EARAM yang telah disahkan untuk menyediakan alat automasi kepada pengamal bagi menilai tahap kesediaan EA organisasi mereka. Keputusan penilaian EARAT dari tiga (3) agensi di MPS menunjukkan tahap persepakatan yang tinggi (dengan skor median lebih dari 4.00) bahawa EARAT memberikan maklumat yang berguna dan berkualiti, menyokong dalam membuat keputusan, serta menyediakan kemudahan penggunaan dan kepuasan pengguna untuk menyokong pembangunan EA di MPS. Sebagai kesimpulan, penyelidikan ini menyumbang kepada pembangunan EARAM untuk menilai kesediaan dalam MPS, membantu dalam proses membuat keputusan, dan merangka pelan strategi bagi pembangunan EA. Kajian ini sejajar dengan badan pengetahuan EA (EABOK) yang berkaitan dengan bidang Organisasi dan Struktur EA, yang memberi tumpuan khusus pada sub-bidang Keperluan Organisasi dan Pemacu.

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LIST OF ABBREVIATIONS

1GovEA	-	1 Government Enterprise Architecture
CVI	-	Content Validity Index
EA	-	Enterprise Architecture
EABOK	-	Enterprise Architecture Body of Knowledge
e-Gov	-	electronic Government
EPU	-	Economic Planning Unit
EARAM	-	Enterprise Architecture Readiness Assessment Model
EARAT	-	Enterprise Architecture Readiness Assessment Tool
ICT	-	Information Communication Technology
ICU	-	Implementation Coordination Unit
ISP	-	IT Strategic Plan
IS	-	Information Systems
IT	-	Information Technology
IQR	-	Inter Quartile Range
MAMPU	-	Malaysian Administrative Modernisation and Management Planning Unit
MPS	-	Malaysian Public Sector
MyGovEA	-	Malaysian Government Enterprise Architecture
SR	-	Systematic Review
TAM	-	Technology Acceptance Model

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CHAPTER 1

INTRODUCTION

1.1 Overview

Enterprise Architecture (EA) is an approach for organisations to plan strategically to facilitate decision-making through the systematic arrangement. EA acts as a blueprint for organisations to achieve current and future business objectives by aligning businesses and their technology strategies. EA is concerned with the systematic arrangement of different business processes, procedures, standards, rules and regulations, information system, current information technical infrastructure, as well as the expected future transformations and objectives (Al-Kharusi, Miskon, & Bahari, 2018; Janssen, 2012; Maheshwari, Janssen, & van Veenstra, 2011; van der Raadt, Bonnet, Schouten, & van Vliet, 2010).

EA is not only a tool that can be used in a financially competitive world, but it is also a tool that is useful in improving the efficiency of organisations (Saha, 2008). As new technologies are discovered and implemented, the benefits of EA continue to grow. Among the benefits of EA are IT alignment and business planning execution process (Boucharas, van Steenberg, Jansen, & Brinkkemper, 2010; Lange & Mendling, 2011), resources optimisation such as technology, people, and process (Boucharas et al., 2010; Isomäki & Penttinen, 2008), and the elimination of duplication and redundancy (Isomäki & Penttinen, 2008). In this sense, EA can benefit organisations in technology, business, and financial areas.

EA is a complex phenomenon as stated by Mykhashchuk, Buckl, Dierl, and Schweda (2011), Radeke (2010), and Bricknall, Darrell, Nilsson, and Pessi (2006). Nevertheless, EA is relatively new in Malaysia (Ahmad, Drus, & Bakar, 2019a; Bakar, Kama, & Harihodin, 2016a; Dahalin, Abd Razak, Ibrahim, Yusop, & Kasiran, 2010; Kamaruddin & Abdullah, 2007) and the interest in EA is undoubtedly growing

(Langenberg & Wegmann, 2004; Winter, Legner & Fischbach, 2014). Many public and private organisations have already embarked in the establishment of EA. Organisations without EA may have to face the risks of being uncompetitive, ineffective and inefficient which eventually lead to a lack of resilience in facing different challenges in the environment (Nikpay, Ahmad, & Rouhani, 2015).

Business value gains from both profit and non-profit organisations such as public sector organisations as their EA maturity improves. Burns, Neutens, Newman, and Power (2009), posited that the two sectors vary significantly in the way they use the EA and their expectations of the EA values for their organisations. Profit-making organisations typically concentrate on utilising EA to guide their organisation-wide strategies such as cost control, pre-and post-merger integrations, consolidation of infrastructure, and the delivery of new products. EA is also perceived as a competitive advantage tool and useful for non-profit organisations, particularly in the public sector to enhance internal collaboration, interoperability, and the ability to share information between departments and agencies. Concentrating on EA efforts to standardised government services helps organisations to strive and handle their resource portfolios more efficiently, especially for large-scale program execution (Burns et al., 2009).

In the planning stage, readiness is vital to ensure a smooth EA establishment process (Bakar, Kama, & Harihodin, 2015a; Dang & Pekkola, 2016b). The establishment is defined as the activities encompassing in the formation and development of an EA (Bakar et al., 2015a). An EA establishment is a set of process involved in EA development, and the typical stages are planning, analysing, designing, developing, and maintaining (Bakar et al., 2015a). However, the readiness of an organisation to embrace EA has never been taken into account (Ahmad et al., 2019b; Desfray & Raymond, 2014). Readiness for EA is an EA establishment's risk analysis, which aims to increase the organisational success of EA practices (Dani, 2015; van der Raadt & van Vliet, 2008).

The lack of organisational readiness for EA can cause a failure in its implementation (Donaldson, Blackburn, Blessner, & Olson, 2015). Hence, previous studies suggested that the readiness assessment is necessary as it helps to identify gaps

in establishing an EA (Ahmad et al., 2019b; Dani, 2015). Identifying gaps in the readiness for EA enables the time and resources to be managed efficiently and prevent failure during the implementation (Dani, 2015). A readiness assessment can also provide a mechanism on how to close the identified gaps by suggesting appropriate measures (Dani, 2015; Handler, 2010; Winter & Fischer, 2006).

Realising the importance of having an EA readiness assessment, the research attempts to identify the factors that can affect the degree of readiness of an organisation in establishing EA. These factors will later be utilised to develop an EA Readiness Assessment Model that can be used as a standard reference. Indeed, it is essential for EA practitioners, organisations, and researchers to understand what are the factors that contribute to the readiness of an EA establishment. Given the Malaysian public sector (MPS) as a case study, this study provides further insights into a successful establishment of EA as a mechanism towards effective and efficient service delivery.

1.2 Problem Background

Interest in the EA is increasing in the public sector (Dang & Pekkola, 2016a). EA establishment was first studied by Roeleven and Broere (2009) who revealed that over 66 per cent of EA programmes in the Netherlands did not meet the expectations due to the length of time spent during the EA establishment process. As the dimension of readiness was not taken into account, it has led to the failure of the establishment itself (Desfray & Raymond, 2014).

While some EA initiatives have been successful, many EA initiatives ended up as disappointments. The disappointments were unnecessarily outright failures, but without concrete results, the initiatives seemed to continue forever (Schmidt & Buxmann, 2011). Limited understanding and lack of resources in EA initiatives due to readiness of organisation itself were often found to be the root causes of the problem (Dang & Pekkola, 2016b). A holistic approach to IT architecture towards achieving EA has been an accepted strategy, but the results of these initiatives varied (Hylving & Bygstad, 2018).

Previous studies showed that the process of establishing EA in the public sector initially appeared to be tedious and complicated (Al-Kharusi et al., 2016; Dang & Pekkola, 2016b; Seppanen, Heikkila, & Liimatainen, 2009). The organisations need to prepare themselves before embarking on an EA project. The EA programmes have experienced integration and interoperability difficulties within and between government organisations (Hjort-Madsen, 2007). A shared understanding between business and IT which includes EA remains an issue. In many organisations, mutual knowledge between business and IT (including EA) continues to be a problem (Iyamu, & Mphahlele, 2014). Despite the growing interest of EA establishment in the MPS, the establishment of EA practices is still slow and considered low in achieving its target. Although EA was introduced in MPS since 2011 and was formalised in 2014, currently in 2019 only eight agencies in MPS had adopted EA practices although in 2014 a total of 25 agencies were targeted to adopt EA by 2016 (MAMPU, 2017).

Therefore, a major concern that needs to be addressed is the readiness of organisations to adopt EA. The lack of readiness in agencies to adopt EA is one of the critical problems that has led to the slow establishment of EA in the organisations (Al-Kharusi et al., 2016). Organisations need to assess its readiness to participate in EA work and be able to participate in cross-public sector services, taking into account, for instance, data protection, security, and profitability aspects (Heikkila & Penttinen, 2016).

