Literature Review Studies in Public Sector's Enterprise Architecture

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Abstract: Recognize the relevant bibliography is important to researchers. It allows better research performance and the conjunction of academic knowledge. This study presents a bibliometric analysis of the main articles, on a worldwide scale, focusing on Enterprise Architecture in public administration. The method uses bibliometric indicators to show existing correlations, based on data from 82 articles cited in the world's main journals between 2013 and 2018. A multidisciplinary approach has identified contributions in technology, science, and government programs. It is possible to acknowledge that research in corporate architecture in the public sector is correlated with e-government strategies and interoperability to achieving goals and solving problems in this area.

1 INTRODUCTION

Public agencies have been supporting technology infrastructures that increasingly focus on delivering services and conducting the business of government. The use of these technologies supports major efforts of reorganization, modernization and reinvention of government using e-Government as a possible solution together with promoting organizational change (Dang and Pekkola, 2017). Such e-Government initiatives have been credited as engines of efficient public administration reform and given their progression state they can be classified based on their implementation and governance levels (Lim and Tang, 2008).

Although there is no common definition for Enterprise Architecture (EA) concept in the literature, many definitions agree that EA concerns the organizing logic articulating business processes, the information used and produced by these processes, the corresponding system applications and the information technology (IT) infrastructure. To ensure that these four components are aligned from business to IT needs, governance standards and practices are requested, as well as the development of governance levels.

Despite the importance of e-Government and EA, there are few studies on their impacts on public agencies performance and empirical evidence is lacking to portray these performance effects. Many studies on e-Government are based mostly on speculative reasoning rather than empirical analysis with rigorous methodologies (Lim and Tang, 2008).

This paper presents exploratory research which uses literature review through bibliometric and contextual analysis to study EA within the public administration and its evolving changes in the last six years.

2 ESSENTIAL ASPECTS OF EA IN PUBLIC SECTOR

John A. Zachman created the expression EA in the 1980s. To Zachman (1987), EA is a set of descriptive representations that was important to define an organization. Therefore, become noticeable the aspects necessary for the management, as well as its maintenance.

Nowadays, Bellman and Griesi (2015) present a definition of EA as the organizing logic of the business process and IT infrastructure, reflecting the requirements of integration and standardization of the companies operating model. The intention of EA is defining how an organization can achieve more effectively current and future goals.

One of the most popular applications is its use as a methodology to improve the interoperability and

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efficiency of inter-and intra-organizational IT systems (Hiekkanen et al., 2013; Janssen et al., 2013; Lemmetti and Pekkola, 2014). These Initiatives are usually voluntary, although some law-mandated examples exist, as in the U.S. ("The E-Government Act", 2002) and Finland ("Act on Information Management Governance in Public Administration", 2011).

Governments normally consist of many agencies with different structures and service/business-areas. This often leads to duplicated information systems and fragmented business services and process, decreasing the possibility of cross-agency interoperability. Therefore, governments pursue EA initiatives, in agencies, to increase online services (Saha, 2010), to provide new tools to manage business and IT alignment within agencies for better integration of technologies, to rationalize data structures and applications, and to provide business modularity (Dang and Pekkola, 2016).

3 LITERATURE REVIEW IN EA

Kotusev (2017) observed that EA literature reviews including distribution in time, research groups and communities, citation and authorship patterns, publication types and geographical distribution, reference discipline, theory types and empirical validity. These variables are also known as bibliometric indicators of scientific quality, scientific activity and scientific impact.

Distribution in time of literature review studies shows that the decade's ending 2000 and decade's beginning 2010 was the apex of publications in government or public sector EA studies (Ramos and Sousa, 2015; Dang and Pekkola, 2017; Lnenicka and Komarkova, 2019)

In Ramos and Sousa (2015), literature review analyzed the period from 1999 to 2014, showed the main EA focus in the public sector was in e-government, service, government, and interoperability. Dang and Pekkola (2017) argued that researches focus on development issues and frameworks, nobody knows how those frameworks and practices are actually used and followed, how well they fit with their purposes, and what the challenges are stakeholders react. According to Lnenicka and Komarkova (2019), big data, open data, cloud computing, and EA framework are relevant themes in government EA.

