The Utility of Enterprise Architecture to Records and Archives Specialists

Dr. Shadrack Katuu
Research Fellow, Department of Information Science
University of South Africa
Pretoria, South Africa
skatuu@gmail.com

***Abstract*—Modern institutions invest large amounts of resources to build technology platforms and business applications to support organizational activities which will fulfil their institutional mandate. Enterprise architecture (EA) has emerged as an approach to improve the alignment between the organization's business and their technology platforms. This article is drawn from a research project investigating the utility of EA for records and archives specialists.**

Keywords—archives management, InterPARES Trust, metadata, records management, TOGAF

I. INTRODUCTION

The emerging transdisciplinary field of computational archival science provides, among other things, a platform that facilitates the exploration of emerging methods and technologies as well as new forms of analysis that support to historical, social, scientific, and cultural research engagement with records/archives [25]. In the last few years experts in computational as well as archival sciences have explored and mapped several concepts and methods in both fields resulting in enriching transdisciplinary efforts.

There are four major categories of computational thinking: data practices, modeling and simulation practices, computational problem-solving practices, and systems thinking practices [34]. Each of these categories has subsets of between five to seven practices (see Fig 1). From a computational thinking perspective, this article falls under systems thinking practices with its focus on understanding the dynamics within systems and how those systems change over time [34]. This article discusses enterprise architecture (EA), that emerged in the 1980s to address institutional complexity in an increasingly sophisticated organizational environment [1]. At the point of EA's emergence, computer software developers and information system engineers realized that they could only design suitable IT components if they "understood how the organisation works as defined by its processes, organisational structure and goals" [1]. EA emerged as an approach to improve the alignment between the organization's business and their information systems [4]. For this reason, EA is regarded as a promising concept to cope with the complexity caused by multifarious technology ecosystems [29].

For decades, records and archives specialists have tried to fulfil their professional mandate using theories and methods developed for a paper rather than digital environment [25]. However, in institutions with complex technological environments, the challenge is how best to understand the complexity in the quest of the identification, capture, management, appraisal, preservation and provision of access to records and archives for as long as they are required. Records and archives specialists need to make sense of the vast array of software applications and technological infrastructure, as well as how they relate to each in supporting the institution's functions and activities. This is necessary to institute any lifecycle management of records/archives or potential records/archives generated by these software applications.

The information technology (IT) field has several options to understanding technological complexity, including EA. This article is drawn from a research project investigating the utility of EA for records and archives specialists. The overall

study constitutes four components: (1) a review of literature on EA; (2) an assessment of EA frameworks with the chosen framework for the study being The Open Group Architecture Framework (TOGAF); (3) the design of an integrated TOGAF model incorporating record keeping requirements; and (4) the validation of the integrated model [19]. This article concentrates on the first and second components while providing an overview of the third and fourth components [20].

II. LITERATURE REVIEW

Modern institutions invest large amounts of resources to build technology platforms and business applications to support organizational activities which will fulfil their institutional mandate. As IT departments build systems, they create legacies based on business assumptions that might no longer hold true [7]. Effective management of technology assets has necessitated the development of portfolio management techniques and models to map out the complete IT ecosystem in their institutions [17, 21]. For many such institutions, creating an inventory of systems or applications is just the beginning of the management process [18].

EA deployment provides holistic views, which are sometimes used to address the organizational structure, business processes, information flow, information systems, and infrastructure [13]. EA models differ from pure business process models as they holistically describe related enterprise capabilities and different layers' assets (see Fig. 1).

A. Deployment of EA Around the World

Individual countries have been adopting EA at different paces and levels of sophistication. For instance, in the late 1990s and early 2000s, a several public sector experts in Australia recognised the potential for EA to be used in modelling the situation in local councils to assess the management of data and information [23]. In the course of the 2000s, Canada embedded EA principles within the federal government with the chief architect's office located within the Treasury Board Secretariat [6].

Countries in the developing world are also making efforts. In South Africa, efforts at establishing EA began in the 2000s with national institutions, including the National Treasury [26] coordinated by guidance from the Department of Public Services and Administration [5]. In addition, Kenya's first EA standards were published in 2016 by the country's Information and Communication Authority [9].

