

Developing Enterprise Architecture Skills: A Developing Country Perspective

Irja Shaanika and Tiko Iyamu

Namibia University of Science and Technology, Windhoek, Namibia
inshaanika@gmail.com, tiyamu@polytechnic.edu.na

Abstract. Through different approaches, organisations strive to evolve their competitiveness, as well as their addressing their operational and strategic needs. Some organisations employ Enterprise Architecture (EA), to bridge the gap between the business and IT, and to providing strategic goals. However, there exists scarcity of EA Skills in many developing countries. This could be attributed to the uniqueness of the discipline. The skills are instrumental in the development and implementation of the EA. What is even more challenging is that EA skills cannot be developed from any training facility, due to its nature of specialisation and seniority of the specialists. The limited training facilities contribute to the scarcity of EA skills in many developing countries, which have impact skill and transfer, and other resource developmental factors. This study therefore explored how and where EA skills can be developed, and what constitute the competency. The study was carried out in Namibia, using the survey technique, in the data collection. Some of the findings include education and training, leadership, and political implications on EA skill development.

Keywords: Information Technology, Enterprise Architecture, Skill, Competency, Training and Education.

1 Introduction

Organisations face challenges of business processes and information technology (IT) infrastructures change due to the driving factors, of globalization, technology explosion, and rapid growth on organizational structure [1]. In an attempt to addressing the challenges, some organisations employed approaches, such as the Enterprise Architecture (EA), to guide and manage their business and IT challenges. Over the years, the EA has increasingly become an important discipline for the management and governance of both business and IT processes and activities [2].

Many organisations consider the EA approach to be of importance to their processes and activities. The approach is often used to translate business vision and strategy into business and technical requirements, periodically. It is argued that EA assist organisations, to create, communicate and improve the key requirements, principles and models, that describes the current and future state of the enterprise in an evolutionary manner [3]. However, the use of EA depend on how it is understood, defined and scoped [4].

Individuals including organisations define the EA differently. The definition is informed and guided by their objectives, and understanding. The definition is critical because it shapes how EA is developed and implemented. Iyamu [5] argued that lack of understanding leads to incompatibility and confusion about the views on the definitions, objectives, process and phases that are required for the development and implementation of the EA.

The EA is a discipline in the field of IT. It is considered to be a unique and highly specialised area of the IT field. It is applied from both operational and strategic perspectives, in many organisations. According to Hiekkänen, Korhonen and Mykkänen [6], EA is used as strategic tool, to holistically address the gap between the business and IT units in many organisations. Some organisations employ EA for governance and management of business and IT processes and activities. Due to the uniqueness and the specialised nature of EA, the skills are scarce to find. In Walrad et al. [7], they emphatically argued that EA skills are not easily available.

Many organisations have not been able to develop and implement the EA primarily because they do not have skilled personnel. What is even more challenging is the availability of the training facilities (places). Very few institutions of higher learning offer EA as a course, in the World, and very limited in Africa. The skills are mainly developed through trainings which are offered by professional bodies, such as The Open Group Architecture Framework (TOGAF), and Gartner Inc. As a result, many organisations as well as researchers are puzzled by how and where to develop such skills [8], [9], [7]. This has made some organisations to consider developing the skills internally. Erosa and Arroyo [10] argued that some skills, which are of technical nature could be best developed through experience but others are best acquired during professional studies.

Skill is defined as the ability to take what you know and apply it to create a desired output [7]. Most often, institutions of higher learning are regarded as organisations for creating and equipping graduates with necessary skills, and foundation preparing them for industries. According to [11], institutions of higher learning are the cradle of learning, theorising, and research; hence they could be used as platform for developing EA skills. In this regard, the development of EA skills is lacking in the Africa continent. This is the main motivation for this study, which objectives were to understand and examine how EA skills could be developed, and the impact.