Most literature review research uses the same databases, as AIS Electronic Library, ACM Digital Library, EBSCO, Google Scholar, IEEE Xplore, JSTOR, Science Direct, Springer Link, Taylor &

Francis and Web of Science, justified for ensuring highest impact in full-text journals and conference proceedings (Rouhani et al, 2015; Dang and Pekkola, 2017; Gampfer et al, 2018; Lnenicka and Komarkova, 2019). However, authors do not review any bibliometric indicators, as SCImago Journal Rank (SJR or ScimagoJR), H-Scopus or Journal Impact Factor (JIF), since these databases have articles that, although indexed, have low academic relevance and impact, not guaranteed the highest impact in full-text journals and conference proceedings.

4 METHODOLOGY

This research is a systematic literature review (SLR) characterized as descriptive, which intends to comprehend the theme in a broader way, through the following steps: first, it was defined topics and research questions: "Where and when were publications about the topic?", "Who are the main authors and their institutional links?", "What are the methodological aspects adopted in the research on the subject?", "What are the main difficulties and benefits of deploying enterprise architecture identified in the studies?"; Second, the database and criteria for the articles, from the consultation of two databases that enabled the survey of journals and scientific events: Capes Periodic Portal and Google Scholar; Third: Identify and select studies, based on the analysis of titles and summaries of articles in the database, considering inclusion and exclusion criteria. Publication in international journals and scientific events, publications between 2013 and 2018 and complete scientific paper published in English met the inclusion criteria. All other articles, as well as manuals, books, roundtables, patents and book chapters were excluded; Fourth: categorizing the articles by reading each one to identify information necessary to classify the research variables; Fifth: quantitative and qualitative analysis were made for data consolidation (all sample) using descriptive statistics and content analysis (for relevant journals and scientific events of the sample). The place of publication, temporary clipping, citations, publishing name, H-Scopus and SJR, Qualis CAPES, subject area and category, authors, institutional affiliation and keywords of the article were information used for the quantitative analysis, as for the qualitative analysis, the article objective, nature of study, research design, approach, data origin, public sphere, organization studied, sampling, data collection technique, data analysis technique, difficulties and benefits of

deployment, description results and research agenda are among the information used.

The option to search for publications in scientific events considers that the temporality of publication in international journals usually takes one to two years, whereas, from scientific events, it usually takes less than a year to be published.

The inclusion criteria restrict the article searches in the databases considering the research context (public administration) and temporal cut of last six years for content analysis allows an overview of the theme evolution.

The Publish or Perish software was used to search for academic publications and the Portal of Periodical Publications of the Coordination of Superior Level Staff Improvement (CAPES) of Brazil allowed the identification of periodicals evaluated by peer review.

For data consolidation, the quantitative analysis used the articles collected from the database (82 articles). For the qualitative analysis, there was a clearance of this sample, resulting in 28 articles, considering the Qualis CAPES stratum, the SCImago Journal Rank (SJR) and the H-Scopus for periodicals. The SJR shows the visibility of journals from developed countries contained in the Scopus® data-base. The H-Scopus aims to quantify the productivity and impact of research by means of the following measures: number of publications per periodical ("h¹") and number of citations of each article ("h²").

5 THE LAST SIX YEARS OF EA RESEARCH IN PUBLIC SECTOR

From the quantitative analysis, it was noticed that, most articles, 71.95% (59 papers), were published in scientific events. None of these papers were later published in a journal. This low recurrence of subsequent publication of event articles in journals increases the need to investigate publications also in proceedings for more comprehensive knowledge of national research publications on the subject.

The scientific production on EA in journals was stable in the period of 2014 to 2016, with six articles per year. However, in terms of publications in scientific events, there was a noticeable growth in 2014, followed by a drop in 2015, and another remarkable growth in 2016 and 2017, as shown in Table 11. As the survey was conducted until August 2018, that year cannot be considered as a full year for analysis, in order to indicate that there was a decrease in production on the subject.