B. Engagement of Records and Archives specialists in the Deployment of EA

While different countries are at varied levels of sophistication, the situation amongst non-IT professionals remains vague. It is difficult to determine the extent to which records and archives specialists are engaged in discussions around EA. The most visible efforts have been through the standardization process. Around 2016, records professionals in ISO's Technical Committee Sub-Committee 11 embarked on creating a common reference for records professionals and enterprise architects about "requirements for records processes and systems" [11].

The goal of the technical report is to establish records managers as key stakeholders in EA. The team is developing a technical report with three objectives:

1. Explaining the core concepts and records management principles to EAs
2. Explaining the core concerns of records management as an EA viewpoint
3. Explaining the alignment of the records management viewpoint and EA methods [11]

The report uses two EA components or tools (i.e., ArchiMate and TOGAF). TOGAF is an EA framework that has been used to illustrate a records management viewpoint relating to the architecture development method (ADM). For this reason, the next section will provide an outline of TOGAF because it has been adopted by records professionals as an EA standard [10].

III. EA FRAMEWORKS - A PRIMER ON TOGAF

The deployment of EA is intended to align goals and perspectives of IT with those of the business.

However, few institutions have adopted EA. Even fewer use EA extensively [8]. One of the reasons for not using EA extensively may be the large variety of frameworks. Since the mid-1980s, EA practitioners developed more than two dozen frameworks, including the Zachman Framework, TOGAF, and the Federal Enterprise Architecture (FEA) framework. These frameworks are popular because of their maturity. Zachman is the oldest; TOGAF and FEA allow free access to resources and information [3].

TOGAF was created by The Open Group as a technology architecture methodology based on the technical architecture framework for information management (TAFIM), a framework developed by the United States Department of Defense [2]. It has become a well-defined method for designing an information system in terms of building blocks and for showing how the building blocks fit and interact [28].

TOGAF has three main pillars:

1. Architecture Development Method (ADM): This describes a method for developing and managing the lifecycle of an EA and forms the core of TOGAF [33].
2. Enterprise Continuum (EC): This provides methods for classifying architecture and solution artifacts, both internal and external to the architecture repository, as they evolve from generic foundation architectures to organization-specific architectures [31].
3. EA Domains (EAD): These are areas of specialisation that are commonly accepted as subsets of an overall EA [32]. These domains include business architecture, applications architecture, technology architecture, and data architecture.

IV. USING TOGAF AS AN ASSESSMENT MECHANISM

TOGAF has been described as a flexible toolkit which can be tailored to fit numerous situations and organizations [22]. As part of a research study conducted under the auspices of the InterPARES Trust project, this researcher is exploring the utility of TOGAF architecture domains in an institutional setting. InterPARES Trust is the fourth phase of a multi-year project investigating the long-term preservation of authentic digital records [14]. This section assesses TOGAF to identify deficiencies and explore concepts of recordkeeping to address the deficiencies.

In the research, the TOGAF EAD was expanded to accommodate a modified form of the records/archives and information lifecycle model. The normal lifecycle model usually constitutes creation or receipt of records or information, their capture, storage and maintenance, use, and disposition [30]. The modified lifecycle within the institutional setting has four phases: (1) information authoring (2) information management; (3) records management; and (4) archives management. Each forms a swim lane through the four layers of the framework. An additional swim lane, titled supporting capabilities, was added to accommodate aspects of the business capabilities that cut across all four phases.

The resulting framework for the institution has anonymized names for applications and technologies (see Fig. 2). In addition, the four TOGAF EADs are layered on top of each other. They are complimented by five swim lanes.

1. **Business Capabilities:** In the top layer (the first four swim lanes) are viewed from left to right. They represent an information management lifecycle with specific capabilities characterizing the phases of the lifecycle. For instance, create, review/edit, and describe constitute information authoring capabilities. Publish, use, and share constitute information management capabilities. The last swim lane, titled supporting capabilities, constitutes aspects that should be common in the previous four lanes, including access control, audit, and search.
2. **Applications:** The second layer constitutes individual business applications supporting business capabilities. These applications may include accounting software, customer relationship management software, human resource management software, or project management software. It may constitute different modules of an enterprise-wide business application covering different

domains, including an enterprise resource planning system. As illustrated, some applications are limited to one lane. Other applications straddle more than one lane.

