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ENTERPRISE ARCHITECTURE: A PERSPECTIVE ON HOW FAR WE HAVE COME, AND DIRECTIONS FOR THE FUTURE

Research paper

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Abstract

Enterprise Architecture (EA) appears to retain the attention of both practitioners and researchers, as the technological complexity of organizations grows. Several researchers have noted that research on EA has been diversifying over time, leading to inconsistent use of terminologies. Further, the benefit claims and other results, rather frequently, are not based on empirical evidence. These shortfalls in research on EA impede EA from maturing as a discipline and from demonstrating its benefit claims. Although there are reasons to believe that the research on EA has progressed, the extent of the progress and the directions for future research are not evident. This study draws on a meta-review of 51 review articles on EA to fill this gap. Indeed, research on EA has progressed. In this paper, the progress and directions for future research are organized along four areas; they are, EA research, EA process, EA benefits and EA principles. This study improves our understanding of the progress that research on EA has made, and the directions that future research on EA should take towards creating a coherent discipline that offers relevant solutions grounded in theory and produced from rigorous research methods.

Keywords: Enterprise Architecture, EA Management, Meta-review, EA research, EA process, EA benefits, EA principles, Systematic literature review.

1   Introduction

Researchers and practitioners believe that Enterprise Architecture is important to organizations. Particularly, several researchers and practitioners regard Enterprise Architecture (EA) as an avenue to manage the complexity of an organization from an architectural perspective in a manner that allows the organization to adapt to changing situations (e.g. Ahlemann et al., 2012; Aier et al., 2011; Lange et al., 2016). In recent years, organizations are becoming more complex as they do not depend only on resources that they possess, but also on resources that they leverage from other organizations to create synergies and derive value (Nan and Tanriverdi, 2017; Sirmon et al., 2011).

Indeed, research shows that interconnecting and sharing resources across function within an organization, and among several organizations; e.g., within an ecosystem, result in benefits; e.g., efficiency and productivity (Saraf et al., 2013; Nan and Tanriverdi, 2017). However, research has also shown that such interconnectedness may as well constrain the ability of an organization to adapt to new situations (Saraf et al., 2013). Thus, the application of EA in organizations and research on EA become more important as organizations become more interconnected. EA is particularly important because it has the propensity to help organizations meet the conflicting requirement of pursing interconnectedness for resource sharing and retaining autonomy for adaptation. This may partly explain the growing inter-

est in research on EA, especially on EA management processes and practices, in recent years (Al-Kharusi et al., 2017; Gampfer et al., 2018; Rahimi et al., 2017).

Notwithstanding its importance, research on EA can better serve organizations when it is based on a sound foundation and produces reusable solutions rather than isolated local solutions (Dang and Pek-kola, 2017; Schöenherr, 2008; Simon et al., 2013). However, research on EA seems to fall short of these two essential requirements. From its inception, around the late 1980s (see Kotusev, 2016), re-search on EA has produced several publications. Earlier publications on EA were produced mostly by practitioners, and thus focused on practitioner led discourse on topics such as EA frameworks, tools, and methods (Langenberg and Wegmann, 2004). Also, these publications speculated several benefits that organization can derive from EA (Niemi, 2008). Further, research on EA was replete with incon-sistent terminologies (Schöenherr, 2008), probably because practitioners developed their own tools and propagated terminologies that were specific to their proprietary tools and organizational contexts. Moreover, research on EA usually employed descriptive methods and rarely offered theoretically grounded explanations for research observations or findings (Langenberg and Wegmann, 2004; Niemi, 2008; Schöenherr, 2008).

In recent years; however, the participation of the academia in research on EA has increased (Dang and Pekkola, 2017; Rahimi et al., 2017). Several researchers have conducted systematic literature reviews to synthesize prior knowledge on EA and to propose conceptual frameworks, theoretical explanations, and themes for future research. A few examples of such efforts are Schöenherr (2008)'s call for a common terminology and structure in research on EA; Tamm et al (2011)'s explanation of how EA may result in organizational benefits; and Simon et al (2013)'s bibliometric exposé of research on EA and call for researchers to link EA to other disciplines. Further, recent literature shows that the use of theory is slowly gaining root in research on EA (Al-Kharusi et al., 2017) and that aside focusing on topics; e.g., EA frameworks and modeling, research on EA is expanding to include talks on other top-ics; e.g., EA management practices (Al-Kharusi et al., 2017; Gampfer et al., 2018). There are, thus, reasons to believe that research on EA has made progress. However, because each prior review article focused on a specific aspect of research on EA, there is gap in our comprehension of how much pro-gress research on EA has made, and the directions for future research. This study fills that gap. Specif-ically, this study answers the question: *What progress has the research on EA made and what are the directions for future research?*

Following the guidance of Webster and Watson (2002) and Rowe (2014), this paper reviews review articles on EA to synthesize knowledge on the progress that research on EA has made and to identify some directions for future research. The progress and directions for future research on EA are orga-nized around four key areas; EA research, EA process, EA benefits, and EA principles. This paper extends our understanding on the progress that research on EA has made and provides guidance for future research.

The rest of the paper is organized as follows. Section two elaborates on the research method that was employed and presents some preliminary findings. Section three discusses the progress that research on EA has made, whereas section four discusses the directions for future research on EA. Section five offers concluding remarks and points out a major limitation of the study.