Table 1: Distribution in years.

Year	Place of Publication		Total
	Journal	Scientific Event	
2013	1	6	7
2014	6	10	16
2015	6	5	11
2016	6	16	22
2017	2	18	20
2018	3	4	7
Total	24	59	82

Analyzing the time distribution, the same behavior verified by Lnenicka and Komarkova (2019) is shown in his analysis from 2003 to 2018. Despite the differential forms of data collection, results converge. Comparing these results with the time distribution performed by Gampter et al (2018), with an analysis period from 1987 to 2016, and the object of analysis been EA, the pattern repeats, except for the fall of publications in 2015.

The 24 articles were published in 21 different journals. Journals with recurrence in publications are "Sustainability", "Software & Systems Modelling", and "Enfoqute", each with two articles. Only the "Enfoque" does not feature H-Scopus and SJR on ScimagoJR. From the 21 journals, 19 present H-Scopus, SJR, and Qualis Capes, in which evaluation is in peer review.

Table 2 shows which are journals with SJR greater than 0.401. This cut from the 0.401 index shows that the journal has a higher stratum in Qualis Capes. Furthermore, for this sample, the SJR index average is 0.53, the median value is 0.48 and the standard deviation is 0.39.

The average for H-Scopus is 40.64; the median value is 40. The maximum value of the SJR obtained was 1.32 from "Government Information Quarterly". Therefore, nine journals are considered more relevant.

Table 2: Journals and Indexes.

Journal	SJR	H	N. Papers
Government Information Quarterly	1,32	76	1
International Journal of Medical Informatics	1,247	88	1
Journal of Intelligent Manufacturing	1,18	63	1
Annual Reviews in Control	0,82	64	1
International Journal of Computer Integrated Manufacturing	0,77	44	1
Enterprise Information Systems	0,72	40	1
Sustainability	0,54	42	2
Indian Journal of Fundamental and Applied Life Sciences	0,48	29	1
Software & Systems Modelling	0,48	41	2

It is worth noting that the journal with a maximum value of H-Scopus was 101 by IEEE Internet Computing, but it has an SJR of 0.38.

Of the 59 articles of scientific events, 47 scientific events were identified, wherein International Conference on Enterprise Information Systems (ICEIS) and Pacific Asia Conference on Information Systems (PACIS) have the highest concentration of articles (4 papers each). Table 3 presents the relation between events evaluated by SJR, H indexes and the number of articles published in it.

Table 3: Conferences related to EA in Public Sector.

Conference	N. of Papers	Years
International Conference on Enterprise Information Systems (ICEIS)	4	2013; 2016; 2017 (2 papers)
Pacific Asia Conference on Information Systems (PACIS)	4	2016, *2017 (3 papers)
European Conference on Information Systems (ECIS)	2	2013; 2016
Joint Rail Conference (JRC)	1	2013
International Conference on Computer and Information Sciences, (ICCOINS)	1	2016
International Conference on Information and Communication Technology (ICoICT)	1	2016
International Conference on Innovative Computing Technology, (INTECH)	1	2016
International Conference on ICT for Smart Society (ICISS)	1	2016
AIP Conference Proceedings	1	2017
International Symposium on Business Modelling and Software Design (BMSD)	1	2016
International Conference on Science in Information Technology: Big Data Spectrum for Future Information Economy (ICSITech)	1	2015
International Conference on Cyber and IT Service Management (CITSM)	1	2016

* Event year is not on the basis of ScimagoJR

These findings of publication places in journals and events are a contribution to researchers and professionals in this area who are interested in submitting articles for publication or even to consult and read articles of EA subject.

Considering articles of journals and scientific events indexed on ScimagoJR, which are in total 32 articles, the subject area concentration is computer science, with 75% of papers (Table 4).

Table 4: Subject area.