Most of the EA readiness-related studies conducted in the Western countries did not provide sufficient information to address the level of EA readiness in Malaysia. Not many studies have put a focus on the EA Readiness Assessment Model itself (Dang & Pekkola, 2016b; Seppänen, Penttinen, & Pulkkinen, 2018). It was found that a comprehensive assessment model for readiness has not been established despite the extensive discussion on EA readiness factors (Al-Kharusi et al., 2016; Banaeianjahromi, 2018; Ylinen & Pekkola, 2018). Although other scholars have proposed other EA readiness models, none of them can fit into the MPS' EA implementation approach due to the MPS' structure of governance and project management.

Notably, only two studies related to EA readiness in the Malaysian context were undertaken. The studies were conducted in 2014 and 2016 to assess the readiness of public sector agencies to establish EA. The studies revealed that the MPS is moving towards a partial readiness to embark on EA practices (MAMPU, 2014b, 2016b). The lack of readiness in the agencies to embrace EA was one of the critical problems that led to slow EA establishment (Yusoff, 2017). Nevertheless, these studies were merely based on the industries' consultant perspective, and there was no assurance on the rigorousness of the readiness assessment instrument used. Moreover, the readiness assessment studies conducted by industries' consultants were based on their own readiness assessment model which lacking perspective in people, process, technology, and the EA catalyst as suggested by many EA scholars (Bakar et al., 2016b; Dang & Pekkola, 2016b; Ojo, Janowski, & Estevez, 2012).

The assessment model used in 2014 was solely based on nine maturity areas taken from Togaf 9.1 EA maturity study framework (MAMPU, 2014c). The result from this assessment shows that MPS EA was still very much in its infancy stage. Most of the agencies did not possess knowledge in EA, and the assessment conducted used EA terms from a prominent EA framework as a basis to formulate EA questions. However, based on preliminary interview with one of the respondents, the questions from the assessment were difficult to understand although a guidebook was provided. Hence, as the model itself can be disputable, the results might not represent the actual scenario of EA establishment in MPS.

Another study conducted by a team of consultants appointed by MAMPU (MAMPU, 2016b) deployed their own EA Readiness Assessment Model which covered only four main factors involving people (commitment, team capability, business case, and stakeholder) while disregarding many other factors such as catalyst enablers (governance, culture, vision, change management, and resources), processes (communication and policy and rules), and technologies (repository, security, and tools). It is clear that the readiness assessment model being used did not depict all of the factors of EA readiness as mentioned before and discussed by other EA scholars (Bakar et al., 2016b; Dang & Pekkola, 2016b; Jahani, Javadein, & Jafari, 2010; Sobczak, 2013; van der Raadt et al., 2010). Thus, the result is not accurate and

comprehensive enough to provide the overall factors related to EA readiness in MPS. Until June 2020, only six agencies in MPS have established EA compared to 25 agencies targeted by MAMPU.

In dealing with problems of EA readiness in MPS and in addressing the knowledge gap in EA establishment, it is vital to understand the factors that influence the readiness of EA establishment in MPS. Hence, this research aims to develop, validate, and evaluate a new model of EA based on these factors.

1.3 Preliminary Interview with Experts

In addition to the review of documents, interviews were conducted with five experts (Appendix A) involved in the establishment of EA in the MPS. This interview identified the current issues on EA establishment especially in the current EA readiness aspects. The findings of the interviews were discussed and the experts' views on issues on EA establishment in their organisations were analysed (Table 1.1). The excerpts of the interview can be referred in Appendix C.

Table 1.1 Experts' Views on EA Establishment Issues in their Organisations

Issues (Themes)	Descriptions	Experts' input				
		Expert 1 (Agency A)	Expert 2 (Company A)	Expert 3 (Agency B)	Expert 4 (Agency A)	Expert 5 (Agency B)
No mandate from government to implement EA initiatives	Refers to no policy or circular towards EA implementation being enforced to an organisation	√	-	√	-	√
Improper EA governance leads to difficulty in managing EA implementation	Refers to different governance structures set up based on the size of the organisation and create variety in EA governance structure	√	-	√	√	√
The absence of EA tool to	Refers to a tool such as EA repository tool	√	√	-	-	-

Issues (Themes)	Descriptions	Experts' input				
		Expert 1 (Agency A)	Expert 2 (Company A)	Expert 3 (Agency B)	Expert 4 (Agency A)	Expert 5 (Agency B)
maintain EA document	and EA modelling tool					
Lack of EA awareness	Refers to a lack of understanding of EA initiative	-	√	√	-	√
Lack of EA readiness	Refers to a lack of readiness in EA implementation	√	√	√	√	√
Limited knowledge and skills on EA among the team	Refers to the knowledge and skills required for the team to manage EA initiatives	-	√	√	√	-

The interviews identified six current issues on EA establishment that may affect the success of EA. Feedbacks on EA issues that were described by the experts demonstrated similarity to other findings. In this case, there were two most highlighted issues in EA implementation. The most common issue throughout and agreed upon by all five experts was the lack of EA readiness, followed by the improper EA governance that was voiced out by four experts. This study will deal and discuss in detail on the former issue.

1.4 Problem Statement

The EA establishment in many organisations have failed, and a primary reason for this failure is the lack of organisational readiness or EA establishment. The lack of EA readiness in an organisation may force the organisation to face several problems in dealing with changes and proper planning in the process of establishing EA. Thus, the real extent of the EA readiness assessment in the MPS sectors can be further studied and improved. Most of the existing EA Readiness Assessment Models were based on industrial standards and specific EA frameworks that could pose problems for implementation in the public sector agencies. Therefore, this research proposed EA Readiness Assessment Model formulated from EA readiness factors in conducting the EA readiness assessment. This model intends to assess readiness in the MPS, support decision-making process, and plan strategies for EA establishment.

1.5 Research Questions

The research questions that are going to be addressed are outlined as follows:

- i. RQ1: What constitute factors of readiness in the EA establishment of an organization?
- ii. RQ2: How to use the identified factors in developing EA Readiness Assessment Model for Malaysian Public Sector?
- iii. RQ3: How to validate the EA Readiness Assessment Model for Malaysian Public Sector ?
- iv. RQ4: How to evaluate EA Readiness Assessment Model in facilitating the Malaysian Public Sector towards the establishment of EA practices?

1.6 Research Objectives

The research objectives were defined to achieve the overall aim of the research which is to develop, validate and evaluate a new readiness assessment model in supporting EA establishment for Malaysian Public Sector. The identified research objectives are:

- RO1. To identify the readiness factors that support EA establishment in Malaysian Public Sector
- RO2. To develop a new EA Readiness Assessment Model in Malaysian Public Sector
- RO3. To validate the developed EA Readiness Assessment Model in Malaysian Public Sector
- RO4. To evaluate the developed EA Readiness Assessment Model in Malaysian Public Sector

1.7 Research Scope

The scope of this study confines the research area and sets the frontiers of what should be investigated. The research scope is further elaborated in the following discussions.

1.7.1 Area of Exploration

The area of exploration in this research is the development of readiness assessment model for supporting EA establishment in MPS. Assessment of readiness should be conducted in the planning stage of EA establishment. Thus, this research focus on the planning stage of EA establishment because the key of successful EA establishment is the readiness of the organisation itself to be identified at the earlier stage.

1.7.2 Research Context

The justification for choosing the MPS is because the establishment of EA in MPS still slow in progress because of readiness of MPS to embrace EA due to lack of readiness assessment conducted. This is because there is lack of mechanism to conduct a readiness assessment for EA establishment in MPS, although there has been continues interest in conducting ICT readiness assessment in MPS.

1.7.3 Unit of Analysis

The unit of analysis for validation of EARAM are 13 experts consist of EA experts in public, private, and academic fields in Malaysia using Delphi Technique. The selected experts have the EA knowledge and have been practicing the EA for more than ten years of experience. Evaluation of EARAM was conducted using a case study method. The case studies are uniquely chosen according to their EA experiences and business functionality. Therefore, this provides the general overview of EA readiness assessment for the public sector agencies in term of EA frameworks and business

function. Therefore, four cases from agencies in MPS that include pilot case were selected in this study. The respondents are an EA team from IT and business unit in the agencies. The selected respondents must be a person who understands EA process and business function of the agency.