2   Research Method

One approach to answering the research question stated above is to conduct a traditional systematic literature review that "comprehensively" covers the literature on EA. However, considering the vast literature on EA, it may be impractical or impossible to comprehensively cover the vast literature on EA in quest to examine the progress that has been made and to suggest directions for future research (Rowe, 2014). Since there are several review articles on diverse topics in EA, a meta-review (i.e. a qualitative review of review articles) on EA provides a plausible alternative to collate and synthesize the progress that research on EA has made, and to identify areas for future research. This approach has been used elsewhere, e.g. in the strategic management literature to consolidate diverse views and find-ings on interorganizational relationships (Parmigiani and Rivera-Santos, 2011). Also see Huang and Yasuda (2016) for a meta-review of research on enterprise resource planning systems.

Therefore, the research method employed in this study is a meta-review (i.e., a qualitative review of review articles) on EA following the guidance of Webster and Watson (2002) and that of Rowe (2014). Literature reviews are usually employed to integrate and synthesize prior research on a topic, and to guide future research; e.g., with theoretical propositions, research frameworks, and themes for future research (Rowe, 2014; Schwarz et al., 2007; Webster and Watson, 2002). In that regard, a review article on a topic in EA is an outcome of a research effort that integrates prior knowledge on that topic. Thus, conducting a meta-review of review articles on EA provides the occasion to synthesize knowledge on a broad range of topics in EA. A meta-review is therefore appropriate to uncover the progress that research on EA has made and the areas that need further research. The sub-sections that follow present how the review articles were selected and reviewed.

2.1 The Selection of Review Articles on EA

Review articles on EA were searched for from various databases including Google Scholar, Science Direct, AIS Electronic Library, and ProQuest using the search term "Enterprise Architecture" AND "literature review". The search returned a total of 7937 results across the databases. The systematic search was done from 15th April to 5th May 2018. The search results are presented in Table 1 below.

The following articles were eliminated. First, extended abstracts, and articles that were written in languages other than English, or whose full versions could not be found or accessed; e.g., Gorkhali & Xu (2017). Second, articles that had the search terms but were not review articles; e.g., editorials. Third, review articles whose subject of review were outside EA; for example, review articles on software architecture. Fourth, review articles that reviewed other fields; e.g., e-Governance (Tambouris et al., 2014), big data (Kehrer et al., 2016), and global network organizations (Mueller et al., 2013), for problems (e.g. requirements and challenges) and then prescribed concepts from EA as remedies. After the screening, 35 review articles on EA remained.

Further, following the guidance of Webster and Watson (2002), the references of the 35 review articles were searched for other review articles that our search missed. Additionally, an exploratory search was done up until 15th October 2019 to augment the list of articles with recent review articles on EA. Sixteen additional review articles on EA were found from the reference check and exploratory search, making a total of 51 review articles on EA as of 15th October 2019. (please see Table 1 below).

Source	Search Term	No. of Papers	Included
Google Scholar	"Literature Review" AND "Enterprise Architecture" (*NB: 1. Using "Enterprise Architecture" AND "Literature Review" returned only one article, i.e. Gorkhali et al (2017) 2. All the 21 articles included were found in the first 13 tabs.*)	7470 (Articles from the first 30 tabs, =300 articles, were read)	21
Science Direct	"Enterprise Architecture" limited by "Review Article"	33	3
ProQuest	"Enterprise Architecture" AND "Literature Review" limited by "Full text" and "Peer Reviewed"	343	2
AISeL	"Enterprise Architecture" AND "Literature Review" limited by "All Repository"	91	9
Total			**35**
Review articles from reference check and exploratory search			**16**
Final number of review papers included (15th October 2019)			**51**

Table 1 Summary of Search Results for Review Papers on EA

2.2 The Review Process and Preliminary Findings

Each of the 51 review articles was fully read and the summaries of the 51 review articles were organized using a spreadsheet. Preliminary findings suggest that systematic literature review on EA is on the increase, especially in recent years (see, *Figure 1*). Most of the review articles were first authored by researchers from institutions in Europe (N = 24) and Asia (N = 14). Particularly, in this sample,

institutions from Germany (N = 9), Malaysia (N = 7), Switzerland (N = 6) and Finland (N = 6) made the most contributions. A number of the review articles are published in the Association of Information Systems (AIS) conferences, e.g. AMCIS (N =3), PACIS (N= 2), ECIS (N=1); affiliated conference, i.e. HICSS (N= 4); and journal, i.e. CAIS (N = 4) and PAJAIS (N = 1).
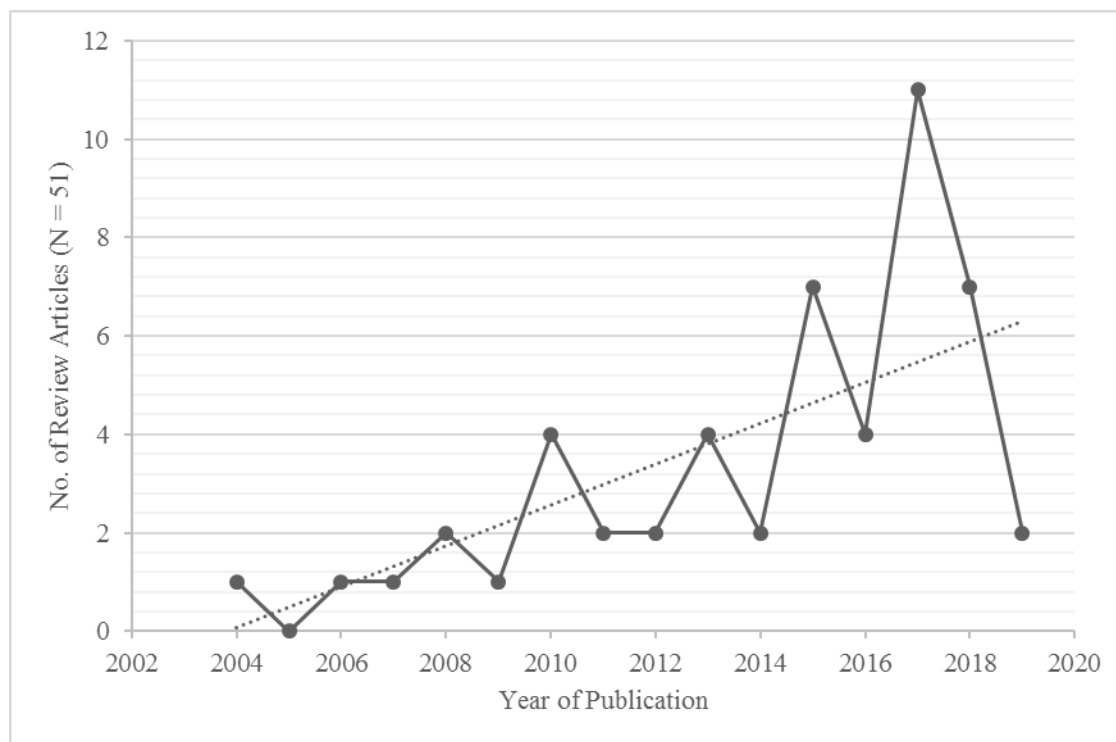