Subject Area	N. of Papers	Frequency
Computer Science	24	75,00%
Engineering	8	25,00%
Social Sciences	7	21,88%
Mathematics	5	15,63%
Environmental Science	4	12,50%
Energy	3	9,38%
Medicine	2	6,25%
Decision Sciences	2	6,25%
Materials Science	1	3,13%
Agricultural and Biological Sciences	1	3,13%
Chemical Engineering	1	3,13%
Biochemistry	1	3,13%
Business	1	3,13%
Management and Accounting	1	3,13%
Genetics and Molecular Biology	1	3,13%

Considering the 82 articles, 139 authors participated in researches. Two authors elaborated the relative majority of researches (30 papers). Researches counting one author were only 11 articles, and the average of authors per research is 2.74. The number of citations of these articles is an important indicator for verification of author's relevance. The author R. Abraham has in a single article, entitled "Enterprise architecture artifacts as boundary objects - A framework of properties", 45 citations, published in Proceedings of 21st European Conference on Information Systems (ECIS 2013). Table 5 shows articles that have above 20 citations.

Table 5: Most cited articles.

Authors	Cites	(Year) Title
R Abraham	45	(2013) Enterprise architecture artifacts as boundary objects- A framework of properties
U Franke, P Johnson, J König	38	(2014) An architecture framework for enterprise IT service availability analysis
A Vargas, L Cuenca, A Boza, I Sacala, M Moisescu	28	(2016) Towards the development of the framework for inter sensing enterprise architecture
P Närman, M Buschle, M Ekstedt	26	(2014) An enterprise architecture framework for multi-attribute information systems analysis
V Burégio, Z Maamar, S Meira	26	(2015) An architecture and guiding framework for the social enterprise

Average citations of the 82 papers is 4.5122, the median value is 1 and the standard deviation is 8.71.

Regarding the author's institutional linking, 70 universities were identified. The University of Technology of Malaysia has the largest number of published articles (6 papers). Seven articles had no or missing information. Table 6 shows the author's institutional affiliation.

Table 6: Author's Affiliation.

(Country) Institutional affiliation	Occ.
(Malaysia) University of Technology Malaysia	6
(Croatia) University of Zagreb	3
(Brazil) University of Brasília	3
(Indonesia) Bandung Institute of Technology	3
(Iran) Islamic Azad University	3
(Germany) University of Rostock	2
(Indonesia) Bina Nusantara University	2
(Croatia) IBISTM	2
(Iran) University of Tehran	2
(Indonesia) University of Lampung	2
(Emirates) American University of Sharjah	2
(Brazil) Federal University of Rio de Janeiro	2
(Canada) Ryerson University	2
(Indonesia) Telkom University	2
(Sweden) Royal Institute of Technology	2
(Finland) Tampere University of Technology	2

Indonesia is the country with the largest amount of research (12 papers), followed by Malaysia (7 papers); Germany and Iran, each with 6 papers; United States of America and France, each with 5 papers; Switzerland, Finland, Brazil and Croatia each with 4 papers. In terms of continents, Europe predominates by participating in 14 researches; then Asia participating in 8 researches; Latin America, Middle Orient participating in 4 researches each; North America in 3 researches; Africa and Oceania with 1 research each.

From the published articles, eight surveys had participants from, at least, one public organization (Table 7).

Table 7: Participating public agencies.

Government Agencies	City, Country
Ministry of Communication and IT	Riyadh, Saudi Arabia
Ministry of ICT	Bogota, Colombia
Government of Ontario	Toronto, Canada
Integration and Interoperability Coordination (SERPRO)	Brasilia, Brazil
New York City Transit (NYCT)	New York, USA
IT Organization of Iran	Tehran, Iran

Among the keywords used in the 82 articles, 230 terms were identified, with only 11 terms with recurrences in at least 3 papers.

Table 8 shows the frequency of use of keywords from the researched articles.

Table 8: Keywords.