3. **Technology:** The third layer constitutes technology platforms to support business applications. These vary depending on where the business applications are hosted and used. For instance, some platforms may work on the desktop/laptop level, server level, or mobile device level.
4. **Data:** The fourth layer does not contain any content in the institutional abstraction. Some EA experts have argued that the data layer should merge with the application layer because applications execute commands using data objects [27].

The gap on the fourth layer caused concern when building the components of the framework. As a result, the institutional decision was to develop metadata attributes to facilitate the assessment content in the other layers. These attributes were adapted from a previous phase of the InterPARES project which had developed a framework for identifying authenticity metadata [12]. In the InterPARES project, the metadata components were mapped over three stages of the lifecycle model. To be adapted to the data layer of the TOGAF, the metadata attributes were extended to cover all four swim lanes (see Fig 3)

The data layer, when incorporated in the larger model, offers several benefits. It provides a general overview of how components in the layers are connected. For institutional stakeholders, the data layer provides an objective and consistent manner to assess metadata requirements implemented in the business applications and technology platforms in the other layers of the framework. Overall, the EA model provides an overview of how each of the components are connected and to what extent they straddle swim lanes in the framework.

V. Conclusion

This article drew from an ongoing study that constitutes four components: (1) a review of literature on EA; (2) an assessment of EA frameworks with the chosen framework for the study being The Open Group Architecture Framework (TOGAF); (3) the design of an integrated TOGAF model incorporating record keeping requirements; and (4) the validation of the integrated model. It outlined the activities undertaken within the first two steps. It demonstrated how an EA framework based on TOGAF assessed an institutional model with four layers: (1) business capabilities; (2) application; (3) technology; and (4) data. The data layer was blank. Therefore, it offered an opportunity to adapt metadata categories and types.

As an ongoing research process, the study will undertake a third step to complete the design of the integrated TOGAF conceptual model. This model should be built incrementally as it considers the conceptual contribution from recordkeeping. The fourth and final step would validate the integrated TOGAF conceptual model. The validation process is necessary when clarifying two issues:

1. Capabilities in the business layer using best practice guidelines and standards
2. Metadata in the data layer by developing a detailed inventory of the individual metadata types within each of the categories so that the model provides practical guidance [16]

This article has demonstrated that EA is a vast subject. This is evident in the number of approaches and frameworks that fall in the domain. Records and archives specialists, through the work of ISO's TC46/SC11 have chosen to one EA framework, TOGAF, to explore their relevance within the profession, they do so in different ways.

- This study looked exclusively at TOGAF. TC46/SC11 used TOGAF in conjunction with ArchiMate.
- This study explored one pillar of TOGAF (i.e., EAD) to find answers. TC46/SC11 used a different pillar, the ADM, to find answers.

Neither of these processes are complete. They will enrich each other in the future as their areas converge. However, they demonstrate the need for

records and archives specialists to continue exploring the emerging opportunities in utilising EA within their professional domain. This study demonstrates how records and archives specialists can harness computational methods, in this case EA that falls within the systems thinking approach, in their quest to fulfilling their professional mandate.

ACKNOWLEDGMENT

The author wishes to thank the anonymous reviewers for their constructive comments to improve the article. The author gratefully acknowledges the thoughtful readings of previous iterations of the article by Adrian Cunningham and Mpho Ngoepe. The views expressed herein are those of the author and should not be attributed to his current employer or any of his previous employers.