However many organisations are challenged by how and where to develop EA skills. The article presents the findings from an investigation on why EA skills are needed in the organisations. The research question was why is EA not deployed in the organisations? This includes understanding what is needed to develop such skills as well as the implications of not having EA.

2 Enterprise Architecture and Training

The EA is defined as “the organising logic for business process and IT infrastructure, reflecting the integration and standardisation requirements of the company’s operating model” [12]. The purpose of an EA is to provide guidance for business process and

their associated information systems toward achieving the organisation's goals according to [1].

In many organisations, the business strategy and IT strategy are often disjointed [13]. Götze [9] argued that in many enterprises, IT department do not develop IT strategy in accordance to business strategy, which result in effortless IT planning. This is attributed to the root source, for lack of alignment in some organisations. Alignment is managed at a senior level (in accordance to structure) in many organisations. Some organisations identify the need to make use of the EA as a bridging tool between business strategy and IT strategy [13]. EA is therefore used and managed by senior employees in the organisations that deploy it. According to Iacob, Jonkers and Quartel[14], closing the gap between the business and IT maximises alignment, thus reducing duplications and inconsistencies among business processes and IT activities. Business and IT are distinct disciplines influencing each other and their coordination is necessary for organisation goals achievements [14]. Therefore, EA intention is to enable organisation in addressing and achieving the balance between business efficiency and IT [15].

EA promotes the belief that an enterprise, as a complex system, can be designed and managed in an orderly manner, to achieving better overall performance [16]. Such performances shape organisation's competitiveness and sustainability. [17] pointed out that EA helps in the communication of key elements that explains the operations and strategic intent of an organization. As such, the implementation of EA helps organisations to innovate and engineer change through stability and flexibility [18]. However, the development and implementation continue to be a challenging process in many organisations. According to [15], EA experiences both technical and non-technical challenges. While Kaisler et al.[3] identified that the challenges are rarely technical, but they arises from factors, such as political, project management, and organizational issues, and weaknesses.

The development and deployment of EA is carried out through its domains, which include business, information, application and technical architectural, and guided by the organisation's goals and objectives [17]. It is through the analysis of the domains' relationships that EA becomes a valuable management tool [19]. According to Iyamu [20], the development and implementations of EA is based on how the organisation defines and understand the concept. Hence the skill-set is crucial.

The definition and understanding of EA is based on the product of organisation EA skills. [21] argued that due to different approaches that are applied by EA, including their tailoring and adaptation to specific domains, highly skilled personnel are required. Wagter et al., [8] defined EA architects as professionals with competencies that are responsible for the creation of organisational strategies. According to Wagter et al. [8], competences represent a dynamic combination of knowledge, expertise, attitudes and responsibilities. An enterprise architects develops IT strategy and enable decisions for for designing and developing and deploying IT to support the business process [22].

The EA is developed and implemented horizontally or vertically, using the enterprise domain approach, respectively. Steghuis and Proper [23] differentiated between EA architect and domain architects, stating that EA architects covers the

breadth of business and IT, and the domain architects focus on the specific aspect of the enterprise, such as business, information, application and technical. Götze [9] categorised enterprise architects into core, implicit, and applied. The architects form enterprise architecture team that is capable of conducting gap and business requirement analysis at various levels of the enterprise[8].

EA enable an overview picture of how IT supports the different business processes, and how they support the operating model that is chosen to facilitate organisational activities [10]. Across the organisation, a common understanding is required between IT and business operating models. Enterprise architects provide such understanding by translating and transforming knowledge across the organisation boundaries. This includes the boundaries between organisations and vendors, and between business and IT [9]. Hence architects have crucial roles in finding the relevant varieties for the different contexts, often in the form of principles, standards, patterns, and policies.