1.8 Significance of the Research

The main significance of this study is the development of assessment model for EA establishment in MPS. The detail significance of this study are organised into three contexts, which are theoretical, methodological and practical. The details are as follows:

1.8.1 Underpinning Theories of the Research

It is anticipated that the model is in line with EA Body of Knowledge (EABOK) related to the area of Organisational Scope and Structure of EA, specially focusing on the sub-area namely Organisational Need and Drivers (Kendrick & Shelton, 2020).

The first significance of the of the research has broadened the area of readiness research in EA by identifying the readiness factors that were important in EA establishment. Advances to the existing body of knowledge were made possible by performing SR with greater availability of published literature and with detailed searching process. Identifying the readiness factors for EA establishment in MPS will overcome the gap of the lack of existing studies that reported the readiness factors in EA establishment. The second significance of the research is a list of readiness factors identified from interview session with EA practitioners in MPS. From the interview, new factors from the context of MPS were suggested by the practitioners to be added in the existing lists from the SR findings. The third significance of the research is the formulation of EA Readiness Assessment Model (EARAM) for EA establishment. The conceptual EARAM was developed from the identified factors from SR and interview. The model was able to evaluate the readiness level of EA establishment in an

organisation. The EARAM is also able to facilitate the EA practitioners in the decision-making process related to preparing the agencies towards the establishment of EA. Until now, there is no established and fixed EA readiness assessment to be used for MPS. Generally, EARAM enables organisations to understand their current readiness level before implementation and being able to take actions to overcome the weaknesses. This fulfils the gap of several studies that have built the definitive model of EA readiness assessment at the organisation level.

1.8.2 Practicality of the Research

For the practical significance of the research, this model can be used as a readiness assessment tool (EARAT) based on EARAM and evaluate the tool (EARAT) using the case study method. This tool is able to assist the EA practitioners in conducting the EA readiness assessment in their respective agencies. This EARAT tool is useful in overcoming the issues of lack of established EA readiness assessment tool in MPS due to various EA readiness assessment tool being based on industry and consultant method.

1.9 Definition of Terms

This section explains terms that have been used throughout the thesis.

Enterprise Architecture (EA) : A complete concept of an organisation structure, business processes, information systems, and technology infrastructure, through a coherent and comprehensive collection of principles, methods, models, diagrams, and other documents that describe the organisation core business (Dang & Pekkola, 2017).

Model : A particular type of version of set of ideas that describe the specific solution for something (van Steenbergen et al., 2011), which in this context refers to the model to assess readiness of EA establishment in MPS.

- Establishment : The activities encompassing the formation and development of EA. EA establishment describes a set of processes involved in the EA development. In general, the common processes involved are plan, analyse, design, develop, and implement (Bakar, Harihodin, & Kama, 2014).
- Assessment : The action of making a judgement, evaluating or estimating the nature, ability, or quality of someone or something (ISO/IEC, 2004). In this study, the term is used to define the evaluation process of EA readiness in the organisation.
- Public Sector Organisation : Type of organisation that deals with production, delivery and allocation of goods and services to its citizens. These services offered by the public sector organisations include social, security, administering urban planning and organising national defences. The government and the local government usually control the public sector (Hjort-Madsen, 2007).
- Readiness : The state of being fully prepared for something (Armenakis, Harris, & Mossholder, 1993).
- Agency : A business or organization providing a particular service on behalf of another business, person, or group. In public sector, agencies reside under ministry (Bakar & Selamat, 2016)
- Company : A commercial business. In this context, company is a private or industrial sector that run business (Garousi et al., 2015)
- Institution : An organization founded for an educational, professional, or social purpose (Adwan & Al-Soufi, 2016)

1.10 The Organisation of the Thesis

This thesis comprises seven chapters. Chapter 1 presents an overview of this research area. It consists of a background of the research statement of the problem, research questions, objectives of the research, and the scope of research. The significance of this research is also discussed. Chapter 2 consists of the literature review. The chapter presents the key concepts of enterprise architecture, EA establishment, and EA Readiness Assessment Model. Several concepts and theories used in the readiness model are also discussed in this chapter. Chapter 3 explains the research methodology used in this research in achieving the research objectives. Moreover, it provides a further discussion on qualitative analysis that used in this research. Chapter 4 describes the foundations and concepts of EA readiness assessment. Chapter 5 describe the empirical work conducted in the research and the evaluation of the proposed EA Readiness Assessment Model. Finally, Chapter 6 provides the overall discussion and conclusion of the research.

REFERENCES

- Aagesen, G., van Veenstra, A. F., Janssen, M., & Krogstie, J. (2011). The entanglement of enterprise architecture and IT-governance: The cases of Norway and the Netherlands. *Proceedings of the Annual Hawaii International Conference on System Sciences*, 1–10.
- Adams, M. K. (2004). *Defining creative scholarship and identifying criteria for evaluating creative scholarship using a modified delphi technique* (Doctoral dissertation). University of Wyoming, Wyoming.
- Adler, M., & Ziglio, E. (1996). *Gazing into the oracle: The Delphi method and its application to social policy and public health*. London: Jessica Kingsley Publishers.
- Adwan, E. J., & Al-Soufi, A. (2016). Practical EA model development : A case study of an educational institution in Bahrain. *International Journal of Computing & Information Science*, 12(1), 105–119.
- Ahmad, N. A., Drus, S. M., & Bakar, N. A. (2019a). Enterprise architecture adoption issues and challenges: a systematic literature review. *Indonesian Journal of Electrical Engineering and Computer Science*, 15(1), 399–408.
- Ahmad, N. A., Drus, S. M., Bakar, N. A. & Othman, M. M. (2018). A systematic review of Enterprise Architecture adoption models. *International Journal of Engineering (UAE)*, 7(4), 369–374.
- Ahmad, N. A., Drus, S. M., Kasim, H., & Othman, M. M. (2019b). Assessing content validity of Enterprise Architecture Adoption Questionnaire (EAAQ) among content experts. *2019 IEEE 9th Symposium on Computer Applications & Industrial Electronics (ISCAIE)*, 160–165. Kota Kinabalu, Malaysia: ISCAIE.
- Ahuja, A., & Ahuja, N. (2008). Why Enterprise Architecture is must for One-Stop e-Government? *Emerging Technologies in E-Government*, 235–241.
- Aier, S. (2014). The role of organizational culture for grounding, management, guidance and effectiveness of enterprise architecture principles. *Information Systems and E-Business Management*, 12(1), 43–70.
- Aier, S., & Schelp, J. (2010). A reassessment of Enterprise Architecture implementation. *Service-Oriented Computing. ICSOC/ServiceWave 2009 Workshops*, 6275, 35–47.
- Aier, S., & Weiss, S. (2012). An institutional framework for analyzing organizational responses to the establishment of architectural transformation. *ECIS 2012 - Proceedings of the 20th*

European Conference on Information Systems. Barcelona, Spain.

- Ajami, S., Ketabi, S., Isfahani, S. S., & Heidari, A. (2011). Readiness assessment of electronic health records implementation. *Acta Informatica Medica*, 19(4), 224–7.
- Al-Araibi, A. A., Mahrin, M. N., & Yusoff, R. C. M. (2019). Technological aspect factors of E-learning readiness in higher education institutions: Delphi technique. *Education and Information Technologies*, 24(1), 567–590.
- Al-Kharusi, H., Miskon, S., & Bahari, M. (2016). Factors influencing the engagement between Enterprise Architects and stakeholders in Enterprise Architecture Development. *Pacific Asia Conference of Information System (PACIS)*, 262.
- Al-Kharusi, H., Miskon, S., & Bahari, M. (2018). Enterprise architecture development approach in the public sector. *International Journal of Enterprise Information Systems*, 14(4), 124–141.
- Alaeddini, M., & Salekfard, S. (2013). Investigating the role of an enterprise architecture project in the business-IT alignment in Iran. *Information Systems Frontiers*, 15(1), 67–88.
- Alghamdi, I. A., Goodwin, R., & Rampersad, G. (2011a). A suggested e-government framework for assessing organizational e-readiness in developing countries. In A. A. Manaf, A. Zeki, M. Zamani, S. Chuprat, & E. El-Qawasmeh (Eds.), *Communications in Computer and Information Science*, 252 CCIS(PART 2), 479–498. Berlin, Heidelberg: Springer.
- Alghamdi, I., Goodwin, R., & Rampersad, G. (2011b). E-Government Readiness assessment for government organizations in developing countries. *Computer and Information Science*, 4(3), 3–17.
- Alshawi, M., & Salleh, H. (2011). IT/IS Readiness Maturity Model. In M. Alshawi & M. Arif (Eds.), *Cases on Performance Measurement and Productivity Improvement*, 23–37. IGI Global Publication.
- Armenakis, A. A., Harris, S. G., & Mossholder, K. W. (1993). Creating readiness for organizational change. *Human Relations*, 46(6), 681–703.
- Armenakis, A., & Harris, S. (2009). Reflections: Our journey in organizational change research and practice. *Journal of Change Management*, 9(2), 127–142.
- Armour, F. J., & Kaisler, S. H. (2001). Enterprise architecture: Agile transition and implementation. *IT Professional*, 3(6), 30–37.
- Azab, N. A. (2009). Assessing electronic government readiness of public organizations. *Communications of the IBIMA*, 8, 95–106.
- Aziz, N. M., & Salleh, H. (2011). A readiness model for IT investment in the construction