Figure 1: Distribution of Review Articles on EA as of 15th October, 2019

One notable observation is that the years covered by the review articles largely overlap, and most of the review articles (N = 28) provided the list of primary articles that were reviewed. However, although the years covered by the review articles largely overlap, the primary articles that were reviewed rarely overlapped. The lack of overlap is not surprising since each review article focused on a particular topic. However, it is informative as to why there seem to be discrepancies in terminologies even among review articles on EA. For instance, Tamm et al., (2011)'s definition of EA includes two main components (i.e., *definition*, e.g., process for planning; and *representation,* e.g., output including EA drawings). Kotusev et al., (2015)'s definition regards EA as a *description*. However, Rahimi et al.,(2017)'s definition regards EA as neither a *description* nor *a management methodology* but as "a fundamental *conception of…* an enterprise's *inherent structure*"(2017, p. 125 emphasis added). Note; however, that the treatment of these inconsistencies is beyond the scope of this paper.

The 51 review articles were thoroughly read, and the main focus, contributions, and implications of each review article were noted. Thereafter, the main focus, contributions, and implications of the review articles were used to create a taxonomy (Nickerson et al., 2013), in order to classify the review articles and to guide the discussion in this paper. Four main areas (i.e., EA research, EA process, EA benefits, and EA principles) emerged.   Thus, the 51 review articles are classified under the 4 main areas. The review articles that are classified under EA research discussed subjects such as the dispersion of EA research (e.g. Dang and Pekkola, 2017; Simon et al., 2013), research methods and theories (e.g. Al-Kharusi et al., 2017), and the meanings of selected terminologies in the EA literature (e.g. Kotusev et al., 2015; Saint-Louis et al., 2017). The review articles that are classified under EA process discussed topics such as the process and methods of doing EA (e.g. Rouhani et al., 2015; Nikpay et al., 2017b), EA stakeholders (e.g. Niemi, 2007; Al-Kharusi et al., 2016), evaluation and analysis of EA (Barbosa et al., 2019; Nikpay et al., 2016), the factors that influence the selection of EA frameworks (Bui, 2017) and business IT alignment (Putro et al., 2017). Review articles that are classified under EA

benefits discussed issues relating to the values that organizations may derive from using EA (e.g. Niemi, 2008; Boucharas et al., 2010) and the mechanisms through which, or paths along which, organizations can derive such values from EA (e.g. Tamm et al., 2011; Lange et al., 2012). Review articles that focus on defining and classifying EA principles, and analyzing research on EA principles are grouped under EA principles (Haki and Legner, 2012; Stelzer, 2010). Note that some of the articles can be classified under multiple areas. However, each review article is classified under an area that matches most with the main focus of the review article (please see *Table 3* below).

The number and percentage of review articles per area are presented in *Table 2* below. The progress that research on EA has made, and the directions for future research in each of the four areas are discussed in sections three and four respectively.

	EA Research	EA Process	EA Benefits	EA Principles	Total
No. of Review Articles	20	18	11	2	51
Percentage of Total	39.22%	35.29%	21.57%	3.92%	100.00%

Table 2: The Number and Percentage of Review Articles per Area

Area	Explanation	Articles
EA Research	This area consists of articles that discuss research on EA, including subjects such as the dispersion of research on EA, research methods and theories employed in research on EA, and the meanings of selected terminologies in the EA literature.	Langenberg and Wegmann (2004); Schöenherr (2008); Schelp and Winter (2009); Radeke (2010); Simon et al. (2013); Zheng and Zheng (2013); Kotusev et al. (2015); Kudlawicz et al. (2015); Ramos and de Sousa Júnior (2015); Rasti et al. (2015); Saint-Louis and Lapalme (2016); Al-Kharusi et al. (2017); Dang and Pekkola (2017); Kotusev (2017); Saint-Louis et al. (2017); Gampfer et al (2018); Nurmi et al. (2018); Kotusev (2018); Saint-Louis and Lapalme (2018); and Schilling (2018).
EA Benefits	This area consists of articles that discuss the benefits of EA and means by which organizations can gain the benefits of EA.	Niemi (2008); Boucharas et al. (2010); Radeke (2011); Tamm et al., (2011); Lange et al. (2012); Labusch and Winter (2013); Wan et al. (2013); Petrikina et al. (2014); Banaeianjahromi and Smolander (2014, 2016); and Gong and Janssen (2019)
EA Process	This area consists of articles that discuss process related issues in EA, including topics such as the process and methods of doing EA, EA stakeholders, evaluation and analysis of EA, the factors that influence the selection of EA frameworks, and business IT alignment	Niemi (2007); Lucke et al. (2010); Bakar et al. (2015); Rouhani et al. (2015); Wißotzki and Sandkuhl, (2015); Al-Kharusi et al. (2016); Nikpay et al. (2016); Santana et al. (2016); Bui, (2017); Nikpay et al. (2017a); Nikpay et al. (2017b); Nkundla-Mgudlwa and Mentz, (2017); Nowakowski et al. (2017); Putro et al. (2017); Rahimi et al. (2017), Zhang et al. (2018); Ansyori et al. (2018); and Barbosa et al. (2019),
EA Principles	This area consists of articles that focus on defining and classifying EA principles, and analyzing research on EA principles.	Stelzer, (2010); and Haki and Legner (2012)