Relevance and context are attributed to the rapid changes in organisations. Change in business environments causes business to change its processes, services and products, for competitiveness [24]. Changes also influence the IT artefacts in the organisations, as new systems are bought, developed or reused, to refocus on new competitiveness. Khan and Zedan [24] argued that business and IT continue to change, and EA is used as a supporting tool. Thus [20] asserts that EA is an agent of change, in the quest for competitiveness. It formalizes the organisation and its information systems to manage the risks that are related to changes [25]. To keep up with the accelerating pace of technology, enterprises should employ the EA [9]. [10] Also argued that enterprises should not just be concerned with business and IT alignments, but also assure employees competencies are aligned with such strategies.

Enterprise architect therefore, need to know how the organisation businesses operate and how decisions are made, and how knowledge is applied when modeling the enterprise architecture [7]. Modeling is essential to describing and understanding EA [3]. [25] elaborated that knowing how enterprise works is important for architects, in order to be able to identify the strengths and weakness of the organisation, and lead gaps recognition .

3 Research Methodology

The study was carried in Namibia, where it was considered to be essential due to the limited number of EA skills in the country, as at the time of the study. Based on the objective of the study, which was to the development of the EA skills and the impact of such skills, the qualitative research method was applied.

The semi-structured interview technique was employed in the collection of data, for two main reason: richness and flexibility. The technique was selected primarily because it enables the gathering of rich data, through insightful view and opinion from the participants [26]. The semi-structured interview technique allows flexibility during data collection, this include instant probing of participants answers. According to [27], the interviewer has the flexibility to rephrase and restructure the questions, during the interviews. For emphasis sake, we cite [26], who explained that the

interviewer may ask additional questions in response to what he or she considered to be significant statement from the interviewee.

A total of ten information technology (IT) specialists were interviewed. The ten individuals, irrespective of their affiliate (employer), are labelled PAS01 to PAS10. This was to respect and maintain confidentiality. The interviewees were from different organisations in the country. The interviewees were selected based on their interest in EA, and their availability. A guide, such as the use of the same questions and format, was used in the interview sections, this was to maintain uniformity and consistency.

The data was interpretively analysed. The interpretivism approach was followed primarily because it allows the researcher to analyse interviewees' subjective reasoning [26]. The core idea of interpretivism is understanding the subjective meaning of persons [28]. To attain this, the researcher uses his or her skills as a social being to try to understand how others understand the world around them [29].

4 Enterprise Architecture Skills and Competency

Enterprise architecture skilled personnel holds the positions of architects, in the forms of Enterprise Architect or domain Architect, such as Information Architect. Their roles and responsibilities differ, but are not entirely independent of each other. However, organisations sometimes differ in the tasks that they assign to the architects. According to one of the interviewees, an IT manager from a financial institution, "*we need architects to be able to utilize our resources effectively within organisation (PAS03)*". *We need architects to carry out that function primarily because they are the most highly specialised people within the IT department.* Another participant, who is employed in one of the Government ministries at the time of the study emphasised that "*because they are specialist individual in their domains, they bring in high level of focus and concentration into the organisation (PAS01)*".

As depicted in Figure 1 below, the Enterprise Architects focus on the entire organisational needs, while the domain Architects concentrate on the areas of their specialisations. A manager briefly explained the role of technical architects: "*The architects are needed to provide guidance on technological artefacts, as well as the guidelines through which they are aligned with organisation objectives (PAS09)*". Similar to the role of technical architects, the business architects are responsible for the strategic modelling of processes and activities. In the view of business managers with one of the mining companies in Namibia, "*we need business architects to define the structure of process flow in the organisation, and build performance measurement model (PAS04)*".

Architectural process is required across the entire units of the organisation that deploys the EA. The need often focuses on unique and critical areas of the organisation. One of the participants, who manage software development in an insurance company, opined as follows: "*We need architects to help us with references in terms of maturity, and they also have the capability to analyse risks. They can see beyond the normal view of organisational operation (PAS02)*".