Keyword	Frequency
Enterprise architecture	47
Enterprise architecture framework	13
Public sector	7
TOGAF	6
E-government	5
Framework	5
Balanced scorecard	4
Zachman framework	4
Change management	3
Software architecture	3
Metrics	3

There is no consensus among authors about the use of keywords for indexing articles. In the evolutionary aspect of EA.

The results are in line with the Lnenicka and Komarkova (2019) analyses of the terms enterprise architecture framework, TOGAF, and Zachman framework, but there is no evidence of big data or cloud computing. The question of e-government still remains according to Ramos and Sousa (2015).

In the public sector, EA has become a tool to support e-government and interoperability activities.

Methodological aspects of publications regarding the approaches of research; data collection strategies; techniques of sampling and analysis. To do so, a new selection was made in the sample of the 82 journals, choosing to work with those that were published in periodicals and scientific events of greater relevance, such as those in Table 3 and 4, thus, the new cut of articles for content analysis has 28 articles.

Initial analyses have shown that most of the published articles (18 papers) are empirical, which refers to reports of specific experiences of public organizations. Of the 9 theoretical articles identified, all are bibliometric surveys. Only one article researched about EA methodology.

There is no predominance in research design, in which 36% (10 papers) are descriptive, 32% (9 papers) are exploratory, 29% (8 papers) are explanatory research and have a qualitative approach.

The use of this methodological approach is consistent with the types of research for analyzing the implementation of EA frameworks.

Regarding the origin of the data, 50% of the publications (14 papers) used primary sources in the collection, in which, data were collected in field surveys. Secondary sources were used in 29% of the publications (8 papers), essentially based on bibliographic analysis research. There were 6 papers

that had secondary and primary data. On the data collection strategies, the greatest recurrence is of case studies (12 papers), followed by bibliographical research (6 papers), the following research strategies were also identified: opinion survey (2 papers), documentary research (2 papers) and experimental research (1 paper).

Bibliographic research, survey, observation, documentary analysis, interview, documentary research, the Delphi method, focus groups and experimental tests are among the instruments of analysis used by the authors. Regarding the data analysis, there was a great predominance of content analysis (16 papers) and then descriptive statistics (2 articles).

The relative majority of empirical studies (7 papers) were carried out at a federal level. Subsequently, there was a concentration of researches carried out at universities (4 papers). Two research in the hospital sector were identified as well. It is worth stressing that the EA theme is an interdisciplinary matter and is part of many countries governance agenda. Thus, articles that analyze the EA of international governments appears.

Among the analyzed articles, it was possible to classify different types of difficulties related to EA, which were grouped in 6 thematic categories (Table 9).

Table 9: EA difficulties in the public sector.

Categories	Reference Examples
Deficiency of the EA model(s) to meet current organizational needs	Amalia, Supriadi (2017); Hussein, Mahrin, Maarop (2017); Nama, Kurniawan (2017); Oberhauser (2018)
Deficiencies in the planning and implementation of EA	Bakar, Selamat (2016); Kurniawan, Hiererra (2016); Lee, Oh, Nam (2016); Moscoso-Zea, Luján-Mora, Cáceres, Schweimanns (2016); Nam (2016); Nam et al (2016); Aliee et al (2017); Bakar, Selamat, Kama (2017); Haghighathoseini et al (2018); Oberhauser (2018)
Difficulty of integration	Amalia, Supriadi (2017); Nama, Kurniawan (2017); Nunes, Cappelli, Costa (2017); Mondorf, Wimmer (2017); AlSoufi (2018)
Conceptual difficulties	Kaddoumi, Watfa (2016); Lee, Oh, Nam (2016); Nam et al (2016); Nunes, Cappelli, Costa (2017)
Technical and non-technical difficulties	Santikarama, Arman (2016); Seghiri (2016); Mondorf, Wimmer (2017); Nama, Kurniawan (2017); Sultan, Miranskyy (2018)
Lack of agility in meeting demands	Kaddoumi, Watfa (2016); Amalia, Supriadi (2017); Nama, Kurniawan (2017); Nunes, Cappelli, Costa (2017); Sultan, Miranskyy (2018)

In the same way, it was identified in the literature possible benefits obtained or expected by public organizations in relation to the adoption of EA. In this case, it was possible to classify benefits in 9 thematic categories (Table 10).