Table 3: A Taxonomy of Review Articles on Enterprise Architecture

3 A Discussion of Progress in Research on EA

3.1 EA Research

EA research has progressed in establishing standardized terminologies within research groups; howbeit, standardized terminologies across the EA research community is still lacking. In 2004, Langenberg and Wegmann (2004)'s review found that practitioners authored most of the literature on EA, and that the EA literature was replete with inconsistent terminologies. Similarly, Schöenherr (2008) found that terminologies were inconsistently used; and research on EA was without a focal theme. However, Schelp and Winter (2009) found that terminologies among researchers that belong to a research group (e.g., in a university) were generally standardized. Also, they noted that research groups that are focused on EA were gravitating towards sharing common terminologies with other groups.

More recently, Simon et al (2013) showed that indeed there exist tight research groups within the EA research community. Simon et al (2013)'s co-authorship analysis showed that members of each research group tend to publish mostly with other members of the same research group. Their citation analysis, however, showed that researchers do cite works of other researchers from different research groups. Thus, Simon et al (2013) asserted that some researchers within the EA community "do share similar thoughts rather than holding to strictly separate schools of thought" (2013, p. 11). Though Simon et al (2013) called for more research collaborations across groups, they cautioned that merely converging the author community may not necessarily lead to unifying terminologies and establishing a common understanding. Thus, notwithstanding the advances towards establishing common terminologies as reported by Schelp and Winter (2009) and Simon et al (2013), recent review articles (e.g. Dang and Pekkola, 2017; Gampfer et al., 2018; Saint-Louis and Lapalme, 2016) still observe inconsistencies in the use of terminologies across the EA research community. Moreover, the definitions of key terminologies, e.g. EA and EAM, do differ among primary papers and review articles. For instance, Saint-Louis et al. (2017) identified 145 different definitions of EA with each definition focusing on an aspect of EA. There are; thus, several calls for further research to streamline terminologies in EA research (e.g. Gampfer et al., 2018; Saint-Louis and Lapalme, 2016). Schöenherr (2008) advised that a plausible means to establish common terminologies in EA research is to commit thorough efforts towards establishing a "common structure" and towards developing core theories that underpin the EA discipline (2008, p. 407).

Research methods and the use of theories in EA research have also been discussed. Results in several review articles show that EA research has made little progress towards the use of theories and rigorous research methods. For instance, Schelp and Winter (2009) observed that there is lack of rigor in how EA research is done and called for a rigorous approach to EA research. Similarly, Radeke (2010) found that EA research was mostly based on prescriptive frameworks and methodologies. Further, Dang and Pekkola (2017) asserted that EA research, especially in the public sector, is driven by "local case studies" aimed at solving practical problems. Also, Al-Kharusi et al (2017) observed that out of 55 empirical studies on EA, only 15 used theory to guide the research or to offer an explanation. Other review articles have also identified the lack of theory in EA research (e.g. Dang and Pekkola, 2017; Kudlawicz et al., 2015; Schöenherr, 2008). Further, researchers have noted that, mostly, explanations offered in EA research are based on the experiences of the authors, or some rhetoric guided by "common sense" instead of theoretically grounded explanations of how and why certain conclusions were made (Kudlawicz et al., 2015). Nurmi et al. (2018) however suggests that, the lack of explanatory and predictive theories in EA may be due to research methods employed in, and the complicated targets of, EA research. Nevertheless, the use of theory is gradually gaining grounds in EA research, especially in recent years (Al-Kharusi et al., 2017). Schilling (2018) found that prior research on EA has employed theories such as institutional theory, actor network theory and chaos and complexity theories to study the dynamics associated with EA. DeLone and McLean IS success model is another famous theory employed in EA research (Al-Kharusi et al., 2017). Also, Nurmi et al. (2018) found that systems theory is widely used in EA research, howbeit in a disjointed manner.

Results from several review articles suggest that EA research has expanded in scope. Several review articles show that earlier discourse on EA was focused on topics such as EA frameworks and the bene-

fits of EA (Langenberg and Wegmann, 2004; Niemi, 2007). Also, EA was considered as a tool to manage the IT landscape. Thus, the discourse on EA centered on managing the IT landscape and lacked linkage with related disciplines and other management practices (Simon et al., 2013). Although the situation has not change drastically, recent review articles suggest that discourse on EA management practices are gaining attention (Al-Kharusi et al., 2017; Gampfer et al., 2018), and that some EA teams do engage with other management teams to formulate and enact strategies at the enterprise level (Rahimi et al., 2017). Also. some review articles suggest that, aside its wide acceptance in the private sector, EA is gaining wide acceptance in the public sector as well (Dang and Pekkola, 2017; Ramos and de Sousa Júnior, 2015; Zheng and Zheng, 2013). Howbeit, EA practices in the public sector are still immature (Dang and Pekkola, 2017).