- industry. *African Journal of Business Management*, 5(7), 2524–2530.
- Aziz, S., Obitz, T., Modi, R., & Sarkar, S. (2006). Enterprise architecture: A governance framework. Part II: Making Enterprise architecture work within the organization. *Infosys Technologies Ltd*, 1–22.
- Bader, G., He, W., Anjomshoaa, A., & Tjoa, A. M. (2012). Proposing a context-aware enterprise mashup readiness assessment framework. *Information Technology & Management*, 13, 377–387.
- Bakar, N. A. A. (2017). *Enterprise architecture implementation assessment model for Malaysian public sector*. PhD Thesis, Universiti Teknologi Malaysia.
- Bakar, N. A. A., & Selamat, H. (2016). Investigating Enterprise Architecture implementation in public sector organisation: A case study of Ministry of Health Malaysia. *2016 3rd IEEE International Conference on Computer and Information Sciences (ICCOINS)*, 1–6.
- Bakar, N. A. A., Harihodin, S., & Kama, N. (2014). An assessment model for government enterprise architecture establishment phase. *Advanced Science Letters*, 20(12), 1987–1991.
- Bakar, N. A. A., Harihodin, S., & Kama, N. (2015a). A systematic review of enterprise architecture assessment models. *Applied Mechanics and Materials*, 735, 339–343.
- Bakar, N. A. A., Harihodin, S., & Kama, N. (2016a). Enterprise architecture implementation model: Measurement from experts and practitioner perspectives. *2016 4th IEEE International Colloquium on Information Science and Technology (CiSt)*, 1–6.
- Bakar, N. A. A., Kama, N., & Harihodin, S. (2015b). A systematic review of enterprise architecture establishment process. *Proceedings of the 5th International Conference on Computing and Informatics, ICOCI 2015*, 720–727.
- Bakar, N. A. A., Kama, N., & Harihodin, S. (2016b). Enterprise architecture development and implementation in public sector: The Malaysian perspective. *Journal of Theoretical and Applied Information Technology*, 88(1), 176–188.
- Bakar, N. A. A., Selamat, H., & Kama, M. N. (2017). Assessing the capability and priority of enterprise architecture implementation in Malaysian public sector. *Pacific Asia Conference on Information Systems (PACIS)*, 79.
- Baker, J., Lovell, K., & Harris, N. (2006). How expert are the experts? An exploration of the concept of 'expert' within Delphi panel techniques. *Nurse Researcher*, 14(1), 59–70.
- Banaeianjahromi, N. (2018). Where enterprise architecture development fails a multiple case of governmental organizations. *2018 12th International Conference on Research Challenges in Information Science (RCIS)*, 1–9.

- Barros, O., & Julio, C. (2011). Enterprise and process architecture patterns. *Business Process Management Journal*, 17(4), 598–618.
- Battleson, B. L., Booth, A., & Weintrop, J. (2001). Usability testing of an academic library web site: a case study. *The Journal of Academic Librarianship*, 27(3), 188–198.
- Bazeley, P. (2009). Analysing qualitative data : More than ‘identifying themes.’ *The Malaysian Journal of Qualitative Research*, 2(2), 6–22.
- Birks, M., & Mills, J. (2015). *Grounded theory: A practical guide*. Los Angeles, CA: Sage.
- Blumenthal, A., Brooks, T., Doucet, G., Sowell, C., Boyd, B. R. S., & Boynton, B. (2012). Enterprise Architecture. *Journal of Enterprise Architecture*, 8(3), 28.
- Bogdan, R. C., & Biklen, S. K. (1992). *Qualitative Research for Education: An Introduction to Theory and Methods*. Boston, MA: Allyn & Bacon.
- Boucharas, V., van Steenberghe, M., Jansen, S., & Brinkkemper, S. (2010). The contribution of enterprise architecture to the achievement of organizational goals: A review of the evidence. *5th International Workshop, Trends in Enterprise Architecture Research (TEAR)*, 70, 1–15. Berlin, Heidelberg: Springer.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101.
- Bricknall, R., Darrell, G., Nilsson, H., & Pessi, K. (2006). Enterprise architecture: critical factors affecting modelling and management. *Proceedings of the 14th European Conference of Information Systems (ECIS)*, 1–13.
- Buckl, S., & Schweda, C. M. (2011). On the State-of-the-Art in Enterprise Architecture Management Literature. *Language*, 144.
- Buckl, S., Matthes, F., & Schweda, C. M. (2009). A viable system perspective on enterprise architecture management. *Proceedings of the 2009 IEEE International Conference on Systems, Man and Cybernetics*, (October), 1483–1488.
- Budhiraja, R., & Sachdeva, S. (2002). E-readiness assessment (India). *International Conference on Building Effective EGovernance*. India: Chandigarh.
- Burns, P., Neutens, M., Newman, D., & Power, T. (2009). *Building value through enterprise architecture: A global study*. Retrieved June 19, 2016, from <http://www.strategyand.pwc.com/reports/building-value-through-enterprise-architecture>
- Cameron, B. H., & McMillan, E. (2013). Enterprise architecture valuation and metrics: A survey-based research study. *Journal of Enterprise Architecture*, 9(1), 39–59
- Choong, Y. C. (2006). *A mapping approach to investigating Information and Communication Technology (ICT) implementation during the building design process* (Doctoral

- dissertation). School of Property, Construction and Project Management, RMIT University.
- Chou, C. (2002). Developing the e-Delphi system: A web-based forecasting tool for educational research. *British Journal of Educational Technology*, 33(2), 233–236.
- Clarke, V., & Braun, V. (2013). Teaching thematic analysis: Overcoming challenges and developing strategies for effective learning. *The Psychologist*, 26(2), 120–123.
- Computer Economics. (2017). *Enterprise architecture not widely embraced*. Retrieved February 10, 2018, from <https://www.computereconomics.com/article.cfm?id=2330>
- Creswell, J. W. (2012). *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative research* (4th ed.). Boston, MA: Pearson.
- Creswell, J. W. (2014). *Research design: Qualitative, quantitative and mixed methods approaches* (4th ed.). Thousand Oaks, CA: Sage Publications Ltd.
- Creswell, J. W., & Poth, C. N. (2013). *Qualitative inquiry and research design: Choosing among five approaches*. Thousand Oaks, CA: Sage Publications Inc.
- Culley, J. M. (2011). Use of a computer-mediated delphi process to validate a mass casualty conceptual model. *Computers, Informatics, Nursing*, 29(5), 272–279.
- Dada, D. (2006). E-Readiness for developing countries: Moving the focus from the environment to the user. *The Electronic Journal of Information Systems in Developing Countries*, 27(1), 1–14.
- Dahalin, Z. M., Abd Razak, R., Ibrahim, H., Yusop, N. I., & Kasiran, M. K. (2010). An enterprise architecture methodology for business-IT alignment: Adopter and developer perspectives. *Communications of the IBIMA*, Article ID 222028, 1–17.
- Dalkey, N., & Helmer, O. (1963). An experimental application of the Delphi method to the use of experts. *Management Science*, 9(3), 458–467.
- Dang, D. D., & Pekkola, S. (2016a). Institutionalising enterprise architecture in the public sector in Vietnam. *The 2016 European Conference on Information Systems (ECIS) Proceedings*. Istanbul, Turkey.
- Dang, D. D., & Pekkola, S. (2016b). Root causes for enterprise architecture problems. *Proceedings of the 20th Pacific Asia Conference on Information Systems (PACIS) Conference on Information Systems 2016*. Chiayi, Taiwan.
- Dang, D. D., & Pekkola, S. (2017). Problems of enterprise architecture adoption in the public sector: Root causes and some solutions. In L. Rusu & G. Viscusi (Eds.), *Information technology governance in public organizations: Theory and practice* (pp. 177–198). Springer International Publishing.