Table 10: EA benefits in the public sector.

Categories	Reference Examples
Achievement of Organizational Objectives	Lee, Oh, Nam (2016); Yuliana, Rahardjo (2016); Bakar, Selamat, Kama (2017); Hussein, Mahrin, Maarop (2017)
Organizational Alignment (from IT to Business)	Bakar, Selamat (2016); Kaddoumi, Watfa (2016); Lee, Oh, Nam (2016); Nam, Oh, Kim (2016); Yuliana, Rahardjo (2016); Amalia, Supriadi (2017); Hussein, Mahrin, Maarop (2017); Nunes, Cappelli, Costa (2017); Sultan, Miranskyy (2018)
Advance of e-government	Bakar, Selamat (2016); Lee, Oh, Nam (2016); Aliee et al (2017); Bakar, Selamat, Kama (2017)
Contribution to organizational change	Abraham (2013); Kaushik, Raman (2015); Kaddoumi, Watfa (2016); Moscoso-Zea et al (2016); Yuliana, Rahardjo (2016); Aliee et al (2017); Bakar, Selamat, Kama (2017); Hussein, Mahrin, Maarop (2017); AlSoufi (2018)
organizational communication	Santikarama, Arman (2016); Yuliana, Rahardjo (2016); Bakar, Selamat, Kama (2017)
organizational knowledge management	Bernus, Noran, Molina (2015); Moscoso-Zea (2016)
Improves organizational (and IT) management	Kaddoumi, Watfa (2016); Lee, SW Oh, Nam (2016); Amalia, Supriadi (2017); Hussein, Mahrin, Maarop (2017); Mondorf, Wimmer (2017); Haghighathoseini et al (2018)
Improves organizational (and IT) performance	Bakar, Selamat (2016); Kaddoumi, Watfa (2016); Moscoso-Zea et al (2016); Seghiri et al (2016)
Promotes the integration of organizational components	Kaushik, Raman (2015); Bakar, Selamat (2016); Dang, Pekkola (2016); Lee, Oh, Nam (2016); Moscoso-Zea et al (2016); Vargas (2016)

6 CONCLUSION

The study analyzed the evolution of EA theme in Public Sector. It is important to note that articles of EA focus on the areas of computer science, engineering, and social sciences, which shows a multidisciplinary character involving different

aspects in the public sector. The analysis shows that consider scientific events and articles published in proceedings can be significant for comprehending the theme since research shows that much of the EA literature appear on scientific events.

Through the bibliometric analysis, we can observe growth in the approach of the theme in worldwide scope, in addition to a change of stakeholders region, which cease to be in majority on the west and come to appear with relevance in the East. The countries with the highest volume of publication in the sample used were Indonesia, Malaysia, Germany, and Iran. Only after this group, comes the United States of America. In conclusion, we find that, after three decades of research, publications and development of EA in West countries, there is a struggle in the East to follow up studies and approaches that started and were implemented through the years. The search for government transparency as a reflection of democratic transformations and more politically involved societies brings EA as a well-researched solution. Malaysia is a good example of a country that is passing through a democratic transition and it appears to be a direct relationship between the development of EA in the country and its new democratic policies. A more particular research in this area can bring greater correlations between the political changes of East countries and their new approaches to EA.

REFERENCES

Abraham, R. (2013, June). Enterprise architecture artifacts as boundary objects-A framework of properties. Association for Information Systems. In *Proceedings of the 21st European Conference on Information Systems* (ECIS 2013).

Aliee, F. S., Bagheriasl, R., Mahjoorian, A., Mobasheri, M., Hoseini, F. and Golpayegani, D. (2017). Towards a National Enterprise Architecture Framework in *Iran. Proceedings of the 19th International Conference on Enterprise Information Systems* (ICEIS 2017).