Due to the significant of the EA to the organisations, it is critical to have knowledgeable personnel in the field, thus, creating knowledge hub. Many of those who participated in the study believe that the development of architects should be at the institutions of higher learning. This could be attributed to the wide scope, which range from software development and implementation, business and systems analysis, business applications, project management, to networking and operating systems. According some of the participants: *“If it was not in higher institution, I would probably have no idea, and I would have not known what exactly enterprise architecture is actually all about”*; and PAS10 - *I think that the development of architects can start in institutions of higher learning, and continue into organisations”*.

Many organisations are faced with strong competition from their competitors, making case for approaches, such as EA, which enable and support competitiveness. Thus, however, require developing and leveraging EA skills, appropriately. EA skills provide an organisation with understanding of how business strategy should be supported by IT). Such understanding is fundamental in defining the relationship between business and IT units, and how their alignment can enhance business competitiveness.

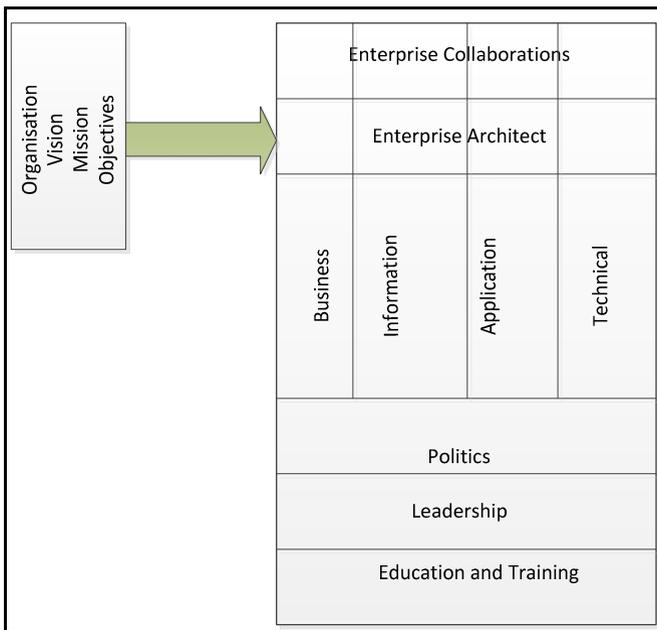


Fig. 1. EA Skill Development

The importance, including the roles and responsibilities of architects in the organisations seems to be well understood. But yet, many organisations do not employ the approach in their operations. The fundamental question is what this study seeks to examine, “why is EA not deployed in the organisations”? Based on the

analysis, which was interpretively carried out, the factors hindering the deployment of the EA in organisation include lack of education and training (skilled personnel), lack of technical leadership, and lack of political will by many organisations.

The factors, as shown in figure 1, are discussed as follows:

i. Education and Training

The shortage of skills was attributed to lack of education or training, or both. The skills cannot be developed based on experience alone. Education of enterprise architecture are provided through institutions of higher learning. This is because of the theorised nature of the course offered by the institutions. Training are considered to be hands-on exercises. Training of EA is often offered by professional bodies, such as TOGAF and Gertner Inc.

Due to the specialised nature of the field, the Architects needs both education and training to equip themselves. The education provides them with the knowledge and skill to be, and act as architects. The training enhances their competence in the field of specialisation, as enterprise architect or domain architect. The education and trainings enabled the architects to be technical leaders in the organisations.

ii. Technical Leadership

Based on the highly skilled and levels of specialisation nature of the Architects, they are relied upon in the organisations, supposedly so. As such, they should provide Leadership, to guide, motivate, and mobilise colleagues and other employees in the organisation. Also, through their leadership roles, the architects are expected to create the vision and culture of architecture in the organisation. Through the leadership, it would be easier and more flexible to govern and manage people, complexity, and document processes and activities within the organisation.