- Dani, A. T. (2015). Enterprise architecture readiness and capability maturity assessment as critical success factors to establish EA as culture. *Business IT Architecture Series ASIA*. Retrived 20 March, 2016 from <https://www.atdsolution.com/enterprise-architecture/article/when-to-implement-enterprise-architecture/>
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340.
- Davis, L. L. (1992). Instrument review: Getting the most from a panel of experts. *Applied Nursing Research*, 5(4), 194–197.
- Deloitte. (2018). *Security: Enterprise architecture*. Retrieved Jan, 2019, from <https://www2.deloitte.com/content/dam/Deloitte/nl/Documents/technology/deloitte-nl-consulting-enterprise-architecture-security.pdf>
- DeLone, W. H., & McLean, E. R. (2003). The DeLone and McLean Model of information systems success: A ten-year update. *Journal of Management Information Systems*, 19(4), 9–30.
- Desfray, P., & Raymond, G. (2014). *Modeling enterprise architecture with Togaf®: A practical guide using UML and BPMN* (pp. 1–24). Waltham, MA: Elsevier.
- DeVellis, R. F. (1991). Applied social research methods series (Vol. 26). *Scale development: Theory and applications*. Sage Publications, Inc.
- Digital News Asia. (2016). *MAMPU implements national enterprise architecture*. Retrieved June 19, 2016 from <https://www.digitalnewsasia.com/digital-economy/mampu-implements-national-enterprise-architecture>
- Doll, W. J., & Torkzadeh, G. (1998). Developing a multidimensional measure of system-use in an organizational context. *Information & Management*, 33(4), 171–185.
- Donaldson, W. M., Blackburn, T. D., Blessner, P., & Olson, B. A. (2015). An examination of the role of enterprise architecture frameworks in enterprise transformation. *Journal of Enterprise Transformation*, 5(3), 218–240.
- Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, 14(4), 532–550.
- Farwick, M., Brey, R., Hauder, M., Roth, S., & Matthes, F. (2013). Enterprise architecture documentation: Empirical analysis of information sources for automation. *2013 46th Hawaii International Conference on System Sciences*, 3868–3877.
- Fischer, R., Aier, S., & Winter, R. (2007). A federated approach to enterprise architecture model maintenance. *Enterprise Modelling and Information Systems Architectures (EMISAJ)*, 2(2), 14–22.

- Foorthuis, R., van Steenberghe, M., Brinkkemper, S., & Bruls, W. (2015). A theory building study of enterprise architecture practices and benefits. *Information Systems Frontiers*, 18(3), 1–24.
- Garousi, G., Garousi-Yusifolu, V., Ruhe, G., Zhi, J., Moussavi, M., & Smith, B. (2015). Usage and usefulness of technical software documentation: An industrial case study. *Information and Software Technology*, 57(1), 664–682.
- Ghozali, K., & Sucahyo, Y. G. (2012). Comparative study of e-government enterprise architecture by primary attributes of 3 Asian countries. *Jurnal Sistem Informasi*, 8(2), 126–132.
- Gilliland, S., Kotze, P., & van der Merwe, A. (2015). Work level related human factors for enterprise architecture as organisational strategy. *2015 International Conference on Enterprise Systems (ES)*, 43–54.
- Goethals, F. (2006). An overview of enterprise architecture framework deliverables. Banda, R.K.J. (ed.) *Enterprise Architecture-An Introduction*. ICFAI University Press.
- Gong, Y., & Janssen, M. (2019). The value of and myths about enterprise architecture. *International Journal of Information Management*, 46, 1–9.
- Gordon, T. (2008). Computer-aided Delphi: An experimental study of comparing round-based with real-time implementation of the method, Sabine Zipfinger, Johannes Kepler University, Linz, Austria (2007). *Technological Forecasting and Social Change*, 75(1), 160–164.
- Gupta, U. G., & Clarke, R. E. (1996). Theory and applications of the Delphi technique: A bibliography (1975–1994). *Technological Forecasting and Social Change*, 53(2), 185–211.
- Habibi, A., Sarafrazi, A., & Izadyar, S. (2014). Delphi technique theoretical framework in qualitative research. *The International Journal Of Engineering And Science*, 3(4), 2319–1813.
- Hamid, N. A., & Zaman, H. B. (2009). Defining Malaysian knowledge society: Results from the Delphi Technique. *Communications in Computer and Information Science*, 49, 179–189.
- Handler, R. (2010). *Enterprise architecture stakeholder engagement key initiative overview*. Retrieved August 10, 2016, from <https://www.gartner.com/en/documents/1277215/enterprise-architecture-stakeholder-engagement-key-initi>
- Handler, T. J. (2016). *Toolkit: Clinical readiness assessment*. Retrieved January 10, 2017, from

www.gartner.com/en/documents/3270917/toolkit-clinical-readiness-assessment

- Hauder, M., Munch, D., Michel, F., Utz, A., & Matthes, F. (2014). Examining adaptive case management to support processes for enterprise architecture management. *2014 IEEE 18th International Enterprise Distributed Object Computing Conference Workshops and Demonstrations*, 23–32.
- Hedayati, A., Shirazi, B., & Fazlollahtabar, H. (2014). An assessment model for the state of organizational readiness inservice oriented architecture implementation based on fuzzy logic. *Computer Science and Information Technology*, 2(1), 1–9.
- Heikkilä, J., & Penttinen, K. (2016). Overview of enterprise architecture work in 15 countries. *Finnish Enterprise Architecture Research Project*. Retrieved January, 2017 from www.vm.fi/julkaisu
- Hjort-Madsen, K. (2007). Institutional patterns of enterprise architecture adoption in government. *Transforming Government: People, Process and Policy*, 1(4), 333–349.
- Hladik, M. (2013). Human dimension of enterprise architecture. *Journal of Eastern Europe Research in Business & Economics*, 2013, 506–514.
- Hsu, C.-C., & Sandford, B. A. (2007). The Delphi technique: Making sense of consensus. *Practical Assessment, Research, and Evaluation*, 12(12), Article 10.
- Hylving, L., & Bygstad, B. (2018). Responding to enterprise architecture initiatives: Loyalty, voice and exit. *Proceedings of the 51st Hawaii International Conference on System Sciences (HICSS-51)*, 2363–2372.
- Hyrkäs, K., Appelqvist-Schmidlechner, K., & Oksa, L. (2003). Validating an instrument for clinical supervision using an expert panel. *International Journal of Nursing Studies*, 40(6), 619–625.
- Info-Tech Research Group. (2010). *Enterprise architecture readiness assessment*. Retrieved August 11, 2016 from <https://www.infotech.com/research/ss/enterprise-architecture-an-engine-for-growth-and-competitive-advantage/enterprise-architecture-readiness-assessment>
- Isomäki, H., & Penttinen, K. (2008). Challenges of government enterprise architecture work-stakeholders' views. *Electronic Government 7th International Conference EGOV 2008*, 35, 364–374. Turin, Italy.
- Iyamu, T., & Mphahlele, L. (2014). The impact of organisational structure on enterprise architecture deployment. *Journal of Systems and Information Technology Information Technology*, 16(1), 2-19.
- Jahani, B., Javadein, S. R. S., & Jafari, H. A. (2010). Measurement of enterprise architecture

- readiness within organizations. *Business Strategy Series*, 11(3), 177–191.
- Janssen, M. (2012). Sociopolitical aspects of interoperability and enterprise architecture in e-government. *Social Science Computer Review*, 30(1), 24–36.
- Kendrick, C. D., Shelton, D. (2020). *Enterprise Architecture Body of Knowledge (EABOK)*. Retrieved January 11, 2020, from <https://eabok.org/organizational-scope/organizational-need-and-drivers/>
- Kamogawa, T., & Okada, H. (2005). A framework for enterprise architecture effectiveness. *Proceedings of ICSSSM'05. 2005 International Conference on Services Systems and Services Management, 2005, 1*, 740–745.
- Kementerian Kewangan Malaysia. (2018). *Peruntukan Dan Perakaunan Perbelanjaan, Terimaan Dan Akaun Amanah Tahun 2018 Berikutan Penyusunan Semula Kementerian*. Retrieved 10 January, 2019 from <http://ppp.treasury.gov.my/makluman/pindaan/368>
- Kitchenham, B. (2004). *Procedures for performing systematic reviews*. Keele University Technical Report (TR/SE-0401).
- Kitchenham, B., & Charters, S. (2007). *Guidelines for performing systematic literature reviews in software engineering*. Keele University and Durham University Joint Report.
- Klischewski, R. (2014). From e-government strategy to services: Challenges of inter-organizational IT governance in Egypt. *Proceedings of the 8th International Conference on Theory and Practice of Electronic Governance (ICEGOV 2014)*, 190–199.
- Kosecoff, J., Fink, A., Brook, R. H., Davies, A. R., Goldberg, G., Linn, L. S., Salisbury, P. C. (1985). General medical care and the education of internists in university hospitals: An evaluation of the teaching hospital general medicine group practice program. *Annals of Internal Medicine*, 102(2), 250–257.
- Kumar, R. (2019). *Research methodology: A step-by-step guide for beginners*. London: Sage Publications Limited.
- Lange, M., & Mendling, J. (2011). An experts' perspective on enterprise architecture goals, framework adoption and benefit assessment. *IEEE International Enterprise Distributed Object Computing Workshop, EDOC*, 304–313.
- Lange, M., Mendling, J., & Recker, J. (2015). An empirical analysis of the factors and measures of Enterprise Architecture Management success. *European Journal of Information Systems*, 8(1), 23–32.
- Langenberg, K., & Wegmann, A. (2004). Enterprise architecture: What aspects is current research targeting. *Laboratory of Systemic Modeling*, 12.
- Lee, J. D., & Kwon, Y. I. (2013). A study on strategy planning and outcome of EA in Korea.