AlSoufi, A. (2018). Bahrain National Enterprise Architecture Framework: a Platform towards a GCC EA Initiative. GSTF. In *Journal on Computing* (JoC), 2(1).

Amalia, E. and Supriadi, H. (2017, June). Development of enterprise architecture in university using TOGAF as framework. In *AIP Conference Proceedings* (Vol. 1855, No. 1, p. 060004). AIP Publishing.

Bakar, N. A. A. and Selamat, H. (2016, August). Investigating Enterprise Architecture implementation in public sector organisation: A case study of Ministry of Health Malaysia. In *Computer and Information Sciences* (ICCOINS), 2016 3rd International Conference on (pp. 1-6). IEEE.

Bakar, A., Selamat, H. and Kama, M. N. (2017). Assessing the Capability and Priority of Enterprise Architecture Implementation in Malaysian Public Sector. In *Pacific Asia Conference on Information Systems*.

Bellman, B., and Griesi, K. (2015, July). Enterprise architecture advances in technical communication. In *Professional Communication Conference* (IPCC), 2015 IEEE International (pp. 1-5). IEEE.

Bernus, P., Noran, O. and Molina, A. (2015). Enterprise architecture: Twenty years of the GERAM framework. *Annual Reviews in Control*, 39, 83-93.

Dang, D. D. and Pekkola, S. (2016, June). Root Causes of Enterprise Architecture Problems in the Public Sector. In *PACIS* (p. 287).

Dang, D. D., and Pekkola, S. (2017). Systematic Literature Review on Enterprise Architecture in the Public Sector. *Electronic Journal of e-Government*, 15(2).

Gampfer, F., Jürgens, A., Müller, M., and Buchkremer, R. (2018). Past, current and future trends in enterprise architecture—A view beyond the horizon. *Computers in Industry*, 100, 70-84.

Haghighathoseini, A., Bobarshad, H., Saghafi, F., Rezaei, M. S. and Bagherzadeh, N. (2018). Hospital enterprise Architecture Framework (Study of Iranian University Hospital Organization). In *International journal of medical informatics*, 114, 88-100.

Hiekkanen, K., Korhonen, J. J., Collin, J., Patricio, E., Helenius, M., and Mykkanen, J. (2013). Architects' Perceptions on EA Use - An Empirical Study. In IEEE 15th *Conference on Business Informatics* (CBI).

Hussein, S. S., Mahrin, M. N. R. and Maarop, N. (2017). Preliminary Study of Malaysian Public Sector (MPS) Transformation Readiness through Enterprise Architecture (EA) Establishment. In *Pacific Asia Conference on Information Systems*.

Janssen, M., Flak, L. S., and Sæbø, Ø. (2013). Government Architecture: Concepts, Use and Impact. In M. A. Wimmer, M. Janssen and H. J. Scholl (Eds.), Electronic Government: *Proceedings of the 12th IFIP WG 8.5 International Conference*, EGOV 2013 (pp. 135-147). Koblenz, Germany.

Kaddoumi, T. and Watfa, M. (2016, August). A proposed agile enterprise architecture framework. In *Innovative Computing Technology* (INTECH), 2016 Sixth International Conference on (pp. 52-57). IEEE.

Kaushik, A. and Raman, A. (2015). The new data-driven enterprise architecture for e-healthcare: Lessons from the Indian public sector. In *Government Information Quarterly*, 32(1), 63-74.

Kotusev, S. (2017). Enterprise architecture: what did we study? *International Journal of Cooperative Information Systems*, 26(04), 1730002.

Kurniawan, Y. and Hiererra, S. E. (2016, May). Information systems design for sustainability financial services company using enterprise architecture framework: A case study approach. In *Information and Communication Technology* (ICoICT), 2016 4th International Conference on (pp. 1-6). IEEE.

Lee, S., Oh, S. W. and Nam, K. (2016). Transformational and transactional factors for the successful implementation of enterprise architecture in public sector. *Sustainability*, 8(5), 456.