Further, review articles have shown that the participation of academic scholars in EA research has increased. Whereas earlier EA literature was dominated by practitioner materials (Langenberg and Wegmann, 2004), recent EA literature is dominated by academic articles which are authored by academic scholars or produced from the collaborations between academic scholars and practitioners (Dang and Pekkola, 2017; Saint-Louis and Lapalme, 2016). Furthermore, research has shown that researchers from all over the world engage in research on EA. Although most contributions come from researchers in Europe, the Americas and Asia, researchers from Oceania and Africa are also active (Dang and Pekkola, 2017; Ramos and de Sousa Júnior, 2015).

3.2   EA Process

Eighteen review articles on EA focused on the process of applying EA in an organization. Although there are two early review articles on EA process; i.e. Niemi (2007)'s review on EA stakeholders, and Lucke et al (2010)'s review on challenges of EA process; all the others 16 review articles on EA process were published between 2015 and 2019 inclusive. This observation corroborates the assertions that EA research efforts are shifting towards, or are at least expanding to include, other topics such as EA management practices and the integration of EA management with other management practices (Al-Kharusi et al., 2017; Gampfer et al., 2018; Rahimi et al., 2017).

Research on EA has progressed in discussing frameworks, tools, methods and processes for introducing, implementing and using EA in organizations. Prior literature on EA has offered plethora of frameworks, tools and methods. Lucke et al (2010) identified some challenges that may confront organizations as they implement these frameworks, tools and methods. Similarly, Rouhani (2015) examined and identified some challenges with EA implementation methods. Conversely, Bakar et al (2015) consolidated prior knowledge and suggested a process model, consisting of six steps, that can guide the establishment of EA in an organization. Further, Nikpay (2017b) elucidated practices and factors that may lead to an effective implementation of EA in an organization. Furthermore, Wißotzki and Sandkuhl (2015) consolidated knowledge on the capabilities that an organization should possess to enable the organization conceive, implement, and derive value from its EA initiatives. Also, research has prescribed models and practices for evaluating EA during post-implementation (Nikpay et al., 2016); processes by which an organization can determine the value of its EA artifacts (Nikpay et al., 2017a); and constructs for measuring the effectiveness of EA implementation (Nkundla-Mgudlwa and Mentz, 2017).

Research on EA has also progressed in identifying and classifying stakeholders and stakeholder related issues in applying EA in an organization. EA stakeholders are people or functions (e.g., architects, business managers, IT managers, and EA users) that may be involved in or affected by the process of applying EA in an organization (Al-Kharusi et al., 2016; Lucke et al., 2010; Niemi, 2007). Niemi (2007) identified and classified the stakeholders of EA. Al-Kharusi et al (2016) investigated the factors (i.e., technical, organizational and personal factors) that may influence the engagement among stakeholders, especially among EA architects and other stakeholders. Further, the review articles show that an effective EA should incorporate the views of several stakeholders, and that the views of several stakeholders may be obtained and incorporated in EA when the stakeholders collaborate. However, achieving collaboration among stakeholders and incorporating their divergent, and sometimes conflicting, views in an EA remains a challenge (Al-Kharusi et al., 2016; Lucke et al., 2010; Niemi, 2007).

Further, research on EA has made progress in identifying the scope of EA and EA management practices and in suggesting factors that an organization may consider in choosing an EA framework or management practice for a particular scope. The scope of EA may refer to the level and extent of components of the enterprise that are covered by an EA intervention. For instance, Rahimi (2017) observed that EAM interventions may cover IT, business capabilities, or business strategy. Similarly, Bui (2017) suggested that EA interventions may be technical, operational or strategic. The broader the scope of EA and EA management, the wider the range of stakeholders that should be considered (Niemi, 2007). Some researchers have observed that the scope of EA management and the type of value that is derivable from an EA initiative are contingent on the scope of EA in the organization (Rahimi et al., 2017) and the type of EA framework that guides the EA initiative (Bui, 2017). In that regard, Rahimi (2017) prescribed a taxonomy of the application of EAM in an organization to guide EA implementation efforts, whilst Bui (2017) identified some essential elements that an organization should consider in choosing an EA framework (cf. Kotusev et al., 2015).

Lastly, research on EA has progressed in investigating how EA and its related processes may influence Business-IT alignment (Zhang et al., 2018) and in identifying the challenges that EA may face in driving and sustaining Business – IT alignment (Putro et al., 2017). However, Zhang et al., (2018) have noted that although several articles talk about the role of EA in creating Business – IT alignment, there is little talk about how EA can sustain Business – IT alignment.

3.3   EA Benefits

Both practitioners and academics have claimed that organizations can derive several benefits from EA (Niemi, 2008; Tamm et al., 2011). For example, EA is believed to help reduce complexities (e.g., related to business-IT alignment) in organizations, reduce cost, increase agility, and improve productivity (Boucharas et al., 2010; Tamm et al., 2011). However, review articles on EA benefits (e.g. Tamm et al., 2011; Boucharas et al., 2010) show that most of the benefit claims are backed by neither empirical results nor theoretical explanations. Lack of clarity on the benefits of EA and the absence of empirical or theoretical justifications for benefit claims may not only impede research on the benefits of EA but may also impede the ability of practitioners to justify investments in EA (Simon et al., 2013; Tamm et al., 2011). Consequently, several researchers have committed efforts to clarifying the EA benefits area of research on EA.