- International Conference on Advanced Communication Technology, ICACT*, (December 2005), 873–879.
- Lee, S., Oh, S., & Nam, K. (2016). Transformational and transactional factors for the successful implementation of enterprise architecture in public sector. *Sustainability*, 8(5), 456.
- Lehman, W. E. K., Greener, J. M., & Simpson, D. D. (2002). Assessing organizational readiness for change. *Journal of Substance Abuse Treatment*, 22(4), 197–209.
- Levy, Y., & Ellis, T. J. (2006). A systems approach to conduct an effective literature review in support of information systems research. *Informing Science Journal*, 9, 181–212.
- Lewin, K. (1951). *Field theory in social science: Selected theoretical papers*. D. Cartwright (Ed.). New York: Harper.
- Liimatainen, K., Hofmann, M., & Heikkilä, J. (2007). Overview of Enterprise Architecture work in 15 countries: Finnish Enterprise Architecture Research Project. Finnish Ministry of Finance, 82.
- Linstone, H. A., & Turoff, M. (Eds.). (1975). *The Delphi method: Techniques and applications* (Vol. 29). Reading, MA: Addison-Wesley.
- Loosveldt, G., & Beullens, K. (2013). “How long will it take?” An analysis of interview length in the fifth round of the European Social Survey. *Survey Research Methods*, 7(2), 69–78.
- Lynn, M. R. (1986). Determination and quantification of content validity. *Nursing Research*, 35(6), 382–386.
- MacCormack, A. D., Lagerstrom, R., & Baldwin, C. Y. (2015). A methodology for operationalizing enterprise architecture and evaluating enterprise IT flexibility. *Harvard Business School Working Paper Series*, 15–060.
- Maheshwari, D., Janssen, M., & van Veenstra, A. F. (2011, September). A multi-level framework for measuring and benchmarking public service organizations: connecting stages-of-growth models and enterprise architecture. *Proceedings of the 5th International Conference on Theory and Practice of Electronic Governance*, 73–80.
- Main, A., Zakaria, N. A., & Yusof, R. (2015). Organisation readiness factors towards IPv6 migration: Expert review. *Procedia - Social and Behavioral Sciences*, 195, 1882–1889.
- MAMPU. (2014a). *Big data governance and enterprise architecture*. Retrieved January 11, 2017, from <https://www.mampu.gov.my/ms/penerbitan-mampu/send/100-forum-asean-cio-2014/276-1-plenary-1-speaker-1-bda-ea-dr-zainuddi>
- MAMPU. (2014b). *Current assessment & change readiness report*. Retrieved January 11, 2017, from <https://mygovea.mampu.gov.my/bm/document-center>
- MAMPU. (2014c). *Kajian pembangunan enterprise architecture sektor awam: Current*

- assessment report*. Retrieved January 11, 2017, from <https://mygovea.mampu.gov.my/bm/document-center>
- MAMPU. (2016a). *Pelan Strategik ICT Sektor Awam*. Malaysian Administrative Modernisation and Management Planning Unit: Prime Minister's Department.
- MAMPU. (2016b). *Readiness of government agencies for enterprise architecture*. Retrieved January 11, 2017, from <https://mygovea.mampu.gov.my/bm/document-center>
- MAMPU. (2017). *Projek Pembangunan Enterprise Architecture (EA) Sektor Awam*. Retrieved January 10, 2019, from <https://mygovea.mampu.gov.my/bm/document-center>
- Martino, J. P. (1972). An introduction to technological forecasting. *The futurist library 1* (Vol. 1). New York: Gordon & Breach.
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*. Thousand Oaks, CA: Sage.
- Modi, L. (2012). *Knowledge management system framework for collaborative open source software development*. PhD Thesis. Universiti Putra Malaysia, Malaysia.
- Molinaro, L. F. R., Ramos, K. H. C., da Cotta Orlandi, T. R., & Abdalla Jr., H. (2010, October). Enterprise architecture to IT governance: an approach based on component business model and performance levels. *International Conference on Enterprise Information Systems* (41-51). Berlin, Heidelberg: Springer.
- Mykhashchuk, M., Buckl, S., Dierl, T., & Schweda, C. M. (2011). Charting the landscape of enterprise architecture management. *Internationale Tagung Wirtschaftsinformatik WI*, 2, 570–577.
- Nam, K., Oh, S. W., Kim, S. K., Goo, J., & Sajid Khan, M. (2016). Dynamics of enterprise architecture in the Korean public sector: Transformational change vs. transactional change. *Sustainability*, 8(11), 1074.
- Niemi, E., & Pekkola, S. (2013). Enterprise architecture quality attributes: A case study. *2013 46th Hawaii International Conference on System Sciences*, 9(1), 3878–3887.
- Nikpay, F., Ahmad, R., & Rouhani, B. (2015). Current issues on enterprise architecture implementation evaluation. *International Journal of Social, Education, Economics and Management Engineering*, 9(1), 112–115.
- Nikpay, F., Ahmad, R., & Kia, C. Y. (2016a). A hybrid method for evaluating enterprise architecture implementation. *Evaluation and Program Planning*, 60, 1–16.
- Nikpay, F., Ahmad, R., Rouhani, B. D., & Shamshirband, S. (2016b). A systematic review on post-implementation evaluation models of enterprise architecture artefacts. *Information Systems Frontiers*, 22, 1–20.

- Nikpay, F., Selamat, H., Rouhani, B. D., & Nikfard, P. (2013). A review of critical success factors of enterprise architecture implementation. *2013 International Conference on Informatics and Creative Multimedia*, 38–42.
- Nowakowski, E., Farwick, M., Trojer, T., Haeusler, M., Kessler, J., & Breu, R. (2018). Enterprise Architecture Planning in the Context of Industry 4.0 Transformations. In *2018 IEEE 22nd International Enterprise Distributed Object Computing Conference (EDOC)*, 35-43.
- Obi, T. (2015). Waseda–IAC international e-government ranking survey. *Waseda University Institute of e-Government, Tokyo*.
- Oda, S. M., Fu, H., & Zhu, Y. (2009). Enterprise information security architecture a review of frameworks, methodology, and case studies. *2009 2nd IEEE Computer Science and Information Technology*, 333–337.
- Ojo, A., Janowski, T., & Estevez, E. (2012). Improving government enterprise architecture practice - Maturity factor analysis. *2012 45th Hawaii International Conference on System Sciences*, 4260–4269.
- Okoli, C., & Schabram, K. (2010). Working papers on information systems: A guide to conducting a systematic literature review of information systems research. *Working Papers on Information Systems*, 10(26), 1–51.
- Plessius, H., Slot, R., & Pruijt, L. (2012). On the categorization and measurability of enterprise architecture benefits with the enterprise architecture value framework. *Trends in Enterprise Architecture Research and Practice-Driven Research on Enterprise Transformation* (pp. 79-92). Berlin, Heidelberg: Springer.
- Polit, D. F., Beck, C. T., & Owen, S. V. (2007). Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. *Research in Nursing & Health*, 30(4), 459–467.
- Radeke, F. (2010). Awaiting explanation in the field of enterprise architecture management. *America Conference on Information System (AMCIS)*, 442.
- Radeke, F. (2011). Toward understanding enterprise architecture management's role in strategic change: Antecedents, processes, outcomes. *Proceedings of the 10th International Conference on Wirtschaftsinformatik WI*, 2, 497–507.
- Rahimi, F., Gøtze, J., & Møller, C. (2017). Enterprise architecture management: Toward a taxonomy of applications. *Communications of the Association for Information Systems*, 40(1), 7.
- Ramakrishnan, S., & Testani, M. (2011). People, process, technology - The three elements for