REFERENCES

[1] Ahlemann, F., Legner, C. and Schafczuk, D. *Introduction*. Springer Science & Business Media, City, 2012.
[2] Armour, F. J., Kaisler, S. H. and Liu, S. Y. A big-picture look at enterprise architectures. *IT professional*, 1, 1 (1999), 35-42.
[3] Basten, D. and Brons, D. *EA frameworks, modeling and tools*. Springer Science & Business Media, City, 2012.
[4] Dang, D. D. and Pekkola, S. Systematic Literature Review on Enterprise Architecture in the Public Sector. *Electronic Journal of e-Government*, 15, 2 (2017), 130-154.
[5] Department of Public Service and Administration [South Africa] *Public Service Corporate Governance of Information and Communication Technology Policy Framework*. 2018, from http://www.dpsa.gov.za/dpsa2g/documents/psictm/2013/CGICT%20Policy%20Framework.pdf, Department of Public Service and Administration [South Africa], Pretoria, 2012.
[6] Doucet, G. Enterprise Architecture at the Government of Canada. In *Proceedings of the Workshop on Government Enterprise Architecture as Enabler of Public Sector Reform* (Washington DC, April 17, 2008). World Bank Group, 2008.
[7] Doucet, G., Gøtze, J., Saha, P. and Bernard, S. A. Coherency management: Using enterprise architecture for alignment, agility, and assurance. *Journal of Enterprise Architecture*, 4, 2 (2009), 27-38.
[8] Hazen, B. T., Kung, L., G. Cegielski, C. and Allison Jones-Farmer, L. Performance expectancy and use of enterprise architecture: training as an intervention. *Journal of Enterprise Information Management*, 27, 2 (2014), 180-196.
[9] ICT Authority [Kenya] *Government ICT Standards: Government Enteprise Architecture*. City, 2016.
[10] International Standards Organization *ISO/PRF TR 21965 Information and documentation -- Records management in enterprise architecture*. 2018, from https://www.iso.org/standard/72312.html?browse=tc, Geneva, 2018.
[11] International Standards Organization *Records Requirements in Enterprise Architecture*. 2018, from https://committee.iso.org/sites/tc46sc11/home/projects/ongoing/records-requirements-in-enterpri.html Geneva, 2018.
[12] InterPARES 3 Project: TEAM Canada *General Study 15 – Application Profile for Authenticity Metadata*. 2018, from http://interpares.org/ip3/display_file.cfm?doc=ip3_canada_gs15_final_report.pdf InterPARES 3 Project, Vancouver, 2012.
[13] Iyamu, T. and Mphahlele, L. The impact of organisational structure on enterprise architecture deployment. *Journal of Systems and Information Technology*, 16, 1 (2014), 2-19.
[14] Jansen, A. and Duranti, L. The InterPARES Trust Project: Trusting Records in an Increasingly Networked Society. In *Proceedings of the 4th International Conference: The Future of Information Sciences (INFuture) 2013* (Zagreb, Croatia, 2013). Faculty of Humanities and Social Sciences, University of Zaghreb, 2013.
[15] Katuu, S. Facing the challenges of managing records in transactional systems. In *Proceedings of the inForum 2017* (Brisbane, Australia, 10th-13th September, 2017). Records and Information Management Professionals Australasia, 2017.
[16] Katuu, S. TR04 Assessing information systems: Facing the challenges of managing records in transactional systems. In *Proceedings of the 2017 International Seminar - InterPARES Trust* (Cape Town, South Africa, 7th December, 2017). InterPARES Trust: Team Africa, 2017.
[17] Katuu, S. Healthcare systems: typologies, framework models and South Africa's health sector *International Journal of Health Governance*, 23, 2 (2018), 134-148.
[18] Katuu, S. *Maturity models in contemporary organizations – An analysis of enterprise content management maturity model*. IGI Global, City, 2018.
[19] Katuu, S. *TR04 Assessing Information Systems: A Template of Analysis - Final Report*. 2018, from https://interparestrust.org/assets/public/dissemination/TR04FinalReportJuly2018.pdf, InterPARES Trust, Vancouver, Canada, 2018.
[20] Katuu, S. Using Enterprise Architecture as a means of understanding institution technology ecosystems. In *Proceedings of the ICMLG 2018 16th International Conference on Management Leadership and Governance* (Bangkok, Thailand, 24-25 May 2018, 2018). Academic Conferences and Publishing International, Reading, UK, 2018.
[21] Kaushik, A. and Raman, A. The new data-driven enterprise architecture for e-healthcare: Lessons from the Indian public sector. *Government Information Quarterly*, 32, 1 (2015), 63-74.
[22] Kotusev, S. *The critical scrutiny of TOGAF*. 2018, from http://www.bcs.org/content/conWebDoc/55892 British Computer Society, 2016.
[23] Local Government Association of Tasmania and School of Information Systems [University of Tasmania] *Information and Knowledge Management National Scoping Study*. 2017, from http://www.lgat.tas.gov.au/webdata/resources/files/Information_Knowledge_Management_Report_v1a.PDF, Australian Local Government Association, 2003.
[24] Maldony, M. and Katuu, S. *Assessing Information Systems: A Template for Analysis (TR04)*. InterPARES Trust, City, 2016.
[25] Marciano, R., Lemieux, V., Hedges, M., Esteva, M., Underwood, W., Kurtz, M. and Conrad, M. *Archival records and training in the age of big data*. Emerald Publishing Limited, City, 2018.
[26] National Treasury [South Africa] *Annual Report 2010-2011*. 2017, from http://www.treasury.gov.za/publications/annual%20reports/national%20treasury/nt%20annual%20report%202010-11.pdf, National Treasury [South Africa], Pretoria, 2011.
[27] Perroud, T. and Inversini, R. *Enterprise Architecture Patterns: Practical Solutions for Recurring IT-Architecture Problems*. Springer-Verlag, Heidelberg, 2013.
[28] Raj, P. and Periasamy, M. *The convergence of enterprise architecture (EA) and cloud computing*. Springer, City, 2011.
[29] Riempp, G. and Gieffers-Ankel, S. Application portfolio management: a decision-oriented view of enterprise architecture. *Information Systems and E-Business Management*, 5, 4 (2007), 359-378.
[30] Shepherd, E. and Yeo, G. *Managing records: a handbook of principles and practice*. Facet publishing, London, 2003.
[31] The Open Group *Enterprise Continuum*. 2018, from http://pubs.opengroup.org/architecture/togaf91-doc/arch/chap39.html, 2011.
[32] The Open Group *Introduction*. 2018, from http://pubs.opengroup.org/architecture/togaf91-doc/arch/index.html, 2011.
[33] The Open Group *Introduction to the ADM*. 2018, from http://pubs.opengroup.org/architecture/togaf91-doc/arch/chap05.html 2011.
[34] Weintrop, D., Beheshti, E., Horn, M., Orton, K., Jona, K., Trouille, L. and Wilensky, U. Defining computational thinking for mathematics and science classrooms. *Journal of Science Education and Technology*, 25, 1 (2016), 127-147.