Lemmetti, J., Pekkola, S. (2014). Enterprise Architecture in Public ICT Procurement in Finland. In *Electronic Government and Electronic Participation*: Joint Proceedings of Ongoing Research and Projects of IFIP WG 8.5 EGOV and ePart, Dublin, Ireland.

Lim, J. H., Tang, S. Y. (2008). Urban e-Government initiatives and environmental decision performance in Korea. *Journal of Public Administration Research and Theory* (pp. 109-138).

Lnenicka, M., and Komarkova, J. (2019). Developing a government enterprise architecture framework to support the requirements of big and open linked data with the use of cloud computing. *International Journal of Information Management*, 46, 124-141.

Mondorf, A. and Wimmer, M. (2017). Contextual Components of an Enterprise Architecture Framework for Pan-European eGovernment Services. In *Proceedings of the 50th Hawaii International Conference on System Sciences.*

Moscoso-Zea, O., Luján-Mora, S., Cáceres, C. E. and Schweimanns, N. (2016, April). Knowledge Management Framework using Enterprise Architecture and Business Intelligence. In *ICEIS* (1) (pp. 244-249).

Nam, K., Oh, S W., Kim, S. K., Goo, J. and Khan, M. S. (2016). Dynamics of Enterprise Architecture in the Korean Public Sector: Transformational Change vs. Transactional Change. *Sustainability*, 8(11), 1074.

Nama, G. F. and Kurniawan, D. (2017, November). An enterprise architecture planning for higher education using The Open Group Architecture Framework (TOGAF): Case study University of Lampung. In Informatics and Computing (ICIC), 2017 *Second International Conference on* (pp. 1-6). IEEE.

Nunes, V. T., Cappelli, C. and Costa, M. V. (2017). FACIN: The Brazilian Government Enterprise Architecture Framework. In *ICEIS* (3) (pp. 433-439).

Oberhauser, R. (2018). The Digital Diamond Framework: An Enterprise Architecture Framework for the Digital Age. In *eKNOW 2018*: The Tenth International Conference on Information, Process, and Knowledge Management

Ramos, K. H. C. and de Sousa Júnior, R. T. (2015). Bibliometric analysis of enterprise architecture in the public administration. International Information Institute (Tokyo). *Information*, 18(2), 501.

Rouhani, B. D., Mahrin, M. N. R., Nikpay, F., Ahmad, R. B., and Nikfard, P. (2015). A systematic literature review on Enterprise Architecture Implementation Methodologies. *Information and Software Technology*, 62, 1-20.

Saha, P. (2010). EA as platform for connected government: Advancing the Whole of Government Enterprise Architecture Adoption with Strategic (Systems) Thinking. In *NUS Institute of Systems Science*, Singapore.

Santikarama, I. and Arman, A. A. (2016, July). Designing enterprise architecture framework for non-cloud to cloud migration using TOGAF, CCRM, and CRMM. In *ICT For Smart Society* (ICISS), 2016 International Conference on (pp. 32-37). IEEE.

Seghiri, R., Boulanger, F., Lecocq, C. and Godefroy, V. (2016, January). An executable model driven framework for enterprise architecture application to the Smart Grids context. In *System Sciences* (HICSS), 2016 49th Hawaii International Conference on (pp. 4546-4555). IEEE.

Sultan, M. and Miranskyy, A. (2015). Ordering stakeholder viewpoint concerns for holistic and incremental Enterprise Architecture: the W6H framework.In *Proceedings of IEEE Fifth International workshop on Requirements Patterns.*

Vargas, A., Cuenca, L., Boza, A., Sacala, I. and Moisescu, M. (2016). Towards the development of the framework for inter sensing enterprise architecture. *Journal of Intelligent Manufacturing*, 27(1), 55-72.

Yuliana, R. and Rahardjo, B. (2016, April). Designing an agile enterprise architecture for mining company by using TOGAF framework. In *Cyber and IT Service Management, International Conference on* (pp. 1-6). IEEE.

Zachman, J. A. (1987). A framework for information systems architecture. *IBM systems journal*, *26*(3), 276-292.