- a successful organizational transformation. *IBM Path Forward to Business Transformation*, 1–21. Retrieved August 11, 2016 from <http://www.iinet2.org/Details.aspx?id=24456>
- Rangiha, M. E., Comuzzi, M., & Karakostas, B. (2016). A framework to capture and reuse process knowledge in business process design and execution using social tagging. *Business Process Management Journal*, 22(4), 835–859.
- Rayens, M. K., & Hahn, E. J. (2000). Building consensus using the Delphi policy. *Policy, Politics and Nursing Practice*, 1(4), 308–315.
- Razak, R. A., Dahalin, Z. M., Dahari, R., Kamaruddin, S. S., & Abdullah, S. (2007). Factors contributing to Enterprise Information Architecture (EIA) practice in Malaysian organizations. 1–5.
- Richardson, G. L., Jackson, B. M., & Dickson, G. W. (1990). A principles-based enterprise architecture: Lessons from Texaco and Star Enterprise. *MIS Quarterly: Management Information Systems*, 14(4), 385–402.
- Ritchie, J., Lewis, J., Nicholls, C. M., & Ormston, R. (2013). *Qualitative research practice: A guide for social science students and researchers*. Sage Publication Ltd.
- Roeleven, S., & Broer, J. (2009). Why two thirds of enterprise architecture projects fail. ARIS Expert Paper.
- Romero, D., Galeano, N., & Molina, A. (2009). Mechanisms for assessing and enhancing organisations' readiness for collaboration in collaborative networks. *International Journal of Production Research*, 47(17), 4691–4710.
- Rood, M. A. (1994, April). Enterprise architecture: definition, content, and utility. *Proceedings of 3rd IEEE Workshop on Enabling Technologies: Infrastructure for Collaborative Enterprises* (pp. 106-111). Morgantown, WV: IEEE Computer Society.
- Rouhani, B. D., Dehghan, Z., Mohamaddoust, R., & Nazari, M. (2015a). A Flexible Enterprise Architecture Management Method (FEAM). *International Journal of Computer and Information Technologies (IJOCIT)*, 3(3), 157–172.
- Rouhani, B. D., Mahrin, M. N. R., Nikfard, P., & Nikpay, F. (2014, September). The role of agent-oriented technology on developing an enterprise architecture implementation methodology. *2014 8th. Malaysian Software Engineering Conference (MySEC)*, 331-335.
- Rouhani, B. D., Mahrin, M. N. R., Nikpay, F., Ahmad, R. B., & Nikfard, P. (2015b). A systematic literature review on Enterprise Architecture Implementation Methodologies. *Information and Software Technology*, 62(1), 1–20.
- Rubio, D. M., Berg-Weger, M., Tebb, S. S., Lee, E. S., & Rauch, S. (2003). Objectifying

- content validity: Conducting a content validity study in social work research. *Social Work Research*, 27(2), 94–104.
- Runeson, P., Host, M., Rainer, A., & Regnell, B. (2012). *Case study research in software engineering - Guidelines and examples*. Hoboken, NJ: John Wiley & Sons.
- Sackman, H. (1975). *Delphi critique*. Lexington, Massachusetts: Lexington Book.
- Saha, P. (2008). A methodology for government transformation with enterprise architecture. *Advances in Government Enterprise Architecture*, 1–29.
- Saha, P. (2009). *Advances in government enterprise architecture*. Hershey, PA: IGI Global.
- Saha, P. (2012). Enterprise architecture for connected e-government. *Enterprise Architecture for Connected E-Government: Practices and Innovations*, 57–77.
- Salamat, M. A., Hassan, S., Fudzee, M. F. M., & Ramli, A. A. (2012). A framework for formulating Malaysia's public policy through citizen e-participation. *Proceedings of Knowledge Management International Conference (KMICe) 2012*, 52–59.
- Saleh, Y., & Alshawi, M. (2005). An alternative model for measuring the success of IS projects: the GPIS model. *Journal of Enterprise Information Management*, 18(1), 47–63.
- Salleh, H., Alshawi, M., Mohamed Sabli, N. A., Zolkafli, U. K., & Judi, S. S. (2011). Measuring readiness for successful information technology/information system (IT/IS) project implementation: A conceptual model. *African Journal of Business Management*, 5(23), 9770–9778.
- Scapolo, F., & Miles, I. (2006). Eliciting experts' knowledge: A comparison of two methods. *Technological Forecasting and Social Change*, 73(6), 679–704.
- Scheele, S. D. (2002). Reality construction as a product of Delphi interaction. *Philosophy: Reality Construction*, 35–67.
- Schekkerman, J. (2004). *Extended Enterprise Architecture Framework (E2AF) Essentials Guide*. Institute for Enterprise Architecture Developments (IFEAD).
- Schekkerman, J. (2005). *Trends in Enterprise Architecture 2005: How are organizations progressing?* (1st ed.). Institute for Enterprise Architecture Developments (IFEAD).
- Schmidt, C., & Buxmann, P. (2011). Outcomes and success factors of enterprise IT architecture management: empirical insight from the international financial services industry. *European Journal of Information Systems*, 20(2), 168–185.
- Seidman, I. (2012). *Interviewing as qualitative research: A guide for researchers in education and the social sciences*. New York: Teachers College Press
- Sekaran, U., & Bougie, R. (2003). *Research methods for business, a skill building approach*. New York: John Wiley & Sons. Inc.

- Seppanen, V., Heikkila, J., & Liimatainen, K. (2009). Key issues in EA-implementation: Case study of two Finnish government agencies. *2009 IEEE Conference on Commerce and Enterprise Computing*, 114–120.
- Seppänen, V., Penttinen, K., & Pulkkinen, M. (2018). Key issues in enterprise architecture adoption in the public sector. *Electronic Journal of e-government*, *16*(1), 46–58.
- Shah, H., & El Kourdi, M. (2007). Frameworks for enterprise architecture. *IT Professional*, *9*(5), 36–41.
- Shareef, M., Ojo, A., & Janowski, T. (2008). A readiness assessment framework for e-government planning: Design and application. *Proceedings of the 2nd International Conference on Theory and Practice of Electronic Governance*, 403–410.
- Simon, D., Fischbach, K., & Schoder, D. (2014). Enterprise architecture management and its role in corporate strategic management. *Information Systems and E-Business Management*, *12*(1), 5–42.
- Singh, S., Moom, R. K., & Singh, H. (2015). Use of Content validity index for selection of occupational safety factors for workers in manufacturing industry. *Humanizing Work and Work Environment Conference*, 496–501.
- Siraj, S., & Ali, A. (2008). Principals projections on the Malaysian secondary school future curriculum. *International Education Studies*, *1*(4), 61–78.
- Siraj, S., Zakaria, A. R., Alias, N., Dewitt, D., Kannan, P., & Ganapathy, J. (2012). Future projection on patriotism among school students using Delphi technique. *Creative Education*, *03*(06), 1053–1059.
- Skulmoski, G. J., Hartman, F. T., & Krahn, J. (2007). The Delphi method for graduate research. *Journal of Information Technology Education: Research*, *6*(1), 1-21.
- Sobczak, A. (2013). Methods of the assessment of enterprise architecture practice maturity in an organization. *Lecture Notes in Business Information Processing*, *158 LNBIP*, 104–111.
- Spewak, S., & Tiemann, M. (2006). Updating the enterprise architecture planning model. *Journal of Enterprise Architecture*, *2*(2), 11–19.
- Taib, M. (2015). MAMPU Implements National Enterprise Architecture. Retrieved Jan 10, 2016, from <https://mygovea.mampu.gov.my/bm/document-center>
- Tambouris, E., Zotou, M., Kalampokis, E., & Tarabanis, K. (2012). Fostering enterprise architecture education and training with the enterprise architecture competence framework. *International Journal of Training and Development*, *16*(2), 128–136.
- Tamm, T., Seddon, P. B., Shanks, G., & Reynolds, P. (2011). How does enterprise architecture add value to organisations?. *Communications of the Association for Information*