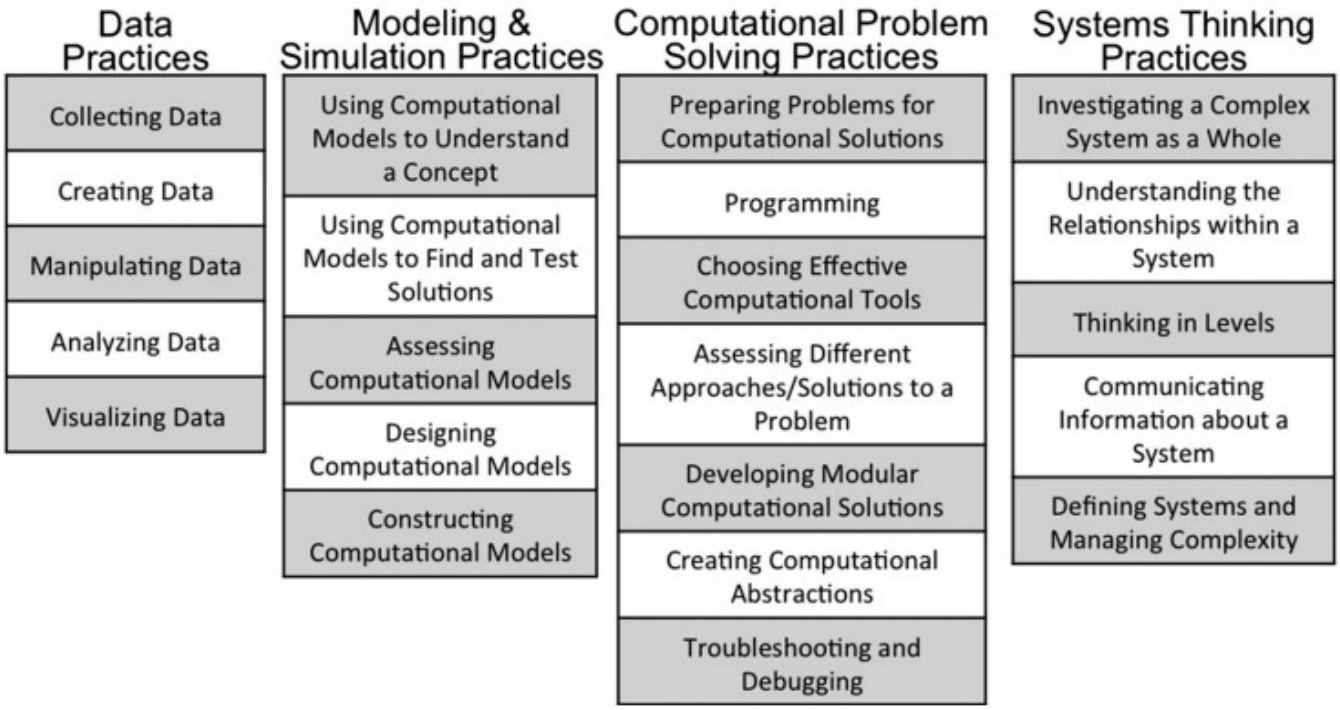

Fig. 1: Computational thinking. Source: [34]