Research on EA benefits has progressed in identifying and classifying EA benefits, and in suggesting mechanisms through which, and paths along which, organizations can derive EA benefits from their EA investments. Using a 2x2 metrics, Niemi (2008) classified EA benefits into 4 main types, namely hard, strategic, indirect and intangible benefits. Boucharas et al (2010) clarified the context in which organizations can derive benefits from EA, and the mechanisms needed to derive such benefits. Boucharas et al (2010) asserted that EA benefits may be linked to financial performance, customer relations, internal productivity, and organizational learning and growth.

Two later review articles discussed the paths along which EA may result in benefits. Tamm et al (2011) employed theories, including dynamic capability theory and resource base theory, to conceptualize a path along which EA may result in benefits. They suggested that EA may lead to benefit by enabling organizational alignment, information availability, resource portfolio management, and resource complementarity (Tamm et al., 2011). Some of the benefits may emanate from EA planning processes whilst others may only be attained by implementing the EA (Tamm et al., 2011). Also, Lange et al (2012) drew on the DeLone and McLean IS Success Model to propose a path along which EA may result in benefit. According to Lange et al (2012), EA quality (i.e., EA product quality, EA function setup quality, and EA service quality) and cultural aspects lead to intention to use, use, and user satisfaction, which in turn leads to net benefit of EA. However, although Lange et al (2012) explained other constructs in their model, they ignored constructs relating to the user (i.e., intention to use, use, and user satisfaction). Lange et al. might have ignored the constructs relating to the user because they "do not regard these socio-organizational dimensions as enablers (but rather inhibitors) of EA benefits"(2012, p. 8). Saint-Louis and Lapalme (2018) found that only 9% of 257 papers considered the socio-technical context of EA, whereas 84% considered the technical context of EA.

Some authors have committed efforts to measuring EA benefits (e.g. Wan et al., 2013) and to investigating the impact of EA on specific aspects of an organization (e.g. Banaeianjahromi and Smolander, 2016; Labusch and Winter, 2013; Radeke, 2011). Wan et al (2013) discussed issues related to identifying, measuring and controlling EA benefits. They asserted that, though it can be easy for an organization to trace and measure tangible benefits, the organization may find it difficult to trace and measure intangible benefits. Thus, whilst some EA benefits (e.g., cost savings) may be measured with financial instruments other EA benefits (e.g., shared understanding about an organization's strategies) may require non-financial instruments (Boucharas et al., 2010; Niemi, 2008; Wan et al., 2013). The rest of the review articles on EA benefit provide insight into the application of EA in specific areas of an organization. Redeke (2011) explains how EAM can support strategic change; Labusch and Winter (2009) explains how EAM may help manage organizational transformation; and Banaeianjahromi and Smolander (2016) explains how EAM can support enterprise integration.

3.4   EA Principles

EA principles are believed to be at the core of EA (Richardson et al., 1990) and to provide the rules that guide how EA is done, and how EA artefacts are designed, represented and evaluated (Hoogervorst, 2004; Stelzer, 2010). However, despite its importance to EA, EA principles are rarely discussed (Haki and Legner, 2012; Stelzer, 2010). Thus, *EA principles* remains a very important yet underdeveloped concept in the EA literature. Only two review articles focused on EA principles.

The first review article on EA principles; that is Stelzer (2010), conceptualized and proposed a definition for EA principles, and classified EA principles into design principles and representation principles. Nevertheless, Stelzer (2010) noted that *EA principles*, as a concept, was still blur and called for further research to further clarify the concepts. The second review article on EA principles; that is Haki and Legner (2012), employed Gregor (2006)'s taxonomy of theories in IS to analyze research on the nature, practice, adoption, and impact of EA principles. Haki and Legner (2012) realized that researchers focus on studying the nature and practice of EA principles, but largely neglect studying the adoption and impact of EA principles leaving several gaps for future research on EA principles.

Area	A Summary of Progress in Research on EA
EA research	• Researchers have identified the need for theory and rigor in EA research, and the need for standardized terminologies and fundamental structures • Researchers have made progress towards establishing common terminologies, especially within research groups • The participation of academic scholars in EA research has increased • EA research is gaining attention in other sectors, e.g. public sector, and is extending to include other topics e.g. EA management practices. • Research on EA has gained attention of several researchers around the globe.
EA process	Researchers have: • proposed and critiqued frameworks, tools, methods and processes for introducing, implementing and using EA in organisations • identified the various scopes of EA in organizations and have prescribed the factors that may influence the choice of EA frameworks and EA management methods • identified and classified stakeholders and stakeholder related issues in applying EA in organizations
EA benefits	Researchers have: • identified and classified EA benefits • suggested mechanisms through which, and paths along which, organizations can attain EA benefits. • identified issues related to tracing, controlling and measuring EA benefits • studied some aspects, e.g. Business – IT alignment, organizational transformation, in which EA can make impact
EA principles	• Researchers have identified, classified, and proposed definitions for, EA principles; and have studied how EA principles are crafted.

Table 4. Summary of Progress in Research on EA

4   A Discussion of Directions for Future Research on EA

4.1   EA Research

Though research on EA has made progress, there are several areas where further efforts are needed. First, research on EA still lacks a fundamental structure that guides research efforts in EA (Radeke, 2010; Schöenherr, 2008). Such a fundamental structure may consist of key concepts in EA and how the concepts relate to each other. Establishing a fundamental structure will make it possible for EA researchers to position their research efforts, and to demonstrate the fundamental concepts and theories to which their research findings contribute. Second, there is the need for a conscientious effort to create mutual understanding of terminologies in research on EA (Al-Kharusi et al., 2017; Simon et al., 2013). Such an effort may rely on a wide range of influential publications on EA. So far, since the primary articles employed in systematic literature reviews on EA rarely overlap, the 51 review articles seem to by-pass each other in the quest to establish mutual understanding of terminologies in research on EA. A viable approach is to conduct a literature review based on a collection of primary articles that were employed in previous review articles. The idea is to produce a collection of influential primary articles that discussed diverse topics, addressed EA issues in different sectors, and used different research methods and theories. Including diverse views and perspectives will provide the occasion for consensus building on EA terminologies (Innes and Booher, 1999).