- Systems*, 28(1).10.
- TOGAF. (2011). Business transformation readiness assessment. Retrieved June 11, 2016, from <https://pubs.opengroup.org/architecture/togaf91-doc/arch/chap30.html>
- United Nations. (2018). E-government survey 2018, Gearing E-government to support transformation towards sustainable and resilient societies. *New York, NY: United Nations*.
- van der Raadt, B., & van Vliet, H. (2008). Designing the enterprise architecture function. *Quality of Software Architectures. Models and Architectures*, 103–118.
- van der Raadt, B., Bonnet, M., Schouten, S., & van Vliet, H. (2010). The relation between EA effectiveness and stakeholder satisfaction. *Journal of Systems and Software*, 83(10), 1954–1969.
- van Steenberghe, M., Foorthuis, R., Mushkudiani, N., Bruls, W., Brinkkemper, S., & Bos, R. (2011). Achieving enterprise architecture benefits: What makes the difference? *2011 IEEE 15th International Enterprise Distributed Object Computing Conference Workshops*, 350–359.
- Vegas, S., Juristo, N., & Basili, V. R. (2003). *Identifying relevant information for testing technique selection: An instantiated characterization schema* (Vol. 8). New York: Springer Science & Business Media.
- von Bary, B., & Westner, M. (2018). Information systems back-sourcing: A literature review. *Journal of Information Technology Management*, XXIX(1), 62–78.
- von der Gracht, H. A. (2012). Consensus measurement in Delphi studies. Review and implications for future quality assurance. *Technological Forecasting and Social Change*, 79(8), 1525–1536.
- Wan Ahmad, W. A. Z., Mukhtar, M., & Yahya, Y. (2018). Validating the social content management framework: A Delphi study. *Jurnal Pengurusan (UKM Journal of Management)*, 53.
- Weiner, B. J. (2020). A theory of organizational readiness for change. In P. Nielsen & S. A. Birken (Eds.), *Handbook on implementation science*. Cheltenham, UK: Edward Elgar Publishing.
- Winter, R., & Fischer, R. (2006). Essential layers, artifacts, and dependencies of enterprise architecture. *Proceedings - 2006 10th IEEE International Enterprise Distributed Object Computing Conference Workshops, EDOCW2006*, (May), 1–12.
- Winter, R., & Schelp, J. (2008). Enterprise architecture governance: The need for a business-to-IT approach. *Proceedings of the 2008 ACM Symposium on Applied Computing*, 548–552.

- Winter, R., Legner, C., & Fischbach, K. (2014). Introduction to the special issue on enterprise architecture management. *Information Systems and E-Business Management*, 12(1), 1–4.
- Wynd, C. A., Schmidt, B., & Schaefer, M. A. (2003). Two quantitative approaches for estimating content validity. *Western Journal of Nursing Research*, 25(5), 508–518.
- Yamamoto, S., Olayan, N. I., & Morisaki, S. (2018). Another look at enterprise architecture framework. *Journal of Business Theory and Practice*, 6(2), 172.
- Yin, R. K. (2009). *Case study research: Design and methods* (4th ed.). Thousand Oaks, CA: Sage.
- Yin, R. K. (2014). *Case Study Research Design and Methods* (5th ed.). Thousand Oaks, CA: Sage.
- Ylimäki, B. T. (2008). Towards a generic evaluation model for enterprise architecture. In E. Niemi, T. Ylimäki, & N. Hämmäläinen (Eds.), *Evaluation of Enterprise and Software Architectures: Critical Issues, Metrics and Practices*, 3(3), 9–16.
- Ylimäki, T. (2006). Towards critical success factors for enterprise architecture. In E. Niemi, T. Ylimäki, & N. Hämmäläinen (Eds.), *Evaluation of Enterprise and Software Architectures: Critical Issues, Metrics and Practices*.
- Ylinen, M., & Pekkola, S. (2018). Enterprise architecture as a scapegoat for difficulties in public sector organizational transformation. *International Conference on Information System*, 1–13.
- Yusoff, M. (2017). *Steering committee meeting for development of enterprise in Malaysian public sector (1GovEA) Phase 1 No. 2/2017*. Malaysian Administrative Modernisation and Management Planning Unit : Prime Minister's Department.
- Zachman, J. A. (1987). A framework for information systems architecture. *IBM Systems Journal*, 26, 276–292.
- Zachman, J. A. (1997). Enterprise architecture: The issue of the century. *Database Programming and Design*, 10(3), 44-53.
- Zakaria, N. A. (2018). *A framework for value-based software process tailoring*. PhD Thesis. Universiti Teknologi Malaysia, Malaysia.
- Zamanzadeh, V., Ghahramanian, A., Rassouli, M., Abbaszadeh, A., & Alavi-Majd, H. (2015). Design and implementation content validity study : Development of an instrument for measuring patient-centered communication. *Journal of caring Sciences*, 4(2), 165–178.
- Zheng, L., & Jiang, Y. (2011). Assessing e-government readiness of local governments in China: Developing a bottom-up approach. *Proceedings of the 5th International Conference on Theory and Practice of Electronic Governance*, 91–96.

LIST OF PUBLICATIONS

Indexed Journals

1. **Hussein, S. S.**, Mahrin, M. N. R., and Maarop, N. (2018). EA Governance towards Sustainability of EA Practices in Digital Government: A Systematic Review. *International Journal of Engineering and Technology*, Vol 7 No 3.20 (2018): Special Issue 20, pp. 311-315 **(Indexed by Scopus)**
2. **Hussein, S. S.**, Mahrin, M. N., Maarop, N., & Bakar, N. A. A. (2018). Evaluation of EA Readiness Assessment Model: A Case Study in Malaysia Public Sector. *Journal of Advanced Research in Dynamical and Control Systems*, 10 (issue 11), 151–157 **(Indexed by Scopus)**
3. **Sumarni Hussein, S.**, Naz'ri Mahrin, M., Maarop, N., Azaliah Abu Bakar, N. (2019). Content Validation of an Enterprise Architecture (EA) Readiness Assessment Instrument. *Journal of Physics: Conference Series*, 1196 (1), art. no. 12047. **(Indexed by Scopus)**
4. **Hussein, S. S.**, Mahrin, M. N. R., Maarop, N., & Bakar, N. A. A. (2020) Development and Validation of Enterprise Architecture (EA) Readiness Assessment Model. *International Journal on Advanced Science, Engineering and Information Technology*, Vol. 10 (2020) No. 1, pages: 157-163. **(Indexed by Scopus)**
5. **Hussein, S. S.**, Mahrin, M. N. R., and Maarop, N. (2017). Sustainability through Innovations of Enterprise Architecture (EA) in Public Sector's Management: Issues and Challenges. *Journal of Southeast Asian Research*. **(Indexed by EBSCO)**

Indexed Conference Proceedings

1. **Hussein, S. S.**, Ismail, Z., Mahrin, M. N. R., Abdullah, M. S., Rahim, N. Z. A., Samy, G. N., and Taib, M. Z. M. (2016, October). Towards designing an EA readiness instrument: A systematic review. In *Information Science and Technology*

(CiSt), 2016 4th IEEE International Colloquium, Tangier Morocco (pp. 158-163)
(Indexed by Scopus)

2. **Hussein, S. S.**, Ismail, Z., Mahrin, M. N. R., EA innovations in managing public sectors: Issues and challenges. In Proceedings of the 27th International Business Information Management Association Conference, IBIMA 2016, Italy Pages 3498-3505 **(Indexed by Scopus)**

Non-Indexed Journals

1. **Hussein, S. S.**, Mahrin, M. N. R., and Maarop, N., Bakar, A. (2018). A Delphi Technique as a Method to Obtain Consensus in Validation of EA Readiness Assessment Model, Open International Journal of Informatics (OIJI).

Non-Indexed Conference Proceedings

1. **Hussein, S. S.**, Mahrin, M. N. R., and Ismail, Z. Towards Readiness in Enterprise Architecture Establishment: A Critical Success Factors. In Postgraduate Annual Research on Informatics Seminar (PARIS), 2016, Kuala Lumpur
2. **Hussein, S. S.**, Ismail, Z., and Mat, M. Z. Towards Sustainability of EA Practices: A Systematic Review. In International Conference on ICT for Transformation (ICT-4T), 2016, Sabah
3. **Hussein, S. S.**, Mahrin, M. N. R., and Maarop, N. Preliminary Study of Malaysian Public Sector (MPS) Transformation Readiness through Enterprise Architecture (EA) Establishment. 21st Pacific Asia Conference on Information Systems (PACIS 2017), Langkawi, Proceedings. 229.
4. **Hussein, S. S.**, Mahrin, M. N. R., and Maarop, N., Bakar, A. Development and Validation of EA Readiness Assessment Model: A Delphi Technique, Postgraduate Annual Research on Informatics Seminar (PARIS), 2018, Kuala Lumpur

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1. **Hussein, S. S.**, Mahrin, M. N. R., and Maarop, N., Bakar, A. EA Readiness Assessment Model For Malaysian Public Sector IP/CR/2019/0488, August 2019