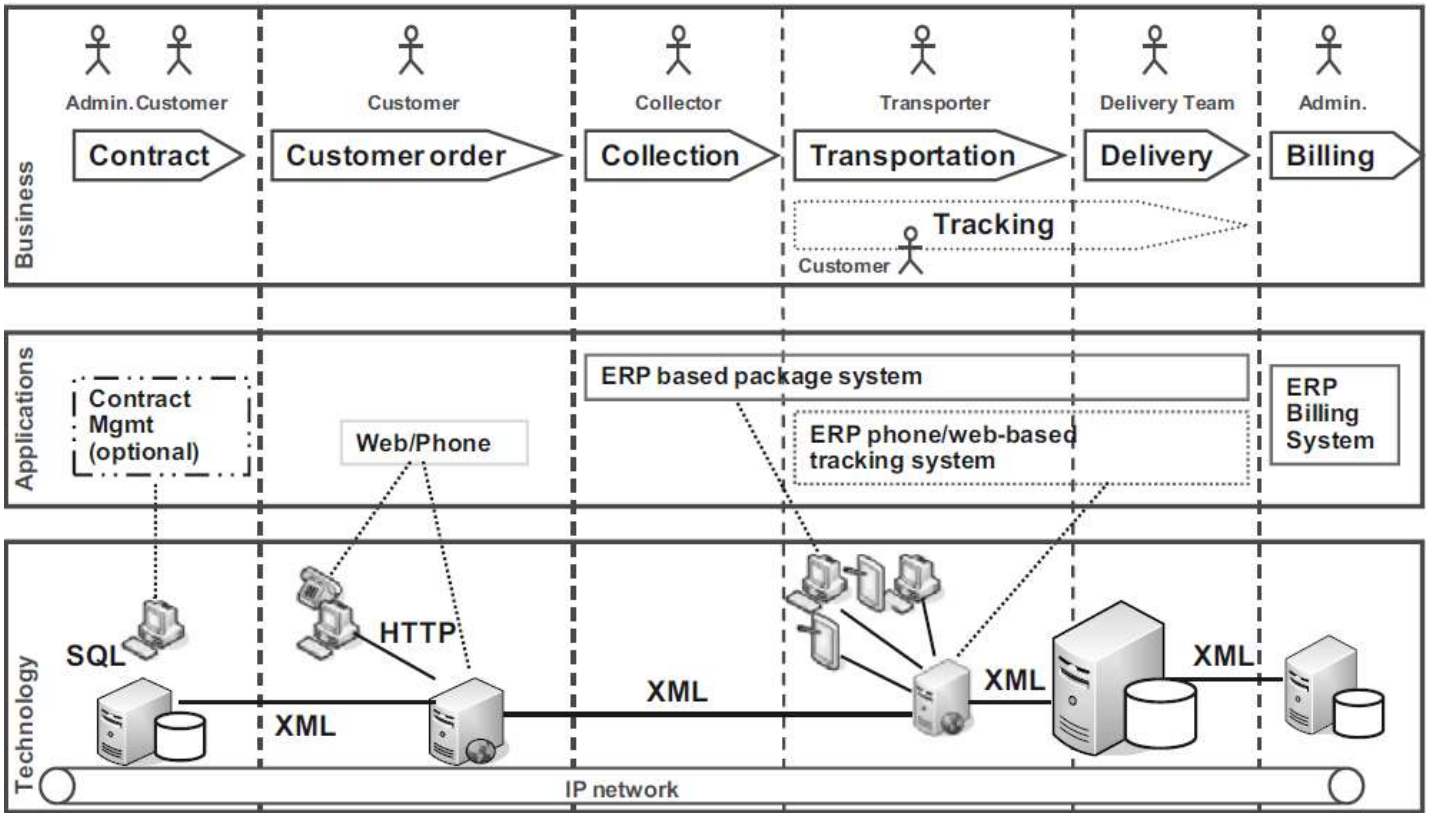

Fig. 2. An example of a simple EA. Source:[3]