Third, research on EA should employ rigorous research methods, and be based on sound conceptual foundations (Al-Kharusi et al., 2017; Kudlawicz et al., 2015; Schöenherr, 2008). This does not suggest that research on EA should embrace rigorous research practices that depart from organizational realities and inhibit the practical relevance of our research findings. Rather, it suggests that research on EA should strive to make practically relevant and reusable contributions which are rooted in theory and produced from rigorous research methods (Nunamaker Jr et al., 2015; Gulati, 2007; Lee, 1999). Indeed, the tight collaboration that exist between EA researchers and practitioners may lure EA researchers into seeking after solutions to "practical problems" at the expense of pursing rigorous and replicable research. However, it may as well provide the occasion for EA researchers to design and implement rigorous research that make practically relevant contributions grounded in theory and empirical evidence. For instance, instead of relying heavily on descriptive case studies, EA researchers may also employ exploratory and explanatory case studies (e.g. see Dubé and Paré, 2003; Pan and Tan, 2011) to produce practically relevant results that may be generalized to, or reusable in, other contexts (Lee and Baskerville, 2003). Researchers who employ design science research may also glean guidance from recent discussions on design science research (e.g. De Leoz and Petter, 2018; Baskerville et al., 2018).

Fourth, EA researchers should establish linkages between EA and other disciplines (Simon et al., 2013). For example, EA researchers may draw on resource management and resource orchestration theories from the strategic management literature (Sirmon et al., 2011, 2008), and on IT capability theories from the Information Systems literature (Bharadwaj, 2000; Stoel and Muhanna, 2009) to explain how EA may add value to the creation of digital business capabilities e.g. digital logistics and digital customer service (Kohli and Grover, 2008).

4.2   EA Process

In recent years, researchers have turned their attention to EA management practices in organizations. However, most of the solutions that are offered are specific to case organizations (Dang and Pekkola, 2017) and are usually disconnected from other management practices in organizations (Rahimi et al., 2017; Simon et al., 2013) . As recommended under *EA theories* above, EA researchers should design EA management methods and practices that can be reused in different organizational contexts. Further, organizations can be better served when EA researchers work with practitioners to integrate EA management methods and practices with other management practices, and into the daily routines in organizations. For instance, a study on how EA management can be integrated with, and used to extend the capabilities of, other managerial practices, e.g. digitalization, in managing mergers and acqui-

sitions, will be useful. Research on how to integrate EA into the daily routines of organizations may also look at how EA can help sustain Business – IT alignment (Zhang et al., 2018).

Also, EA researchers should focus on uncovering the characteristics of the EA management methods and practices that make them integrable within different organizational contexts. Bui (2017), for instance, has enlightened us on the essential elements that may influence the choice of an EA framework. However, these essential elements describe only the EA framework but do not include elements that describe an organization's internal and institutional environment which may also influence the choice of an EA framework and, thus, EA management methods and practices. For instance, future research can investigate the influence that organizational context, e.g. the strategic orientation, size, structure, and life cycle of an organization (Chan et al., 1997; Sabherwal and Chan, 2001; Sirmon et al., 2011); and institutional context, e.g., sector and institutional pressure (Meyer and Rowan, 1977; Scott, 2013), may have on the choice of EA frameworks and EA management methods and practices. The roles of different stakeholders in the integration process is another viable area for future research.

Further, prior literature suggests that the scope of EA can be technical, operational or strategic (Bui, 2017), and that the scope of EA management can cover IT, business capability, or business strategy (Rahimi et al., 2017). However, little is known about whether the scopes represent a variance model (i.e., an organization chooses a scope, e.g., technical or IT, and gains high maturity in only that scope), or a process model (i.e., an organization starts from a narrow scope, e.g. technical or IT, and matures towards a broader scope, e.g. strategic scope). Future research may employ variance theory and/or process theory (Markus and Robey, 1988) to study the scope of EA and EA management and how they evolve in an organization.

Research on EA capabilities; that is, the abilities that an organization should possess in order to conceive, develop, manage and derive value from its EA initiatives, have not received much attention in the EA literature (Wißotzki and Sandkuhl, 2015). Future research should study how an organization may acquire, develop or leverage these capabilities. However, researchers should endeavour to create linkages between EA capabilities and other organizational capabilities, e.g. IT capabilities (Stoel and Muhanna, 2009) and resource orchestration capabilities (Sirmon et al., 2011, 2008).

4.3   EA Benefits

Starting from a myriad of unsubstantiated benefit claims, research on EA benefits has made substantial progress with classifying EA benefits and explaining how organizations can derive benefits from their EA investments. However, there are several areas where future research can contribute. First, future research should complement and extend existing models. For instance, researchers should examine how the "benefit enablers" in Tamm et al (2011)'s model may result in organizational benefits of EA. Indeed, the "benefit enablers" may be considered as intermediate benefits. In that regard, researchers should study how to measure the "benefit enablers" and study the organizational contexts needed to derive such intermediate benefits from EA.