Some of the leadership components and could be attributed to political will. It is sometimes difficult to disassociate leadership from political interplay. This is attributed to the role of a leader, to drive and lead in the network that the actor finds his or herself. You cannot be an architect if you cannot lead the people towards achieving the organisation's objectives.

iii. Political Will

Empirically from the study, another reason why the EA approach is not considered or employed in some organisations, is due to lack of political will to do so. Enterprise architecture depends on factors, such as efficiency and effectiveness to succeed. These factors are driven by motivation, mobilisation and resources, which manifest from politics, and political will. Where more than one person is involved, politics is involved, consciously or unconsciously, or even so, what Giddens refers to as practical unconsciousness. Giddens defined practical unconsciousness as "What actors know (believe) about social conditions, including especially the conditions of their own action, but cannot express discursively; no bar of repression, however, protects practical consciousness as is the case with the unconscious" [30].

The deployment and exercises of the EA processes and activities can be political. This is primarily because of the roles and responsibilities which are associated to it. To some extent, they are made powerful, and take away some functions from certain individuals and groups in the organisation.

Institutions of higher learning need to begin to introduce Enterprise Architecture as a course, at both undergraduate and postgraduate levels. As revealed in this study, the curriculum of the course should encompass components, such as technical, Leadership, and Politics know-how.

5 Conclusion

Enterprise architecture is considered to be a field that require highly skilled and competent personnel, due to its role in the organisation. The EA is intended to bridge the gap between the business and IT units, as well drive the strategies of the organisation from both business and technology perspectives. The roles of the EA require the personnel to be highly skilled, through education and trainings.

As revealed in the study, EA skills are not easily accessible or available. The skill is beyond technical know-how, which includes non-technical factors, such as leadership and politics. As such, the developers of education and training of the EA curriculum need to take into cognisance, this include non-technical factors.

The findings from this study should boost the confidence levels of managers of business and IT in organisations, particularly in Africa, where EA skills are lacking in a significant high proportion. The study exposes the managers to learn some critical factors, thoughts and beliefs about EA. It hereby make them know what are required, to develop and implement EA in their organisations. The study also reassures sponsors and investors on the significant of the EA in organisations.

References

1. Cekerekil, S., Mticahit, G., Emin, B.: An Agile Approach for Converting Enterprise Architectures. IEEE, Intanbul (2013)
2. Osterlind, M., Johnson, P., Karnati, K., Lagerstro, R., Valja, M.: Enterprise Architecture Evaluation using Utility theory. In: 17th IEEE International Enterprise Distributed Object Computing Conference Workshops, pp. 347–351. IEEE (2013)
3. Kaisler, S., Armour, F., Valivullah, M.: Enterprise Architecting: Critical Problems. In: Proceedings of the 38th Hawaii International Conference on System sciences (2005)
4. Schekkerman, J.: How to survive in the Jungle of Enterprise Architecture Frameworks (2009)
5. Iyamu, T.: Enterprise Architecture As Information Technology Strategy. In: IEEE Conference on Commerce and Enterprise Computing, pp. 82–88. IEEE Computer Society (2011)
6. Hiekkänen, K., Mykkänen, J., Korhonen, J.: Architects' perceptions on EA use: An empirical study. In: 15th IEEE Conference on Business Informatics (CBI), Vienna, Austria, July 15-8 (2013)
7. Walrad, C., Lane, M., Wallk, J., Hirst, D.: Architecting a Profession. IT Pro., pp. 42–49 (January/February 2014)
8. Wager, R., Henderik, A.: Proper, & Witte, D. Enterprise Architecture: A strategic specialisma. In: 14th International Conference on Commerce and Enterprise Computing, pp. 1–8. IEEE (2012)