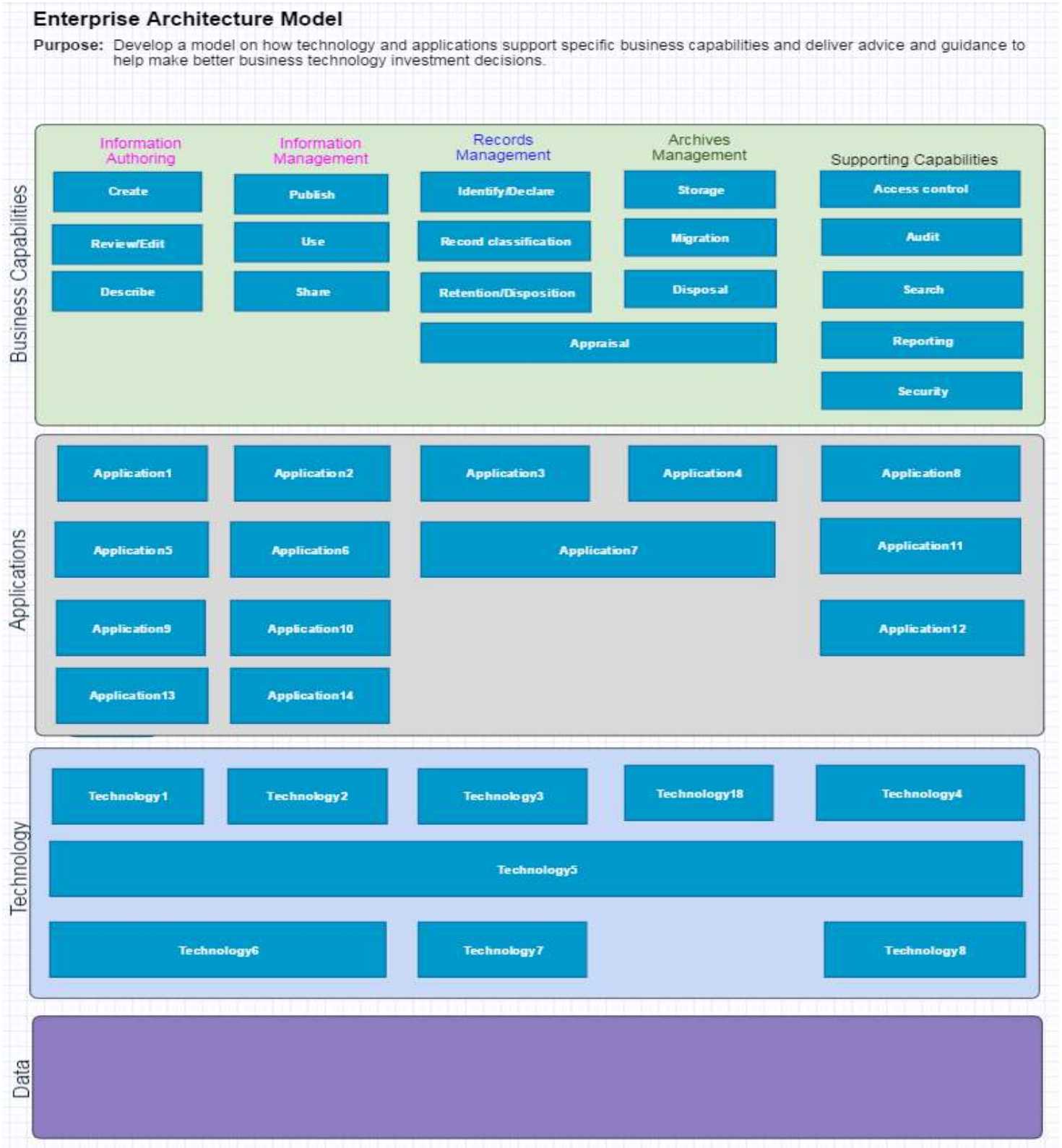

Fig. 3. EA model adapted from TOGAF framework. Source: [24]