Second, contrary to Lange et al (2012)'s views, a study of the characteristics of EA artefacts and EA management practices that influence the attitude (i.e. intension to use), behaviour (use), and perception (user satisfaction) of users (Delone and McLean, 2003) is worthwhile. Moreover, research has highlighted the importance of addressing stakeholder issues (Al-Kharusi et al., 2016; Niemi, 2007) and the intangible benefits that may ensue from EA planning processes (Tamm et al., 2011). Thus, researchers who are interested in EA benefits should rather embrace, rather than ignore, the social and political contexts that surround the development, management and use of EA in organizations. In this regard, researchers may draw from the literature on; for example, participatory design (Bjögvinsson et al., 2012; Halskov and Hansen, 2015; Schuler and Namioka, 1993), and the relationship between *participation*, *involvement* and *use of artefacts* (Barki and Hartwick, 1994; Harris and Weistroffer, 2009). Also, De Leoz and Petter (2018) provide a design science research process that can guide EA researchers on how to embed the social context into design artefacts (e.g., EA models and practices).

Third, EA researchers have done well to classify EA benefits, however they have largely ignored the classification of EA investments. EA researchers may leverage advances in business value of IT re-

search. Research on the business value of IT suggests that using appropriate classification of IT investments allow researchers to better determine and measure the benefits of IT investments (Kohli and Devaraj, 2003; Lim et al., 2011; Sabherwal and Jeyaraj, 2015). Accordingly, classifying EA investments will enable EA researchers to better align EA investments with EA benefits, and to identify and control for factors that may confound the relationship between EA investment and EA benefits (Kohli and Sherer, 2002). Classifying EA investment will also enable EA researchers to choose appropriate measures and research methods for research on EA benefits (Kohli and Sherer, 2002).

4.4 EA Principles

EA principles have received less attention. Thus, there is the need for further research on the empirical and conceptual foundation of EA principles; on the development, adoption and use of EA principles; and on how EA principles may lead to value or EA benefits (Haki and Legner, 2012; Stelzer, 2010). A conscientious effort towards laying the conceptual foundation for research on EA principles will certainly be a value addition to research on EA.

Area	A Summary of Direction for Future Research. Future research should…
EA research	• Establish a common foundational structure that guides research on EA • Improve mutual understanding of terminologies and concepts across research groups • Increase the rigor of research on EA (increase the use of theories and research methods) • Make theoretical contributions and create reusable/transferable design artefacts • Link EA with adjacent disciplines e.g. strategic management and information systems
EA process	• Develop reusable/transferrable EA management practices that are linked to other management practices • Study the social and organizational contexts of EA (e.g. the adoption and institutionalization of EA) • Study how EA capabilities can be acquired, developed, or leveraged to extend other organizational capabilities
EA benefits	• Complement, extend, and empirically examine current models on EA benefits • Study the political and social factors that may influence EA benefits • Create a taxonomy of EA investments, and design appropriate tools and research to measure EA benefits whilst controlling for confounding factors
EA principles	• Improve on the conceptual and empirical foundation for EA principles • Focus on the development, adoption and use of EA principles • Study how EA principles may lead to EA benefits

Table 5 Summary of Directions for Future Research on EA

5 Conclusions and Limitations

Owing to the importance of EA, it has received considerable attention from both practitioners and researchers. However, research shows that the EA literature and practice is plagued with inconsistent terminologies and unsubstantiated claims. Though prior literature reviews have enlightened us on progress in specific areas of EA, we still lack a comprehensive understanding of the progress that EA has made and the direction for the future. The aim of this paper is to extend our understanding of how much progress research on EA has made and the directions for future research. Thus, drawing on a meta review of 51 review articles on EA, this study discusses the findings along four areas; including, EA research, EA process, EA benefit, and EA principles. Indeed, research on EA has made progress in all four areas; however, progress in research on EA principles is scanty. Section three of this paper discussed the progress that research on EA has made. Notably, EA researchers and practitioners have not only proposed frameworks, methods, and processes for introducing and managing EA in an organization, but they have also identified and classified EA benefits and have suggested mechanisms through which an organization can gain EA benefits. Another remarkable progress is that that some EA related terminologies are gaining common usage especially within research groups, and that EA is gaining attention in diverse sectors (e.g., public sector) and around the world.

Nevertheless, there are several important issues that have been identified and which need further research (see section four). Some of the prominent issues include, the need to establish a fundamental understanding and structure of EA; the need to engage in research practices that produce reusable/transferable solutions; and the need for researchers and practitioners to consider the social and organizational contexts that may influence EA adoption and benefit. Further, there are very few primary research articles and review articles on EA principles. Owing to the importance of EA principles to EA research and practice, practitioners and researchers should commit more time to improving our understanding of EA principles, how EA principles may lead to EA benefits (Lumor et al., 2016), and the roll that EA principles could play in unifying the architectural approach in complex organizational setting.

Taken together, sections three and four of this paper improve our understanding of the progress that the research on EA has made, and the directions that future research on EA should take in order to create a coherent discipline that offers relevant solutions grounded in theory and produced from rigorous research methods. Therefore, as EA researchers and practitioners pursue solutions to new challenges (e.g., creating resilient EA to support the conflicting needs for resource sharing and interconnectedness, on the one hand, and the autonomy to effect dynamic change, on the other hand); they should adopt research practices that improve the quality of their solutions and drive EA towards a coherent discipline.

This study has its obvious limitations. Employing a meta-review limits the discussions in this paper to the aspects of EA on which *review articles* have been published. In other words, there may be areas in which research on EA has made advances but have not been captured in the discussions in this paper. However, the 51 review articles provide a considerable coverage of the research on EA based on which this study synthesises the progress that research on EA has made and the directions for future research on EA. Future research, especially systematic literature reviews, should study the progress that have been made in areas that have not been covered in this meta-review.

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