9. Götze, J.: The Changing Role of the Enterprise Architect. In: 17th IEEE International Enterprise Distributed Object Computing Conference Workshops, pp. 319–326. IEEE (2013)
10. Erosa, V., Arroyo, P.: Technology Management Competences Supporting the Business Strategy. In: PICMET 2009 Proceedings, pp. 2190–2199. PICMET, Oregon (2009)
11. Yang, Z., Qixial, L.: Innovation Pattern Analysis of The Industry-University-Research Cooperation. In: 2012 International Symposium on Information Technology in Medicine and Education, pp. 274–277. IEEE (2012)
12. Ross, J., Weill, P., Robertson, D.: Enterprise Architecture as a Strategy: Creating a Foundation for Business Execution. Harvard Business Press, United States of America (2006)
13. Jin, M., Peng, W., Kung, D.: Research of Information System Technology Architecture. In: 2010 2nd International Conference on Industrial and Information Systems, pp. 293–296. IEEE (2010)
14. Iacob, M.-E., Jonkers, H., Quartel, D.: Capturing Business Strategy And Value In Enterprise Architecture To Support Portfolio Valuation. In: IEEE 16th International Enterprise Distributed Object Computing Conference, pp. 11–19. IEEE (2012)
15. Iyamu, T.: Theoretical Analysis Strategic Implementation of Enterprise Architecture. International Journal of Actor-Network Theory and Technological Innovation 2(3), 17–32 (2010)
16. Rosasco, N., Dehlinger, J.: Business Architecture Elicitation for Enterprise Architecture: VMOST versus Conventional Strategy Capture. In: The 9th International Conference on Software Engineering Research, Management and Applications, Baltimore, pp. 153–157 (2001)
17. Alonso, I., Verdún, J., Caro, E.: The IT Implicated Within The Enterprise Architecture Model. In: Analysis of Architecture Models and Focus IT Architecture Domain, pp. 1–5 (2010)
18. Rouhani, B., Mahrin, M., Nikpay, F., Nikfard, P.: A Comparison Enterprise Architecture Implementation Methodologies. In: International Conference on Informatics and Creative Multimedia, pp. 1–5. IEEE (2013)
19. Xueying, W., Xiongwei, Z.: Aligning Business and IT Using Enterprise Architecture, 1-5 (2008)
20. Iyamu, T.: Enterprise architecture: From concept to Practise. Heidelberg Press, Australia (2013)
21. Antunes, G., Barateiro, J., Becker, C., Borbinha, J., Vieira, R.: Modeling Contextual Concerns in Enterprise Architecture. In: 15th IEEE International Enterprise Distributed Object Computing Conference Workshops, pp. 3–10. IEEE (2011)
22. Armour, F., Kaisler, S., Huizinga, E.: Business and Enterprise Architecture: Processes, Approches and Challenges. In: 45th Hawaii International Conference on System Sciences, p. 4229. IEEE (2012)
23. Steghuis, C., Proper, E.: Competencies and Responsibilities of Enterprise Architects. In: Dietz, J.L.G., Albani, A., Barjis, J. (eds.) CIAO! 2008 and EOMAS 2008. LNBIP, vol. 10, pp. 93–107. Springer, Heidelberg (2008)
24. Khan, M., Zedan, H.: Alignment Strategies and frameworks in co-Evolution of Business and Information Technology. In: International Conference on Information Networking and Automation, pp. 133–136. IEEE (2010)
25. Lakhrouit, J., Baïna, K.: State of the Art of the Maturity Models to an Evaluation of the Enterprise Architecture. IEEE, Rabat (2013)

26. Rowley, J., Jones, R., Vassiliou, M., Hanna, S.: Using card-based games to enhance the value of semi-structured interviews. *International Journal of Market Research* 54(1) (April 14, 2011)
27. Draper, A., Swift, J.: Qualitative research in nutrition and dietetics: Data collection issues. *Journal of Human Nutrition and Dietetics* 24(1), 3–13 (2010)
28. Goldkuhl, G.: Pragmatism vs interpretivism in qualitative information systems research. *European Journal of Information Systems* 21(1), 135–146 (2012)
29. O'Donoghue, T.: *Planning Your Qualitative Research Project: An Introduction to interpretivist research in education*. Routledge, New York (2006)
30. Giddens, A.: *The Constitution of Society: Outline of the Theory of Structuration*. Polity Press, Cambridge (1984)