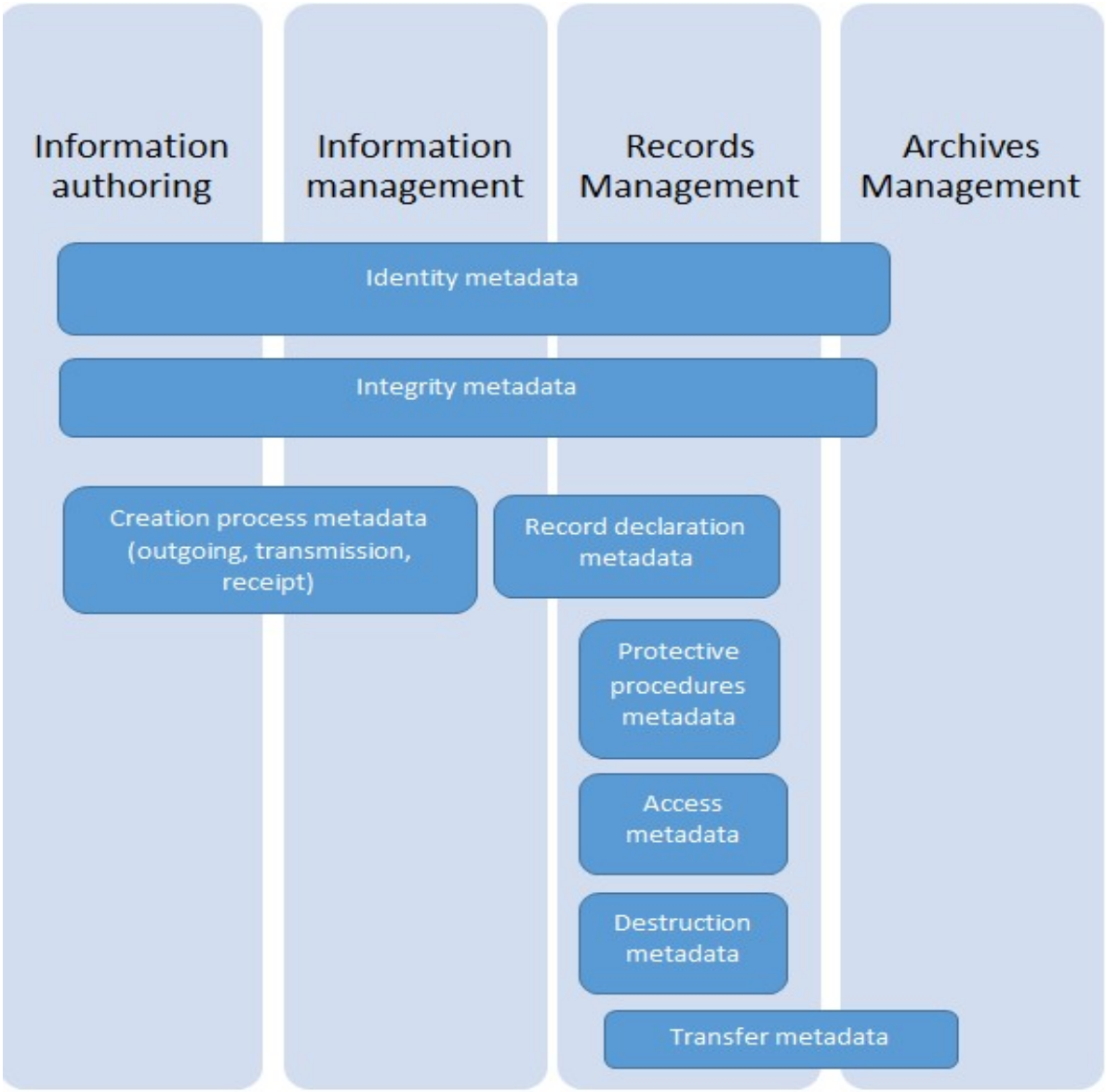

Fig. 4. Types of metadata for the data layer of the EA model. Source: [15]